



BUY SMART. BUILD BETTER.

INDEFINITE QUANTITY CONTRACT - JOC TECHNICAL SPECIFICATIONS

BOOK 1 OF 1 CSI DIVISION 01-43 2014

UNITED STATES POSTAL SERVICE



**UNITED STATES
POSTAL SERVICE**

GORDIAN
JOC SOLUTIONS

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01 General Requirements

01 10 00 00	SUMMARY OF WORK
01 11 04 00	CONTRACT DOCUMENTS
01 22 16 00	No Specification Required
01 23 00 00	ALTERNATES
01 32 00 00	CONSTRUCTION PROGRESS DOCUMENTATION
01 32 33 00	LEED Requirements
01 33 00 00	SUBMITTAL PROCEDURES
01 35 43 00	ENVIRONMENTAL PROCEDURES**
01 40 00 00	QUALITY REQUIREMENTS
01 50 00 00	TEMPORARY FACILITIES AND CONTROLS
01 60 00 00	PRODUCT REQUIREMENTS
01 71 23 16	Cutting and Patching
01 73 00 00	EXECUTION
01 74 19 00	CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
01 77 04 00	CLOSEOUT PROCEDURES AND TRAINING
01 91 13 00	GENERAL COMMISSIONING REQUIREMENTS

02 Existing Conditions

02 26 23 00	R&A ASBESTOS LABORATORY ANALYSIS REPORT
02 41 00 00	R&A ROOF REMOVAL AND SUBSTRATE PREPARATION
02 41 13 00	CSF SELECTIVE SITE DEMOLITION**
02 41 13 13	Portland Cement Concrete Removal
02 41 19 00	CSF SELECTIVE STRUCTURE DEMOLITION**
02 82 00 00	Removal Of Friable Asbestos-Containing Materials
02 82 33 00	R&A REMOVAL AND DISPOSAL OF NON-FRIABLE ACM
02 85 00 00	Mold Remediation

03 Concrete

03 01 50 00	R&A CONCRETE ROOF DECK REPAIR
03 10 00 00	MPF CONCRETE FORMING AND ACCESSORIES**
03 10 00 00	CSF CONCRETE FORMING AND ACCESSORIES**
03 20 00 00	CSF CONCRETE REINFORCEMENT**
03 20 00 00	MPF CONCRETE REINFORCEMENT**
03 30 00 00	CSF CAST-IN-PLACE CONCRETE**
03 30 00 00	MPF CAST-IN-PLACE CONCRETE**
03 41 16 00	Precast Lightweight Roof Slabs
03 41 26 00	Unbonded Post-Tensioned Concrete
03 47 13 00	MPF TILT-UP CONCRETE**
03 47 13 00	CSF TILT-UP CONCRETE**
03 51 13 00	R&A CEMENTITIOUS WOOD FIBER ROOF DECK REPAIR AND REPLACEMENT
03 51 16 00	R&A GYPSUM CONCRETE ROOF DECK REPAIR/REPLACEMENT
03 51 16 00a	Gypsum Plank Decking
03 51 16 00b	Gypsum Concrete Decks
03 52 16 00	R&A LIGHTWEIGHT INSULATING CONCRETE REPAIR AND REPLACEMENT

04 Masonry

04 01 20 51	Clay Masonry Restoration And Cleaning
04 01 40 52	Stone Restoration And Cleaning
04 01 40 91	Stone Masonry
04 05 13 26	Unit Masonry Assemblies
04 05 14 00	CSF MASONRY MORTARING AND GROUTING
04 05 14 00	MPF MASONRY MORTARING AND GROUTING
04 05 26 00	Scaffolding Tubular Steel
04 21 00 00	CSF CLAY UNIT MASONRY
04 22 00 00	MPF CONCRETE UNIT MASONRY

04 22 00 00 CSF CONCRETE UNIT MASONRY

05 Metals

05 12 00 00 MPF STRUCTURAL STEEL FRAMING
05 12 00 00 CSF STRUCTURAL STEEL
05 21 00 00 MPF STEEL JOIST FRAMING
05 21 00 00 CSF STEEL JOIST FRAMING
05 31 00 00 MPF STEEL DECKING**
05 31 00 00 CSF STEEL DECKING
05 31 23 00 R&A STEEL ROOF DECK REPAIR AND REPLACEMENT
05 40 00 00 MPF COLD-FORMED METAL FRAMING
05 40 00 00 CSF COLD-FORMED METAL FRAMING
05 50 00 00 CSF METAL FABRICATIONS**
05 50 00 00 MPF METAL FABRICATIONS**
05 52 13 00 CSF PIPE AND TUBE RAILINGS
05 52 13 00 MPF PIPE AND TUBE RAILINGS
05 53 13 00 Gratings
05 58 16 00 Ornamental Formed Metal

06 Wood, Plastics, and Composites

06 01 20 91 Wood Restoration
06 05 73 33 Wood Decking
06 10 00 00 CSF ROUGH CARPENTRY
06 10 53 00 R&A MISCELLANEOUS ROUGH CARPENTRY FOR ROOF REPLACEMENT
06 15 16 00 R&A WOOD ROOF DECK REPAIR AND REPLACEMENT
06 16 23 00 Sheathing
06 17 53 00 CSF SHOP-FABRICATED WOOD TRUSSES**
06 20 00 00 CSF FINISH CARPENTRY**
06 25 16 00 Paneling
06 41 16 00 MPF PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS**
06 42 19 00 Plastic Paneling
06 51 13 00 Plastic Lumber
06 51 13 00a Composite Plastic Lumber
06 51 13 00b Structural Plastic Lumber
06 74 13 00 Pultruded Fiberglass Industrial Grating
06 81 13 00 Pultruded Fiberglass Structural Shapes

07 Thermal And Moisture Protection

07 01 51 00 R&A BITUMINOUS ROOFING REPAIR
07 01 52 00 R&A SINGLE-PLY ROOFING REPAIR
07 11 13 00 CSF BITUMINOUS DAMPPROOFING
07 19 00 00 CSF WATER REPELLENTS
07 21 00 00 MPF THERMAL INSULATION
07 21 00 00 CSF THERMAL INSULATION**
07 22 15 00 R&A INSULATION UNDERLAYMENT FOR ROOF REPLACEMENT
07 22 21 00 R&A ROOF INSULATION AND COVER BOARD OVER INSULATION UNDERLAYMENT
07 22 23 00 R&A ROOF INSULATION AND COVER BOARD OVER STEEL AND WOOD ROOF DECKS
07 24 13 00 Water-Drainage Exterior Insulation and Finish System (EIFS)
07 31 00 00 CSF SHINGLES AND SHAKES
07 31 13 00 R&A ASPHALT SHINGLE ROOFING
07 31 33 00 Composite Rubber Shingles
07 41 13 00 CSF METAL ROOF PANELS
07 46 00 00 CSF SIDING
07 46 16 00 Metal Wall Panels
07 46 16 00a Metal Plate Wall Panels
07 46 63 00 Insulated-Core Metal Wall Panels
07 51 13 00 CSF BUILT-UP ASPHALT ROOFING**

07 51 13 00	R&A BUILT-UP ASPHALT ROOFING
07 51 13 00	MPF BUILT-UP ASPHALT ROOFING**
07 51 16 00	R&A BUILT-UP COAL TAR PITCH ROOFING
07 51 16 00	CSF BUILT-UP COAL TAR PITCH ROOFING**
07 51 16 00	MPF BUILT-UP COAL TAR PITCH ROOFING**
07 52 00 00	MPF MODIFIED BITUMINOUS MEMBRANE ROOFING**
07 52 00 00	CSF MODIFIED BITUMINOUS MEMBRANE ROOFING**
07 52 13 00	R&A APP MODIFIED BITUMEN ROOFING
07 52 15 00	R&A MB SURFACING PLY OVER BUR ROOFING
07 52 16 00	CSF SBS MODIFIED BITUMEN ROOFING IN COLD ADHESIVE**
07 52 16 00	MPF SBS MODIFIED BITUMEN ROOFING IN COLD ADHESIVE**
07 52 16 00	R&A SBS MODIFIED BITUMEN ROOFING IN COLD ADHESIVE
07 52 17 00	CSF SBS MODIFIED BITUMEN ROOFING IN HOT ASPHALT**
07 52 17 00	MPF SBS MODIFIED BITUMEN ROOFING IN HOT ASPHALT**
07 52 17 00	R&A SBS MODIFIED BITUMEN ROOFING IN HOT ASPHALT
07 53 16 00	CSF CHLOROSULFONATE- POLYETHYLENE (CSPE) ROOFING
07 53 23 00	CSF ETHYLENE-PROPYLENE-DIENE-MONOMER ROOFING
07 53 24 00	R&A FULLY-ADHERED EPDM ROOFING
07 54 19 00	MPF POLYVINYL-CHLORIDE MEMBRANE ROOFING
07 54 19 00	CSF POLYVINYL-CHLORIDE MEMBRANE ROOFING
07 54 20 00	R&A FULLY-ADHERED PVC ROOFING
07 54 23 00	MPF THERMOPLASTIC-POLYOLEFIN ROOFING
07 54 23 00	CSF THERMOPLASTIC-POLYOLEFIN ROOFING
07 56 00 00	R&A ACRYLIC ELASTOMERIC ROOF COATING FOR SHEET METAL ROOFING
07 61 00 00	CSF SHEET METAL ROOFING
07 61 13 00	CSF STANDING SEAM SHEET METAL ROOFING
07 61 13 00	MPF STANDING SEAM SHEET METAL ROOFING
07 61 13 00	R&A STANDING SEAM SHEET METAL ROOFING
07 62 00 00	CSF SHEET METAL FLASHING AND TRIM
07 62 02 00	CSF SHEET METAL FOR BUILT-UP ROOFING
07 62 02 00	R&A SHEET METAL FOR BUILT-UP ROOFING
07 62 02 00	MPF SHEET METAL FOR BUILT-UP ROOFING
07 62 03 00	MPF SHEET METAL FOR MODIFIED BITUMEN ROOFING
07 62 03 00	CSF SHEET METAL FOR MODIFIED BITUMEN ROOFING
07 62 03 00	R&A SHEET METAL FOR MODIFIED BITUMEN ROOFING
07 62 05 00	R&A SHEET METAL FOR EPDM ROOFING
07 62 05 00	MPF SHEET METAL FOR EPDM ROOFING
07 62 05 00	CSF SHEET METAL FOR EPDM ROOFING
07 62 07 00	R&A SHEET METAL FOR PVC ROOFING
07 62 07 00	CSF SHEET METAL FOR PVC ROOFING
07 62 07 00	MPF SHEET METAL FOR PVC ROOFING
07 72 13 00	CSF MANUFACTURED CURBS
07 72 33 00	CSF ROOF HATCHES
07 72 56 00	Heat Tracing for Fire-Suppression Piping
07 72 56 00a	Heat Tracing for Plumbing Piping
07 72 56 00b	Heat Tracing for HVAC Piping
07 84 00 00	CSF FIRESTOPPING
07 84 00 00	MPF FIRESTOPPING
07 92 00 00	CSF JOINT SEALANTS
07 92 00 00	MPF JOINT SEALANTS
07 92 01 00	R&A SEALANTS FOR ROOF REPLACEMENT

08 Openings

08 11 00 00	CSF METAL DOORS AND FRAMES**
08 11 00 00	MPF METAL DOORS AND FRAMES**
08 14 00 00	MPF WOOD DOORS**
08 14 00 00	CSF WOOD DOORS**
08 14 16 00	Flush Wood Doors
08 16 13 00	Fiberglass Reinforced Plastic (FRP) Doors and Frames
08 16 13 00a	Insulated Fiberglass Doors and Frames
08 16 13 00b	Fiberglass Reinforced Polyester (FRP) Flush Doors
08 30 00 00	MPF SPECIALTY DOORS AND FRAMES**
08 31 13 00	CSF ACCESS DOORS AND FRAMES
08 33 23 00	CSF OVERHEAD COILING DOORS**
08 33 36 00	Side Coiling Grilles
08 35 00 00	CSF FOLDING DOORS AND GRILLES**
08 35 00 00	MPF FOLDING DOORS AND GRILLES**

08 36 13 00	CSF SECTIONAL DOORS
08 36 13 00	MPF SECTIONAL DOORS
08 36 14 00	MPF SECTIONAL KNOCKOUT DOORS**
08 38 00 00	CSF TRAFFIC DOORS**
08 38 00 00	MPF TRAFFIC DOORS**
08 41 13 00	CSF ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS**
08 41 13 00	MPF ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS**
08 42 29 00	CSF AUTOMATIC ENTRANCES**
08 42 29 00	MPF AUTOMATIC ENTRANCES**
08 45 00 00	CSF TRANSLUCENT WALL AND ROOF ASSEMBLIES
08 51 13 00	CSF ALUMINUM WINDOWS
08 52 00 00	CSF WOOD WINDOWS
08 53 13 00	Vinyl Windows
08 62 00 00	CSF UNIT SKYLIGHTS
08 63 00 00	Fiberglass-Sandwich-Panel Assemblies
08 71 00 00	MPF DOOR HARDWARE**
08 71 00 00	CSF DOOR HARDWARE**
08 80 00 00	MPF GLAZING
08 80 00 00	CSF GLAZING
08 87 14 00	MPF SOLAR CONTROL GLAZING FILMS
08 87 14 00	CSF SOLAR CONTROL GLAZING FILMS
08 87 53 00	Fragment Retention Film For Glass
08 90 00 00	MPF LOUVERS AND VENTS
08 90 00 00	CSF LOUVERS AND VENTS

09 Finishes

09 01 60 00	Portland Cement Terrazzo Flooring
09 22 13 00	Gypsum Plaster
09 22 13 00a	Gypsum Veneer Plaster
09 22 13 00b	Portland Cement Plaster
09 22 16 00	CSF NON-STRUCTURAL METAL FRAMING
09 22 16 13	Non-Load-Bearing Steel Framing
09 22 36 23	Lath and Plaster Renovation
09 23 13 00	Gypsum Board Renovation
09 29 00 00	CSF GYPSUM BOARD**
09 29 00 00	MPF GYPSUM BOARD**
09 31 00 00	Ceramic Tile
09 51 13 00	CSF ACOUSTICAL PANEL CEILINGS**
09 51 13 00	MPF ACOUSTICAL PANEL CEILINGS**
09 51 23 00	Acoustical Tile Ceilings
09 51 33 00	Acoustical Metal Pan Ceilings
09 54 23 00	CSF LINEAR METAL CEILINGS
09 62 15 00	JURATILE FLOORING
09 65 00 00	CSF RESILIENT FLOORING**
09 65 00 00	MPF RESILIENT FLOORING**
09 65 13 13	Cork Flooring
09 66 23 16	Resinous Matrix Terrazzo Flooring
09 67 23 00	MPF RESINOUS FLOORING
09 67 23 00	CSF RESINOUS FLOORING
09 68 00 00	MPF CARPET
09 91 00 00	CSF PAINTING**
09 91 00 00	MPF PAINTING**
09 91 13 00	High-Temperature-Resistant Coatings
09 91 23 00	Interior Painting
09 96 56 00	CSF EPOXY COATINGS
09 96 56 00	MPF EPOXY COATINGS
09 96 56 00b	Fiberglass Reinforced Epoxy Coating

10 Specialties

10 14 04 00	CSF POSTAL SIGNAGE**
10 14 04 00	MPF POSTAL SIGNAGE**

10 14 14 00	CSF MISCELLANEOUS SIGNAGE
10 14 14 00	MPF MISCELLANEOUS SIGNAGE
10 14 53 00	CSF TRAFFIC SIGNAGE**
10 15 00 00	CSF BULLETIN BOARDS
10 21 13 00	CSF WIRE MESH PARTITIONS**
10 21 13 00	MPF WIRE MESH PARTITIONS**
10 21 13 19	Solid Surface Material Toilet Compartments
10 21 14 00	CSF TOILET COMPARTMENTS
10 21 15 00	CSF TOILET COMPARTMENTS
10 21 15 00	MPF TOILET COMPARTMENTS
10 21 16 00	Cubicle Curtains and Tracks
10 22 19 13	Demountable Partitions
10 26 00 00	CSF WALL AND DOOR PROTECTION
10 26 00 00	MPF WALL AND DOOR PROTECTION
10 26 13 00	CSF CORNER GUARDS
10 28 13 00	CSF TOILET ACCESSORIES**
10 28 13 00	MPF TOILET ACCESSORIES**
10 44 00 00	CSF FIRE PROTECTION SPECIALTIES
10 44 00 00	MPF FIRE PROTECTION SPECIALTIES
10 44 13 00	Fire Extinguisher Cabinets
10 44 16 13	Fire Extinguishers
10 51 13 00	Wire Basket Lockers
10 51 13 00a	MPF METAL LOCKERS**
10 51 13 00a	CSF METAL LOCKERS**
10 55 23 23	Postal Specialties
10 55 26 00	CSF PARCEL LOCKERS**
10 56 13 16	Metal Storage Shelving
10 73 13 00	Awnings
10 73 16 00	CSF CANOPIES
10 75 00 00	CSF FLAGPOLES
10 75 00 00	MPF FLAGPOLES
10 81 13 00	Oriented Flexible Netting Bird Barrier
10 81 13 00a	MPF BIRD CONTROL DEVICES
10 88 00 00	CSF SCALES**

11 Equipment

11 11 04 00	MPF BATTERY CHARGING RACKS**
11 12 00 00	CSF PARKING CONTROL EQUIPMENT
11 12 00 00	MPF PARKING CONTROL EQUIPMENT
11 13 00 00	CSF LOADING DOCK EQUIPMENT**
11 13 00 00	MPF LOADING DOCK EQUIPMENT**
11 13 04 00	CSF DOCK LIFT (SCISSORS TYPE)**
11 14 14 00	CSF PORTABLE POSTS AND RAILINGS**
11 14 15 00	MPF TURNSTILES
11 17 04 00	CSF BULLET RESISTANT SCREENLINE
11 26 00 00	CSF UNIT KITCHENS
11 40 00 00	MPF FOODSERVICE EQUIPMENT**
11 53 34 00	CSF PORTABLE EMERGENCY EYEWASH STATIONS

12 Furnishings

12 20 00 00	CSF WINDOW TREATMENTS
12 22 13 00	Draperies and Tracks
12 31 16 00	Kitchen Casework, Stainless Steel Cabinets
12 32 16 00	CSF MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK
12 32 16 00	MPF MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK
12 35 04 00	CSF POSTAL CASEWORK**
12 35 04 00	MPF POSTAL CASEWORK**
12 36 23 13	Stone Countertops
12 41 04 00	CSF PORTABLE SAFETY LADDERS
12 48 13 00	CSF ENTRANCE FLOOR MATS AND FRAMES**
12 48 13 00	MPF ENTRANCE FLOOR MATS AND FRAMES**
12 56 53 00	Laboratory Casework
12 59 13 00	Systems Furniture

12 93 13 00 Miscellaneous Site and Street Furnishings

13 Special Construction

13 27 00 00 CSF VAULTS**
13 34 19 00 MPF METAL BUILDING SYSTEMS
13 60 00 00 MPF MOTOR FUEL UNDERGROUND STORAGE TANKS
13 60 05 00 R&A REMOVAL OF UNDERGROUND STORAGE TANKS
13 60 10 00 MPF UNDERGROUND MOTOR FUEL PIPING AND RELATED SYSTEMS
13 60 20 00 MPF MOTOR FUEL ELECTRICAL SYSTEM

14 Conveying Equipment

14 21 00 00 MPF ELECTRIC TRACTION ELEVATORS
14 24 00 00 MPF HYDRAULIC ELEVATORS
14 26 00 00 Limited-Use/Limited-Application Elevators
14 45 00 00 MPF VEHICLE LIFTS
14 45 00 00 CSF VEHICLE LIFTS

21 Fire Suppression

21 00 00 00 CSF FIRE SUPPRESSION
21 00 00 00 MPF FIRE SUPPRESSION
21 05 00 00 Common Work Results for Fire Suppression
21 05 19 00 Meters and Gages for Plumbing Piping
21 05 19 00a Meters and Gages for HVAC Piping
21 11 19 00 Fire-Suppression Standpipes
21 13 13 00 Wet-Pipe Fire-Suppression Sprinklers
21 13 16 00 Dry-Pipe Fire-Suppression Sprinklers
21 16 00 00 Pressure-Maintenance Pumps
21 31 13 00 Electric-Drive, Centrifugal Fire Pumps
21 31 16 00 Diesel-Drive, Centrifugal Fire Pumps

22 Plumbing

22 00 00 00 MPF PLUMBING
22 01 40 00 Emergency Plumbing Fixtures
22 05 00 00 CSF COMMON WORK RESULTS FOR PLUMBING
22 05 00 00 MPF COMMON WORK RESULTS FOR PLUMBING
22 05 23 00 Piped Utilities Basic Materials And Methods
22 05 23 00a General-Duty Valves for Plumbing Piping
22 05 23 00b General-Duty Valves for HVAC Piping
22 05 76 00 Storm Drainage Piping Specialties
22 07 19 00 Fire-Suppression Systems Insulation
22 07 19 00a CSF PLUMBING PIPING INSULATION
22 08 00 00 MPF COMMISSIONING OF PLUMBING**
22 10 00 00 CSF PLUMBING PIPING AND PUMPS
22 11 16 00 Compressed-Air Piping For Laboratory And Healthcare Facilities
22 11 16 00a Vacuum Piping For Laboratory And Healthcare Facilities
22 11 16 00b Gas Piping For Laboratory And Healthcare Facilities
22 11 16 00c CSF DOMESTIC WATER PIPING
22 11 16 00c MPF DOMESTIC WATER PIPING
22 11 19 00 Electronic Air Cleaners
22 11 19 00a CSF DOMESTIC WATER PIPING SPECIALTIES
22 11 19 00a MPF DOMESTIC WATER PIPING SPECIALTIES
22 11 23 39 Water Supply Wells
22 12 23 26 Facility Fuel-Oil Piping



22 13 16 00	CSF SANITARY WASTE AND VENT PIPING
22 13 16 00	MPF SANITARY WASTE AND VENT PIPING
22 13 19 00	CSF SANITARY WASTE PIPING SPECIALTIES
22 13 19 00	MPF SANITARY WASTE PIPING SPECIALTIES
22 13 19 13	High-Efficiency Particulate Filtration
22 13 29 13	Sewage Pumps
22 14 13 00	CSF FACILITY STORM DRAINAGE PIPING
22 14 13 00	MPF FACILITY STORM DRAINAGE PIPING
22 14 29 13	Sump Pumps
22 15 13 00	MPF COMPRESSED-AIR PIPING
22 15 19 00	MPF GENERAL-SERVICE PACKAGED AIR COMPRESSORS AND RECEIVERS
22 33 00 00	CSF ELECTRIC DOMESTIC WATER HEATERS**
22 34 00 00	Fuel-Fired, Domestic Water Heaters
22 40 00 00	MPF PLUMBING FIXTURES
22 40 00 00	CSF PLUMBING FIXTURES
22 43 39 00	Medical Plumbing Fixtures
22 45 00 00	MPF EMERGENCY PLUMBING FIXTURES
22 45 00 00	CSF EMERGENCY PLUMBING FIXTURES
22 47 00 00	MPF DRINKING FOUNTAINS AND WATER COOLERS
22 66 83 16	Chemical-Waste Systems for Laboratory and Healthcare Facilities

23 Heating, Ventilating, And Air-Conditioning (HVAC)

23 01 30 51	HVAC Air-Distribution System Cleaning
23 01 50 00	Cast-Iron Boilers
23 01 60 00	Condensing Units
23 05 00 00	CSF COMMON WORK RESULTS FOR HVAC
23 05 00 00	MPF COMMON WORK RESULTS FOR HVAC
23 05 16 00	Expansion Fittings and Loops for Plumbing Piping
23 05 16 00a	Expansion Fittings and Loops for HVAC Piping
23 05 23 00	MPF GENERAL DUTY VALVES FOR HVAC PIPING
23 05 23 00	CSF GENERAL DUTY VALVES FOR HVAC PIPING
23 05 29 00	Hangers and Supports for Plumbing Piping and Equipment
23 05 29 00a	Hangers and Supports for HVAC Piping and Equipment
23 05 48 00	Vibration And Seismic Controls For Fire-Suppression Piping And Equipment
23 05 48 00a	Vibration And Seismic Controls For Plumbing Piping And Equipment
23 05 48 00b	Vibration And Seismic Controls For HVAC Piping And Equipment
23 05 53 00	Identification for Plumbing Piping and Equipment
23 05 53 00a	Identification for HVAC Piping and Equipment
23 05 93 00	CSF TESTING, ADJUSTING AND BALANCING FOR HVAC
23 05 93 00	MPF TESTING, ADJUSTING AND BALANCING FOR HVAC
23 07 13 00	MPF DUCT INSULATION**
23 07 13 00	CSF DUCT INSULATION**
23 07 19 00	MPF HVAC PIPING INSULATION**
23 07 19 00	CSF HVAC PIPING INSULATION**
23 08 00 00	CSF COMMISSIONING OF HVAC**
23 08 00 00	MPF COMMISSIONING OF HVAC**
23 09 04 00	CSF INSTRUMENTATION AND CONTROL FOR HVAC (CSF MEDIUM)
23 09 05 00	CSF INSTRUMENTATION AND CONTROL FOR HVAC (CSF SMALL)
23 09 15 00	CSF VARIABLE FREQUENCY MOTOR CONTROLLERS
23 09 15 00	MPF VARIABLE SPEED DRIVES
23 11 23 00	Facility Liquefied-Petroleum Gas Piping
23 11 23 00a	CSF FACILITY NATURAL-GAS PIPING
23 11 23 00a	MPF FACILITY NATURAL-GAS PIPING
23 21 13 23	Radiant Heating Piping
23 21 23 00	MPF HYDRONIC PUMPS
23 22 13 00	MPF STEAM AND CONDENSATE HEATING PIPING
23 23 00 00	CSF REFRIGERANT PIPING
23 23 00 00	MPF REFRIGERANT PIPING
23 23 16 00	Refrigerant Detection And Alarm
23 25 13 00	HVAC Water Treatment
23 31 00 00	CSF HVAC DUCTS AND CASINGS**
23 31 00 00	MPF HVAC DUCTS AND CASINGS
23 33 00 00	MPF AIR DUCT ACCESSORIES
23 33 00 00	CSF AIR DUCT ACCESSORIES
23 33 13 13	Draft Control Devices
23 34 14 00	CSF CIRCULATING FANS
23 34 16 00	CSF CENTRIFUGAL HVAC FANS

23 34 23 00	MPF VAC POWER VENTILATORS
23 36 00 00	MPF AIR TERMINAL UNITS
23 36 00 00	CSF AIR TERMINAL UNITS
23 37 13 00	MPF DIFFUSERS, REGISTERS, AND GRILLES
23 37 13 00	CSF DIFFUSERS, REGISTERS AND GRILLES
23 41 00 00	MPF PARTICULATE AIR FILTRATION
23 42 13 00	Gas-Phase Air Filtration
23 51 00 00	MPF BREECHINGS, CHIMNEYS, AND STACKS
23 51 00 00	CSF BREECHINGS, CHIMNEYS, AND STACKS
23 52 13 00	Electric Boilers
23 52 16 00	CSF CONDENSING BOILERS
23 52 16 00	MPF CONDENSING BOILERS
23 52 33 16	Water-Tube Boilers
23 52 36 00	Fire-Tube Boilers
23 55 23 00	CSF GAS-FIRED RADIANT HEATERS
23 55 23 00	MPF GAS-FIRED RADIANT HEATERS
23 55 23 13	Radiant Heating and Cooling Units
23 55 23 13a	Radiant-Heating Electric Panels
23 57 13 00	Heat Exchangers
23 61 16 00	Rotary-Screw Water Chillers
23 62 13 00	Indirect-Fired Absorption Water Chillers
23 63 13 00	Air-Cooled Condensers
23 64 13 16	Direct-Fired Absorption Water Chillers
23 64 16 00	MPF CENTRIFUGAL WATER CHILLERS
23 64 16 16	Fan-Coil Units
23 64 19 00	Reciprocating Water Chillers
23 64 23 00	Scroll Water Chillers
23 64 23 00a	MPF AIR-COOLED ROTARY WATER CHILLERS
23 64 23 00a	CSF AIR-COOLED ROTARY WATER CHILLERS
23 65 00 00	CSF COOLING TOWERS
23 65 00 00	MPF COOLING TOWERS
23 72 00 00	MPF AIR-TO-AIR ENERGY RECOVERY EQUIPMENT
23 73 13 00	MPF MODULAR INDOOR AIR-HANDLING UNITS
23 74 13 00	Packaged, Outdoor, Central-Station Air-Handling Units
23 74 13 00a	Rooftop Replacement Air Units
23 74 13 00b	Self-Contained Air-Conditioners
23 74 23 00	Direct-Fired, Makeup Air Units
23 74 23 00a	Indirect-Fired, Packaged H&V Units
23 74 70 00	CSF ELECTRIC HEATERS
23 76 13 00	Mechanical Dehumidification Units
23 81 00 00	MPF DECENTRALIZED UNITARY HVAC EQUIPMENT**
23 81 00 00	CSF DECENTRALIZED UNITARY HVAC EQUIPMENT
23 81 13 00	Packaged Terminal Air Conditioners
23 81 23 00	MPF COMPUTER-ROOM AIR-CONDITIONERS
23 81 26 00	CSF SPLIT-SYSTEM AIR CONDITIONERS
23 82 16 00	Air Coils
23 82 29 00	Convection Heating Units
23 82 39 00	CSF UNIT HEATERS
23 82 39 00	MPF UNIT HEATERS
23 83 13 00	Radiant-Heating Electric Cables
23 84 13 00	MPF HUMIDIFIERS

25 Integrated Automation

25 05 04 00	MPF BUILDING AUTOMATION SYSTEM (BAS) GENERAL
25 08 04 00	MPF BUILDING AUTOMATION SYSTEM (BAS) COMMISSIONING
25 11 04 00	MPF METERING DEVICES
25 13 04 00	CSF FACILITY SYSTEM INTEGRATION INTO ENTERPRISE ENERGY MANAGEMENT
25 14 04 00	MPF BAS EQUIPMENT, SOFTWARE AND PROGRAMMING
25 30 04 00	MPF BAS BASIC MATERIALS AND SENSORS
25 51 04 00	MPF EEMS INTEGRATION
25 90 04 00	MPF SEQUENCE OF OPERATION**

26 Electrical

26 05 00 00	MPF COMMON WORK RESULTS FOR ELECTRICAL
26 05 00 00	CSF COMMON WORK RESULTS FOR ELECTRICAL
26 05 13 00	Undercarpet Cables
26 05 13 00a	MPF MEDIUM VOLTAGE CABLES (5 KV – 15 KV)
26 05 19 00	MPF LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
26 05 19 00	CSF LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
26 05 19 13	Electrical Renovation
26 05 19 16	Control-Voltage Electrical Power Cables
26 05 19 16a	Communications Equipment Room Fittings
26 05 19 16b	Communications Backbone Cabling
26 05 19 16c	Communications Horizontal Cabling
26 05 19 16d	Conductors and Cables for Electronic Safety and Security
26 05 19 23	Monorails With Electric Powered Hoists
26 05 26 00	Grounding And Bonding
26 05 29 00	Hangers And Supports For Electrical Systems
26 05 29 00a	Vibration And Seismic Controls For Electrical Systems
26 05 33 00	CSF RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS
26 05 33 00	MPF RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS
26 05 36 00	Cable Trays
26 06 23 00	MPF LIGHTING CONTROL DEVICES**
26 06 23 00	CSF LIGHTING CONTROLS DEVICES**
26 06 23 00	R&A LIGHTING CONTROL DEVICES (MPF)**
26 08 00 00	MPF COMMISSIONING OF ELECTRICAL SYSTEMS
26 08 00 00	CSF COMMISSIONING OF ELECTRICAL SYSTEMS
26 09 23 00	Electrical Power Monitoring And Control
26 09 23 00a	Motor-Control Centers
26 09 23 00b	Central Dimming Controls
26 09 23 00c	Modular Dimming Controls
26 11 16 00	Switchgear
26 11 16 00a	MPF SECONDARY UNIT SUBSTATIONS
26 12 13 00	Low-Voltage Transformers
26 12 16 00	MPF DRY-TYPE, MEDIUM-VOLTAGE TRANSFORMERS
26 13 13 00	MPF METAL-CLAD MEDIUM VOLTAGE CIRCUIT BREAKER SWITCHGEAR
26 13 17 00	MPF MEDIUM-VOLTAGE INTERRUPTER SWITCHGEAR
26 14 14 00	MPF INFRARED VIEWING PANES (IR WINDOWS)
26 22 00 00	MPF SECONDARY DRY TYPE TRANSFORMERS**
26 22 00 00	CSF SECONDARY DRY-TYPE TRANSFORMERS**
26 24 13 00	Electricity Metering
26 24 13 00a	CSF SWITCHBOARDS
26 24 13 00a	MPF SWITCHBOARDS
26 24 16 00	MPF PANELBOARDS
26 24 16 00	CSF PANELBOARDS
26 24 19 00	Power Distribution Units
26 27 26 00	CSF WIRING DEVICES
26 27 26 00	MPF WIRING DEVICES
26 28 13 00	Fuses
26 28 16 00	MPF ENCLOSED SWITCHES AND CIRCUIT BREAKERS
26 28 16 00	CSF ENCLOSED SWITCHES
26 29 23 00	CSF VARIABLE FREQUENCY MOTOR CONTROLLERS
26 29 34 00	MPF VARIABLE SPEED DRIVES
26 31 00 00	Photovoltaic Energy Equipment
26 32 13 13	Packaged Engine Generators
26 33 43 00	Central Battery Inverters
26 33 43 00a	Public Address and Mass Notification Systems
26 35 33 00	Power Factor Correction Capacitors
26 36 13 00	Transfer Switches
26 41 00 00	MPF FACILITY LIGHTNING PROTECTION
26 41 13 00	CSF LIGHTNING PROTECTION FOR STRUCTURES
26 41 28 00	MPF SURGE PROTECTIVE DEVICES (SPDS)
26 41 28 00	CSF SURGE PROTECTIVE DEVICES (SPDS)
26 42 13 00	Cathodic Protection
26 43 13 00	Transient Voltage Suppression
26 51 00 00	MPF INTERIOR LIGHTING**
26 51 00 00	CSF INTERIOR LIGHTING**
26 56 00 00	CSF EXTERIOR LIGHTING**
26 56 00 00	MPF EXTERIOR LIGHTING**

27 Communications

27 05 00 00	CSF COMMON WORK RESULTS FOR COMMUNICATIONS**
27 05 00 00	MPF COMMON WORK RESULTS FOR COMMUNICATIONS**
27 11 00 00	MPF COMMUNICATIONS EQUIPMENT ROOM FITTINGS
27 11 00 00	CSF COMMUNICATIONS EQUIPMENT ROOM FITTINGS
27 13 00 00	MPF COMMUNICATIONS BACKBONE CABLING**
27 13 00 00	CSF COMMUNICATIONS BACKBONE CABLING**
27 15 00 00	MPF COMMUNICATIONS HORIZONTAL CABLING**
27 15 00 00	CSF COMMUNICATIONS HORIZONTAL CABLING**
27 51 16 00	MPF PUBLIC ADDRESS AND PAGING SYSTEMS
27 51 16 00	CSF PUBLIC ADDRESS PAGING SYSTEMS
27 51 17 00	MPF VIDEO INTERCOM AND EXTERIOR GATE CONTROL SYSTEM
27 51 23 00	CSF INTERCOMMUNICATION AND PROGRAM SYSTEMS
27 53 13 00	MPF WIRELESS, SYNCHRONIZED, GPS CLOCK SYSTEM

28 Electronic Safety And Security

28 13 04 00	MPF ENTERPRISE PHYSICAL ACCESS CONTROL SYSTEM**
28 16 00 00	CSF INTRUSION DETECTION SYSTEM**
28 16 00 00	MPF INTRUSION DETECTION**
28 23 00 00	Video Surveillance
28 23 04 00	CSF SECURITY, BURGLARY AND ROBBERY COUNTERMEASURES ANALOG CCTV
28 23 04 00	MPF SECURITY, BURGLARY AND ROBBERY COUNTERMEASURES ANALOG CCTV
28 23 05 00	MPF INTEGRATED SECURITY AND INVESTIGATIVE PLATFORM (ISIP) CCTV SYSTEM**
28 23 05 00	CSF INTEGRATED SECURITY AND INVESTIGATIVE PLATFORM (ISIP) CCTV SYSTEM**
28 31 00 00	CSF FIRE DETECTION AND ALARM
28 31 00 00	MPF FIRE DETECTION AND ALARM
28 31 23 00	Digital, Addressable Fire-Alarm System
28 31 23 00a	Zoned (DC Loop) Fire-Alarm System

31 Earthwork

31 00 00 00	Earthwork
31 10 00 00	CSF SITE CLEARING**
31 10 00 00	MPF SITE CLEARING**
31 20 00 00	MPF EARTH MOVING
31 20 00 00	CSF EARTH MOVING
31 23 00 00	MPF EXCAVATION AND FILL
31 23 00 00	CSF EXCAVATION AND FILL
31 23 16 13	Excavation Support And Protection
31 23 17 00	MPF ROCK EXCAVATION
31 23 17 00	CSF ROCK EXCAVATION
31 25 00 00	MPF EROSION AND SEDIMENTATION CONTROLS
31 25 00 00	CSF EROSION AND SEDIMENTATION CONTROLS
31 31 00 00	MPF SOIL TREATMENT
31 31 00 00	CSF SOIL TREATMENT
31 32 00 00	CSF SOIL STABILIZATION
31 32 00 00	MPF SOIL STABILIZATION
31 32 13 16	Soil Stabilization-Lime
31 62 19 00	CSF TIMBER PILES
31 62 19 00	MPF TIMBER PILES
31 62 23 00	CSF COMPOSITE PILES
31 62 23 00	MPF COMPOSITE PILES
31 63 29 00	MPF DRILLED CONCRETE PIERS AND SHAFTS
31 63 29 00	CSF DRILLED CONCRETE PIERS AND SHAFTS

32 Exterior Improvements

32 01 11 53	Cement Concrete Pavement
32 01 16 71	Grinding/Grooving Pavement
32 01 90 00	CSF OPERATION AND MAINTENANCE OF PLANTING**
32 01 90 00	MPF OPERATION AND MAINTENANCE OF PLANTING**
32 12 16 00	MPF ASPHALT PAVING
32 12 16 00	CSF ASPHALT PAVING
32 13 13 00	CSF CONCRETE PAVING
32 13 13 00	MPF CONCRETE PAVING
32 13 13 17	Roller Compacted Concrete Pavement
32 14 43 00	Porous Unit Paving
32 14 43 00a	Vitrified Brick Pavement Replacement
32 17 23 00	CSF PAVEMENT MARKINGS
32 17 23 00	MPF PAVEMENT MARKINGS
32 17 26 00	Tactile/Detectable Warning Tile
32 18 26 00	Lawns And Grasses
32 31 13 00	CSF CHAIN LINK FENCES AND GATES**
32 31 13 00	MPF CHAIN LINK FENCES AND GATES**
32 31 19 00	Ornamental Metal Fences and Gates
32 33 00 00	CSF SITE FURNISHINGS
32 84 13 00	Irrigation Systems
32 91 13 00	CSF SOIL PREPARATION
32 91 19 13	Septic Tank Systems
32 92 00 00	MPF TURF AND GRASSES**
32 92 00 00	CSF TURF AND GRASSES**
32 93 00 00	MPF PLANTS**
32 93 00 00	CSF PLANTS**

33 Utilities

33 01 30 72	Pipe Lining
33 11 00 00	CSF WATER UTILITY DISTRIBUTION PIPING
33 11 00 00	MPF WATER UTILITY DISTRIBUTION PIPING
33 20 00 00	MPF WELLS
33 20 00 00	CSF WELLS
33 30 00 00	CSF SANITARY SEWERAGE UTILITIES
33 30 00 00	MPF SANITARY SEWERAGE UTILITIES
33 36 00 00	CSF UTILITY SEPTIC TANKS
33 36 00 00	MPF UTILITY SEPTIC TANKS
33 40 00 00	MPF STORM DRAINAGE UTILITIES
33 40 00 00	CSF STORM DRAINAGE UTILITIES
33 42 16 13	Culverts
33 44 19 19	Oil/Water Separator
33 46 13 00	CSF FOUNDATION DRAINAGE
33 46 13 00	MPF FOUNDATION DRAINAGE
33 49 13 00	MPF STORM DRAINAGE MANHOLES, FRAMES, AND COVERS
33 49 13 00	CSF STORM DRAINAGE MANHOLES, FRAMES, AND COVERS
33 51 00 00	MPF NATURAL-GAS DISTRIBUTION
33 51 00 00	CSF NATURAL-GAS DISTRIBUTION
33 71 73 00	CSF ELECTRICAL UTILITY SERVICES**
33 71 73 00	MPF ELECTRICAL UTILITY SERVICES

34 Transportation

34 71 13 16	Active Vehicle Barriers
34 71 13 16a	Beam-Type Guardrail

41 Material Processing And Handling Equipment

41 01 20 00	Material Handling Hoists
41 22 23 13	Monorails With Air Motor Powered Hoist
41 22 23 13a	Monorails With Manual Hoist

Note: Sections indicated with double asterisks () have required Parts or Articles and are to be considered “mandatory”.**



SECTION 01 10 00 00 - SUMMARY OF WORK

NOTE TO SPECIFIER

This Section is intended for use with ALL project types: Design-Bid-Build (DBB), Design-Build (DB), Repair & Alteration (R&A) and New Construction Leased (NCL) type projects that use the Building Standard Design Specifications. Modify as needed for project specific requirements.

PART 1 - GENERAL

1.1 SCOPE

- A. The [Contractor – used in DDB, DB or R&A] or [Landlord – used in NCL] must provide all material, labor, tools, plant, supplies, equipment, transportation, superintendence, temporary construction of every nature, and all other services and facilities necessary to complete the construction of a postal facility for the Postal Service, including all incidental work described in the contract documents. [Insert the following in NCL projects - For purposes of this construction project, the terms "Landlord", "Lessor", "Owner", "Offeror", and "Contractor" are interchangeable and refer to the party whose proposal is accepted by the Postal Service. It is the Landlord's sole responsibility to clarify design and construction responsibilities among the Landlord's designers, contractors and other agents.]
- B. The scope of work is attached to the Contract.
- C. All work shall be in accordance with applicable codes and local regulations that may apply. In case of conflict in or between the Contract Documents and a governing code or ordinance, the more stringent standard shall apply.

NOTE TO SPECIFIER

Delete "Postal Service Furnished - Contractor Installed Equipment" paragraph if not applicable to Project.

1.2 POSTAL SERVICE FURNISHED – CONTRACTOR INSTALLED EQUIPMENT

- A. The Postal Service will furnish to the Contractor the equipment to be incorporated or installed in the work as identified in the Scope, Specifications, and/or drawings.
- B. The Contractor will complete the Postal Service Furnished – Contractor Installed Equipment form found in Attachment A, identifying quantities and desired delivery dates.
- C. Scheduling and installation must be in accordance with the terms and conditions of the contract provisions and clauses, including those concerning *Postal Service Property*.

1.3 MISCELLANEOUS CONTRACT EXPENSES

NOTE TO SPECIFIER

Complete as required for specific project.

- A. In accordance with the terms and conditions of the contract provisions and clauses, including those concerning *Permits and Responsibilities* and, *Building Codes, Fees and Charges*, the Contractor must include in its price proposal a separate line item for the cost each of the following fees or charges payable to State, local, or special community development agencies:
Water service connection and meter fee



Electrical company required fees	_____
Telephone company required fees	_____
Off-site inspection fees	_____
Sanitary sewer connection fee	_____
Environmental Permits/Registrations	_____
Other permits or fees	_____

- B. If the actual cost of any item identified above is more or less than the amount listed, the contract price will be adjusted accordingly by a contract modification. The adjustment will not include overhead and profit. The Contractor must, within 30 days after incurring the expenses, inform the Contracting Officer that the payment has been made. Evidence of the actual amount paid must be provided. The contract amount will be adjusted upward or downward as necessary to accommodate actual charges from the utilities. The Contractor must provide all coordination with the utilities in accomplishing their work and must make all payments to the utilities for their work.
- C. The Contractor must include all additional fees, as required, in the price proposal.

1.4 USPS DIRECT VENDOR EQUIPMENT OR SUPPLIES

- A. In accordance with the terms and conditions of the contract provisions and clauses, including those concerning, *Direct Vendor / Pre-selected Sources*, the Contractor is solely responsible for contracting with the Direct Vendor and ordering, payment, receiving, accepting, storage and installation of United States Postal Service Direct Vendor equipment or supplies. Ordering instructions are included in each specification section.
- B. The Contractor will off-load, inspect the delivered equipment or supplies to make sure they are in good condition, acknowledge receipt, and accept the delivered goods.

NOTE TO SPECIFIER

Edit the list of Direct Vendor items to reflect project requirements.

- C. Direct Vendor items in this contract are limited to specific items, as shown in the drawings and listed below:
1. Section 083614 – Sectional Knockout Doors
 2. Section 083800 - Traffic Doors
 3. Section 101404 - Postal Signage
 4. Section 111304 - Dock Lift (Scissors Type)
 5. Section 123504 - Postal Casework
 6. Section 282305 - Integrated Security and Investigative Platform (ISIP) CCTV System

1.5 USPS PRE-APPROVED VENDOR EQUIPMENT OR SUPPLIES

- A. The Contractor is solely responsible for contracting with the Pre-Approved Vendor and ordering, payment, receiving, accepting, storage and installation of United States Postal Service Pre-Approved Vendor equipment or supplies. Ordering instructions are included in each specification section.
- B. The Contractor will off-load, inspect the delivered equipment or supplies to make sure they are in good condition, acknowledge receipt, and accept the delivered goods.

NOTE TO SPECIFIER



Edit the list of Pre-Approved Vendor items to reflect project requirements.

- C. Pre-Approved Vendor items in this contract are limited to specific items, as shown in the drawings and listed below:
1. Section 083500 - Folding Doors and Grilles

1.6 MISCELLANEOUS EQUIPMENT CROSS-REFERENCE LIST

- A. The following table is a cross-reference for equipment that may be shown in the drawings. The Contractor is solely responsible for ordering, payment, receiving, accepting, storage and installation of the equipment or supplies as specified in each specification section. USPS Standards for Facility Accessibility Handbook RE-4 supersedes standards in question of conflict.

Equipment Number	Description	Specification Section
E300	Parcel Lockers 1'-3"	105526
E302	Parcel Lockers 2'-0"	105526
E401	Standard Clerk Workstation (Base Unit Only). Square Post (For Non-POS & POS Locations)	123504
	Kit, 5-Drawer w/ 2-Drawer Inserts (For Non-POS Locations Only)	123504
	Kit, 2-Stamp Drawers w/ 1 insert, Closure Panel (For POS Locations Only)	123504
E402	Accessible Counter Add-On, Option "A." 32" Wide, 34" High (For Non-POS & POS Locations)	123504
E403	Clerk Workstation w/ Accessible Option "B." 84" Wide, 34" High (COMPLETE UNIT with 36" HC counter - Same for both NON-POS & POS Locations)	123504
E404	Clerk Workstation w/ Accessible Option "C." 72" Wide, 34" High (COMPLETE UNIT with 24" HC counter - Same for both NON-POS & POS Locations)	123504
E406	Pedestrian Guidance Barrier	111414
E506	Employees Lockers	105113
E511	Fire Extinguisher	104400
E512	Office ladder	124104
E530	Window Blinds	122000
E531	Bench	105113

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED



USPS Specification issued: 10/1/2013

Postal Service Furnished – [Contractor] [Landlord] Installed Equipment					
Equipment Number	Postal Service Identification Number (PSIN)	Description	Quantity	Desired Delivery Dates	
				After	Before
	Facilities Items				
	0830	Vestibule Door Chain(s)			
	0831	Vestibule Padlock(s)			
	01032	Wire Basket (used as a retainer in conjunction with item 1807, Letter Drop Panel)	*		
	0912B	Cylinder for Corridor Doors opening directly into Inspector's private office within Inspection Suite; Evidence Storage; Interview Rooms.			
	0912C	Cylinder for Corridor Doors opening directly into Inspector's reception office; on all Inspector's Offices if not accessible through interconnecting doors.			
	0912D	Cylinder, Interior Lookout Gallery Doors			
	0931AHL	Left Hand Cylinder for exterior doors to Inspection Offices and/or entrance doors from public spaces to LOG and/or exterior doors to LOG.			
	0931AHR	Right Hand Cylinder for exterior doors to Inspection Offices and/or entrance doors from public spaces to LOG and/or exterior doors to LOG.			
	C1864	Glow light for Lookout Gallery			
	Retail Items				
E101	1577D	Letter Drop Unit			
E301	1809/1810	Rack Assembly and Cover (shipped as one unit)			
	1811	Post Office Box Side Trim (For 1800 and 1900 series)			
	1812A	Post Office Box Trim Strip, Lower (standard length, cut to fit)			
	1812B	Post Office Box Trim Strip, Upper (standard length, cut to fit)			
	1814	Letter Drop Plate			
	2901	No. 1 Assembly, 12 #1 Post Office Boxes Modules	*		
	2902	No. 2 Assembly, 8 #2 Post Office Boxes Modules	*		
	2903	No. 3 Assembly, 4 #3 Post Office Boxes Modules	*		
	2904	No. 4 Assembly, 2 #4 Post Office Boxes Drawer Modules	*		
	2905	No. 5 Assembly, 1 #5 Post Office Boxes Drawer Module	*		
E502		Key Case Wall Mount			
	Miscellaneous Items				
	None	Impact Cones (mechanization)	*		
	None	Extendible Conveyor (mechanization)	*		
	None	PSDS Cable (linear feet)	*		
	None	Floor Scale Cable (linear feet)	*		
	None	10 feet, 61 Conductor Cable, Female Drop	*		
	None	15 feet, 61 Conductor Cable, Female Drop	*		
	None	10 feet, 61 Conductor Cable, Male Drop	*		



Postal Service Furnished – [Contractor] [Landlord] Installed Equipment					
Equipment Number	Postal Service Identification Number (PSIN)	Description	Quantity	Desired Delivery Dates	
				After	Before
	None	15 feet, 61 Conductor Cable, Male Drop	*		
	None	PSDS Scales and Auxiliary Equipment			

The [Contractor] [Landlord] is responsible for determining equipment quantities and the desired delivery dates and providing them to the contracting officer within 45 days of Notice to Proceed. The [Contractor] [Landlord] is responsible for assembling and installing this equipment. Note that certain equipment not listed above, such as security containers, carrier cases and mail processing equipment, may be furnished and installed by USPS. Guidance may be requested from the contracting officer.

*: The [Contractor] [Landlord] shall request this information from the Contracting Officer Representative (COR) before completing and submitting this form.

** No PSIN# provided for this equipment. Contact Supplies Material Management, Topeka for order information.

END OF SECTION 01 10 00 00



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SECTION 01 11 04 00 - CONTRACT DOCUMENTS

NOTE TO SPECIFIER

This Section is intended for use with ALL project types: Design-Bid-Build (DBB), Design-Build (DB), Repair & Alteration (R&A) and New Construction Leased (NCL) type projects that use the Building Standard Design Specifications. Modify as needed for project specific requirements.

1.1 General

- A. The contract documents consist of the items included, or attached and incorporated by reference, in Section B, The Contract, B. 1500, *Attachments*.

NOTE TO SPECIFIER

Select Paragraph above or below for New Construction Leased (NCL) type projects.

- A. The contract documents consist of the items included, or attached and incorporated by reference, in the Lease, including General Conditions to USPS Lease and Construction Rider.

1.2 Drawing List

- A. The contract drawings consist of the items included, or attached and incorporated by reference, in Section B, The Contract, B. 1500, *Attachments*.

NOTE TO SPECIFIER

Select Paragraph above or below New Construction Leased (NCL) type projects.

- A. The contract documents are listed in the Construction Rider.

NOTE TO SPECIFIER

Select Paragraph above or below as most appropriate for project.

B.	1	Drawing number	Date	Title
		[]	[]	[]
		[]	[]	[]

USPS Specification issued: 10/1/2013

Last revised: 4/16/2013

END OF SECTION 01 11 04 00



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SECTION 01 22 16 00 - NO SPECIFICATION REQUIRED

1.1 GENERAL

- A. A separate specification is not required for this item. The description given in the line item of the Construction Task Catalog completely defines the item.

1.2 PRODUCTS - (Not Used)

1.3 EXECUTION - (Not Used)

END OF SECTION 01 22 16 00



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Task	Specification	Specification Description
01 22 20 00	01 22 16 00	No Specification Required
01 22 23 00	01 22 16 00	No Specification Required



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SECTION 01 23 00 00 - ALTERNATES

NOTE TO SPECIFIER

This Section is intended for use with ALL project types: Design-Bid-Build (DBB), Design-Build (DB), Repair & Alteration (R&A) and New Construction Leased (NCL) type projects that use the Building Standard Design Specifications. No parts of this section shall be excluded or revised. The regulatory requirements and/or protection are not to be compromised or forfeited.

****THIS ENTIRE SECTION CONSISTS OF REQUIRED PARTS OR ARTICLES. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN & CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 – GENERAL**1.1 SUMMARY**

- A. Section includes: Alternates to be submitted to U.S. Postal Service with Proposal.
 - 1. Submission procedures.
 - 2. Documentation of changes to Contract Sum/Price and Contract Time.
- B. Related Documents: The Contract Documents, as defined in Section 011004 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 DEFINITIONS

- A. Alternate: The net amount to be added to or deducted from the Base Proposal Price for work identified in Schedule of Alternates.

1.3 SUBMISSION REQUIREMENTS

- A. Extent of Alternates:
 - 1. Determine the full extent of Work affected by proposed Alternates.
 - 2. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.
 - a. Include as part of each Alternate, miscellaneous devices, accessory objects and similar items incidental to or required for a complete installation whether or not mentioned as part of the Alternate.
- B. Submission Form: Complete Schedule of Alternates below and attach to Proposal.
 - 1. Substitutions are permitted unless prohibited by a relevant specification section for that product or material. Submit a request for substitution for any manufacturer not named in accordance with Section 016000 - Product Requirements.
- C. Schedule: The Alternates consist of the items included, or attached and incorporated by reference in Section B, The Contract, B. 1500 Attachments. Specification Sections referenced in the Schedule contain requirements for materials and methods necessary to achieve the Work described under each Alternate.
 - 1. Alternates describe environmental requirements.
 - 2. Conform to Contract Documents for requirements for performance, appearance, workmanship and materials not modified under the Alternate Bids.

1.4 SELECTION AND AWARD OF ALTERNATES



- A. Acceptance or Rejection: Alternates quoted on Schedule of Alternates and attached to Proposal will be reviewed and accepted or rejected at the USPS's option. None, any, or all Alternates may be accepted or rejected by U.S. Postal Service.
- B. Accepted Alternates will be identified in the Contract.
- C. Some Alternates and respective pricing will survive the Contract and will remain valid for the period stated in the Schedule of Alternates below.

NOTE TO SPECIFIER

Edit alternates below by adding and/or deleting alternates for the specific conditions and requirements of the project site. Some items are listed as alternates rather than in the base proposal because only one product source is known at this time.

1.5 SCHEDULE OF ALTERNATES

- A. Alternate Number 1: [EXAMPLE} State the amount to be added to or deducted from the Base Proposal Price if in lieu of securing the formwork to slab on grade using screws, as required by Specification Section 034713-1.6B, the formwork is secured on the slab on grade using adhesive. This Alternate will remain valid until submittal and approval of product data, shop drawings and calculations (This example limits the time to the shop drawing approval date. Another way to state the time is "This Alternate will remain valid every 90 days or yearly, whatever is reasonable for the commodity until the period of performance ends".)

Add: _____ dollars, or Deduct: _____ dollars.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED

USPS Specification issued: 10/1/2013
Last revised: 9/17/2013

END OF SECTION 01 23 00 00



SECTION 01 32 00 00 - CONSTRUCTION PROGRESS DOCUMENTATION

NOTE TO SPECIFIER

This Section is intended for use with ALL project types: Design-Bid-Build (DBB), Design-Build (DB), Repair & Alteration (R&A) and New Construction Leased (NCL) type projects that use the Building Standard Design Specifications. Design-Bid-Build (DBB), New Construction type projects. Modify as needed for project specific requirements.

NOTE TO SPECIFIER

Include Construction Progress Chart only if listed in Block 9 of Page 1 – Offer and Award (Select for smaller, less complex projects where a simple bar chart is sufficient). Modify as required for specific project scope.

1.1 Scheduling Work

- A. Before any of the work is started, the Contractor must confer with the COR and agree on a sequence of procedures: means of access to premises and building; delivery of materials and use of approaches; use of corridors, stairways, elevators, and similar means of communication; and the location of partitions, eating spaces for Contractor's employees, and the like.
- B. No work can be done during the holiday mailing season between [] and [] [November 15 and January 5] without written permission from the COR.
- C. No work can be scheduled between the hours of [] and [], in the [] area without written permission from the COR.

1.2 Construction Progress Chart

- A. In accordance with the terms and conditions of the contract provisions and clauses, including those concerning *Construction Progress Chart*, prepare and submit a progress chart within five (5) days after receipt of the Notice to Proceed to show the principal categories of work corresponding with those used in the Schedule of Values:
 1. The order in which the Contractor proposes to carry on the work.
 2. The date on which it will start each category of work.
 3. The contemplated dates for completion.
- B. The chart must be in suitable scale to indicate graphically the total percentage of work scheduled to be in place at any time. At intervals as directed by the COR the Contractor must:
 1. Adjust the chart to reflect any changes in the contract work.
 2. Enter on the chart the total percentage of work actually in place.
 3. Submit six (6) copies of the chart to the Contracting Officer or their designated representative.

NOTE TO SPECIFIER

Include analysis requirements for Mail Processing Facilities (MPF) and other large, complex facilities only. Otherwise, omit it.

1.3 Contractor-Prepared Network Analysis System - Include Contractor-Prepared Network Analysis System only if listed in Block 9 of Page 1 – Offer and Award. Modify as required for specific project scope.



- A. Prepare a Network Analysis System in accordance with the terms and conditions of the contract provisions and clauses concerning *Network Analysis System and Update*, to include, at a minimum, the elements described below. In preparation of this system, the scheduling of construction is the responsibility of the Contractor. The requirement for the system is included to ensure adequate planning and execution of the work and to assist the COR in appraising the reasonableness of the proposed schedule and evaluating progress of the work. The system must consist of diagrams and accompanying mathematical analyses.
- B. Diagrams must show the order and interdependence of activities and the sequence in which the work is to be done as planned by the Contractor. The basic concept of a network analysis diagram must be followed to show how the start of a given activity is dependent on the completion of preceding activities and its completion restricts the start of the following activities. In all cases, the project completion date must be shown on the diagrams as the latest completion date of all activities.
- C. The detailed network activities must include, in addition to construction activities, the submittal and approval of samples of materials and shop drawings, the procurement of critical materials and equipment, and the fabrication of special materials and equipment and their installation and testing. All activities of the Postal Service that affect progress and dates required by the contract for completion of all or parts of the work must be shown. The activities that compose the following separate buildings and features must be separately identifiable by coding or use of sub-networks or both.

Building or Feature	Minimum Number of Activities
Mail Processing Building	250
Customer Service Building	100
Site Work	70
Mechanization	50
Vehicle Maintenance Building	40

- D. The selection and number of activities are subject to the COR's approval. Detailed networks must be drafted to show a continuous flow from left to right, with no arrows from right to left. The following information must be shown on the diagram for each activity, preceding the following event numbers: description of the activity, cost, activity duration, and workforce requirements in workdays.
- E. A summary bar chart must be provided on a 30-inch x 42-inch sheet, consisting of a minimum of 30 activities and based on and supported by detailed diagrams. The summary bar chart must be time-scaled, using units of approximately one-half inch to equal 1 week, or other suitable scale approved by the COR. Weekends and holidays must be indicated.
- F. Mathematical Analysis
1. The mathematical analysis of the network diagram must include a tabulation of each activity. The following information must be furnished as a minimum for each activity:
 - a. Numbers of preceding and following events.
 - b. Activity description.
 - c. Estimated duration of activities in days.
 - d. Earliest finish date.
 - e. Actual start date.
 - f. Actual finish date.
 - g. Latest start date.
 - h. Latest finish date.
 - i. Slack or float.
 - j. Monetary value of activity, with a labor and material cost breakdown.
 - k. Percentage of activity completed.
 - l. Contractor's earnings based on the portion of activity completed.
 - m. Workforce requirements in workdays.



2. The program or means used in making the mathematical computation must be capable of compiling the total value of completed and partially completed activities and subtotals from separate buildings or features.
 3. The analysis must list the activities in sorts or groups as follows:
 - a. By the preceding event number, from lowest to highest, then in the order of the following event number.
 - b. By the amount of slack, then in order of preceding event number.
 - c. By responsibility in order of earliest allowance start date.
 - d. In order of latest allowable start dates, then in order of preceding event numbers, then in order of succeeding even numbers.
- G. Submission and approval of the system must be as follows:
1. A preliminary network defining the Contractor's planned operations during the first 90 days after receipt of a Notice to Proceed must be submitted at the preconstruction conference after receipt of a Notice to Proceed.
 2. The complete network analysis, consisting of the detailed network mathematical analysis, schedule of anticipated earnings as of the last day of each month, and network diagrams, must be submitted within 30 days after receipt of Notice to Proceed.

NOTE TO SPECIFIER

Include the submission and approval requirements above and delete the paragraph below for MPF and other large, complex facilities. For all other projects, delete the submission and approval requirements above and include the paragraph below.

- H. Submission and approval of the system must be as follows:
1. A preliminary network defining the Contractor's planned operations must be submitted at the preconstruction conference after receipt of a Notice to Proceed.
 2. The complete network analysis must be submitted within 30 days after receipt of Notice to Proceed.

NOTE TO SPECIFIER

Include the paragraph below for MPF and other large, complex facilities only. Otherwise, omit it.

- I. The Contractor must participate in a review and evaluation of the proposed network diagrams and analysis by the COR. Any revisions necessary as a result of this review must be resubmitted for approval of the COR within ten calendar days after the conference. The approved schedule must then be the schedule to be used by the Contractor for planning, organizing, and directing the work, reporting progress, and requesting payment for work accomplished. Thereafter, if the Contractor desires to make changes in its method of operating and scheduling, the Contractor must notify the COR in writing stating the reasons for the change. If the COR considers these changes to be major, the COR may require the Contractor to revise and submit for approval, without additional cost to the Postal Service, all of the affected portions of the detailed diagrams and mathematical analysis to show the effect on the entire project. A change may be considered major if the time estimated to be required or actually used for an activity, or the logic of the sequence of activities varies from the original plan to a degree that there is a reasonable doubt as to its effect on contract completion dates. Changes that affect activities with adequate slack time must be considered minor, except that an accumulation of minor changes may be considered a major change when their cumulative effect might affect the contract completion date.
- J. The Contractor must submit at monthly intervals a report of actual construction progress by updating the mathematical analysis. Entering updated information into the mathematical analysis is subject to the approval of the COR.
- K. The report must show the activities or portion of activities completed during the reporting period and their total value as a basis for the Contractor's periodic request for payment. Payments made under the terms and conditions of the contract provisions and clauses, including those concerning *Payment*



(*Construction*), must be based on the total value of the activities or of partially completed activities after verification by the COR. The report must state the percentage of the work actually completed and scheduled on the report date and the progress along the critical path in terms of days ahead or behind the allowable dates. If the project is behind schedule, progress along other paths with negative slack must also be reported. The Contractor must also submit a narrative report with the updated analysis, which must include, but is not limited to, a description of the problem areas, current and anticipated delaying factors and their impact, and an explanation of corrective actions taken or proposed.

- L. The sheet size of diagrams must be 30 inches x 42 inches. Each updated copy must show the date of the latest revision.
- M. Initial submittal and complete revisions must be submitted in three copies.
- N. Periodic reports must be submitted in two copies.
- O. Network analysis system revisions occurring as a result of modifications or changes in the work must be in accordance with the terms and conditions of the contract provisions and clauses, including those concerning *Network Analysis Systems and Update*.
- P. Float or slack is defined as the amount of time between the early start date and the late start date of any of the activities in the network analysis system schedule. Float or slack time is not time for the exclusive use or benefit of either the Postal Service or the Contractor. Extensions of time for performance required under the terms and conditions of the contract provisions and clauses, including those concerning *Changes; Differing Site Conditions; Termination for Convenience or Default; Excusable Delays; or Suspensions and Delays* may be granted only to the extent that equitable time adjustments for the activity or activities affected exceed the total float or slack along the channels involved at the time that Notice to Proceed was issued for the change.

USPS Specification issued: 10/1/2013

Last revised: 4/16/2013

END OF SECTION 01 32 00 00

SECTION 01 32 33 00 - LEED REQUIREMENTS**1.1 GENERAL****A. Summary**

1. Section includes general requirements and procedures for compliance with certain USGBC LEED prerequisites and credits needed for Project to obtain LEED –Certified **OR** Silver **OR** Gold **OR** Platinum, **as directed**, certification based on LEED-NC, Version 2.2 **OR** LEED-CI, Version 2.0, **as directed**.
 - a. Other LEED prerequisites and credits needed to obtain LEED certification depend on material selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable product requests.
 - b. Additional LEED prerequisites and credits needed to obtain the indicated LEED certification depend on design and other aspects of Project that are not part of the Work of the Contract.

B. Definitions

1. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship." Certificates shall include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
2. LEED: Leadership in Energy & Environmental Design.
3. Rapidly Renewable Materials: Materials made from plants that are typically harvested within a 10-year or shorter cycle. Rapidly renewable materials include products made from bamboo, cotton, flax, jute, straw, sunflower seed hulls, vegetable oils, or wool.
4. Regional Materials (for LEED-NC): Materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
5. Regionally Manufactured Materials (for LEED-CI): Materials that are manufactured within a radius of 500 miles (800 km) from Project site. Manufacturing refers to the final assembly of components into the building product that is installed at Project site.
6. Regionally Extracted and Manufactured Materials (for LEED-CI): Regionally manufactured materials made from raw materials that are extracted, harvested, or recovered within a radius of 500 miles (800 km) from Project site.
7. Recycled Content (for LEED-NC): The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
 - a. "Post-consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 - b. "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.
8. Recycled Content (for LEED-CI): The percentage by weight of constituents that have been recovered or otherwise diverted from the solid waste stream, either during the manufacturing process (pre-consumer), or after consumer use (post-consumer).
 - a. Spills and scraps from the original manufacturing process that are combined with other constituents after a minimal amount of reprocessing for use in further production of the same product are not recycled materials.



- b. Discarded materials from one manufacturing process that are used as constituents in another manufacturing process are pre-consumer recycled materials.

C. Submittals

1. General: Submit additional LEED submittals required by other Specification Sections.
2. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.
3. Project Materials Cost Data: Provide statement indicating total cost for building materials used for Project, excluding mechanical, electrical, and plumbing components, and specialty items such as elevators and equipment. Include statement indicating total cost for wood-based materials used for Project, **as directed**.
4. LEED Action Plans: Provide preliminary submittals within seven **OR 14 OR 30 OR 60, as directed**, days of date established for commencement of the Work **OR** the Notice to Proceed **OR** the Notice of Award, **as directed**, indicating how the following requirements will be met:
 - a. Credit MR 2.1 and Credit MR 2.2, **as directed**: Waste management plan complying with Division 01 Section "Construction Waste Management And Disposal".
 - b. Credit MR 3.1 and Credit MR 3.2, **as directed**: List of proposed salvaged and refurbished materials. Identify each material that will be salvaged or refurbished, including its source and cost.
 - c. Credit MR 4.1 and Credit MR 4.2, **as directed**: List of proposed materials with recycled content. Indicate cost, post-consumer recycled content, and pre-consumer recycled content for each product having recycled content.
 - d. Credit MR 5.1 and Credit MR 5.2 (for LEED-NC), **as directed**: List of proposed regional materials. Identify each regional material, including its source, cost, and the fraction by weight that is considered regional.
 - e. Credit MR 5.1 and Credit MR 5.2 (for LEED-CI), **as directed**: List of proposed regionally manufactured materials and regionally extracted and manufactured materials, **as directed**.
 - 1) Identify each regionally manufactured material, including its source and cost.
 - 2) For LEED-CI Credit MR 5.2, identify each regionally extracted and manufactured material, including its source and cost.
 - f. Credit MR 7: List of proposed certified wood products. Indicate each product containing certified wood, including its source and cost of certified wood products.
 - g. Credit EQ 3.1: Construction indoor-air-quality management plan.
5. LEED Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with LEED action plans for the following:
 - a. Credit MR 2.1 and Credit MR 2.2, **as directed**: Waste reduction progress reports complying with Division 01 Section "Construction Waste Management And Disposal".
 - b. Credit MR 3.1 and Credit MR 3.2, **as directed**: Salvaged and refurbished materials.
 - c. Credit MR 4.1 and Credit MR 4.2, **as directed**: Recycled content.
 - d. Credit MR 5.1 and Credit MR 5.2 (for LEED-NC), **as directed**: Regional materials.
 - e. Credit MR 5.1 and Credit MR 5.2 (for LEED-CI), **as directed**: Regionally manufactured materials and regionally extracted and manufactured materials, **as directed**.
 - f. Credit MR 7: Certified wood products.
6. LEED Documentation Submittals:
 - a. Credit EA 5: Product data and wiring diagrams for sensors and data collection system used to provide continuous metering of building energy-consumption performance over time **OR** a period of time of not less than one year of postconstruction occupancy, **as directed**.
 - b. Credit MR 2.1 **OR** and Credit MR 2.2, **as directed**: Comply with Division 01 Section "Construction Waste Management And Disposal".
 - c. Credit MR 3.1 and Credit MR 3.2, **as directed**: Receipts for salvaged and refurbished materials used for Project, indicating sources and costs for salvaged and refurbished materials.



- d. Credit MR 4.1 and Credit MR 4.2, **as directed**: Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
- e. Credit MR 5.1 and Credit MR 5.2 (for LEED-NC), **as directed**: Product data for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
- f. Credit MR 5.1 and Credit MR 5.2 (for LEED-CI), **as directed**: Product data indicating location of material manufacturer for regionally manufactured materials. Include statement indicating cost for each regionally manufactured material and for each regionally extracted and manufactured material, **as directed**.
 - 1) Include statement indicating distance from manufacturer to Project for each regionally manufactured material.
 - 2) For LEED-CI Credit MR 5.2, include statement indicating location of and distance from Project to point of extraction, harvest, or recovery for each raw material used in regionally extracted and manufactured materials.
- g. Credit MR 7: Product data and chain-of-custody certificates for products containing certified wood. Include statement indicating cost for each certified wood product.
- h. Credit EQ 3.1:
 - 1) Construction indoor-air-quality management plan.
 - 2) Product data for temporary filtration media.
 - 3) Product data for filtration media used during occupancy.
 - 4) Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the indoor-air-quality management measures, such as protection of ducts and on-site stored or installed absorptive materials.
- i. Credit EQ 3.2:
 - 1) Signed statement describing the building air flush-out procedures including the dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.
 - 2) Product data for filtration media used during flush-out and during occupancy.
 - 3) Report from testing and inspecting agency indicating results of indoor-air-quality testing and documentation showing compliance with indoor-air-quality testing procedures and requirements.
- j. Credit EQ 4.1: Product data for adhesives and sealants used inside the weatherproofing system indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- k. Credit EQ 4.2: Product data for paints and coatings used inside the weatherproofing system indicating VOC content **OR** chemical composition and VOC content (for LEED-CI), **as directed**, of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- l. Credit EQ 4.4: Product data for products containing composite wood or agrifiber products or wood glues indicating that they do not contain urea-formaldehyde resin.

D. Quality Assurance

- 1. LEED Coordinator: Engage an experienced LEED-Accredited Professional to coordinate LEED requirements. LEED coordinator may also serve as waste management coordinator.

1.2 PRODUCTS

A. Salvaged And Refurbished Materials

- 1. Credit MR 3.1: Provide salvaged or refurbished materials for 5 percent of building materials (by cost).

**OR**

Credit MR 3.1 and Credit MR 3.2: Provide salvaged or refurbished materials for 10 percent of building materials (by cost). Recycled Content Of Materials

2. Credit MR 4.1: Provide building materials with recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of 10 percent of cost of materials used for Project.

OR

Credit MR 4.1 and Credit MR 4.2: Provide building materials with recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of 20 percent of cost of materials used for Project.

- a. Cost of post-consumer recycled content of an item shall be determined by dividing weight of post-consumer recycled content in the item by total weight of the item and multiplying by cost of the item.
- b. Cost of post-consumer recycled content plus one-half of pre-consumer recycled content of an item shall be determined by dividing weight of post-consumer recycled content plus one-half of pre-consumer recycled content in the item by total weight of the item and multiplying by cost of the item.
- c. Do not include mechanical and electrical components in the calculation.

B. Regional Materials

1. Credit MR 5.1 (for LEED-NC): Provide 10 percent of building materials (by cost) that are regional materials.

OR

Credit MR 5.1 and Credit MR 5.2 (for LEED-NC): Provide 20 percent of building materials (by cost) that are regional materials.

2. Credit MR 5.1 (for LEED-CI): Provide 20 percent of building materials (by cost) that are regionally manufactured materials.
3. Credit MR 5.2 (for LEED-CI): Provide 10 percent of building materials (by cost) that are regionally extracted and manufactured materials.

C. Certified Wood

1. Credit MR 7: Provide a minimum of 50 percent (by cost) of wood-based materials that are produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
 - a. Wood-based materials include, but are not limited to, the following materials when made from wood, engineered wood products, or wood-based panel products:
 - 1) Rough carpentry.
 - 2) Miscellaneous carpentry.
 - 3) Heavy timber construction.
 - 4) Wood decking.
 - 5) Metal-plate-connected wood trusses.
 - 6) Structural glued-laminated timber.
 - 7) Finish carpentry.
 - 8) Architectural woodwork.
 - 9) Wood paneling.
 - 10) Wood veneer wall covering.
 - 11) Wood flooring.
 - 12) Wood lockers.
 - 13) Wood cabinets.
 - 14) Furniture (for LEED-CI).

D. Low-Emitting Materials

1. Credit EQ 4.1: For field applications that are inside the weatherproofing system, use adhesives and sealants that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

- a. Wood Glues: 30 g/L.
 - b. Metal to Metal Adhesives: 30 g/L.
 - c. Adhesives for Porous Materials (Except Wood): 50 g/L.
 - d. Subfloor Adhesives: 50 g/L.
 - e. Plastic Foam Adhesives: 50 g/L.
 - f. Carpet Adhesives: 50 g/L.
 - g. Carpet Pad Adhesives: 50 g/L.
 - h. VCT and Asphalt Tile Adhesives: 50 g/L.
 - i. Cove Base Adhesives: 50 g/L.
 - j. Gypsum Board and Panel Adhesives: 50 g/L.
 - k. Rubber Floor Adhesives: 60 g/L.
 - l. Ceramic Tile Adhesives: 65 g/L.
 - m. Multipurpose Construction Adhesives: 70 g/L.
 - n. Fiberglass Adhesives: 80 g/L.
 - o. Contact Adhesive: 80 g/L.
 - p. Structural Glazing Adhesives: 100 g/L.
 - q. Wood Flooring Adhesive: 100 g/L.
 - r. Structural Wood Member Adhesive: 140 g/L.
 - s. Special Purpose Contact Adhesive (contact adhesive that is used to bond melamine covered board, metal, unsupported vinyl, Teflon, ultra-high molecular weight polyethylene, rubber or wood veneer 1/16 inch or less in thickness to any surface): 250 g/L.
 - t. Top and Trim Adhesive: 250 g/L.
 - u. Plastic Cement Welding Compounds: 350 g/L.
 - v. ABS Welding Compounds: 400 g/L.
 - w. CPVC Welding Compounds: 490 g/L.
 - x. PVC Welding Compounds: 510 g/L.
 - y. Adhesive Primer for Plastic: 650 g/L.
 - z. Sheet Applied Rubber Lining Adhesive: 850 g/L.
 - aa. Aerosol Adhesive, General Purpose Mist Spray: 65 percent by weight.
 - bb. Aerosol Adhesive, General Purpose Web Spray: 55 percent by weight.
 - cc. Special Purpose Aerosol Adhesive (All Types): 70 percent by weight.
 - dd. Other Adhesives: 250 g/L.
 - ee. Architectural Sealants: 250 g/L.
 - ff. Nonmembrane Roof Sealants: 300 g/L.
 - gg. Single-Ply Roof Membrane Sealants: 450 g/L.
 - hh. Other Sealants: 420 g/L.
 - ii. Sealant Primers for Nonporous Substrates: 250 g/L.
 - jj. Sealant Primers for Porous Substrates: 775 g/L.
 - kk. Modified Bituminous Sealant Primers: 500 g/L.
 - ll. Other Sealant Primers: 750 g/L.
2. Credit EQ 4.2: For field applications that are inside the weatherproofing system, use paints and coatings that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical restrictions (for LEED-CI):
- a. For LEED-NC
 - 1) Flat Paints, Coatings, and Primers: VOC not more than 50 g/L.
 - 2) Nonflat Paints, Coatings, and Primers: VOC not more than 150 g/L.
 - 3) Anticorrosive and Antirust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 - 4) Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
 - 5) Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
 - 6) Floor Coatings: VOC not more than 100 g/L.
 - 7) Shellacs, Clear: VOC not more than 730 g/L.
 - 8) Shellacs, Pigmented: VOC not more than 550 g/L.
 - 9) Stains: VOC not more than 250 g/L.
 - b. For LEED-CI
 - 1) Flat Interior Topcoat Paints: VOC not more than 50 g/L.



- 2) Nonflat Interior Topcoat Paints: VOC not more than 150 g/L.
- 3) Anticorrosive and Antirust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
- 4) Clear Wood Finishes, Varnishes and Sanding Sealers: VOC not more than 350 g/L.
- 5) Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
- 6) Floor Coatings: VOC not more than 100 g/L.
- 7) Shellacs, Clear: VOC not more than 730 g/L.
- 8) Shellacs, Pigmented: VOC not more than 550 g/L.
- 9) Stains: VOC not more than 250 g/L.
- 10) Primers, Sealers, and Undercoaters: VOC not more than 200 g/L.
- 11) Dry-Fog Coatings: VOC not more than 400 g/L.
- 12) Zinc-Rich Industrial Maintenance Primers: VOC not more than 340 g/L.
- 13) Pretreatment Wash Primers: VOC not more than 420 g/L.
- 14) Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
- 15) Restricted Components: Paints and coatings shall not contain any of the following:
 - a) Acrolein.
 - b) Acrylonitrile.
 - c) Antimony.
 - d) Benzene.
 - e) Butyl benzyl phthalate.
 - f) Cadmium.
 - g) Di (2-ethylhexyl) phthalate.
 - h) Di-n-butyl phthalate.
 - i) Di-n-octyl phthalate.
 - j) 1,2-dichlorobenzene.
 - k) Diethyl phthalate.
 - l) Dimethyl phthalate.
 - m) Ethylbenzene.
 - n) Formaldehyde.
 - o) Hexavalent chromium.
 - p) Isophorone.
 - q) Lead.
 - r) Mercury.
 - s) Methyl ethyl ketone.
 - t) Methyl isobutyl ketone.
 - u) Methylene chloride.
 - v) Naphthalene.
 - w) Toluene (methylbenzene).
 - x) 1,1,1-trichloroethane.
 - y) Vinyl chloride.
3. Credit EQ 4.4: Do not use composite wood or agrifiber products or adhesives that contain urea-formaldehyde resin.

1.3 EXECUTION

- A. Refrigerant And Clean-Agent Fire-Extinguishing-Agent Removal
 1. Prerequisite EA 3: Remove CFC-based refrigerants from existing HVAC&R equipment indicated to remain and replace with refrigerants that are not CFC based. Replace or adjust existing equipment to accommodate new refrigerant as described in Division 23.
 2. Credit EA 4: Remove clean-agent fire-extinguishing agents that contain HCFCs or halons and replace with agent that does not contain HCFCs or halons. See Division 21 Section "Clean-agent Fire Extinguishing Systems" for additional requirements.



B. Measurement And Verification

1. Credit EA 5: Implement measurement and verification plan consistent with Option B: Energy Conservation Measure Isolation **OR** Option D: Calibrated Simulation, Savings Estimation Method 2, **as directed**, in the EVO's "International Performance Measurement and Verification Protocol (IPMVP) Volume III: Concepts and Options for Determining Energy Savings in New Construction," the Owner.
2. If not already in place, install metering equipment to measure energy usage. Monitor, record, and trend log measurements.
3. Evaluate energy performance and efficiency by comparing actual to predicted performance.
4. Measurement and verification period shall cover at least one year of postconstruction occupancy.

C. Construction Waste Management

1. Credit MR 2.1 and Credit MR 2.2, **as directed**: Comply with Division 01 Section "Construction Waste Management And Disposal".

D. Construction Indoor-Air-Quality Management

1. Credit EQ 3.1: Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction."
 - a. If the Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Division 01 Section "Temporary Facilities And Controls", install filter media having a MERV 8 according to ASHRAE 52.2 at each return-air inlet for the air-handling system used during construction.
 - b. Replace all air filters immediately prior to occupancy.
2. Credit EQ 3.2: Comply with one of the following requirements:
 - a. After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total volume of 14000 cu. ft. (4 300 000 L) of outdoor air per sq. ft. (sq. m) of floor area while maintaining an internal temperature of at least 60 deg F (16 deg C) and a relative humidity no higher than 60 percent.
 - b. If occupancy is desired prior to flush-out completion, the space may be occupied following delivery of a minimum of 3500 cu. ft. (1 070 000 L) of outdoor air per sq. ft. (sq. m) of floor area to the space. Once a space is occupied, it shall be ventilated at a minimum rate of 0.30 cfm per sq. ft. (1.52 L/s per sq. m) of outside air or the design minimum outside air rate determined in EQ Prerequisite 1, whichever is greater. During each day of the flush-out period, ventilation shall begin a minimum of three hours prior to occupancy and continue during occupancy. These conditions shall be maintained until a total of 14000 cu. ft./sq. ft. (4 300 000 L/sq. m) of outside air has been delivered to the space.
 - c. Air-Quality Testing:
 - 1) Conduct baseline indoor-air-quality testing, after construction ends and prior to occupancy, using testing protocols consistent with the EPA's "Compendium of Methods for the Determination of Air Pollutants in Indoor Air," and as additionally detailed in the USGBC's "LEED-NC" **OR** "LEED-CI", **as directed**: Reference Guide."
 - 2) Demonstrate that the contaminant maximum concentrations listed below are not exceeded:
 - a) Formaldehyde: 50 ppb.
 - b) Particulates (PM10): 50 micrograms/cu. m.
 - c) Total Volatile Organic Compounds (TVOC): 500 micrograms/cu. m.
 - d) 4-Phenylcyclohexene (4-PH): 6.5 micrograms/cu. m.
 - e) Carbon Monoxide: 9 ppm and no greater than 2 ppm above outdoor levels.
 - 3) For each sampling point where the maximum concentration limits are exceeded, conduct additional flush-out with outside air and retest the specific parameter(s) exceeded to indicate the requirements are achieved. Repeat procedure until all requirements have been met. When retesting noncomplying building areas, take samples from same locations as in the first test.
 - 4) Air-sample testing shall be conducted as follows:



- a) All measurements shall be conducted prior to occupancy but during normal occupied hours, and with building ventilation system starting at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the duration of the air testing.
- b) Building shall have all interior finishes installed including, but not limited to, millwork, doors, paint, carpet, and acoustic tiles. Nonfixed furnishings such as workstations and partitions are encouraged, but not required, to be in place for the testing.
- c) Number of sampling locations will vary depending on the size of building and number of ventilation systems. For each portion of building served by a separate ventilation system, the number of sampling points shall not be less than one per 25,000 sq. ft. (2300 sq. m) or for each contiguous floor area, whichever is larger, and shall include areas with the least ventilation and greatest presumed source strength.
- d) Air samples shall be collected between 3 and 6 feet (0.9 and 1.8 m) from the floor to represent the breathing zone of occupants, and over a minimum four-hour period.

END OF SECTION 01 32 33 00



SECTION 01 33 00 00 - SUBMITTAL PROCEDURES

NOTE TO SPECIFIER

This Section is intended for use with ALL project types: Design-Bid-Build (DBB), Design-Build (DB), Repair & Alteration (R&A) and New Construction Leased (NCL) type projects that use the Building Standard Design Specifications. Modify as needed for project specific requirements.

1.1 Schedule of Submittals

- A. In accordance with the terms and conditions of the contract provisions and clauses, including those concerning Shop Drawings, Coordination Drawings, *Record "As Built" Drawings, and Schedules*; within 30 days after receiving a Notice to Proceed, the Contractor must complete the Schedule of Submittals, in the format indicated below, in duplicate, listing all items that must be furnished for review and approval by the Postal Service. The schedule must indicate the type of items (such as sample, shop drawings, catalog cut, and so forth) and include the scheduled dates of submittal. In preparing the schedule, adequate time (10 business days or more, exclusive of time in the mails) must be allowed for review and approval and possible resubmittal. Also, the schedule must be coordinated with the approved construction progress chart. The Contractor must revise and/or update the schedule as directed. Such revised schedules must be made available to the COR for monitoring.
- B. Within 30 days after receiving a Notice to Proceed, the Contractor must complete and submit to the COR a listing of all subcontractors, including subcontractor name, address, telephone number, fax number and email address. Include an updated list with each progress payment request.
- C. Schedule of Submittals Format

Project _____

Contract No. _____

Project Description _____

Spec. Section	Spec. Description	Paragraph Number	*Submittal Type	Date		Action Taken	Assigned Number
				Submittal	Returned		

*Submittal Type:

C – Certificate

S – Sample

SD – Shop Drawing

CD – Catalog Data

PL – Spare Parts List

MM – Maintenance Manual

1.2 Shop Drawings and Related Data

- A. Submittal of shop drawings, samples and related data must conform to the requirements of the terms and conditions of the contract provisions and clauses, including those concerning, *Record "As Built" Drawings, and Samples*. Prior to submittal, the Contractor must stamp the submittal to indicate that it



has been reviewed and approved. The Contractor must make any corrections required by the COR. If the Contractor considers any correction indicated on the drawings to constitute a change to the contract drawings or specifications, notice, as required under the terms and conditions of the contract provisions and clauses, including those concerning Changes must be given to the COR. [Four] [] prints of all approved shop drawings must be given to the COR. The approval of the drawings by the COR must not be construed as a complete check but indicates only that the general method of construction and detailing is satisfactory. Approval of the shop drawings does not relieve the Contractor of responsibility for any error that may exist because the Contractor is responsible for the dimensions and design of adequate connections and details and for satisfactory construction of all work. The submission by the Contractor must be accompanied by a transmittal letter of a type approved by the COR.

1. Each shop drawing must have a blank area of 5 by 5 inches, located adjacent to the title block. The title block must display:
 - a. Number and title of drawing;
 - b. Date of drawing or revision;
 - c. Name of project building or facility;
 - d. Name of Contractor and (if appropriate) of subcontractor submitting drawing;
 - e. Clear identity of contents and location on the work; and
 - f. Project title and contract number.
2. All drawings to be provided shall be clear and fully representative of the facility and fixed mechanization work.
3. Drawing files to be in .dwg and .pdf formats. .dwg files to be generated from Autocad revision 12 or other revision level concurred by USPS.
4. Documents other than drawings shall be provided in MicroSoft Word format.
5. Interim project documentation may be provide to USPS electronically
6. All final project documentation shall be provided to the USPS on a single CD or DVD media

1.3 Equipment Room Layout Drawings

- A. The Contractor must prepare and submit equipment room layout drawings as required by the technical provisions as well as for areas where equipment proposed for use could present interface or space difficulties. Room layout drawings must be submitted within 40 days after receiving a Notice to Proceed and must conform to the specified requirements for shop drawings. Submittals describing the various mechanical and electrical equipment items that are to be installed in the areas represented by the layout drawings must be assembled and submitted concurrently and must be accompanied by the room layout drawings. Room layout drawings must be consolidated for all trades, to scale, and must show all pertinent structural and fenestration features and other items, such as cabinets, that are required for installation and that affect the available space. All mechanical and electrical equipment and accessories must be shown to scale in the plan and also in elevation or section in their installation positions. Ductwork and piping must be shown.

1.4 Material, Equipment, and Fixture Lists

- A. When required by the technical provisions, lists of materials, equipment, and fixtures must be submitted by the Contractor in accordance with the requirements specified for shop drawings. The lists must be supported by sufficient descriptive material, such as catalogs, cuts, diagrams, and other data published by the manufacturer, as well as by evidence of compliance with safety and performance standards, to demonstrate conformance to the specification requirements. Catalog numbers alone are not acceptable. The data must include the name and address of the nearest service and maintenance organization that regularly stocks repair parts. No consideration will be given to partial lists submitted from time to time. Approval of materials and equipment is tentative, subject to submission of complete shop drawings indicating compliance with the contract documents.



1.5 Certificates of Compliance

- A. Any certificates required for demonstrating proof of compliance of materials with specification requirements, including mail certificates, statements of application, and extended guarantees, must be signed and submitted 4 copies to the COR at least 10 days before delivery. The Contractor must review all certificates before submissions are made to the COR, to ensure compliance with the contract specification requirements and to ensure that the affidavit is properly signed. Each certificate must be signed by an official authorized to certify on behalf of the manufacturing company and must contain the name and address of the Contractor, the project name and location, and the quantity and date or dates of shipment or delivery to which the certificates apply. Copies of laboratory test reports submitted with certificates must contain the name and address of the testing laboratory and the dates of tests to which the report applies. Certification must not be construed as relieving the Contractor from furnishing satisfactory material if, after tests are performed on selected samples, the material is found not to meet the specific requirements.

1.6 A-E's Review of Submittals

- A. When submittals are reviewed by the A-E on behalf of the COR, each submittal must be returned to the Contractor stamped or marked by the A-E in one of the following ways:
 - 1. A Action: The Contractor is advised that "A Action" means that fabrication, manufacture, or construction may proceed, provided the work complies with the contract documents.
 - 2. B Action: The Contractor is advised that "B Action" means that fabrication, manufacture, or construction may proceed, provided the work complies with the A-E's notations and the contract documents.
 - 3. C Action: The Contractor is advised that "C Action" means that no work may be fabricated, manufactured, or constructed and that the Contractor must make a new submittal to the A-E. Any submission marked "C Action" is not permitted on the site.
- B. The A-E must return reproducibles stamped "A Action" or "B Action" to the Contractor, who is responsible for obtaining prints of them and for distributing them to the field and to subcontractors.
- C. In the case of shop drawings in the form of manufacturers' descriptive literature, catalog cuts, and brochures stamped "A Action" or "B Action," the A-E must return the stamped copies to the Contractor, who is responsible for distributing them to the field and to the subcontractors. If the shop drawings are stamped "C Action," the A-E will return stamped copies to the Contractor, who must submit new shop drawings to the A-E.
- D. In the case of samples stamped "A Action" or "B Action," the A-E must return one of the samples to the Contractor. In the case of samples stamped "C Action," the A-E must return all of the submitted samples.

1.7 Spare Parts Data

- A. Spare parts data must be submitted in quadruplicate in accordance with the terms and conditions of the contract provisions and clauses, including those concerning *Spare Parts Data*.

1.8 Schedule of Values

- A. In accordance with the terms and conditions of the contract provisions and clauses concerning, *Construction Cost Breakdown*, the Contractor must submit a construction cost breakdown using the attached Schedule of Values. When applicable, a separate cost breakdown form must be submitted for each separate building. However, the total cost of site work for the facility must be included in the cost estimate breakdown for the main postal building. The number of items provided on the Systems

Fixed Mechanization Construction Cost Estimate Breakdown Summary

Project
01 - General Requirements
General
Contractor

Location



Construction Cost Estimate Breakdown form are the minimum required. Additional subdivision of these items may be used by the Contractor.

- B. Submit the construction cost breakdown after contract award to the COR. A Sample Schedule of Values and Definitions is attached to this Section, as Attachment A.
- C. Do not delete items from the Schedule of Values form. However, expand the schedule "Description of Work" as necessary to allow evaluation of work or to make partial payments.
- D. If the contract price changes, the Schedule of Values must be revised to reflect the change(s) and forwarded to the COR.
- E. A current Schedule of Values must accompany all Contractor Requests for Payment.

NOTE TO SPECIFIER

Schedule of Values form can be found on the Building Design Standards CD-ROM. Print out exhibit with definitions, and include at the end of this section.

NOTE TO SPECIFIER

Delete Paragraph and Summary Form below for projects without fixed mechanization.

1.9 Fixed Mechanization Construction Cost Estimate Breakdown Summary

- A. In accordance with the terms and conditions of the contract provisions and clauses concerning, *Construction Cost Breakdown*, the Contractor must submit a construction cost estimate using the Fixed Mechanization Construction Cost Estimate Breakdown Summary indicated below. When applicable, a separate cost estimate breakdown form must be submitted for each separate building. The number of items provided on the form are the minimum required. Additional subdivision of these items may be used by the Contractor.
- B. Submit the Fixed Mechanization Construction Cost Estimate Breakdown Summary after contract award to the COR.



Mechanization
Contractor

Date	Prepared by	Checked by	USPS Specific ation issued: 10/1/201 3 Last revised: 9/17/201 3
1.	Bulk Conveyors		
	Designation	Cost	Designation
			Cost
	<i>Subtotal</i>		
		Quantity	Length (ft.)
3.	Extendable Conveyors (loading)		
4.	Extendable Conveyors (unloading)		
5.	Sack Sorting Machine (belt)		
6.	Sack Sorting Machine (over and under)		
7.	Sack Sorting Machine (carousel)		
8.	Multi-Slide Sorter (sacks)		
9.	Multi-Slide Sorter (parcels)		
11.	Sawtooth Platforms		
	Designation	Cost	Designation
			Cost
	Other		
	<i>Subtotal</i>		
		Cost	Quantity (Total)
10.	Tray Conveyors		Length
	MPR (24VDC)		
	Spirals All, (Up/DWN)		
	Belt		
	Diverging and Converging		
	Gravity		
	LCTS		
	HSTS		
	Other		
	<i>Subtotal</i>		
12.	Other		
	<i>Subtotal</i>		
	<i>Total Fixed Mechanization Cost</i>		

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SECTION
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SECTION 01 35 43 00 - ENVIRONMENTAL PROCEDURES**

NOTE TO SPECIFIER

This Section is intended for use with ALL project types: Design-Bid-Build (DBB), Design-Build (DB), Repair & Alteration (R&A) and New Construction Leased (NCL) type projects that use the Building Standard Design Specifications. No parts of this section shall be excluded or revised. The regulatory requirements and/or protection are not to be compromised or forfeited.

****THIS ENTIRE SECTION CONSISTS OF REQUIRED PARTS OR ARTICLES. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN & CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 – GENERAL

1.1 SCOPE

- A. This section is required in accordance with the terms and conditions of the contract provisions and clauses, including those concerning Safety & Health Standards, Accident Prevention, Protection of the Environment, Existing Vegetation, Structures, Utilities and Improvements, and Handling Asbestos and other Hazardous Materials. The work covered by this section consists of furnishing all labor, material, and equipment and performing all work required for compliance with environmental regulations and preventing pollution during, and as a result of, construction operations under this contract, in addition to those measures set forth in other technical provisions of these specifications.
- B. The Contractor and subcontractors must comply with all applicable federal, state and local laws and regulations related to the environment, health and safety.

1.2 NOTIFICATION

- A. The Contractor must, after receiving a notice of noncompliance with the foregoing provisions, immediately take corrective action. The notice, when delivered to its Contractor or its authorized representative at the site of the work, is deemed sufficient for this purpose. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost because of any such stop orders may be made the subject of a claim for extension of time or for excess costs or damages by the Contractor unless it is subsequently determined that the Contractor was in compliance and the Contractor demonstrates that it is otherwise entitled to an extension of time, excess costs or damages, under the applicable terms and conditions of the contract provisions and clauses.

1.3 ENVIRONMENTAL REGULATORY COMPLIANCE

- A. Within 30 days after receiving the notice to proceed or not less than 15 days prior to commencing on-site work, the Contractor must submit any environmental documents that are required by federal, state or local environmental regulations. Plans must be approved by the COR prior to commencing on-site work and must describe and include, but is not limited to, the following
 - 1. Erosion Control and Stormwater Management Plan that describes erosion control methods, surface drainage, storm water permitting requirements, and if applicable, protection of site wetlands and/or compliance with wetland permits. This must ensure any federal, state or local permitting requirements for site preparation, erosion control or surface drainage are met.



2. Landscape Management and Protection Plan that ensures any site-specific beneficial landscaping requirements are met. The plan shall describe the prevention and restoration of landscape damage, temporary roads and embankments, and post construction cleanup as prescribed in the terms and conditions of the contract provisions and clauses, including those concerning *Protection of the Environment, Existing Vegetation, Structures, Utilities and Improvements*.
3. Waste Minimization and Management Plan must describe how natural resources potentially impacted by construction will be protected or managed; construction wastes will be stored and disposed of or recycled; and pollutants associated with building materials will be controlled. The waste minimization and management section of the plan must also list materials and construction debris to be recycled, and address the disposal of solid and hazardous wastes and materials, including asbestos and lead-based paint. It must also include tables applicable to the reclamation of chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) in accordance with 1.4 (B) below.

NOTE TO SPECIFIER

Part 1.3, A., 4 & 5. below must be included if an environmental assessment (EA) was prepared for this project. The EA and the Finding of No Significant Impact (FONSI) statement must be included in construction contracts, as well as any other environmental document which identifies site conditions of which the Contractor should be aware.

4. Environmental Compliance Plan must document NEPA compliance by describing mitigation measures to address environmental concerns/sensitive receptors identified in the National Environmental Policy Act (NEPA) document(s) in Section B. 1500, *Attachments*, of the contract.
5. The construction specifications in this contract must include mitigation measures to avoid or minimize potential environmental impacts identified in the NEPA document(s).

1.4 ENVIRONMENTAL SITE CONTROLS

- A. Location of Hazardous Materials: The location of the Contractor's temporary storage of any hazardous materials and/or wastes must be appropriately marked and included in the health and Safety Plan (see Section 1.5 below).
- B. Refrigerant Recovery, Recycling, and Disposal: Any work involving the replacement or repair of equipment containing refrigerant shall meet the following requirements:
 1. Recover and recycle or dispose of refrigerant from equipment according to 40 CFR 82 and local regulations.
 2. The work shall be completed by a certified refrigerant recovery technician, per 40 CFR 82 and local regulations.
 3. Provide a statement signed by the certified refrigerant recovery technician that the work was completed per 40 CFR 82 and local regulations. Include the name and address of technician and date refrigerant was recovered.
- C. Post-construction Cleanup or Obliteration: The Contractor must remove and properly dispose of all signs of temporary construction facilities such as haul roads, work area, structures, foundations of temporary structures, excess or waste materials, or any other vestiges of construction as directed by the COR. No separate or direct payment may be made for post-construction cleanup and all associated costs must be considered included in the contract price.
- D. Historical and Archeological: Monuments, markers, and works of art must be protected. Items discovered that have potential historical or archeological interest must be preserved. The Contractor must leave the archeological find undisturbed and must immediately report the find to the COR so that the proper authority may be notified.



- E. Dust Control: The Contractor must keep the site free from dust in accordance with applicable federal, state and/or local regulations.
- F. Noise Minimization: The Contractor must perform demolition and construction operations to minimize noise including conducting work during less sensitive hours of the day in accordance with applicable noise control regulations.

1.5 HEALTH AND SAFETY

- A. Prior to commencing on-site work, the Contractor must submit an Occupational Safety and Health Administration (OSHA) Emergency Action Plan (EAP) to the Contracting Officer to demonstrate compliance by the Contractor and subcontractors with applicable OSHA regulations. If the Contractor is not required by OSHA to develop a written EAP, i.e. if 10 or fewer are employed for the construction project or any other specific regulations identified by OSHA, then the Contractor shall submit to the Contracting Officer a signed letter stating the Contractor shall meet OSHA's EAP requirements in a verbal communication to all employees.
- B. The Postal Service has provided a *Safety and Health Guide for Contractors*, as Attachment A to this section. Prior to commencing on-site work, Contractor must read the *Safety and Health Guide for Contractors* and must sign the attached Certificate of Understanding acknowledging and accepting the requirements stated therein.

NOTE TO SPECIFIER

Delete paragraph below if the project construction cost is expected to be less than \$100,000, unless directed otherwise by the Contracting Officer.

- C. Prior to commencing on-site work, the Contractor must submit a project-specific Project Safety Plan to the Contracting Officer. The plan must include, but is not limited to, hazard communication, labeling, emergency response and preparedness and training.
- D. Copies of Material Safety Data Sheets (MSDSs) for any hazardous material(s), as defined by OSHA's Hazard Communications Standard, must be included whenever such materials arrive on-site. MSDSs must be kept together and maintained centrally on-site through to project completion. Provide a copy of each MSDS in the Operating and Maintenance Manual. The use of asbestos containing materials, in excess of one percent as defined by US Environmental Protection Agency regulations, is prohibited in the construction of this project. Provide an executed copy of the "Certificate of Asbestos and Lead-Based Paint (New Work)" in the Operating and Maintenance Manual and include a copy with the final payment request.
- E. The use of lead-based paint is prohibited in the construction of this project.
- F. The use of lead-containing solder for plumbing and plumbing fixtures is prohibited in the construction of this project.
- G. In accordance with the terms and conditions of the contract provisions and clauses, including those concerning *Asbestos Free and Lead-Based Paint Free Certification*, the Contractor must sign and submit to the Contracting Officer the attached "Certification of Asbestos and Lead-Based Paint" for this project. The signed certificate is required to be included in the final payment request.
- H. Do not use any of the USPS targeted chemicals (see regulated and prohibited materials identified under Safety and Health and related environmental requirements).

PART 2 - PRODUCTS



NOT USED

PART 3 - EXECUTION

NOT USED

USPS Specification issued: 10/1/2013
Last revised: 9/17/2013

Safety and Health Guide for Contractors**Certificate of Understanding**

This *Safety and Health Guide for Contractors* was developed by the Postal Service to provide guidance for contractors hired to perform repair, alteration, renovation, demolition, equipment installation, and other work requiring access to postal-owned or -leased property.

Distribution

A copy of this Certificate of Understanding should be signed by the Contractor's representative at the post award orientation conference or before the commencement of work. A copy of this guide should be readily accessible where the work is being performed. The contracting officer's representative (COR) should thoroughly brief the Contractor's representative on the Contract Safety and Health Requirements contained herein.

Contractor's Verification Statement

As a representative of _____ (Contractor's name), I have received the *Safety and Health Guide for Contractors* prepared by the Postal Service. As the Contractor's representative, I understand and accept the requirements contained herein, and I have reviewed each of the required sections of the guide with the COR and/or the designated Postal Service representative. I agree to review the contents of this guide with all subcontractors hired to perform work on postal property.

Contractor's Representative

Printed Name: _____ Contact Number: _____
Signature: _____ Date: _____

Designated Postal Service Representative

Printed Name: _____ Contact Number: _____
Signature: _____ Date: _____

Safety Representative (If Required by COR)

Printed Name: _____ Contact Number: _____
Signature: _____ Date: _____

Postal Service CO, COR, or Project Manager

Printed Name: _____ Contact Number: _____
Signature: _____ Date: _____

Maintain a copy of this signed form in the Postal Service and Contractor's project files.



Safety and Health and Related Environmental Requirements

The Contractor is required to meet all applicable OSHA, federal, state, and local safety, health, and related environmental requirements in addition to the US Postal Service requirement listed in this table.	
Issue	Postal Requirements
Asbestos	<p><i>Review of Facility Asbestos Survey:</i> Before any building maintenance, equipment installation, renovation, alteration, demolition, or other project begins, determine whether ACBM will be disturbed.</p> <p><i>Proper Work Practices:</i> If ACBM is present, follow proper control procedures and work practices.</p> <p><i>Consultation With Facility Asbestos Coordinator:</i> Consult with the facility manager or his or her designee before the start of any work likely to disturb ACBM. Disturbance means activities that crumble or pulverize ACBM or presumed asbestos-containing material (PACM) or generate visible debris. Operations may include drilling, abrading, cutting a hole, pulling cable, and crawling through tunnels or attics and spaces above the ceiling where asbestos is actively disturbed or asbestos-containing debris is actively disturbed.</p> <p><i>Asbestos Work Authorization:</i> You must have an approved Form 8210, <i>Work Authorization-Asbestos</i>, before work begins within any building containing asbestos.</p>
Barricades, Barriers, and Warnings	Your barricades must meet the OSHA requirements. In addition, you assume control of your work area during your activities unless otherwise specified in writing by the contracting officer (CO) or contracting officer's representative (COR).
Confined Spaces	<p>Confined space work must meet the OSHA requirements. You must have a comprehensive confined space program that includes a written program, employee training, entry and testing equipment, and rescue capabilities.</p> <p>If you require access to confined space requiring a permit, then the trained, designated Postal Service representative must review and approve the project and permit. Entry into other confined spaces must be in accordance with OSHA regulations.</p>
Electrical Work	Lock or rope off work areas involving exposed energized equipment or have an attendant present to prevent accidental contact by unqualified people. Refer to the Barricade section of this guideline for additional information.
Elevated Work and Fall Protection	Follow strictly the applicable OSHA fall protection requirements.
Excavation	<p>All excavations 4 feet or more in depth must be properly shored or sloped and meet all OSHA requirements.</p> <p>Before any digging or drilling commences, inform the Postal Service COR and call Dig Safe or its local equivalent to determine whether any underground utilities are located in the work area. Submit documentation that these notifications have been performed. You must not begin digging or drilling until you have verified that underground utilities have been identified and are properly marked so that work may be accomplished in a safe manner.</p>
Fire Protection	<p>Do not block, remove, or otherwise prevent Postal Service fire extinguishers from being immediately accessible and usable.</p> <p>If a system must be impaired by a scheduled shutdown, notify the appropriate Postal Service representative and do not proceed without Postal Service authorization.</p>
Hazard Communication	<p>Inform the Postal Service before any chemicals are used. Before materials are brought on site, provide material safety data sheets (MSDSs) and an inventory of materials. For projects that are anticipated to use substantial quantities of hazardous materials, you may be required to provide a routing, storage, and waste disposal plan.</p> <p>Upon request, the Postal Service will make available to you MSDSs for hazardous materials the Postal Service uses in the Contractor work area.</p>
Hazardous Materials	<p>Follow all OSHA requirements regarding hazardous materials. Hazardous materials include, but are not limited to, flammable and combustible liquids, gasoline, diesel fuel, motor oil, lubricating oil, hydraulic oil, corrosive cleaners, and battery acid.</p> <p>Provide secondary containment for all containers of liquids that are over 5 gallons in capacity. Immediately report all hazardous material releases ("spills"), regardless of how small or where they occur, to the designated Postal Service representative. Releases include solids, liquids, and gases.</p>



Scaffolding	Follow strictly the applicable OSHA scaffolding requirements. Provide adequate barrier protection around the scaffolding to prevent hazards to postal workers.
Walking and Working Surfaces	If the project requires temporary modifications to the means of egress, inform the designated Postal Service representative before performing such actions, provide appropriate alternative means of egress, and communicated these to all employees.



Emergency Procedures

Preparations for Emergency	<p>Be prepared for emergency situations.</p> <p>Ensure that emergency telephone numbers are site specific, readily available, easily read, and communicated to all employees.</p> <p>Train and authorize employees to implement emergency procedures.</p>
Medical Emergencies	<p>Have procedures and medical supplies to provide emergency medical services for your own personnel.</p> <p>Determine how to contact emergency medical services before work begins, and have on-site capabilities to contact such services immediately.</p>
Fires	<p>See Fire Protection above.</p> <p>In the event of a fire, you must:</p> <ul style="list-style-type: none"> - Immediately remove personnel from the area or building following Postal Service evacuation procedures. - Immediately contact the nearest postal employee and inform him or her of the fire. You may also activate an emergency alarm in the area. If no postal employees are on-site, immediately contact the local fire department. <p>Personnel trained in the use and limitations of fire extinguishers may attempt to extinguish the fire if it is safe to do so.</p>
Chemical Releases	<p>See Hazardous Materials above.</p> <p>If the event of a hazardous material release, you must:</p> <ul style="list-style-type: none"> - Immediately remove personnel from the area or building following Postal Service evacuation procedures. - Immediately contact the designated Postal Service representative and inform him or her of the release. You may also activate an emergency alarm in the area. If no postal employees are on-site, immediately contact the local fire department. <p>Contractor personnel should not respond to the release unless specifically trained and protected to perform hazardous material response.</p>
Power Outages	<p>In the event of a power outage, you must:</p> <ul style="list-style-type: none"> - Immediately stop work and assemble for a head count and possible facility egress. - Inform all contract employees that equipment may automatically restart when power resumes. - Immediately contact the designated Postal Service representative and inform him or her of the status of contract work and personnel head count. Relay at this time all hazards created due to the power outage. <p>When power resumes evaluate the status of operations that were being performed relative to hazard potential. For example, the interruption of ventilation in confined spaces may generate atmospheric hazards.</p>
Accident Investigation and Reporting	<p>As soon as is practical after an accident, investigate and document an accident investigation. The documentation must describe the incident and identify the causes and the corrective actions that will prevent future incidents.</p> <p>Report all accidents, whether or not they result in injury. Give the written report to the Postal Service COR within 24 hours of the accident or incident.</p>



Certificate of Asbestos and Lead-Based Paint
(New Work)

To: Contracting Officer, United States Postal Service

Subject: Certification for new construction

Postal facility name: _____

Postal facility address: _____

Certification for new construction:

This Contractor/Owner hereby certifies that no asbestos-containing material in excess of 1 percent as defined by applicable US Environmental Protection Agency regulations, and no lead-based paint has been furnished or installed at the referenced project.

Contractor/Owner name: _____

Signature: _____

Address: _____

Telephone: _____ Date executed: _____

The penalty for making a false statement is prescribed by 18 USC 1001.

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SECTION 01 40 00 00 - QUALITY REQUIREMENTS

NOTE TO SPECIFIER

This Section is intended for use with ALL project types: Design-Bid-Build (DBB), Design-Build (DB), Repair & Alteration (R&A) and New Construction Leased (NCL) type projects that use the Building Standard Design Specifications. Design-Bid-Build (DBB), Modify as needed for project specific requirements. [Insert the following in NCL projects - For purposes of this construction project, the terms "Landlord", "Lessor", "Owner", "Offeror", and "Contractor" are interchangeable and refer to the party whose proposal is accepted by the Postal Service. It is the Landlord's sole responsibility to clarify design and construction responsibilities among the Landlord's designers, contractors and other agents.]

1.1 Contractor Quality Control

- A. Contractor Quality Control: The Contractor is responsible for the overall quality of all its own work and the work performed by their subcontractors working under this contract. The quality of any part of the work installed must not be less than that required by the technical divisions of this specification. If the COR determines that the quality of work does not conform to the applicable specifications and drawings, the Contractor will be advised in writing of the areas of nonconformance, and within 7 days the Contractor must correct the deficiencies and advise the COR in writing of the corrective action taken.
- B. Noncompliance with Quality Control Requirements: Failure of the Contractor to comply with the above requirements may be cause for termination for default as defined in the terms and conditions of the contract provisions and clauses, including those concerning, *Termination for Convenience or Default*, of the general contract clauses.

1.2 Submittals

- A. Prior to the start of on-site work, the Contractor must submit to the Contracting Officer a Contractor Quality Control Plan that includes the following information:
 - 1. Quality Control Organization: In chart form, showing relationship of Quality Control organization to other elements of Contractor's organization.
 - 2. Names and qualifications of personnel in Quality Control organization, including Contractor Quality Control Representative, inspectors, Independent Testing and Inspection Laboratory, and Independent HVAC Test and Balance Agency.
 - 3. Procedures for reviewing coordination drawings, shop drawings, certificates, certifications, or other submittals.
 - 4. Testing and inspection schedule, keyed to Construction Schedule, indicating tests and inspections to be performed, names of persons responsible for inspection and testing for each segment of work including preparatory, initial, and follow-up.
 - 5. Proposed forms to be used including Contractor's Daily Report, Contractor Test and Inspection Report and Non-Compliance Check-Off List.
- B. Independent Testing and Inspection Laboratory: Submit the following.
 - 1. Name.
 - 2. Address.
 - 3. Telephone number.
 - 4. Names of full time registered engineer.
 - 5. Responsible officer.
 - 6. Copy of report of laboratory facilities inspection made by Materials Reference Laboratory of National Bureau of Standards during most recent inspection, with memorandum of remedies of any deficiencies reported by inspection.



1.3 Quality Control Procedures

- A. Monitor quality control over Contractor staff, subcontractors, suppliers, manufacturers, products, services, site conditions, and workmanship.
- B. Comply fully with manufacturer's published instructions, including each step in sequence of installation.
- C. Should manufacturer's published instructions conflict with Contract Documents, request clarification from COR before proceeding.
- D. Comply with specified standards as a minimum quality for work, except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform work by persons who are thoroughly qualified and trained in their respective trade, to produce workmanship of specified quality.
- F. Perform tests required by governing authorities having jurisdiction and utilities having jurisdiction.

1.4 Testing and Inspection Laboratory Services

- A. Selection and Payment:
 - 1. The Contractor shall pay for services of an Independent Testing and Inspection Laboratory to perform specified testing and inspection.
 - 2. Employment of Independent Testing and Inspection Laboratory in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.
- B. Quality Assurance:
 - 1. Comply with requirements of all applicable ASTM standards.
 - 2. Laboratory: Authorized to operate in State in which Project is located.
 - 3. Laboratory Staff: Maintain a full time registered engineer on staff to review services.
 - 4. Testing Equipment: Calibrated at reasonable intervals with devices of and accuracy traceable to either National Bureau of Standards or accepted values of natural physical constraints.
- C. Laboratory Responsibilities. Contractor shall ensure the Laboratory has the following responsibilities and limits on authority:
 - 1. Test samples of mixes submitted by Contractor.
 - 2. Provide qualified personnel at Project site. Cooperate with COR and Contractor in performance of services.
 - 3. Perform specified sampling, testing, and inspection of Products in accordance with specified standards.
 - 4. Determine compliance of materials and mixes with requirements of Contract Documents.
 - 5. Promptly notify Contractor Quality Control Representative and COR of observed irregularities or non-conformance of work or Products.
 - 6. Submit one copy of all test results directly to the COR.
 - 7. Perform additional tests as required by COR.
 - 8. Attend appropriate preconstruction meetings and progress meetings.
- D. Limits on Authority. Contractor shall ensure the Laboratory has the following limits on authority:
 - 1. Laboratory may not release, revoke, alter, or expand on requirements of Contract Documents.
 - 2. Laboratory may not approve or accept any portion of work.
 - 3. Laboratory may not assume any duties of Contractors.
 - 4. Laboratory has no authority to stop work.

1.5 Contractor Field Inspection and Testing



- A. Contractor: Test and Inspect work provided under this Contract to ensure work is in compliance with Contract requirements. Required tests and inspections are indicated in each individual Specification Section.
- B. Preparatory Inspection: Performed prior to beginning work and prior to beginning each segment of work and includes:
 - 1. Review of Contract requirements.
 - 2. Review of shop drawings and other submittal data after return and approval.
 - 3. Examination to assure materials and equipment conform to Contract requirements.
 - 4. Examination to assure required preliminary or preparatory work is complete.
- C. Initial Inspection: Performed when representative portion of each segment of work is completed and includes:
 - 1. Performance of required tests.
 - 2. Quality of workmanship.
 - 3. Review for omissions or dimensional errors.
 - 4. Examination of products used, connections and supports.
 - 5. Approval or rejection of inspected segment of work.
- D. Follow-Up Inspections: Performed daily, and more frequently as necessary, to assure non-complying work has been corrected.
- E. Testing and Inspection: Perform testing and inspection in accordance with requirements in individual Specification Sections.

1.6 Contractor's Daily Report

- A. In accordance with the terms and conditions of the contract provisions and clauses, including those concerning *Performance and Superintendence of Work by Contractor*, the Contractor shall submit daily report to COR, for days that work was performed. Include the following information:
 - 1. Date, weather, minimum and maximum temperatures, rainfall, and other pertinent weather occurrences.
 - 2. Daily workforce of Contractor and subcontractors, by trades.
 - 3. Description of work started, ongoing work, and work completed by each subcontractor.
 - 4. Coordination implemented between various trades.
 - 5. Approval of substrates received from various trades.
 - 6. Nonconforming and unsatisfactory items to be corrected.
 - 7. Remarks, to include at a minimum, any potential delays, schedule changes, workplace incidents or other items of note. However, nothing reported herein shall relieve the Contractor of the separate responsibility under other terms and conditions of the Contract provisions and clauses to provide specific notice to the Contracting Officer,

1.7 Contractor's Test and Inspection Reports

- A. Prepare and submit, to COR, a written report of each test or inspection signed by Contractor Quality Control Representative performing inspection within 2 days following day inspection was made.
- B. Include the following on written reports of inspection:
 - 1. Cover sheet prominently identifying that inspection "CONFORMS" or "DOES NOT CONFORM" to Contract Documents.
 - 2. Date of inspection and date of report.
 - 3. Project name, location, solicitation number, and Contractor.
 - 4. Names and titles of individuals making inspection, if not Contractor's Project Field Superintendent.
 - 5. Description of Contract requirements for inspection by referencing Specification Section.



6. Description of inspection made, interpretation of inspection results, and notification of significant conditions at time of inspection.
7. Requirements for follow-up inspections.

1.8 Non-Compliance Check-Off List

- A. Maintain check-off list of work that does not comply with Contract Documents, stating specifically what is non-complying, date faulty work was originally discovered, and date work was corrected. No requirement to report deficiencies corrected same day it was discovered. Submit copy of Non-Compliance Check-Off List of non-complying work items to COR on a weekly basis.

1.9 Completion and Inspection of Work

- A. Prior to final acceptance by Contracting Officer, submit a certification signed by Contractor to Contracting Officer stating that all work has been inspected and all work, except as specifically noted, is complete and in compliance with Contract Documents.

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END OF SECTION 01 40 00 00



Task	Specification	Specification Description
01 45 23 00	01 22 16 00	No Specification Required



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SECTION 01 50 00 00 - TEMPORARY FACILITIES AND CONTROLS

NOTE TO SPECIFIER

This Section is intended for use with ALL project types: Design-Bid-Build (DBB), Design-Build (DB), Repair & Alteration (R&A) and New Construction Leased (NCL) type projects that use the Building Standard Design Specifications. Modify as needed for project specific requirements.

1.1 General

- A. The Contractor must provide all temporary facilities and services required to complete the work and to comply with OSHA and other applicable regulations.
- B. The Contractor must maintain temporary facilities in a proper, safe, operating and sanitary condition for the duration of this Contract. Upon completion of this Contract, all such temporary work and facilities shall be removed in their entirety and the premises will be restored to its prior condition.

1.2 Project Sign

- A. The Contractor must provide and maintain a construction project sign at the location directed by the COR. The sign must conform to the Construction Sign as detailed in the Contract drawings. The information needed to complete the wording on the sign is provided by the COR and will be essentially as shown on the cover of the specification. The sign must be erected within 15 days after receiving a Notice to Proceed. The sign will remain the property of the Contractor and must be removed upon completion of the work and the premises will be restored to its prior condition.
- B. Construction Site Sign:
 - 1. Silk-screened, painted or pressure-sensitive vinyl letters applied to Medium Density Overlay plywood sign.
 - 2. Red: Match Benjamin Moore OP-67.
 - 3. Blue: Match PPG 7062 Federal Blue.
 - 4. White background.
- C. The Contractor must construct and erect a minimum of two hard hat signs at locations designated by the COR. The signs must be erected prior to the commencement of on-site work.

1.3 Bulletin Board

- A. A weatherproof bulletin board, not less than 36 inches wide and 30 inches high, with hinged glass door must be provided adjacent to, or mounted on, the Contractor's project office. If adjacent to the office, the bulletin board must be securely mounted on not less than two posts. The bulletin board and posts must be painted or have approved factory finish. The bulletin board must be easily accessible at all times and must contain wage rates, equal opportunity notice, and other items required to be posted.
- B. The Contractor must maintain the bulletin board in good condition throughout the life of the project. The bulletin board will remain the property of the Contractor and upon completion of the project must be removed from the site and the premises will be restored to its prior condition.

1.4 Construction-Use Utilities

- A. The Contractor must arrange with the local utility companies for gas, water, and electricity required for construction under this project and must pay all costs in connection with them. The Contractor must, at



its own expense, make all temporary connections and install distribution lines. All temporary lines must be maintained by the Contractor in a manner satisfactory to the COR and must be removed by the Contractor in like manner before final acceptance of the construction.

1.5 Temporary Electricity

- A. **Costs:** The Contractor must make arrangements with the serving utility for power, pay deposits, and install equipment, poles, wiring, switches, and outlets necessary to provide adequate supply for lighting and power for construction purposes. The Contractor must pay for power used during construction and for removal of all temporary equipment.
- B. **Service Required:** The Contractor must provide temporary electric power throughout the construction period so that power can be secured at any desired point with no more than a 100-foot extension cord; power centers for miscellaneous tools and equipment used in the construction work (not less than one per 2,000 square feet of floor space, consisting of a weatherproof distribution box with a minimum of four 20-amp, 120-volt grounded outlets with a circuit breaker protection for each outlet); lighting for safe and adequate working conditions throughout buildings and stairways (at least 1/4 watts of incandescent lighting per square foot, with a socket voltage of at least 110 volts and using 100 watt lamps minimum); power for construction site offices and other temporary storage and construction building; and power for testing and checking equipment welding units, and terrazzo grinders.
- C. **Safety:** The Contractor must provide and maintain lights and signs to prevent damage or injury and must illuminate all hazardous areas. Safety lights must be kept burning from dusk to dawn.
- D. **Requirements of Regulatory Agencies:** The Contractor must obtain permits as required by local government authorities; obtain easements as required across private property other than that of the Owner for temporary power service; and comply with the National Electrical Code, applicable local codes, and utility regulations.
- E. **Use of Permanent System:** The Contractor must regulate any part of the permanent electrical system that is used for construction purposes in order to prevent interference with safety and with the orderly progress of the work. The Contractor must leave permanent electrical services in a condition as good as new.
- F. **Materials:** The materials may be new or used but must be adequate in capacity for the purposes intended and must not create unsafe conditions or violate the requirements of applicable codes. At the Contractor's option, patented specialty materials may be used if UL-approved.
- G. **Conductors:** The Contractor must use wire, cable, or busses of appropriate type, sized in accordance with the National Electrical Code for the applied loads. Use only UL-approved wire.
- H. **Equipment:** In compliance with NEMA standards, the Contractor must provide an appropriate enclosure for the environment in which the equipment is used.
- I. **Installation:** The Contractor must provide all required facilities, including transformers, conductors, poles, conduits, raceways, fuses, switches, fixtures, and lamps, located so as to avoid interference with cranes and materials-handling equipment, storage areas, traffic areas, and work under other contracts. The Contractor must install all work to have a neat and orderly appearance and to make it structurally sound throughout. The Contractor must maintain it to give continuous service and to provide safe working conditions. The Contractor must modify the service as required by the progress of the job.
- J. **Removal:** The Contractor must remove all temporary equipment and materials upon completion of construction, repair all damage caused by the installation, and the premises will be restored to its prior condition.



1.6 Temporary Heating and Ventilation

- A. The Contractor must provide cold weather protection and temporary heat and fuel as required to carry on the work expeditiously during inclement weather, protect all work and materials against damage from dampness and cold, dry out the building, and provide suitable working conditions for the installation and curing of materials until final acceptance by the Contracting Officer. The Contractor must refer to requirements in detailed specifications for temperatures to be provided and maintained for installation and curing of work under the various trades.
- B. The Contractor must provide temporary heat consisting of smokeless heating appliances satisfactory to the COR. The Contractor must furnish and pay for all necessary fuel and attendants in any trade and must maintain temporary heat at temperatures adequate for the intended purpose.
- C. When the permanent heating system is operable and the Contractor elects to use it, the Contractor must provide all fuel, labor, materials, services, equipment, and attendants necessary to operate the permanent heating system for temporary heat and to maintain a minimum temperature as specified in the terms and conditions of the contract provisions and clauses, including those concerning *Heat*. If the permanent system is used to provide temporary heating and ventilation, the Contractor must replace all filters and restore the system to a condition satisfactory to the COR.

1.7 Temporary Water

- A. The Contractor must provide and maintain a temporary water supply system for building purposes, extending branches to convenient points and terminating them with a proper stop and hose connection. Before any paving is laid, the temporary supply must be removed and the tap in the main supply properly capped.

1.8 Sanitary Provisions

- A. The Contractor must provide and keep in neat and sanitary condition conveniences and accommodations for the use of the construction personnel necessary to comply with the requirements and regulations of the local department of health and of other bodies having jurisdiction.

1.9 Approaches and Exits

- A. The Contractor must provide all necessary approaches and exits required to properly execute the work.
- B. In connection with these, the Contractor must provide for temporary drainage to keep the site free from standing water at all times.

1.10 Postal Service Field Office

- A. Within 30 days after receiving a Notice to Proceed, the Contractor must furnish a building or trailer having a minimum of [____] square feet of floor space to serve as a USPS temporary field office. It must be located where directed and must be reserved for Postal Service use only. Drinking water facilities, adequate lighting, ventilation, heating, air-conditioning equipment, a copy machine, and a partition-enclosed chemical toilet must be furnished and maintained by the Contractor. The Contractor must provide hook-up to utility services and telephone services and must pay the cost of all services except long-distance phone calls. Used field office buildings and used furniture and equipment in good condition are acceptable. Entrance doors must be equipped with a substantial lock. Janitorial service must be furnished by the Contractor. If a building is provided, it must be constructed to be easily moved, and the Contractor must relocate the building twice during the contract, if directed to do so. All-weather



vehicle and pedestrian access and all-weather parking areas for six cars must be provided at the field office location. The temporary field office, including furniture, with the exception of any office equipment including computers, printers, FAX machines, etc., will remain the property of the Contractor and must be removed from the site after the work is completed and the premises will be restored to its prior condition.

NOTE TO SPECIFIER

Consult with the COR for direction on field office requirements and attach the approved list at the end of this section.

- B. Detailed List of Furnishings and Equipment. See Attachment at the end of this section for a list of equipment to be included in the USPS field office.
- 1.11 Project Photos - Required on construction contracts that exceed \$10,000.00. The number of photographs, and their content, shall be appropriate to the Contract Scope of Work, with their intended purpose being to illustrate, generally, the work in place for which this payment application applies.

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END OF SECTION 01 50 00 00



Task	Specification	Specification Description
01 51 13 00	26 05 19 13	Electrical Renovation
01 51 26 00	26 05 19 13	Electrical Renovation
01 52 13 00	01 22 16 00	No Specification Required
01 52 19 00	01 22 16 00	No Specification Required
01 54 23 00	01 22 16 00	No Specification Required
01 54 23 00	04 05 26 00	Scaffolding Tubular Steel
01 54 26 00	01 22 16 00	No Specification Required
01 54 30 00	01 22 16 00	No Specification Required
01 55 26 00	01 22 16 00	No Specification Required
01 56 16 00	01 22 16 00	No Specification Required
01 56 26 00	01 22 16 00	No Specification Required
01 56 29 00	01 22 16 00	No Specification Required
01 56 33 00	01 22 16 00	No Specification Required
01 56 39 00	01 22 16 00	No Specification Required
01 58 13 00	01 22 16 00	No Specification Required



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**SECTION 01 60 00 00 - PRODUCT REQUIREMENTS**

NOTE TO SPECIFIER

This Section is intended for use with ALL project types: Design-Bid-Build (DBB), Design-Build (DB), Repair & Alteration (R&A) and New Construction Leased (NCL) type projects that use the Building Standard Design Specifications. Modify as needed for project specific requirements.

1.1 Product Options and Substitutions

- A. Refer to the terms and conditions of the contract provisions and clauses, including those concerning *Optional Materials or Methods (Construction), Materials and Workmanship, Information On "Equal" Products and Brand Name or Equal.*
- B. Provide Products that comply with Contract Documents, which are undamaged and new at time of installation.
- C. Provide Products complete with accessories, trim, finish, safety guards, and other devices and details needed for complete installation and intended use and effect.
- D. Substitutions may be considered when the Contractor:
 - 1. Becomes aware of a product or procedure that is more environmentally sensitive or is otherwise advantageous to the Postal Service;
 - 2. Represents that he has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;
 - 3. Will provide the same guarantee for the substitution that he would for that specified; and
 - 4. Will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects, at no additional cost to the Postal Service and at no extension of the Contract completion date.

1.2 Product Delivery Requirements

- A. Transport and handle Products in accordance with manufacturer's instructions, using means and methods that will prevent damage, deterioration and loss, including theft.
- B. Schedule Product delivery to minimize long-term storage at Project site and prevent overcrowding of construction spaces.
- C. Coordinate Product delivery with installation schedule to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
- D. Deliver Products to Project site in undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
- E. Promptly inspect shipments to ensure that Products comply with project requirements, quantities are correct, Products are undamaged, and properly protected.
- F. Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.



1.3 Product Storage and Handling Requirements

- A. Store and protect Products in accordance with manufacturers' published instructions, with seals and labels intact and legible.
- B. Store Products subject to damage by elements above ground, under cover in weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's published instructions.
- C. For exterior storage of fabricated Products, place on sloped supports, above ground.
- D. Provide off-site storage and protection when Project site does not permit on-site storage or protection.
- E. Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation or potential degradation of Products.
- F. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- G. Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.
- H. Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.

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END OF SECTION 01 60 00 00



Task	Specification	Specification Description
01 66 19 00	01 22 16 00	No Specification Required
01 71 13 00	01 22 16 00	No Specification Required



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SECTION 01 71 23 16 - CUTTING AND PATCHING**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for cutting and patching. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes procedural requirements for cutting and patching.

C. Definitions

1. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
2. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

D. Submittals

1. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
 - a. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
 - b. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
 - c. Products: List products to be used and firms or entities that will perform the Work.
 - d. Dates: Indicate when cutting and patching will be performed.
 - e. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.
 - f. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
 - g. the Owner's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

E. Quality Assurance

1. LEED Requirements for Building Reuse:
 - a. Credit MR 1.1 and 1.2, **as directed**: Maintain existing building structure (including structural floor and roof decking) and envelope (exterior skin and framing, excluding window assemblies and nonstructural roofing material) not indicated to be removed; do not cut such existing construction beyond indicated limits.
 - b. Credit MR 1.3: Maintain existing interior nonstructural elements (interior walls, doors, floor coverings, and ceiling systems) not indicated to be removed; do not cut such existing construction beyond indicated limits.
 - c. Credit MR 1.2 and 1.3, **as directed**: Maintain existing nonshell, nonstructural components (walls, flooring, and ceilings) not indicated to be removed; do not cut such existing construction beyond indicated limits.



2. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
 - a. **Refer to the Owner for list of elements that might otherwise be overlooked as structural elements and that require Architect's or Construction Manager's approval of a cutting and patching proposal.**
3. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include the following:
 - a. Primary operational systems and equipment.
 - b. Air or smoke barriers.
 - c. Fire-suppression systems.
 - d. Mechanical systems piping and ducts.
 - e. Control systems.
 - f. Communication systems.
 - g. Conveying systems.
 - h. Electrical wiring systems.
 - i. Operating systems of special construction in Division 13.
4. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include the following:
 - a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.
 - c. Exterior curtain-wall construction.
 - d. Equipment supports.
 - e. Piping, ductwork, vessels, and equipment.
 - f. Noise- and vibration-control elements and systems.
5. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
6. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

F. Warranty

1. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

1.2 PRODUCTS

A. Materials

1. General: Comply with requirements specified in other Sections.
2. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - a. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.



1.3 EXECUTION

A. Preparation

1. Temporary Support: Provide temporary support of Work to be cut.
2. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
3. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
4. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize **OR** prevent, **as directed**, interruption to occupied areas.

B. Performance

1. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - a. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
2. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - a. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - b. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - c. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - d. Excavating and Backfilling: Comply with requirements in applicable Division 31 where required by cutting and patching operations.
 - e. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - f. Proceed with patching after construction operations requiring cutting are complete.
3. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
 - a. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 - b. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - 1) Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - 2) Restore damaged pipe covering to its original condition.
 - c. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - 1) Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.



- d. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
- e. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.
- 4. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01 71 23 16

SECTION 01 73 00 00 - EXECUTION

NOTE TO SPECIFIER

This Section is intended for use with ALL project types: Design-Bid-Build (DBB), Design-Build (DB, Repair & Alteration (R&A) and New Construction Leased (NCL) type projects that use the Building Standard Design Specifications. Modify as needed for project specific requirements.

1.1 Layout of Work

- A. The Contractor must lay out its work from Postal Service-established base lines and benchmarks indicated on the drawings and is responsible for all measurements based on them. The Contractor must furnish, at its own expense, all stakes, templates, platforms, equipment, tools, materials, and labor as may be required in laying out any part of the work from the base lines and benchmarks established by the Postal Service. The Contractor is responsible for the execution of the work to those lines and grades established or indicated by the COR.

1.2 Contractor's Temporary Use of Facilities and Equipment

- A. No new facilities or equipment intended for the permanent installation, including materials-handling vehicles, may be used for temporary purposes unless specified in the Contract or unless the Contractor has the written permission of the COR.

1.3 Cleaning

- A. Refer to the terms and conditions of the contract provisions and clauses, including those clauses *Debris and Clean Up*.
- B. Cleaning During Construction:
 - 1. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
 - 2. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
 - 3. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
 - 4. Collect and remove waste materials, debris, and rubbish from site as specified in the Environmental Compliance and Management Plan as required in Section 013543 - Environmental Procedures.
- C. Final Cleaning:
 - 1. Use cleaning materials and agents recommended by manufacturer or fabricator of surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property, or that might damage finished surfaces.
 - 2. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of Work to condition expected from a commercial building cleaning and maintenance program. Comply with manufacturer's published instructions.
 - 3. Complete following cleaning operations before requesting COR inspection for Substantial Completion.
 - a. Clean Project Site, yard and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste materials, litter and foreign substances. Sweep paved areas broom clean. Remove petro-chemical spills, stains and other foreign



- deposits. Rake grounds that are neither planted nor paved, to a smooth even-textured surface.
- b. Remove tools, construction equipment, machinery and surplus material from Project Site.
 - c. Remove snow and ice to provide safe access to building.
 - d. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - e. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics and similar spaces.
 - f. Broom clean concrete floors in unoccupied spaces.
 - g. Provide final cleaning, waxing, and buffing of resilient tile, in accordance with manufacturer's requirements.
 - h. Vacuum clean carpet and similar soft surfaces, removing debris and excess nap. Shampoo if required.
 - i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - j. Remove labels that are not permanent labels.
 - k. Touch-up and otherwise repair and restore marred exposed finishes and surfaces. Replace finishes and surfaces that can not be satisfactorily repaired or restored, or that show evidence of repair or restoration. Do not paint over "UL" and similar labels, including mechanical and electrical name plates.
 - l. Wipe surfaces of mechanical and electrical equipment, and other similar equipment. Remove excess lubrication, paint and mortar droppings and other foreign substances.
 - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - n. Replace air disposable filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills. Clean ducts, blowers, and coils if units were operated without filters during construction.
 - o. Clean light fixtures, lamps, globes and reflectors to function with full efficiency. Replace burned out bulbs, and defective and noisy starters in fluorescent and mercury vapor fixtures.
 - p. Leave Project clean and ready for occupancy.
4. Engage an experienced licensed exterminator to make a final inspection, and rid Project of rodents, insects, and other pests. Comply with regulations of local authorities having jurisdiction.
 5. Remove temporary protection and facilities installed during construction to protect previously completed installations during remainder of construction.
 6. Comply with governing regulations and safety standards for cleaning operations. Remove waste materials from Project Site and dispose of in accordance with requirements of local authorities having jurisdiction.
 7. Where extra materials of value remain after completion of construction, they become Postal Service property and these materials should be stored as directed by COR.

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END OF SECTION 01 73 00 00



Task	Specification	Specification Description
01 74 13 00	01 71 23 16	Cutting and Patching
01 74 16 00	01 22 16 00	No Specification Required



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SECTION 01 74 19 00 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

NOTE TO SPECIFIER

This Section includes requirements for waste management and the protection of natural resources. This section is intended for use with ALL project types: Design-Bid-Build (DBB), Design-Build (DB), Repair & Alteration (R&A) and New Construction Leased (NCL) type projects that use the Building Standard Design Specifications. Modify as needed for project specific requirements. This section emphasizes a team approach – including U.S. Postal Service, design professional, the contractor – to address environmental issues. Use this section for green projects and as directed by the COR. Do not revise this section without prior approval or direction from the USPS COR.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Procedures for achieving the most environmentally conscious Work feasible within the limits of the Construction Schedule, Contract Sum, and available materials, equipment, and products.
 - 1. Participate in promoting efforts of Postal Service to create an energy-efficient and environmentally-sensitive structure.
 - 2. Use recycled-content, toxic-free, and environmentally-sensitive materials and equipment.
 - 3. Use environmentally-sensitive procedures.
 - a. Protect the environment, both on-site and off-site, during demolition and construction operations.
 - b. Prevent environmental pollution and damage.
 - c. Effect optimum control of solid wastes.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 013200 - Construction Progress Documentation.
 - 2. Section 014000 - Quality Requirements: Contractor's Daily Report.
 - 3. Section 015000 - Temporary Facilities And Controls: Temporary ventilation, progress cleaning and waste removal.
 - 4. Section 016000 - Product Requirements: Substitutions.
 - 5. Section 017704 – Closeout Procedures and Training: Record submittals.
 - 6. Section 024113 – Selective Site Demolition.

1.2 DEFINITIONS

- A. Adequate ventilation: Ventilation, including air circulation and air changes, required to cure materials, dissipate humidity, and prevent accumulation of dust fumes, vapors, or gases.
- B. Construction and demolition waste: Includes solid wastes, such as building materials, packaging, rubbish, debris, and rubble resulting from construction, remodeling, repair, and demolition operations.
 - 1. Rubbish: Includes both combustible and noncombustible wastes but excludes recyclable materials such as paper, boxes, glass, metal, lumber scrap and metal cans.
 - 2. Debris: Includes both combustible and noncombustible wastes, such as leaves and tree trimmings, stumps and rubble that result from construction or maintenance and repair work.
- C. Chemical waste: Includes petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.



- D. Diversion: Redirection of waste ordinarily deposited in a municipal landfill to a recycling facility or to another destination for reuse.
- E. Environmental pollution and damage: The presence of chemical, physical, or biological elements or agents, which adversely affect human health or welfare; unfavorably alter ecological balances; or degrade the utility of the environment for aesthetic, cultural, or historical purposes.
- F. Hazardous materials: Includes pesticides, biocides, and carcinogens as listed by recognized authorities, such as the Environmental Protection Agency (EPA) and the International Agency for Research on Cancer (IARC).
- G. Interior final finishes: Materials and products that will be exposed at interior, occupied spaces; including flooring, wallcovering, finish carpentry, and ceilings.
- H. Municipal Solid Waste Landfill: A permitted facility that accepts solid, non-hazardous waste such as household, commercial, and industrial waste, including construction and demolition waste.
- I. Packaged dry products: Materials and products that are installed in dry form and are delivered to the site in manufacturer's packaging; including carpets, resilient flooring, ceiling tiles, and insulation.
- J. Sediment: Soil and other debris that has been eroded and transported by storm or well production runoff water.
- K. Sanitary wastes:
 - 1. Garbage: Refuse and scraps resulting from preparation, cooking, distribution, or consumption of food.
 - 2. Sewage: Domestic sanitary sewage.
- L. Wet products: Materials and products installed in wet form, including paints, sealants, adhesives, and special coatings.

1.3 SUBMITTALS

- A. Solid Waste Management and Environmental Protection Plan: Prepare and **submit at the Preconstruction Meeting** a Solid Waste Management and Environmental Protection Plan including, but not limited to, the following:
 - 1. Procedures for Recycling/Re-Use Program.
 - 2. Schedule for application of interior finishes.
 - 3. Revise and resubmit Solid Waste Management and Environmental Protection Plan as required by Postal Service.
 - a. Approval of the Contractor's Solid Waste Management and Environmental Protection Plan, will not relieve the Contractor of responsibility for adequate and continuing control of pollutants and other environmental protection measures.
 - 4. Any permits required by local, state or federal agencies.
- B. With each Contractor's Report as specified in Section 014000 – Quality Requirements, submit an updated Summary Of Solid Waste Disposal And Diversion. Submit on form in Appendix A of this Section. Include manifests, weight tickets, receipts, and invoices specifically identifying the Project and waste material for:
 - 1. Municipal Solid Waste Landfills.
 - 2. Recycling/Reuse Facilities.
- C. With Record Submittals as specified in Section 017704 - Closeout Procedures and Training, submit the following:



1. Final Summary Of Solid Waste Disposal And Diversion. Submit on form in Appendix A of this Section.
2. Resource Conservation and Recovery Act Project Summary. Submit on form in Appendix B of this Section.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

3.1 RECYCLING AND REUSE

- A. Collection: Implement a recycling/reuse program that includes separate collection of waste materials of the following types as appropriate to authorized local and regional recycling/reuse facilities:
 1. Asphalt.
 2. Concrete.
 3. Metal.
 - a. Ferrous.
 - b. Non-ferrous.
 4. Wood.
 5. Debris.
 6. Glass.
 7. Clay brick.
 8. Paper/Cardboard.
 9. Plastic.
 10. Gypsum.
 11. Paint.
 12. Carpet.
 13. Others as appropriate.
- B. Recycling/reuse centers: Contact state and/or local governmental solid waste offices, Environmental Protection Agency (EPA) regional offices, and authorized applicable non-profit organizations.
 1. Asphalt
 2. Concrete.
 3. Metal.
 4. Wood.
 5. Debris.
 6. Glass.
 7. Clay brick.
 8. Paper/Cardboard.
 9. Plastic.
 10. Gypsum.
 11. Paint.
 12. Carpet.
 13. Others as appropriate.
- C. Handling:
 1. Clean materials which are contaminated prior to placing in collection containers. Deliver materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to recycling process.
 2. Arrange for collection by or delivery to the appropriate recycling or reuse facility.



- D. Participate in re-use programs: identify local and regional re-use programs, including but not limited to non-profit organizations such as schools, local housing agencies, and public arts programs, that accept used materials. The following are examples for Contractor's information only.
 - 1. National materials exchange network, such as CAL-MAX, a free service provided by various state and regional offices, designed to help businesses find markets for materials that traditionally would be discarded. The premise of the program is that material discarded by one business may be a resource for another business.
 - a. Items and regions covered by materials exchange programs may vary. Contact the applicable regional materials exchange program. In California, contact CAL-MAX at (916) 255-2369.
 - 2. Habitat For Humanity, a non-profit housing organization that rehabilitates and builds housing for low income families.
 - a. Sites requiring donated materials vary. Contact the national hotline (800) HABITAT.
- E. Rebates, tax credits, and other savings obtained for recycled or re-used materials accrue to Contractor.

3.2 ENVIRONMENTAL CONTROLS

- A. Protection of natural resources: Preserve the natural resources within the Project boundaries and outside the limits of permanent Work performed under this Contract in their existing condition or restore to an equivalent or improved condition as approved by Postal Service, upon completion of the Work.
 - 1. Confine demolition and construction activities to work area limits indicated on the Drawings and as directed by COR.
 - a. Temporary construction: As specified in Section 015000 - Temporary Facilities And Controls.
 - b. Demolition and salvage operations: As specified in Section 024119 - Selective Structure Demolition.
 - c. Disposal operations for demolished and waste materials that are not identified to be salvaged, recycled or reused:
 - 1) Remove debris, rubbish, and other waste materials resulting from demolition and construction operations, from site.
 - 2) No burning permitted.
 - 3) Transport materials with appropriate vehicles and dispose off-site to areas which are approved for disposal by governing authorities having jurisdiction.
 - 4) Avoid spillage by covering and securing loads when hauling on or adjacent to public streets or highways. Remove spillage and sweep, wash, or otherwise clean project site, streets, or highways.
 - 5) Comply with applicable federal, state and/or local regulations.
 - 2. Water resources as follows:
 - a. Comply with requirements of the National Pollutant Discharge Elimination System (NPDES) and the State Pollutant Discharge Elimination System (SPDES).
 - b. Oily substances: Prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water.
 - 1) Store and service construction equipment at areas designated for collection of oil wastes.
 - c. Mosquito abatement: Prevent ponding of stagnant water conducive to mosquito breeding habitat.
 - d. Prevent run-off from site during demolition and construction operations.



3. Land resources: Prior to construction, identify land resources to be preserved within the Work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, top soil, and land forms without permission from Postal Service.
4. Air Resources: Prevent creation of dust, air pollution, and odors.
 - a. Use water sprinkling, temporary enclosures, and other appropriate methods to limit dust and dirt rising and scattering in air to lowest practical level.
 - 1) Do not use water when it may create hazardous or other adverse conditions such as flooding and pollution.
 - b. Do not use any hazardous chemicals on USPS property when it is a shared work space with USPS employees. If chemicals are authorized for use, store volatile liquids, including fuels and solvents, in closed containers.
 - c. Properly maintain equipment to reduce gaseous pollutant emissions.
 - d. Interior final finishes: Schedule construction operations involving wet products prior to packaged dry products to the greatest extent possible in accordance with Postal Service approved Solid Waste Management and Environmental Protection Plan.
 - e. Temporary Ventilation: As specified in Section 015000 - Temporary Facilities And Controls, and as follows:
 - 1) Provide adequate ventilation during and after installation of interior wet products and interior final finishes.
 - 2) Provide adequate ventilation of packaged dry products prior to installation. Remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources and residues. Provide a temperature range of 60 degrees F minimum to 90 degree F maximum continuously during the ventilation period. Do not ventilate within limits of Work unless otherwise approved by the COR.
 - f. Pre-occupancy ventilation: After final completion and prior to initial occupancy, provide adequate ventilation for minimum 5 days. Pre-occupancy ventilation procedures:
 - 1) Use supply air fans and ducts only.
 - 2) Temporarily seal exhaust ducts.
 - 3) Temporarily disable exhaust fans.
 - 4) Provide exhaust through operable windows or temporary openings.
 - 5) Provide temporary exhaust fans as required to pull exhaust air from deep interior locations. Stair towers may be used for exhausting air from the building during the temporary ventilation.
 - 6) After pre-occupancy ventilation and prior to final testing and balancing of HVAC system, replace air filters and make HVAC system fully operational.
5. Fish and Wildlife Resources: Manage and control construction activities to minimize interference with, disturbance of, and damage to fish and wildlife.
6. Noise Control: Perform demolition and construction operations to minimize noise. Perform noise producing work in less sensitive hours of the day or week as directed by Postal Service .
 - a. Repetitive, high level impact noise will be permitted only between the hours of 8:00 a.m. and 6:00 p.m. Do not exceed the following dB limitations:

Sound Level in dB

70
80

Time Duration of Impact Noise

More than 12 minutes in any hour
More than 3 minutes in any hour

- b. Provide equipment, sound-deadening devices, and take noise abatement measures that are necessary for compliance.



USPS Master Specifications, issued: 10/1/2013
Last revised: 9/17/2013



Appendix A

SUMMARY OF SOLID WASTE DISPOSAL AND DIVERSION

Project Name: _____

FMS Project Number: _____

Contractor Name: _____

License Number: _____

Contractor Address: _____

Solid Waste Material	Date Material Disposed/ Diverted	Amount Disposed/ Diverted (ton or cu. yd)	Municipal Solid Waste Facility (name, address, & phone number)	Recycling/Reuse Facility (name, address, & phone number)	Comments (if disposed, state why not diverted)
Asphalt					
Concrete					
Metal					
Wood					
Debris					
Glass					
Clay brick					
Paper/ Cardboard					
Plastic					
Gypsum					
Paint					
Carpet					
Other:					

Signature: _____

Date: _____

RESOURCE CONSERVATION AND RECOVERY ACT - PROJECT SUMMARY.

Project Name: _____ FMS Project Number: _____
Contractor Name: _____ License Number: _____
Contractor Address: _____

1.0 EPA GUIDELINE ITEMS

A. Fly Ash:

1. Total dollar amount of concrete and cement provided for this project. \$_____.
2. Total dollar amount of concrete and cement containing fly ash provided for this project. \$_____.
3. Were there any technical impediments to increasing the amount of concrete and cement containing fly ash provided for this project? _____.
 - a. If yes, please explain. _____

_____.

B. Building Insulation Products:

1. Total dollar amount of building insulation products provided for this project. \$_____.
2. Total dollar amount of building insulation products containing recycled materials provided for this project. \$_____.
3. Were there any technical impediments to increasing the amount of building insulation products containing recycled materials provided for this project? _____.
 - a. If yes, please explain. _____

_____.

C. Carpet:

1. Total dollar amount of carpet provided for this project. \$_____.
2. Total dollar amount of carpet containing recycled materials provided for this project. \$_____.
3. Were there any technical impediments to increasing the amount of carpet containing recycled materials provided for this project? _____.
 - a. If yes, please explain. _____

_____.



D. Floor Tiles (resilient):

1. Total dollar amount of floor tile (resilient) provided for this project. \$_____.
2. Total dollar amount of floor tile (resilient) containing recycled materials provided for this project. \$_____.
3. Were there any technical impediments to increasing the amount of floor tile (resilient) containing recycled materials provided for this project? _____.
 a. If yes, please explain. _____

 _____.

E. Floor Tiles (ceramic):

1. Total dollar amount of floor tile (ceramic) provided for this project. \$_____.
2. Total dollar amount of floor tile (ceramic) containing recycled materials provided for this project. \$_____.
3. Were there any technical impediments to increasing the amount of floor tile (ceramic) containing recycled materials provided for this project? _____.
 a. If yes, please explain. _____

 _____.

F. Hydraulic Mulch:

1. Total dollar amount of hydraulic mulch provided for this project. \$_____.
2. Total dollar amount of hydraulic mulch containing recycled materials provided for this project. \$_____.
3. Were there any technical impediments to increasing the amount of hydraulic mulch containing recycled materials provided for this project? _____.
 a. If yes, please explain. _____

 _____.

G. Compost:

1. Total dollar amount of compost provided for this project. \$_____.
2. Total dollar amount of compost containing recycled materials provided for this project. \$_____.
3. Were there any technical impediments to increasing the amount of hydraulic mulch containing recycled materials provided for this project? _____.
 a. If yes, please explain. _____

 _____.

2.0 SPECIFICATIONS

NOT USED



3.0 SOLID WASTE PREVENTION

- A. Total dollar amount of solid waste disposed (landfill) for this project. \$_____.
- B. Total weight of solid waste disposed (landfill) for this project. \$_____.

4.0 RECYCLING

- A. Total dollar value of solid waste diverted from landfill and recycled or reused for this project. (Express as total dollar amount for solid waste disposal in landfill for equivalent type and amount of diverted waste.)
\$_____.
- B. Total weight of solid waste diverted from landfill and recycled or reused for this project. (Express as total weight for solid waste disposal in landfill for equivalent type and amount of diverted waste.)
Tons_____.

5.0 COMMENTS

- A. Comments and suggestions for increasing amount of recycled materials used in construction materials.

_____.
- B. Comments and suggestions for improving solid waste prevention and recycling efforts during construction.

_____.

Signature: _____ Date: _____

END OF SECTION 01 74 19 00



Task	Specification	Specification Description
01 74 19 00	01 22 16 00	No Specification Required
01 74 23 00	01 71 23 16	Cutting and Patching



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SECTION 01 77 04 00 - CLOSEOUT PROCEDURES AND TRAINING

NOTE TO SPECIFIER

This Section is intended for use with ALL project types: Design-Bid-Build (DBB), Design-Build (DB), Repair & Alteration (R&A) and New Construction Leased (NCL) type projects that use the Building Standard Design Specifications. Design-Bid-Build (DBB), New Construction type projects that use a Design and Construction contract. Modify as needed for project specific requirements. EDIT BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT. The degree of detail required for this section is related to the number and complexity of systems and equipment required for a particular project. Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 – GENERAL**1.1 MANUALS**

- A. Purpose: Operation and maintenance manuals are for the training of, and use by, Postal Service employees in the operation and maintenance of the systems and related equipment as specified below. The manuals must consist of instruction on systems and equipment. A separate manual or chapter must be prepared for each of the following classes of equipment or system:
 - 1. Landscaping.
 - 2. Roof system.
 - 3. Doors.
 - 4. Security system.
 - 5. Fire protection.
 - 6. Plumbing systems.
 - 7. Mechanical systems.
 - 8. Electrical systems.
 - 9. Miscellaneous building equipment and systems.
 - 10. Mechanization (for requirements for mechanization maintenance manuals, see Mechanization Specification M-5000).
- B. Content: Unless otherwise indicated, each chapter must contain the following, as applicable:
 - Introduction.
 - Table of contents.
 - Description of system (including design intent and considerations).
- C. Preparation: The outline below is intended as a general guide for preparing the manuals. The manuals must be prepared to provide for the optimum operation and maintenance of the various systems. The description of systems and general operating instructions for plumbing and electrical manuals may cover only complicated or unusual parts of these systems, such as sewage ejectors, transformers, high tension switchgear, and signal and alarm systems. Manufacturer's literature and data must be those of the actual equipment installed under contract for the particular facility. Further guidance is available in the ASHRAE Handbook, 1984, Systems Volume, Chapter 39, Mechanical Maintenance.
- D. Suggested Outline for Operation and Maintenance (O&M) Manuals: This is a suggested outline, with general requirements of O&M manuals. The outline is presented to indicate the extent of material to be covered and the individual items required in manuals for Mail Processing Facilities. The outline may be modified to suit specific installations; however, the purpose of the manual must be fulfilled. The manual is not intended to duplicate manufacturers' data, but proper references must be made in the text of the O&M manual to indicate that that information is applicable and where it is located.
 - 1. Part I. Description and Design Intent
 - a. Introduction



- 1) Provide a brief description of project and purpose of the maintenance manual. The following statements must be included: "Operation and maintenance of this equipment must be performed in accordance with this manual and posted instructions, subject to compliance with applicable technical guides and standards issued by USPS. It is recognized that minor changes in control points and settings will be required, based on actual operating experience, to correct varying conditions and improve operation. When such changes appear necessary, they must be submitted to the maintenance manager for consideration. Upon approval of any changes, the applicable portions of all copies of the manual and proposed instructions must be revised and reissued, and any change in operating procedure brought to the attention of all operating personnel."
 - 2) "This manual is specifically developed to assist the Postal official in charge at the facility to operate and maintain the building systems and equipment. Manufacturers' recommendations set forth for certain components must be followed during the complete warranty period for that equipment."
 - 3) Contents of Manual. This portion of the introduction must explain that the manual is to contain complete operating, maintenance, and safety instructions for all equipment listed. It must also contain any other appropriate references as required to outline an explanation of the manuals and major categories of reference material required with the manuals.
- b. Table of Contents
- 1) The table of contents must list numbers and titles of chapters, sections, and main paragraphs, with their page numbers. Each volume in a set of manuals must contain its own table of contents. Publications containing 10 or more illustrations or tables must include a list of illustrations or tables, as applicable. These lists must show number, title, and page number of each illustration and table. Following is a typical table of contents:
 - a. Landscaping
 - 1.) Irrigation system
 - 2.) Lawns and grasses
 - 3.) Exterior plants
 - 4.) Plant maintenance
 - b. Roof System
 - 1.) Roof and flashing type
 - 2.) Local inspection (frequency and what is included)
 - 3.) Maintenance (when manufacturer performs, if USPS performs what methods compatible materials, etc.)
 - c. Doors
 - 1.) Overhead coiling doors
 - 2.) Folding closures
 - 3.) Sectional overhead doors
 - 4.) Impact traffic doors
 - 5.) Automatic entrance doors
 - 6.) Specialized hardware
 - d. Security Systems
 - 1.) CCTV system
 - 2.) Intrusion detection
 - 3.) Electronic article surveillance
 - 4.) Access control
 - e. Fire Protection System
 - 1.) Water supply and distribution

- 2.) Exterior fire hydrants
 - 3.) Sprinklers
 - 4.) Fire Department connections
 - 5.) Fire extinguishers
 - 6.) Exit signs
 - f. Plumbing Systems
 - 1.) Potable water
 - 2.) Domestic hot water
 - 3.) Roof and sanitary drains
 - g. Mechanical Systems
 - 1.) Space conditioning
 - 2.) Heating
 - 3.) Central chilled water and distribution
 - 4.) HVAC instrumentation and controls
 - h. Electrical Systems
 - 1.) Incoming Service
 - 2.) Electrical power distribution
 - 3.) Lighting and lighting controls
 - 4.) Fire alarm
 - 5.) Emergency lighting unit
 - i. Miscellaneous Building Equipment
 - 1.) Postal Parcel Lockers
 - 2.) Floor mats
 - 3.) Dock equipment
 - 4.) Window Treatments
 - 5.) Elevators
 - 6.) Scales
 - 7.) Dust collectors
 - 8.) Vehicle maintenance equipment
- 2. Part II. Operating Sequence and Procedures
 - a. Contents: Each chapter must describe the procedures necessary for Postal Service personnel to operate the system and equipment covered in that chapter.
 - b. Operating Procedures: The operating procedures must be divided into four subsections: Startup, Operation, Emergency Operation, and Shutdown.
 - 1) Startup: Give complete instructions for energizing the equipment and making initial settings and adjustments whenever applicable. If equipment is fully automatic, a statement to that effect is all that is required. If a specific sequence of steps must be performed, give step-by-step instructions in the proper sequence. If timing- (such as warm-up between power-on and adjustment) is important, clearly state the specific minimum time required at the proper point in the procedure. Refer to controls and indicators by panel; make references consistent with the nomenclature used in illustrations and tables of controls and indicators. If preliminary settings differ for different modes of operations, give procedures for each mode.
 - 2) Operation: Give detailed instructions in proper sequence for each mode of operation. When, for a given action on the part of the operator, alternate equipment responses are possible, give the appropriate operation reaction to each.
 - 3) Emergency Operation: If some functions of the equipment can be operated while other functions are disabled, give instructions for operations under these conditions. Include here only those alternate methods of operation (from normal) that the operator can follow when there is a partial failure or malfunctioning of components, or other unusual condition.



- 4) Shutdown: Include instructions for stopping and securing the equipment after operation. If a particular sequence is required, give step-by-step instructions in that order.
3. Part III. Maintenance Instructions and Requirements
 - a. Contents: Each chapter must describe the procedures necessary for Postal Service personnel to perform the maintenance on the systems and equipment covered in that chapter. Emphasis must be placed on the method of mechanical control of systems and equipment from a maintenance standpoint. References must be made, as appropriate, to drawings, schematics, and sequences of operation included as part of the construction Contract drawings and specifications that show piping and equipment arrangements and items of control. Prints of these drawings must be reduced to 11 inches x 17 inches for insertion in the manuals. Drawings must represent the "as-built" condition.
 - b. Maintenance Procedures: The maintenance procedures must be divided into two categories: Preventive Maintenance and Corrective Maintenance.
 1. Preventive Maintenance
 - a. Provide a schedule for preventive maintenance. State, preferably in tabular form, the recommended frequency of performance for each preventive maintenance task (cleaning, inspection, and scheduled overhauls).
 - b. Provide instruction and schedules for all routine maintenance cleaning and inspection, with recommended lubricants.
 - c. If periodic inspection of equipment is required for operation, cleaning, or other reasons, indicate the items to be inspected and give the inspection criteria for, but not limited to, the following:
 - 1.) Motors
 - 2.) Controls
 - 3.) Filters
 - 4.) Heat exchangers
 2. Provide instruction for minor repairs or adjustments required for preventive maintenance routines. Minor repair and adjustment must be limited to repairs and adjustments that may be performed without special tools or test equipment and that require no special training or skills. Identify test points and give values for each.
 - c. Corrective Maintenance
 1. Corrective Maintenance: Corrective maintenance instructions must be predicated upon a logical effect-to-cause troubleshooting philosophy and a rapid replacement procedure to minimize equipment downtime. Instructions and data must appear in the normal sequence of corrective maintenance, for example, troubleshooting first, repair and replacement of parts second, and then the parts list.
 2. Troubleshooting: This information must describe the general procedure for locating malfunctions and must give, in detail, any specific remedial procedures or techniques. The data shown are intended to isolate only the most common equipment deficiencies. Troubleshooting tables, charts, or diagrams may be used to present specific procedures. A guide to this type must be a three-column chart. The columns must be entitled Malfunction, Probable Cause, and Recommended Action. The information must be alphabetically arranged by component, and each component must, in turn, list deficiencies that may be expected. Each deficiency must contain one or more problems with a recommended correction.
 3. Repair and Replacement: Indicate the repair and replacement procedures most likely to be required in the maintenance of the equipment. Information included here must consist of step-by-step instructions for repair and replacement of defective items. Include all



- information required to accomplish repair or replacement, including information such as torque values. Identify all tools, special equipment, and materials that may be required. Identify uses for maintenance equipment. The paragraphs must contain headings to identify the topics covered.
4. Safety Precautions: This subsection must comprise a listing of safety precautions and instructions to be followed before, during, and after repairs or adjustments are made or routine maintenance is performed.
 - d. Manufacturers' Brochures: Include manufacturers' descriptive literature covering devices used in the system, together with illustrations, exploded views, and renewal parts lists. This section must also include special devices manufactured by the Contractor.
 - e. Special Maintenance: Provide information of a maintenance nature covering warranty items that have not been discussed elsewhere.
 - f. Shop Drawings: Provide a copy of all approved shop drawings covering approval of equipment for the project with the manufacturers' brochures.
 - g. Spare Parts Lists: Include a recommended spare parts list for all equipment furnished for the project. The parts list must include a tabulation of descriptive data for all the electrical-electronic spare parts and all the mechanical spare parts proposed for each type of equipment or system. Each part must be properly identified by part number and manufacturer.
 - h. Warranty: Include a copy of the "special" or extended warranty in the operation and maintenance manual.

NOTE TO SPECIFIER

The number of manuals and timeframes for submittal must be reviewed and edited for the specific project requirements. Consult with the COR for direction.

- E. Submittal, In both "hard" and electronic DVD or CD-ROM format:
 1. Preliminary Submittal: Two draft copies of the completed manuscript for items in this outline must be submitted to the COR for review within [60] [30] [__] days after approval of equipment to be provided. One copy will be returned to the Contractor within [30] [15] [__] days after submittal and, if required, must be revised and resubmitted within [30] [15] [__] days.
 2. Final Submittal: four complete sets of manuals must be furnished to the COR not later than [90] [30] [__] days before completion of the project.
 3. Final Submittal must be accepted by the COR before training can begin.

1.2 POSTED OPERATING INSTRUCTIONS

- A. General. Operating instructions and diagrams must be prepared for posting near the equipment. Posted operating instructions must be photographic or equal non-fading reproductions framed under glass or encased in non-discoloring plastic and must be mounted in locations as directed. Copies of the posted operating instructions must also be used with the O&M manuals as a basis for training Postal Service personnel in the operation and maintenance of systems and related equipment installed under contract at the facility.
- B. Posted operating instructions must consist of simplified, consolidated equipment, control, and power diagrams graphically representing the entire system and actual equipment installed, including concise written instructions on how to start and stop systems, what settings and conditions are to be observed, and what control adjustments are to be made or maintained by the operation. Posted operating instructions must include, but are not limited to the following:
 1. Boiler and burner controls.
 2. Refrigeration controls.
 3. Heating, ventilating, and air-conditioning controls for each system.



4. Controls for dust collection systems.
5. One-line schematic diagrams of water supply (plumbing).
6. One-line diagrams of steam distribution and hot water and chilled water systems, including risers, main shutoff valves, balancing cocks, and the like.
7. One-line isometric diagrams of sanitary drainage.

1.3 TRAINING

- A. The Contractor must train Postal Service personnel in the operation and maintenance of mechanical and electrical equipment. Coordination must be maintained with systems designers for developing the hours of instruction and scope of material to be covered. Training of Postal Service personnel must not begin until the COR has approved the final submittal copy of each O&M manual.
- B. Schedule Submittal: The proposed scope of training and materials and instruction schedule must be submitted for review and approval approximately 30 days before the scheduled completion of the buildings. Mutually agreeable dates for training must be arranged with the COR, but the training must be completed before final acceptance of the facility.
- C. Scope of Training: Training must include classroom and on-the-job instructions by qualified installation and maintenance personnel having the necessary knowledge, experience, and teaching skills. The use of recording on digital media (DVD or CD discs) during the instruction period is required. Discs must be turned over to the COR after training has been completed.

NOTE TO SPECIFIER

The timeframes for providing training must be reviewed and edited for the specific project requirements. Consult with the COR for direction.

- D. Time Period of Training: The minimum specific hours of training time required for each category of major equipment and systems is indicated below. Past experience indicates a workable ratio in the vicinity of approximately 25 percent classroom to 75 percent application, except that the ratio may be reversed for control systems. The COR must have the option of redistributing the training times, subject to the total time specified. Training must be presented on an 8-hour per day, 5-day per week schedule, with all reading assignments and review to be within this period.

1.4 TRAINING PERIOD

Item	Time (Hours)
1. Roofing	[8] [4] [___]
2. Special Doors	[16] [8] [___]
3. Dock Equipment	[16] [8] [___]
4. Security Equipment	[16] [8] [___]
5. Heating Plant Covers heat-generating equipment, such as heat exchangers, boilers, and burners; electric resistance heating; and related equipment, where applicable (including combustion testing), together with associated operation and safety controls.	[24] [12] [___]
6. Cooling Plant Covers the refrigeration plant, cooling tower (including water treatment), and related equipment, together with associated operating and safety controls.	[28] [14] [___]
7. Ventilation	



- | | | |
|-----|--|-------------------|
| | Covers air-handling units with heating and cooling coils, fans, and all other air-handling equipment, together with associated operating and limit controls. | [16] [8] [___] |
| 8. | Overall Control System
Covers central control center, coordinating respective controls of heating, cooling, and ventilation systems, and shows how these controls work together to provide an integrated overall control of the complete air-conditioning system, both heating and cooling, as well as all other utility control systems. | [32] [16] [___] |
| 9. | Electrical System
Covers all building services, lighting, lighting controls, and intercommunications, and security system. | [64] [32] [___] |
| 10. | Elevators
Covers operation of the different types installed, demonstrations in the machine room on the various operating and control equipment installed, and explanation of the use of the electric circuit diagrams (of sufficient size) to ensure proper operation and assistance in troubleshooting. | [24] [12] [___] |
| 11. | Piping and Plumbing
Includes, but is not limited to, domestic water supply, storm and sanitary drainage systems, cold-water supply systems, sprinkler systems, and the like. | [40] [20] [___] |
| 12. | Miscellaneous
Includes, but is not limited to, vehicle maintenance equipment, fire protection and alarm equipment, dust collection systems, compressed air systems, automatic door operators, dock levelers, truck scales, data collection center, and all other equipment not specifically covered above. | [40] [20] [___] |
| 13. | Mechanization
See Mechanization Specification M-5000. | |

1.5 TRAINING PARTICIPATION SHEETS

- A. Submit to the COR sign-in sheets with the dates and names of all training participants. Training sheets must be reviewed and certified by an authorized facility manager.

NOTE TO SPECIFIER

Many specification sections contain particular submittal requirements that go beyond the requirements for Systems Manuals, Operating Instructions and Training listed above. Reference any sections and submittals that may be overlooked.

1.6 OTHER CLOSEOUT SUBMITTALS

- A. Additional requirements for Systems Manuals, Operating Instructions, Training and other deliverables are contained in individual Specification Sections. All closeout requirements must be provided to and accepted by the COR prior to requesting final payment. Examples of additional closeout requirements include, but are not limited to, the following
1. Final Punch-List with all items certified as complete.
 2. In accordance with the terms and conditions of the contract provisions and clauses, including those concerning *Record "As Built" Drawings*, the Contractor shall submit certified As-Built Record Drawings and Specifications in the quantities and media specified.
 3. In accordance with the terms and conditions of the contract provisions and clauses, including those concerning *Warranty*, the Contractor shall submit all transferable guarantees and warranties for equipment, materials and installations furnished by any manufacturer, supplier, or installer.
 4. Signed Asbestos and Lead-Based Paint Certificate.
 5. RE-4 Certification of Accessibility (CoA) and Facility Accessibility Survey Report.
 6. Material Safety Data Sheets.



7. Signed and sealed Contractor Release of Claims.
8. []

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED

USPS Master Specifications, issued: 10/1/2013
Last revised: 9/17/2013

END OF SECTION 01 77 04 00

**SECTION 01 91 13 00 - GENERAL COMMISSIONING REQUIREMENTS**

NOTE TO SPECIFIER

Use this Specification Section for Mail Processing Facilities only. This Specification is intended as a guide to the Architect/Engineer preparing the Construction Documents. The degree of commissioning that will be required for the project shall be specified by the COR.

NOTE TO SPECIFIER

REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER. Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.01 91 13 00**

PART 1 - GENERAL**1.1 WORK INCLUDED**

- A. Commissioning requirements common to all Sections.
- B. Systems and equipment start-up and functional performance testing.
- C. Validation of proper and thorough installation of systems and equipment.
- D. Equipment performance verification.
- E. Documentation of tests, procedures, and installations.
- F. Training.

1.2 SCOPE

NOTE TO SPECIFIER

This Section includes requirements common across all Divisions of the work. Requirements specific to individual Sections shall be specified in the technical specification for each of Divisions 22, 23, and 26. Edit to suit project requirements.

- A. The Commissioning ("Cx") Plan outlines the commissioning process outside of the Construction Contract. The specification sections dictate all requirements of the commissioning process relative to the Construction Contract. The Cx Plan is available for reference at the request of the Contractor; however it is not part of the Construction Contract.
- B. This Section and other Sections of the specification detail the Contractor's responsibilities relative to the Cx process and it expands on the Cx Plan, which covers the roles and responsibilities of Parties outside of the Construction Contract. The degree of commissioning that will be required for this project shall include the specific requirements listed in the Division 22, 23 and/or 26 specifications.

1.3 GENERAL DESCRIPTION



- A. Commissioning ("Cx") is the process of ensuring that all building systems are installed and perform interactively according to the design intent; that systems are efficient and cost effective and meet the Postal Service's operational needs; that the installation is adequately documented; and that the Operators are adequately trained. It serves as a tool to minimize post-occupancy operational problems. It establishes testing and communication protocols in an effort to advance the building systems from installation to full dynamic operation and optimization.
- B. The Postal Service shall retain an independent Commissioning Authority (CxA) to provide Commissioning Services through preapproved vendors.
- C. CxA shall work with the Contractor, the AE, and the Postal Service Project Manager to direct and oversee the Cx process and perform functional performance testing.
- D. The Cx process shall begin at the 95% review of the design documentation for Design/Build (DB), R&A and Design/Bid/Build (DBB) projects. However, the work shall commence at the 30% design stage for special projects, such as Geothermal, Compressed Natural Gas or Electrical Generation Projects.

1.4 RELATED WORK AND DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section
- B. Commissioning Plan: The Cx Plan shall be available for reference as it outlines responsibilities outside of the Construction Contract. It gives the Contractor a perspective as to the overall process. It encompasses the entire Cx process including design phase and post construction tasks.
- C. Section 013300 - Submittal Procedures: Stipulates additional copies of submittals to be submitted and refers to other sections for additional submittal requirements related to Cx.
- D. Section 017704 - Closeout Procedures and Training: Defines the milestones in completion incorporating the Cx process.
- E. Individual Specification Sections: Individual sections stipulate installation, start-up, warranty, O&M documentation, and training requirements for the system or device specified in the Section.

1.5 REFERENCE STANDARDS

- A. ASHRAE Guideline, "Guideline for Commissioning HVAC Systems"
- B. ASHRAE Guideline, "Preparation of Operating and Maintenance Documentation for Building Systems"
- C. AABC Commissioning Group (ACG)
- D. NEBB – Procedural Standards for Building Systems Commissioning
- E. National Electric Code (NEC)
- F. American Society for Testing and Materials (ASTM)
- G. Electronics Industry Association/Telecommunications Industry Association (EIA/TIA)



- H. Illuminating Engineering Society (IES)
- I. Institute of Electrical and Electronics Engineers (IEEE)
- J. International Electrical Testing Association (NETA)
- K. National Electrical Manufacturers Associates (NEMA)
- L. National Fire Protection Association (NFPA)
- M. Underwriters Laboratory, Inc. (UL)

1.6 DOCUMENTATION

- A. Contractor shall provide to the CxA the following per the procedures specified herein and in other Sections of the specification:
 - 1. Drawings and Data. One hard copy and one electronic copy of Drawings and product data related to systems or equipment to be commissioned. CxA shall review and incorporate comments for Contractor's consideration.
 - 2. Draft Start-Up Procedures. Contractor shall develop Start-up Procedures for all applicable equipment and systems along with the manufacturer's application, installation and start-up procedures. CxA will initially provide to the Contractor generic Start-up Checklists, the content of which must be reviewed by the Contractor and supplemented with manufacturer-specific requirements and the Contractor's own internal quality assurance procedures and checks. CxA will review draft and recommend approval or provide comments.
 - 3. Schedule Updates. Issue periodic updates to the construction schedule.
 - 4. Action Item Response. Respond to Action Items by Cx team members.
 - 5. Field Testing Agency Reports (other than TAB). Provide all documentation of work of independent testing agencies required by the specification. These shall be provided prior to Acceptance Phase. Field Testing Agency Reports should be provided in PDF electronic format.
 - 6. Completed Start-Up Procedures. Completed Start-Up Procedure documentation for all applicable equipment and systems.
 - 7. Equipment Warranties. Provide prior to the start of the Acceptance Phase.
- B. Record Drawings: Contractor shall maintain at the site an updated set of record or 'As-Built' documents reflecting actual installed conditions and all approved changes and modifications to the contract documents. Contractor shall provide access to the CxA to review the As-Built and Record Drawings. Provide Record Drawings in accordance with Division 1.
- C. Reports. The Cx agent shall provide a final report with executive summary of overall results, description of items commissioned, test data, conclusions, recommendations, etc. to the COR within 14 days after the completion of the commissioning process. If, due to circumstances beyond the control of the Cx agent, the Cx process cannot be completed in accordance with the schedule, then, at the discretion of the COR, a preliminary report shall be submitted detailing the results of the Cx activities completed thus far, with a final report to be submitted at a later agreed upon date.

1.7 COMMISSIONING SCHEDULING



- A. The Cx will be categorized into Phases as indicated below. Note that per schedule, different systems and/or areas may be in different phases at any given time given that the Cx and testing process will be integrated into the construction process:
1. Construction Phase: This is the period of time where the systems are installed, much of the Cx documentation is developed, the systems are started, and the majority of the Contractor required training is performed. On any given system or area, the Construction Phase will end when the CxA approves proceeding with the Functional Performance testing.
 2. Acceptance Phase: This is the period of time where the systems will be functionally tested and the systems will operate through an endurance period.
 3. Warranty Phase: This is the period of time that coincides with the start and end of the Contractor's base warranty.

1.8 CONTRACTOR RESPONSIBILITIES

- A. Construction Phase: The Postal Service shall provide independent Cx Services through preapproved vendors. The AE shall be responsible for coordinating with the CxA as necessary to assist them in completing the Cx Report. In particular, the Contractor shall be responsible for providing assistance from their test and balance contractor, BAS controls contractor, mechanical contractor, electrical contractor, etc. to confirm that the functionality of the new equipment meets the original design intent, operates efficiently, and demonstrates that all of the required features of the new system are functioning as specified in the design documents.
- B. Acceptance Phase: The following delineates the Cx-related responsibilities of the Contractor (and their subcontractors) during the Acceptance Phase.
1. Assist CxA in functional performance testing. Assistance will generally include the following:
 - a. Manipulate systems and equipment to facilitate testing.
 - b. Provide any specialized instrumentation necessary for functional performance testing.
 - c. Manipulate systems to facilitate functional performance testing.
 2. Correct any work not in accordance with Contract Documents.
 3. Maintain record documentation, and update and resubmit it after completion.
- C. Warranty Phase: The following delineates the Cx-related responsibilities of the Contractor (and their subcontractors) during the Warranty Phase.
1. Provide warranty service;
 2. Participate as required in opposite season testing;
 3. Correct any deficiencies identified throughout the Warranty Phase;
 4. Update record documentation to reflect any changes made throughout the Warranty Phase.

1.9 CX KICK OFF/COORDINATION MEETING

- A. CxA shall schedule and conduct a Cx coordination meeting at the appropriate time after the award of the Construction Contract.

1.10 START-UP PROCEDURES AND DOCUMENTATION

- A. Purpose: The Cx process requires that the normal quality control processes involved with preparing systems and equipment for operation are performed to a high standard of care and are thoroughly documented. The Start-up procedures shall be performed to all systems and

equipment specified in the Contract documents. The Cx process requires all Parties to collaborate to establish the optimal standard of care for starting systems and equipment. The Contractor performs the Start-up procedures, documents the results, and provides them to the CxA.

- B. Sampling and Final Submission: All systems shall be started and documented per the approved procedures and NO sampling strategy is used. Completed Start-up and prefunctional checklists for all pieces of equipment shall be submitted to CxA prior to any associated functional performance testing.
- C. Postal Service Access: Contractor shall allow access by Postal Service representatives to inspect the equipment and ensure its proper operation.

1.11 FUNCTIONAL PERFORMANCE TESTING

- A. The objective of Functional Performance Testing is to demonstrate that each system is operating according to the documented design intent of the Contract Documents. Functional Performance Testing facilitates bringing the systems from a state of functional completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.
- B. The logistics and procedures involved in Functional Performance Testing are outlined below.

1.12 TRAINING

- A. Adequate and thorough training of the Operators and the facilities staff is vital to effective transition and early occupancy of the building. A key goal of the Cx Team is to ensure that this is accomplished. Contractors, Subcontractors, and Manufacturers/Vendors as specified shall prepare and conduct training sessions on the installed systems and equipment for which they are responsible. The Contractor shall be responsible for insuring all other training is performed in accordance with the Contract Documents.

PART 2 – PRODUCTS

2.1 INSTRUMENTATION

- A. All testing equipment used in the Cx process shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. All equipment shall be calibrated according to the manufacturer's recommended intervals. Calibration tags shall be affixed or certificates readily available.
- B. Testing Instrumentation: Contractor shall provide all instrumentation necessary for tests for which they are responsible. CxA will provide standard instrumentation for measuring medium and low voltage electrical voltage, current, power factor, power, and THD. CxA will provide receptacle testers for normal and GFI receptacle tests. Contractor shall provide all other instrumentation required to accomplish the specified testing.
- C. Test kits for meters and gages shall be provided to the Postal Service new. Previously used test kits will be unacceptable. Kits shall be submitted prior to the Acceptance Phase.

PART 3 – EXECUTION



3.1 START-UP STANDARD OF CARE

- A. Procedures that establish a minimum Standard-of-Care for the start-up, check out and testing of applicable equipment are specified in the individual technical specifications. Contractor shall apply this Standard-of-Care and document per the Cx requirements.

3.2 START-UP/FUNCTIONAL TEST PROCEDURES - GENERAL

- A. This Section outlines 'generic' or minimally acceptable Start-Up and Functional Test Procedures for systems and equipment. These items shall provide a minimum guideline for the Contractor to determine the level of care required for start-up of the systems.

3.3 PROCEDURES COMMON TO ALL SYSTEMS

The following start-up verifications/procedures are common to all systems.

- A. Checkout shall proceed from devices to the components to the systems.
- B. Verify labeling is affixed per spec and visible.
- C. Verify prerequisite procedures are done.
- D. Inspect for damage.
- E. Verify system is applied per the manufacturer's recommendations.
- F. Verify system has been started up per the manufacturer's recommendations.
- G. Verify that access is provided for inspection, operation and repair.
- H. Verify that access is provided for replacement of the equipment.
- I. Verify the record drawings, submittal data and O&M documentation accurately reflect the installed systems.
- J. Verify all gages and test ports are provided as required by Contract Documents and manufacturer's recommendations.
- K. Verify all recorded nameplate data is accurate.
- L. Verify that the installation is done in a manner that ensures safe operation and maintenance.
- M. Verify specified replacement material/spare parts have been provided as required by the Construction Documents.
- N. Verify all rotating parts are properly lubricated.
- O. Verify all monitoring and ensure all alarms are active and set per Postal Service's requirements.



USPS Master Specifications, issued: 10/1/2013
Last revised: 4/16/2013

END OF SECTION



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Task	Specification	Specification Description
01 95 06 00	01 22 16 00	No Specification Required
01 95 08 00	01 22 16 00	No Specification Required
01 95 09 00	01 22 16 00	No Specification Required
01 95 10 00	01 22 16 00	No Specification Required
01 95 22 00	01 22 16 00	No Specification Required
01 95 22 00	22 01 40 00	Emergency Plumbing Fixtures
01 95 23 00	01 22 16 00	No Specification Required
01 95 26 00	01 22 16 00	No Specification Required



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SECTION 02 26 23 00 - R&A ASBESTOS LABORATORY ANALYSIS REPORT

NOTE TO SPECIFIER

This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Section Formatting:

Consistent formatting of Sections gives the complete document a professional look. This Section uses a 10pt. Arial font, and is formatted as follows:

1. Insert one 10pt. line after the Section Number. Section Number is in CAPS.
2. Insert two 10pt. lines after the Section Title. Section Title is in CAPS.
3. Insert one 10pt. line after a PART. PARTS are in CAPS. If a Section is not used, include NOT USED following the PART title as shown below.
4. Insert one 10pt. line after Article paragraphs. Articles are in CAPS.
5. Insert two 10pt. lines at the end of an Article.
6. Complete Section with END OF SETION.
7. No lines should be placed between paragraphs and sub-paragraphs, or between sub-paragraphs and other sub-paragraphs.

Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED



Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes results obtained from laboratory analysis of samples taken for asbestos testing.
- B. Review the lab reports contained within this Section, and any additional, applicable, environmental surveys completed at the project site that may affect project work. Take caution during roof removal to avoid disturbance of identified ACM.

NOTE TO SPECIFIER

Review laboratory analysis reports of collected samples:

- 1. *For projects that indicate no ACM present in sampled materials, DELETE paragraph 1.2B below.*
- 2. *For projects that indicate the presence of asbestos in sampled materials, do not edit Article 1.2 – RELATED SECTIONS.*

1.2 RELATED SECTIONS

- A. Section 013543 – Environmental Procedures
- B. Section 028233 – Removal and Disposal of Non-Friable ACM

1.3 LABORATORY TESTING FOR ASBESTOS

- A. **NOTE:** The information contained within this Section regarding asbestos sampling reflects the condition at the test core and sampling location. This data is based on random, limited test cores made into the roofing system. Conditions at the test core locations may not be representative of the entire roof area. The Contractor is cautioned that the use of the following data is done solely at their own risk.

NOTE TO SPECIFIER

Review laboratory analysis reports of collected samples:

- 1. *For projects that indicate no ACM present in sampled materials, DELETE paragraph 1.3C from the list below.*
- 2. *For projects that indicate the presence of asbestos in sampled materials, EDIT paragraph 1.3C to reflect the roof area location of ACM, and the type of ACM containing material.*

Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

NOTE TO SPECIFIER

EDIT laboratory name providing analysis reports in paragraphs 1.3B and 1.3C.

- B. Refer to the attached laboratory report provided by (Insert name of NVLAP-Accredited laboratory). The report indicates that no asbestos-containing building materials (ACMs) were found in the sampled roofing components.



- C. Refer to the attached laboratory report provided by (Insert Name of NVLAP Accredited laboratory). The report indicates that asbestos-containing building materials (ACMs) were found in the following roof system components:
1. Roof Areas (List Applicable Roof Areas) – Bituminous roof membrane.
 2. Roof Areas (List Applicable Roof Areas) – Bituminous flashings and strip-ins.
 3. Roof Areas (List Applicable Roof Areas) – Bituminous underlayment.

NOTE TO SPECIFIER

Review laboratory analysis reports of collected samples:

1. *For projects that indicate no ACM present in sampled materials, DELETE references to Section 028233 from paragraph 1.3D below.*
2. *For projects that indicate the presence of asbestos in sampled materials, do not edit paragraph 1.3D.*

- D. Refer to Sections 013543 and 028233 for removal, handling, and disposal requirements of non-friable ACMs.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED

USPS CSF Specifications issued: 10/1/2013
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NOTE TO SPECIFIER

Attach laboratory analysis reports and any additional supporting documentation.

NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 02 26 23 00



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Task	Specification	Specification Description
02 32 19 00	01 22 16 00	No Specification Required



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SECTION 02 41 00 00 - R&A ROOF REMOVAL AND SUBSTRATE PREPARATION

NOTE TO SPECIFIER

This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section. Items in blue require action by the specifier/designer.

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Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED

Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.



PART 1 - GENERAL

1.1 SUMMARY

- A. Removal of existing roofing components and substrate preparation related to roof replacement work.

NOTE TO SPECIFIER

If the project consists of an existing mechanically-attached single-ply roof membrane, ballasted roof membrane, and/or rigid board foam insulation, recycling of existing components MAY be chosen as an alternate. Review recycling options with the USPS Project Manager. If recycling is chosen as an alternate, do not edit paragraph 1.1B. If recycling is not required, DELETE paragraph 1.1B.

- B. Recycling of ballasted single ply roof membranes, mechanically-attached single-ply roof membranes, pavers, and foam insulation.

NOTE TO SPECIFIER

Review available field data and EDIT list below. DELETE Section references to structural deck types not applicable this project. Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 030150 – Concrete Roof Deck Repair
- D. Section 035113 – Cementitious Wood Fiber Roof Deck Repair and Replacement
- E. Section 035116 – Gypsum Concrete Roof Deck Repair and Replacement
- F. Section 035216 – Lightweight Insulating Concrete Repair and Replacement
- G. Section 053123 – Steel Roof Deck Repair and Replacement
- H. Section 061516 – Wood Roof Deck Repair and Replacement

NOTE TO SPECIFIER

Review available field data. DELETE Article 1.3 if roof drains are not present on the project. Re-number articles after editing, if necessary.

1.3 UNIT PRICES

- A. Provide unit prices for the work described in Item 3.6.

NOTE TO SPECIFIER



Review available field data, and discuss recycling alternates with the USPS Project Manager. If recycling of existing roofing components is specified, INCLUDE Article 1.4 – ALTERNATES in the Section. If recycling is not specified, DELETE Article 1.4 – ALTERNATES. Re-number Articles after editing, if necessary.

1.4 ALTERNATES

NOTE TO SPECIFIER

Review available field data. EDIT paragraph 1.4A to reflect existing components that may be recycled. Re-number/letter paragraphs/sub-paragraphs after editing, if necessary.

- A. Provide alternate pricing for recycling of the following existing roof system components:
 - 1. Stone ballast and/or concrete pavers.
 - 2. Ballasted single-ply roof membrane.
 - 3. Mechanically-attached single-ply roof membrane.
 - 4. Rigid foam insulation board.
- B. Refer to Article 3.8 for preparation requirements related to recycling of existing components.
- C. Contact Nationwide Foam Recycling, Framingham, MA, (888) 820-2760, or similar recycling company, for recycling of existing roofing components.
- D. The recycler shall provide a certificate/letter to the Owner identifying the following:
 - 1. Project name and location.
 - 2. Contractor name.
 - 3. Components recycled as part of the project.
 - 4. Total weight and/or volume of materials recycled.

1.5 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 - 1. American Society for Testing and Materials (ASTM)
 - a. ASTM F 1667 – Standard Specification for Driven Fasteners: Nails, Spikes, and Staples
 - 2. Factory Mutual Global (FM)
 - 3. National Roofing Contractors Association (NRCA)

1.6 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.7 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed to install the specified products and is eligible to receive a manufacturer's warranty. The firm shall have a minimum of 5 years documented experience performing work equal or similar to the specified work.



- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform roof removal work during inclement weather.
- B. Cold weather precautions:
 - 1. Refer to product manufacturer and NRCA requirements and recommendations for cold weather application requirements and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

PART 2 – PRODUCTS

2.1 FASTENERS

- A. For re-securement of steel deck to structural steel, per Article 3.4: Teks 5 self-drilling fastener with hex washer head, manufactured by ITW Buildex or other FM-approved fastener.
- B. For re-securement of wood deck to underlying structural components, per Article 3.4:
 - 1. For untreated wood: Minimum 8d common nails with ring shanks, complying with the requirements of ASTM F 1667. Length as necessary to penetrate minimum 1-1/4-inch depth into underlying wood structural framing.



- C. For re-securement of existing perimeter wood nailers to underlying substrates, per Article 3.5:
1. For securement to untreated wood: No. 14 fluorocarbon-coated screws, length as necessary to penetrate minimum 1-1/4-inch depth into underlying wood substrate.
 2. For securement to treated wood: Stainless steel screws; length as necessary to penetrate minimum 1-1/4-inch depth into underlying wood substrate.
 3. For securement to existing masonry walls: 1/4-inch minimum diameter "Tapcon" screws or other fastener type suitable to adequately secure the wood to the existing masonry wall.

NOTE TO SPECIFIER

Review available field data. DELETE Article 2.2 if roof drains are not present on the project. Re-number articles after editing, if necessary.

2.2 REPLACEMENT DRAIN COMPONENTS

- A. Roof drain assembly: Clamping ring type; cast iron drain bowl, clamping ring, strainer, and related fittings; such as Type 21500 (Size as necessary to match existing drain pipe size) by Josam Company.
1. Piping:
 - a. To match existing, by size and type; as necessary to comply with applicable insurance requirements, and local codes.
 2. Drain connectors, hangers, and clamps:
 - a. Drain connections as required; as necessary to comply with applicable insurance requirements, and local codes.
- B. Roof drain clamping ring (for use where existing is missing or damaged): Cast iron; type and size to fit existing drain bowl.
- C. Roof drain strainer (for use where existing is missing or damaged): Cast iron; type and size to fit existing drain assembly.

NOTE TO SPECIFIER

Review available field data. DELETE Article 2.3 if roof drain inserts will not be required on the project. Re-number articles after editing, if necessary.

2.3 RETROFIT ROOF DRAIN INSERTS

- A. Retrofit roof drain insert: Retrofit drain assembly, clamping ring and strainer: Product such as "Hercules RetroDrain", manufactured by OMG Roofing Products, Agawam, MA, or approved equal. Size and configuration as necessary to accommodate existing roof drain and pipe.

PART 3 - EXECUTION

3.1 GENERAL

- A. Exercise caution to avoid damage to components indicated as "existing" or remaining in place. Do not disturb these components.
- B. Prior to any cutting, drilling, or removals, view both sides of the surface affected. If damage occurs to existing components, repair or replace components defaced or damaged during removals to the satisfaction of the Owner.



NOTE TO SPECIFIER

Review available field data. DELETE paragraph 3.1.C if roof drains are not present on the project. Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

- C. Prior to work start, the contractor shall obtain the services of a licensed plumber to verify that all roof drains and plumbing vents located within the project area are free of debris and properly functioning. Notify the Owner immediately if roof drains or plumbing vents are found to be blocked, clogged, or otherwise not properly functioning. The licensed plumber shall provide a letter indicating all roof drains and plumbing vents in the project area are free of debris and properly functioning. Refer to Section 013300.

3.2 ROOF REMOVAL

- A. Removal of existing roofing and related components: Remove and discard all existing roofing materials down to the structural deck, ~~except components designated for recycling per Article 1.4.~~ This includes spray-applied polyurethane foam roof systems (where existing), roofing membranes, base flashings, penetration flashings, insulation, underlying roof membranes, underlayments, and sheet metal flashings and accessories, as indicated in the specifications and drawings. Remove all roofing and related components in a manner that will not cause damage to the underlying structural deck.

NOTE TO SPECIFIER

Review available field data. DELETE sub-paragraph 3.2.B.1 if existing mechanically-attached thermoplastic roofing membranes over existing cementitious wood fiber, gypsum concrete, or lightweight insulating concrete are not present on the project. Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

NOTE TO SPECIFIER

Review available field data. DELETE sub-paragraph 3.2.B.2 if existing bituminous roofing membranes over existing cementitious wood fiber, gypsum concrete, or lightweight insulating concrete are not present on the project. Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

NOTE TO SPECIFIER

Review available field data. DELETE paragraph 3.2B if neither of the above-referenced conditions apply to this project. Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

- B. Specific removal instructions:
1. Removal of existing mechanically-attached thermoplastic roof systems and insulation over existing cementitious wood fiber and gypsum concrete roof decks:
 - a. Cut membrane into manageable sections, leaving membrane and insulation mechanically attached to the deck in place; remove and discard.
 - b. At remaining locations where the membrane and insulation is mechanically attached, "back-out" fasteners in a manner that will not damage the existing roof deck; Do not pull fasteners from deck.
 - c. If fasteners cannot be "backed out", mechanically cut fasteners flush with the roof deck. Cut fasteners in a manner that will not create sparks.
 - d. Remove and discard of fasteners and previously secured membrane and insulation.
 2. Removal of underlying bituminous roofing membranes and underlayments directly over



concrete, cementitious wood fiber, gypsum concrete and lightweight insulating concrete roof decks:

- a. If present, remove overlying roof systems and insulation. Mechanically cut the bituminous roofing membrane into manageable sections, taking care not to damage the underlying roof deck.
 - b. Scrape the membrane off of the existing roof deck in a manner that does not damage the existing roof deck.
 - c. If bituminous roof membrane or underlayment cannot be removed without damage to the underlying roof deck, immediately notify the Owner for further instruction.
- C. Remove obsolete/abandoned roof penetrations and equipment as noted on the project drawings. Prior to removals, confirm and coordinate removal of obsolete penetrations and equipment with the Owner. Repair openings created by the removal of penetrations and equipment as specified.
 - D. Do not begin work until the substrates have been prepared as specified, and are ready and acceptable to have materials installed. By beginning work, the Contractor acknowledges that the substrates are satisfactory.
 - E. To the extent possible, inspect the underside of the structural deck for conduit. If conduit is found to be present directly on the underside of structural decks, take necessary precautions to protect these conduits from puncture.
 - F. Contractor shall take all precautions during roof demolition to protect the building and adjacent surfaces from being soiled and damaged.
 - G. Coordinate the roof demolition work with new roofing work in such a manner as to keep the new roofing materials, building and building interior dry and watertight.
 - H. Do not stockpile or store debris on the roof or on the ground. Place all debris in a dumpster. Cover dumpsters left on site overnight with a tarp.
 - I. Existing roof system protection:
 1. Do not use adjacent roof areas as storage areas for roofing materials.
 2. Where excessive traffic over new or existing roofing is unavoidable, provide and use 3/4-inch plywood, set over a minimum of 1-1/2 inch thick rigid board insulation to protect roofing components in place (expanded polystyrene insulation is not acceptable).
 3. When materials are stored on the roof, provide roof protection as indicated above.

3.3 TEMPORARY DISPLACEMENT OF ROOFTOP EQUIPMENT

- A. Temporary displacement of mechanical units:
 1. If mechanical units are to be temporarily displaced, shut off all affected electrical, plumbing and gas lines and disconnect all electrical, plumbing, gas lines and ventilation ducts where required to allow for lifting mechanical units prior to roof removal work. All disconnection of plumbing, gas lines, electrical conduit and ventilation ducts is to be performed by a licensed mechanical/electrical contractor. Coordinate all disconnections with the Owner.
 2. Lift units in a manner that will not cause damage to the mechanical unit, mechanical unit components or structural deck.
 3. Prior to leaving the site, return units to their original position, resulting in a watertight condition.
 4. Ensure mechanical units are returned to their previous operational condition prior to leaving the site.
 5. Within high wind and hurricane zones, and if required by local codes: provide additional



securement and strapping (hurricane straps) as required to mechanical units displaced during roof replacement work.

- B. Temporary displacement of gas lines, conduit, junction boxes and condensate lines:
 - 1. Temporarily displace gas lines, conduit, junction boxes, condensate lines or other items that may interfere with roof replacement work. Any necessary disconnection of gas lines, conduit and junction boxes is to be performed by a licensed mechanical/electrical contractor as applicable to the work being performed. Coordinate all disconnections with the Owner.
- C. After completion of work, reinstall any mechanical units that have been temporarily displaced. Reconnect all electrical, plumbing, gas lines and ventilation ducts where required. All reconnection of plumbing, gas lines, electrical conduit and ventilation ducts is to be performed by a licensed mechanical/electrical contractor. Coordinate all reconnections with the Owner.
- D. After completion of work, reconnect any gas lines, conduit and/or junction boxes have been disconnected. Reconnection of gas lines, conduit and/or junction boxes is to be performed by a licensed mechanical/electrical contractor as applicable to the work being performed. Coordinate all reconnections with the Owner.

3.4 DECK INSPECTION AND RE-SECUREMENT

NOTE TO SPECIFIER

Review available field data and EDIT the list of Sections included in paragraph 3.4A. DELETE Section references to structural deck types not applicable to this project.

- A. After completion of roof removal work, inspect the existing roof deck. If damaged or deteriorated roof deck is encountered, notify the Owner immediately. Refer to Sections 030150, 035113, 035116, 035216, 053123 and 061516 for roof deck repair/replacement procedures.

NOTE TO SPECIFIER

Review available field data. DELETE paragraph 3.4B if steel decks are not present on this project. DELETE paragraph 3.4C if wood decks are not present on this project. Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

- B. Re-securement of steel decks:
 - 1. For locations requiring a wind uplift rating of FM 1-90 or less:
 - a. In the field of the roof, re-secure the existing steel deck at a maximum spacing of 12-inches on center (every other rib for 1-1/2 in. deck) at underlying supports in the field of the roof. At the roof perimeters and corners, re-secure the deck at a maximum spacing of 6 inches on center (every rib for 1-1/2 in deck) at all underlying supports.
 - b. At each deck side lap, secure the deck to the supporting members. For interlocking-type side laps, secure both sides of the lap (upper and lower). For overlap-type side laps, ensure securement penetrates all deck panels at the laps.
 - c. Ensure spacing between each side lap fastener or side lap fasteners and supports is no more than 36-inches in the field of the roof and no more than 30-inches on center in the perimeter and corner areas. Fasten overlap-type side laps with FM-Approved side lap fasteners.
 - 2. For locations requiring a wind uplift rating of FM 1-105 through 1-120:
 - a. In the field of the roof, re-secure the existing steel deck at a maximum spacing of 6-inches on center (at every rib for 1-1/2 in. deck) at underlying supports in the



- field of the roof. At the roof perimeters and corners, re-secure the deck with two fasteners every 6-inches on center (two fasteners at each rib location for 1-1/2 in deck) at all underlying supports.
 - b. At each deck side lap, secure the deck to the supporting members. For interlocking-type side laps, secure both sides of the lap (upper and lower). For overlap-type side laps, ensure securement penetrates all deck panels at the laps.
 - c. Ensure spacing between each side lap fastener or side lap fasteners and supports is no more than 30-inches in the field of the roof and no more than 15-inches on center in the perimeter and corner areas. Fasten overlap-type side laps with FM-Approved side lap fasteners.
 - 3. For locations requiring a wind uplift rating of FM 1-135 or greater:
 - a. In the field of the roof, re-secure the existing steel deck at a maximum spacing of 6-inches on center (at every rib for 1-1/2 in. deck) at underlying supports in the field of the roof. At the roof perimeters and corners, re-secure the deck with two fasteners every 6-inches on center (two fasteners at each rib location for 1-1/2 in deck) at all underlying supports.
 - b. At each deck side lap, secure the deck to the supporting members. For interlocking-type side laps, secure both sides of the lap (upper and lower). For overlap-type side laps, ensure securement penetrates all deck panels at the laps.
 - c. Ensure spacing between each side lap fastener or side lap fasteners and supports is no more than 24-inches in the field of the roof and no more than 15-inches on center in the perimeter and corner areas. Fasten overlap-type side laps with FM-Approved side lap fasteners.
- C. Re-securement of wood decks:
 - 1. For projects located within wind speed design regions up to 90 mph:
 - a. In the field of the roof and perimeters, re-secure the existing wood deck at supported panel edges 6-inches o.c. max., and 12-inches o.c. max. at intermediate panel supports.
 - b. At corners, re-secure the existing wood deck at supported panel edges and intermediate panel supports 6-inches o.c. max.
 - 2. For projects located within wind speed design regions over 90 mph and up to 120 miles per hour:
 - a. In the field of the roof, re-secure the existing wood deck at supported panel edges 6-inches o.c. max., and 12-inches o.c. max. at intermediate panel supports.
 - b. At perimeters, re-secure the existing wood deck at supported panel edges and intermediate panel supports 6-inches o.c. max.
 - c. At corners, re-secure the existing wood deck at supported panel edges and intermediate panel supports 4-inches o.c. max.
 - 3. For projects located within wind speed design regions over 120 mph and up to 150 miles per hour:
 - a. In the field of the roof, re-secure the existing wood deck at supported panel edges 6-inches o.c. max., and 12-inches o.c. max. at intermediate panel supports.
 - b. At perimeters, re-secure the existing wood deck at supported panel edges and intermediate panel supports 4-inches o.c. max.
 - c. At corners, re-secure the existing wood deck at supported panel edges and intermediate panel supports 3-inches o.c. max.

3.5 RE-SECUREMENT OF PERIMETER WOOD BLOCKING

- A. Re-secure wood blocking (nailers) to the underlying substrate at perimeters in a manner to resist a minimum force of 300 lbs. per linear foot, at a minimum spacing of 12-inches on center.



NOTE TO SPECIFIER

Review available field data. *DELETE Article 3.6 if roof drains are not present on the project.*

3.6 ROOF DRAIN INSPECTION AND REPAIR

- A. If drain assemblies are found to be damaged, contact the Owner. Replace drain assemblies found to be damaged (*Unit Price Work*):
 - 1. Remove and discard the entire roof drain assembly.
 - 2. Install replacement roof drain bowl, clamping ring, strainer and related fittings at locations of original drain assembly. Connect the bowls to the existing piping in accordance with manufacturer requirements and recommendations, and all local and state plumbing codes.
- B. If the clamping ring is missing, damaged, or does not fit the drain strainer, install a new clamping ring (*Unit Price Work*).
- C. If the roof drain strainer is missing, damaged, or plastic, install a new roof drain strainer (*Unit Price Work*).

3.7 ROOF INSERT INSTALLATION

- A. Install retrofit roof drain inserts following the requirements and recommendations of the retrofit roof drain insert manufacturer.

3.8 RECYCLING OF EXISTING ROOFING COMPONENTS (ALTERNATE WORK)

- A. Concrete pavers:
 - 1. Inspect existing concrete pavers for damage. Discard pavers found to be damaged.
 - 2. Remove stone ballast and concrete pavers from the roof surface.
 - 3. Contact the recycler for instructions regarding storage of concrete pavers awaiting pick-up.
- B. Stone ballast:
 - 1. Remove stone ballast from the roof surface.
 - 2. Contact the recycler for instructions regarding storage of ballast awaiting pick-up.
- C. Rigid board foam insulation:
 - 1. Confirm securement type of rigid board insulation. Note that rigid board foam insulation adhered using asphalt or low-rise foam adhesive cannot be recycled.
 - 2. Inspect condition of existing rigid board foam insulation. Discard insulation boards found to be wet and/or damaged.
 - 3. Remove insulation boards from the roof surface.
 - 4. Contact the recycling company for instructions regarding storage of rigid board foam insulation awaiting pick-up.
- D. Mechanically-attached single-ply roofing membrane:
 - 1. Confirm securement type of single-ply roofing membrane. Note that fully-adhered roofing membranes cannot be recycled.
 - 2. Cut membrane into manageable pieces, following the instructions of the recycler. Remove and discard existing membrane seams, fastening strips, and associated fasteners.



3. Remove roofing membrane from the roof surface.
 4. Contact the recycler for instructions regarding storage of roofing membrane awaiting pick-up.
- E. Mechanically-attached single-ply roofing membrane:
1. Confirm securement type of single-ply roofing membrane. Note that fully-adhered roofing membranes cannot be recycled.
 2. After ballast removal, cut membrane into manageable pieces, following the instructions of the recycler. Remove and discard existing membrane seams, fastening strips, and associated fasteners.
 3. Remove roofing membrane from the roof surface.
 4. Contact the recycler for instructions regarding storage of roofing membrane awaiting pick-up.

NOTE TO SPECIFIER

Review available field data. DELETE Article 3.9 if an existing lightning protection system is not present on the project.

3.9 EXISTING LIGHTNING PROTECTION SYSTEMS

- A. Prior to the start of work, review current building lightning protection and building grounding methods with the Owner. Verify the existing lightning protection system is properly functioning.
 1. If existing lighting protection system is found to be damaged or inoperable, notify the Owner immediately.
- B. Do not alter or modify the existing lighting protection system.
- C. After completion of work, verify the existing lighting protection system is properly functioning.

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Last revised: 3/6/2013

NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 02 41 00 00



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**SECTION 02 41 13 00 - CSF SELECTIVE SITE DEMOLITION****

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where demolition of existing site items and structures is necessary.

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL**1.1 SUMMARY****A. Section Includes:**

1. Demolition of designated site structures, retaining walls, fences, and foundations.
2. Demolition and removal of pavements, curbs and gutters, drainage structures, drainage pipe, utilities, site signs, and landscaping.
3. Disconnecting and capping or removal of identified utilities.
4. Removal of underground tanks and piping.
5. Filling voids in subgrade created as a result of removals or demolition.
6. Disposal of demolished materials.

- B. Related Documents:** The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:

1. Section 013543 - Environmental Procedures: Recycling and reuse of waste materials.
2. Section 015000 - Temporary Facilities and Controls: Temporary protection and barriers. Removal and disposal of demolished materials. Coordination of temporary utilities.
3. Section 311000- Site Clearing: Clearing outside periphery of structures.
4. Section 312000 - Earth Moving: Fill material.

1.2 QUALITY ASSURANCE**A. Regulatory Requirements:**

1. Conform to applicable local code for demolition of structures, safety of adjacent buildings and structures, dust control and runoff control.
2. Obtain required permits and licenses from authorities having jurisdiction. Pay associated fees including disposal charges.



3. Notify affected utility companies before starting work and comply with utility company requirements.
4. Do not close or obstruct roadways, sidewalks or fire hydrants without permits.
5. Barricade and mark hazards as necessary.
6. Conform to applicable regulatory procedures when discovering hazardous or contaminated materials. Notify Contracting Officer immediately upon discovery of hazardous or contaminated materials. Do not commence removals, remediation, or abatement without authorization from Contracting Officer.

1.3 PROJECT CONDITIONS

A. Existing Conditions:

1. Structures indicated for demolition will be discontinued in use and vacated prior to start of Work.
2. United States Postal Service assumes no responsibility for condition of structures to be demolished.
3. Unless otherwise indicated in the Contract Documents or specified by the Contracting Officer, remove items of salvageable value to Contractor from project site and structure. Storage or sale of removed items on project site not permitted.
4. Burning or fires of any nature not permitted.

NOTE TO SPECIFIER

Blasting is specified in Section 312317 - Rock Excavation. If explosives are to be used in demolition work, include submittal requirements, and quality assurance requirements similar to those used in Section 312317. NFPA 495 is the national Code for Explosive Materials.

5. Do not bring explosives on site without written approval of authorities having jurisdiction. Such written approval will not relieve Contractor of total responsibility for injury to persons or for damage to property due to blasting operations. Comply with governing regulations for use of explosives. Notify company of procedures and schedule in advance of explosive use.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

- A. Refer to in Section 312000.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.

NOTE TO SPECIFIER

Insert specific existing site items that need field verification before starting work.

- B. Site Verification of Conditions: Verify that field measurements, surfaces, substrates, and conditions are as required, and ready to receive Work.
 1. Locate existing utilities as specified in Section.312000
 2. [_____].



3. Verify:
 - a. [_____].
 - b. [_____].
 - c. [_____].

- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to United States Postal Service.

3.2 PREPARATION

- A. Provide, erect, and maintain erosion control devices, dust control measures, temporary barriers, and security devices at locations indicated on Drawings and as specified in Section. 015000
- B. Protect appurtenances and structures which are not indicated to be demolished. Repair damage caused by demolition operations at no additional cost to United States Postal Service.
- C. Prevent movement or settlement of adjacent structures. Provide bracing and shoring as required.
- D. Mark location of utilities. Protect and maintain, in safe and operable condition, utilities to remain. Provide temporary services during interruptions to existing utilities acceptable to governing authorities and United States Postal Service.
- E. Clear areas around items and structures indicated to be demolished as specified in Section 311000.

3.3 CONSTRUCTION

- A. Demolition Requirements:
 1. Conduct demolition to minimize interference with adjacent structures or pavements.
 2. Stop operations immediately if adjacent structures appear to be in danger. Notify Contracting Officer immediately. Do not resume operations until directed by Contracting Officer.
 3. Conduct operations with minimum interference to public or private access. Maintain access and egress at all times.
 4. Obtain written permission from adjacent property owners when demolition equipment will traverse, infringe upon, or limit access to their property.
 5. Sprinkle soil and demolition work area with water to minimize dust. Provide hoses and water connections for this purpose.
 6. Comply with governing regulations pertaining to environmental protection.
 7. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing prior to start of work.
- B. Demolition:
 1. Disconnect and remove designated utilities within demolition areas.
 2. Notify inhabitants of on-site structures of intent to demolish two weeks prior to demolition and verify property is vacated prior to starting demolition.
 3. Verify structures are unoccupied; then demolish structures completely and remove from site using methods as required to complete work within limitations of governing regulations. Small structures may be removed intact when acceptable to Contracting Officer and authorities having jurisdiction.
 4. Proceed with demolition in systematic manner, from top of structure to ground.
 5. Locate demolition equipment and remove materials using procedures to prevent excessive loading to supporting walls, floors, or framing.



6. Demolish concrete and masonry in small sections. Break up concrete slabs-on-grade that are 2 or more feet below proposed subgrade.
7. Demolish and remove below grade construction and concrete slabs on grade to a minimum depth of two feet below proposed subgrade.

C. Filling Voids:

1. Completely fill below grade areas and voids existing or resulting from demolition or removal of structures (pits, wells, cisterns, etc.) using approved select fill materials consisting of stone, gravel, and sand free from debris, trash, frozen materials, roots, and other organic matter.
2. Remove standing water, frost, frozen, or unsuitable material, trash, and debris from areas to be filled before fill placement.
3. Place fill materials in horizontal layers and compact each layer at optimum moisture content of fill material to proposed density as specified in Section. 312000
4. Grade surface to match adjacent grades and to provide flow of surface drainage after fill placement and compaction.

NOTE TO SPECIFIER

"REQUIRED Article (Disposal of Demolished Materials) follows. Do not revise this Article, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer.

D. Disposal of Demolished Materials:

1. Collect, recycle, reuse and dispose of demolished materials as specified in Section 013543-Environmental Procedures and as approved by the U.S. Postal Service in the Solid Waste Management and Environmental Protection Plan.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION 02 41 13 00

SECTION 02 41 13 13 - PORTLAND CEMENT CONCRETE REMOVAL**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for portland cement concrete removal. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Section Includes:

1. Provide all labor, materials and equipment required for the removal work and disposal of existing Portland Cement Concrete indicated on the drawings and specified, including but not limited to the following:
 - a. Saw cutting existing concrete pavements, sidewalks, driveways, curbs and gutters noted on drawings to be removed.
 - b. Saw cutting existing concrete sidewalks for new tree pit openings (refer to drawings for locations).
 - c. Saw cutting existing bituminous paving noted on drawings to be removed.
 - d. Removal and disposal of demolished concrete sidewalks, driveways, curbs and gutters, including concrete removed for new tree pit openings.
 - e. Removal and disposal of demolished bituminous paving.
 - f. All excavating, rough grading and compacting as required to establish subgrade for new sidewalks, and Subgrade and Sub-Base for driveways.
 - g. Providing, placing and grading sand fill under new sidewalks. Top of compacted subgrades shall allow for the placement of sidewalks plus thickness of sand fill.
 - h. Removal and disposal of excavated material.

C. Special Requirements:

1. Protection: Provide protection barricades, maintain all lights and signals and other measures as required by federal, state, and municipal laws, for the full period of demolition operations and remove same when directed. In removing work, perform all work required to protect and maintain adjacent property, streets, alleys, sidewalks, curbs, and other structures remaining in place.

1.2 PRODUCTS**A. Backfilling Material:**

1. Sand: Natural sand, with the following gradation: 100% passing the 1 sieve-, 65-100% passing the No. 4 sieve; 40-90% passing the No. 10 sieve- 30-80% passing the No. 16 sieve- 10-50% passing the No. 50 sieve; 0-30% passing the No. 100 sieve, and 0-10% passing the No. 200 sieve.
2. Crushed Stone: Crushed stone having a #57 crusher run gradation.

1.3 EXECUTION**A. Demolition:**

1. The contractor shall accept the site as it finds it and shall inform itself as to the character and types of work to be removed. The Owner assumes no responsibility for the condition of the existing construction to be removed or demolished.
2. No demolition shall be commenced until a program of operations has been coordinated with the Owner, except that preparatory work may be started if specifically approved by the Owner.



3. Operations shall be done in such manner as to avoid hazards to persons and property and interference with use of adjacent areas or interruption of free passage to and from such areas. Maintain Pedestrian access to all private entrances where construction of new sidewalks is in progress. Provide temporary walk ways or other means as required to maintain entry into the private properties, complying with all laws and ordinances and as approved by the Owner. Care shall be taken to prevent the spread of dust and flying particles.
4. Demolition and removal work shall be executed in a careful and orderly manner. Accumulation of rubbish will not be permitted.
5. After work is started, it shall be continued to completion at a rate that will allow the balance of the work to be completed within the time specified. If extra shifts are necessary beyond regular working hours, the work shall proceed with a minimum of nuisance to surrounding properties.
6. Contractor shall determine the nature and extent of demolition that will be necessary by comparing the drawings with the existing field conditions. It is expressly understood that this contract includes all work of a demolition nature that may be required or necessary for a full and complete execution of the work, whether particularly referred to herein or not.

B. Removal And Excavation:

1. When removing existing sidewalks, driveways, curbs and gutters provisions shall be made for satisfactory transition between replacements and the portion remaining in place. The contractor shall saw cut to a minimum depth of 1-1/2 inches with a concrete sawing machine to prevent the surface from spalling when the concrete is broken out. This work shall be done in such a manner that a straight joint will be secured.
2. It shall be the responsibility of the contractor to determine the thickness of the existing sidewalk to be removed. No additional compensation will be allowed because of variations from the assumed thickness or from the thickness shown on the plans.
3. After existing concrete sidewalks and driveways have been removed, excavate to depth required for sand fill.
4. The bottoms of all excavations shall be properly leveled off and all loose materials shall be removed from excavations. All wood, timber and organic materials, that are exposed at the bottom of all excavations, shall be removed and the area backfilled with sand and compacted.
5. Any excess or unauthorized excavation shall be backfilled with sand and compacted, at no additional cost to the Owner.
6. No backfill shall be placed in standing water, on frozen ground or on surfaces which have not been approved by the Commissioner.
7. Backfilling for all areas shall be approved material. Backfill shall be compacted to 95% maximum density in accordance with ASTM D 1557.
8. Contractor shall determine the nature and extent of excavation work that will be necessary by comparing the drawings with the existing areas to be excavated. It is expressly understood that this contract includes all work of an excavation nature that may be required or necessary for a complete execution of all excavation work, whether particularly referred to herein or not.

C. Disposal Of Materials:

1. All demolished and unsuitable materials, including excavated earth removed to establish required grade elevations shall be disposed of legally in such a manner that public or private property will not be damaged or endangered.

D. Clean-Up:

1. On completion of the demolition work, excavation work and before acceptance by the Owner, clean the areas affected, including areas outside the limits of the contractor's work area where permission to work has been granted. Remove surplus construction material or debris resulting from the demolition work and excavation work, and dispose of legally off the site.
2. Access routes to and from the site shall be kept clean of debris resulting from the work.

END OF SECTION 02 41 13 13



Task	Specification	Specification Description
02 41 16 13	02 41 13 13	Portland Cement Concrete Removal



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SECTION 02 41 19 00 - CSF SELECTIVE STRUCTURE DEMOLITION**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where selective demolition of existing building items and structure is part of the Work for remodeling or building expansions. Use for RSD interior tenant improvements for demolition of existing building lease space areas. Section 024113 "Selective Site Demolition" should be used for sitework demolition of existing site improvements and structures.

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Procedures for demolition and removal of existing building elements.
 - 2. Removal of designated building equipment and fixtures.
 - 3. Salvaged items.
 - 4. Salvaged material.
 - 5. Salvaged items for re-use.
- B. Related Documents: The Contract Documents, as defined in Section 011000- Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 013543- Environmental Procedures: Recycling and reuse of waste materials.

1.2 SYSTEM DESCRIPTION

- A. The extent of Selective Demolition Work is that Work necessary, and required to facilitate the new construction indicated.
- B. Demolition shall be such that all construction, new and existing, can be performed, and completed in accordance with the construction documents.
- C. The contractor shall visit the project site and familiarize himself with the existing conditions and project requirements.



- D. Verify the scope of the Work under this Section including salvage material. The United States Postal Service will be responsible for removing all materials and equipment which the United States Postal Service wishes to salvage prior to the beginning of this Work.
- E. The existing fire protection sprinkler system shall remain in place.

1.3 QUALITY ASSURANCE

- A. Engage only personnel who can demonstrate not less than five years successful experience in Work of similar character.
- B. Performance Criteria:
 1. Requirements of Structural Work: Do not cut structural work in a manner resulting in a reduction of load-carrying capacity of load/deflection ratio.
 2. Operational and Safety Limitations: Do not cut operational elements and safety-related components in a manner resulting in a reduction of capacities to perform in a manner intended or resulting in a decreased operational life, increased maintenance or decreased safety.
 3. Visual Requirements: Do not cut work which is exposed on the exterior or exposed in occupied spaces of the building in a manner resulting in a reduction of visual qualities or resulting in substantial evidence of the demolition work judged by the Architect to be cut and patched in a visually unsatisfactory manner.
 4. Loading: Do not superimpose loads at any point upon existing structure beyond design capacity including loads attributable to materials, construction equipment, demolition operations and shoring and bracing.
 5. Vibration: Do not use means, methods, techniques or procedures which would induce vibration into any element of the structure.
 6. Fire: Do not use means, methods, techniques or procedures which would produce any fire hazard unless otherwise approved by Contracting Officer.
 7. Water: Do not use means, methods, techniques or procedures which would produce excessive water run-off, and water pollution.
 8. Air Pollution: Do not use means, methods, techniques or procedures which would produce uncontrolled dust, fumes or other damaging air pollution.

1.4 PROJECT SITE

- A. Indicated "Existing Construction" was obtained from existing drawings or other information which may not reflect actual conditions. The Contractor shall verify all existing conditions and notify the Contracting Officer of discrepancies before proceeding with the Work.
- B. Perform the removal, cutting, drilling, etc., of existing work with extreme care, and using small tools in order not to jeopardize the structural integrity of the building.

NOTE TO SPECIFIER

Verify with the USPS Contracting Officer the occupancy of the Project Site.

- C. Occupancy: Contractor [shall] [shall not] have full use of the facility during construction.
- D. Condition of Structure: The United States Postal Service assumes no responsibility for the actual condition of portions of the structure to be demolished.

NOTE TO SPECIFIER



Edit below as required for occupancy restrictions..

- E. Partial removal: Items of salvageable value to the Contractor may be removed from the structure as the work progresses if not claimed by the United States Postal Service. Salvaged items must be transported from the site as they are removed.
- F. Protection: Make sure that the safe passage of persons around the area of demolition is maintained during the demolition operation. Conduct operations to prevent injury to adjacent buildings, structures, other facilities, and persons.

1.5 PROTECTION OF EXISTING CONSTRUCTION

- A. Provide temporary protection of existing construction (floors, roof, and walls) when adjoining new work and in traffic areas.
- B. Provide temporary construction, constructed of framing and plywood, to protect existing construction and surrounding surfaces from damage by movement of materials and personnel.
- C. The contractor is responsible for all damage to existing structure and shall replace or repair all areas of damage.
- D. Repair, replace, or rebuild existing construction as required or as directed which has been removed, altered or disrupted to allow for new construction. Existing construction shall be corrected to match adjacent construction, new or existing.
- E. Perform cutting of existing concrete and masonry construction with saws and core drills. Do not use jack-hammers or explosives.

1.6 SHORING AND BRACING

- A. Provide temporary shoring of existing construction to allow removal of existing structural elements. Maintain shoring until new structural elements are in place and accepted.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Use NOT USED if Salvaged Items or Materials are not part of the Work.

NOTE TO SPECIFIER

Use SALVAGED ITEMS below if specific Project will have items salvaged. Consult with USPS Contracting Officer.

2.1 SALVAGED ITEMS

- A. The Contract Documents indicate the existing materials that are to be reinstalled in the new construction. The Contractor shall remove, protect and reinstall these items as indicated.
 - 1. Items for "Reinstallation" will be indicated as such within the Contract Documents.
- B. Materials scheduled for reinstallation which are damaged by the Contractor to the extent that they cannot be reinstalled shall be replaced by the Contractor with equal quality material at no additional cost to the United States Postal Service.



- C. Coordinate with the Contracting Officer on disposition of salvage items note scheduled for reinstallation, demolished materials, and equipment. Salvaged materials, not reinstalled, shall be delivered, as directed, to the United States Postal Service.

NOTE TO SPECIFIER

Use SALVAGED MATERIALS below if specific Project will have materials salvaged. Consult with USPS Contracting Officer.

2.2 SALVAGED MATERIALS

- A. Removed and salvaged materials of value not designated for reinstallation, unless claimed as salvage by the United States Postal Service, shall become the property of the Contractor and shall be removed from the premises by the Contractor and recycled, reused or disposed of as specified in Section 013543- Environmental Procedures.
- B. The United States Postal Service will remove or, under separate contract, have all materials and equipment which the United States Postal Service requires removed prior to Work under this Section begins.

NOTE TO SPECIFIER

Use SALVAGED ITEMS FOR RE-USE below if specific Project will have items salvaged. Consult with USPS Contracting Officer.

2.3 SALVAGED ITEMS FOR RE-USE

- A. Materials and items scheduled for re-use which are damaged by the contractor to the extent which they cannot be re-used shall be replaced by the Contractor at no additional cost to the United States Postal Service.
- B. Contractor shall remove and salvage the existing roof hatch and access ladder for re-use. Store on site in protected area for reinstallation as indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.



- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Temporary Support: Provide adequate temporary support for work to be cut to prevent failure. Do not endanger other work.
- B. Provide adequate protection of other work during selective demolition to prevent damage and provide protection of the work from adverse weather exposure.

3.3 PROCEDURE

- A. Employ only skilled tradesmen to perform selective demolition.
- B. Cut work by methods least likely to damage work to be retained and work adjoining.
- C. In general, where physical cutting action is required, cut work with sawing and grinding tools, not with hammering and chopping tools. Core drill openings through concrete and masonry work.
- D. Patch with seams which are durable and as invisible as possible. Comply with specified tolerances for the work.
- E. Where selective demolition terminates at a surface or finish to remain, completely remove all traces of material selectively demolished, including mortar beds. Provide smooth, even, substrate transition.

3.4 POLLUTION CONTROLS

- A. Use temporary enclosures and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level.
- B. Comply with governing authorities pertaining to environmental protection.
 - 1. Protect natural resources as specified in Section 013543 - Environmental Procedures.
- C. Clean adjacent portion of the structure and improvement of dust, dirt and debris caused by demolition operations, as directed by Contracting Officer and governing authorities. Return adjacent areas to conditions existing prior to the start of the work.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. Collect, recycle, reuse, and dispose of demolished materials as specified in Section 013543 - Environmental Procedures and as approved by the U.S. Postal Service in the Solid Waste Management and Environmental Protection Plan.

NOTE TO SPECIFIER

The following is some sample text that may be used. Provide text below that describes the selective demolition Work for specific Project. Coordinate with Drawings. Do not repeat information that will be indicated on Drawings.

3.6 SCHEDULE OF SELECTIVE DEMOLITION



- A. Slab on Grade:
 - 1. Where indicated, saw cut perimeter of existing slab minimum of 50 percent of slab thickness to provide a breaking point to remove existing concrete.
 - 2. Break concrete slab to be removed into portions easily removed, maximum 3 foot dimensions in any side.
 - 3. Remove all concrete pieces within removed area down to the existing subgrade.
- B. Exterior Masonry:
 - 1. Locate portion of existing masonry wall to be removed.
 - 2. Using small power tools, remove only that portion of the exterior wall which is required for the indicated new construction.
- C. Interior Floor Finishes:
 - 1. Remove all interior floor tile finish material.
- D. Interior Walls and Partitions:
 - 1. All interior wall and partitions shall be removed unless otherwise indicated on drawings.
 - 2. Remove all top and bottom framing tracks and over head braces.
- E. Mechanical System:
 - 1. Remove all mechanical equipment and related ductwork.
 - 2. Provide temporary weathertight protection of all openings in roof and exterior walls.
 - 3. Remove all accessories to the mechanical system including hanger straps.
- F. Plumbing:
 - 1. Remove all plumbing fixtures and accessories including all exposed supply, waste, and vent piping.
 - 2. Concealed piping within and below slab construction shall be identified, and capped a minimum of 3 inches (8 cm) below finish floor.
- G. Electrical Service:
 - 1. All electrical circuits within the existing structure shall be abandoned from the existing service entrance section, beyond.
 - 2. Remove all abandoned electrical conduit, boxes, and wiring back to the existing electrical service which is to remain.
- H. Provide additional selective demolition as indicated and required by the Contract Documents and as required for indicated new construction.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION 02 41 19 00



Task	Specification	Specification Description
02 41 19 13	01 71 23 16	Cutting and Patching
02 41 19 13	02 41 13 13	Portland Cement Concrete Removal
02 41 19 16	02 41 13 13	Portland Cement Concrete Removal
02 43 13 00	01 22 16 00	No Specification Required
02 62 16 00	01 22 16 00	No Specification Required
02 66 13 00	01 22 16 00	No Specification Required
02 66 23 00	01 22 16 00	No Specification Required



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SECTION 02 82 00 00 - REMOVAL OF FRIABLE ASBESTOS-CONTAINING MATERIALS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for removal of friable asbestos-containing materials. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Description

1. Furnish all labor, materials, facilities, equipment, services, employee training and testing, permits and agreements necessary to perform the work required for asbestos removal, encapsulation, repair, clean-up, decontamination, re-insulation and all other work in accordance with these specifications, in accordance with the latest regulations from the U.S. Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), the recommendations of National Institute of Occupational Safety and Health (NIOSH), and any other applicable federal, state and local government regulations. Whenever there is a conflict or overlap of the above references, the most stringent provision is applicable.
2. The work specified herein shall be performed by competent persons trained, knowledgeable and qualified in the state-of-the-art techniques of asbestos abatement, handling and subsequent cleaning of contaminated areas.

C. Scope

1. The quantities of materials and limits of abatement work area(s) shall be verified by the asbestos contractor.

D. Asbestos Hazard

1. Asbestos-containing material when damaged or disturbed is subject to fiber releases. Wet methods are a primary means of controlling fiber release.
2. Strict compliance with each of the provisions outlined in these specifications for the encapsulation, repair and handling of asbestos-containing material is of great importance, because:
 - a. The inhalation of airborne asbestos fibers can cause a very serious and often fatal disease.
 - b. Workers may not be aware they are inhaling asbestos fibers.
 - c. Symptoms of the disease do not appear for many years.
 - d. Only the Contractor and its employees can prevent the inhalation of asbestos fibers, which can lead to the development of asbestos-related disease.
 - e. No insurance is available to provide for asbestos-related disease.

E. Other Hazardous Material

1. Contractor shall comply with OSHA 29 CFR 1926.62 - Lead in Construction when demolishing any equipment or architectural component identified as lead-containing or lead-based paint. The work of this project is considered a demolition activity.
2. the Owner anticipates that a substantial amount of the Project will involve lead paint.

F. Qualifications

1. the Owner and the Owner's Representative will verify and approve the experience of the Asbestos Abatement Contractor based upon submission at the time of bidding by Contractor evidence of the following:
 - a. Experience: Provide the names and locations of at least three asbestos abatement projects of comparable size and complexity comparable with this work. Provide the names and telephone numbers of contact person at previous projects. Provide the final air monitoring decontamination fiber levels achieved.



- b. Personnel: Provide the name(s) of "Competent Person" as defined by OSHA 29 CFR 1926.32(f) - Asbestos. Demonstrate the education and specialized training with successful completion of examination of an EPA approved course. Provide evidence of participation in five projects of complexity comparable with this project.
- c. Licensing and Certification: The Contractor must hold a current, valid asbestos license issued by the State in which the work is to be performed.

G. Notices And Record Keeping

1. Contractor shall maintain for at least 30 years, a record for each asbestos project in which the Contractor engages. Each record shall include the following information: name, address, and social security number of all personnel involved with the project, the name address and social security number of the OSHA "Competent Person" who will supervise the work, the amount of asbestos material that was removed, repaired, encapsulated or disturbed, the commencement and completion date of the work, copies of Hazardous Waste Manifest(s), personal air monitoring results and any other appropriate information.
2. The Contractor shall send written notification as required by USEPA National Emission Standards for Hazardous Air Pollutants (NESHAPS) Asbestos Regulations (40 CFR 61, Subpart M) to the Owner, at least 10 working days prior to beginning any work on asbestos-containing materials.
3. Include the following information:
 - a. Name and address of the Owner or operator.
 - b. Description of the facility being demolished or renovated, including the size, age, and prior use of the facility.
 - c. Estimate of the approximate amount of asbestos material present in the facility in terms of linear feet of pipe, and surface area on other facility components. For facilities in which the amount of asbestos materials is less than 80 linear meters (260 linear feet) on pipes and less than 15 square meters (160 square feet) on other facility components, explain techniques of estimation.
 - d. Location of the facility being demolished or renovated.
 - e. Scheduled starting and completion dates of demolition or renovation.
 - f. Nature of planned demolition or renovation and method(s) to be used.
 - g. Procedures to be used to comply with the requirements of USEPA National Emission Standards for Hazardous Air Pollutants (NESHAPS) Asbestos Regulations (40 CFR 61 Subpart M).
 - h. Name and location of the waste disposal site where the asbestos waste material will be deposited.
4. Prior to commencement of work, the Contractor shall submit the following documents to the Owner's Representative. No work will be allowed to start until these documents have been approved:
 - a. The schedule of the work, including manpower, length and number of work shifts. Schedule shall be coordinated with the Owner's full occupancy of all areas of the building.
 - b. Satisfactory proof that written notification has been provided to the EPA regional office and the Owner.
 - c. Proof that all required permits, disposal site locations, and arrangements for transportation and disposal of asbestos-contaminated materials, supplies and the like have been obtained.
 - d. Complete a worker certificate indicating that all employees have had instruction and training on the hazards of asbestos exposure, the use and fitting of respirators, protective dress, wet and dry decontamination procedures, entry and exit from work areas, and all aspects of work procedures and protective measures.
 - e. Documentation indicating that all employees have received appropriate medical examinations and have successfully passed fit testing for the respirator to be worn. As a minimum, medical exams must be consistent with OSHA 29 CFR 1926.1101(K)(9)(viii)(G)-Asbestos Regulation.



- f. Samples of signs to be used in and around the work area to comply with OSHA 29 CFR 1926.1101(K)(9)(viii)(I)- Asbestos regulations and as required by federal, state and municipal regulations.
- g. Material Safety Data Sheets (OSHA form 174 or equivalent) for all chemicals used during work performed under this section.
- h. Encapsulation data and encapsulation procedures.
- i. Design of pressure differential system including calculation used to arrive at the number of machines necessary to achieve one air change per every 10 minutes.
- j. Location of personnel and material decontamination units for each work area.
5. Contractor shall provide written notification to the Owner's Representative of its intent to start work at least five days in advance. In no case will the Contractor start work until authorization to proceed is given.
6. During the work, Contractor shall maintain a daily log which will be kept at the job site. Items to be included in the daily log shall include but are not limited to the following:
 - a. Meetings, purpose, attendees, discussions, items of resolution.
 - b. Visitations, authorized and unauthorized.
 - c. Sign-in sheets of all personnel entering and leaving the work area.
 - d. Special or unusual events (i.e., barrier breeching equipment failures).
 - e. Personal air monitoring results.
 - f. Two copies of the daily log are required for Project Closeout.
- H. Terminology (Definitions)
 1. Abatement - Procedures to control fiber release from asbestos-containing materials. Includes removal, enclosure or encapsulation.
 2. Air Lock - A system for permitting ingress or egress without permitting air movement between any two adjacent areas consisting of two curtained doorways. The air lock must be maintained in an uncontaminated condition at all times.
 3. Air Monitoring; - The process of measuring the asbestos fiber content of a specific volume of air in a stated period of time using methods approved or recommended by OSHA, EPA, NIOSH or other method approved by the Owner or the Owner's Representative.
 4. Amended water - Water to which a surfactant has been added.
 5. Asbestos - A generic name given to a number of naturally occurring hydrated mineral silicates that possess a unique crystalline structure, are incombustible in air, and are separable into fibers. Asbestos includes the asbestiform varieties of Chrysotile (serpentine), Crocidolite (Riebeckite), Amosite (Cummingtonite-Grünite), Anthophyllite, Actinolite, and Tremolite.
 6. Asbestos-containing material (ACM) - Any material that contains more than 1 percent asbestos by weight as determined by Polarized Light Microscopy (PLM).
 7. Authorized Visitor - the Owner or its designated representative, or a representative of any regulatory or other agency having jurisdiction over the project.
 8. Class I - Asbestos work means activities involving the removal of thermal systems insulation (TSI) and surfacing ACM and PACM.
 9. Class II - Asbestos work means activities involving the removal of ACM which is not TSI or surfacing material. This includes, but is not limited to, the removal of asbestos-containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastics.
 10. Class III - Asbestos work means repair and maintenance operations where "ACM" including TSI and surfacing ACM and PACM is likely to be disturbed.
 11. Class IV - Asbestos work means maintenance and custodial activities during which employees contact but do not disturb ACM or PACM and activities to clean-up dust, waste and debris resulting from Class I, II and III activities.
 12. Critical Barrier - A unit of temporary construction which provides the only separation between an asbestos work area and an adjacent, potentially occupied, space. The critical barrier is composed of at least one intact sheet of polyethylene sheeting.
 13. Decontamination Enclosure System - A series of connected rooms with curtained doorways between any two adjacent rooms, for the decontamination of workers or of materials and equipment. A decontamination system contains at least two air locks.



14. Disposal - All procedures necessary to transport and deposit the asbestos-contaminated material stripped and removed from the building in a waste disposal site in compliance with applicable federal, state, and local regulations.
15. Disposal Site - A site approved by the EPA for the disposal of asbestos-containing wastes.
16. Encapsulant - A liquid which can be applied to asbestos-containing materials and which controls the possible release of fibers from the materials.
17. Encapsulation - The use of an agent to seal the surface (bridging encapsulant) or penetrate the bulk (penetrating encapsulant) of the asbestos-containing material.
18. HEPA -High Efficiency Particulate Air - A type of filter which is 99.97% efficient at filtering particles of 0.3 micrometers in diameter.
19. HEPA Vacuum Equipment - Vacuuming equipment equipped with a HEPA filter in the exhaust outlet, and so designed and maintained that 99.97% of all particles of 0.3 micrometer in diameter in the inlet air are collected and retained.
20. Negative Pressure Respirators - Respirators which function by the wearer breathing in air through a filter.
21. NIOSH - National Institute of Occupational Safety and Health.
22. the Owner's Representative - Authorized Consultants
23. Permissible Exposure Level (PEL) - A level of airborne fibers specified by OSHA as an occupational exposure standard for asbestos. It is 0.1 f/cc of air, eight-hour TWA, as measured by Phase Contrast Microscopy.
24. Repair - The restoration of damaged or deteriorated asbestos-containing material to intact condition.
25. Respirator Protection Program - A set of procedures and equipment required by OSHA if employees wear negative pressure respirators or if fiber levels are above the PEL.
26. Surfactant - Chemical wetting agent added to water to improve penetration, thus reducing the amount of water required for a given operation or area, and enhancing the effect of the water in reducing fiber release.
27. Thermal Systems Insulation - Material applied to pipes, fittings, boilers, breeching, tanks, ducts or other interior structural components to prevent heat loss or gain, or water condensation, or for other purposes.
28. Wet Cleaning - The process of eliminating asbestos contamination from building surfaces and objects by using cloths and mops or other cleaning tools that have been dampened with clean water and afterwards disposing of these cleaning tools as asbestos-contaminated waste.

I. Permits And Licenses:

1. The Contractor must maintain current licenses as required by applicable state or local jurisdictions for the removal, transporting, disposal or other regulated activity relative to the work of this contract.

J. Regulations

1. This section sets forth governmental regulations and industry standards which are included and incorporated herein by reference and made a part of the specifications. This section also sets forth those notices and permits which are known to the Owner and which either must be applied for and received, or which must be given to governmental agencies before start of work.
2. Except to the extent that more explicit or more stringent requirements are written directly into the contract documents, all applicable codes, regulations, and standards have the same force and effect (and are made a part of the contract documents by reference) as if copied directly into the contract documents, or as if published copies are bound herewith.
3. The Contractor shall assume full responsibility and liability for the compliance with all applicable federal, state, and local regulations pertaining to work practices, hauling, disposal, and protection of workers, visitors to the site, and persons occupying areas adjacent to the site. The Contractor is responsible for providing medical examinations and maintaining medical records of personnel as required by the applicable federal, state, and local regulations. The Contractor shall hold the Owner and the Owner's Representative harmless for failure to comply with any applicable work,



- hauling, disposal, safety, health or other regulation on the part of itself, its employees, or its Sub-Contractors.
4. Federal requirements which govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following regulations:
 - a. U.S. Department of Labor, Occupational Safety and Health Administration, (OSHA), including but not limited to:
 - 1) U.S. Department of Labor, OSHA, including, but not limited to:
 - a) Occupational Exposure to Asbestos, Tremolite, Anthophyllite and Actinolite; Final Rules
Title 29, Part 1910, Section 1001
Part 1926, Section 1101 of the Code of Federal Regulations
 - b) Respiratory Protection
Title 29, Part 1910, Section 134 of the Code of Federal Regulations
 - c) Construction Industry
Title 29, Part 1926.1011, of the Code of Federal Regulation
 - d) Access to Employee Exposure and Medical Records
Title 29, Part 1910, Section 2 of the Code of Federal Regulations
 - e) Hazard Communication
Title 29, Part 1910, Section 1200 of the Code of Federal Regulations
 - f) Specifications for Accident Prevention Signs and Tags
Title 29, Part 1910, Section 145 of the Code of Federal Regulations
 - 2) U.S. Environmental Protection Agency (EPA) including, but not limited to:
 - a) Asbestos Abatement Projects Rule
40 CFR Part 762
CPTS 62044, FRL 2843-9
Federal Register, Vol. 50 No. 134, July 12, 1985
P28530-28540
 - b) Regulation for Asbestos
Title 40, Part 61, Subpart A of the Code of Federal Regulations
 - c) National Emission Standard for Asbestos
Title 40, Part 61, Subpart M (Revised Subpart B) of the Code of Federal Regulations
 - 3) State requirements which govern asbestos abatement work and/or hauling and disposal of asbestos waste materials.
 - 4) Contractor shall abide by all local requirements which govern asbestos abatement work or hauling and disposal of asbestos waste materials including the following:
 - a) American National Standards Institute (ANSI)
1430 Broadway
New York, NY 10018
(212) 354-3300
 - b) Fundamentals Governing the Design and Operation of Local Exhaust Systems
Publication Z9.2-79
 - c) Practices for Respiratory Protection Publication Z288.2-80
 - d) American Society for Testing and Materials (ASTM)
1916 Race Street
Philadelphia, PA 19103
(215) 299-5400
 - e) Specification for Encapsulants for Friable Asbestos-Containing Building Materials
 - f) Safety and Health Requirements Relating to Occupational Exposure to Asbestos

K. the Owner's Representative

1. the Owner's Representative is authorized by the Owner to perform the following:
 - a. Have free access to all asbestos work areas.



- b. To assist in interpretation of procedures.
- c. To advise on all provisions of the contract documents pertaining to the control of asbestos.
- d. To stop work if, in the course of performing their monitoring duties, an instance of substantial nonconformance with the contract documents is observed.
- e. To stop work if a situation presenting a health hazard to workers or the Owner's employees or occupants of the building is observed.
- f. To act as the Owner's liaison in technical matters involving the asbestos-related work.
- g. To perform air sampling inside and outside the asbestos work area during the project. The Contractor shall cooperate fully with the Owner's Representative, its agents and employees, and ensure cooperation of its workers during collection of air samples and work area inspections.
- h. the Owner's Representative role in advising the Owner on environmental health matters does not relieve the Contractor's obligation to comply with all applicable health and safety regulations. Air monitoring results generated by the Owner's Representative shall not be used by the Contractor to represent compliance with regulatory agency requirements for monitoring of worker's exposure to airborne asbestos, nor shall any other activity on the part of the Owner's Representative represent the Contractor's compliance with applicable health and safety regulations.

L. Pre-Construction Conference

- 1. An initial progress meeting recognized as "Pre-Construction Conference" shall be held prior to start of any work. Contractor shall meet at project site, with General Superintendent, the Owner, the Owner's Representative, and other entities concerned with asbestos abatement work. Record discussions and agreements and furnish copy to each participant. Provide at least 72 hours advance notice to all participants prior to convening Pre-Construction Conference.
- 2. This is an organizational meeting, to review responsibilities and personnel assignments, to locate the containment and decontamination areas; and temporary facilities including power, light, water, etc.
- 3. Submit waivers on forms, and executed in a manner acceptable to the Owner. Administrative requirements that must proceed or coincide with Contractor's submittal for final payment shall consist of the following:
 - a. Completion of project closeout requirements.
 - b. Completion of items specified for completion beyond time of Final Completion (regardless of whether special payment application was previously made).
 - c. Assurance, satisfactory to the Owner, that unsettled claims will be settled and that work not actually completed and accepted will be completed without undue delay.
 - d. Transmittal of required project construction records to the Owner.
 - e. Landfill receipts for all asbestos-containing material.
 - f. Proof, satisfactory to the Owner, that taxes, fees and similar obligations of Contractor have been paid.
 - g. Removal of temporary facilities, services, surplus materials, rubbish and similar elements.
 - h. Consent of surety for final payment.

M. Project Closeout

- 1. Project closeout is the term used to describe certain collective project requirements that indicate completion of the work to be fulfilled near the end of the contract time. Also, in preparation for final acceptance of the work by the Owner, as well as, final payment to the Contractor and the normal termination of the Contract.
- 2. Include supporting documentation for completion as indicated in these contract documents.
- 3. Submit a statement on accounting of changes to the Contract Sum.
- 4. Advise the Owner of pending insurance change-over requirements.
- 5. Submit specific warranties, workmanship and maintenance bonds, maintenance agreements, final certifications and similar documents.



6. Obtain and submit releases enabling the Owner's full, unrestricted use of the work area and access to services and utilities. Where required, include occupancy permits, operating certificates and similar releases.
7. Results of the completed inspection will form the initial "punch-list" for final acceptance.
8. A complete record, certified by the testing laboratory, of all personal air monitoring results.
9. Complete the following cleaning operations as outlined in Paragraph "Decontamination Procedures" before requesting the Owner's Representative inspection for certification of Final Completion.
 - a. Remove exposed labels in finished spaces which are not required as permanent labels on materials supplied as part of the work, except for "Asbestos", "Asbestos Free", or Thermal Insulation Labels specified elsewhere.
 - b. Clean transparent materials, affected by the work including mirrors and window/door glass, to a polished condition, removing substances which are noticeably vision-obscuring materials. Replace broken glass and damaged transparent materials.
 - c. Clean exposed hard-surfaced finishes affected by the work, to a dirt-free condition, free of dust, stains, films and similar distracting substances. Except as otherwise indicated, avoid disturbance of natural weathering of exterior surfaces. Restore reflective surfaces to original reflective condition.
 - d. Clean plumbing fixtures affected by the work to a sanitary condition, free of stains including those resulting from water exposure.
 - e. Replace all HVAC filters using materials supplied by the Owner or clean non-replaceable filters after minimum of two days of operation of HVAC equipment.
 - f. Clean light fixtures and lamps, which have been affected by the work so as to function with full efficiency. Replace lamps where inoperable.
 - g. Repair any damage to wall, ceiling and floor surfaces caused by installation and removal of the polyethylene sheeting.

N. Personnel Protection

1. Prior to commencement of work, the workers shall be instructed and be knowledgeable in the areas described in Paragraph "Submittals and Notices" having to do with employees.
2. Worker Protection - shall comply with 29 CFR 1910.134 (Respiratory Protection).
 - a. Because there is no known safe level of exposure to asbestos, it is prudent to reduce worker's exposures to as low a level as possible. Proper respiratory protection is critical in minimizing exposure.
 - b. Workers shall be provided, as a minimum, with personally issued and marked respirators equipped with high efficiency particulate filters approved by NIOSH to be worn in the designated work area and/or whenever a potential exposure to asbestos exists. Sufficient filters shall be provided for replacement as required by the workers or applicable regulations. Disposable respirators shall not be used.
 - c. No worker shall be exposed to levels greater than 0.01 f/cc as determined by the protection factor of the respirator worn and the work area fiber levels.
 - d. Whenever powered purifying respirator protection is used, a sufficient supply of replacement batteries and HEPA filter cartridges shall be provided to the workers.
 - e. Air monitoring required by OSHA is work of the Contractor and not covered in this specification. Contractor shall post, on a daily basis, results of the air monitoring results from the previous shift. A complete record, certified by the testing laboratory, of all personal air monitoring tests and results will be furnished to the Owner and the Owner's Representative prior to Contractor's Request for Final Payment.
 - f. During encapsulation operations or usage of other organic base aerosols (e.g., spray glue, expanding foam), workers shall be provided with combination cartridges consisting of organic vapor and HEPA sections.
 - g. Workers shall be provided with sufficient sets of protective full-body clothing to be worn in the designated work area and/or whenever potential exposure to asbestos exists. Such clothing shall include, but not be limited to, full-body coveralls, headgear and gloves. Workers shall assure that hoods covering their hair are worn in the designated work areas



- at all times. Eye protection and hard hats shall be provided as required by applicable safety regulations. Eye protection shall be worn during encapsulation operations. Non-disposable type protective clothing and footwear shall be left in the work area until the end of the asbestos abatement work, at which time such items will be disposed of as asbestos waste.
- h. Non-skid footwear shall be provided to all abatement workers. Disposable clothing shall be adequately sealed to the footwear to prevent body contamination.
 - i. Protective clothing shall not be worn in lieu of street clothing outside the work area.
 - j. Visitor Clothing: The Contractor shall provide authorized visitors with suitable respirator, protective clothing, headgear, eye protection, and footwear as described herein, whenever they enter the work area.
3. Decontamination and Work Procedures: The decontamination and work procedures to be followed by workers shall be posted as described in these specifications.
 4. Worker and Authorized Visitor Protection Procedures:
 - a. Each worker and authorized visitor shall, upon entering the job site, remove street clothes in a designated clean change area and put on a respirator with new filters and clean protective clothing before entering the work area.
 - b. The Contractor's employees shall perform a positive/negative respirator fit test each time it enters the work area. If leakage occurs, the respirator must be re-adjusted or replaced.
 - c. Workers shall maintain their respirators in a safe operating condition. The condition of respirators shall be checked daily.
 - d. Workers and visitors shall complete the decontamination procedures as outlined in the specification upon exiting the work area.
 - e. Workers shall not eat, drink, smoke, or chew gum or tobacco in or near the asbestos work areas.
 - f. Workers shall be fully protected with respirators and protective clothing immediately prior to the first disturbance of asbestos-containing or contaminated materials and until final cleanup is completed.

O. Air Monitoring

1. The airborne fiber counts outside the work area will be monitored to detect faults in the work area isolation such as contamination of the building outside of the work areas with airborne asbestos fibers, failure of filtration or rupture in the negative pressure system.
Should any of the above occur, the Contractor shall immediately cease asbestos abatement activities until the fault is corrected. Work shall not recommence until authorized by the Owner's Representative. In the case of mini-enclosures the Owner's Representative will monitor air in a remote location of the residence to determine the baseline of asbestos.
2. The airborne fiber counts in the work area will be monitored. The purpose of this air monitoring will be to detect airborne fiber counts which may significantly challenge the ability of the work area isolation procedures to protect the balance of the building or outside of the building from contamination by airborne fibers. In the case of mini-enclosures the Owner's representative may monitor air outside of several enclosures if they are in close proximity.
3. Contractor shall maintain an average airborne count inside the work area of less than 0.5 f/cc. If the fiber counts rise above this figure for any sample taken, revise work procedures to lower fiber counts. If the TWA fiber count for any work shift or eight-hour period exceeds 0.5 f/cc, stop all work, leave pressure differential system in operation and notify the Owner's Representative. Do not recommence work until authorized in writing by the Owner's Representative.
4. If airborne fiber counts exceed 1.0 f/cc for any period of time cease all work until fiber counts fall below 0.5 f/cc and notify the Owner's Representative. Do not recommence work until authorized in writing by the Owner's Representative.
5. If any air sample taken outside of the work area exceeds the 0.01 f/cc of air, Contractor shall immediately and automatically stop all work. If this air sample was taken inside the building and outside of critical barriers around the work area, immediately erect new critical barriers to isolate the affected area from the balance of the building. Erect Critical Barriers at the next existing structural isolation of the involved space (e.g., wall, ceiling, and floor). Leave Critical Barriers in



- place until completion of work and insure that the operation of the negative pressure system in the work area results in a flow of air from the balance of the building into the affected area.
6. If the exit from the clean room of the personnel decontamination unit enters the affected area, establish a temporary decontamination facility consisting of a shower room and changing room. After cleaning and decontamination of the affected area remove the shower room and leave the changing room in place as an air lock.
 7. After certification of visual inspection in the work area, remove critical barriers separating the work area from the affected area. Final air samples will be taken within the entire area.
 8. The following procedure will be used to resolve any disputes regarding fiber types when a project has been stopped due to excessive airborne fiber counts. "Airborne Fibers" referred to above include all fibers regardless of composition as counted in the Phase Contrast Microscopy (PCM) NIOSH 7400 Method procedures. If work has stopped due to high airborne fiber counts, air samples will be secured in the same area by the Owner's Representative for analysis by electron microscopy. "Airborne fibers" counted in samples analyzed by Scanning or Transmission Electron Microscopy (TEM) shall be only asbestos fibers, but of any diameter and length. Subsequent to analysis by Electron Microscopy the number of airborne fibers shall be determined by multiplying the number of fibers, regardless of composition, counted by the PCM NIOSH 7400 Method procedure by a number equal to asbestos fibers counted divided by all fibers counted in the electron microscopy analysis.
 9. If electron microscopy is used to arrive at the basis for determining airborne fiber counts in accordance with the above paragraph, and if the average of airborne asbestos fibers in all samples taken exceeds 0.1 f/cc, or if any one sample exceeds 0.2 f/cc, then the cost of such analysis will be born by the Contractor, at no additional cost to the Owner.
 10. the Owner's Representative will secure at least the following air samples to establish a base line before start of work involving large enclosures:

Location Sampled	Number of Samples	Analysis Method	Detection Limit f/cc	Minimum Volume Liters	Rate LPM
Each Work Area	1	PCM	0.01	1,900	2-16
Outside Each Work Area	1-3	PCM	0.01	1,900	2-16

11. Base Line is an action level expressed in f/cc, which is ten percent greater than the largest of the following:
 - a. Average of the samples collected on cellulose ester filters outside each work area.
 - b. Average of the samples collected on cellulose ester filters outside the building.
 - c. 0.01 fibers per cubic centimeter.
12. Daily: From start of work of Paragraph "Temporary Enclosure" through the work of Paragraph "Project Decontamination," the Owner may be taking the following samples on a daily basis. The location of each air sample will be determined by the Owner's Representative.
 - a. Baseline
 - b. Work Area
13. For larger enclosures samples will be collected on 25 mm cassettes with the following filter media:

PCM: 0.8 micrometer mixed cellulose ester.

Location Sampled	Number of Samples	Analysis Method	Detection Limit f/cc	Minimum Volume Liters	Rate LPM
Each Work Area	2	PCM	0.01	1,900 as required by conditions	2-16
Outside Each Work Area Critical Barrier	1	PCM	0.01	1,900	2-16
Clean Room	1	PCM	0.01	1,900	2-16
Equip Decon	1	PCM	0.01	1,900	2-16



14. Additional samples may be taken at the Owner or the Owner's Representative discretion. If airborne fiber counts exceed allowed limits, additional samples will be taken as necessary to monitor fiber levels.
15. The services of a testing laboratory will be employed by the Owner to perform laboratory analysis of the air samples. Samples will be sent daily so that verbal reports on air samples can be obtained in a timely manner. A complete record, certified by the testing laboratory, of all air monitoring tests and results will be furnished to the Owner's Representative, the Owner and the Contractor.
16. Air samples may be analyzed on site by the Owner's Representative, if they are to be analyzed by the NIOSH 7400 Method.
17. Cellulose ester filters will be analyzed using the PCM NIOSH 7400 Method. Thus analysis will be carried out at a laboratory located off the job site.
18. At the completion of the work in occupied areas and prior to the dismantling of the isolation system, final air clearance will be conducted by the Owner's Representative.
19. Decontamination of the work area will be considered complete when all samples indicate fiber levels are less than 0.01 f/cc of air as analyzed by PCM NIOSH 7400 Method or an average of less than 70 structures per square millimeter of filter area as analyzed by TEM; Level II AHERA Method.
20. The Contractor may conduct its own air monitoring and laboratory testing. If it elects to do this the cost of such air monitoring and laboratory testing shall be included in the Contract Sum.

P. Equipment Removal Procedures

1. Clean all external surfaces of contaminated waste containers and equipment thoroughly by wet sponging or HEPA vacuuming before moving such items into the equipment decontamination enclosure system washroom for final cleaning and removal to uncontaminated areas. Ensure that personnel do not leave the work areas through the equipment decontamination enclosure system.

Q. Disposal Activities

1. It is the responsibility of the Contractor to comply with current federal, state and local regulations concerning the waste handling, transportation, and disposal of asbestos-containing material (ACM) and accompanying solvents or residues.
2. The Contractor will document actual disposal of the waste at the designated landfill by completing Disposal Certificate or submitting proof of landfill receipt.

1.2 PRODUCTS

A. Materials

1. All Contractor's equipment delivered to the site shall be free of asbestos contamination.
2. Store all materials subject to damage off the ground, away from wet or damp surfaces, and under cover sufficient to prevent damage or contamination.
3. Damaged or deteriorating materials shall not be used and shall be removed from the premises. Materials that become contaminated shall be disposed of in accordance with applicable regulations.
4. Polyethylene flame retardant sheet of 6-mil thickness shall be used unless otherwise specified. Polyethylene sheeting shall be sized to minimize the frequency of joints. Polyethylene sheeting must satisfy the National Fire Prevention Association Standard 701, "Small Scale Fire Test for Flame Resistant Textile and Film."
5. Adhesive tape shall be capable of sealing joints of adjacent sheets of polyethylene and for use in attachment of polyethylene sheet to finished or unfinished surfaces of similar materials and shall be capable of adhering under dry and wet conditions, including use of amended water. Contractor shall use adhesive tape compatible with finished surfaces.



6. Protective devices such as, but not limited to, disposable clothing, respirators, gloves, hard hats, etc. shall be used.
7. Wetting agent shall be a mixture of 50/50 polyoxyethylene ether and polyglycol ester or equivalent commercial product.
8. Encapsulant materials shall be the bridging and penetrating type and conform with the following characteristics:
 - a. Encapsulants shall not be solvent-based or utilize a hydrocarbon in the liquid in which the solid parts of the encapsulant are suspended.
 - b. Encapsulant shall not be flammable.
9. A non-hardening lagging sealer for enclosing and sealing raw exposed edges and surfaces of asbestos-containing materials.
10. Pre-mixed or job mixed insulating plaster manufactured for use on plumbing equipment shall be used when repairing damaged thermal insulation material.
11. Non-woven fibrous glass mat and open weave glass fiber mat cloth for repair of thermal systems insulation.
12. Fire retardant sealant shall prevent fire, smoke, water and toxic fumes from penetrating through sealants. Sealant shall have a flame spread, smoke and fuel contribution of zero, and shall be ASTM and Underwriter's Laboratory (UL) rated for three hours for standard method of fire test for fire stop systems.

B. Tools And Equipment

1. Provide suitable tools for repair and encapsulation of asbestos-containing materials and for removal of asbestos-containing materials that are beyond repair. Wire brushes shall not be used as a means of removing or cleaning asbestos-containing materials from surfaces, if they are used as the surface is being sprayed with water or amended water.
2. Provide sufficient number of HEPA-filtered vacuum cleaners equipped with pick-up adapters, steel floor wands, crevice tools, and carpet tools.
3. Airless sprayers capable of spraying amended water shall be provided in sufficient number to allow continuous uninterrupted work.
4. Asbestos filtration devices shall utilize high efficiency particulate air (HEPA) filtration systems.
5. Transportation equipment, as required, shall be suitable for loading, temporary storage, and unloading of contaminated waste without exposure to persons or property, and shall be quiet in motion if used within the building.

1.3 EXECUTION

A. Safety Procedures For Power And Lighting

1. The use of wet methods for removal, repair, encapsulation or cleaning procedures increases the potential for electrical shock when working around electrical panels, conduit, light fixtures, alarm systems, junction boxes, transformers, etc. In coordination with the Owner, de-energize as much electrical equipment as possible to prevent electrical shock to employees performing the work. The Contractor shall use the following precautions:
 - a. Use non-conductive tools and vacuum attachments.
 - b. Utilize "hot line" covers over energized cables and power lines when possible.
 - c. Ensure all electrical equipment in use is properly grounded before the job starts. Check outlets, wiring, extension cords and power pickups.
 - d. Avoid stringing wiring across floors. Elevate wiring if possible.
 - e. Ensure electrical outlets are tightly sealed and taped to avoid water spray.
 - f. Determine operating voltages of equipment and lines before working on or near energized parts.
 - g. Energized parts must be insulated or guarded from employee contact and other conductive objects. Extension cords must be three-wire type and connected to a Ground Fault Interrupter (GFI) circuit.
 - h. Lock or secure de-energized circuits at panel and post warning signs.



- i. Seal heating vents with two layers of polyethylene sheeting prior to the start of work. The Contractor shall repair any damage caused by Contractor's operations to duct work, grilles, dampers, louvers or HVAC equipment at the completion of the work at Contractor's expense. Coordinate all lock out and or de-energizing with the Owner.

B. Temporary Facilities

1. Use qualified tradesmen for installation of temporary services and facilities. Locate temporary services and facilities where they will serve the entire project adequately and result in minimum interference with the performance of the work and operations of the building. Coordinate all installations and shut downs with building owner.
2. Relocate, modify and extend services and facilities as required during the course of work so as to accommodate the entire work of the project.
3. Provide new or used materials and equipment that are undamaged and in serviceable condition. Provide only materials and equipment that are recognized as being suitable for the intended use, by compliance with appropriate standards.
4. During the erection and/or moving of scaffolding, care must be exercised so that the polyethylene floor covering is not damaged.
5. Clean, as necessary, debris from non-slip surfaces.
6. At the completion of abatement work, clean all construction aids within the work area, wrap in one layer of 6-mil polyethylene sheet and seal before removal from the work area.
7. Temporary water service connections to the Owner's water system shall include back flow protection. Valves shall be temperature and pressure rated for operation of the temperatures and pressures encountered.
8. Employ heavy-duty abrasion-resistant hoses with a pressure rating 50 percent greater than the maximum pressure of the water distribution system to provide water into each work area and to each Decontamination Unit. Provide fittings as required to allow for connection to existing wall hydrants or spouts, as well as temporary water heating equipment, branch piping, showers, shut-off nozzles and equipment.
9. Electrical Services shall comply with applicable NEMA, NECA and UL standards and governing regulations for materials and layout of temporary electric service.
10. Provide a weatherproof, grounded temporary electric power service and distribution system of sufficient size, capacity, and power characteristics to accommodate performance of work during the construction period. Install temporary lighting adequate to provide sufficient illumination for safe work and traffic conditions in every area of work.
11. Provide receptacle outlets equipped with ground fault interrupters, reset button and pilot light, for plug-in connection of power tools and equipment.
12. Use only grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Use single lengths or use waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas of work. All cords shall be elevated off the floor inside the containment area.
13. Temporary wiring in the work area shall be type UL non-metallic sheathed cable located overhead and exposed for surveillance. Do not wire temporary lighting with plain, exposed (insulated) electrical conductors. Provide liquid tight enclosures or boxes for wiring devices.
14. Provide Type "A" fire extinguishers for temporary offices and similar spaces where there is minimal danger of electrical or grease-oil-flammable liquid fires. In other locations provide type "ABC" dry chemical extinguishers, or a combination of several extinguishers of NFPA recommended types for the exposures in each case.
15. Use of the Owner's existing toilet facilities, as indicated, will be permitted, so long as these facilities are properly cleaned and maintained in a condition acceptable to the Owner. At Final Completion, restore these facilities to the condition prevalent at the time of initial use. All provisions of these specifications regarding leaving the work area must be met.
16. When mini-enclosures area being used all of the requirements above will be enforced by the Owner's Representative. The construction and set-up of the mini-enclosures may be done by the Abatement Contractor.



C. Pressure Differential System

1. Before start of work Contractor shall submit design of pressure differential system to the Owner's Representative for review. Do not begin work until system has been approved by the Owner's Representative. Include in the submittal the following:
 - a. Number of pressure differential machines required and the calculations necessary to determine the number of machines.
 - b. Description of projected air-flow within work area and methods required to provide adequate air flow in all portions of the work area.
2. If the enclosure is not a mini-enclosure, the Contractor must supply the required number of asbestos air filtration units to the site in accordance with these specifications. Each unit shall include the following:
 - a. Cabinet constructed of steel or other durable materials able to withstand damage from rough handling and transportation. The width of the cabinet should be less than 30 inches to fit through standard-size doorways. Cabinet shall be factory sealed to prevent asbestos-containing dust from being released during use, transport, or maintenance. Access to and replacement of all air filters shall be from intake end. Unit shall be mounted on casters or wheels.
 - b. Rate capacity of fan according to useable air-moving capacity under actual operating conditions. Use centrifugal-type fan.
 - c. The final filter shall be the HEPA type. The filter media (folded into closely pleated panels) must be completely sealed on all edges with a structurally rigid frame.
 - d. A continuous rubber gasket shall be located between the filter and the filter housing to form a tight seal.
 - e. Provide HEPA Units that are individually tested and certified on site by an independent testing agency to have an efficiency of not less than 99.97 percent when challenged with 0.3 μ m dioctylphthalate (DOP) particles when tested in accordance with Military Standard Number 2182 and Army Instruction Manual 136-300-175A. Provide filters that bear a UL586 label to indicate ability to perform under specified conditions.
 - f. Pre-filters, which protect the final filter by removing the larger particles, are required to prolong the operating life of the HEPA filter. Two stages of pre-filtration are required. The first-stage pre-filter shall be a low-efficiency type (e.g., for particles 10 microns and larger). The second-stage (or intermediate) filter shall have a medium efficiency (e.g., effective for particles down to 5 microns). Pre-filters and intermediate filters shall be installed either on or in the intake grid of the unit and held in place with special housings or clamps.
 - g. Each unit shall be equipped with a Magnahelic gauge or manometer to measure the pressure drop across filters and indicate when filters have become loaded and need to be changed. A table indicating the useable air-handling capacity for various static pressure readings on the Magnahelic gauge shall be affixed near the gauge for reference, or the Magnahelic reading indicating at what point the filters should be changed, noting Cubic Feet per Minute (CFM) air delivery at that point. Provide units equipped with an elapsed time meter to show the total accumulated hours of operation.
 - h. The unit shall have an electrical (or mechanical) lockout to prevent fan from operating without a HEPA filter. Units shall be equipped with automatic shutdown system to stop fan in the event of a major rupture in the HEPA filter or blocked air discharge. Warning lights are required to indicate normal operation, too high a pressure drop across the filters (i.e., filter overloading), and too low of a pressure drop (i.e., major rupture in HEPA filter or obstructed discharge).
 - i. Electrical components shall be approved by the National Electrical Manufacturers Association (NEMA) and Underwriters' Laboratories (UL). Each unit shall be equipped with overload protection sized for the equipment. The motor, fan, fan housing, and cabinet shall be grounded.
 - j. If a mini-enclosure is used the air filtration unit may be a HEPA filtered vacuum with a flow rate of at least 100 cubic feet per minute (CFM).
3. Provide a fully operational pressure differential system within the work area maintaining continuously a pressure differential across work area enclosures of 0.02 inches of water for glove



- bag operations and mini-containments. Demonstrate to the Owner's Representative the pressure differential by use of pressure differential meter or a manometer, before disturbance of any asbestos-containing materials. In the case of a mini-enclosure visual evidence of pressure differential through the use of a smoke generation tube shall be sufficient as in paragraph C.13 of this section.
4. Continuously monitor and record the pressure differential between the work area and the building outside of the work area.
 5. Provide fully operational negative pressure systems supplying a minimum of one air change every ten minutes (six changes per hour), less in the instance of a mini-enclosure. Determine the volume in cubic feet of the work area by multiplying floor area by ceiling height. Determine total ventilation requirement in cubic feet per minute (cfm) for the work area by dividing this volume by the air change rate.
 6. Ventilation Required (CFM) = Volume of work area (cu. ft.)/10 min.
 7. Determine number of units needed to achieve ten-minute change rate by dividing the ventilation requirement (CFM) above capacity of exhaust unit(s) used. Capacity of a unit for purposes of this section is the capacity in cubic feet per minute with fully loaded filters (pressure differential which causes loaded filter warning light to come on) in the machines labeled operating characteristics.
 8. Add one additional unit as a backup in case of equipment failure or machine shutdown for filter changing.
 9. Locate exhaust unit(s) so that makeup air enters work area primarily through decontamination facilities and traverses work area as much as possible. This may be accomplished by positioning the unit(s) at a maximum distance from the worker access opening or other makeup air sources.
 10. Vent to outside of building, unless authorized in writing by the Owner's Representative.
 11. Each unit shall be serviced by a dedicated minimum 115v-20A circuit with overload device tied into an existing building electrical panel which has sufficient spare capacity to accommodate the load of all pressure differential units connected. Dedication of an existing circuit may be accomplished by shutting down existing loads on the circuit.
 12. Test pressure differential system before any asbestos-containing material is wetted or removed. After the work area has been prepared, the decontamination facility set up, and the exhaust unit(s) installed, start the unit(s) (one at a time). Demonstrate operation and testing of pressure differential system to the Owner's Representative.
 13. Demonstrate of operations of the pressure differential system to the Owner's Representative will include, but not be limited to, the following:
 - a. Plastic barriers and sheeting move lightly in toward work area.
 - b. Curtain of decontamination units move lightly in toward work area.
 - c. There is a noticeable movement of air through the decontamination unit. Use stroke tube to demonstrate air movement from clean room, and from equipment room to work area.
 - d. Use smoke tubes to demonstrate a positive motion of air across all area in which work is to be performed.
 - e. Use a differential pressure meter or manometer to demonstrate a pressure difference of at least 0.02 inches (as allowed) of water across every barrier separating the work area from the balance of the building or outside. This is not required in the case of a mini enclosure.
 14. Start exhaust units before beginning work (before any asbestos-containing material is disturbed). After abatement work has begun, run units continuously to maintain a constant negative pressure until decontamination of the work area is complete. Do not turn off units at the end of the work shift or when abatement operations temporarily stop.
 15. Do not shut down pressure differential system during encapsulating procedures, unless authorized by the Owner's Representative in writing. Start abatement work at a location farthest from the exhaust units and proceed toward them. If an electric power failure occurs, immediately stop all abatement work and do not resume until power is restored and exhaust units are operating again.
 16. At completion of abatement work, allow exhaust units to run as specified to remove airborne fibers that may have been generated during abatement work and cleanup and to purge the work area with clean makeup air. The units may be required to run for a longer time after decontamination, if



dry or only partially wetted asbestos material was encountered during any abatement work. In the case of a mini-enclosure the vacuum may be removed and the entrance sealed following encapsulation until the clearance sample is collected.

17. Prior to final air test, remove pre-filter and wipe out inside lip of negative air machine.
18. When a final inspection and the results of final air tests indicate that the area has been decontaminated, exhaust units may be removed from the work area. Before removal from the work area, remove and properly dispose of pre-filter, and seal Intake to the machine with 6-mil polyethylene to prevent environmental contamination from the filters.

D. Work Area Preparation

1. The work area is the location where asbestos-abatement work occurs. It is a variable of the extent of work of the contract. It may be a portion of a room, a single room, or a complex of rooms. A "work area" is considered contaminated during the work, and must be isolated from the balance of the building, and decontaminated at the completion of the asbestos-control work.
2. Pre-clean fixed objects, walls and floor surfaces within the proposed work areas using HEPA filtered vacuum equipment and wet cleaning methods as appropriate.
3. Seal all openings, supply and exhaust vents, and convectors within ten feet of the work area with 6-mil polyethylene sheeting secured and completely sealed with plastic adhesion tape.
4. Contact fire control agencies to review procedures prior to start of work.
5. Provide flame resistant polyethylene sheeting that conforms to requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame-resistant Textiles and Films. Provide largest size possible to minimize seams, four- or six- mils thick, frosted or black.
6. Provide spray adhesive in aerosol cans which is specifically formulated to stick tenaciously to sheet polyethylene and supporting surface.
7. Completely isolate the work area from other parts of the building so as to prevent asbestos-containing dust or debris from passing beyond the isolated area. Should the area beyond the work area(s) become contaminated with asbestos-containing dust or debris as a consequence of the work, clean those areas in accordance with the procedures indicated in Paragraph "Decontamination Procedures." All such required cleaning or decontamination shall be performed at no additional cost to the Owner.
8. Place all tools (i.e., scaffolding, staging) necessary for the work in the area to be isolated prior to erection of plastic sheeting temporary enclosure.
9. Disable ventilation systems or any other system bringing air into or out of the work area. Disable system by disconnecting wires, removing circuit breakers, by lockable switch or other positive means that will prevent accidental premature restarting of equipment.
10. Remove and dispose of all electrical and mechanical items, such as lighting fixtures, clocks, diffusers, registers, escutcheon plates, etc., which cover any part of the surface on which work is to be performed.
11. All general construction items such as cabinets, casework, doors and window trim, moldings, ceilings, trim, etc., which cover the surface of the work as required to prevent interference with the work. To be performed by the Owner: clean, decontaminate and reinstall all such materials, upon completion of all removal work with materials, finishes, and workmanship to match existing installations before start of work.
12. Permit Access to the work area only through the Decontamination Unit. All other means of access shall be closed off and sealed and warning signs displayed on the clean side of the sealed access.
13. Provide Warning Signs at each visual and physical barriers reading as follows in both English and Spanish:

<u>Legend</u>	<u>Notation</u>
KEEP OUT	3" Sans Serif Gothic or Block
BEYOND THIS POINT	1" Sans Serif Gothic or Block
ASBESTOS ABATEMENT WORK	1" Sans Serif Gothic or Block



IN PROGRESS
BREATHING ASBESTOS DUST MAY BE
HAZARDOUS TO YOUR HEALTH

1" Sans Serif Gothic or Block
14 Point Gothic

14. Alternate methods of containing the work area may be submitted to the Owner's Representative for approval. Do not proceed with any such method(s) without prior written approval of the Owner's Representative.
15. Individually seal all ventilation openings (supply and exhaust), lighting fixtures, clocks, doorways, windows, convectors and speakers, and other openings into the work area with plastic adhesion tape alone or with polyethylene sheeting at least 4-mil in thickness, taped securely in place with plastic adhesion tape. Maintain seal until all work including Project Decontamination is completed. Take care in sealing off lighting fixtures to avoid melting or burning of sheeting.
16. Provide sheet plastic barriers at least 6-mil in thickness as required to completely seal openings from the work area into adjacent areas. Seal the perimeter of all sheet plastic barriers with plastic adhesion tape or spray cement.
17. Where applicable, construct framing of the containment out of fire treated wood or aluminum studs. Mini-enclosure frames may be constructed of Polyvinyl Chloride (PVC) tubing.
18. Cover all walls in work area extending to the underside of the ceiling grid system with one layer of polyethylene sheeting, at least 6-mil in thickness, mechanically supported and sealed with plastic adhesion tape or spray-glue in the same manner as "Critical Barrier" sheet plastic barriers. Tape all joints with plastic adhesion tape. Contractor shall be responsible for repair of damaged wall finishes.
19. Cover floor with two layers of 6-mil polyethylene sheeting (exclude for floor tile and adhesive).
20. Provide Pressure Differential System per Paragraph "Pressure Differential System."
21. If the enclosure barrier is breached in any manner that could allow the passage of asbestos debris or airborne fibers, then add the affected area to the work area, enclose it as required by this section of the specification and decontaminate it as described in Paragraph "Decontamination Procedures."
22. Establishing a Mini-Containment area:
 - a. Establish work area so that unauthorized entry is prevented; Construct a two-compartment fire treated wood frame around work area; install one layer 6-mil polyethylene sheeting to structural members and two layers 6 mil polyethylene sheeting to the floor. Exception: no floor required if mini-containment is being constructed to perform a floor tile activity. Seal all edges to wall, ceiling, and floor surfaces with duct tape. Install viewing inspection windows, where feasible.
 - b. Seal all penetrations with duct tape such as pipes, electrical conduit, or ducts contained within the mini-containment.
 - c. Install triple 6-mil polyethylene flaps at both doorways. Place portable sprayer with clean water, disposable towels, and pre-labeled disposal bag in air lock.
 - d. Install appropriate signs on outside of mini-containment area.
 - e. Install HEPA vacuum; extend hose into mini-containment area for general vacuuming, negative air, and cleaning of disposal suit.
 - f. Accumulate all loose materials for disposal. Place in approved container. Apply appropriate labels. Adequately wet clean all wall, floor, tool and equipment surfaces.
 - g. Abatement worker must wear two disposable suits. Remove outer suit in work area and place in a plastic bag. Enter air lock.
 - h. In air lock, wet wipe respirator and wash hands with clean water. Remove respirator and place in a clean plastic bag. Proceed to remote shower unit where inner suit may be removed.

E. Worker Protection

1. This section describes the equipment and procedures required for protecting workers against asbestos contamination and other work place hazards except for respiratory protection.
2. Respiratory Protection is specified in Paragraph "Respiratory Protection."



3. Train in accordance with EPA's Model Accreditation Plan, 40 CFR 763 - Asbestos, all workers in the dangers inherent in handling asbestos and breathing asbestos dust and in proper work procedures and personal and area protective measures. Include but do not limit the topics covered in the course to the following:
 - a. Methods of recognizing asbestos.
 - b. Health effects associated with asbestos.
 - c. Relationship between smoking and asbestos in producing lung cancer.
 - d. Nature of operations that could result in exposure to asbestos.
4. Importance of and instruction in the use of necessary protective controls, practices and procedures to minimize exposure including:

Engineering controls
 Work practices
 Respirators
 Housekeeping procedures
 Hygiene facilities
 Protective clothing
 Decontamination procedures
 Emergency procedures
 Waste disposal procedures
 Appropriate work practices for the work
 Requirements of medical surveillance program
 Review of OSHA 29 CFR 1926.1101(k)(9)(viii)(G) - Asbestos
 Pressure differential systems
 Work practices including hands on or on job training
 Personal decontamination procedures
 Air monitoring, personal and area

5. Provide medical examinations for all workers who may encounter an airborne fiber level of 0.1 f/cc or greater for an 8 hour time weighted average. In the absence of specific airborne fiber data, provide medical examination for all workers who will enter the work area for any reason. Examination shall, at minimum, meet OSHA requirements as set forth in 29 CFR 1926.1101(k)(9)(viii)(G) - Asbestos. In addition, provide an evaluation of the individual's ability to work in environments capable of producing heat stress in the worker.
6. Before start of work Contractor shall submit the following to the Owner's Representative for review. Do not start work until receipt of the Owner's Representative.
 - a. An original signed copy of the Certificate of Worker's Acknowledgement found at the end of this specification, for each worker who is to be at the job site or enter the work area.
 - b. Courses outline or name of institution providing the worker training course.
 - c. Report from medical examination conducted within last 12 months as part of compliance with OSHA medical surveillance requirements for each worker who is to enter the work area.
7. Provide disposable full-body coveralls and disposable head covers, and require that they be worn by all workers in the work area. Provide a sufficient number for all required changes, for all workers in the work area.
8. Provide work boots with non-skid soles, and where required by OSHA, foot protectives, for all workers. Provide boots at no cost to workers. Paint uppers of all boots red with water proof enamel. Do not allow boots to be removed from the work area for any reason, after being contaminated with asbestos-containing material. Dispose of boots as asbestos contaminated waste at the end of the work.
9. Provide head protectives (hard hats) as required by OSHA for all workers, and provide four spares for use by the Owner's Representative, and the Owner. Label hats with same warning labels as used on disposal bags. Require hard hats to be worn at all times that work is in progress that may potentially cause head injury. Provide hard hats with plastic strap type suspension. Require hats



to remain in the work area throughout the work. Thoroughly clean, decontaminate and bag hats before removing them from work area at the end of the work.

10. Provide eye protectives (goggles) as required by OSHA for all workers involved in scraping, spraying, or any other activity which may potentially cause eye injury.
11. Provide work gloves to all workers and require that they be worn at all times in the work area. Do not remove gloves from work area. Dispose of gloves as asbestos contaminated waste at the end of the work.
12. Respirators, disposable coveralls, head covers, and footwear covers shall be provided by the contractor for the Owner, the Owner's Representative, and other authorized representatives who may inspect the job site.
13. Provide worker protection as required by the most stringent OSHA and/or EPA standards applicable to the work. The following procedures are minimums to be adhered to regardless of fiber count in the work area.
14. Each time work is entered, remove all street clothes in the changing room of the Personnel Decontamination Unit and put on new disposable coverall, new head cover, and a clean respirator. Proceed through shower room to equipment room and put on work boots.
15. In the event a mini-enclosure is used refer to Paragraph "Work Area Preparation" for personal decontamination procedures.

F. Respiratory Protection

1. Instruct and train each worker involved in asbestos abatement or maintenance and repair of friable asbestos-containing materials in proper respiratory use and require that each worker always wear a respirator, properly fitted on the face in the work area from the start of any operation which may cause airborne asbestos fibers until the work area is completely decontaminated. Use respiratory protection appropriate for the fiber level encountered in the work place or as required for other toxic or oxygen-deficient situations encountered.
2. Except to the extent that more stringent requirements are written directly into the Contract Documents, the following regulations and standards have the same force and effect (and are made a part of the Contract Documents by reference) as if copied directly into the Contract Documents, or as if published copies were bound herewith. Where there is a conflict in requirements set forth in these regulations and standards meet the more stringent requirement.
 - a. OSHA - U.S. Department of Labor Occupational Safety and Health Administration, Safety and Health Standards 29 CFR 1910, Section 1001 and Section 1910.134.29 CFR 1926.
 - b. ANSI - American National Standard Practices for Respiratory Protection. ANSI Z88.2-1980.
 - c. NIOSH - National Institute for Occupational Safety and Health.
 - d. MSHA - Mine Safety and Health Administration.

G. Type Of Respiratory Protection Required

1. Provide Respiratory Protection as indicated in paragraph below. Where paragraph below does not apply, determine the proper level of protection by dividing the expected or actual airborne fiber count in the work area by the "protection factors" given below. The level of respiratory protection which supplies an airborne fiber level inside the respirator, at the breathing zone of the wearer, at or below 0.01 fibers/cubic centimeter is the minimum level of protection allowed.
2. Eight-hour Time Weighted Average (TWA) of asbestos fibers to which any worker may be exposed shall not exceed 0.1 fibers/cubic centimeter.
3. For purposes of this section fibers are defined as all fibers regardless of composition as counted in the OSHA Reference Method (ORM), NIOSH P&CAM 239 or 7400 procedure, or asbestos fibers of any size as counted using either a scanning or transmission electron microscope.
4. Require that respiratory protection be used at all times that there is any possibility of disturbance of asbestos-containing materials whether intentional or accidental.
5. Require that a respirator be worn by anyone in a work area at all times, regardless of activity, during a period that starts with any operation which could cause airborne fibers until the area has been cleared for re-occupancy.



H. Respiratory Protection Factor

<u>Respirator Type</u>	<u>Protection Factor</u>
Air purifying: Negative pressure respirator High efficiency filter Half facepiece	10
Air purifying: Negative pressure respirator High efficiency filter Full facepiece	50
Powered-air purifying (PAPR): Positive pressure respirator High efficiency filter Half or Full facepiece	100
Type C supplied air: Positive pressure respirator continuous-flow Half or full facepiece	100
Type C supplied air: Positive pressure respirator pressure demand Full facepiece	1000
Type C supplied air: Positive pressure respirator pressure demand Full facepiece Equipped with an auxiliary positive pressure Self-contained breathing apparatus (SCBA)	over 1000
Self-contained breathing apparatus (SCBA): Positive Pressure respirator Pressure demand Full facepiece	over 1000

I. Air Purifying Respirator

1. Provide half face or full face type respirators. Equip full-face respirators with a nose cup or other anti-fogging device as would be appropriate for use in air temperatures less than 32 degrees Fahrenheit.
2. Provide, at a minimum, HEPA type filters labeled with NIOSH and MSHA certification for "Radionuclides, Radon Daughters, Dust, Fumes, Mists including Asbestos-Containing Dusts and Mists" and color coded in accordance with ANSI Z228.2 (1980). In addition, a chemical cartridge section may be added, if required, for solvents, etc., in use. In this case, provide cartridges that have each section of the combination canister labeled with the appropriate color code and NIOSH/MSHA Certification.
3. Supply with a sufficient quantity of respirator filters approved for asbestos, so that workers can change filters during the work day. Require that respirators be wet-rinsed, and filters discarded, each time a worker leaves the work area. Require that new filters be installed each time a worker re-enters the work area. Store respirators and filters at the job site in the changing room and protect totally from exposure to asbestos prior to their use. Do not use single use, disposable or quarterface respirators.



- J. Powered Air Purifying Respirator (PAPR)
1. Provide full-facepiece type respirators. Provide nose-cups for full-facepiece respirators. Provide, at a minimum, HEPA type cartridges approved by NIOSH/MSHA and certified for use in atmospheres containing asbestos dusts.
 2. Provide, at a minimum, one extra battery pack for each respirator so that one can be charging while one is in use.
 3. Provide non-cloth belts capable of being decontaminated in shower.
 4. Supply with a sufficient quantity of high efficiency respirator filters approved for asbestos so that workers can change filters at any time that flow through the face piece decreases to the level at which the manufacturer recommends filter replacement. Require that regardless of flow, filter cartridges be replaced after 40 hours of use. Require that HEPA elements in filter cartridges be protected from wetting during showering. Require entire exterior housing of respirator including blower unit, filter cartridges, hoses, battery pack, face mask, belt, and cords to be washed each time a worker leaves the work area. Caution should be used to avoid shorting battery pack during washing.
- K. Required Respiratory Protection
1. Regardless of airborne fiber levels, require the following minimum level of respiratory protection:
 - a. Half-face air purifying respirators may be used during set-up of the containment and removal of the material so long as fiber counts inside the respirator do not exceed .01 f/cc fibers per cubic centimeter.
- L. Decontamination Units -Three-Stage
1. Provide a Personnel Decontamination Unit consisting of a serial arrangement of rooms or spaces, Changing Room, Shower Room, Equipment Room adjacent to each full containment area.
 2. Require all persons without exception to pass through this decontamination unit for entry into and exiting from the work area for any purpose. Do not remove equipment or materials through Personnel Decontamination Unit.
 3. Changing (Clean) Room:
 - a. Provide a room that is physically and visually separated from the rest of the building for the purpose of changing into protective clothing.
 - b. Locate so that access to work area from changing room is through shower room.
 - c. Separate changing room from the building by a double-sheeted polyethylene flapped doorway.
 - d. Provide sub-panel at changing room to accommodate all removal equipment. Power sub-panel directly from a building electrical panel. Connect all electrical branch circuits in decontamination unit and particularly any pumps in shower room to a ground-fault circuit protection device.
 4. Shower Room:
 - a. Provide a completely water tight operational shower to be used for transit by cleanly dressed workers heading for the work area from the changing room, or for showering by workers headed out of the work area after undressing in the equipment room.
 - b. Construct room by providing a shower pan and two shower walls in a configuration that will cause water running down walls to drip into pan. Install a freely draining wood floor in shower pan at elevation of top of pan.
 - c. Separate this room from rest of building, drying room and airlock with airtight walls fabricated of 6-mil polyethylene.
 - d. Provide splash proof entrances to Drying Room and Airlock.
 5. Equipment Room (contaminated area):
 - a. Require work equipment, footwear and additional contaminated work clothing to be left here. This is a change and transit area for workers. Separate this room from the work area by a 6-mil polyethylene flap doorway.
 - b. Separate this room from the rest of the building, the shower room and work area with air tight walls fabricated of 6-mil polyethylene.



6. Clean Room: Provide Clean Room to isolate the holding room from the building exterior.
7. Load-out Area:
 - a. The load-out area is the transfer area from the building to a truck or dumpster.
 - b. Wet wipe bags before they are passed through the equipment decon-chamber.
 - c. When cleaning is complete pass items into holding room. Close all doorways except the doorway between the holding room and the Clean Room.
 - d. Workers from the area outside the containment area enter holding area and remove decontaminated equipment and/or containers for disposal.
 - e. Require these workers to wear full protective clothing and appropriate respiratory protection.
 - f. At no time is a worker from an uncontaminated area to enter the enclosure when a removal worker is inside.
 - g. Post an approximately 20 inch x 14 inch manufactured caution sign at each entrance to the work area displaying the following legend with letter sizes and styles of a visibility required by OSHA 29 CFR 1926.1101(k)(9)(viii)(J) - Asbestos.

LEGEND

DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD

RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED
IN THIS AREA

- h. Provide spacing between respective lines at least equal to the height of the respective upper line.
- i. Additional Signage: Shall also be posted in accordance with OSHA 29 CFR 1926.1101(k)(9)(viii)(J) - Asbestos

DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD

AUTHORIZED PERSONNEL ONLY

RESPIRATORS AND PROTECTIVE CLOTHING
ARE REQUIRED IN THIS AREA

DANGER

ASBESTOS

CANCER AND LUNG HAZARD

KEEP OUT

- j. Post an approximately 10 inch by 14 inch manufactured sign at each entrance to each work area displaying the following legend with letter sizes and styles of a visibility at least equal to the following:

LEGEND

No Food, Beverages or Tobacco Permitted
All Persons Shall Don Protective
Clothing (Coverings) Before
Entering the Work Area
All Persons Shall Shower Immediately
After Leaving Work Area and Before
Entering the Changing Area

NOTATION

3/4 inch Block
3/4 inch Block

3/4 inch Block



M. Decontamination Procedures

1. Contractor shall require all workers and visitors to adhere to the following personal decontamination procedures whenever they leave the work area:
 - a. Require that all workers use the following decontamination procedure as a minimum requirement whenever leaving the work area.
 - b. When exiting area, remove disposable coveralls, disposable head covers, and disposable footwear covers or boots in the Equipment Room.
 - c. Still wearing respirators, proceed to showers. Showering is mandatory. Care must be taken to follow reasonable procedures in removing the respirator to avoid asbestos fibers while showering. The following procedure is required as a minimum:
 - 1) Thoroughly wet body including hair and face. If using a PAPR, hold blower unit above head to keep canisters dry.
 - 2) With respirator still in place thoroughly wash body, hair, respirator face piece, and all parts of the respirator except the blower unit and battery pack on a PAPR. Pay particular attention to seal between face and respirator and under straps.
 - 3) Take a deep breath, hold it and/or exhale slowly, completely wet hair, face, and respirator. While still holding breath, remove respirator and hold it away from face before starting to breathe.
 - 4) Carefully wash face-piece of respirator inside and out.
 - d. If using PAPR, shut down in the following sequence, first cap inlets to filter cartridges, then turn off blower unit (this sequence will help keep debris which has collected on the inlet side of filter from dislodging and contaminating the outside of the unit). Thoroughly wash blower unit and hoses. Carefully wash battery pack with wet rag. Be extremely cautious of getting water in battery pack as this will short out and destroy battery.
 - 1) Shower completely with soap and water.
 - 2) Rinse thoroughly.
 - 3) Rinse shower room walls and floor prior to exit.
 - 4) Proceed from shower to changing room and change into street clothes or into new disposable work items.
 - e. Require that all workers use the following decontamination procedure as a minimum requirement whenever leaving the work area with a half or full face cartridge type respirator:
 - 1) When exiting area, remove disposable coveralls, disposable headcovers, and disposable footwear covers or boots in the equipment room.
 - 2) Still wearing respirators, proceed to showers. Showering is mandatory. Care must be taken to follow reasonable procedures in removing the respirator and filters to avoid asbestos fibers while showering. The following procedure is required as a minimum:
 - 3) Thoroughly wet body from neck down.
 - 4) Wet hair as thoroughly as possible without wetting the respirator filter if using an air purifying type respirator.
 - 5) Take a deep breath, hold it and/or exhale slowly, complete wetting of hair, thoroughly wetting face, respirator and filter (air purifying respirator). While still holding breath, remove respirator and hold it away from face before starting to breathe.
 - 6) Dispose of wet filters from air purifying respirator.
 - 7) Carefully wash facepiece of respirator inside and out.
 - 8) Shower completely with soap and water.
 - 9) Rinse thoroughly.
 - 10) Rinse shower room walls and floor prior to exit.
 - 11) Proceed from shower to changing room and change into street clothes or into new disposable work items.

N. Project Decontamination

1. If the asbestos abatement work is on damaged or friable materials, then the building space is deemed contaminated before start of the work and in need of decontamination. In this case, the



- procedure includes two cleanings of the primary barrier plastic prior to its removal and two cleanings of the room surfaces to remove any new or existing contamination.
2. Work of this section includes the decontamination of air in the work area which has been, or may have been contaminated by the elevated airborne asbestos fiber levels generated during abatement activities, or which may previously have had elevated fiber levels due to friable materials in the space.
 3. Work of this section also includes the cleaning, decontamination, and removal of temporary facilities installed prior to abatement work and decontamination of all surfaces (ceiling, walls, floor) of the work area, and all furniture or equipment in the work area.
 4. First Cleaning
 - a. Carry out a first cleaning of all surfaces of the work area including items of remaining sheeting, tools, scaffolding and/or staging by use of damp-cleaning and mopping, and/or a HEPA filtered vacuum. (Note: A HEPA vacuum will fail if used with wet material). Do not perform dry dusting or dry sweeping. Use each surface of a cleaning cloth one time only and then dispose as contaminated waste. Continue this cleaning until there is no visible debris from removed materials on plastic sheeting or other surfaces. Upon authorization of the Owner's Representative proceed with encapsulation of substrate.
 - b. Perform encapsulation of substrate where required at this time. Maintain pressure differential system in operation during encapsulation work. Allow encapsulant to dry before proceeding with removal of Secondary layer of plastic.
 5. Second Cleaning
 - a. Upon authorization of the Owner's Representative, remove all Primary Barrier sheeting and Material Decontamination Unit, if there is one, leaving only the following:
 - 1) Critical Barrier which forms the sole barrier between the work area and other portions of the building or outside.
 - 2) Critical Barrier Sheeting over lighting fixtures and clocks, ventilation openings, doorways, convectors, speakers and other openings.
 - 3) Personnel Decontamination Unit.
 - 4) Pressure Differential System in continuous operation.
 - b. Remove all filters in Air Handling System(s) and dispose of as asbestos-containing waste.
 6. Final Cleaning: Carry out a final cleaning of all surfaces in the work in the same manner as the first cleaning immediately after removal of primary plastic. This cleaning is now being applied to existing room surfaces. Take care to avoid water marks or other damage to surfaces.
 7. Visual Inspection: Perform a complete visual inspection with the Owner's Representative of the entire work area including decontamination unit, all plastic sheeting, seals over ventilation openings, doorways, windows, and other openings; look for debris from any sources, residue on surfaces, dust or other matter. If any such debris, residue, dust or other matter is found repeat cleaning and continue decontamination procedure from that point. When the area is visually clean, complete the certification at the end of this section.
 8. Final Air Sampling
 - a. After the work area is found to be visually clean, air samples will be taken and analyzed in accordance with the procedures set forth in Paragraph "Powered Air Purifying Respirator (PAPR).
 - b. If Release Criteria are not met, repeat cleaning and continue decontamination procedure from that point.
 - c. If Release Criteria is met, remove the interior of the decontamination unit leaving in place only the Critical Barriers separating the work area from the rest of the building and the operating negative pressure system.
 - d. Any small quantities of residual material found upon removal of the plastic sheeting shall be removed with a HEPA filtered vacuum cleaner and local area protection. If significant quantities, as determined by the Owner's Representative, are found then the entire area affected shall be decontaminated as specified herein for the cleaning.

O. Work Area Clearance

1. Air Monitoring



- a. Visual Inspection is required as a prerequisite of air testing.
- b. To determine if the elevated airborne asbestos structure concentration during abatement operations have been reduced to the specified level, the Owner's Representative will secure samples and analyze them according to the following procedures.
2. Aggressive Sampling
 - a. All air samples will be taken using aggressive sampling techniques as follows. (There are no standards available for flow rate of leaf blowers or large fans. However, this information is not critical to the success of the procedure).
 - b. Before sampling pumps are started, the exhaust from forced-air equipment (leaf blower with at least 1 horsepower electric motor) will be swept against all walls, ceilings, floors, ledges and other surfaces in the room. This procedure will be continued for five minutes per 10,000 cubic feet of room volume.
 - c. Air samples will be collected in areas subject to normal air circulation away from room corners, obstructed locations, and sites near windows, doors or vents.
3. Schedule of Air Samples
 - a. General: The number and volume of air samples taken and analytical methods used by the Owner's Representative will be in accordance with the following schedule. Sample volumes given may vary depending upon the analytical instruments used. In each homogeneous work area after completion of all cleaning work, samples will be taken and analyzed by either PCM or TEM analysis.
 - b. Transmission Electron Microscopy (TEM) Samples:
 - 1) In each homogeneous work area after completion of all cleaning work, samples will be taken and analyzed by either PCM or TEM analysis as follows:
 - 2) Samples will be collected on 25 mm cassettes with filter media: TEM - 0.45 micrometer mixed cellulose ester or 0.40 micrometer polycarbonate, with 5.0 micron mixed cellulose ester backing filter.

Location Sampled	Number of Samples	Detection Limit (f/cc)	Minimum Volume (Liters)	Rate LPM
Each Work Area	5	0.005	1,300	2-10

- 3) TEM Analysis will be performed using the analysis method set forth in the AHERA Regulation 40 CFR Part 763 Appendix A.
- 4) Asbestos Structures referred to in this Section include asbestos fibers, bundles, clusters, or matrices, as defined by method of analysis.
- 5) Decontamination of the work site is complete when all the sample results are below 0.01 fibers per cubic centimeters (f/cc) of air or 70 structures per square millimeter.
- c. Phase Contrast Microscopy (PCM) Samples:
 - 1) In each homogeneous work area after completion of all cleaning work, samples may be taken and analyzed as follows:
 - 2) Samples will be analyzed by PCM for clearance in areas where ceiling tile and/or pipe insulation are removed
 - 3) Samples will be collected on 25 mm cassettes with filter media: PCM - 0.8 micrometer mixed cellulose ester.

Location Sampled	Number of Samples	Detection Limit (s/cc)	Minimum Volume (Liters)	Rate LPM
Each Work Area	1-5	0.01	2,400	2-10

- 4) PCM Analysis: Fibers on each filter will be measured using the NIOSH 7400 Method entitled "Fibers" published in the NIOSH Manual of Analytical Methods, 3rd Edition, Second Supplement, August 1987.



- 5) Fibers: Referred to in this section include fibers regardless of composition as counted by the phase contrast microscopy method used
 - 6) Decontamination of the work site is complete when all the sample results are below 0.01 fibers per cubic centimeters (f/cc) of air or 70 structures per square millimeter.
4. Failure of Clearance Sampling: Should results from analysis of final clearance air samples not meet the specified criteria, Contractor will be responsible for the payment of all costs, including Consultant's time for subsequent clearance air sampling. The costs associated with subsequent re-sampling for final clearance shall be deducted from the Contractor's final payment of the contract amount.
- P. Removal Of Pipe Insulation
1. The work of this section applied to the removal of asbestos-containing Pipe Insulation.
 - a. Place one layer of 6-mil fire retardant polyethylene sheeting directly below the work. The sheet shall be of sufficient size to completely wrap the pipe once it has been removed.
 - b. Thoroughly wet the ends of the pipe with amended water and scrape off a minimum of 6 inches of asbestos wrap from both ends of the pipe. Immediately place the wetted material into pre-labeled asbestos disposal bag(s).
 - c. Detach the pipe at each scraped end and place the pipe onto one sheet of 6-mil fire retardant polyethylene sheeting. Wrap the pipe with the 6-mil fire retardant polyethylene sheeting. Contractor shall wrap the pipe with a second sheet of 6-mil, fire retardant polyethylene sheeting and label as asbestos-containing material. Dispose of the bag(s) and duct in accordance with the Paragraph "Handling and Disposal of Asbestos Contaminated Waste" of this specification.
 - d. Upon clearance from the Owner's Representative, Contractor shall remove the 6-mil, fire retardant polyethylene sheeting from the openings.
- Q. Glove Bag Removal
1. The work of this section applies to full containment or glovebag removal.
 2. Isolate the area in accordance with Paragraph "Temporary Facilities."
 3. Construct a decontamination unit as described in Paragraph "Decontamination Units" and attach to the work area.
 4. Set up pressure differential isolation and ventilation of the work area in accordance to Paragraph "Pressure Differential System."
 - a. Upon approval of the enclosure by the Owner's Representative, Contractor may proceed to remove the material using the following method.
 - b. Thoroughly wet to satisfaction of the Owner's Representative, asbestos-containing insulation to be removed prior to stripping and/or tooling to reduce fiber dispersal into the air. Accomplish wetting by a fine spray (mist) of amended water or removal encapsulant. Saturate material sufficiently to wet the substrate without causing excess dripping. Allow time for removal encapsulant to penetrate material thoroughly. If amended water is used, spray material repeatedly during the work process to maintain a continuously wet condition. If a removal encapsulant is used, apply in strict accordance with manufacturer's written instructions. If insulation is covered with canvas, Contractor will wet the exterior covering and slice it with utility knife while saturating the material.
 - c. Mist work area continuously with amended water whenever necessary to reduce airborne fiber levels using commercially available "foggers."
 - d. Remove saturated asbestos-containing material in small sections from all areas. Do not allow material to dry out. As it is removed, simultaneously pack material while still wet into disposal bags. Twist neck of bags, bend over and seal with minimum three wraps of duct tape. Clean outside and move to wash down station adjacent to material decontamination unit.
 - e. Evacuate air from disposal bags with a HEPA filtered vacuum cleaner before sealing.
 - f. Contractor must always clean area of visible asbestos debris prior to end of shift.
 5. These procedures shall be followed to remove pipe insulation elbows:
 - a. Install critical barriers to isolate the work site. Install 2 or 3 Stage Decontamination Units.



- b. HEPA vacuum the work site.
- c. Provide negative air machine in addition to those required, in the vicinity of the work. Arrange so that exhaust is into the work area, oriented in a direction away from the work. Extend a 2-inch diameter flexible non-collapsing duct from the intake end to a point no more than 4'-0" from any scraping or brushing activity.
- d. Locate intake of duct so that airflow is horizontally and slightly downward into intake. Replace primary filter on negative air machine at an interval of no greater than 30 minutes. Allow no more than one scraping or brushing activity per negative air machine.
- e. Check pipe where the work will be performed. Wrap damaged (broken lagging, hanging, etc.), pipe in 6 mil plastic and "candy-stripe" with duct tape. Place one layer of duct tape around undamaged pipe at each end where the glovebag will be attached.
- f. Place necessary tools into pouch located inside glovebag. This will usually include: bone saw, utility knife, rags, scrub brush, wire cutters, tin snips and pre-wetted cloth.
- g. Place one strip of plastic adhesion tape along the edge of the open top slit of glove bag for reinforcement.
- h. Place the glove bag around section of pipe to be worked on and staple top together through reinforcing tape. Next, tape the ends of glovebag to pipe itself, where previously covered with plastic or tape.
- i. Use smoke tube and aspirator bulb to test seal. Place tube into water sleeve (two-inch opening to glovebag) squeezing bulb and filling bag with visible smoke. Remove smoke tube and twist water sleeve closed. While holding the water sleeve tightly, gently squeeze glovebag and by using a flashlight, look for smoke leaking out, (especially at the top and ends of the glovebag). If leaks are found, tape closed using plastic adhesion tape and re-test.
- j. Insert wand from garden sprayer through water sleeve. Plastic adhesion tape water sleeve tightly around the wand to prevent leakage.
- k. One person places its hands into the long-sleeved gloves while the second person directs garden sprayer at the work.
- l. Use bone saw, if required, to cut insulation at each end of the section to be removed. A bone saw is a serrated heavy gauge wire with ring-type handles at each end. Throughout this process, spray amended water or removal encapsulant on the cutting area to keep dust to a minimum.
- m. Remove insulation using putty knives or other tools. Place pieces in bottom of bag without dropping.
- n. Rinse all tools with water inside the bag and place back into pouch.
- o. Using scrub brush, rags and water, scrub and wipe down the exposed pipe. (Inexpensive horse rub-down mittens work well for this).
- p. Remove water wand from water sleeve and attach the small nozzle from HEPA-filtered vacuum. Turn on the vacuum only briefly to collapse the bag.
- q. Remove the vacuum nozzle, twist water sleeve closed and seal with plastic adhesion tape.

R. Handling And Disposal Of Asbestos-Containing Waste

- 1. All waste and asbestos contaminated waste shall be double bagged in pre-labeled 6-mil airtight puncture resistant bags. Labeling shall be in accordance with OSHA and EPA requirements.
 - a. Bags of asbestos-containing waste shall be sealed with tape in the work area. Asbestos waste shall not be allowed to dry out prior to sealing bags. While in the work area, bags shall be decontaminated of any bulk debris by wet wiping. Bags shall be pre-labeled in accordance with OSHA and EPA.
 - b. The Contractor shall ensure that the sealed bags are transported to the waste disposal site.
- 2. The Contractor shall establish a manifest system to enable the Owner to report the quantity of asbestos waste being deposited at the landfill. Contractor shall report the quantity of waste in pounds or tons as appropriate. The Contractor must be able to demonstrate custody over all asbestos waste from the time it is removed from the work area until it is deposited at the land fill.



- a. Copies of the manifest and any receipts generated during the handling and disposal process shall be provided to the Owner's Representative and the Owner.
 - b. Final manifest and documents must be provided to the Owner's Representative and the Owner within two weeks of the removal of the asbestos materials from the site by the waste hauler.
- S. Encapsulation Of Asbestos-Containing Materials
 - 1. General provisions of Contract, including General and Supplementary Conditions and Division 01, apply to work of this section.
 - a. The work includes the sealing of all piping or vessels from which asbestos-containing insulation has been removed with one coat of a lock down encapsulant.
 - b. Where repair work is being performed, the end will be sealed with a minimum of one coat of bridging encapsulant.
 - 2. Submittals
 - a. Product Data: Submit manufacturer's technical information including label analysis and application instructions for each material proposed for use.
 - b. Installation Instructions: Submit manufacturer's installation instructions with specific project requirements noted.
 - c. Performance Warrantee: Submit manufacturer's performance guarantee.
 - d. Certification: Submit written approval of entity installing the encapsulant from encapsulant manufacturer.
 - e. Material Safety Data Sheet: Submit the Material Safety Data Sheet, or equivalent, in accordance with the OSHA Hazard Communication Standard (29 CFR 1910.1200) for each surfactant and encapsulating material proposed for use on the work. Include a separate attachment for each sheet indicating the specific worker protective equipment proposed for use with the material indicated.
 - 3. Deliver materials to the job site in original, new and unopened packages and containers bearing manufacturer's name and label, and following information:
 - a. Name or title of material
 - b. Manufacturer's stock number and date of manufacture
 - c. Manufacturer's name
 - d. Thinning Instructions
 - e. Application Instructions
 - 4. Deliver materials together with a copy of the OSHA Material Safety Data Sheet for the material.
 - 5. Job Conditions
 - a. Apply encapsulating materials only when environmental conditions in the work area are as required by the manufacturer's instructions.
 - 6. Quality Assurance
 - a. Installation of Spray-on Encapsulation Materials: Install spray-on materials by a firm and personnel approved by the manufacturer of the primary materials.
 - b. Testing: Test material to be encapsulated using methods set forth in ASTM E1494 "Standard Practice for Encapsulants Spray-or-Trowel-Applied for Friable Asbestos-Containing Building Materials."
 - c. Performance Warranty: Submit written Performance Warranty, executed by the manufacturer and co-signed by the Contractor, agreeing to repair/replace spray-on work which has cracked, fallen from substrate, or otherwise deteriorated to a condition where it would not perform effectively for its intended purposes due substantially to defective materials or workmanship and not due to abuse by occupants, improper maintenance, non-foreseeable ambient exposures or other causes beyond anticipated conditions and manufacturer's/contractor's control.
 - d. Compatibility: Selection and use of encapsulant shall be compatible with replacement materials. Submit manufacturer's data indicating compatibility with replacement materials.
 - 7. Product Selection
 - a. Encapsulants: Provide penetrating or bridging type encapsulants specifically designed for application to asbestos-containing material.



- b. Standards: Product shall be rated as acceptable for use intended when field tested in accordance with ASTM E1494 "Standard Practice for Encapsulants Spray-or-Trowel-Applied for Friable Asbestos-Containing Building Materials."
 - c. Fire Safety: Use only materials that have a flame spread index of less than 25, when dry, when tested in accordance with ASTM E84.
- 8. Manufacturers
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products, which may be incorporated in the work, include, but are not limited to the following:
 - 1) Penetrating Encapsulants: As currently accepted by the EPA. Refer to most recent EPA approval list.
 - 2) Bridging Encapsulants: As currently accepted by the EPA. Refer to most recent EPA approval list.
- 9. General
 - a. Prior to applying any encapsulating material, ensure that application of the sealer will not cause the base material to fail and allow the sealed material to fall of its own weight or separate from the substrate. Should Contractor doubt the ability of the installation to support the sealant, request direction from the Owner's Representative before proceeding with the encapsulating work.
 - b. Do Not Commence Application of encapsulating materials until all removal work within the work area has been completed.
- 10. Worker Protection
 - a. Before beginning work with any material for which a Material Safety Data Sheet has been submitted, provide workers with the required protective equipment. Require that appropriate protective equipment be used at all times.
 - b. In addition to protective breathing equipment required by OSHA requirements or by this specification, use painting pre-filters on respirators to protect the dust filters when organic solvent based encapsulants are used.
- 11. Substrate
 - a. Apply lock down encapsulant to all substrate after all asbestos-containing materials have been removed. Apply in strict accordance with the manufacturer's printed instructions for use of the encapsulation as an asbestos coating. Any deviations from such printed instructions shall be approved by the Owner's Representative in writing prior to commencing work.
 - b. Apply encapsulant with an airless spray gun with air pressure and nozzle orifice as recommended by the encapsulant manufacturer.

T. Removal Of Floor Tile

- 1. This section applies to the removal of floor tile.
 - a. Prior to start of work, wet wipe all surfaces including floor tile to remove any visible dust.
 - b. Isolate the room by sealing hallway or doors and installing critical barriers on all ducting, windows and other penetrations of the room, in the specified area. Install a splash guard a minimum of 4 feet high on the walls of the room with one layer of 6-mil fire retardant poly.
 - c. Install a two-stage decontamination configuration contiguous (under certain conditions may be remote) with the work in accordance with Paragraph "Decontamination Units."
 - d. Using water or amended water in a Hudson-type sprayer or garden sprayer, lightly mist the area where the material is to be removed. This may take several passes with the hose of the sprayer. Allow time for the water to soak into the material.
 - e. Immediately place individual tiles in proper asbestos disposal bags. Vacuum collapse the bag, twist the neck of the bag, tape with duct tape, fold the twisted portion over onto itself and tape again. Wipe the outside of the bag with clean damp cloths and place the bag into a second prelabeled disposal bag. Tape shut the second bag.

U. Removal Of Fireproofing



1. The work of this section applies to the removal of all asbestos containing fireproofing including all over-spray that may be located on concrete block, columns, metal deck, beams, fixtures conduit and ducting.
 - a. Isolate the floor per Paragraph "Temporary Enclosure."
 - b. Construct a decontamination unit as described in Paragraph "Decontamination Units" and attach to the work area.
 - c. Set up pressure differential isolation and ventilation of the work area in accordance to Paragraph "Temporary Pressure Differential and Air Circulation System."
 - d. Upon approval of the enclosure by the Owner's Representative, contractor may proceed to remove the material using the following method.
 - e. Pre-clean columns, beams, electrical, mechanical and plumbing systems in the work area using wet wipe and HEPA vacuuming methods. Mask off with flame retardant polyethylene sheeting to protect from contamination during bulk abatement.
 - f. Thoroughly wet to satisfaction of the Owner's Representative, asbestos-containing fireproofing to be removed prior to stripping and/or tooling to reduce fiber dispersal into the air. Accomplish wetting by a fine spray (mist) of amended water or removal encapsulant. Saturate material sufficiently to wet the substrate without causing excess dripping. Allow time for removal encapsulant to penetrate material thoroughly. If amended water is used, spray material repeatedly during the work process to maintain a continuously wet condition. If a removal encapsulant is used, apply in strict accordance with manufacturer's written instructions.
 - g. Mist work area continuously with amended water whenever necessary to reduce airborne fiber levels using commercially available "foggers."
 - h. Remove saturated asbestos-containing material in small sections from all areas. Do not allow material to dry out. As it is removed, simultaneously pack material while still wet into disposal bags. Twist neck of bags, bend over and seal with minimum three wraps of duct tape. Clean outside and move to wash down station adjacent to material decontamination unit.
 - i. Evacuate air from disposal bags with a HEPA filtered vacuum cleaner before sealing.
 - j. Provide Pressure Differential Machine in addition to those required in Paragraph "Pressure Differential System," in the vicinity of the work. Arrange so that exhaust is into the work area, oriented in a direction away from the work. Extend a 12" diameter flexible non-collapsing duct from the intake end to a point no more than 4'-0" from any scraping or brushing activity.
 - k. Locate intake of duct so that air flow is horizontally and slightly down-ward into intake. Replace primary filter on pressure differential machine at an interval of no greater than 30 minutes. Allow no more than one scraping or brushing activity per pressure differential machine.
- V. Removal Of Wall Plaster: HEPA vacuum work site.
1. Place two layers of 6-mil flame retardant polyethylene sheeting on the floor adjacent to the wall to be demolished. Pull the wall down in manageable sections onto the polyethylene sheeting. Control dust and fiber release by misting the air and lightly wetting the material with amended water from a Hudson-type sprayer or garden sprayer as it is demolished.
 2. Wrap the first layer of polyethylene sheeting around the material and seal with duct tape. Wrap the second layer of polyethylene sheeting around the bundle and seal with duct tape.
 3. Label and dispose of the entire bundle.
 4. Provide Pressure Differential Machine in addition to those required in Paragraph "Pressure Differential System," in the vicinity of the work. Arrange so that exhaust is into the work area, oriented in a direction away from the work. Extend a 12-inch diameter flexible non-collapsing duct from the intake end to a point no more than 4'-0" from any scraping or brushing activity.
 5. Locate intake of duct so that air flow is horizontally and slightly down-ward into intake. Replace primary filter on negative air machine at an interval of no greater than 30 minutes.

W. Clean-Up Of Asbestos-Containing Debris On Ceiling Tile Or Solid Ceiling



1. This section applies to the decontamination of the entire plaster ceiling, removal of existing fiberglass on duct work and removal of all batt insulation covering the existing plaster ceiling.
 - a. Isolate the floor per Paragraph "Temporary Facilities."
 - b. Construct a decontamination unit as described in Paragraph "Decontamination Units" and attach to the work area. General Contractor will give direction regarding exact location of decontamination unit(s).
 - c. Set up pressure differential isolation and ventilation of the work area in accordance to Paragraph "Temporary Pressure Differential and Air Circulation System."
 - d. Upon approval of the enclosure by the Owner's Representative, contractor may proceed to remove the material using the following method:
2. These procedures shall be followed to for clean up of asbestos-containing debris on existing plaster ceiling:
 - a. This work will be performed prior to the removal of fireproofing. The isolation of the work area is considered essential to the pre-cleaning activities for the total area. Isolate the area in accordance with Paragraph "Temporary Facilities."
 - b. Remove asbestos-containing debris and fiberglass batt and duct insulation and decontaminate the area using the following procedures:
 - 1) Remove all small debris with the HEPA vacuum.
 - 2) Gently mist all fiberglass insulation, remove from ducts and ceiling and place into pre-labeled hazardous disposal bags and dispose of in accordance with Paragraph "Disposal of Asbestos Containing Waste Material."
 - 3) Exposure of ducting will expose all fireproofing overspray, this material may be removed during the removal of fireproofing from decks and beams.
 - 4) Pick up all large visible debris on the ceiling or any horizontal surfaces and place in the bottom of a 6-mil polyethylene disposal bag conforming to the requirements of Paragraph "Disposal of Asbestos-Containing Waste." Place pieces in the bag without dropping and avoiding unnecessary disturbance and release of material.
 - 5) HEPA vacuum the entire plaster ceiling surface.
 - c. Upon completion of the decontamination of the area request a visual inspection of the ceiling and other horizontal surfaces. This area will be considered a portion of work area for the duration of the work and will be included in the final encapsulation of the area.

X. Removal Of Adhesive: This section applies to the removal of all asbestos-containing floor tile and adhesive, sheet vinyl flooring, vinyl floor tile, and baseboard adhesive, etc.

1. Ensure that workers are equipped with proper respiratory protection. In addition to the HEPA cartridges, respirators must also be equipped with organic solvent cartridges.
2. Provide HEPA filtered fan units in the vicinity of the work. Arrange so that units exhaust outside the building. Replace primary filters on HEPA filtered fan units at an interval of no greater than 30 minutes.
3. Apply adhesive removal solvent as recommended by manufacturer after removal of floor tile has been completed.
4. Provide tile adhesive (mastic) remover that meets the following criteria:
 - a. Flash Point: 122E or greater.
 - b. Special Precautions: No heavy smoke generated if ignited.
 - c. Health Effects: Limited to mild skin rash or eye irritation.
 - d. Respiratory Protection: MSHA - NIOSH approved Organic vapor cartridges in conjunction with standard HEPA filters.
 - e. Petroleum Distillates: None.
 - f. Odor: Pine, Citrus or none.

Use of diesel fuel in the removal of tile and baseboard adhesive is strictly prohibited.

5. Remove adhesive in small sections from all areas. Do not allow material to dry out. As adhesive is removed, simultaneously pack rags contaminated with adhesive material into disposal bags. Twist



- neck of bags, bend over and seal with minimum three wraps of duct tape. Clean outside of bag and move to material decontamination unit.
6. Upon completion of adhesive removal, thoroughly clean bare substrate of all solvent residue.
 7. Place adhesive residue in proper asbestos disposal bags. Vacuum collapse the bag, twist the neck of the bag, tape with duct tape, fold the twisted portion over onto itself and tape again. Wipe the outside of the bag with clean damp cloths and place bag into second prelabeled disposal bag. Tape shut the second bag.

**CERTIFICATE OF WORKER'S ACKNOWLEDGEMENT**

PROJECT NAME: _____

PROJECT ADDRESS: _____

CONTRACTOR: _____

WORKING WITH ASBESTOS CAN BE DANGEROUS. INHALING ASBESTOS FIBERS HAS BEEN LINKED WITH VARIOUS TYPES OF CANCER IF YOU SMOKE AND INHALE ASBESTOS FIBERS, THE CHANCE THAT YOU WILL DEVELOP LUNG CANCER IS GREATER THAN THAT OF THE NON-SMOKING PUBLIC.

Your employer's contract with the Owner for the above project requires that: You be supplied with the proper respirator and be trained in its use. You be trained in safe work practices and in the use of the equipment found on the job. You receive a medical examination. These things are to have been done at no cost to you. By signing this certification you are assuring the Owner that your employer has met these obligations to you.

RESPIRATORY PROTECTION: I have been trained in the proper use of respirators, and informed of the type respirator to be used on the above referenced project. I have a copy of the written respiratory protection manual issued by my employers. I have been equipped at no cost with the respirator to be used on the above project.

TRAINING COURSE: I have been trained in the dangers inherent in handling asbestos and breathing asbestos dust and in proper work procedures and personal and area protective measures. The topics covered in the course included the following:

- Physical characteristics of asbestos
- Health hazards associated with asbestos
- Respiratory protection
- Use of protective equipment
- Pressure differential systems
- Work practices including hands-on or on-the-job training
- Personal decontamination procedures
- Air monitoring, personal and area

MEDICAL EXAMINATION: I have had a medical examination within the last 12 months which was paid for by my employer. This examination included: health history, pulmonary function tests and may have included an evaluation of a chest x-ray.

Signature _____ Witness _____

Printed Name _____ Social Security Number _____

**CERTIFICATION OF VISUAL INSPECTION****AREA** _____

In accordance with Paragraph "Project Decontamination" the Contractor hereby certifies that it has visually inspected the work area (all surfaces including pipes, beams, ledges, walls, ceiling and floor, Decontamination Unit, sheet plastic, etc.) and has found no dust, debris or residue.

By: _____

Signature _____ Date _____

Print Name _____

Print Title _____

OWNER'S REPRESENTATIVE CERTIFICATION

the Owner's Representative hereby certifies that it has accompanied the Contractor on its visual inspection and verifies that this inspection has been thorough and to the best of its knowledge and belief, the Contractor's certification above is a true and honest one.

Signature _____ Date _____

Print Name _____

Print Title _____



RESPIRATORY PROTECTION PROGRAM

Project Name _____

Location _____

Date _____

Based upon airborne asbestos-fiber counts encountered on previous projects of similar type working on materials similar to those found on the above referenced project. The following level of respiratory protection is proposed for the indicated operations to maintain an Airborne Fiber Count (as measured by the NIOSH 7400 Method) below the specified Permissible Exposure Limit (PEL) inside the respirator face piece.

Operation	Anticipated f/cc	Respiratory Protection	Protection Factor	f/cc in Mask
Installing sheet plastic				
Removing trim in contact with asbestos-containing material				
Removal of architectural finish or fireproofing				
Removal of pipe insulation				
Removal of fitting insulation				
Encapsulation of pipe and boiler insulation				
Gross debris removal				
Cleaning "primary" sheet plastic				
Cleaning "critical" barrier				
Removing Decontamination Unit				
Other				

The Contractor certifies that to the best of its knowledge and belief the above represent a true and accurate representation of Airborne Fiber Counts to be expected for the operations indicated, and are based upon airborne fiber data from past projects with similar materials and operations.

Contractor _____

Signature _____ Date _____

Print Name _____ Title _____

END OF SECTION 02 82 00 00



Task	Specification	Specification Description
02 82 00 00	01 22 16 00	No Specification Required



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SECTION 02 82 33 00 - R&A REMOVAL AND DISPOSAL OF NON-FRIABLE ACM

NOTE TO SPECIFIER

This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section.

NOTE TO SPECIFIER

INCLUDE this Section if roofing materials are identified within Section 022623 as containing non-friable ACM.

NOTE TO SPECIFIER

Section Formatting:

Consistent formatting of Sections gives the complete document a professional look. This Section uses a 10pt. Arial font, and is formatted as follows:

1. *Insert one 10pt. line after the Section Number. Section Number is in CAPS.*
2. *Insert two 10pt. lines after the Section Title. Section Title is in CAPS.*
3. *Insert one 10pt. line after a PART. PARTS are in CAPS. If a Section is not used, include NOT USED following the PART title as shown below.*
4. *Insert one 10pt. line after Article paragraphs. Articles are in CAPS.*
5. *Insert two 10pt. lines at the end of an Article.*
6. *Complete Section with END OF SETION.*
7. *No lines should be placed between paragraphs and sub-paragraphs, or between sub-paragraphs and other sub-paragraphs.*

Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED



Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

PART 1 - GENERAL

1.1 SUMMARY

- A. Removal and disposal of non-friable asbestos-containing materials related to roof replacement.

1.2 RELATED SECTIONS

- A. Section 013543 – Environmental Procedures
- B. Section 022623 – Asbestos Laboratory Analysis Report
- C. Section 024100 – Roof Removal and Substrate Preparation

1.3 QUALITY ASSURANCE PROCEDURES

- A. Immediately refer any conflicts between the requirements outlined in this Section and those of regulatory agencies to the Owner for resolution.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

3.1 GENERAL

- A. Roofing components have been determined to be asbestos-containing materials (ACMs). Refer to the laboratory report located in Section 022623 for location of ACMs identified during sampling of roof membranes and flashings in the project work areas.
- B. Complete PS Form 8210 – Work Authorization – Asbestos. Refer to Section 013543, Sub-paragraph 1.5.H, and the attached form and instructions.
- C. Removal of identified ACM shall be performed by contractor personnel trained for such removal. Prior to work start, the contractor shall provide an ACM removal plan, identifying ACM components to be removed, personnel performing the work, documentation of training provided to personnel performing work, methodology for custody, handling and disposal of ACM, and the schedule for performing removal work. Maintain this documentation on-site. The contractor shall provide all necessary labor, materials, equipment and transportation to perform ACM removal work.
- D. The contractor shall maintain a contact person on-site during work.
- E. If additional suspect ACMs are uncovered, other than those indicated in Section 022623, the contractor shall notify the Contracting Officer immediately.



- F. The contractor shall provide necessary permits and/or licenses necessary for ACM removal.
- G. The contractor shall comply with all applicable local, state, federal, and Owner-mandated regulations and requirements related to removal of ACM.
- H. Remove identified ACMs, following all applicable federal, state, local, and Owner-mandated requirements identified in Section 013543 for removal, handling, and disposal of non-friable ACMs. Dispose of ACMs as required by these regulations and requirements.

USPS CSF Specifications issued: 10/1/2013

Last revised: 3/6/2013

NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 02 82 33 00



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Task	Specification	Specification Description
02 83 00 00	01 22 16 00	No Specification Required



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SECTION 02 85 00 00 - MOLD REMEDIATION**1.1 GENERAL****A. Description Of Work**

1. This specification covers the removal and disposal of mold. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. List of all personnel to be involved in the work with their training and certifications.
2. List of all products and procedures proposed for use in performance of the work.
3. Test reports.
4. Certificates.

C. References

1. U.S. EPA "Mold Remediation in Schools and Commercial Buildings"
2. U.S. EPA "A Brief Guide to Mold, Moisture, and Your Home"

D. Quality Assurance

1. Conform to all Federal, State, and Local regulations which govern the handling and disposal of mold materials.

1.2 PRODUCT - (Not Used)**1.3 EXECUTION**

- A. Environmental Assessment:** The presence of mold, water damage, or musty odors shall be addressed immediately. In all instances, any source(s) of water must be stopped and the extent of water damaged determined. Water damaged materials shall be dried and repaired. Mold damaged materials shall be remediated in accordance with this document.

1. **Visual Inspection:** A visual inspection is the most important initial step in identifying a possible contamination problem. The extent of any water damage and mold growth shall be visually assessed. This assessment is important in determining remedial strategies. Ventilation systems shall also be visually checked, particularly for damp filters but also for damp conditions elsewhere in the system and overall cleanliness. Ceiling tiles, gypsum wallboard (sheetrock), cardboard, paper, and other cellulosic surfaces shall be given careful attention during a visual inspection. The use of equipment such as a boroscope, to view spaces in ductwork or behind walls, or a moisture meter, to detect moisture in building materials, may be helpful in identifying hidden sources of fungal growth and the extent of water damage.

2. **Bulk/Surface Sampling**

- a. Bulk or surface sampling is not required to undertake a remediation. Remediation of visually identified fungal contamination shall proceed without further evaluation.
- b. Bulk or surface samples may need to be collected to identify specific fungal contaminants as part of a medical evaluation if occupants are experiencing symptoms which may be related to fungal exposure or to identify the presence or absence of mold if a visual inspection is equivocal (e.g., discoloration, and staining).
- c. An individual trained in appropriate sampling methodology shall perform bulk or surface sampling. Bulk samples shall be collected from visibly moldy surfaces by scraping or cutting materials with a clean tool into a clean plastic bag. Surface samples shall be collected by wiping a measured area with a sterile swab or by stripping the suspect surface



with clear tape. Surface sampling is less destructive than bulk sampling. Other sampling methods may also be available. A laboratory specializing in mycology shall be consulted for specific sampling and delivery instructions.

3. Air Monitoring
 - a. Air sampling for fungi shall not be part of a routine assessment. This is because decisions about appropriate remediation strategies can usually be made on the basis of a visual inspection. In addition, air-sampling methods for some fungi are prone to false negative results and therefore cannot be used to definitively rule out contamination.
 - b. Air monitoring may be necessary if an individual(s) has been diagnosed with a disease that is or may be associated with a fungal exposure (e.g., pulmonary hemorrhage/hemosiderosis, and aspergillosis).
 - c. Air monitoring may be necessary if there is evidence from a visual inspection or bulk sampling that ventilation systems may be contaminated. The purpose of such air monitoring is to assess the extent of contamination throughout a building. It is preferable to conduct sampling while ventilation systems are operating.
 - d. Air monitoring may be necessary if the presence of mold is suspected (e.g., musty odors) but cannot be identified by a visual inspection or bulk sampling (e.g., mold growth behind walls). The purpose of such air monitoring is to determine the location and/or extent of contamination.
 - e. If air monitoring is performed, for comparative purposes, outdoor air samples shall be collected concurrently at an air intake, if possible, and at a location representative of outdoor air. For additional information on air sampling, refer to the American Conference of Governmental Industrial Hygienists' document, "Bioaerosols: Assessment and Control."
 - f. Personnel conducting the sampling shall be trained in proper air sampling methods for microbial contaminants. A laboratory specializing in mycology shall be consulted for specific sampling and shipping instructions.
4. Analysis of Environmental Samples
 - a. Microscopic identification of the spores/colonies requires considerable expertise. These services are not routinely available from commercial laboratories. Documented quality control in the laboratories used for analysis of the bulk/surface and air samples is necessary. The American Industrial Hygiene Association (AIHA) offers accreditation to microbial laboratories (Environmental Microbiology Laboratory Accreditation Program (EMLAP)). Accredited laboratories must participate in quarterly proficiency testing (Environmental Microbiology Proficiency Analytical Testing Program (EMPAT)).
5. Evaluation of bulk/surface and air sampling data shall be performed by an experienced health professional. The presence of few or trace amounts of fungal spores in bulk/surface sampling shall be considered background. Amounts greater than this or the presence of fungal fragments (e.g., hyphae, and conidiophores) may suggest fungal colonization, growth, and/or accumulation at or near the sampled location. Air samples shall be evaluated by means of comparison (i.e., indoors to outdoors) and by fungal type (e.g., genera, and species). In general, the levels and types of fungi found should be similar indoors (in non-problem buildings) as compared to the outdoor air. Differences in the levels or types of fungi found in air samples may indicate that moisture sources and resultant fungal growth may be problematic.

B. Remediation

1. General
 - a. **In all situations, the underlying cause of water accumulation must be rectified or fungal growth will recur.** Any initial water infiltration shall be stopped and cleaned immediately. An immediate response (within 24 to 48 hours) and thorough clean up, drying, and/or removal of water damaged materials will prevent or limit mold growth. If the source of water is elevated humidity, relative humidity shall be maintained at levels below 60% to inhibit mold growth. Emphasis shall be on ensuring proper repairs of the building infrastructure, so that water damage and moisture buildup does not recur.
 - b. Five different levels of abatement are described below. The size of the area impacted by fungal contamination primarily determines the type of remediation. The sizing levels below



are based on professional judgment and practicality; currently there is not adequate data to relate the extent of contamination to frequency or severity of health effects. **The goal of remediation is to remove or clean contaminated materials in a way that prevents the emission of fungi and dust contaminated with fungi from leaving a work area and entering an occupied or non-abatement area, while protecting the health of workers performing the abatement.** The listed remediation methods were designed to achieve this goal, however, due to the general nature of these methods it is the responsibility of the people conducting remediation to ensure the methods enacted are adequate. The listed remediation methods are not meant to exclude other similarly effective methods. Any changes to the remediation methods listed in these guidelines, however, shall be carefully considered prior to implementation.

- c. Non-porous (e.g., metals, glass, and hard plastics) and semi-porous (e.g., wood, and concrete) materials that are structurally sound and are visibly moldy can be cleaned and reused. Cleaning shall be done using a detergent solution. Porous materials such as ceiling tiles and insulation, and wallboards with more than a small area of contamination shall be removed and discarded. Porous materials (e.g., wallboard, and fabrics) that can be cleaned, can be reused, but should be discarded if possible. A professional restoration consultant shall be contacted when restoring porous materials with more than a small area of fungal contamination. All materials to be reused shall be dry and visibly free from mold. Routine inspections shall be conducted to confirm the effectiveness of remediation work.
- d. The use of gaseous, vapor-phase, or aerosolized biocides for remedial purposes is **not** recommended. The use of biocides in this manner can pose health concerns for people in occupied spaces of the building and for people returning to the treated space if used improperly. Furthermore, the effectiveness of these treatments is unproven and does not address the possible health concerns from the presence of the remaining non-viable mold. For additional information on the use of biocides for remedial purposes, refer to the American Conference of Governmental Industrial Hygienists' document, "Bioaerosols: Assessment and Control."
- 2. **Level I: Small Isolated Areas** (10 sq. ft or less) - e.g., ceiling tiles, small areas on walls
 - a. Remediation can be conducted by regular building maintenance staff. Such persons shall receive training on proper clean up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).
 - b. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection shall be worn.
 - c. The work area shall be unoccupied. Vacating people from spaces adjacent to the work area is not necessary but is recommended in the presence of infants (less than 12 months old), persons recovering from recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity, pneumonitis, and severe allergies).
 - d. Containment of the work area is not necessary. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.
 - e. Contaminated materials that cannot be cleaned shall be removed from the building in a sealed plastic bag. There are no special requirements for the disposal of moldy materials.
 - f. The work area and areas used by remedial workers for egress shall be cleaned with a damp cloth and/or mop and a detergent solution.
 - g. All areas shall be left dry and visibly free from contamination and debris.
- 3. **Level II: Mid-Sized Isolated Areas** (10 - 30 sq. ft.) - e.g., individual wallboard panels.
 - a. Remediation can be conducted by regular building maintenance staff. Such persons shall receive training on proper clean up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).
 - b. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection shall be worn.



- c. The work area shall be unoccupied. Vacating people from spaces adjacent to the work area is not necessary but is recommended in the presence of infants (less than 12 months old), persons having undergone recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity, pneumonitis, and severe allergies).
- d. The work area shall be covered with a plastic sheet(s) and sealed with tape before remediation, to contain dust/debris.
- e. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.
- f. Contaminated materials that cannot be cleaned shall be removed from the building in sealed plastic bags. There are no special requirements for the disposal of moldy materials.
- g. The work area and areas used by remedial workers for egress shall be HEPA vacuumed (a vacuum equipped with a High-Efficiency Particulate Air filter) and cleaned with a damp cloth and/or mop and a detergent solution.
- h. All areas shall be left dry and visibly free from contamination and debris.
- 4. **Level III: Large Isolated Areas** (30 - 100 square feet) - e.g., several wallboard panels.
 - a. A health and safety professional with experience performing microbial investigations shall be consulted prior to remediation activities to provide oversight for the project.
 - b. The following procedures *at a minimum* are recommended:
 - 1) Personnel trained in the handling of hazardous materials and equipped with respiratory protection, (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection shall be worn.
 - 2) The work area and areas directly adjacent shall be covered with a plastic sheet(s) and taped before remediation, to contain dust/debris.
 - 3) Seal ventilation ducts/grills in the work area and areas directly adjacent with plastic sheeting.
 - 4) The work area and areas directly adjacent shall be unoccupied. Further vacating of people from spaces near the work area is recommended in the presence of infants (less than 12 months old), persons having undergone recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity, pneumonitis, and severe allergies).
 - 5) Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.
 - 6) Contaminated materials that cannot be cleaned shall be removed from the building in sealed plastic bags. There are no special requirements for the disposal of moldy materials.
 - 7) The work area and surrounding areas shall be HEPA vacuumed and cleaned with a damp cloth and/or mop and a detergent solution.
 - 8) All areas shall be left dry and visibly free from contamination and debris.
 - c. If abatement procedures are expected to generate a lot of dust (e.g., abrasive cleaning of contaminated surfaces, demolition of plaster walls) or the visible concentration of the fungi is heavy (blanket coverage as opposed to patchy), then it is recommended that the remediation procedures for Level IV are followed.
- 5. **Level IV: Extensive Contamination** (greater than 100 contiguous square feet in an area)
 - a. A health and safety professional with experience performing microbial investigations shall be consulted prior to remediation activities to provide oversight for the project. The following procedures are recommended:
 - 1) Personnel trained in the handling of hazardous materials equipped with:
 - a) Full-face respirators with high efficiency particulate air (HEPA) cartridges
 - b) Disposable protective clothing covering both head and shoes
 - c) Gloves
 - 2) Containment of the affected area:



- a) Complete isolation of work area from occupied spaces using plastic sheeting sealed with duct tape (including ventilation ducts/grills, fixtures, and any other openings)
 - b) The use of an exhaust fan with a HEPA filter to generate negative pressurization
 - c) Airlocks and decontamination room
 - 3) Vacating people from spaces adjacent to the work area is not necessary but is recommended in the presence of infants (less than 12 months old), persons having undergone recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity, pneumonitis, and severe allergies).
 - 4) Contaminated materials that cannot be cleaned shall be removed from the building in sealed plastic bags. The outside of the bags shall be cleaned with a damp cloth and a detergent solution or HEPA vacuumed in the decontamination chamber prior to their transport to uncontaminated areas of the building. There are no special requirements for the disposal of moldy materials.
 - 5) The contained area and decontamination room shall be HEPA vacuumed and cleaned with a damp cloth and/or mop with a detergent solution and be visibly clean prior to the removal of isolation barriers.
 - 6) Air monitoring shall be conducted prior to occupancy to determine if the area is fit to reoccupy.
6. **Level V: Remediation of HVAC Systems**
- a. A Small Isolated Area of Contamination (<10 square feet) in the HVAC System
 - 1) Remediation can be conducted by regular building maintenance staff. Such persons shall receive training on proper clean up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).
 - 2) Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection shall be worn.
 - 3) The HVAC system shall be shut down prior to any remedial activities.
 - 4) The work area shall be covered with a plastic sheet(s) and sealed with tape before remediation, to contain dust/debris.
 - 5) Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.
 - 6) Growth supporting materials that are contaminated, such as the paper on the insulation of interior lined ducts and filters, shall be removed. Other contaminated materials that cannot be cleaned shall be removed in sealed plastic bags. There are no special requirements for the disposal of moldy materials.
 - 7) The work area and areas immediately surrounding the work area shall be HEPA vacuumed and cleaned with a damp cloth and/or mop and a detergent solution.
 - 8) All areas shall be left dry and visibly free from contamination and debris.
 - 9) A variety of biocides are recommended by HVAC manufacturers for use with HVAC components, such as, cooling coils and condensation pans. HVAC manufacturers shall be consulted for the products they recommend for use in their systems.
 - b. Areas of Contamination (>10 square feet) in the HVAC System: A health and safety professional with experience performing microbial investigations shall be consulted prior to remediation activities to provide oversight for remediation projects involving more than a small isolated area in an HVAC system. The following procedures are recommended:
 - 1) Personnel trained in the handling of hazardous materials equipped with:
 - a) Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended.
 - b) Gloves and eye protection



- c) Full-face respirators with HEPA cartridges and disposable protective clothing covering both head and shoes shall be worn if contamination is greater than 30 square feet.
 - 2) The HVAC system shall be shut down prior to any remedial activities.
 - 3) Containment of the affected area:
 - a) Complete isolation of work area from the other areas of the HVAC system using plastic sheeting sealed with duct tape.
 - b) The use of an exhaust fan with a HEPA filter to generate negative pressurization.
 - c) Airlocks and decontamination room if contamination is greater than 30 square feet.
 - 4) Growth supporting materials that are contaminated, such as the paper on the insulation of interior lined ducts and filters, shall be removed. Other contaminated materials that cannot be cleaned should be removed in sealed plastic bags. When a decontamination chamber is present, the outside of the bags shall be cleaned with a damp cloth and a detergent solution or HEPA vacuumed prior to their transport to uncontaminated areas of the building. There are no special requirements for the disposal of moldy materials.
 - 5) The contained area and decontamination room shall be HEPA vacuumed and cleaned with a damp cloth and/or mop and a detergent solution prior to the removal of isolation barriers.
 - 6) All areas shall be left dry and visibly free from contamination and debris.
 - 7) Air monitoring shall be conducted prior to re-occupancy with the HVAC system in operation to determine if the area(s) served by the system are fit to reoccupy.
 - 8) A variety of biocides are recommended by HVAC manufacturers for use with HVAC components, such as, cooling coils and condensation pans. HVAC manufacturers shall be consulted for the products they recommend for use in their systems.
- 7. Hazard Communication: When fungal growth requiring large-scale remediation is found, the building owner, management, and/or employer shall notify occupants in the affected area(s) of its presence. Notification shall include a description of the remedial measures to be taken and a timetable for completion. Group meetings held before and after remediation with full disclosure of plans and results can be an effective communication mechanism. Individuals with persistent health problems that appear to be related to bioaerosol exposure should see their physicians for a referral to practitioners who are trained in occupational/environmental medicine or related specialties and are knowledgeable about these types of exposures. Individuals seeking medical attention shall be provided with a copy of all inspection results and interpretation to give to their medical practitioners.

END OF SECTION 02 85 00 00



Task	Specification	Specification Description
02 89 00 00	01 22 16 00	No Specification Required



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SECTION 03 01 50 00 - R&A CONCRETE ROOF DECK REPAIR

NOTE TO SPECIFIER

*This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section. **Edit Section footer information only – do not edit Section contents.***

NOTE TO SPECIFIER

INCLUDE this Section for projects where roof replacement will occur over existing concrete structural decks.

NOTE TO SPECIFIER

Section Formatting:

Consistent formatting of Sections gives the complete document a professional look. This Section uses a 10pt. Arial font, and is formatted as follows:

1. *Insert one 10pt. line after the Section Number. Section Number is in CAPS.*
2. *Insert two 10pt. lines after the Section Title. Section Title is in CAPS.*
3. *Insert one 10pt. line after a PART. PARTS are in CAPS. If a Section is not used, include NOT USED following the PART title as shown below.*
4. *Insert one 10pt. line after Article paragraphs. Articles are in CAPS.*
5. *Insert two 10pt. lines at the end of an Article.*
6. *Complete Section with END OF SETION.*
7. *No lines should be placed between paragraphs and sub-paragraphs, or between sub-paragraphs and other sub-paragraphs.*

Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED



Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

PART 1 - GENERAL

1.1 SUMMARY

- A. Concrete roof deck repair associated with roof replacement work.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 024100 – Roof Removal and Substrate Preparation
- D. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 UNIT PRICES

- A. Provide unit prices for the work described in paragraphs 3.2A, 3.2B and 3.2C.

1.4 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 - 1. American Society for Testing and Materials (ASTM)
 - a. ASTM C 928 - Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs
 - b. ASTM C 317 - Standard Specification for Gypsum Concrete

1.5 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300, including technical data sheets and Material Safety Data Sheets for products proposed for use.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.6 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed to install the specified products and is eligible to receive a manufacturer's warranty. The firm shall have a minimum of 5 years documented experience performing work equal or similar to the specified work.



- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform concrete repair work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

PART 2 - PRODUCTS

2.1 CONCRETE DECK REPAIR MATERIALS

- A. For use at repair outlined in paragraph 3.2A:
 - 1. Steel plate: 16-gauge galvanized with pre-drilled holes for fasteners and plates.
 - 2. Fasteners and plates: For securing steel plate to concrete deck: Structural concrete deck plate and fastener system such as JM "Structural Concrete Deck Fasteners and Plates", #14 fasteners with knurled thread, and 3-1/2 inch galvalume plates; fastener length as necessary to penetrate 1-inch minimum into roof deck, manufactured by Johns Manville, Denver, CO, or approved equal.
- B. For use at repairs outlined in paragraph 3.2B:



1. Bonding agent and reinforcement protection: Sika "Armotec 110 EpoCem", manufactured by Sika Corporation, Lyndhurst, NJ, or approved equal.
 2. Concrete patch material: Rapid hardening, early strength gaining, cementitious, patching material for concrete, complying with ASTM C 928; such as "SikaQuick 1000", manufactured by Sika Corporation, Lyndhurst, NJ, or approved equal.
- C. For use at repair outlined in paragraph 3.2C:
1. Grout: ASTM C 317, Class A; compressive strength of 500 psi.
 2. Water: Potable.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.
- B. Inspect existing concrete decks for defects such as holes, spalling, cracks, and other defects. If an opening less than or equal to 8-inches in diameter exists, refer to paragraph 3.2A, "Repair at Opening Caused by Obsolete Roof Penetration Removal". If defects exist that will make installation of the specified adhered underlayment or insulation impossible, refer to paragraph 3.2B, "Localized Concrete Deck Repair".

3.2 CONCRETE DECK REPAIR

- A. Repair at Opening Caused by Obsolete Roof Penetration Removal (*Unit Price Work*):
1. At locations indicated by the Owner, cover the existing opening with 16-gauge steel plate stock. Lap the plate a minimum of 8-inches beyond the opening on all sides. Fasten the steel plate with specified fasteners and plates 12-inches on center. Secure the plate a minimum of 2-inches in from the outside edge of the repair plate.
- B. Localized Concrete Deck Repair (*Unit Price Work*):
1. To the extent indicated by the Owner, remove any damaged or loose existing concrete deck material from the repair area.
 2. Apply bonding agent and reinforcement protection to the repair area following the requirements and recommendations of the product manufacturer.
 3. Apply concrete patch material to the repair area following the requirements and recommendations of the product manufacturer. Ensure finished patch is level and flush with adjacent deck surface.
 4. Allow the patch material time to cure. If necessary, provide temporary protection from inclement weather while the concrete patching material cures. Refer to manufacturer's requirements for cure time. Inspect the completed repair to ensure the roof deck is suitable to receive new roofing materials.
- C. Localized Pre-Cast Concrete Deck Joint Repair (*Unit Price Work*):
1. To the extent indicated by the Owner, remove any damaged or loose existing concrete deck material from the joint repair area.
 2. Apply mortar to the joint area following the requirements and recommendations of the product manufacturer. Ensure finished patch is level and flush with adjacent deck surface.
 3. Allow the patch material time to cure. If necessary, provide temporary protection from inclement weather while the concrete patching material cures. Refer to manufacturer's requirements for cure time. Inspect the completed repair to ensure the roof deck is suitable to receive new roofing materials.



USPS CSF Specifications issued: 10/1/2013
 Last revised: 3/6/2013

NOTE TO SPECIFIER

*Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to **black** text. Review the footer information with the USPS Project Manager for accuracy.*

END OF SECTION 03 01 50 00



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SECTION 03 10 00 00 - MPF CONCRETE FORMING AND ACCESSORIES**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Formwork for cast-in place concrete, with shoring, bracing and anchorage.
 - 2. Openings for other work.
 - 3. Form accessories.
 - 4. Form stripping.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 032000 - Concrete Reinforcement: Coordination between formwork and reinforcement.
 - 2. Section 033000 - Cast-in-Place Concrete: Supply of concrete accessories for placement by this section.

1.2 REFERENCES

- A. American Concrete Institute (ACI) Codes and Standards latest editions:
 - 1. ACI 301 - Structural Concrete for Buildings.
 - 2. ACI 318 - Building Code Requirements for Reinforced Concrete.
 - 3. ACI 347 - Recommended Practice For Concrete Formwork.
 - 4. []
- B. United States Department of Commerce Product Standard (PS):
 - 1. PS 1 - Construction and Industrial Plywood.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.



1. Product Data: Provide data on void form materials and installation requirements. Submit data on form-coating materials.
2. Shop Drawings: Indicate pertinent dimensions, materials, required installation and removal of bracing, shoring [,and reshoring] and arrangement of joints and ties.

NOTE TO SPECIFIER:

Retain section below if LEED criteria is required for project.

- B. LEED Submittals:
 1. Product data and statements for credits being considered.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 347.
- B. Where necessary, design formwork, shoring [, and reshoring] under direct supervision of a Professional Engineer experienced in design of formwork and licensed in State where Project is located.

NOTE TO SPECIFIER

Retain option below if retained in submittal section of this specification.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Deliver void forms and installation instructions in manufacturer's packaging.
- C. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Environmental Impact:
 1. Formwork: Reuse forms to greatest extent possible without damaging structural integrity of concrete and without damaging aesthetics of exposed concrete.

PART 2 - PRODUCTS

2.1 WOOD FORMS

- A. Forms for Exposed Finish Concrete: Plywood panels, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.
 1. Plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.



- B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

- C. Lumber: Construction grade; with grade stamp clearly visible.

NOTE TO SPECIFIER

Edit PREFABRICATED FORMS below for specific requirements of Project design.

2.2 PREFABRICATED FORMS

- A. Preformed Steel Forms: Minimum 16 gage, well matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- B. Void Forms (Carton Forms): Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set. Thickness indicated on drawings.
- C. Tubular Column Type: Metal or fiberglass-reinforced plastic. Provide units with sufficient wall thickness to resist wet concrete loads without deformation.
- D. Forms for Textured Finish Concrete: Units of face design, size, arrangement, and configuration to match Architect's control sample. Provide solid backing and form supports to ensure stability of textured form liners.

2.3 ACCESSORIES

- A. Form Ties: Factory-fabricated, removable or snap-off type, metal, of fixed or adjustable length as applicable, with cone ends. Designed to prevent form deflection and to prevent spalling concrete upon removal. Back break dimension, 1-1/2 inch from exposed concrete surface. Provide ties that, when removed, will leave holes not larger than 1 inch diameter in concrete surface.

NOTE TO SPECIFIER

"REQUIRED Article (Form Release Agent) follows. Do not revise this Article, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer."

- B. Form Release Agent: 100 percent biodegradable colorless agent which will not stain concrete, or absorb moisture, or impair natural bonding or color characteristics of subsequent coatings intended for use on concrete surfaces. Zero VOC.
1. Envirolux by Conspec, Kansas City, KS, (800) 348-7351 or (913) 287-1700.
 2. SMD-10 Soy Form Release by Strategic Market Development (800) 959-1071 or (815) 935-0863.
 3. Bio-Form by Leahy-Wolf, Franklin Park, IL, (888) 873-5327 or (847) 455-5710.
 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- C. Corners: Chamfered, wood strip 3/4 x 3/4 inch size; maximum possible lengths.
- D. Dovetail Anchor Slot: Galvanized steel, 22 gage thick, foam filled, release tape sealed slots, anchors for securing to concrete formwork.
- E. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

**NOTE TO SPECIFIER**

Use **WATERSTOPS** below where waterstops are required by Project design.

- F. Waterstops (Rubber/PVC): Rubber or Polyvinyl chloride, minimum 1,750 tensile strength, minimum 50 degrees F to plus 175 degrees F working temperature range, width as indicated on Drawings, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, and conditions are as required, and ready to receive Work.
 - 1. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with Drawings.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to United States Postal Service.

NOTE TO SPECIFIER

Use **EARTHFORMS** below where earthforms are permitted for Project.

3.2 EARTH FORMS

- A. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.3 FORMWORK INSTALLATION

- A. Install formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 347R.
- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
- C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores upon approval by the Professional Engineer responsible for their design.
- D. Align joints and make watertight. Furnish in largest available sizes to minimize number of joints and to conform to joint system indicated on Drawings.
- E. Obtain approval from the Engineer or Architect before framing openings in structural members which are not indicated on Drawings.



- F. Provide chamfer strips on external corners of concrete members, to produce uniform, smooth lines and tight edge joints.

NOTE TO SPECIFIER

Use paragraph below when VOID FORMS are used.

- G. Install void forms in accordance with manufacturer's published instructions. Protect forms from moisture or crushing.

3.4 FORM RELEASE AGENT APPLICATION

- A. Apply form release agent on formwork in accordance with manufacturer's published instructions.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are effected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Provide formed openings where required for items to be embedded in passing through concrete work.
- B. Locate and set in place items which will be cast directly into concrete.
- C. Coordinate with work of other sections in forming and placing openings, slots, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.
- D. Install accessories in accordance with manufacturer's published instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- F. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

NOTE TO SPECIFIER

Use paragraph below where waterstops are required by Project design.

- G. Install waterstops in accordance with manufacturer's published instructions continuous without displacing reinforcement. Seal joints watertight.

3.6 FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
- C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.



- D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

NOTE TO SPECIFIER

Retain option below if retained in submittal section of this specification.

3.7 CONSTRUCTION

- A. Site Tolerances:
1. Construct formwork to maintain tolerances required by ACI 301 and ACI 347.
 2. Camber slabs and beams 1/4 inch per 10 feet in accordance with ACI 301.

3.8 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection and testing.
- B. Inspect erected formwork, shoring [, and reshoring], and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

3.9 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- B. Do not remove shoring without approval from the Professional Engineer responsible for their design.
- C. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- D. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 3/31/2010

END OF SECTION 03 10 00 00



SECTION 03 10 00 00 - CSF CONCRETE FORMING AND ACCESSORIES**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information must be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
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 - 2. Section 033000 - Cast-in-Place Concrete: Supply of concrete accessories for placement by this section.

1.2 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 301 - Structural Concrete for Buildings.
 - 2. ACI 318 - Building Code Requirements for Reinforced Concrete.
 - 3. ACI 347 - Recommended Practice For Concrete Formwork.
- B. United States Department of Commerce Product Standard (PS):
 - 1. PS 1 - Construction and Industrial Plywood.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.



1. Product Data: Provide data on void form materials and installation requirements. Submit data on form-coating materials.
2. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 347.
- B. Where necessary, design formwork under direct supervision of a Professional Engineer experienced in design of formwork and licensed in State where Project is located.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Deliver void forms and installation instructions in manufacturer's packaging.
- C. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Environmental Impact:
 1. Formwork: Reuse forms to greatest extent possible without damaging structural integrity of concrete and without damaging aesthetics of exposed concrete.

PART 2 - PRODUCTS

2.1 WOOD FORMS

- A. Forms for Exposed Finish Concrete: Plywood panels, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.
 1. Plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.
- B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
- C. Lumber: Construction grade; with grade stamp clearly visible.

NOTE TO SPECIFIER

Edit PREFABRICATED FORMS below for specific requirements of Project design.

2.2 PREFABRICATED FORMS



- A. Preformed Steel Forms: Minimum 16 gage, well matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- B. Void Forms (Carton Forms): Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set. Thickness indicated on drawings.
- C. Tubular Column Type: Metal or fiberglass-reinforced plastic. Provide units with sufficient wall thickness to resist wet concrete loads without deformation.
- D. Forms for Textured Finish Concrete: Units of face design, size, arrangement, and configuration to match Architect's control sample. Provide solid backing and form supports to ensure stability of textured form liners.

2.3 ACCESSORIES

- A. Form Ties: Factory-fabricated, removable or snap-off type, metal, of fixed or adjustable length as applicable, with cone ends. Designed to prevent form deflection and to prevent spalling concrete upon removal. Back break dimension, 1-1/2 inch from exposed concrete surface. Provide ties that, when removed, will leave holes not larger than 1 inch diameter in concrete surface.

NOTE TO SPECIFIER

"REQUIRED Article (Form Release Agent) follows. Do not revise this Article, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer."

- B. Form Release Agent: 100 percent biodegradable colorless agent which will not stain concrete, or absorb moisture, or impair natural bonding or color characteristics of subsequent coatings intended for use on concrete surfaces. Zero VOC.
 - 1. Envirolux by Conspec, Kansas City, KS, (800) 348-7351 or (913) 287-1700.
 - 2. SMD-10 Soy Form Release by Strategic Market Development (800) 959-1071 or (815) 935-0863.
 - 3. Bio-Form by Leahy-Wolf, Franklin Park, IL, (888) 873-5327 or (847) 455-5710.
 - 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- C. Corners: Chamfered, wood strip 3/4 x 3/4 inch size; maximum possible lengths.
- D. Dovetail Anchor Slot: Galvanized steel, 22 gage thick, foam filled, release tape sealed slots, anchors for securing to concrete formwork.
- E. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

NOTE TO SPECIFIER

Use WATERSTOPS below where waterstops are required by Project design.

- F. Waterstops (Rubber/PVC): Rubber or Polyvinyl chloride, minimum 1,750 tensile strength, minimum 50 degrees F to plus 175 degrees F working temperature range, width as indicated on Drawings, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing.



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, and conditions are as required, and ready to receive Work.
 - 1. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with Drawings.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to United States Postal Service.

NOTE TO SPECIFIER

Use EARTHFORMS below where earthforms are permitted for Project.

3.2 EARTH FORMS

- A. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.3 FORMWORK INSTALLATION

- A. Install formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 347R.
- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
- C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- D. Align joints and make watertight. Furnish in largest available sizes to minimize number of joints and to conform to joint system indicated on Drawings.
- E. Obtain Contracting Officer approval before framing openings in structural members which are not indicated on Drawings.
- F. Provide chamfer strips on external corners of concrete members, to produce uniform, smooth lines and tight edge joints.

NOTE TO SPECIFIER

Use paragraph below when VOID FORMS are used.

- G. Install void forms in accordance with manufacturer's published instructions. Protect forms from moisture or crushing.



3.4 FORM RELEASE AGENT APPLICATION

- A. Apply form release agent on formwork in accordance with manufacturer's published instructions.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are effected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Provide formed openings where required for items to be embedded in passing through concrete work.
- B. Locate and set in place items which will be cast directly into concrete.
- C. Coordinate with work of other sections in forming and placing openings, slots, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.
- D. Install accessories in accordance with manufacturer's published instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- F. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

NOTE TO SPECIFIER

Use paragraph below where waterstops are required by Project design.

- G. Install waterstops in accordance with manufacturer's published instructions continuous without displacing reinforcement. Seal joints watertight.

3.6 FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
- C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
- D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.7 CONSTRUCTION

- A. Site Tolerances:
 - 1. Construct formwork to maintain tolerances required by ACI 301 and ACI 347.
 - 2. Camber slabs and beams 1/4 inch per 10 feet in accordance with ACI 301.



3.8 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection and testing.
- B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

3.9 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION 03 10 00 00



Task	Specification	Specification Description
03 11 13 00	01 22 16 00	No Specification Required
03 11 23 00	01 22 16 00	No Specification Required



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SECTION 03 20 00 00 - CSF CONCRETE REINFORCEMENT**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.03 20 00 00

NOTE TO SPECIFIER

Use this section where Concrete Reinforcement is part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information must be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Reinforcing steel bars.
 2. Steel wire fabric.
 3. Reinforcement accessories.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 1. Section 316329 - Drilled Concrete Piers and Shafts: Reinforcement for drilled pier foundations.
 2. Section 031000 - Concrete Forming and Accessories: Coordination between formwork and reinforcing.
 3. Section 033000 - Cast-in-Place Concrete: Coordination between concrete placement and reinforcing.

1.2 REFERENCES

- A. American Concrete Institute (ACI):
 1. ACI 301 - Structural Concrete for Buildings.
 2. ACI 318 - Building Code Requirements For Reinforced Concrete.

3. ACI SP-66 - American Concrete Institute - Detailing Manual.

B. American Society for Testing and Materials (ASTM):

1. ASTM A 184 - Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
2. ASTM A 615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
3. ASTM A 704 - Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.

C. American Welding Society (AWS):

1. AWS D1.4 - Structural Welding Code for Reinforcing Steel.

D. Concrete Reinforcing Steel Institute (CRSI):

1. CRSI - Manual of Practice.
2. CRSI 63 - Recommended Practice For Placing Reinforcing Bars.
3. CRSI 65 - Recommended Practice For Placing Bar Supports, Specifications and Nomenclature.

1.3 SUBMITTALS

A. Section 013300 – Submittal Procedures: Procedures for submittals.

1. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel [and wire fabric, bending and cutting schedules, and supporting and spacing device. Include special reinforcement required for openings through concrete structures.
2. Assurance/Control Submittals;
 - a. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
 - b. Submit certified copies of mill test report of reinforcement materials analysis.
 - c. Welder's Certificates.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with CRSI 63, 65 and Manual of Practice ACI 301, ACI SP-66, ACI 318, and ASTM A 184.
- B. Design reinforcement under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State where the Project is located.
- C. Welders' Certificates: Submit certificate, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Resource Management

1. Recycled Content
 - a. Steel Products: Post-consumer recycled content plus one half of pre-consumer recycled content not less than [] percent.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Reinforcing Steel: ASTM A 615, 60 ksi yield grade; deformed billet steel bars, unfinished.



- B. Reinforcing Steel Mat: ASTM A 704, ASTM A 615, 60 ksi yield grade; steel bars or rods, unfinished.
- C. Reinforcing Steel Mesh: ASTM A185; 6X6, w 1.4 X w 1.4.
- D. Dowels at Construction Joints: 1/4" x 4.5" Diamond Dowels by PNA Construction Technologies or approved equal.

2.2 ACCESSORIES

- A. Tie Wire: Minimum 16 gage annealed type.
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor barrier puncture.
- C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel type(CRSI, Class 1) or stainless steel protected(CRSI, Class 2); size and shape as required.

2.3 FABRICATION

- A. Fabricate concrete reinforcing in accordance with ACI SP-66 and ACI 318.
- B. Weld reinforcement in accordance with AWS D1.4.
- C. Locate reinforcing splices not indicated on drawings, at point of minimum stress. Review location of splices with Contracting Officer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to United States Postal Service.

3.2 PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
- B. Do not displace or damage vapor barrier.
- C. Accommodate placement of formed openings.
- D. Maintain concrete cover around reinforcing in accordance with ACI 318.



3.3 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection.
- B. Inspect reinforcing locations, bar types and sizes, wire ties, and welding (if applicable).

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



SECTION 03 20 00 00 - MPF CONCRETE REINFORCEMENT**

NOTE TO SPECIFIER

Use this section for Mail Processing Facilities.

****THIS ENTIRE SECTION CONSISTS OF REQUIRED PARTS OR ARTICLES. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Reinforcing steel bars.
 - 2. Steel wire mesh.
 - 3. Reinforcement accessories.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 316329 - Drilled Concrete Piers and Shafts: Reinforcement for drilled pier foundations.
 - 2. Section 031000 - Concrete Forming and Accessories: Coordination between formwork and reinforcing.
 - 3. Section 033000 - Cast-in-Place Concrete: Coordination between concrete placement and reinforcing.

1.2 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 301 - Structural Concrete for Buildings.
 - 2. ACI 318 - Building Code Requirements For Reinforced Concrete.
 - 3. ACI SP-66 - American Concrete Institute - Detailing Manual.
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM A 184 - Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
 - 2. ASTM A 615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
 - 3. ASTM A 704 - Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
- C. American Welding Society (AWS):
 - 1. AWS D1.4 - Structural Welding Code for Reinforcing Steel.
- D. Concrete Reinforcing Steel Institute (CRSI):
 - 1. CRSI - Manual of Practice.
 - 2. CRSI 63 - Recommended Practice For Placing Reinforcing Bars.
 - 3. CRSI 65 - Recommended Practice For Placing Bar Supports, Specifications and Nomenclature.

1.3 SUBMITTALS

- A. Section 013300 – Submittal Procedures: Procedures for submittals.
 - 1. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel [and wire fabric, bending and cutting schedules, and supporting and spacing device. Include special reinforcement required for openings through concrete structures.
 - 2. Assurance/Control Submittals;
 - a. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
 - b. Submit certified copies of mill test report of reinforcement materials analysis.
 - c. Welder's Certificates.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with CRSI 63, 65 and Manual of Practice ACI 301, ACI SP-66, ACI 318, and ASTM A 184.
- B. Design reinforcement under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State where the Project is located.
- C. Welders' Certificates: Submit certificate, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Reinforcing Steel: ASTM A 615, 60 ksi yield grade; deformed billet steel bars, unfinished.
- B. Reinforcing Steel Mat: ASTM A 704, ASTM A 615, 60 ksi yield grade; steel bars or rods, unfinished.
- C. Reinforcing Steel Mesh: ASTM A185; 6X6, w 1.4 X w 1.4.
- D. Dowels at Construction Joints: 1/4" x 4.5" Diamond Dowels by PNA Construction Technologies or approved equal.

2.2 ACCESSORIES

- A. Tie Wire: Minimum 16 gage annealed type.
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor barrier puncture.
- C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel type(CRSI, Class 1) or stainless steel protected(CRSI, Class 2); size and shape as required.

2.3 FABRICATION

- A. Fabricate concrete reinforcing in accordance with ACI SP-66 and ACI 318.



- B. Weld reinforcement in accordance with AWS D1.4.
- C. Locate reinforcing splices not indicated on drawings, at point of minimum stress. Review location of splices with Contracting Officer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to United States Postal Service.

3.2 PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
- B. Do not displace or damage vapor barrier.
- C. Accommodate placement of formed openings.
- D. Maintain concrete cover around reinforcing in accordance with ACI 318.

3.3 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection.
- B. Inspect reinforcing locations, bar types and sizes, wire ties, and welding (if applicable).

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 6/29/2010

END OF SECTION 03 20 00 00



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SECTION 03 30 00 00 - CSF CAST-IN-PLACE CONCRETE**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.03 30 00 00

NOTE TO SPECIFIER

Use this section where Cast-in-Place Concrete is part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information must be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Includes all labor, materials and appliances, and perform all operations in connection with the installation of Concrete Work, and all related work incidental to the completion thereof, as shown on the drawings, complete, in strict accordance with the drawings and as specified herein. Section Includes:
 - 1. Cast-in-place (CIP) concrete in building frame elements, walls, foundations, foundation walls, slabs-on-grade, and mechanical equipment pads.
 - 2. Finishing of concrete floor slabs and toppings. Concrete liquid surface treatment, sealer, and slip-resistant coatings.
 - 3. Expansion and contraction, control joints in CIP concrete.
 - 4. Concrete curing and protection.
 - 5. Non-shrink grout including installation and forming.
 - 6. Testing related services.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents and References in Section 1.2.
- C. Related Sections: Related work specified elsewhere includes but may not be limited to
 - 1. Section 031000: Concrete Forming and Accessories
 - 2. Section 032000: Concrete Reinforcement

1.2 REFERENCES

- A. General:
1. The publications listed below form a part of this specification to the extent referenced.
 2. Where a date is given for reference standards, the edition of that date shall be used. Where no date is given for reference standards, the latest edition available on the date of Notice Inviting Bids shall be used
- B. American Association of State Highway and Transportation Officials (AASHTO)
1. AASHTO M182, "Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats."
- C. Unless otherwise shown or specified, the work shall conform to the following standards and recommendations of the American Concrete Institute (ACI), latest editions adopted:
1. ACI 117, "Standard Specification for Tolerances for Concrete Construction and Materials."
 2. ACI 121R, "Quality Assurance Systems for Concrete Construction."
 3. ACI211.1, "Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete."
 4. ACI 212.2R, "Guide for Use of Admixtures in Concrete."
 5. ACI 214, "Recommended Practice for Evaluation of Strength Test Results of Concrete."
 6. ACI 301, "Specification for Structure /Concrete."
 7. ACI 302.1R, "Guide for Concrete Floor and Slab Construction."
 8. ACI 304R, "Guide for Measuring, Mixing, Transporting, and Placing Concrete."
 9. ACI 304.2-R, "Placing Concrete by Pumping Methods."
 10. ACI 305, "Hot Weather Concreting."
 11. ACI 306, "Cold Weather Concreting."
 12. ACI 306.1 "Standard Specification for Cold Weather Concreting."
 13. ACI 308, "Standard Practice for Curing Concrete."
 14. ACI 309R, "Guide for Consolidation for Concrete."
 15. ACI 315, "Details and Detailing of Concrete Reinforcement."
 16. ACI 318, "Building Code Requirements for Structural Concrete."
 17. ACI 347, "Guide to Formwork for Concrete."
 18. ACI 347.2R "Guide for Shoring/Reshoring of Concrete Multistory Buildings."
 19. ACI 503.2, "Standard Specification for Bonding Plastic Concrete to Hardened Concrete with a Multi-Component Epoxy Adhesive."
 20. ACI SP-15, "Field Reference Manual" which includes ACI 301 "Specifications for Structural Concrete for Buildings" and reference standards specified therein.
- D. American Welding Society (AWS)
1. AWS D1.4, "Structural Welding Code Reinforcing."
- E. American Society for Testing and Materials (ASTM).
1. ASTM A615, "Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement."
 2. ASTM C31, "Standard Practice for Making and Curing Concrete Test Specimens in the Field."
 3. ASTM C33, "Standard Specification for Concrete Aggregates."
 4. ASTM C39, "Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens."
 5. ASTM C42, "Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete."
 6. ASTM C94, "Standard Specification for Ready-Mixed Concrete."
 7. ASTM C109, "Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)"
 8. ASTM C114, "Standard Test Method for Chemical Analysis of Hydraulic Cement."
 9. ASTM C138, "Standard Test Method for Unit Weight, Yield, and Air Content of Concrete (Gravimetric) of Concrete."
 10. ASTM C143, "Standard Test Method for Slump of Hydraulic Cement-Cement Concrete."



11. ASTM C150, "Standard Specification for Portland Cement."
 12. ASTM C156, "Standard Test Method for Water Retention by Concrete Curing Materials."
 13. ASTM C171, "Standard Specification for Sheet Materials for Curing Concrete."
 14. ASTM C173, "Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method."
 15. ASTM C231, "Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method."
 16. ASTM C260, "Standard Specification for Air Entraining Admixtures for Concrete."
 17. ASTM C309, "Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete."
 18. ASTM C311, "Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland-Cement Concrete."
 19. ASTM C387, "Standard Specification for Packaged, Dry, Combined Materials for Mortars and Concrete."
 20. ASTM C457, "Standard Test Method for Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete."
 21. ASTM C494, "Standard Specification for Chemical Admixtures for Concrete."
 22. ASTM C618, "Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete."
 23. ASTM C920, "Standard Specification for Elastomeric Joint Sealants."
 24. ASTM C685, "Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing."
 25. ASTM C989, "Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars."
 26. ASTM C1260, "Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)."
 27. ASTM C1567, "Standard Test Method for Potential Alkali Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)."
 28. ASTM E154, "Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Slabs, On Walls, or as Ground Cover."
 29. ASTM E1155, "Standard Test Method for Determining F Floor Flatness and FL Floor Levelness Numbers"
 30. ASTM D2240, "Standard Test Method for Rubber Property-Durometer Hardness."
- F. Concrete Reinforcing Steel Institute (CRSI),
1. CRSI "Manual of Standard Practice."

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
1. Review of submittals will cover general design only. In no case shall submittal review relieve the Contractor of the responsibility for strength of concrete, general or detailed dimension, quality or quantity of materials, or any other conditions, functions, performance or guarantees required.
 2. Product Data:
 - a. Manufacturers' literature containing product and installation specifications and details.
 - b. Where Manufacturer's specifications, recommendations, and/or directions are required in this specification, deliver to the Contracting Officer two (2) copies of such printed specifications, recommendations, and/or directions for approval before any work is commenced.
 - c. Sources of fine and coarse aggregate. Once approved, the source of fine and coarse aggregate shall not be changed without written approval of the Engineer.
 - d. List of manufacturers and brand names for cement, mineral and liquid admixtures, bond breakers, curing compounds, joint sealants, and materials other than aggregates and reinforcing steel. Include product data sheets, instructions, and specifications for use.
 3. Shop Drawings:



- a. All shop drawings and calculations must bear the seal and signature of an engineer registered in the jurisdiction where project is being constructed.
- b. Cast-in-place concrete shown on structural drawings, prepared under the supervision of a registered Professional Engineer, including:
 - 1) Rebar placing drawings (ACI 315, "Detailing Manual SP-66-(04)" or CRSI "Manual of Standard Practice MSP-2-81"): Show bar sizes, bending, placing, spacing, locations, and quantities of reinforcing and wire fabric and supporting and spacing accessories. Provide steel order lists including bending and cutting details for all reinforcement shown on the structural design drawings.
 - 2) Form construction details, including jointing, special formed joints or reveals, location and pattern of form tie placement, and other items that affect exposed concrete visually.
 - 3) Calculations for any formwork, shoring and/or reshoring.
4. Batch Plant Equipment and Procedures
 - a. Supplier of concrete and ready-mix grout. Only one source will be approved for the Contractor, including all subcontractors. All concrete and ready-mixed grout supplied to the project shall originate from the approved single facility.
 - b. The following information shall be submitted:
 - 1) Name of supplier.
 - 2) Plant location.
 - 3) Plant volume and output capacity.
 - 4) Capacity of transit equipment.
 - 5) Estimated travel time from plant to jobsite.
 - c. If the Contractor elects to use an on-site concrete batching plant, the following information shall be submitted:
 - 1) Drawings and data including proposed location of the batch plant on the site.
 - 2) List of and performance data for material handling equipment.
 - 3) Procedures for processing, handling, transporting, sorting, and proportioning the materials for concrete.
 - d. All other data necessary to show the supplier's capability to produce concrete of the quality and quantity required.
5. Concrete Procedures
 - a. The following information shall be submitted:
 - 1) Placement drawings for slab-on-grade shall be submitted indicating location and size, placement sequence, joint locations, and embedded items.
 - 2) Procedure for mixing and transporting concrete to the point of placement.
 - 3) Procedures for placement of concrete.
 - 4) Methods of obtaining and maintaining the required concrete temperature during placement and initial curing.
 - 5) Procedures for consolidating the concrete.
 - 6) Procedures how concrete is finished and cured (slab-on-grade concrete).
6. Assurance/Control Submittals:
 - a. Test Reports: Submit the following reports directly to Contracting Officer from Testing Laboratory, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
 - b. Submit laboratory test reports for concrete materials and mix design test, including certified copy of results of aggregate tested by ASTM C1260 or C1567. Mix designs for each strength and type of concrete proposed for use. Details to be included are found in section 2.7.
 - c. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - d. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
7. Delivery Tickets:
 - a. Copies of delivery tickets for each load of concrete delivered to site.



- b. Indicate on each ticket information required by ASTM C94 including additional information required herein.
 - c. Mix identification number on ticket shall match number on submitted and approved mix design
 - d. Indicate number of drum revolution from when water is added until concrete is discharged.
 - e. Submit copies to Testing Laboratory same day as concrete delivery.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Project Record Documents: Accurately record the following:
 - a. Shop drawings shall be corrected to reflect actual field changes and become part of the "Record As-Built Drawings".
 - 2. Extra Products: Submit extra products as specified in this Section.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 - 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.
- B. Pre-Installation Meetings:
 - 1. Convene a pre-installation meeting at least one week prior to commencing Work of this Section.
 - 2. Require attendance of parties directly affecting Work of this Section including subgrade preparation formwork, reinforcement, pumping, or other means of conveying, placement, finishing, sawing, curing, joint sealing, or other pertinent portions of the work.
 - 3. Representatives to be present are personnel who are directly involved in the project and who have authority to control the work..
 - 4. Review conditions of operations, procedures and coordination with related Work. Agenda:
 - a. Tour, inspect, and discuss conditions of concrete work.
 - b. Review concrete testing and their requirements.
 - c. Review required submittals, both completed and yet to be completed.
 - d. Review Drawings.
 - e. Approve proposed equipment.
 - f. Review concrete batching, transporting, placement, consolidation, finishing, and curing procedures.
 - g. Review and finalize construction schedule related to concrete work and verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
 - h. Review required inspections, testing, certifying, and material usage accounting procedures.
 - i. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.
 - j. Review safety precautions relating to concrete work operations.
 - k. Environmental procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver materials in unopened containers with labels identifying contents.
- C. Store powdered materials in dry area and in manner to prevent damage. Protect liquid materials from freezing or exceeding maximum storage temperatures set by product manufacturer.



1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Jobsite Requirements:
1. Conform to ACI 305 R when placing concrete during hot weather.
 2. Conform to ACI 306 R when placing concrete during cold weather.

1.7 ENVIRONMENTAL REQUIREMENTS

NOTE TO SPECIFIER

Use when requested and or approved by Contracting Officer and where available and commonly used.

- A. Resource Management:
1. Recycled Content:
 - a. Concrete: Fly ash may be used as a substitute for a maximum of 25 percent of Portland cement.
 - b. Concrete: Ground granulated blast furnace slag (GGBFS) may be used as a substitute for a maximum of 30 percent of Portland cement.
 - c. recycled newsprint joint filler: Post-consumer recycled content plus one half of pre-consumer recycled content not less than [] percent.

- B. Environmental Impact:
1. Concrete placement accessories:
 - a. Mixing equipment: Return excess concrete to supplier; minimize water used to wash equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Applied Concrete Technology, Inc., Post Office Box 548, Grayslake, IL 60030, Toll Free: 800-228-6694, Phone: 847-548-2444, Fax: 847-548-2555. www.procrete.com
 2. The Euclid Chemical Company, 19218 Redwood Road, Cleveland, OH 44110, Phone: 216-1-9222, Toll Free: (800) 321-7628, Fax: 216-531-9596 www.euclidchemical.com.
 3. Fortifiber Corporation, 419 W. Plumb Lane, Reno, NV 89509, Toll Free: 800-773-4777, Fax: 775-333-6411, Website: www.fortifiber.com.
 4. ChemRex Inc., Shakopee, Minnesota 55379, Toll Free: 800-433-9517, Fax: 800-496-6067.
 5. BASF Construction Chemicals North America (former Master Builders), 23700 Chagrin Boulevard, Cleveland, OH 44122, Phone: 216-839-7500, Fax: 216-839-8821.
 6. W.R. Meadows, Inc., PO Box 338, Hampshire, Illinois 60140-0338, Toll Free: 800-342-5976, Phone: 847-683-4500.
 7. Reef Industries, 9209 Alameda Genoa, Houston, Texas 77075, Phone: 713-507-4251, Toll Free: 800-231-6074, Fax: 713-507-4295.
 8. Stego Industries LLC, 27442 Calle Arroyo Suite A, San Juan, Capistrano, CA 92675, Phone: 877-464-7834, Fax: 949-493-5165, www.stegoindustries.com.
 9. L & M Construction Chemicals, Inc. 14851 Calhoun Rd., Omaha, NE 68152-1140; Phone: 402-453-6600, Fax: 402-453-0244.
 10. Curecrete Chemical Company, Inc., 1203 W. Spring Creek Pl., Springville, UT Phone: 801- 489-5663.
 11. Midwest Floor Care Inc., 17202 Princeton Rd, Adams, NE 68301, Phone: 402-788-2820.



12. General Resource Technology, Inc., 2978 Center Court, Eagan, MN 55121, Phone: 800-324-8154, Fax: 651-454-4252, www.grtinc.com.

B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 CONCRETE MATERIALS

A. Concrete:

1. Concrete shall be in accordance with ASTM C94. If a conflict exists between ASTM C94 and these specifications, these specifications shall govern.

B. Portland Cement: ASTM C150 – Type I unless otherwise specified or approved by the Engineer.

1. Assume full responsibility for the quality and soundness of cement. Cement is to be of one type and from the same mill; it is to be of uniform color for all concrete with permanently exposed concrete finishes.

C. Liquid admixtures: All admixtures shall be used in conformance with the manufacturer's recommendations. When air entraining admixtures, water reducing admixtures, high range water reducing admixtures, and non-corrosive accelerating admixtures are used in any combination, all products shall be from the same manufacturer or the ready-mix concrete producer shall certify that they are compatible. The following admixtures are permitted when approved in writing prior to use or are required as specified herein and shall be used in strict accordance with the manufacturer's specifications or recommendations:

1. Calcium chloride: Conform to ACI 301. The water soluble chloride ion level shall not exceed 0.3 percent by weight of cement.
2. Air-entraining admixtures: ASTM C260 shall be used to achieve the specified air content in all permanently exposed exterior concrete. For steel hard trowel interior slab finish, do not use air entrainment admixtures. The total air entrainment (entrained and entrapped air) must not exceed 3 percent. For steel trowel exterior slab finish, comply with ACI 318 and ACI 302.
 - a. Euclid: AEA-92 or Air Mix 200.
 - b. BASF: Micro-Air, MBVR-Standard, and MB AE 90.
 - c. Sika: Sika AEA-14, Sika AEA-15, and Sika Air.
 - d. W.R. Grace: Darex EH, Darex II AEA, Daravair AT60, Daravair 1400, and Daravair 1000.
3. Water-reducing admixtures: Conform to ASTM C494, Type A, containing not more chloride ions than allowed in paragraph C., above.
 - a. Euclid: Eucon WR series or Eucon MR.
 - b. BASF: Masterpave, Masterpave N, PolyHeed 997, Pozzoloth 220N, and Glenium 7500.
 - c. W.R. Grace: Daracem 55 and Daracem 65, WRDA 82 and WRDA with HYCOL.
 - d. Sika: Sikament HP, Plastocrete 161, and Sikament 686.
 - e. General Resource Technology: Polychem 400 NC and Polychem 1000.
4. Water-reducing/accelerating admixtures: Conform to ASTM C494, Type C or E having long-term test results showing non-rusting on metal deck and reinforcing steel.
 - a. Euclid: Accelguard series.
 - b. BASF: Pozzutec 20+, Pozzoloth NC 534, and Rheocrete CNI.
 - c. Sika: Sika Rapid-1 and Plasocrete 161FL.
 - d. W.R. Grace: Lubricon NCA, Polarset, and DCI.
5. Water-reducing/retarding admixtures: Conform to ASTM C494, Type D containing not more than 1 percent chloride ions.
 - a. Euclid: Eucon Retarder series.
 - b. BASF: Delvo Stabilizer, Masterpave series, and Pozzoloth 100XR, 200N, 220N and 322N.
 - c. Sika: Plastimet.
 - d. W.R. Grace: Daratard 17, WRDA-64, and WRDA-82.



6. High-range/water-reducing (HRWR) admixtures: Conform to ASTM C494, Type F or G super plasticizers containing 1 percent maximum chloride ions may be used with low slump (3 inches maximum) concrete to produce flowable concrete (up to 8 inches slump) with early strength gain and 28-day strengths equal to reference concrete. HRWR admixture may be used providing not more than 60 minutes is allowed from addition of admixture to final placement of concrete. HRWR admixture shall be used in concrete with a maximum water/ cement ratio of 0.50 or less and is suggested in the following:
- In pumped concrete.
 - In concrete topping slabs
 - In lieu of the specified water-reducing admixture (Type A) where confinement of placing due to heavy reinforcement or narrow space requires flowable concrete.
 - Where more than 30 minutes is required between the addition of admixtures to final placement of the concrete, a combination of water-reducing, set controlling admixtures (ASTM C494, Types A, D, & E) as in Master Builders Company "Synergized Performance System" may be used.
 - Euclid: Eucon 37 or Eucon 537.
 - BASF: Rheobuild 1000, Glenium 3000 NS, and Glenium 3400NV.
 - Sika: Sikament 300, Viscocrete 2100, and Sikament 686.
 - W.R. Grace: Daracem 100, ADVA Cast 530, Mira 92, and ADVA Cast 575.

NOTE TO SPECIFIER

Use when requested and or approved by Contracting Officer and where fly ash and or ground granulated blast furnace slag are available and commonly used. It provides better durability, workability and minimizes corrosion at no increased cost. It is also environmentally beneficial because it is a recycled product and requires less water in the mix.

- D. Fly ash: Conform to ASTM C618. The use of a quality fly ash will be permitted as a cement-reducing admixture (minimum 15 percent and maximum 25 percent). Fly ash used in concrete shall be from a single source and of a single class in combination with Portland cement of a single source and single class unless otherwise approved by the Engineer. The fly ash shall meet all of the requirements of ASTM C618, Class C or Class F, with the following special requirements: The loss on ignition in Table 1 shall not exceed 3 percent. Compliance to Table 1A shall apply. The amount retained on the 325 sieve in Table 2 shall not exceed 34 percent. Where a Type II low-alkali cement is specified, the total C_3A shall be less than 8 percent of total cementitious material. The chemical analysis of the fly ash shall be reported in accordance with ASTM C311. Quality assurance testing and reports for a minimum of six months shall be submitted by the fly ash supplier. The option to use fly ash must be approved prior to use.
- E. Granulated Blast Furnace Slag is an alternative to fly ash and shall conform to ASTM C989 Grade 100 Or 120. Granulated blast furnace slag may be used as a substitute for a maximum of 30 percent of Portland cement.

- F. Certification: Certification of the above requirements is required from the admixture manufacturer prior to mix design review and approval by the Contracting Officer. Upon request by the Contracting Officer, a qualified representative is to be provided to assure proper use of admixtures. Use of admixtures, other than listed above will be permitted only when approved.
- G. Aggregates:
- Normal-weight concrete - ASTM C33. For slabs, also conform to combined aggregate grading recommendations of ACI 302 and ACI 302.1R, unless otherwise permitted.
 - All concrete exposed to the weather shall conform to the limits of deleterious substances and physical properties of Table 3, ASTM C 33.



3. Local aggregates: Local aggregates not complying with ASTM C33 but which have been shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to the Contracting Officer.
4. The nominal size of an aggregate particle shall not exceed:
 - a. 20 percent of the narrowest dimension between sides of forms.
 - b. 33 percent of the depth of slabs.
 - c. 75 percent of the dimension between reinforcing bars.
 - d. 75 percent of the dimension between reinforcing bars and forms.
5. Maximum size of coarse aggregates and minimum cementitious contents: ACI 301 and ACI 302.1R.
6. Concrete aggregate alkali-silica reactivity (ASR) shall be tested in accordance with ASTM C1260 with a 14-day expansion (no supplementary cementing materials) or ASTM C1567 (with supplementary cementing materials) of less than 0.1 percent. Materials (cement, supplementary cementing materials, and aggregates) to be used in the concrete shall be tested. Coarse aggregates and fine aggregates shall be individually tested. If two grades of coarse aggregates are blended they shall be individually tested.
7. Abrasive aggregates non-slip finishes: Fused aluminum oxide grits, or crushed emery, as abrasive for non-slip finish with emery aggregate containing not less than 40 percent aluminum oxide and not less than 25 percent ferric oxide. Use material that is factory-graded, packaged, rustproof, non-glazing, and unaffected by freezing, moisture, and cleaning materials.

H. Water:

1. Clean, potable, and free of injurious amounts of oil, acid, alkali, organic or other deleterious matter not detrimental to concrete; drinkable.
2. Water shall contain no more than 650 parts per million of chlorides as Cl or more than 1000 parts per million of sulfates as SO₄. In no case shall the water contain an amount of impurities that will cause a change in the setting time of Portland cement of neither more than 25 percent nor a reduction in compressive strength of mortar at 14 days of more than 5 percent when compared to the results obtained with distilled water when tested in accordance with ASTM C109.
3. Water used for curing shall not contain impurities in amounts to cause discoloration of the concrete or mortar or to produce etching of the surface.
4. Recycled water shall conform to ASTM C94.

2.3 GROUT/MORTARS

A. Cement grout: Conform to ASTM C387 "Dry packaged mixtures" or:

1. Mix at the site, in composition of one volume of Portland cement to 2-1/2 volumes of fine aggregate.
2. Mix the materials dry; then add sufficient water to make the mixture flow under its own weight.
3. Submittals: The following laboratory test results shall be submitted to show compliance with the requirements of this specification:
 - a. Initial setting time: 8 hours maximum
 - b. Vertical shrinkage: 0
 - c. Compressive strength: 4500 psi 1 day
 - d. Compressive strength: 8500 psi 7 days
 - e. Compressive strength: 10,000 psi 28 days
4. Field service: When required by the contracting officer, provide a qualified concrete technician employed by the Grout Manufacturer to assist in the initial grouting operations.
 - a. Euclid: NS Grout or Hi Flow Grout or E3 Grout series.
 - b. Sika: SikaGrout #212.
 - c. BASF: Masterflow 555 and Masterflow 928.

NOTE TO SPECIFIER

Exposed slabs shall be sealed in a fashion compatible with the curing method specified.

2.4 CURING/SEALING/HARDENERS

- A. Dissipating liquid membrane-forming compounds for curing concrete; Conform to ASTM C309, Type 1. Curing compound shall be compatible with floor sealer or finish used. Low VOC.
1. Euclid: VOX Kurex DR VOX series; waterborne products.
 2. W.R. Meadows: 1100-Clear series.
 3. Edoco: Burke Aqua Resin Cure.
 4. L&M Construction Chemicals: Cure R.
 5. BASF: Kure 200W
 6. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Method of curing shall be approved by the finish flooring applicator where finishes are indicated.
- C. Exterior Sealers: applied to horizontal concrete surfaces permanently exposed to salts, deicer chemicals and moisture, including parking decks. The manufacturer shall provide a five year labor and materials warranty on performance of the sealer. Sealer shall be compatible with the curing compound used.
1. Euclid: Eucoguard or Diamond Clear or Super Diamond Clear.
 2. ChemREX: Hydrozo Clear 40.
 3. Substitutions: Permitted.

NOTE TO SPECIFIER

The following materials provide varying levels of protection, sealant and hardness. Review products for project appropriateness. Substitutions are permitted.

- D. Liquid Densifier/Sealer/Hardener: to be applied on exposed concrete floors cured with dissipating membrane forming curing compound to harden and densify concrete surfaces. Sealers are to be clear, chemically reactive, a waterborne solution of silicate or silicate materials and proprietary components, odorless, and colorless.
1. ChemMasters: Chemisil Plus
 2. Conspec Marketing and Manufacturing Co., Inc. Intraseal
 3. Euclid Chemical Company: Euco Diamond Hard (Liquid Sealer and Hardener)
 4. L&M Construction Chemicals: Seal Hard (Liquid Sealer and Hardener)
 5. Curecrete Chemical Company: Ashford Formula (Liquid Sealer and Hardener)
 6. W.R. Meadows, Inc.: Liqui-Hard
 7. Sika: Sikafloor 3S
 8. Sonneborn: Kure-N-Harden
 9. Symons Corporation: Buff Hard
 10. Or approved equal.

2.5 JOINTS AND EMBEDDED ITEMS:

- A. Construction and Contraction Joints: Comply with ACI 301 and recommendations of ACI 302.1R. Sealant shall be two-part semi-rigid epoxy, and shall have minimum Shore A Hardness of 80 when measured with ASTM D2240.
- B. Isolation Joints: Fillers shall consist of 1/8 inch width strips of neoprene, synthetic rubber, or approved substitute, extending the full depth of the slab. Sealant shall be two-part elastomeric type, polyurethane base.



2.6 VAPOR BARRIER/RETARDER

NOTE TO SPECIFIER

In the paragraph below, select [below] or [above] based on sub grade conditions and ACI committee 302 recommendations.

- A. Provide cover over prepared soil, [below][above] aggregate subbase material at slabs-on-grade, where shown on the plans. Use only materials which are resistant to decay when coated in accordance with ASTM E154.
 - 1. Vapor Retarder: Polyethylene sheet not less than 10 mils thick, or
 - 2. Vapor Barrier:
 - a. Stego: Stego Wrap Vapor Barrier 10 –mil
 - b. Fortifiber: Moistop and Moistop Ultra 10.
 - c. Insulation Solution Viper Vaporcheck 10.

NOTE TO SPECIFIER

Delete the paragraph above and retain the paragraph below if the thicker barrier is required due to soil condition and the recommendation of geotechnical report. Otherwise, delete the paragraph below.

- 3. Vapor Barrier:
 - a. Stego: Stego Wrap Vapor Barrier 15 –mil
 - b. Fortifiber: Moistop and Moistop Ultra 15.
 - c. W.R. Grace: Florprufe 120.
 - d. Insulation Solution Viper Vaporcheck 16
- 4. Or approved equal.

2.7 PROPORTIONING

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If laboratory trial batch method is used, use an independent testing facility acceptable to Contracting Officer for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing and inspection unless otherwise acceptable to Contracting Officer.
- B. Submit written reports to the testing laboratory of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed and approved. Include the following information for each concrete mix design:
 - 1. Method used to determine the proposed mix design.
 - 2. Gradation of fine and coarse aggregates, plus combined aggregate gradation for slabs, ACI 302.1R.
 - 3. Aggregate specific gravities and absorptions.
 - 4. Proportions of all ingredients including reported on a saturated surface dried basis all admixtures added either at the time of batching or at the job site.
 - 5. Water-cementitious ratio.
 - 6. Slump, ASTM C143.
 - 7. Certification of the chloride content of individual admixtures and of the mixes as proposed.
 - 8. Air Content: ASTM C173 (Volumetric Method).
 - 9. Unit weight of concrete, ASTM C138.
 - 10. Strength at 3, 7, and 28 days, ASTM C39.
 - 11. Method of recording batch proportions.
 - 12. Substantiating test reports.
- C. Concrete types and strengths: Minimum 28 Day Compressive Strength shall be per design requirements but not less than:
 - 1. Paving base, columns, beams, walls, foundations, and footings: 3,500 psi.



2. Slab-on-grade: 4,000 psi.
3. Normal or Lightweight concrete on metal deck: 3,000 psi.
4. Tilt-up: 4,000 psi.
5. All concrete exposed to weather shall be air entrained (ASTM C260).
6. All concrete shall be normal weight except as noted above.

When the concrete mix design is developed from laboratory trial batching, adjust proportions to produce a design mix at least 1200 psi greater than the specified strength.

When the field experience method is used, the required average compressive strength shall be determined in accordance with ACI 318. Documentation that proposed concrete proportions will produce an average compressive strength equal to or greater than the required average compressive strength shall consist of a field strength test record representing materials and proportions to be used for this project. A field strength test record shall consist of at least 10 consecutive tests encompassing a period of time of not less than 45 days and made within the past 12 months.

Also, see general and specific notes on structural drawings.

- D. Weights: All concrete shall be normal-weight concrete unless otherwise designated on the structural drawings.
- E. Aggregate gradation: For slabs, also conform to combined aggregate grading recommendations of ACI 302.1R, unless otherwise permitted. For all other concrete not otherwise noted the coarse aggregate gradation shall conform to ASTM C33 size no. 57 or larger.
- F. Durability: Conform to ACI 301.
 1. All concrete exposed to potentially destructive weathering, such as freezing and thawing, or to deicer chemicals is to be air-entrained, 6 percent ± 1 percent, a minimum six sacks cementitious per cubic yard of concrete, 0.45 maximum water-cementitious ratio, and, 4 inch maximum slump.
 2. Water-cement ratio: For concrete subject to freezing and thawing or deicer chemicals, the water-cement ratio shall not exceed 0.53 by weight including any water added to meet specified slump in accordance with the requirements of ASTM C94 unless otherwise noted.
- G. Slump: Conform to ACI 301.
 1. 3 ½ inch maximum for consolidation by vibration
 2. 5 inch maximum for consolidation by other methods
 3. 8 inch maximum for flowable concrete. Concrete containing HRWR admixture (super plasticizer): 3 inch maximum before addition of HRWR
 4. Where field conditions require slump to exceed that specified above, the increased slump shall be obtained by the use of a superplasticizer only, and the Contractor shall obtain written approval from the Contracting Officer who may require an adjustment to the mix.
- H. Slab-On-Grade
 1. Concrete shall conform to ACI 302.1R except that the minimum 28-day compressive strength shall be 4000 psi.
 2. The minimum cementitious content shall be in accordance with ACI 302.1R Table 6.2.
 3. The maximum water-cementitious ratio shall be 0.48.
 4. The maximum water content shall not be greater than 250 lbs per cubic yard of concrete.
 5. The air content shall be less than 3 percent.
- I. Production of concrete: Conform to ACI 301:
 1. Cast-in-place concrete used in the work shall be produced at a single off-site batching plant or may be produced at an on-site batch plant.
 2. All concrete shall be proportioned conforming to the approved mix designs and of the materials contained in those approved mixes. A certified copy of the design weights for each mix shall be kept at the producing plant for each class of concrete used on the project.



3. Plant equipment and facilities are to conform to the "Check List for Certification of Ready -Mixed Concrete Production Facilities" of the National Ready-Mixed Concrete Association (NRMCA) and have NRMCA or approved certification within the past year.
4. Coarse aggregates shall be washed and, if necessary, shall be uniformly moistened just before batching. Each size of coarse aggregate shall be batched from separate bins as required to produce the combined grading requirements.
5. Prior to adding a high-range water reducer (super plasticizer), slump shall not exceed the working limit. The high-range water reducing admixture shall be accurately measured and pressure-injected into the mixer as a single dose. If added at the jobsite, the field dispensing system shall conform to the same requirements as a plant system and tested prior to each day's operation. After the addition of the high-range water reducer, the concrete shall be mixed at mixing speed for a minimum of 5 minutes.
6. Ready-mixed and on-site batched concrete shall be batched, mixed, and transported in accordance with ASTM C94.
 - a. Truck mixers and their operation shall ensure that the discharged concrete is uniformly within acceptable limits of consistency, mix, and grading. All mechanical details of the mixer, such as water-measuring and discharge apparatus, conditions of the blades, speed of rotation, general mechanical condition of the unit, and clearance of the drum shall be checked before the use of the unit will be permitted.
 - b. Truck mixers shall be equipped with approved revolution counters by which the number of revolutions of the drum or blades may readily be verified. The water tank system of the truck shall be equipped with gauges that permit accurate determination of the tank contents.
 - c. Each batch of concrete shall be mixed in a truck mixer for not less than 80 revolutions of the drum or blades and at the rate of rotation designated as mixing speed by the manufacturer of the equipment. Additional mixing, if any, shall be at the speed designated as the agitating speed by the manufacturer of the equipment. All materials, including mixing water but excluding any high-range water reducers added onsite, shall be in the mixer drum before actuating the revolution counter for determining the number of revolutions of mixing.
 - d. The concrete producer shall furnish duplicate delivery tickets, one for the Contractor and one given to the Owner's Representative for each batch of concrete. The information provided on the delivery ticket shall include the quantity of materials batched including the amount of free water in the aggregate and any water added onsite. Show the date, time of day batched, and if ready-mixed the time of discharge from the truck. The quantity of water that can be added at the site without exceeding the maximum water-cementitious ratio specified shall be noted on the delivery ticket.
7. Concrete produced by on-site volumetric batching and continuous mixing if approved shall conform to ASTM C685.
8. For concrete produced on site with a central batch plant, mixing shall be done in an approved batch mixer.
 - a. The Contractor shall maintain and operate the on-site batch plant and transportation equipment in a manner that will produce the results specified in this section.
 - b. The Engineer reserves the right to reject the proposed on-site plant if, in his/her opinion, the on-site plant will interfere with other operations or impair the quality of the concrete.
 - c. The quantities of cement, pozzolanic materials, and aggregates used in each batch shall be determined by automatic weighing. The quantity of water shall be determined by weighing or volumetric measurement.
 - d. The weighing equipment for aggregates shall be readily adjustable both to compensate for variation in moisture content of the aggregates and for changing mix proportions. Moisture-sensing devices shall automatically compensate the aggregate weights for changes in moisture content. The charging of weigh hoppers directly from aggregate handling equipment such as front-end loaders will not be permitted.
 - e. Mixers in centralized batching and mixing plants shall be arranged so that mixing actions can be observed from a location convenient to the mixing-plant operator's station.
 - f. Equipment shall be provided that discharges pozzolanic material into the cement hopper only after the addition of the Portland cement. Pozzolanic materials shall be stored in such a manner as to permit ready access for the purpose of inspection and sampling and be

- suitably protected against contamination of moisture. Should any pozzolan show evidence of contamination or be otherwise unsuitable, the Engineer will reject it and require that it be removed from the site.
- g. Dispensers for admixtures shall have the capacity of the full quantity of the properly diluted solution required for each batch. They shall be maintained in a clean and freely operating condition. Admixtures shall be added to the premeasured water for the batch or shall be discharged into the batch by flowing automatically and uniformly into the stream of mixing water from the beginning to end of its flow into the mixer. Equipment for measurement shall give visual confirmation of the accuracy of the measurement for each batch.
 - h. The central batch mixer shall be rotated at a speed recommended by the manufacturer and mixing shall be continued for a minimum of 1-1/2 minutes after all materials are in the drum.
 - i. Each stationary mixer shall be equipped with a mechanically operated timing and signaling device that will indicate and ensure the completion of the required mixing period and will count the batches.
 - j. All concrete shall be mixed until there is a uniform distribution of the materials and shall be discharged completely before the mixer is recharged.
9. The Engineer may increase the mixing time when the charging and mixing operations fail to produce a delivered batch in which variations of consistency, mix, or grading are within the limits specified.
 10. Variations in consistency during the discharge of a single batch shall not exceed 1 inch of slump, except that a greater variation will be permitted if the slump of the concrete decreases and no water is added. Variations in mix and in grading of different parts of the delivered batch shall be within limits stated in ASTM C94.
 11. Water shall be introduced prior to, during, and following mixer-charging operations.
 12. When a mixer produces unsatisfactory results, it shall be repaired promptly and effectively, or it shall be replaced.
 13. Mixers shall not be loaded in excess of their rated capacity.
 14. Overmixing, such as to require addition of water to preserve the required consistency or to reduce slump, will not be permitted.
 15. All other concrete: Conform to ACI 301
 16. Use of accelerating admixtures in cold weather and retarding admixtures in hot weather shall not relax placement requirements specified herein.
 17. All concrete placed at ambient temperatures below 50 degrees F is to contain an approved accelerator. The concrete temperature when delivered at the site shall be at least 50 degrees F.
 18. All concrete placed at ambient temperatures above 80 degrees F is to contain an approved retarder.
 19. All concrete required to be air-entrained is to contain an approved air-entraining admixture.
 20. When improved workability, pumpability, lower water-cement ratio, or high ultimate and/or early strength is required, the HRWR admixture (super plasticizer) may be used.
 21. Ensure air content for slabs with steel trowel finish is less than 3.0 percent.
 22. The concrete shall be of such consistency and composition that it can be worked readily into the corners and angles of the forms and around reinforcement without permitting materials to segregate or free water to collect on the surfaces. Within the limiting requirements, adjust the consistency of the concrete as may be necessary to produce mixtures which will be placeable with reasonable methods of placing and compacting. Maintain on the job at all times adequate extra cement to be used at rate of 1/2 sack cement per cubic yard concrete for each 2" slump increase for corrections due to wetness desired or obtained. No water shall be added to concrete except under the direct awareness of the project inspector.
 23. No water shall be added to concrete except under the direct awareness of the project inspector. The water-cementitious ratio stated on the approved mix designs shall not be exceeded unless approved by the Engineer. Re-tempered concrete shall be mixed for not less than 80 revolutions of the drum or blades and at the rate of rotation designated as mixing speed by the manufacturer of the equipment.
 24. Adjustments to concrete mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant



at no additional cost to Contracting Officer. Laboratory test data for revised mix design and strength results must be submitted and accepted before using in work.

2.8 FORMWORK

- A. Section 031000: Concrete Forming and Accessories

2.9 REINFORCING MATERIALS

- A. Section 032000: Concrete Reinforcement

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION - GENERAL

- A. Install all cast-in-place concrete work in accordance with ACI 301 except as herein specified.
- B. All bearing materials shall be inspected by the Geotechnical Engineer prior to placing concrete. The Geotechnical Engineer shall be the sole judge as to the suitability of the bearing material.
- C. Compact stone base aggregate to thickness indicated on drawings. Roll poof stone screenings topping to provide smooth hard surface on which to place slab. Surface should not show footprints or truck tracks when driven over
- D. Immediately before placing concrete, spaces to be occupied by concrete shall be free from standing water, ice, mud, and debris.
- E. Concrete shall not be deposited under water or where water in motion may injure the surface finish of the concrete.
- F. Immediately before placing concrete for exterior sidewalk, curb and gutter, pavements, and slab-on-grade, subbases and compacted subgrades shall be thoroughly moistened, but not muddied, by sprinkling with water. Surfaces shall be kept moist by frequent sprinkling, as required, up to the time of placing of concrete.
- G. Forms and the reinforcement shall be thoroughly cleaned of ice and other coatings. Remove surplus form releasing agent from the contact face of forms.
- H. Notify all trades concerned and the Owner's Representative sufficiently in advance of the scheduled time for concrete placement to permit installation of all required work by other trades.
- I. Before placing concrete, all required embedded items, including dovetail anchor slots, anchors, inserts, curb angles, metal frames, fixtures, sleeves, drains, stair nosings, accessory devices for Mechanical and Electrical installations shall be properly located, accurately positioned and built into the construction, and maintained securely in place.

- J. Build into construction all items furnished by the Owner and other trades. Provide all offsets, pockets, slabs, chases and recesses as job conditions require.
- K. Place and properly support reinforcing steel and anchor bolts.
- L. The alignment, orientation, spacing, and embedment length of mechanical load transfer devices in slab-on-grade and pavements shall conform to dimensions and tolerances shown on the drawings.
- M. The Contracting Officer Representative should attend the first concrete pour.

3.3 INSTALLATION - FORMWORK

- A. Section 031000 - Concrete Forming and Accessories
- B. Construction and Contraction Joints: Conform to ACI 301 and recommendations of ACI 302.1R.

3.4 REINFORCEMENT

- A. Placement: Section 032000 - Concrete Reinforcement

3.5 METHODS OF PLACEMENT AND PLACING CONCRETE

- A. Placement: Conform to ACI 301:
 1. Maintain concrete cover around reinforcing as per Section 3.3 above and ACI 301.
 2. The methods and equipment used for transporting concrete to the site work and the time that elapses during transportation shall not cause segregation of coarse aggregate or slump loss in excess of 1 inch when measured at the point of discharge.
 3. Concrete shall be placed within 90 minutes after the water has been added to the cement and aggregates. Concrete shall be placed prior to initial concrete set.
 4. Placing of concrete will not be permitted during rainfall or when rain appears imminent. If rain should fall subsequent to placement, the concrete shall be completely protected until curing is complete.
 5. Cold-Weather Placement: Comply with provisions of ACI 306.1 "Standard Specifications for Cold-Weather Concreting" and as follows.
 - a. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
 - b. When necessary, arrangements for heating, covering, insulating, or housing the concrete work shall be made in advance of placement and shall be adequate to maintain the required temperature during the first 24 hours.
 - c. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
 - d. Concrete shall not be placed on frozen ground or placed when the ambient temperature is 40 deg F or less and dropping.
 - e. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - f. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures using vented heaters and insulating blankets.
 - g. Vent heater exhaust gases that contain carbon dioxide outside of enclosed areas.
 - h. Concrete temperatures shall be maintained above 50 degrees F for the first 7 days of curing..
 6. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305R "Standard Specification for Hot-Weather Concreting" and as specified.



- a. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice of a size that will melt completely during mixing may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
- b. Reject any concrete that has a temperature at the point of placement above 90 deg F, unless approved otherwise by the Construction Project Manager. When air temperatures are between 80 and 90 deg F the maximum mixing and delivery time is reduced to 75 minutes. When air temperatures exceed 90 deg F, the maximum mixing and delivery time is reduced to 60 minutes.
- c. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
- d. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
- e. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Contracting Officer.
- f. Spray evaporative retardants, wind breaks, misters, or shade concrete when the rate of surface evaporation when calculated in accordance with ACI 305.5 exceeds 0.2 lb/sq. foot per hour.

B. Depositing Concrete

1. Deposit concrete as near its final position as possible to avoid segregation due to rehandling or flowing. Hoppers, tremies, pump line, ducts, chutes, or other methods approved by the Engineer shall be used to deposit concrete in its final position within the specified time limits and without segregation of the mix.
2. The sequence of concrete placement and the number, type, position, and design of joints shall be approved by the Engineer prior to concrete placement.
3. Place floor slabs-on-grade by "strip cast" method.
4. Concrete shall be deposited as nearly as practical in its final position to avoid segregation due to re-handling or flowing. No concrete shall have a free fall of over three feet from truck, mixer, or buggies.
5. The concreting shall be carried on at such a rate that the concrete is plastic at all times and flows readily into the spaces between reinforcing bars. No concrete that has partially hardened or been contaminated by foreign materials shall be deposited in the work
6. When concreting is started, it shall be carried on as a continuous operation until the placing of the section is completed.
7. Except as intercepted by joints, concrete shall be placed in continuous layers. The depth of layers shall not exceed 20 inches. Succeeding layers shall be placed while the previous layer is still plastic. Concrete placement shall begin at the lowest point in each section of concrete to be placed.
8. Protect adjacent surfaces from concrete drippings, spillage, and splashes. Hardened or partially hardened splashes or accumulations of concrete on forms or reinforcement shall be removed before the work proceeds. Clean all damaged surfaces immediately.
9. All conveyances shall be thoroughly cleaned at frequent intervals during the placement of the concrete, and before the beginning a new run of concrete all hardened concrete and foreign materials shall be removed from the surfaces.
10. The Superintendent or Foreman in charge of concrete work shall mark on the drawings the time and date of the placing of each concrete pour. Locations where concrete test cylinders are made shall also be noted on the drawings. Such drawings shall be kept on file at the job until its completion and shall be subject to the inspection of the Owner's Representative at all times.

C. Conveyor Belts and Chutes

1. Chutes or conveyor belts shall not be used except as approved by the Engineer.
2. Concrete shall be conveyed from the mixer to the place of final deposit by methods that will prevent separation and loss of material.
3. Chutes longer than 50 feet and conveyor belts longer than 110 feet will not be permitted.

4. Equipment for conveying and chuting concrete shall be of such size and design as to insure a practically continuous flow of concrete at the delivery point without separation of material.
5. Provide runways or other means for wheeled equipment to convey concrete to point of deposit. Construct runways so that supports will not bear upon reinforcement or fresh concrete.
6. The minimum slope of chutes shall enable concrete of the specified consistency to readily flow.
7. Ends of chutes, hopper gates, and other points of concrete discharge throughout the conveying, hoisting, and placing system shall be designed and arranged so that concrete passing from them will not fall separated into whatever receptacle immediately receiving the concrete. Adequate headroom provision must be made at such points for a vertical drop and for proper baffling.
8. If a conveyor belt is used, it shall be wiped clean by a device operated so that none of the mortar adhering to the belt will be wasted.

D. Pumping of Concrete

1. The type and operation of a concrete pump shall be subject to the approval of the Engineer. The equipment used in placing the concrete and the method of its operation shall introduce the concrete into the forms without high velocity. Placing equipment shall be operated only by experienced operators.
2. During pumping, the Contractor shall have on-site a standby placing system, acceptable to the Engineer, to ensure that in the event of breakdown of the primary placing equipment, the concrete placement can continue without cold joints.
3. The minimum diameter of the hose or conduit shall be 4 inches unless otherwise approved by the engineer. Aluminum conduits shall not be used for conveying the concrete. Pumping equipment, hoses, and conduits that are not functioning properly shall be replaced.

E. Joints

1. Joints shall be vertical in walls and horizontal in slabs.
2. Dowel bars and tie bars shall be inspected
3. Control joints for controlling concrete shrinkage shall be provided in floor slabs, walls, decks, conduits, and channels as shown on the plans or approved by the Engineer.
4. Joint spacing and sawcut depth for slab-on-grade and concrete pavement shall conform to that shown on the pour sequencing plan and/or drawings.
 - a. Sawed control (contraction) joints for pavements and slab-on-grade shall be installed as soon as practical so as not to ravel the concrete but less than 12 hours.
 - b. The minimum sawcut joint depth shall be 1/4 of the slab thickness unless an early-entry SOFF-CUT saw is used in accordance with manufacturer recommendations (typically sawed between 1 to 4 hours after finishing to a 1 inch minimum depth.
 - c. Joint spacing shall in feet shall not exceed 2-1/2 times the slab thickness in inches unless otherwise approved by the Engineer.
 - d. The long dimension of a slab shall not exceed 1.5 times the short dimension unless otherwise approved by the Engineer.
5. Joints in slabs shall align with joints in adjoining walls unless otherwise approved by the Engineer or shown in the drawings. Joints shall also line up with architectural reveals and form lines. All corners shall be relieved by cutting joint to adjacent control joint.
6. When not otherwise shown on the drawings or specified, concrete placement for walls shall be constructed in segments no longer than 30 unless otherwise approved by the Engineer.
7. If there is a delay in casting but prior to concrete initial set, the concrete placed after the delay shall be thoroughly spaded and consolidated at the edge of that previously placed to avoid cold joints. Concrete shall then be brought to correct level and struck off with a straight edge. Bullfoats shall be used to smooth slab surfaces, leaving it free of humps or hollows.
8. Where placing concrete is interrupted long enough for the concrete to take its initial set, the working face shall be made a construction joint.
 - a. Preparation and disposition of unplanned cold joints in walls shall be approved by the Engineer.
 - b. For slab-on-grade, pavements, sidewalk, and curb and gutter, concrete shall be removed back to the nearest planned joint and a construction joint installed.
9. Unless otherwise noted on the drawings, where concrete is to be placed against existing concrete, except in the case of expansion joints, the joint face of the existing concrete shall be roughened.



- a. Before new concrete is placed against hardened concrete, the bonding surface of the existing concrete shall be roughened to an amplitude of 0.25 inch using bush hammers, abrasive blasting, or high-pressure water blasting.
 - b. Fresh concrete may be green-cut with water blasting and hand tools to remove concrete laitance and spillage and to expose sound aggregate.
 - c. The prepared surfaces of hardened concrete shall be kept thoroughly wet during the 24-hour period immediately prior to the placement of the new concrete. Wetting shall be accomplished by continuous sprinkling or by covering exposed surfaces with wet burlap.
 - d. Where shown on the drawings or permitted by the Engineer, bond-preventing compound shall be applied by brush in accordance with the manufacturer's printed instructions.
10. Corner sections of walls shall not be placed until the adjoining wall sections have cured at least 14 days.
- F. Consolidation
1. All concrete shall be thoroughly consolidated by internal mechanical vibrators during the placing operation and shall be thoroughly worked around the reinforcement and embedded fixtures and into corners of the forms.
 2. Concrete for slabs 8 inches thick or less may be consolidated with vibrating screeds. Slabs between 8 to 12 inches thick shall be compacted with internal vibrators and (optionally) with vibrating screeds.
 3. Concrete shall be consolidated by vibration to the maximum practicable density. The concrete shall be free from pockets of coarse aggregate and entrapped air.
 4. Vibrators shall have a minimum diameter of 3 inches with a frequency of at least 7000 vibrations per minute and with an amplitude adequate to consolidate the concrete in the section being placed.
 5. Forms shall contain sufficient windows or shall be limited in height to allow visual observation of the concrete during placement. Sufficient illumination shall be provided in the interior of forms so that at the places of concrete deposition the concrete shall be visible from the deck or runway.
 6. Vibrators shall not be secured to forms or reinforcement.
 7. Keep a minimum of two standby vibrators in operable condition on the job during concreting operations.
 8. Consolidation shall be carried on continuously with the placing of concrete.
 9. The number of vibrators employed shall be sufficient to consolidate the concrete within 15 minutes after it is deposited in the forms.
 10. When consolidating each layer of concrete, the vibrator shall be operated at regular and frequent intervals 18 to 30 inches apart.
 11. The vibrator shall be kept in nearly a vertical position as practicable. The use of vibrators to shift or drag concrete after deposition will not be permitted. Vibrators shall not be laid horizontally or laid over.
 12. The vibrator head shall penetrate 6 to 8 inches into the preceding layer and then be withdrawn at a slow rate. The top part of each layer shall be re-vibrated systematically at the latest time the concrete can be made plastic by means of vibration.
 13. Concrete shall not be placed until the previous layer has been vibrated.
 14. Unless directed otherwise by the Engineer, the top 2 feet of walls shall be re-vibrated approximately 1 hour after placement of concrete and while a running vibrator will still sink under its own weight into the concrete and liquefy it momentarily.
- G. Protection of cast concrete: Conform to ACI 301.
- H. Repair of surface defects: ACI 301.
1. Inspect concrete surfaces and surfaces to be painted immediately upon removal of forms. Irregularities shall be immediately rubbed or ground to secure a smooth, uniform, and continuous surface.
 2. Clean surfaces of tie holes. Tie holes shall be filled solid with patching mortar.
 3. Surfaces to be smoothed shall not be plastered or coated.
- Patch imperfections as needed or as directed by the Contracting Officer. Repairs in accordance with Section 3.8 shall not be made until the surface has been inspected and repair methods have been approved by the Contracting Officer..

3.6 FINISHING

- A. Finishing of formed surfaces: ACI 301:
1. Tops of forms:
 - a. Strike concrete smooth at tops of forms.
 - b. Float to texture comparable to formed surfaces.
 2. Formed surfaces:
 - a. Finished formed surfaces shall conform accurately to the shape, alignment, grades, and sections shown on the drawings or prescribed by the Engineer.
 - b. Surfaces shall be free from fins, bulges, ridges, honeycombing, or roughness of any kind and shall present a finished, smooth, continuous hard surface.
 - c. Permanently exposed surfaces: ACI 301 - "Smooth Form Finish" with the fins ground smooth and air holes shall be filled with a non-shrink mortar. The color of the patch material shall match the color of the surrounding concrete. Surfaces in unfinished areas unexposed to public view: ACI 301- "Rough Form Finish".
- B. Slabs: Minimum slab surface tolerance must satisfy ACI 301 and ACI 302.1R as measured in accordance with ASTM E1155.
1. Slabs-on-grade:
 - a. For exposed slabs, install semi-rigid epoxy sealant in construction and contraction joints after slab has a minimum of 60 days or otherwise approved by the Engineer..
 - b. Separate slabs-on-grade from vertical surfaces with 1/2 inch-thick joint filler. Extend joint filler from bottom of slab to within 1/8 inch of finished slab surface.
 - c. Allowable tolerance for slab on grade surfaces, measured in accordance with ACI 117 and ASTM E1155, shall meet or exceed an overall value of FF35/FL25, with minimum local value of FF24/FL17.
 2. Suspended Floor Slab:
 - a. Minimum surface tolerances: FF25 & FL20 overall and FF20 & FL15 local.
 3. Concrete Finishes:
 - a. The following will not be permitted on slab or floor finishes:
 - 1) Dusting dry cement or sand on the surface to absorb excess moisture.
 - 2) Use of a mortar finishing coat.
 - 3) Excessive troweling or manipulation that brings water or a large amount of fines to the surface.
 - 4) Use of a Fresno.
 - 5) Addition of water to the surface during the finishing operation.
 - 6) Use of the floor during construction in a manner that leads to marring or staining the finish.
 - b. Surface preparation
 - 1) The concrete shall be brought up evenly to slightly above finished grade and shall be thoroughly compacted and consolidated. The top shall be struck off to accurately established grade strips or grade blocks. Complete screeding before any excess moisture or bleedwater is present on the surface.
 - 2) After bull floating, defer additional finishing operations until the concrete has stiffened sufficiently to sustain foot traffic pressure with an indentation of not more than 1/4 inch.
 - c. Floor Slabs: Steel trowel finish unless otherwise noted on the plans. As soon as the moisture sheen has disappeared from the floated surface and the concrete has hardened sufficiently to prevent drawing moisture and fine materials to the surface, the surface shall be steel troweled to produce a smooth, hard, uniform finish. Final steel troweling shall be conducted after the concrete is hard enough that no mortar accumulates on the trowel when manipulated with heavy pressure. Machine finishing may be used for troweling.
 - d. Exposed concrete slabs sealed or sealed and hardened using a liquid compound compatible with the curing method used.
 - e. Exterior Concrete Finishes: Unless otherwise noted on the drawings, floors, walkways, and roof finishes shall be sloped a minimum 0.125 inch per foot to drain water. A light steel



- trowel with broom finish unless otherwise noted on the plans. Apply exterior sealer to surfaces exposed to deicer chemicals that is compatible with the curing method used.
- f. Exposed Ramps, Landings and Stair Treads: A light steel trowel with broom finish unless otherwise noted on the plans. Surfaces shall be sealed or sealed and hardened using a liquid compound compatible with the curing method used.
 - g. A heavy broom finish shall be provided on disabled person ramps, utility ramps, and around exterior loading docks.

3.7 CURING, PROTECTION, LIQUID HARDNERS AND SEALERS

A. Temperature, Wind, and Humidity

1. When concrete slabs and other unformed concrete is placed in warm, dry, dusty, or windy conditions, concrete surfaces shall be protected from rapid drying by use of windbreaks, shading, fogging with properly designed nozzles, or a combination of these measures. Hot weather concreting procedures provided in ACI 305R shall be used when ambient conditions dictate.
2. Cold weather concreting procedures provided in ACI 306R shall be used when ambient conditions dictate.
3. Changes in air temperature immediately adjacent to the concrete during and immediately following the 7-day initial curing period shall be kept as uniform as possible and shall not exceed 5 deg. F in any 1 hour or 50 deg. F. in any 24-hour time period.

B. Curing Compound

1. All curing methods shall be placed immediately after final finishing (i.e., within two hours). Contractor's attention is directed to the fact that experience shows the most important time of curing is from three to four hours after placing and extending five to six hours thereafter. It is extremely important, therefore, to prevent loss of moisture, particularly during this period when concrete is especially vulnerable to plastic shrinkage cracks. All exposed surfaces of concrete including floor slabs, whether or not they receive a finish flooring, shall be protected from premature drying for a minimum of seven days.
2. Apply the specified curing compound in strict accordance with manufacturer's written instructions. Curing compound shall not be diluted by the addition of solvents or thinners, nor shall it be altered in any other manner. Curing compound that has become chilled and is too viscous for satisfactory application shall be heated by steam or hot water bath until it has proper fluidity. The temperature of the compound shall not exceed 100 °F. Curing compound shall not be heated by direct exposure of the container to fire.
3. When used on an unformed concrete surface, application of the first coat of curing compound shall commence immediately after finishing operations have been completed. When curing compound is used on a formed concrete surface, the surface shall first be moistened with a fine spray of water immediately after the forms have been removed. The spray shall be continued until the surface does not readily absorb further water. As soon as the surface film of water has disappeared and the surface is almost dry, the first coat of curing compound shall be applied. In the event that application is delayed on either formed or unformed surfaces, the surface shall be kept continuously moist until the compound has been applied or the specified period of water curing has elapsed.
4. Surfaces shall be sprayed uniformly with 2 coats of curing compound. Each coat shall provide a minimum coverage of 1 gallon per 250 square feet of surface. As soon as the first coat has become dry, a second coat shall be applied in the same manner. The direction of application of the second coat shall be perpendicular to the first coat. The curing compound shall be sprayed using approved pneumatic or pump driven equipment having the following characteristics:
 - a. Separate lines to the nozzle for material and for compressed air
 - b. A filtering system for the removal or entrapment of contaminants
 - c. A constant application pressure
5. Curing compound shall not be used on any concrete surface specified to receive additional concrete, coatings, grout, and chemical treatment

C. Protection

1. Freshly placed concrete shall be protected against wash by rain.
 2. Dust control shall be provided in the surrounding areas during placement. If, in the opinion of the Engineer, these conditions are not satisfactory met, concrete shall not be placed.
 3. During the first 2 day period of curing, no traffic on or loading of the floors will be permitted.
 4. The contractor shall allow no traffic and take precautions to avoid damage to the membrane of the curing compound for a period of not less than 28 days. Damage shall be repaired immediately to the satisfaction of the Engineer.
 5. Special care shall be taken to prevent avoid damaging the surfaces and joints due to load stresses from construction equipment, heavy shock, and excessive vibration. During construction activities, concrete shall be protected against damage with plywood or other approved materials until final acceptance by the Engineer.
 6. Precautions shall be taken to prevent overloading floors, pavements, slabs, beams, and other members. The Contractor shall comply with the Engineer's instructions regarding the loads that will be permitted on these members during construction.
 7. Self-supporting structures shall not be loaded in such a way to overstress the concrete.
- D. All floor slabs shall be cured using products and methods compatible with selected floor adhesives, toppings, and other finish materials.
- E. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
1. Remove curing compounds per the manufacturer's instructions after curing is complete as required to ensure compatibility of any finish treatments, paints, or coatings.
 2. Remove sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 3. Apply liquid in accordance with manufacturer's instructions and until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water to remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
- F. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instruction.

3.8 PATCHING AND REPAIR

- A. Concrete will be considered by the Engineer as not conforming to the intent of the drawings and specifications for the following reasons:
1. Concrete this is not formed as shown on the drawings.
 2. Concrete this is not in true alignment or level.
 3. Concrete which exhibits a defective surface.
 4. Concrete with defects that reduce the structural integrity of a member or members.
 5. Concrete jointed slabs with uncontrolled random cracking.
- B. Non-conforming concrete to required thickness, lines, details, and elevations will be rejected by the Contracting Officer and shall be modified or replaced with concrete that conforms to the contract requirements without a claim by the Contractor for additional cost or extension of contract time.
- C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Contracting Officer for each individual area. Should the Contracting Officer grant permission for the Contractor to attempt restoration of a defective area by patching or other repair methods, such permission shall not be considered a waiver of the Contracting Officer's right to require complete removal of the defective area if, in the Engineer's opinion, the restoration does not provide the structural or aesthetic integrity of the member or members.
- D. All repairs of defective areas shall conform to ACI 301. On areas requiring treatment of defects and until such repairs have been completed, only water cure will be permitted
- E. At any time prior to final acceptance, concrete found to be defective, damaged, or not in accordance with the specifications shall be repaired or removed and replaced with acceptable concrete.
- F. If approved by the Contracting Officer, repair or replace concrete with excessive honeycombing due to improper placement.



1. Honeycombed areas shall be removed down to solid concrete a minimum of 1 inch over the entire area. Feathered edges will not be permitted. If chipping is necessary, the edges shall be perpendicular to the surface or slightly undercut.
2. Laitance and soft material shall be removed prior to patching with a pea gravel concrete mix and bonding agent approved by the Engineer.
3. The area to be patched and an area at least 6 inches wide surrounding it shall be dampened to prevent absorption of water from the patching materials.
4. If a cement slurry bonding grout is approved, the heavy-cream consistency grout shall then be rigorously brushed into the surface. The concrete patch material shall be installed prior to the bonding grout skimming over or drying.
5. If approved, a bonding admixture, bonding compound, or epoxy adhesive may be used in strict accordance with the manufacturer's preparation and application recommendations. Comply with ACI 301 and ACI 503.2 for standard specifications for bonding plastic concrete to hardened concrete with a multiple component epoxy adhesive.
6. The repair concrete shall be thoroughly consolidated in place and struck off so as to leave the patch slightly higher than the surrounding surface. The concrete shall be left undisturbed for at least 1 hour to permit initial shrinkage then finished.
7. The patched area shall be kept damp for 7 days.
8. The color of the patch material shall match the color of the surrounding concrete. Repairs shall be made promptly while the base concrete is less than 28 days old.
9. Metal tools shall not be used in finishing a patch in a formed wall that will be exposed.
- G. Areas requiring patching shall not exceed 2 sq. ft. per 1000 sq. ft. of surface area and shall be widely dispersed. Areas showing excessive defects as determined by the Contracting Officer shall be removed and replaced.
- H. High spots identified in the floor flatness and levelness survey may be removed with bump grinding. Areas to be ground shall not exceed more than 10 percent of any one slab nor more than 5 percent of the total slab-on-grade area. There are no limitations for exterior concrete pavement areas requiring grinding.
- I. If approved by the Contracting Officer, concrete slab random cracking may be routed and sealed. The number of interior/exterior slabs to be routed and sealed shall not exceed more than 20 feet of any one slab nor more than 5 percent of the total number of slab-on-grade/pavement slabs. Slabs with more than one structural crack or with multiple cracks within a slab shall be removed and replaced. If random cracks are attributed to non-working sawcut control joints, uncracked joints parallel to the cracking shall be filled with a structural epoxy.
- J. Interior slab-on-grade subjected to lift truck traffic shall be routed and sealed with a semi-rigid epoxy sealant. Exterior slabs may be routed and sealed with the flexible joint sealant to be installed in pavement joints.

3.9 GROUTING

- A. After steel columns have been installed and leveled, grout the space between the bottom of the plate and concrete, using cement grout completely filling the space and forming solid bearing for the column base plate.

3.10 EVALUATION AND ACCEPTANCE OF CONCRETE

- A. Comply with ACI 301 and modifications in this section.
- B. Compressive strength
 1. Sets of standard-cured quality assurance cylinders will be taken by the Engineer during the progress of the work. The number of cylinder sets taken for each concrete mix design placed each day shall not be less than one set per day, nor less than one set for each 150 cu yds of concrete nor less than one set for each 5000 sq ft of surface area for slabs or walls.
 2. A set of cylinders consists of five cylinders cured in accordance with ASTM C31: one to be tested at 7 days and two to be tested and their strengths averaged at 28 days in accordance with ASTM



C31. The fourth and fifth cylinders may be used to test at other ages or to verify strength after 28 days in the event the 28-day strengths are low.

3. A 28-day compressive strength test shall consist of the average strength of at least two cylinders fabricated from a single load of concrete.
 4. The strength level of the concrete will be considered satisfactory so long as the averages of all sets of three consecutive strength tests equal or exceed the specified strength, f'_c , by more than 500 psi, not more than 10 percent of the tests are less than the specified 28-day strength, and no individual test is more than 500 psi below the 28-day specified strength.
 5. Should cylinder tests fail to meet the strength acceptance requirements or if deficient construction is suspected, core tests may be required and the costs of such tests paid by the Contractor. The Engineer shall identify core locations to least to impair the strength of the structure. Four-inch diameter cores shall be tested in accordance with ASTM C42.
 6. At least three representative cores shall be drilled from each member or area of concrete that is considered potentially deficient. If before testing, one or more cores shows evidence of having been damaged subsequent to or during the removal from the structure, it shall be replaced.
 7. Concrete in the area represented by core tests will be considered adequate if the average strength of the cores is equal to or at least 85 percent of and if no single core is less than 75 percent of the specified strength.
 8. Concrete that is deficient shall be isolated and retested to establish the boundary of deficient concrete. Concrete in the deficient area shall be removed and replaced.
 9. Core holes shall be repaired as directed by the Engineer.
- C. Air content will be determined in accordance with ASTM C231. The air content shall be taken with each set of test cylinders. If the air content is outside the specified range, the concrete shall be rejected. If concrete is to be air entrained for freeze-thaw durability, cores will be located to isolate deficient concrete by evaluating the air-void system in accordance with ASTM C457. Concrete in the deficient area shall be removed and replaced.
- D. Slump tests will be performed prior to placing the concrete. Such tests shall be made for each set of test cylinders defined for compressive strength. If the slump is outside the specified range, the concrete shall be rejected.
- E. The frequency of testing shall be increased if concrete fails to meet the acceptance criteria or if deemed by the Engineer to be too variable.

3.11 ACCEPTANCE OF STRUCTURE

- A. Comply with ACI 301 and modifications in this section.
- B. Completed concrete work, which meets all applicable requirements, will be accepted without qualification.
- C. Completed concrete work which fails to meet one or more requirements but which has been repaired to bring it into compliance will be accepted without qualification.
- D. Completed concrete work which fails to meet one or more requirements and which cannot be brought into compliance may be accepted or rejected by the Contracting officer. In this event, modifications may be required to assure that remaining work complies with the requirements.
- E. The costs of any additional tests or analysis, including additional architectural and engineering services, performed to prove the adequacy of the concrete work, shall be borne by the Contractor without extension of contract time.

3.12 MISCELLANEOUS CONCRETE

- A. Curbs: Provide monolithic finish to interior surface of curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.



- B. Equipment bases and foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment with template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

3.13 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Requirements:
1. Provide and maintain an adequate program of quality control for the materials, production methods, and workmanship to assure conformance of all work to the project contract documents. ACI 121R outlines the essential elements of the Material Control portion of the QA program.
 2. All materials, equipment, and methods shall be subject to verification inspections and/or testing as specified herein; ACI 121R.
 3. Testing and Evaluation:
 - a. Furnish and pay for the services of an independent Testing Laboratory satisfactory to the Contracting Officer. The testing laboratory shall have prime responsibility for review, verification inspection, and testing of the concrete producer's materials, operations, facilities, and quality control procedures and evaluating the results for conformance with these specifications complying with ACI 121R.
 - b. The Testing Laboratory will be required to provide evidence of recent inspection of its facilities by the Cement and Concrete Reference Laboratory of the National Bureau of Standards (NBS) and to show that any deficiencies have been corrected.
 - c. In addition to the requirements and duties in ACI 301 the testing laboratory shall provide the following:
 - 1) One or more additional test cylinders shall be taken during cold weather concrete placement and cured on the job site under conditions of concrete represented to determine safe form-stripping period.
 - 2) Sample (and test when directed by the contracting officer) each shipment of cement and aggregates and verify approved admixtures. Store samples in a protected place until authorized to dispose of them.
 - 3) Inspect concrete batching, mixing, and delivery operations periodically or as directed by the Contracting Officer.
 - 4) Review manufacturer's reports and/or certification for each shipment of cement and reinforcing steel and/or conduct laboratory tests or spot checks of the materials as received for compliance with specifications.
 - 5) Submit to the Contracting Officer and concrete producer, during construction, the results of concrete tests.
 - 6) Include the following information:
 - i. Date of placement.
 - ii. Structure and relative location.
 - iii. The concrete mix design.
 - iv. Unit weight of concrete - ASTM C138
 - v. Slump - ASTM C143
 - vi. Air content of freshly-mixed concrete by the pressure method, ASTM C231 or the volumetric method, ASTM C173.
 - vii. Concrete temperature (at placement time).
 - viii. Air temperature (at placement time).
 - ix. Strength determined in accordance with ASTM C39.
 - x. Other testing or inspection as required.
 - d. The Testing Laboratory shall assess and report floor flatness and levelness in accordance with ASTM E1155.
 - e. Field and concrete plant inspections are to be made by a competent representative of the Testing Laboratory during all structural concreting operations including periodic audit and spot check of the Producer's and/or Contractor's quality control procedures to assure proper and adequate control. When it appears that any material furnished fails to fulfill



specification requirements, the Testing Laboratory is to report such deficiency immediately to the Contracting Officer and appropriately record it in his report.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



SECTION 03 30 00 00 - MPF CAST-IN-PLACE CONCRETE**

NOTE TO SPECIFIER

Use this section for Mail Processing Facilities.

****THIS ENTIRE SECTION CONSISTS OF REQUIRED PARTS OR ARTICLES. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Includes all labor, materials and appliances, and perform all operations in connection with the installation of Concrete Work, and all related work incidental to the completion thereof, as shown on the drawings, complete, in strict accordance with the drawings and as specified herein. Section Includes:
 - 1. Cast-in-place (CIP) concrete in building frame elements, walls, foundations, foundation walls, slabs-on-grade, and mechanical equipment pads.
 - 2. Finishing of concrete floor slabs and toppings. Concrete liquid surface treatment, sealer, and slip-resistant coatings.
 - 3. Expansion and contraction, control joints in CIP concrete.
 - 4. Concrete curing and protection.
 - 5. Non-shrink grout including installation and forming.
 - 6. Testing related services.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents and References in Section 1.2.
- C. Related Sections: Related work specified elsewhere includes but may not be limited to
 - 1. Section 031000: Concrete Forming and Accessories
 - 2. Section 032000: Concrete Reinforcement

1.2 REFERENCES

- A. American Concrete Institute (ACI) Codes and Standards latest editions:
 - 1. ACI 117, "Standard Specification for Tolerances for Concrete Construction and Materials."
 - 2. ACI 301, "Specification for Structure /Concrete."
 - 3. ACI 302.1R, "Guide for Concrete Floor and Slab Construction."
 - 4. ACI 304R, "Guide for Measuring, Mixing, Transporting, and Placing Concrete."
 - 5. ACI 305, "Hot Weather Concreting."
 - 6. ACI 306, "Cold Weather Concreting."
 - 7. ACI 311, "Recommended Practice for Concrete Inspection."
 - 8. ACI 315, "Details and Detailing of Concrete Reinforcement."
 - 9. ACI 318, "Building Code Requirements for Structural Concrete."
 - 10. ACI 347, "Guide to Formwork for Concrete."

NOTE TO SPECIFIER



Insert additional code references required for specific project.

11. []

B. American Welding Society (AWS)

1. AWS D1.4, "Structural Welding Code Reinforcing."

C. American Society for Testing and Materials (ASTM).

1. ASTM A615, "Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement."
2. ASTM C33, "Standard Specification for Concrete Aggregates."
3. ASTM C94, "Standard Specification for Ready-Mixed Concrete."
4. ASTM C150, "Standard Specification for Portland Cement."
5. ASTM C260, "Standard Specification for Air Entraining Admixtures for Concrete."
6. ASTM C309, "Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete."
7. ASTM C494, "Standard Specification for Chemical Admixtures for Concrete."
8. ASTM C618, "Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete."
9. ASTM C989, "Standard Specification for Ground Granulated Blast-Furnace Slag for Use in

D. Concrete Reinforcing Steel Institute (CRSI),

1. CRSI "Manual of Standard Practice."

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

1. Product Data: Provide data technical, testing, and source for mix design materials and additives, steel reinforcement, joint sealant [, and other products as specified on the drawings.]
2. Shop Drawings: Provide shop drawings for reinforcement, layout, detailing, and placing prior to fabrication, site delivery, and installation.
 - a. Mix design submittals.
 - b. Rebar placing drawings (ACI 315, "Detailing Manual SP-66-(04)" or CRSI "Manual of Standard PracticeMSP-2-81"): Show bar sizes, bending, placing, spacing, locations, and quantities of reinforcing and wire fabric and supporting and spacing accessories. Provide steel order lists including bending and cutting details for all reinforcement shown on the structural design drawings.
 - c. Form construction details, including jointing, special formed joints or reveals, location and pattern of form tie placement [, and other items that affect exposed concrete visually.]
 - d. Calculations and layout drawings for formwork, shoring and/or reshoring [, and other submittals indicated on the drawings.] Work shall be prepared and signed and sealed by a Professional Engineer.
3. Assurance/Control Submittals:
 - a. Test Reports: Prepare reports in conformance with Section 014000 - Quality Requirements:
 - b. Submit laboratory test reports for concrete materials and mix designs for each strength and type of concrete proposed for use.
 - c. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
4. Delivery Tickets:
 - a. Copies of delivery tickets for each load of concrete delivered to site.
 - b. Indicate on each ticket the exact time that the mix is batched.
 - c. Mix identification number on ticket shall match number on submitted and approved mix design



- d. Submit copies to Testing Laboratory for verification of compliance with placing time.

NOTE TO SPECIFIER

Retain sub-section below if LEED criteria is required for project.

- B. LEED submittals:
1. Product data and statements for credits being considered.

1.4 QUALITY ASSURANCE

- A. Perform work in accordance with the Codes and Standards referenced in section 1.2 of this specification.
1. Provide qualification data for manufacturers and installers.
- B. Pre-Installation Conference:
1. Conduct a pre-installation conference prior to commencing Work of this Section.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver materials in unopened containers with labels identifying contents.
- C. Store powdered materials in dry area and in manner to prevent damage. Protect liquid materials from freezing or exceeding maximum storage temperatures set by product manufacturer.

1.6 ENVIRONMENTAL REQUIREMENTS

NOTE TO SPECIFIER

Specify project locations where fly ash and or ground granulated blast furnace slag are acceptable and areas where use is restricted, such as areas where rapid curing and early strength of concrete is required.

- A. Resource Management:
1. Recycled Content:
a. Concrete: Fly ash may be used as a substitute for a maximum of 25 percent of Portland cement unless otherwise specified by the engineer.
b. Concrete: Ground granulated blast furnace slag (GGBFS) may be used as a substitute for a maximum of 30 percent of Portland cement.
c. Steel Products: Post consumer recycled content plus one-half of preconsumer recycled not less than [] percent.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:



1. Applied Concrete Technology, Inc., Post Office Box 548, Grayslake, IL 60030, Toll Free: 800-228-6694, Phone: 847-548-2444, Fax: 847-548-2555. www.protecrete.com
2. The Euclid Chemical Company, 19218 Redwood Road, Cleveland, OH 44110, Phone: 216-1-9222, Toll Free: (800) 321-7628, Fax: 216-531-9596 www.euclidchemical.com.
3. Fortifiber Corporation, 419 W. Plumb Lane, Reno, NV 89509, Toll Free: 800-773-4777, Fax: 775-333-6411, Website: www.fortifiber.com.
4. ChemRex Inc., Shakopee, Minnesota 55379, Toll Free: 800-433-9517, Fax: 800-496-6067.
5. BASF Construction Chemicals North America (former Master Builders), 23700 Chagrin Boulevard, Cleveland, OH 44122, Phone: 216-839-7500, Fax: 216-839-8821.
6. W.R. Meadows, Inc., PO Box 338, Hampshire, Illinois 60140-0338, Toll Free: 800-342-5976, Phone: 847-683-4500.
7. Reef Industries, 9209 Almeda Genoa, Houston, Texas 77075, Phone: 713-507-4251, Toll Free: 800-231-6074, Fax: 713-507-4295.
8. Stego Industries LLC, 27442 Calle Arroyo Suite A, San Juan, Capistrano, CA 92675, Phone: 877-464-7834, Fax: 949-493-5165, www.stegoindustries.com.
9. L & M Construction Chemicals, Inc. 14851 Calhoun Rd., Omaha, NE 68152-1140; Phone: 402-453-6600, Fax: 402-453-0244.
10. Curecrete Chemical Company, Inc., 1203 W. Spring Creek Pl., Springville, UT Phone: 801- 489-5663.
11. Midwest Floor Care Inc., 17202 Princeton Rd, Adams, NE 68301, Phone: 402-788-2820.
12. General Resource Technology, Inc., 2978 Center Court, Eagan, MN 55121, Phone: 800-324-8154, Fax: 651-454-4252, www.grtinc.com.

B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150 – Type [] [supplement with] [fly ash] [ground granulated blast-furnace slag].
- B. Liquid admixtures: The following admixtures are permitted when approved in writing prior to use or are required as specified herein and shall be used in strict accordance with the manufacturer's specifications or recommendations:
1. Calcium chloride: Conform to ACI 301. The water soluble chloride ion level shall not exceed 0.3 percent by weight of cement.
 2. Air-entraining admixtures: ASTM C260 For steel hard trowel interior slab finish, do not use air entrainment admixtures.
 3. Water-reducing admixtures: Conform to ASTM C494, Type A.
 4. Water-reducing/accelerating admixtures: Conform to ASTM C494, Type C or E.
 5. Water-reducing/retarding admixtures: Conform to ASTM C494, Type D.
 - a. High-range/water-reducing (HRWR) admixtures: Conform to ASTM C494, Type F or G super plasticizers. HRWR admixture shall be used in concrete with a maximum water/cement ratio of 0.50 or less.

NOTE TO SPECIFIER

Specify project locations where fly ash and or ground granulated blast furnace slag are acceptable and areas where use is restricted, such as areas where rapid curing and early strength of concrete is required.



- C. Fly ash: Conform to ASTM C618. The use of a quality fly ash will be permitted as a cement-reducing admixture (minimum 15 percent and maximum 25 percent) unless otherwise restricted by the engineer. Fly ash used in concrete shall be from a single source and of a single class in combination with Portland cement of a single source and single class unless otherwise approved by the Engineer.
- D. Granulated Blast Furnace Slag is an alternative to fly ash and shall conform to ASTM C989 Grade 100 or 120. Granulated blast furnace slag may be used as a substitute for a maximum of 30 percent of Portland cement.

- E. Aggregates:
1. Normal-weight concrete - ASTM C33.
 2. Light-weight concrete – ASTM C330.
 3. Aggregates shall be from a single source.
- F. Water:
1. Clean, potable, and free of injurious amounts of oil, acid, alkali, organic or other deleterious matter not detrimental to concrete; drinkable.

2.3 GROUT/MORTARS

- A. Cement grout: Conform to ASTM C387 "Dry packaged mixtures".

NOTE TO SPECIFIER

Exposed slabs shall be sealed in a fashion compatible with the curing method specified.

2.4 CURING/SEALING/HARDENERS

- A. Dissipating liquid membrane-forming compounds for curing concrete; Conform to ASTM C309, Type 1. Curing compound shall be compatible with floor sealer or finish used. Low VOC.
- B. Method of curing shall be approved by the finish flooring applicator where finishes are indicated.
- C. Exterior Sealers: applied to horizontal concrete surfaces permanently exposed to salts, deicer chemicals and moisture, including parking decks. The manufacturer shall provide a five year labor and materials warranty on performance of the sealer. Sealer shall be compatible with the curing compound used.

NOTE TO SPECIFIER

The following materials provide varying levels of protection, sealant and hardness. Review products for project appropriateness.

- D. Liquid Densifier/Sealer/Hardener: to be applied on exposed concrete floors cured with dissipating membrane forming curing compound to harden and densify concrete surfaces. Sealers are to be clear, chemically reactive, a waterborne solution of silicate or silicate materials and proprietary components, odorless, and colorless.

2.5 JOINTS AND EMBEDDED ITEMS:

- A. Construction and Contraction Joints: Sealant shall be two-part semi-rigid epoxy, and shall have minimum Shore A Hardness of 80 when measured with ASTM D2240.



- B. Isolation Joints: Fillers shall consist of 1/8 inch width strips of neoprene, synthetic rubber, or approved substitute, extending the full depth of the slab. Sealant shall be two-part elastomeric type, polyurethane base.

2.6 VAPOR BARRIER/RETARDER

NOTE TO SPECIFIER

In the paragraph below, select [below] or [above] based on sub grade conditions and ACI committee 302 recommendations.

- A. Provide cover over prepared soil, [below][above] aggregate subbase material at slabs-on-grade, where shown on the plans with a minimum thickness of 10 mils.. Use only materials which are resistant to decay.

2.7 PROPORTIONING

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If laboratory trial batch method is used, use an independent testing facility acceptable to Contracting Officer for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing and inspection unless otherwise acceptable to Contracting Officer.
- B. Submit written reports to the testing laboratory of each proposed mix for each class of concrete. Do not begin concrete production until mixes have been reviewed and approved.
- C. Concrete types and strengths: Minimum 28 Day Compressive Strength shall be per design requirements but not less than:
1. Paving base, columns, beams, walls, foundations, and footings: 3,500 psi.
 2. Slab-on-grade: 4,000 psi.
 3. Normal or Lightweight concrete on metal deck: 3,000 psi.
 4. Tilt-up: 4,000 psi.

NOTE TO SPECIFIER

Insert if applicable to project.

5. All concrete exposed to weather shall be air entrained (ASTM C260).
6. All concrete shall be normal weight except as noted above.
7. []

- D. Durability: Conform to ACI 301.
1. All concrete exposed to potentially destructive weathering, such as freezing and thawing, or to de-icer chemicals is to be air-entrained, [] ± 1 percent.,
 2. Water-cement ratio: For concrete subject to freezing and thawing or deicer chemicals, the water-cement ratio shall not exceed 0.53 by weight including any water added.



- E. Slump: Conform to ACI 301 and to specific project mix requirements.
- F. Production of concrete: Conform to ACI 301:
 - 1. Cast-in-place concrete used in the work shall be produced at a single off-site batching plant or may be produced at an on-site batch plant.
 - 2. All concrete shall be proportioned conforming to the approved mix designs and of the materials contained in those approved mixes.
 - 3. Prior to adding a high-range water reducer (super plasticizer), slump shall not exceed the working limit.
 - 4. Ready-mixed and on-site batched concrete shall be batched, mixed, and transported in accordance with ASTM C94.
 - a. The concrete producer shall furnish duplicate delivery tickets, one for the Contractor and one given to the Owner's Representative for each batch of concrete. The information provided on the delivery ticket shall include the quantity of materials batched including the amount of free water in the aggregate and any water added onsite. Show the date, time of day batched, and if ready-mixed the time of discharge from the truck. The quantity of water that can be added at the site without exceeding the maximum water-cementitious ratio specified shall be noted on the delivery ticket.
 - 5. For concrete produced on site with a central batch plant, mixing shall be done in an approved batch mixer concrete shall be batched, mixed, and transported in accordance with ASTM C94.
 - 6. Variations in consistency during the discharge of a single batch shall not exceed 1 inch of slump, except that a greater variation will be permitted if the slump of the concrete decreases and no water is added.
 - 7. All other concrete: Conform to ACI 301
 - 8. When improved workability, pumpability, lower water-cement ratio, or high ultimate and/or early strength is required, the HRWR admixture (super plasticizer) may be used.
 - 9. Ensure air content for slabs with steel trowel finish is less than 3.0 percent.
 - 10. No water shall be added to concrete except under the direct awareness of the project inspector.
 - 11. Adjustments to concrete mixes: Mix design adjustments may be requested by Contractor for approval by the Engineer at no additional cost to Contracting Officer. Laboratory test data for revised mix design and strength results must be submitted and accepted before using in work.

2.8 FORMWORK

- A. Section 031000: Concrete Forming and Accessories

2.9 REINFORCING MATERIALS

- A. Section 032000: Concrete Reinforcement

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.



- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION - GENERAL

- A. Install all cast-in-place concrete work in accordance with ACI 301 except as herein specified.
- B. All bearing materials shall be inspected by the Geotechnical Engineer prior to placing concrete. The Geotechnical Engineer specify site preparation requirements and provide recommendations to the Architect/Engineer prior to placing concrete.
- C. Immediately before placing concrete, spaces to be occupied by concrete shall be free from standing water, ice, mud, and debris.
- D. Concrete shall not be deposited under water or where water in motion may injure the surface finish of the concrete.
- E. Forms and the reinforcement shall be thoroughly cleaned of ice and other coatings. Remove surplus form releasing agent from the contact face of forms.
- F. Notify all trades concerned and the Owner's Representative sufficiently in advance of the scheduled time for concrete placement to permit installation of all required work by other trades.
- G. Before placing concrete, all required embedded items, including dovetail anchor slots, anchors, inserts, curb angles, metal frames, fixtures, sleeves, drains, stair nosings, accessory devices for Mechanical and Electrical installations shall be properly located, accurately positioned and built into the construction, and maintained securely in place.
- H. Build into construction all items furnished by the Owner and other trades. Provide all offsets, pockets, slabs, chases and recesses as job conditions require.
- I. Place and properly support reinforcing steel and anchor bolts.
- J. The alignment, orientation, spacing, and embedment length of mechanical load transfer devices in slab-on-grade and pavements shall conform to dimensions and tolerances shown on the drawings.

3.3 INSTALLATION - FORMWORK

- A. Section 031000 Concrete Forming and Accessories
- B. Construction and Contraction Joints: Conform to ACI 301 and recommendations of ACI 302.1R.

3.4 REINFORCEMENT

- A. Placement: Section 032000 Concrete Reinforcement

3.5 METHODS OF PLACEMENT AND PLACING CONCRETE

- A. Placement: Conform to ACI 301:



1. Concrete shall be placed within 90 minutes after the water has been added to the cement and aggregates. Concrete shall be placed prior to initial concrete set.
 2. Placing of concrete will not be permitted during rainfall or when rain appears imminent. If rain should fall subsequent to placement, the concrete shall be completely protected until curing is complete.
 3. Cold-Weather Placement: Comply with provisions of ACI 306.1 "Standard Specifications for Cold-Weather Concreting" for placement at temperatures below 40 deg F (4 deg C).
 - a. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
 - b. Concrete shall not be placed on frozen ground or placed when the ambient temperature is 40 deg F or less and dropping.
 - c. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures using vented heaters and insulating blankets.
 - d. Concrete temperatures shall be maintained above 50 degrees F for the first 7 days of curing.
 4. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305R "Standard Specification for Hot-Weather Concreting" for placement at temperatures above 90 deg F (32 deg C).
 - a. Reject any concrete that has a temperature at the point of placement above 90 deg F unless approved otherwise by the Engineer. When air temperatures are between 80 and 90 deg F the maximum mixing and delivery time is reduced to 75 minutes. When air temperatures exceed 90 deg F, the maximum mixing and delivery time is reduced to 60 minutes.
 - b. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to the Engineer.
- B. Depositing Concrete
1. Deposit concrete as near its final position as possible to avoid segregation due to rehandling or flowing.
 2. The number, type, position, and design of joints shall be approved by the Engineer prior to concrete placement.
 3. The concreting shall be carried on at such a rate that the concrete is plastic at all times and flows readily into the spaces between reinforcing bars. No concrete that has partially hardened or been contaminated by foreign materials shall be deposited in the work
 4. When concreting is started, it shall be carried on as a continuous operation until the placing of the section is completed.
 5. Except as intercepted by joints, concrete shall be placed in continuous layers.
 6. Field records shall be kept of the time and date of the placing of each concrete pour. Locations where concrete test cylinders are made shall also be recorded. Records shall be kept on file at the job until its completion and shall be subject to the inspection of the Owner's Representative at all times.
- C. Joints
1. Joints shall be vertical in walls and horizontal in slabs [unless otherwise specified on the drawings].
 2. Dowel bars and tie bars shall be inspected
 3. Control joints for controlling concrete shrinkage shall be provided in floor slabs, walls, decks, conduits, and channels as shown on the plans or approved by the Engineer.
 4. Joint spacing and sawcut depth for slab-on-grade and concrete pavement shall conform to that shown on the pour sequencing plan and/or drawings.
 - a. Sawed control (contraction) joints for pavements and slab-on-grade shall be installed as soon as practical so as not to ravel the concrete but less than 12 hours.
 - b. Joint spacing shall in feet shall not exceed 2-1/2 times the slab thickness in inches unless otherwise approved by the Engineer.
 5. Joints in slabs shall align with joints in adjoining walls unless otherwise approved by the Architect/Engineer or shown in the drawings. Joints shall also line up with architectural reveals and form lines. All corners shall be relieved by cutting joint to adjacent control joint.

6. If there is a delay in casting but prior to concrete initial set, the concrete placed after the delay shall be thoroughly spaded and consolidated at the edge of that previously placed to avoid cold joints.
7. Where placing concrete is interrupted long enough for the concrete to take its initial set, the working face shall be made a construction joint.
 - a. Preparation and disposition of unplanned cold joints in walls shall be approved by the Engineer.
 - b. For slab-on-grade, pavements, sidewalk, and curb and gutter, concrete shall be removed back to the nearest planned joint and a construction joint installed.
8. Unless otherwise noted on the drawings, where concrete is to be placed against existing concrete, except in the case of expansion joints, the joint face of the existing concrete shall be roughened.
9. Corner sections of walls shall not be placed until the adjoining wall sections have cured at least 14 days.

D. Consolidation

1. All concrete shall be thoroughly consolidated by internal mechanical vibrators during the placing operation and shall be thoroughly worked around the reinforcement and embedded fixtures and into corners of the forms.
2. Consolidation shall be carried on continuously with the placing of concrete.
3. The vibrator shall be kept in nearly a vertical position as practicable. The use of vibrators to shift or drag concrete after deposition will not be permitted. Vibrators shall not be laid horizontally or laid over.
4. Concrete shall not be placed until the previous layer has been vibrated.
5. Unless directed otherwise by the Engineer, the top 2 feet of walls shall be re-vibrated approximately 1 hour after placement of concrete and while a running vibrator will still sink under its own weight into the concrete and liquefy it momentarily.

E. Protection of cast concrete: Conform to ACI 301.

F. Repair of surface defects: Conform to ACI 301.

3.6 FINISHING

A. Finishing of formed surfaces: ACI 301:

1. Tops of forms:
 - a. Strike concrete smooth at tops of forms.
 - b. Float to texture comparable to formed surfaces.
2. Formed surfaces:
 - a. Finished formed surfaces shall conform accurately to the shape, alignment, grades, and sections shown on the drawings or prescribed by the Engineer.
 - b. Surfaces shall be free from fins, bulges, ridges, honeycombing, or roughness of any kind and shall present a finished, smooth, continuous hard surface.
 - c. Rough form finish at unfinished areas unexposed to public view. Smooth form finish at surfaces exposed to public view.

B. Slabs: Minimum slab surface tolerance must satisfy ACI 301 and ACI 302.1R.

1. Slabs-on-grade:
 - a. For exposed slabs, install semi-rigid epoxy sealant in construction and contraction joints after slab has a minimum of 60 days or otherwise approved by the Engineer..
 - b. Allowable tolerance for slab on grade surfaces, measured in accordance with ACI 117 shall meet or exceed an overall value of FF35/FL25, with minimum local value of FF24/FL17.
2. Suspended Floor Slab:
 - a. Minimum surface tolerances: FF25 & FL20 overall and FF20 & FL15 local.
3. Concrete Finishes:
 - a. Floor Slabs: Steel trowel finish unless otherwise noted on the plans.
 - b. Exposed concrete slabs sealed or sealed and hardened using a liquid compound compatible with the curing method used.



- c. Exterior Concrete Finishes: Unless otherwise noted on the drawings, floors, walkways, and roof finishes shall be sloped a minimum 0.125 inch per foot to drain water. A light steel trowel with broom finish unless otherwise noted on the plans. Apply exterior sealer to surfaces exposed to deicer chemicals that is compatible with the curing method used.
- d. Exposed Ramps, Landings and Stair Treads: A light steel trowel with broom finish unless otherwise noted on the plans. Surfaces shall be sealed or sealed and hardened using a liquid compound compatible with the curing method used.
- e. A heavy broom finish shall be provided on disabled person ramps, utility ramps, and around exterior loading docks.

3.7 CURING, PROTECTION, LIQUID HARDNERS AND SEALERS

- A. Temperature, Wind, and Humidity
 - 1. When concrete slabs and other unformed concrete is placed in warm, dry, dusty, or windy conditions, concrete surfaces shall be protected from rapid drying by use of windbreaks, shading, fogging with properly designed nozzles, or a combination of these measures. Hot weather concreting procedures provided in ACI 305R shall be used when ambient conditions dictate.
 - 2. Cold weather concreting procedures provided in ACI 306R shall be used when ambient conditions dictate.
- B. Curing Compound
 - 1. All curing methods shall be placed [within two hours] after final finishing. All exposed surfaces of concrete including floor slabs, whether or not they receive a finish flooring, shall be protected from premature drying for a minimum of seven days.
 - 2. Apply the specified curing compound in accordance with manufacturer's written instructions.
 - 3. When used on an unformed concrete surface, application of the first coat of curing compound shall commence immediately after finishing operations have been completed. When curing compound is used on a formed concrete surface, the surface shall first be moistened with a fine spray of water immediately after the forms have been removed.
 - a. Surfaces shall be sprayed uniformly with 2 coats of curing compound. As soon as the first coat has become dry, a second coat shall be applied in the same manner. The direction of application of the second coat shall be perpendicular to the first coat.
 - 4. Curing compound shall not be used on any concrete surface specified to receive additional concrete, coatings, grout, and chemical treatment
- C. Protection
 - 1. Freshly placed concrete shall be protected against wash by rain.
 - 2. Dust control shall be provided in the surrounding areas during placement.
 - 3. During the first 2 day period of curing, no traffic on or loading of the floors will be permitted unless otherwise approved by the Engineer.
 - 4. The contractor shall allow no traffic and take precautions to avoid damage to the membrane of the curing compound for a period of not less than 28 days. Damage shall be repaired immediately.
 - 5. Self-supporting structures shall not be loaded in such a way to overstress the concrete.
- D. All floor slabs shall be cured using products and methods compatible with selected floor adhesives, toppings, and other finish materials.
- E. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
- F. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete according to manufacturer's written instruction.

3.8 PATCHING AND REPAIR



- A. All repairs of defective areas shall conform to ACI 301. On areas requiring treatment of defects and until such repairs have been completed, only water cure will be permitted
- B. At any time prior to final acceptance, concrete found to be defective, damaged, or not in accordance with the specifications shall be repaired or removed and replaced with acceptable concrete.
- C. Repair or replace concrete with excessive honeycombing due to improper placement.
 - 1. If approved, a bonding admixture, bonding compound, or epoxy adhesive may be used in accordance with the manufacturer's preparation and application recommendations. Comply with ACI 301 and ACI 503.2 for standard specifications for bonding plastic concrete to hardened concrete with a multiple component epoxy adhesive.
 - 2. The repair concrete shall be thoroughly consolidated in place and struck off so as to leave the patch slightly higher than the surrounding surface. The concrete shall be left undisturbed for at least 1 hour to permit initial shrinkage then finished.
 - 3. The patched area shall be kept damp for 7 days.
 - 4. The color of the patch material shall match the color of the surrounding concrete. Repairs shall be made promptly while the base concrete is less than 28 days old
- D. Areas showing excessive defects as determined by the Architect/Engineer shall be removed and replaced.
- E. High spots identified in the floor flatness and levelness survey may be removed with bump grinding. Areas to be ground shall not exceed more than 10 percent of any one slab nor more than 5 percent of the total slab-on-grade area.
- F. If approved by the Architect/Engineer, concrete slab random cracking may be routed and sealed. Slabs with more than one structural crack or with multiple cracks within a slab shall be removed and replaced. If random cracks are attributed to non-working sawcut control joints, uncracked joints parallel to the cracking shall be filled with a structural epoxy.
- G. Interior slab-on-grade subjected to lift truck traffic shall be routed and sealed with a semi-rigid epoxy sealant. Exterior slabs may be routed and sealed with the flexible joint sealant to be installed in pavement joints.

3.9 GROUTING

- A. After steel columns have been installed and leveled, grout the space between the bottom of the plate and concrete, using cement grout completely filling the space and forming solid bearing for the column base plate.

3.10 EVALUATION AND ACCEPTANCE OF CONCRETE

- A. Comply with ACI 301, ACI 318-Chapter 5 and ACI 311 for compressive strength, slump, and frequency of testing.
- B. The frequency of testing indicated in the aforementioned codes and standards shall be increased if concrete fails to meet the acceptance criteria or if deemed by the Engineer to be too variable.

3.11 ACCEPTANCE OF STRUCTURE

- A. Comply with ACI 301 and modifications in this section.
- B. Completed concrete work, which meets all applicable requirements, will be accepted without qualification.



- C. Completed concrete work which fails to meet one or more requirements but which has been repaired to bring it into compliance will be accepted without qualification.
- D. Completed concrete work which fails to meet one or more requirements and which cannot be brought into compliance may be accepted or rejected by the Contracting officer. In this event, modifications may be required to assure that remaining work complies with the requirements.
- E. The costs of any additional tests or analysis, including additional architectural and engineering services, performed to prove the adequacy of the concrete work, shall be borne by the Contractor without extension of contract time.

3.12 MISCELLANEOUS CONCRETE

- A. Curbs: Provide monolithic finish to interior surface of curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- B. Equipment bases and foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment with template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

3.13 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Requirements:
 - 1. Provide and maintain an adequate program of quality control for the materials, production methods, and workmanship to assure conformance of all work to the project contract documents.
 - 2. Testing and Evaluation:
 - a. Furnish and pay for the services of an independent Testing Laboratory satisfactory to the Contracting Officer. The testing laboratory shall have prime responsibility for review, verification inspection, and testing of the concrete producer's materials, operations, facilities, and quality control procedures and evaluating the results for conformance with these specifications.
 - b. In addition to the requirements and duties in ACI 301 the testing laboratory shall provide the following:
 - a. One or more additional test cylinders shall be taken during cold weather concrete placement and cured on the job site under conditions of concrete represented to determine safe form-stripping period.
 - b. Inspect concrete batching, mixing, and delivery operations periodically or as directed by the Contracting Officer.
 - c. Submit to the Contracting Officer and concrete producer, during construction, the results of concrete tests.
 - c. The Testing Laboratory shall assess and report floor flatness and levelness in accordance with the requirements of this specification.
 - d. Field and concrete plant inspections are to be made by a competent representative of the Testing Laboratory during all structural concreting operations including periodic audit and spot check of the Producer's and/or Contractor's quality control procedures to assure proper and adequate control. When it appears that any material furnished fails to fulfill specification requirements, the Testing Laboratory is to report such deficiency immediately to the Contracting Officer and appropriately record it in his report.



Last revised: 3/31/2010

END OF SECTION 03 30 00 00



Task	Specification	Specification Description
03 31 13 00	32 01 11 53	Cement Concrete Pavement
03 31 13 00	32 13 13 17	Roller Compacted Concrete Pavement



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SECTION 03 41 16 00 - PRECAST LIGHTWEIGHT ROOF SLABS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of precast lightweight roof deck concrete channels, concrete planks, and gypsum planks. Products shall be as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

1.2 PRODUCTS

- A. Channel Slabs: Slabs shall be composed of Portland cement and lightweight aggregate with minimum compressive strength 3,750 psi. Legs shall be reinforced with deformed bars; web shall have welded wire fabric reinforcement. Channels shall support a 30 psf live load plus a 20 psf superimposed dead load.
- B. Concrete Planks: Planks shall be composed of Portland cement and lightweight aggregate with a minimum compressive strength of 3,750 psi. Planks shall be reinforced with welded wire fabric. Planks shall support a 30 psf live load plus a 20 psf superimposed dead load.
- C. Gypsum Planks shall conform to ASTM C 956, factory-laminated to 2-inch thickness, 2-foot wide panels. Planks shall be continuously supported along sides.
- D. Subpurlins shall be bulb-ties, ASTM A 440.
- E. Grout shall be lightweight concrete or gypsum concrete.

1.3 EXECUTION

- A. Concrete Channels and Planks shall be securely attached to support steel or concrete by metal clips or other approved attachments; minimum support bearing shall be 4 inches. Open joints between channels or planks shall be filled with lightweight concrete grout. Planks with tongue and groove edges may not require grouting.
- B. Gypsum Planks shall be snugly fit between bulb-tee subpurlins. Subpurlins shall be tack-welded or screw-attached to supporting steel or weld bar cast in supporting concrete. Joints at bulb-tees shall be grouted with gypsum grout.

END OF SECTION 03 41 16 00



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SECTION 03 41 26 00 - UNBONDED POST-TENSIONED CONCRETE

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for unbonded post-tensioned concrete. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Furnishing post-tensioning reinforcement and accessories including non-encapsulated and encapsulated prestressing tendons, pocket formers, support bars, bar chairs, and slab bolsters.
 - b. Installing post-tensioning tendons.
 - c. Performing post-tensioning operations including stressing and finishing tendons.
 - d. Recording tendon elongations and gage pressures.
 - e. Finishing tendon ends and patching stressing pockets.

C. Definitions

1. Strand Tail: Excess strand length extending past the anchorage device.
2. Stressing Blockout: Opening created in the slab to allow access to stressing-end anchorages.
3. Stressing Pocket: Void formed by pocket former at stressing-end anchorage to provide required cover over wedges and strand tail.
4. Wedge Cavity: Cone-shaped hole in anchorage device designed to hold the wedges that anchor the strand.

D. Performance Requirements

1. Structural Performance: Design cast-in-place, post-tensioned concrete reinforcement as indicated in this Section. Show final effective forces, tendon profiles, and nonprestressed reinforcement on design Shop Drawings.
2. Employ professional Engineer, registered in <Insert State>, and acceptable to the Owner, to perform design. Sign and seal design Shop Drawings and design calculations submitted to the Owner for review. Prepare and seal drawings and calculations for submittal to authorities having jurisdiction. Comply with design intent, criteria, and requirements of the Contract Documents.
3. Design structure to withstand loads according to governing codes, within limits and under conditions indicated.
4. Average Precompression:
 - a. Minimum Average Slab Precompression: 125 psi (0.86 MPa) **OR** 200 psi (1.4 MPa), **as directed**.
 - b. Maximum Average Slab Precompression: 300 psi (2.1 MPa) **OR** 500 psi (3.4 MPa), **as directed**.
 - c. Minimum Average Precompression in T-, L-, and Rectangular-Beam Cross Sections: 200 psi (1.4 MPa).
 - d. Minimum Precompression in Slab Section Not Included in T- or L-Beam Section: 100 psi (0.7 MPa).
 - e. Maximum Precompression in Transfer Girders: 1000 psi (6.9 MPa). Specify stage-stressing sequence to avoid overstress.
5. Comply with ACI 318 (ACI 318M) limits on stresses at transfer of prestress and under service load.
6. Comply with ACI 318 (ACI 318M) requirements for minimum bonded reinforcement.
7. Comply with ACI 318 (ACI 318M) requirements for concrete cover over reinforcement.

8. Design members such that thickness and concrete cover over reinforcement comply with fire-resistance requirements of authorities having jurisdiction.
9. Design members such that thickness and concrete cover over reinforcement comply with the following fire-resistance requirements:
 - a. Slabs: Two hours.
 - b. Beam: Two hours.
10. Deflection Limits Including Creep and Shrinkage Effects:
 - a. Total Dead Load: $L/600$.
 - b. Total Dead Plus Live Load: $L/360$.
11. Slab Design:
 - a. Minimum Slab Thickness: 5-1/2 inches (140 mm).
 - 1) Minimum Thickness if Conduit Is Embedded: 6 inches (150 mm).
 - 2) Maximum Span/Depth Ratio: 45.
 - b. Locate closure strips at midspan and adjust tendon forces and profiles accordingly. Calculate moments in spans with closure strips assuming a continuous slab. Provide only nonprestressed reinforcement within closure strips. Design reinforcement in closure strip to carry ultimate moment at midspan.

E. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
3. Shop Drawings: Installation drawings including plans, elevations, sections, details, and notes prepared by or under the supervision of a registered professional engineer detailing tendon layout and installation procedures.
4. Product Certificates:
5. Qualification Data: For Installer, manufacturer, and testing agency.
6. Mill Test Reports: For prestressing strand.
7. Field quality-control test reports.
8. Calibration Certificates: For jacks and gages.
9. Stressing Records: Filled out by testing agency during stressing operation with the following information recorded:
 - a. Name of Project.
 - b. Date of approved installation drawings used for installation and stressing.
 - c. Floor number and concrete placement area.
 - d. Date of stressing operation.
 - e. Weather conditions including temperature and rainfall.
 - f. Name and signature of inspector.
 - g. Name of individual in charge of stressing operation.
 - h. Serial or identification numbers of jack and gage.
 - i. Date of jack-and-gage calibration certificates.
 - j. Gage pressure to achieve required stressing force per supplied calibration chart.
 - k. Tendon identification mark.
 - l. Calculated tendon elongation.
 - m. Actual tendon elongation.
 - n. Actual gage pressure.

F. Quality Assurance

1. Installer Qualifications: A qualified installer whose full-time Project superintendent has successfully completed PTI's Level 1 - Field Fundamentals course or has equivalent verifiable experience and knowledge acceptable to the Owner.



- a. Superintendent must have received training from post-tensioning supplier in the operation of stressing equipment to be used on Project.
 2. Manufacturer Qualifications: Fabricating plant certified by PTI.
 3. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 - a. Testing Agency Inspector: Personnel performing field inspections and measuring elongations shall have successfully completed PTI's Level 1 - Field Fundamentals course or shall have equivalent qualifications acceptable to the Owner.
 4. ACI Publications: Comply with ACI 423.6, "Specification for Unbonded Single Strand Tendons," unless otherwise indicated in the Contract Documents.
 5. Preinstallation Conference: Conduct conference at Project site.
- G. Delivery, Storage, And Handling
1. Deliver, store, and handle post-tensioning materials according to PTI's "Field Procedures Manual for Unbonded Single Strand Tendons."
- H. Coordination
1. Attachments and Penetrations:
 - a. Attach permanent fixtures such as curtain-wall systems, handrails, fire-protection equipment, lights, and security devices to the slab using embedded anchors. Drilled anchors are not allowed unless authorized in writing by the Owner.
 - b. Power-driven fasteners are not allowed unless authorized in writing by the Owner.
 - c. Core drilling for sleeves or other penetrations is not allowed unless authorized in writing by the Owner.
 - d. Protect penetrations within 18 inches (460 mm) of an anchorage with ASTM A 53/A 53M, Schedule 40 steel pipe.

1.2 PRODUCTS

- A. Prestressing Tendons
1. Prestressing Strand: ASTM A 416/A 416M, Grade 270 (Grade 1860), uncoated, 7-wire, low-relaxation, 0.5-inch- (12.7-mm-) **OR** 0.6-inch- (15.2-mm-), **as directed**, diameter strand.
 2. Post-Tensioning Coating: Compound with friction-reducing, moisture-displacing, and corrosion-inhibiting properties specified in ACI 423.6; chemically stable and nonreactive with prestressing steel, nonprestressed reinforcement, sheathing material, and concrete.
 - a. Minimum Coating Weight: 2.5 lb (1.14 kg) for 0.5-inch- (12.7-mm-) diameter strand **OR** 3 lb (1.36 kg) for 0.6-inch- (15.2-mm-) diameter strand, **as directed**, per 100 feet (30 m) of strand.
 - b. Completely fill annular space between strand and sheathing over entire tendon length with post-tensioning coating.
 3. Tendon Sheathing: Comply with ACI 423.6.
 - a. Minimum Thickness: 0.050 inch (1.25 mm) for polyethylene or polypropylene with a minimum density of 0.034 lb/cu. in. (0.9 g/cu. cm).
 - b. Continuous over the entire length of tendon to provide watertight encapsulation of strand and between anchorages to prevent intrusion of cement paste or loss of coating for a non-encapsulated system.
 4. Anchorage Device and Coupler Assembly: Assembly of strand, wedges, and anchorage device or coupler complying with static and fatigue testing requirements in ACI 423.6 and capable of developing 95 percent of actual breaking strength of strand.
 - a. Anchorage Bearing Stresses: Comply with ACI 423.6 for stresses at transfer load and service load.
 - b. Fixed-End Anchorage Device Assemblies: Plant fabricated with wedges seated at a load of not less than 80 percent and not more than 85 percent of breaking strength of strand.
 5. Encapsulation System: Watertight encapsulation of prestressing strand consisting of the following:



- a. Wedge-Cavity Caps: Attached to anchorages with a positive mechanical connection and completely filled with post-tensioning coating.
 - 1) Caps for Fixed and Stressing-End Anchorages Devices: Designed to provide watertight encapsulation of wedge cavity. Sized to allow required extension of strand past the wedges.
 - a) Attach cap for fixed-end anchorage device in fabricating plant.
 - 2) Caps at Intermediate Anchorages: Open to allow passage of strand.
 - b. Sleeves: Attached to anchorage device with positive mechanical connection; overlapped a minimum of 4 inches (100 mm) with sheathing and completely filled with post-tensioning coating.
- B. Nonprestressed Steel Bars
1. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 **OR** 60, **as directed**, percent.
 2. Support Bars, Reinforcing Bars, Hairpins: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed. Minimum support bar size is 1/2 inch (13 mm).
 3. Low-Alloy-Steel Support Bars, Reinforcing Bars, Hairpins: ASTM A 706/A 706M, deformed.
 4. Galvanized Support Bars, Reinforcing Bars, Hairpins: ASTM A 615/A 615M, Grade 60 (Grade 420) **OR** ASTM A 706/A 706M, **as directed**, deformed bars, ASTM A 767/A 767M, Class I **OR** II, **as directed**, zinc coated after fabrication and bending.
 - a. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.
 5. Epoxy-Coated Support Bars, Reinforcing Bars, Hairpins: ASTM A 615/A 615M, Grade 60 (Grade 420) **OR** ASTM A 706/A 706M, **as directed**, deformed bars, ASTM A 775/A 775M epoxy coated with less than 2 percent damaged coating in each 12-inch (300-mm) bar length.
 - a. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on bars and complying with ASTM A 775/A 775M. Repair damaged areas according to ASTM D 3963/D 3963M.
 6. Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening tendons and tendon support bars in place. Manufacture bar supports, according to CRSI's "Manual of Standard Practice," from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:
 - a. For uncoated bars, use all-plastic **OR** CRSI Class 1 plastic-protected **OR** CRSI Class 2 stainless-steel, **as directed**, bar supports.
 - b. For epoxy-coated bars, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire **OR** all-plastic, **as directed**, bar supports.
 - c. For zinc-coated bars, use galvanized wire or dielectric-polymer-coated wire **OR** all-plastic, **as directed**, bar supports.
- C. Accessories
1. Pocket Formers: Capable of completely sealing wedge cavity; sized to provide the required cover over the anchorage and allow access for cutting strand tail.
 2. Anchorage Fasteners: Stainless-steel **OR** Galvanized steel **OR** Uncoated steel, **as directed**, nails, wires, and screws used to attach anchorage devices to formwork.
 3. Sheathing Repair Tape: Elastic, self-adhesive, moistureproof tape with minimum width of 2 inches (50 mm), in contrasting color to tendon sheathing; nonreactive with sheathing, coating, or prestressing steel.
- D. Patching Material
1. Patching Material: One component, polymer-modified, premixed patching material containing selected silica aggregates and portland cement, suitable for vertical and overhead application. Do not use material containing chlorides or other chemicals known to be deleterious to prestressing steel or material that is reactive with prestressing steel, anchorage device material, or concrete.



1.3 EXECUTION

A. Formwork

1. Provide formwork for post-tensioned elements as specified in Division 03 Section "Cast-in-place Concrete". Design formwork to support load redistribution that may occur during stressing operation. Ensure that formwork does not restrain elastic shortening, camber, or deflection resulting from application of prestressing force.
2. Do not remove forms supporting post-tensioned elements until tendons have been fully stressed and elongations have been approved by the Owner, unless authorized in writing by the Owner.
3. Do not place concrete in supported floors until tendons on supporting floors have been stressed and elongations have been approved by the Owner, unless authorized in writing by the Owner.

B. Nonprestressed Steel Reinforcement Placement

1. Placement of nonprestressed steel reinforcement is specified in Division 03 Section "Cast-in-place Concrete". Coordinate placement of nonprestressed steel reinforcement with installation of post-tensioning tendons.

C. Tendon Installation

1. Install tendons according to approved installation drawings and procedures stated in PTI's "Field Procedures Manual for Unbonded Single Strand Tendons."
2. Tendon Supports: Provide continuous slab bolsters or bars supported on individual high chairs spaced at a maximum of 42 inches (1070 mm) o.c. to ensure tendons remain in their designated positions during construction operations and concrete placement.
 - a. Support tendons as required to provide profiles shown on installation drawings. Position supports at high and low points and at intervals not exceeding 48 inches (1220 mm). Ensure that tendon profiles between high and low points are smooth parabolic curves.
 - b. Attach tendons to supporting chairs and reinforcement without damaging tendon sheathing.
 - c. Support slab tendons independent of beam reinforcement.
3. Maintain tendon profile within maximum allowable deviations from design profile as follows:
 - a. 1/4 inch (6.3 mm) for member depth less than or equal to 8 inches (200 mm).
 - b. 3/8 inch (10 mm) for member depth greater than 8 inches (200 mm) and less than or equal to 24 inches (610 mm).
 - c. 1/2 inch (13 mm) for member depth greater than 24 inches (610 mm).
4. Maintain minimum radius of curvature of 480-strand diameters for lateral deviations to avoid openings, ducts, and embedded items. Maintain a minimum of 2 inches (50 mm) of separation between tendons at locations of curvature.
5. Limit tendon bundles to five tendons. Do not twist or entwine tendons within a bundle. Maintain a minimum distance of 12 inches (300 mm) between center of adjacent bundles.
6. If tendon locations conflict with nonprestressed reinforcement or embedded items, tendon placement governs unless changes are authorized in writing by the Owner. Obtain the Owner's approval before relocating tendons or tendon anchorages that interfere with one another.
7. Deviations in horizontal spacing and location of slab tendons are permitted when required to avoid openings and inserts.
8. Installation of Anchorage Devices:
 - a. Place anchorage devices at locations shown on approved installation drawings.
 - b. Do not switch fixed and stressing-end anchorage locations unless authorized in writing by the Owner.
 - c. Attach pocket formers, intermediate anchorage devices, and stressing-end anchorage devices securely to bulkhead forms. Install stressing-end and intermediate anchorage devices perpendicular to tendon axis.
 - d. Install tendons straight, without vertical or horizontal curvature, for a minimum of 12 inches (300 mm) behind stressing-end and intermediate anchorages.
 - e. Embed intermediate anchorage devices at construction joints in first concrete placed at joint.

- f. Minimum splice length in reinforcing bars at anchorages is 24 inches (600 mm). Stagger splices a minimum of 60 inches (1500 mm).
 - g. Place fixed-end anchorage devices in formwork at locations shown on installation drawings. Support anchorages firmly to avoid movement during concrete placement.
 - h. Remove loose caps on fixed-end anchorages, refill with post-tensioning coating, and re-attach caps to achieve a watertight enclosure.
 - 9. Maintain minimum concrete cover as follows:
 - a. From Exterior Edge of Concrete to Wedge Cavity: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**.
 - b. From Exterior Edge of Concrete to Strand Tail: 3/4 inch (19 mm).
 - c. From Exterior Edge of Concrete to Wedge-Cavity Cap: 1 inch (25 mm).
 - d. Top, Bottom, and Edge Cover for Anchorage Devices: 3/4 inch (19 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
 - 10. Maintain minimum clearance of 6 inches (150 mm) between tendons and openings.
 - 11. Prior to concrete placement, mark tendon locations on formwork with spray paint.
 - 12. Do not install sleeves within 36 inches (914 mm) of anchorages after tendon layout has been inspected unless authorized in writing by the Owner.
 - 13. Do not install conduit, pipe, or embeds requiring movement of tendons after tendon layout has been inspected unless authorized in writing by the Owner.
 - 14. Do not use couplers unless location has been approved by the Owner.
- D. Sheathing Inspection And Repair
 - 1. Inspect sheathing for damage after installing tendons. Repair damaged areas by restoring post-tensioning coating and repairing or replacing tendon sheathing.
 - a. Ensure that sheathing is watertight and there are no air voids.
 - b. Follow tape repair procedures in PTI's "Field Procedures Manual for Unbonded Single Strand Tendons."
 - 2. Maximum length of exposed strand behind anchorages is as follows:
 - a. Fixed End: 12 inches (300 mm).
 - b. Intermediate and Stressing End: 0 inches (0 mm) **OR** 1 inch (25 mm), **as directed**.
 - 1) Cover exposed strand with sheathing repair tape to prevent contact with concrete.
 - 3. Immediately remove and replace tendons that have damaged strand.
- E. Concrete Placement
 - 1. Do not place concrete until placement of tendons and nonprestressed steel reinforcement has been inspected by special inspector **OR** testing agency, **as directed**.
 - 2. Provide the Owner and special inspector **OR** testing agency, **as directed**, a minimum of 48 hours' notice before concrete placement.
 - 3. Place concrete as specified in Division 03 Section "Cast-in-place Concrete". Ensure compaction of concrete around anchorages.
 - 4. Ensure that position of tendon and nonprestressed steel reinforcement does not change during concrete placement. Reposition tendons and nonprestressed steel reinforcement moved during concrete placement.
 - 5. Ensure that method of concrete placement does not damage tendon sheathing. Do not support pump lines, chutes, or other concrete placing equipment on tendons.
- F. Tendon Stressing
 - 1. Calibrate stressing jacks and gages at start of job and at least every six months thereafter. Keep copies of calibration certificates for each jack-and-gage pair on Project site and available for inspection. Exercise care in handling stressing equipment to ensure that proper calibration is maintained.
 - 2. Stress tendons only under supervision of qualified post-tensioning superintendent.
 - 3. Do not begin stressing operations until concrete strength has reached 3000 psi (20.7 MPa) as indicated by compression tests of field-cured cylinders.
 - 4. Complete stressing within 96 hours of concrete placement.



5. If concrete has not reached required strength, obtain the Owner's approval to partially stress tendons and delay final stressing until concrete has reached required strength.
 6. Stage stress transfer girders **OR** foundation mats, **as directed**, according to schedule shown on the Contract Drawings.
 7. If detensioning and restressing of tendon is required, discard wedges used in original stressing and provide new wedges.
 8. Mark and measure elongations according to PTI's "Field Procedures Manual for Unbonded Single Strand Tendons." Measure elongations to closest 1/8 inch (3.2 mm).
 9. Submit stressing records within one day of completion of stressing. If discrepancies between measured and calculated elongations exceed plus or minus 7 percent, resolve these discrepancies to satisfaction of the Owner.
 10. Prestressing will be considered acceptable if gage pressures shown on stressing record correspond to required stressing force and calculated and measured elongations agree within 7 percent.
 11. If measured elongations deviate from calculated elongations by more than 7 percent, additional testing, restressing, strengthening, or replacement of affected elements may be required.
- G. Tendon Finishing
1. Do not cut strand tails or cover anchorages until stressing records have been reviewed and approved by the Owner.
 2. Cut strand tails as soon as possible after approval of elongations.
 3. Cut strand tail between 1/2 and 3/4 inch (13 and 19 mm) from wedges. Do not damage tendon or concrete during removal of strand tail. Acceptable methods of cutting strand tail include the following:
 - a. Oxyacetylene flame.
 - b. Abrasive wheel.
 - c. Hydraulic shears.
 - d. Plasma cutting.
 4. Install caps and sleeves on intermediate anchorages within one day of stressing.
 5. Cut strand tails and install caps on stressing-end anchorages within one day of the Owner's acceptance of elongations.
 6. Patch stressing pockets within one day of cutting strand tail. Clean inside surface of pocket to remove laitance or post-tensioning coating before installing patch material. Finish patch material flush with adjacent concrete.
- H. Field Quality Control
1. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports. Cooperate with testing agency to facilitate the execution of its duties.
 - a. Before concrete placement, special inspector **OR** testing agency, **as directed**, will inspect the following for compliance with post-tensioning installation drawings and the Contract Documents:
 - 1) Location and number of tendons.
 - 2) Tendon profiles and cover.
 - 3) Installation of backup bars, hairpins, and other nonprestressed reinforcement shown on post-tensioning installation drawings.
 - 4) Installation of pocket formers and anchorage devices.
 - 5) Repair of damaged sheathing.
 - 6) Connections between sheathing and anchorage devices.
 - b. Special inspector **OR** Testing agency, **as directed**, will record tendon elongations during stressing.
 - c. Special inspector **OR** Testing agency, **as directed**, will immediately report deviations from the Contract Documents to the Owner.
- I. Protection



1. Do not expose tendons to electric ground currents, welding sparks, or temperatures that would degrade component.
2. Protect exposed components within one workday of their exposure during installation.
3. Prevent water from entering tendons during installation and stressing.
4. Provide weather protection to stressing-end anchorages if strand tails are not cut within 10 days of stressing the tendons.

J. Repairs

1. Submit repair procedure to the Owner for evaluation and approval.
2. Do not proceed with repairs requiring removal of concrete unless authorized in writing by the Owner.

END OF SECTION 03 41 26 00



SECTION 03 47 13 00 - MPF TILT-UP CONCRETE**

NOTE TO SPECIFIER

Use this section for Mail Processing Facilities.

****THIS ENTIRE SECTION CONSISTS OF REQUIRED PARTS OR ARTICLES. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Tilt-up sitecast concrete wall panels, non-load bearing, erected from mold to final position.
2. Supports, devices, and attachments.
3. Reinforcement, anchorages, and accessories.

B. Related Sections:

1. Section 012300 - Alternates.
2. Section 033000 - Cast-In-Place Concrete: Grout and concrete curing.
3. Section 051200 - Structural Steel Framing: Support plates and angles with anchor studs, expansion bolts, and epoxy bolts which are embedded in or cast into concrete for supporting structural steel, steel joists, and steel deck.
4. Section 055000 - Metal Fabrications: Other metal components cast into concrete.
5. Section 076200 - Sheet Metal Flashing and Trim: Counterflashing receivers or reglets.
6. Section 079200 - Joint Sealants: Installation of panel joint sealers.
7. Section 099100 - Painting: Priming metal inserts.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A 615 - Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
2. ASTM C 33 - Specification for Concrete Aggregates.
3. ASTM C 94 - Specification for Ready-mixed Concrete.
4. ASTM C127 - Test Method for Specific Gravity and Absorption of Course Aggregate.
5. ASTM C128 - Test Method for Specific Gravity and Absorption of Fine Aggregate.
6. ASTM C 150 - Specification for Portland Cement.
7. ASTM C 260 - Specification for Air-Entraining Admixtures for Concrete.

B. American Welding Society (AWS):

1. AWS D1.1 - Structural Welding Code.

C. Concrete Reinforcing Steel Institute (CRSI):

1. CRSI Manual of Practice.

D. Portland Cement Association (PCA):

1. PCA EB 074D - Tilt-Up Load-Bearing Walls.
2. PCA EB 079B - Tilt-Up Concrete Walls.
3. PCA EB 110D - Connections for Tilt-Up Wall Construction.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements:
1. Concrete tilt-slab panels are designed for in place stresses only. Lifting and handling stress design is responsibility of Contractor and erector. Execute design for lifting, handling, and erection stresses by a registered Professional Engineer in the State in which the project is located.
 2. Design units and connections for wind load as indicated on Drawings and as required by governing codes. Design units and connections to withstand applicable dead loads and erection stresses.
 3. Design tilt-up units and connections in accordance with, as general guides, PCA EB 074D, PCA EB 079 B, and PVA EB 110D.
 4. Provide sealed and finished panel joints to match and coincide with location of vertical rustication joints.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
1. Shop Drawings: Indicate layout, tilt-up unit locations, configuration, unit identification marks, reinforcement, connection details, support items, location of lifting devices, dimensions, openings, and relationship to adjacent components.
 2. Product Data: Adhesive (Alternate 1 Section 012300)
 3. Calculations including load exerted on the slab during forming and lifting panels in place for Alternates 1 Section 012300

1.5 QUALITY ASSURANCE

- A. Qualifications:
1. Fabricator: Company specializing in performing Work of this Section with minimum five years documented experience with established quality control program in effect.
 2. Erector: Company specializing in performing precast concrete erection Work of this Section with minimum five years documented experience.
 3. Welding: AWS D1.1.
 4. Fabricator and Erector: Certify and indicate experienced personnel, physical facilities, management process, and quality control procedures.
- B. Regulatory Requirements: Construct and install precast concrete wall panels to meet requirements of local governing building code.
- C. Mock-Ups:
1. Fabricate and erect at site, one full size panel, illustrating shape, lifting device, and attachment points, and finish.
 2. Fabricate and erect at location determined by Contracting Officer
 3. Prepare a sample of repairs.
 4. Obtain inspection and approval of wall panel and repair samples.
 5. Approved mock-up may remain as part of Work.
- D. Pre-Installation Meeting:
1. Convene a pre-installation meeting at site, one week prior to commencing Work of this Section. Require attendance of parties directly affecting Work of this Section, including, but not limited to, Contracting Officer Contractor, Construction Manager, Tilt-up Concrete Wall Panel Fabricator and Tilt-up Concrete Wall Panel Erector.
 2. Contact Construction Manager two weeks prior to pre-installation meeting to confirm schedule.



3. Review preparation and installation procedures and coordinate scheduling required with related Work.
4. Record discussions of meeting and decisions and agreements (or disagreements) reached, and furnish copy of record to each party attending. Review foreseeable methods and procedures related to Manufactured Wall Panel Work, including:
 - a. Discuss procedures for Bid Alternate 1 in Section 012300, and set up guidelines if the Contracting Officer elects to proceed with Bid Alternate 1.
 - b. Tour, inspect, and discuss conditions of wall panel casting, erection, attachment structure components, locations, and other preparatory work performed by other trades.
 - c. Review wall panel system requirements (drawings, specifications, and other Contract Documents).
 - d. Review required submittals, both completed and yet to be completed.
 - e. Review and finalize construction schedule related to wall panel work and verify availability of materials, erector's personnel, equipment and facilities needed to make progress and avoid delays.
 - f. Review required inspections, testing, certifying, and material usage accounting procedures.
 - g. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Cast panels on the slab on grade after the slab has reached its designed compressive strength. The formwork shall be secured on the slab on ground with screws using predrilled holes. A repair method must be submitted and a sample of repairs must be prepared with the mock up for approval. The precast concrete panels must be handled with equipment to protect units from dirt and damage. The Contractor upon approval of Contracting Officer may secure the panels on the slab with adhesive.
- C. Do not place panels on ground.
- D. Transport panels in vertical or near-vertical position.
- E. Support panels during shipment on expanded polystyrene or similar non-staining shock-absorbing materials.
- F. Provide lateral support sufficient to prevent excessive bowing and warping. Adequately protect edges of units by padding or other means to prevent staining, chipping, or spalling of concrete.
- G. Minimize lateral movement by casting panels as close as possible to erection location.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Concrete:
 1. Cement: ASTM C 150; Type I. Use same brand, type, and source of supply.
 2. Air Entrainment: ASTM C 260.
 3. Aggregates: ASTM C 33; maximum 2 percent water absorption rate. Use same type of aggregate and source of supply.
 4. Water: Clean potable water, not detrimental to concrete.
 5. Bond Breaker: By same manufacturer as curing compound for casting slab.

- B. Form Release Agent:
 - 1. Polymerized solution of synthetic resins and organic compounds containing no wax, oil, silicates, or varnish.
 - 2. Not sensitive to lime, alkalis, or organic acids.
 - 3. Compatible with coating, adhesives, or sealants applied to panel surfaces.
- C. Reinforcing Steel: ASTM A 615, Grade 60.
- D. Inserts: Galvanized with stainless steel tips.
- E. Flashings Receivers: 28 gage formed galvanized steel.
- F. Bar Supports: Class E; CRSI Manual of Practice.
- G. Bearing Pads: Neoprene, 70 durometer.

2.2 MIXES

- A. Mix concrete in accordance with ASTM C 94.
- B. Provide concrete with the following characteristics:
 - 1. Compressive Strength: 4000 psi at 28 days.
 - 2. Air Content: 5 percent, plus or minus 1.5 percent.
 - 3. Minimum Cement Content: 550 lb./cu yd.
 - 4. Maximum Water/Cement Ratio: 0.53.
 - 5. Maximum Coarse Aggregate Size: 3/4 inch.
 - 6. Slump: Not to exceed 4 inches.

2.3 FABRICATION

- A. Forms: Smooth, rigid, and constructed on materials that shall result in finished products conforming to shape, lines, and dimensions indicated on Drawings.
- B. Finish: Free of honeycomb cast against poured in place casting bed, forms, and accessories. Provide smooth steel troweled true surface, if not a formed surface.
- C. Reinforcing:
 - 1. Cover reinforcing steel with a minimum 1-1/2 inch concrete unless an increased cover is specified by the Engineer.
 - 2. Do not use metal chairs, with or without coatings, or plastic-tip chairs in the finished face of panels. Utilize plastic chairs with configuration to ensure a sufficient amount of concrete encases the tip of the chair.
- D. Curing: As specified in Section 033000.
- E. Panel Identification:
 - 1. Mark each precast panel to correspond to identification mark on Shop Drawings for panel location.
 - 2. Mark each precast panel with date cast.
- F. Embedded Items: Cast connectors, weld plates, and other embedded items detailed on Drawings. Take care to match up pairs of weld plates or other connectors. Coordinate locations of embedded



items with metal building manufacturer. Paint surfaces of embedded items with primer after completion of welding.

G. Allowable Tolerances:

1. Length and width of precast units measured at face adjacent to mold:
 - a. Units 10 Feet or Under: $\pm 1/8$ inch.
 - b. Units 10 Feet to 20 Feet: $+1/8$ inch; $-3/16$ inch.
 - c. Units 20 Feet to 30 Feet: $+1/8$ inch; $-1/4$ inch.
 - d. Units Over 30 Feet: $\pm 1/16$ inch for each additional 10 feet.
2. Thickness of Units: $+1/4$ inch; $-1/8$ inch.
3. Dimensions for Windows, Doors, Louvers, and Other Openings: Maximum of $1/8$ inch per 6 feet, or $1/4$ inch total.
4. Units and Openings Within Units: Not out of square more than $1/8$ inch per 6 feet, or $1/4$ inch total.
5. Location of Inserts, Bolts, and Pipe Sleeves: $\pm 1/4$ inch.
6. Location of Flashing Receivers or Reglets: $\pm 1/4$ inch.
7. Bowing or warping of precast panels after casting: Not to exceed $L/500$.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces and adjacent areas where wall panels will be cast and erected and verify that conditions conform to requirements. Verify lines, levels, and dimensions of previously constructed Work. Verify that structure and anchorage inserts not within tolerances required to erect panels have been corrected. Verify location of all inserts prior to placing concrete for panels.
- B. Determine field conditions by actual measurements.
- C. Report to Contracting Officer any condition in previously constructed Work that would prevent satisfactory completion of the work under this Section. Do not proceed until conditions are corrected under other Sections.
- D. Beginning of casting and erection indicates acceptance of previously constructed Work and existing conditions

3.2 ERECTION

- A. Set precast concrete wall panels straight, level, plumb, and square.
- B. Non-cumulative Erection Tolerances:
 1. Joint Dimension: Nominal $3/8$ inch; to vary not more than $+3/16$ inch or $-1/8$ inch.
 2. Joint Taper: Panel edges at joint not out of parallel over $1/40$ inch per foot.
 3. Edge Alignment: Misalignment of panel edges not exceeding $1/4$ inch.
 4. Panel Face Offset:
 - a. Faces of adjacent panels offset not over $1/8$ inch.
 - b. Bowed panels, within allowable bowing tolerances, arranged so offset between adjacent panels does not exceed $1/4$ inch.
- C. Set units dry, without mortar, attaining specified joint dimension on bearing pads. Use steel shims as required to level panel.



- D. Fasten precast concrete panels in place by bolting or welding, or both. Protect units from damage by field welding or cutting operations. Provide non-combustible shields as necessary during erection operations. Protect all work and materials of other trades at all times.
- E. Tighten bolted connections with equal torque, or finger tighten as indicated on Structural Drawings.
- F. Secure bolts with lock washers or tack-weld nut to bolt.
- G. Provide temporary bracing for panels. Maintain bracing in place until final support is provided.
- H. Clean field welds with wire brush and protect materials other than stainless steel with primer or with zinc rich coating.
- I. Remove shims and spacers from joints requiring sealant prior to installing sealant.
- J. Grout connection to foundation with non-shrink grout as specified in Section 033000.
- K. Waterproof embedded steel plates and angles below grade with asphaltic mastic prior to backfill.

3.3 SEALING

- A. Seal joints between panels or between panel and adjacent materials as indicated on Drawings and as specified in Section 079200.

3.4 FIELD QUALITY CONTROL

- A. Inspect precast concrete wall panel installation.
- B. Correct deficiencies in Work which inspection indicates are not in compliance with Contract documents.

3.5 PATCHING

- A. Mix and place patching mixture to match color and texture of surrounding concrete and to minimize shrinkage.
- B. Adhere patch to hardened concrete with bonding agent.
- C. Level patch to plane of panel surface.
- D. Replace defective precast concrete wall panels if patching is not acceptable to Construction Manager as directed by Contracting Officer.
- E. Fill bubbles larger than 1/8 inch with sand cement and rub smooth.
- F. Clean and patch concrete floor slabs where temporary brace inserts are located.

3.6 CLEANING

- A. After erection, clean soiled precast concrete wall panel surfaces with detergent and water, using fiber brush and sponge. Rinse thoroughly with clean water.



- B. Do not use acid to clean panels. Consult Special Coating manufacturer for recommended cleaning methods for stains remaining after initial cleaning.
- C. Rinse thoroughly with clear water immediately after using cleaner.

3.7 PROTECTION

- A. Provide protective measures to prevent damage to concrete wall panels and adjacent Work.

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Last revised: 3/31/2010

END OF SECTION 03 47 13 00



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SECTION 03 47 13 00 - CSF TILT-UP CONCRETE**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Tilt-Up Precast Concrete Wall Panels is part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Tilt-up sitecast concrete wall panels, non-load bearing, erected from mold to final position.
 2. Supports, devices, and attachments.
 3. Reinforcement, anchorages, and accessories.
- B. Related Sections:
 1. Section 012300 - Alternates.
 2. Section 033000 - Cast-In-Place Concrete: Grout and concrete curing.
 3. Section 051200 - Structural Steel Framing: Support plates and angles with anchor studs, expansion bolts, and epoxy bolts which are embedded in or cast into concrete for supporting structural steel, steel joists, and steel deck.
 4. Section 055000 - Metal Fabrications: Other metal components cast into concrete.
 5. Section 076200 - Sheet Metal Flashing and Trim: Counterflashing receivers or reglets.
 6. Section 079200 - Joint Sealants: Installation of panel joint sealers.
 7. Section 099100 - Painting: Priming metal inserts.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 1. ASTM A 615 - Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 2. ASTM C 33 - Specification for Concrete Aggregates.
 3. ASTM C 94 - Specification for Ready-mixed Concrete.
 4. ASTM C127 - Test Method for Specific Gravity and Absorption of Course Aggregate.
 5. ASTM C128 - Test Method for Specific Gravity and Absorption of Fine Aggregate.
 6. ASTM C 150 - Specification for Portland Cement.
 7. ASTM C 260 - Specification for Air-Entraining Admixtures for Concrete.
- B. American Welding Society (AWS):
 1. AWS D1.1 - Structural Welding Code.

- C. Concrete Reinforcing Steel Institute (CRSI):
 - 1. CRSI Manual of Practice.
- D. Portland Cement Association (PCA):
 - 1. PCA EB 074D - Tilt-Up Load-Bearing Walls.
 - 2. PCA EB 079B - Tilt-Up Concrete Walls.
 - 3. PCA EB 110D - Connections for Tilt-Up Wall Construction.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Concrete tilt-slab panels are designed for in place stresses only. Lifting and handling stress design is responsibility of Contractor and erector. Execute design for lifting, handling, and erection stresses by a registered Professional Engineer in the State in which the project is located.
 - 2. Design units and connections for wind load as indicated on Drawings and as required by governing codes. Design units and connections to withstand applicable dead loads and erection stresses.
 - 3. Design tilt-up units and connections in accordance with, as general guides, PCA EB 074D, PCA EB 079 B, and PVA EB 110D.
 - 4. Provide sealed and finished panel joints to match and coincide with location of vertical rustication joints.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Shop Drawings: Indicate layout, tilt-up unit locations, configuration, unit identification marks, reinforcement, connection details, support items, location of lifting devices, dimensions, openings, and relationship to adjacent components.
 - 2. Product Data: Adhesive (Alternate 1 Section 012300)
 - 3. Calculations including load exerted on the slab during forming and lifting panels in place for Alternate 1 Section 012300

1.5 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Fabricator: Company specializing in performing Work of this Section with minimum five years documented experience with established quality control program in effect.
 - 2. Erector: Company specializing in performing precast concrete erection Work of this Section with minimum five years documented experience.
 - 3. Welding: AWS D1.1.
 - 4. Fabricator and Erector: Certify and indicate experienced personnel, physical facilities, management process, and quality control procedures.
- B. Regulatory Requirements: Construct and install precast concrete wall panels to meet requirements of local governing building code.
- C. Mock-Ups:
 - 1. Fabricate and erect at site, one full size panel, illustrating shape, lifting device, and attachment points, and finish.
 - 2. Fabricate and erect at location determined by Contracting Officer



3. Prepare a sample of repairs.
 4. Obtain inspection and approval of wall panel and repair samples.
 5. Approved mock-up may remain as part of Work.
- D. Pre-Installation Meeting:
1. Convene a pre-installation meeting at site, one week prior to commencing Work of this Section. Require attendance of parties directly affecting Work of this Section, including, but not limited to, Contracting Officer Contractor, Construction Manager, Tilt-up Concrete Wall Panel Fabricator and Tilt-up Concrete Wall Panel Erector.
 2. Contact Construction Manager two weeks prior to pre-installation meeting to confirm schedule.
 3. Review preparation and installation procedures and coordinate scheduling required with related Work.
 4. Record discussions of meeting and decisions and agreements (or disagreements) reached, and furnish copy of record to each party attending. Review foreseeable methods and procedures related to Manufactured Wall Panel Work, including:
 - a. Discuss procedures for Bid Alternate 1 in Section 012300 and set up guidelines if the Contracting Officer elects to proceed with Bid Alternate 1.
 - b. Tour, inspect, and discuss conditions of wall panel casting, erection, attachment structure components, locations, and other preparatory work performed by other trades.
 - c. Review wall panel system requirements (drawings, specifications, and other Contract Documents).
 - d. Review required submittals, both completed and yet to be completed.
 - e. Review and finalize construction schedule related to wall panel work and verify availability of materials, erector's personnel, equipment and facilities needed to make progress and avoid delays.
 - f. Review required inspections, testing, certifying, and material usage accounting procedures.
 - g. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Cast panels on the slab on grade after the slab has reached its designed compressive strength. The formwork shall be secured on the slab on ground with screws using predrilled holes. A repair method must be submitted and a sample of repairs must be prepared with the mock up for approval. The precast concrete panels must be handled with equipment to protect units from dirt and damage. The Contractor upon approval of Contracting Officer may secure the panels on the slab with adhesive in accordance with Bid Alternate 1 in Specification Section 012300.
- C. Do not place panels on ground.
- D. Transport panels in vertical or near-vertical position.
- E. Support panels during shipment on expanded polystyrene or similar non-staining shock-absorbing materials.
- F. Provide lateral support sufficient to prevent excessive bowing and warping. Adequately protect edges of units by padding or other means to prevent staining, chipping, or spalling of concrete.
- G. Minimize lateral movement by casting panels as close as possible to erection location.

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. Concrete:
 - 1. Cement: ASTM C 150; Type I. Use same brand, type, and source of supply.
 - 2. Air Entrainment: ASTM C 260.
 - 3. Aggregates: ASTM C 33; maximum 2 percent water absorption rate. Use same type of aggregate and source of supply.
 - 4. Water: Clean potable water, not detrimental to concrete.
 - 5. Bond Breaker: By same manufacturer as curing compound for casting slab.
- B. Form Release Agent:
 - 1. Polymerized solution of synthetic resins and organic compounds containing no wax, oil, silicates, or varnish.
 - 2. Not sensitive to lime, alkalis, or organic acids.
 - 3. Compatible with coating, adhesives, or sealants applied to panel surfaces.
- C. Reinforcing Steel: ASTM A 615, Grade 60.
- D. Inserts: Galvanized with stainless steel tips.
- E. Flashings Receivers: 28 gage formed galvanized steel.
- F. Bar Supports: Class E; CRSI Manual of Practice.
- G. Bearing Pads: Neoprene, 70 durometer.

2.2 MIXES

- A. Mix concrete in accordance with ASTM C 94.
- B. Provide concrete with the following characteristics:
 - 1. Compressive Strength: 4000 psi at 28 days.
 - 2. Air Content: 5 percent, plus or minus 1.5 percent.
 - 3. Minimum Cement Content: 550 lb./cu yd.
 - 4. Maximum Water/Cement Ratio: 0.53.
 - 5. Maximum Coarse Aggregate Size: 3/4 inch.
 - 6. Slump: Not to exceed 4 inches.

2.3 FABRICATION

- A. Forms: Smooth, rigid, and constructed on materials that shall result in finished products conforming to shape, lines, and dimensions indicated on Drawings.
- B. Finish: Free of honeycomb cast against poured in place casting bed, forms, and accessories. Provide smooth steel troweled true surface, if not a formed surface.
- C. Reinforcing:
 - 1. Cover reinforcing steel with 1-1/2 inch concrete.
 - 2. Do not use metal chairs, with or without coatings, in the finished face of panels. Metal chairs with plastic tips or stainless steel feet may be used.
- D. Curing: As specified in Section 033000.



- E. Panel Identification:
 - 1. Mark each precast panel to correspond to identification mark on Shop Drawings for panel location.
 - 2. Mark each precast panel with date cast.
- F. Embedded Items: Cast connectors, weld plates, and other embedded items detailed on Drawings. Take care to match up pairs of weld plates or other connectors. Coordinate locations of embedded items with metal building manufacturer. Paint surfaces of embedded items with primer after completion of welding.
- G. Allowable Tolerances:
 - 1. Length and width of precast units measured at face adjacent to mold:
 - a. Units 10 Feet or Under: $\pm 1/8$ inch.
 - b. Units 10 Feet to 20 Feet: $+1/8$ inch; $-3/16$ inch.
 - c. Units 20 Feet to 30 Feet: $+1/8$ inch; $-1/4$ inch.
 - d. Units Over 30 Feet: $\pm 1/16$ inch for each additional 10 feet.
 - 2. Thickness of Units: $+1/4$ inch; $-1/8$ inch.
 - 3. Dimensions for Windows, Doors, Louvers, and Other Openings: Maximum of $1/8$ inch per 6 feet, or $1/4$ inch total.
 - 4. Units and Openings Within Units: Not out of square more than $1/8$ inch per 6 feet, or $1/4$ inch total.
 - 5. Location of Inserts, Bolts, and Pipe Sleeves: $\pm 1/4$ inch.
 - 6. Location of Flashing Receivers or Reglets: $\pm 1/4$ inch.
 - 7. Bowing or warping of precast panels after casting: Not to exceed $L/500$.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces and adjacent areas where wall panels will be cast and erected and verify that conditions conform to requirements. Verify lines, levels, and dimensions of previously constructed Work. Verify that structure and anchorage inserts not within tolerances required to erect panels have been corrected. Verify location of all inserts prior to placing concrete for panels.
- B. Determine field conditions by actual measurements.
- C. Report to Contracting Officer any condition in previously constructed Work that would prevent satisfactory completion of the work under this Section. Do not proceed until conditions are corrected under other Sections.
- D. Beginning of casting and erection indicates acceptance of previously constructed Work and existing conditions

3.2 ERECTION

- A. Set precast concrete wall panels straight, level, plumb, and square.
- B. Non-cumulative Erection Tolerances:
 - 1. Joint Dimension: Nominal $3/8$ inch; to vary not more than $+3/16$ inch or $-1/8$ inch.
 - 2. Joint Taper: Panel edges at joint not out of parallel over $1/40$ inch per foot.
 - 3. Edge Alignment: Misalignment of panel edges not exceeding $1/4$ inch.
 - 4. Panel Face Offset:



- a. Faces of adjacent panels offset not over 1/8 inch.
 - b. Bowed panels, within allowable bowing tolerances, arranged so offset between adjacent panels does not exceed 1/4 inch.
- C. Set units dry, without mortar, attaining specified joint dimension on bearing pads. Use steel shims as required to level panel.
- D. Fasten precast concrete panels in place by bolting or welding, or both. Protect units from damage by field welding or cutting operations. Provide non-combustible shields as necessary during erection operations. Protect all work and materials of other trades at all times.
- E. Tighten bolted connections with equal torque, or finger tighten as indicated on Structural Drawings.
- F. Secure bolts with lock washers or tack-weld nut to bolt.
- G. Provide temporary bracing for panels. Maintain bracing in place until final support is provided.
- H. Clean field welds with wire brush and protect materials other than stainless steel with primer or with zinc rich coating.
- I. Remove shims and spacers from joints requiring sealant prior to installing sealant.
- J. Grout connection to foundation with non-shrink grout as specified in Section 033000.
- K. Waterproof embedded steel plates and angles below grade with asphaltic mastic prior to backfill.

3.3 SEALING

- A. Seal joints between panels or between panel and adjacent materials as indicated on Drawings and as specified in Section 079200.

3.4 FIELD QUALITY CONTROL

- A. Inspect precast concrete wall panel installation.
- B. Correct deficiencies in Work which inspection indicates are not in compliance with Contract documents.

3.5 PATCHING

- A. Mix and place patching mixture to match color and texture of surrounding concrete and to minimize shrinkage.
- B. Adhere patch to hardened concrete with bonding agent.
- C. Level patch to plane of panel surface.
- D. Replace defective precast concrete wall panels if patching is not acceptable to Construction Manager as directed by Contracting Officer.
- E. Fill bubbles larger than 1/8 inch with sand cement and rub smooth.
- F. Clean and patch concrete floor slabs where temporary brace inserts are located.



3.6 CLEANING

- A. After erection, clean soiled precast concrete wall panel surfaces with detergent and water, using fiber brush and sponge. Rinse thoroughly with clean water.
- B. Do not use acid to clean panels. Consult Special Coating manufacturer for recommended cleaning methods for stains remaining after initial cleaning.
- C. Rinse thoroughly with clear water immediately after using cleaner.

3.7 PROTECTION

- A. Provide protective measures to prevent damage to concrete wall panels and adjacent Work.

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Last revised: 4/12/2011

END OF SECTION 03 47 13 00



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SECTION 03 51 13 00 - R&A CEMENTITIOUS WOOD FIBER ROOF DECK REPAIR AND REPLACEMENT

NOTE TO SPECIFIER

*This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section. **Edit Section footer information only – do not edit Section contents.***

NOTE TO SPECIFIER

Include this Section for projects where roof replacement will occur over existing cementitious wood fiber structural decks.

NOTE TO SPECIFIER

Section Formatting:

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7. No lines should be placed between paragraphs and sub-paragraphs, or between sub-paragraphs and other sub-paragraphs.

Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED



Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

PART 1 - GENERAL

1.1 SUMMARY

- A. Cementitious wood fiber roof deck repair and replacement associated with roof replacement.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 024100 – Roof Removal and Substrate Preparation
- D. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 UNIT PRICES

- A. Provide unit prices for the work described in paragraphs 3.2A and 3.2B.

1.4 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 - 1. American Society for Testing and Materials (ASTM)
 - a. ASTM C 317 - Standard Specification for Gypsum Concrete
 - 2. National Roof Deck Contractors Association (NRDCA)

1.5 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.6 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed to install the specified products and is eligible to receive a manufacturer's warranty. The firm shall have a minimum of 5 years documented experience performing work equal or similar to the specified work.



- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform cementitious wood fiber deck repair/replacement work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

PART 2 - PRODUCTS

2.1 CEMENTITIOUS WOOD FIBER DECK REPAIR/REPLACEMENT MATERIALS

- A. For use at repair outlined in paragraph 3.2A:
 - 1. Steel plate: 16-gauge galvanized with pre-drilled holes for fasteners and plates.
 - 2. Fasteners and plates: For securing steel plate to gypsum concrete deck: Glass-filled, nylon auger-type fastener such as Drill-Tec NTB-1HEO with 3-inch steel plate, length as necessary to penetrate 1-inch minimum into roof deck, manufactured by GAF Corporation, Wayne, NJ, or approved equal.
- B. For use at repair outlined in paragraph 3.2B:



1. Cementitious wood fiber roof deck panels: Size, composition, color and texture to match existing.
2. Grout: ASTM C 317, Class A; compressive strength of 500 psi.
3. Water: Potable.
4. Fasteners: Type, configuration and size to match existing panel fastening system.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.
- B. Inspect existing cementitious wood fiber decks for deterioration and other defects. If an opening less than or equal to 8-inches in diameter exists, refer to paragraph 3.2A, "Repair at Opening Caused by Obsolete Roof Penetration Removal". If a defect exists greater than 8-inches in diameter, refer to the paragraph 3.2B, "Cementitious Wood Fiber Roof Deck Panel Replacement".

3.2 CEMENTITIOUS WOOD FIBER DECK REPAIR AND REPLACEMENT

- A. Repair at Opening Caused by Obsolete Roof Penetration Removal (*Unit Price Work*):
 1. At locations indicated by the Owner, cover the existing opening with 16-gauge steel plate stock. Lap the plate a minimum of 8-inches beyond the opening on all sides. Fasten the steel plate with specified fasteners and plates 12-inches on center. Secure the plate a minimum of 2-inches in from the outside edge of the repair plate.
- B. Cementitious Wood Fiber Roof Deck Panel Replacement (*Unit Price Work*):
 1. Prior to the start of work, inspect the interior area below the area of damaged cementitious wood fiber roof deck. Remove items from the replacement area that may be damaged during work activities. Provide adequate interior protection to protect interior surfaces and finishes from damage prior to the start of work. The Contractor shall provide an "Interior Protection Representative" during replacement work.
 2. To the extent indicated by the Owner, remove all existing defective and damaged cementitious wood fiber roof deck panels, down to the underlying structural supports.
 3. Replace existing damaged panels with new panels. Refer to panel manufacturer's requirements, NRDCA recommendations for installation of cementitious wood fiber roof deck panels and applicable local codes for additional installation requirements.
 4. Fasten panels in a manner to match fastening system of existing panels.
 5. Install grout at joints between replacement deck panels and existing adjacent panels. Level grout after installation to provide a smooth, level surface.
 6. Inspect the completed replacement to ensure roof deck is suitable to receive new roofing materials.

USPS CSF Specifications issued: 10/1/2013
Last revised: 3/6/2013

NOTE TO SPECIFIER



Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 03 51 13 00



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SECTION 03 51 16 00 - R&A GYPSUM CONCRETE ROOF DECK REPAIR/REPLACEMENT

NOTE TO SPECIFIER

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NOTE TO SPECIFIER

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NOTE TO SPECIFIER

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Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED

R&A GYPSUM CONCRETE ROOF DECK
REPAIR/REPLACEMENT

Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

PART 1 - GENERAL

1.1 SUMMARY

- A. Gypsum concrete roof deck repair and replacement associated with roof replacement work.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 024100 – Roof Removal and Substrate Preparation
- D. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 UNIT PRICES

- A. Provide unit prices for the work described in paragraphs 3.2A, 3.2B, 3.2C and 3.2D.

1.4 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 - 1. Factory Mutual Engineering Corporation (FM)
 - 2. American Society for Testing and Materials (ASTM)
 - a. ASTM C 317 - Standard Specification for Gypsum Concrete
 - 3. National Roof Deck Contractors Association (NRDCA)
 - 4. Steel Deck Institute

1.5 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.6 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed to install the



specified products and is eligible to receive a manufacturer's warranty. The firm shall have a minimum of 5 years documented experience performing work equal or similar to the specified work.

- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform gypsum concrete repair/replacement work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

PART 2 - PRODUCTS

2.1 GYPSUM DECK REPAIR/REPLACEMENT MATERIALS

- A. For use at repair outlined in paragraph 3.2A:
 - 1. Steel plate: 16-gauge galvanized with pre-drilled holes for fasteners and plates.
 - 2. Fasteners and plates: For securing steel plate to gypsum concrete deck: Glass-filled, nylon auger-type fastener such as Drill-Tec NTB-1HEO with 3-inch steel plate, length as



necessary to penetrate 1-inch minimum into roof deck, manufactured by GAF Corporation, Wayne, NJ, or approved equal.

- B. For use at repairs outlined in paragraphs 3.2B and 3.2C:
 - 1. Gypsum Concrete: Ready-mix gypsum which complies with ASTM C 317, such as Pyrofill, manufactured by United States Gypsum or approved equal.
 - 2. Water: Potable.
- C. For use at repair outlined in paragraph 3.2C:
 - 1. Formboard panels: To match existing in type, thickness and quality, or as necessary to comply with requirements of applicable insurance agencies and local codes.
 - 2. Reinforcing steel mesh: To match existing in type, configuration and quality, or as necessary to comply with requirements of applicable insurance agencies and local codes.
 - 3. Galvanized cross tees: Type, configuration and size to match existing.
- D. For use with full gypsum concrete deck replacement, outlined in paragraph 3.2D:
 - 1. Full sections of steel decking; gauge, profile, and finish as necessary to comply with requirements of applicable insurance agencies and local codes.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.
- B. Inspect existing gypsum concrete decks for deterioration and other defects. If an opening less than or equal to 8-inches in diameter exists, refer to paragraph 3.2A, "Repair at Opening Caused by Obsolete Roof Penetration Removal". If a defect exists that does not extend to the formboard, refer to the paragraph 3.2B, "Localized Gypsum Concrete Deck Repair". If the defect extends to and includes the formboard, refer to paragraph 3.2C, "Gypsum Concrete Deck Replacement". For full gypsum deck removal and replacement with steel deck, refer to paragraph 3.2D, "Full Gypsum Concrete Deck Replacement".

3.2 GYPSUM CONCRETE DECK REPAIR AND REPLACEMENT

- A. Repair at Opening Caused by Obsolete Roof Penetration Removal (*Unit Price Work*):
 - 1. At locations indicated by the Owner, cover the existing opening with 16-gauge steel plate stock. Lap the plate a minimum of 8-inches beyond the opening on all sides. Fasten the steel plate with specified fasteners and plates 12-inches on center. Secure the plate a minimum of 2-inches in from the outside edge of the repair plate.
- B. Localized Gypsum Concrete Deck Repair (*Unit Price Work*):
 - 1. Prior to the start of work, inspect the interior area below the area of damaged gypsum concrete roof deck. Remove items from the replacement area that may be damaged during work activities. Provide adequate interior protection to protect interior surfaces and finishes from damage prior to the start of work. The Contractor shall provide an "Interior Protection Representative" during replacement work.
 - 2. To the extent indicated by the Owner, remove any damaged or loose existing gypsum concrete deck material from the repair area.
 - 3. Replace damaged or deteriorated gypsum decking, excluding formboard and mesh, with gypsum patch material of thickness to match existing adjacent gypsum and to provide a structurally sound roof deck.



4. Allow the patch material time to cure. If necessary, provide temporary protection from inclement weather while gypsum concrete cures. Refer to manufacturer's requirements for cure time. Inspect the completed repair to ensure the roof deck is suitable to receive new roofing materials.
- C. Gypsum Concrete Deck Replacement (*Unit Price Work*):
1. Prior to the start of work, inspect the interior area below the area of damaged gypsum concrete deck. Remove items from the replacement area that may be damaged during work activities. Provide adequate interior protection to protect interior surfaces and finishes from damage prior to the start of work. The Contractor is to provide an "Interior Protection Representative" during replacement work.
 2. To the extent indicated by the Owner, remove damaged, deteriorated and/or loose existing gypsum concrete decking, including reinforcing mesh and formboard. Leave a minimum of 3-inches of fiberglass mesh at each cross tee for tie-in to new reinforced mesh.
 3. Install galvanized cross tees. Install formboard(s) into cross tees.
 4. Install reinforcing mesh. Tie-in to the existing mesh. Refer to the reinforcing mesh manufacturer and the NRDC for tie-in requirements.
 5. Replace removed gypsum concrete decking with matching type and thickness material, to provide a structurally sound roof deck. Refer to gypsum concrete manufacturer, NRDC recommendations for installation of gypsum concrete and applicable local codes for additional installation requirements.
 6. Allow the patch material time to cure. If necessary, provide temporary protection from inclement weather while gypsum concrete cures. Refer to manufacturer's requirements for cure time. Inspect the completed replacement to ensure the roof deck is suitable to receive new roofing materials.
- D. Full Gypsum Concrete Deck Replacement (*Unit Price Work*):
1. To the extent indicated by the Owner, remove all existing gypsum concrete decking, including reinforcing mesh, formboard and bulb-tees, down to the underlying structural supports.
 2. Replace existing gypsum concrete decking with steel deck. Install steel decking in full sections. Install new decking in accordance with the requirements of FM, Steel Deck Institute, and applicable local codes to provide a structurally sound roof deck. Inspect the completed replacement to ensure roof deck is suitable to receive new roofing materials.

USPS CSF Specifications issued: 10/1/2013
Last revised: 3/6/2013

NOTE TO SPECIFIER

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END OF SECTION 03 51 16 00



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SECTION 03 51 16 00a - GYPSUM PLANK DECKING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for gypsum plank decking for interstitial decks **OR** fire rated interstitial decks, **as directed**, and roof decks. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Fire Tests: Fire tests, data and certifications substantiating that Gypsum Plank Decking complies with fire rating requirements.
2. Shop Drawings: Show typical plank layouts, perimeter and framed opening supports and details of construction, installation, fastenings and grouting.
3. Manufacturer's Literature and Data: Each item specified.
4. Load tables for sub-purlins.

C. Quality Control

1. Work performed by experienced, qualified installers approved by manufacturer of gypsum plank.
2. Gypsum materials products of one manufacturer.

D. Delivery And Storage

1. Deliver materials in original packages, containers, or bundles bearing brand name and name of manufacturer.
2. Store materials in a manner that prevents damage before use. When stored under tarpaulins, provide ventilation to prevent moisture accumulation under tarpaulin.
3. Store gypsum planks flat and off ground. Handle and stack in a manner to prevent damage to face, ends, and edges and keep dry until used.
4. Store gypsum concrete off ground and keep dry until used.

1.2 PRODUCTS

A. Materials

1. Structural Steel Tee Sub-purlins:
 - a. Open web truss-tees, hot-rolled bulb-tees or folded sheet metal tees as required by design loads, spans and fire ratings.
 - b. Flanges: Provide 5/8-inch (16 mm) minimum bearing for gypsum planks.
 - c. Galvanize or factory coat sub-purlins with manufacturer's standard primer.
 - d. Open web truss-tees: Fabricate from cold-formed steel wire conforming to ASTM A82.
 - e. Hot-rolled bulb-tees: Rail-shaped, fabricated from hot-rolled steel conforming to ASTM A36/A36M or ASTM A499.
 - f. Folded sheet metal tees: Fabricate from sheet steel conforming to ASTM A653 and ASTM A568/A568M.
2. Cross-Tees:
 - a. Cold-Formed, Fabrication from sheet steel conforming to ASTM A653/A653M or ASTM A568/A568M.
 - b. Size: 1-1/4-inches (30 mm) by 1/2-inch (13 mm) by 0.023-inch (0.6 mm) thick by 24-inches (600 mm) long.
 - c. Tees shall be galvanized or factory coated with manufacturer's standard primer.
3. Gypsum Deck Plank:
 - a. Fabricated of gypsum board: ASTM C442.



- b. Nominal Size: 2-inches (50 mm) **OR** 2-5/8-inches (65 mm), **as directed**, thick by 24-inches (600 mm) wide by main purlin span. Where possible, length should span two main purlin spans.
 - c. Factory laminate from two 1-inch (25 mm) thick gypsum panels with top panel edge set back along sub-purlin edge not more than 1/2-inch (13 mm).
 - d. Offset edges encased in water-resistant paper.
 - 4. Gypsum Deck Panels: ASTM C36, Type "X", 5/8-inch (16 mm) thick by 24-inches (600 mm) wide by main purlin span.
 - 5. Grout: Gypsum Concrete: ASTM C317, Class A, 500 psi (3.5 MPa) minimum compressive strength.
 - 6. Miscellaneous Materials: Adhesives, mastics, cements, tapes and primers shall be as recommended by the gypsum plank manufacturer and shall be compatible with the material to which they are to be bonded.
- B. Deck System
- 1. Interstitial deck: Provide two-hour fire rating as tested by gypsum plank manufacturer under ASTM E119.
 - 2. Roof Deck: Provide one hour **OR** 1-1/2 hour, **as directed**, fire rating per tested assembly by Underwriters' Laboratory Inc. or other testing.

1.3 EXECUTION

A. Installation

- 1. Weld per AWS D1.1.
- 2. Sub-purlins:
 - a. Space at approximately 24-5/8-inches (650 mm) on center to provide minimum 5/8 inch (16 mm) continuous bearing for gypsum plank or deck.
 - b. Install framing of openings.
 - c. Touch up welds with same type of rust-inhibitive paint used for primer.
 - d. Interstitial Decks: Use 3/4-inch (19 mm) fillet welds on both sides of sub-purlins at math purlin.
 - e. Roof Decks: Use minimum 1/2-inch (13 mm) fillet welds on alternate sides of sub-purlins, both sides at end joints to main purlins.
 - f. For fire rated roof decks weld per fire test assembly.
- 3. For Two Hour fire rated interstitial decks **OR** fire-rated roof decks, **as directed**.
 - a. Place gypsum deck panels on bottom flanges of sub-purlins with 5/8-inch (16 mm) minimum continuous bearing.
 - b. Place gypsum deck plank over gypsum deck panels, with off-set edges "up" to form a "T" receptacle for gypsum grout.
 - c. Cut to fit around openings shown.
 - d. Install plank to conform to fire test assembly.
- 4. Gypsum Deck Plank for Roof Decks:
 - a. Place plank on lower flanges of sub-purlins or other framing with ends and edges supported.
 - b. Stagger joints in adjacent courses.
 - c. Support end joints with cross-tees not supported by framing.
 - d. Cut plank to fit at ends and framed openings.
- 5. Provide continuous 5/8-inch (16 mm) minimum bearing for plank support at deck perimeter, plank ends and openings exceeding 8-inches (200 mm).
- 6. Grout:
 - a. Mix gypsum concrete thoroughly using a minimum amount of water to form a thick, pourable consistency.
 - b. Fill edge joints to slight excess with single pour at sub-purlins.
 - 1) Grout end joints on single span system against steel framing.



- 2) After initial set, strike of excess to form smooth, flush joint.
 - 3) Form cant strips and curbs where shown.
- c. Fill joints at roof ridges, hips and valleys.
7. Patching:
 - a. Fill with grout and smooth any surface damage to gypsum plank.
 - b. Remove and replace cracked, broken, and plank damaged beyond repair.
8. Cleaning and Protection:
 - a. Upon completion of gypsum plank decking, remove, debris and sweep surface clean. Leave ready for subsequent work.
 - b. Protect finished deck from weather and subsequent construction operations.
 - c. Provide hardboard or plywood temporary protection over decking subject to repetitive impact or wheeled loads.

END OF SECTION 03 51 16 00a



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SECTION 03 51 16 00b - GYPSUM CONCRETE DECKS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of gypsum concrete decks. Products shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

1.2 PRODUCTS

A. Gypsum Concrete: ASTM C 317, Class A.

B. Formboards:

1. Gypsum Board: ASTM C 318.
2. Mineral Fiber Board: ASTM C612.
3. Glass Fiber Board: Lightweight, rigid, composed of pressed glass fibers.

C. Bulb Tees: ASTM A 499, Grade 50.

D. Reinforcing Mesh:

1. Welded Wire Fabric: ASTM A 185, galvanized, 12 x 48-W0.5 x W0.5.
2. Woven Wire Fabric: ASTM A 82, galvanized, 19 gauge wire, 2-inch hexagonal mesh.

1.3 EXECUTION

- A. Support System: Sub-purlins shall be spaced to support formboards and rigidly attached to main supports. Formboards shall fit snugly at sub-purlins and at wall, curbs, and openings.
- B. Reinforcement: Lay wire fabric continuously over sub-purlins. Do not lap side of reinforcement.
- C. Gypsum Concrete: Gypsum concrete shall be placed continuously without interruption until entire panel or section is complete. Immediately after placement, screed, level, and trowel smooth.

END OF SECTION 03 51 16 00b



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Task	Specification	Specification Description
03 51 16 00	03 41 16 00	Precast Lightweight Roof Slabs



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SECTION 03 52 16 00 - R&A LIGHTWEIGHT INSULATING CONCRETE REPAIR AND REPLACEMENT

NOTE TO SPECIFIER

*This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section. **Edit Section footer information only – do not edit Section contents.***

NOTE TO SPECIFIER

Include this Section for projects where roof replacement will occur over existing lightweight insulating concrete decks intended to remain in place.

NOTE TO SPECIFIER

Section Formatting:

Consistent formatting of Sections gives the complete document a professional look. This Section uses a 10pt. Arial font, and is formatted as follows:

1. *Insert one 10pt. line after the Section Number. Section Number is in CAPS.*
2. *Insert two 10pt. lines after the Section Title. Section Title is in CAPS.*
3. *Insert one 10pt. line after a PART. PARTS are in CAPS. If a Section is not used, include NOT USED following the PART title as shown below.*
4. *Insert one 10pt. line after Article paragraphs. Articles are in CAPS.*
5. *Insert two 10pt. lines at the end of an Article.*
6. *Complete Section with END OF SETION.*
7. *No lines should be placed between paragraphs and sub-paragraphs, or between sub-paragraphs and other sub-paragraphs.*

Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED



Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

PART 1 - GENERAL

1.1 SUMMARY

- A. Lightweight insulating concrete repair and replacement associated with roof replacement work.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 024100 – Roof Removal and Substrate Preparation
- D. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 UNIT PRICES

- A. On the Unit Price Schedule, provide unit prices for the work described in paragraphs 3.2A, 3.2B and 3.2C.

1.4 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.5 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed to install the specified products and is eligible to receive a manufacturer's warranty. The firm shall have a minimum of 5 years documented experience performing work equal or similar to the specified work.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing



dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.

- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform lightweight insulating concrete repair and replacement work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

PART 2 - PRODUCTS

2.1 LIGHTWEIGHT INSULATING CONCRETE REPAIR/REPLACEMENT MATERIALS

- A. For use at repair outlined in paragraphs 3.2A and 3.2C:
 - 1. Lightweight insulating concrete premix product, suitable for repair of lightweight insulating concrete in a reroofing application, such as NVS Premix, manufactured by Siplast, Irving TX, or approved equal.
 - 2. Water: Potable.
- B. For use at repairs outlined in Items 3.2B:
 - 1. Fast-setting, lightweight insulating concrete patch material, such as Zono-Patch, manufactured by Siplast, Irving TX, or approved equal.
 - 2. Water: Potable.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.
- B. Inspect existing lightweight insulating concrete for deterioration and other defects. If areas of surface spalling of lightweight insulating concrete are observed, refer to paragraph 3.2A, "Repair of Lightweight Insulating Concrete Surface Spalling". If defects are observed penetrating greater than 1-inch into the LWIC, refer to the paragraph 3.2B, "Localized Lightweight Insulating Concrete Repair".

3.2 LIGHTWEIGHT INSULATING CONCRETE REPAIR

- A. Repair of Lightweight Insulating Concrete Surface Spalling - Greater than 1/8-inch in depth (*Unit Price Work*):
 - 1. Where indicated by the Owner, remove lightweight insulating concrete where material has flaked loose from the surface, sweep away and remove loose and spalled material.
 - 2. At locations where spalling has penetrated to a depth greater than 1/8-inch, square cut the affected area to a minimum depth of 1-inch. Do not feather edge cuts at corners.
 - 3. Install lightweight insulating concrete patch material, following the recommendations and requirements of the patch material manufacturer. Tool patch material flush with the surface of adjacent lightweight insulating concrete.
 - 4. Prior to the installation of roofing materials over the repair area, allow the patch material time to dry.
- B. Repair of Small Holes in Lightweight Insulating Concrete - For holes less than 6-inches in diameter (*Unit Price Work*):
 - 1. To the extent indicated by the Owner, remove lightweight insulating concrete where material has flaked loose from the surface, sweep away and remove loose and spalled material.
 - 2. Install lightweight insulating concrete patch material into the hole or depression, following the recommendations and requirements of the patch material manufacturer. Tool patch material flush with the surface of adjacent lightweight insulating concrete.
 - 3. Prior to the installation of roofing materials over the repair area, allow the patch material time to dry.
- C. Localized Lightweight Insulating Concrete Repair (*Unit Price Work*):
 - 1. To the extent indicated by the Owner, remove damaged existing lightweight insulating concrete and underlying rigid board insulating materials down to the existing structural deck.
 - 2. Replace damaged or deteriorated rigid board insulation. Type and thickness of replacement insulation shall match existing.
 - 3. Install lightweight insulating concrete patch material, following the recommendations and requirements of the patch material manufacturer. Tool patch material flush with the surface of adjacent lightweight insulating concrete.
 - 4. Prior to the installation of roofing materials over the repair area, allow the patch material time to dry.

USPS CSF Specifications issued: 10/1/2013
Last revised: 3/6/2013



NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 03 52 16 00



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Task	Specification	Specification Description
03 52 16 00	03 41 16 00	Precast Lightweight Roof Slabs
03 61 16 00	01 22 16 00	No Specification Required
03 64 26 00	01 22 16 00	No Specification Required



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SECTION 04 01 20 51 - CLAY MASONRY RESTORATION AND CLEANING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for clay masonry restoration and cleaning. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes maintenance of unit masonry consisting of brick and terra cotta clay masonry restoration and cleaning as follows:
 - a. Unused anchor removal.
 - b. Repairing unit masonry, including replacing units.
 - c. Painting steel uncovered during the work.
 - d. Reanchoring veneers.
 - e. Repointing joints.
 - f. Preliminary cleaning, including removing plant growth.
 - g. Cleaning exposed unit masonry surfaces.
2. Owner-Furnished Material: Salvaged brick (if salvaged brick is available from the Owner for reuse).

C. Definitions

1. Very Low-Pressure Spray: Under 100 psi (690 kPa).
2. Low-Pressure Spray: 100 to 400 psi (690 to 2750 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).
3. Medium-Pressure Spray: 400 to 800 psi (2750 to 5510 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).
4. High-Pressure Spray: 800 to 1200 psi (5510 to 8250 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).
5. Saturation Coefficient: Ratio of the weight of water absorbed during immersion in cold water to weight absorbed during immersion in boiling water; used as an indication of resistance of masonry units to freezing and thawing.

D. Preconstruction Testing

1. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on masonry units as follows.
 - a. Existing Brick and Terra Cotta: Test each type of existing masonry unit indicated for replacement, according to testing methods in ASTM C 67 for compressive strength, 24-hour cold-water absorption, 5-hour boil absorption, saturation coefficient, and initial rate of absorption (suction). Carefully remove five existing units from locations designated by the Owner. Take testing samples from these units.
 - b. Existing Mortar: Test according to ASTM C 295, modified as agreed by testing service and the Owner for Project requirements, to determine proportional composition of original ingredients, sizes and colors of aggregates, and approximate strength. Use X-ray diffraction, infrared spectroscopy, and differential thermal analysis as necessary to supplement microscopical methods. Carefully remove existing mortar from within joints at five locations designated by the Owner or testing service.
 - c. Temporary Patch: as directed by the Owner, provide temporary materials at locations from which existing samples were taken.
 - d. Replacement Brick and Terra Cotta: Test each proposed type of replacement masonry unit, according to sampling and testing methods in ASTM C 67 for compressive strength, 24-hour cold-water absorption, 5-hour boil absorption, saturation coefficient, and initial rate of absorption (suction).

E. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For the following:
 - a. Full-size patterns with complete dimensions for new terra cotta units, specially molded brick shapes, and brick arches and their jointing, showing relation of existing to new units.
 - b. Setting number of each new terra cotta unit and its location on the structure in annotated plans and elevations.
 - c. Provisions for expansion joints or other sealant joints.
 - d. Provisions for flashing, lighting fixtures, conduits, and weep holes as required.
 - e. Replacement and repair anchors. Include details of anchors within individual masonry units, with locations of anchors and dimensions of holes and recesses in units required for anchors.
3. Samples: For each exposed product and for each color and texture specified.
4. Preconstruction Test Reports.

F. Quality Assurance

1. Restoration Specialist Qualifications: Engage an experienced, preapproved masonry restoration and cleaning firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience installing standard unit masonry is not sufficient experience for masonry restoration work.
 - a. At Contractor's option, work may be divided between two specialist firms: one for cleaning work and one for repair work.
 - b. Field Supervision: Restoration specialist firms shall maintain experienced full-time supervisors on Project site during times that clay masonry restoration and cleaning work is in progress. Supervisors shall not be changed during Project except for causes beyond the control of restoration specialist firm.
 - c. Restoration Worker Qualifications: Persons who are experienced and specialize in restoration work of types they will be performing. When masonry units are being patched, assign at least one worker among those performing patching work who is trained and certified by manufacturer of patching compound to apply its products.
2. Terra Cotta Manufacturer Qualifications: A firm regularly engaged in manufacturing custom architectural terra cotta units for building restoration purposes, of same type and of similar size, complexity, and tolerances as those required for the Work.
3. Mockups: Prepare mockups of restoration and cleaning to demonstrate aesthetic effects and set quality standards for materials and execution and for fabrication and installation.
 - a. Masonry Repair: Prepare sample areas for each type of masonry material indicated to have repair work performed. If not otherwise indicated, size each mockup not smaller than 2 adjacent whole units or approximately 48 inches (1200 mm) in least dimension. Erect sample areas in existing walls unless otherwise indicated, to demonstrate quality of materials, workmanship, and blending with existing work. Include the following as a minimum:
 - 1) Replacement:
 - a) Four brick units replaced.
 - b) Four terra cotta units replaced.
 - 2) Reanchoring Veneers: Install three masonry repair anchors in mockup wall assembly of each anchor type required.
 - 3) Patching: Three small holes at least 1 inch (25 mm) in diameter **OR** as directed, **as directed**, for each type of masonry material indicated to be patched, so as to leave no evidence of repair.
 - 4) Widening Joints: Widen a joint in 2 separate locations, each approximately 12 inches (300 mm) long **OR** as directed, **as directed**.
 - b. Repointing: Rake out joints in 2 separate areas, each approximately 36 inches (900 mm) high by 48 inches (1200 mm) wide **OR** as indicated, **as directed**, for each type of repointing required and repoint one of the areas.



- c. Cleaning: Clean an area approximately 25 sq. ft. (2.3 sq. m) **OR** as indicated, **as directed**, for each type of masonry and surface condition.
- 4. Preinstallation Conference: Conduct conference at Project site.
- G. Delivery, Storage, And Handling
 - 1. Deliver masonry units to Project site strapped together in suitable packs or pallets or in heavy-duty cartons.
 - 2. Deliver each piece of terra cotta with code mark or setting number on unexposed face, corresponding to Shop Drawings, using nonstaining paint.
 - 3. Deliver other materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
 - 4. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
 - 5. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.
 - 6. Store lime putty covered with water in sealed containers.
 - 7. Store sand where grading and other required characteristics can be maintained and contamination avoided.
- H. Project Conditions
 - 1. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit masonry restoration and cleaning work to be performed according to manufacturers' written instructions and specified requirements.
 - 2. Repair masonry units and repoint mortar joints only when air temperature is between 40 and 90 deg F (4 and 32 deg C) and is predicted to remain so for at least 7 days after completion of the Work unless otherwise indicated.
 - 3. Cold-Weather Requirements: Comply with the following procedures for masonry repair and mortar-joint pointing unless otherwise indicated:
 - a. When air temperature is below 40 deg F (4 deg C), heat mortar ingredients, masonry repair materials, and existing masonry walls to produce temperatures between 40 and 120 deg F (4 and 49 deg C).
 - b. When mean daily air temperature is below 40 deg F (4 deg C), provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for 7 days after repair and pointing.
 - c. Hot-Weather Requirements: Protect masonry repair and mortar-joint pointing when temperature and humidity conditions produce excessive evaporation of water from mortar and repair materials. Provide artificial shade and wind breaks and use cooled materials as required to minimize evaporation. Do not apply mortar to substrates with temperatures of 90 deg F (32 deg C) and above unless otherwise indicated.
 - 4. For manufactured repair materials, perform work within the environmental limits set by each manufacturer.
 - 5. Clean masonry surfaces only when air temperature is 40 deg F (4 deg C) and above and is predicted to remain so for at least 7 days after completion of cleaning.

1.2 PRODUCTS

- A. Masonry Materials
 - 1. Face Brick: Provide face brick, including specially molded, ground, cut, or sawed shapes where required to complete masonry restoration work.
 - a. Provide units with physical properties, colors, color variation within units, surface texture, size, and shape to match existing brickwork.
 - 1) Physical Properties per ASTM C 67:
 - 2) For existing brickwork that exhibits a range of colors or color variation within units, provide brick that proportionally matches that range and variation rather than brick that matches an individual color within that range.

- b. Special Shapes:
 - 1) Provide specially molded, 100 percent solid shapes for applications where core holes or "frogs" could be exposed to view or weather when in final position and where shapes produced by sawing would result in sawed surfaces being exposed to view.
 - 2) Provide specially ground units, shaped to match patterns, for arches and where indicated.
 - 3) Mechanical chopping or breaking brick, or bonding pieces of brick together by adhesive, are not acceptable procedures for fabricating special shapes.
- c. Tolerances as Fabricated: Comply with tolerance requirements in ASTM C 216, Type FBX **OR** Comply with tolerance requirements in ASTM C 216, Type FBS, **as directed**.
- 2. Building Brick: Provide building brick complying with ASTM C 62, of same vertical dimension as face brick, for masonry work concealed from view.
 - a. Grade SW where in contact with earth.
 - b. Grade SW, MW, or NW for concealed backup.
- 3. Salvaged Brick: Obtain salvaged brick from the Owner from location shown on Drawings. Clean off residual mortar.
- 4. Glazed Terra Cotta: Provide new terra cotta units to match existing terra cotta units in body composition, physical properties, color, gloss, surface texture, thickness, profile, dimensions, and composition of surface glaze.
 - a. Physical Properties: Provide units with tested physical properties within 10 percent of those determined from preconstruction testing of selected existing units.
 - 1) Physical Properties per ASTM C 67:
 - b. Tolerances as Fabricated: Comply with tolerance requirements in ASTM C 212, Type FTX.
- 5. Brownstone Terra Cotta: Provide new, unglazed, brownstone terra cotta units to match existing terra cotta units in body composition, physical properties, colors, color variation within units, surface texture, unit profile, and dimensions.
 - a. Physical Properties: Provide units with tested physical properties within 10 percent of those determined from preconstruction testing of selected existing units.
 - b. Physical Properties per ASTM C 67:
 - c. Tolerances as Fabricated: Comply with tolerance requirements in ASTM C 212, Type FTX.
 - d. For existing terra cotta that exhibits a range of colors or color variation within units, provide terra cotta that proportionally matches that range and variation rather than terra cotta that matches an individual color within that range.

B. Mortar Materials

- 1. Portland Cement: ASTM C 150, Type I or Type II, white or gray or both where required for color matching of exposed mortar.
 - a. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.
- 2. Hydrated Lime: ASTM C 207, Type S.
- 3. Factory-Prepared Lime Putty: ASTM C 1489.
- 4. Quicklime: ASTM C 5, pulverized lime.
- 5. Mortar Sand: ASTM C 144 unless otherwise indicated.
 - a. Color: Provide natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.
 - b. For pointing mortar, provide sand with rounded edges.
 - c. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
- 6. Mortar Pigments: Natural and synthetic iron oxides, compounded for mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars.
- 7. Water: Potable.



C. Manufactured Repair Materials

1. Masonry Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching masonry.
 - a. Use formulation that is vapor- and water permeable (equal to or more than the masonry unit), exhibits low shrinkage, has lower modulus of elasticity than the masonry units being repaired, and develops high bond strength to all types of masonry.
 - b. Use formulation having working qualities and retardation control to permit forming and sculpturing where necessary.
 - c. Formulate patching compound used for patching brick and terra cotta in colors and textures to match each masonry unit being patched.
2. Terra Cotta Glaze Replacement: A high-solids, nonyellowing, fade-resistant, waterborne polyurethane or epoxy coating intended for exterior use as terra cotta glaze replacement. Product shall be custom mixed by manufacturer to match color and gloss of existing terra cotta glaze.

D. Paint Removers

1. Alkaline Paste Paint Remover: Manufacturer's standard alkaline paste formulation for removing paint coatings from masonry.
2. Covered or Skin-Forming Alkaline Paint Remover: Manufacturer's standard covered or skin-forming alkaline formulation for removing paint coatings from masonry.
3. Solvent-Type Paint Remover: Manufacturer's standard water-rinsable, solvent-type gel formulation for removing paint coatings from masonry.
4. Low-Odor, Solvent-Type Paint Remover: Manufacturer's standard low-odor, water-rinsable solvent-type gel formulation, containing no methanol or methylene chloride, for removing paint coatings from masonry.

E. Cleaning Materials

1. Water: Potable.
2. Hot Water: Water heated to a temperature of 140 to 160 deg F (60 to 71 deg C).
3. Job-Mixed Detergent Solution: Solution prepared by mixing 2 cups (0.5 L) of tetrasodium polyphosphate, 1/2 cup (125 mL) of laundry detergent, and 20 quarts (20 L) of hot water for every 5 gal. (20 L) of solution required.
4. Job-Mixed Mold, Mildew, and Algae Remover: Solution prepared by mixing 2 cups (0.5 L) of tetrasodium polyphosphate, 5 quarts (5 L) of 5 percent sodium hypochlorite (bleach), and 15 quarts (15 L) of hot water for every 5 gal. (20 L) of solution required.
5. Nonacidic Gel Cleaner: Manufacturer's standard gel formulation, with pH between 6 and 9, that contains detergents with chelating agents and is specifically formulated for cleaning masonry surfaces.
6. Nonacidic Liquid Cleaner: Manufacturer's standard mildly alkaline liquid cleaner formulated for removing mold, mildew, and other organic soiling from ordinary building materials, including polished stone, brick, aluminum, plastics, and wood.
7. Mild Acidic Cleaner: Manufacturer's standard mildly acidic cleaner containing no muriatic (hydrochloric), hydrofluoric, or sulfuric acid; or ammonium bifluoride or chlorine bleaches.
8. Acidic Cleaner: Manufacturer's standard acidic masonry cleaner composed of hydrofluoric acid or ammonium bifluoride blended with other acids, detergents, wetting agents, and inhibitors.
9. Two-Part Chemical Cleaner: Manufacturer's standard system consisting of potassium or sodium hydroxide based, alkaline prewash cleaner and acidic afterwash cleaner that does not contain hydrofluoric acid.

F. Accessory Materials

1. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, and polished stone surfaces from damaging effects of acidic and alkaline masonry cleaners.
2. Terra Cotta Anchors: Type and size indicated or, if not indicated, to match existing anchors in size and type. Fabricate anchors from Type 304 **OR** Type 316, **as directed**, stainless steel.

3. Masonry Repair Anchors, Expansion Type: Mechanical fasteners designed for masonry veneer stabilization consisting of 1/4-inch- (6-mm-) diameter, Type 304 **OR** Type 316, **as directed**, stainless-steel rod with brass expanding shells at each end and water-shedding washer in the middle. Expanding shells shall be designed to provide positive mechanical anchorage to veneer on one end and backup masonry on the other.
4. Masonry Repair Anchors, Spiral Type: Type 304 **OR** Type 316, **as directed**, stainless-steel spiral rods designed to anchor to backing and veneer. Anchors are flexible in plane of veneer but rigid perpendicular to it.
 - a. Provide adhesive-installed anchors complete with manufacturer's standard epoxy adhesive and injection tubes, or other devices required for installation.
 - b. Provide driven-in anchors designed to be installed in drilled holes and relying on screw effect rather than adhesive to secure them to backup and veneer.
5. Masonry Repair Anchors, Rod/Screen Tube Type: Stainless-steel screen tube with or without Type 304 **OR** Type 316, **as directed**, stainless-steel rod, adhesive installed by injection with manufacturer's standard epoxy adhesive, complete with other devices required for installation.
6. Sealant Materials:
 - a. Provide manufacturer's standard chemically curing, elastomeric sealant(s) of base polymer and characteristics indicated below that comply with applicable requirements in Division 07 Section "Joint Sealants".
 - 1) Single-component, nonsag urethane sealant.
 - b. Colors: Provide colors of exposed sealants to match colors of masonry adjoining installed sealant unless otherwise indicated.
 - c. Ground-Mortar Aggregate: Custom crushed and ground pointing mortar sand or existing mortar retrieved from joints. Grind to a particle size that matches the adjacent mortar aggregate and color. Remove all fines passing the 100 sieve.
7. Joint-Sealant Backing:
 - a. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) or Type B (bicellular material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
 - b. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where acceptable.
8. Setting Buttons: Resilient plastic buttons, nonstaining to masonry, sized to suit joint thicknesses and bed depths of masonry units without intruding into required depths of pointing materials.
9. Masking Tape: Nonstaining, nonabsorbent material, compatible with pointing mortar, joint primers, sealants, and surfaces adjacent to joints; that will easily come off entirely, including adhesive.
10. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer complying with MPI #79, Alkyd Anticorrosive Metal Primer or SSPC-Paint 20 or SSPC-Paint 29 zinc-rich coating.
 - a. Use coating requiring no better than SSPC-SP 2, "Hand Tool Cleaning" **OR** SSPC-SP 3, "Power Tool Cleaning" **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning", **as directed**, surface preparation according to manufacturer's literature or certified statement.
 - b. Use coating with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
11. Miscellaneous Products: Select materials and methods of use based on the following, subject to approval of a mockup:
 - a. Previous effectiveness in performing the work involved.
 - b. Little possibility of damaging exposed surfaces.
 - c. Consistency of each application.
 - d. Uniformity of the resulting overall appearance.
 - e. Do not use products or tools that could do the following:
 - 1) Remove, alter, or in any way harm the present condition or future preservation of existing surfaces, including surrounding surfaces not in contract.



- 2) Leave a residue on surfaces.

G. Mortar Mixes

1. Preparing Lime Putty: Slake quicklime and prepare lime putty according to appendix to ASTM C 5 and manufacturer's written instructions.
2. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.
 - a. Mixing Pointing Mortar: Thoroughly mix cementitious materials and sand together before adding any water. Then mix again adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material.
3. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without the Owner's approval.
 - a. Mortar Pigments: Where mortar pigments are indicated, do not exceed a pigment-to-cement ratio of 1:10 by weight.
4. Do not use admixtures in mortar unless otherwise indicated.
5. Mortar Proportions: Mix mortar materials in the following proportions:
 - a. Pointing Mortar for Brick: 1 part portland cement, 2 parts lime, and 6 parts sand **OR** 1 part portland cement, 6 parts lime, and 12 parts sand, **as directed**.
 - 1) Add mortar pigments to produce mortar colors required.
 - b. Pointing Mortar for Terra Cotta: 1 part white portland cement, 1 part lime, and 6 parts sand.
 - 1) Add mortar pigments to produce mortar colors required.
 - c. Rebuilding (Setting) Mortar: Same as pointing mortar except mortar pigments are not required, **as directed**.
 - d. Rebuilding (Setting) Mortar: 1 part portland cement, 2 parts lime, and 6 parts sand **OR** 1 part portland cement, 6 parts lime, and 12 parts sand, **as directed**.
 - e. Rebuilding (Setting) Mortar: Comply with ASTM C 270, Proportion Specification, Type N unless otherwise indicated; with cementitious material limited to portland cement and lime.

H. Chemical Cleaning Solutions

1. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended by chemical-cleaner manufacturer.
2. Acidic Cleaner Solution for Brick and Brownstone Terra Cotta: Dilute with water to produce hydrofluoric acid content of 3 percent or less, but not greater than that recommended by chemical-cleaner manufacturer.
3. Acidic Cleaner Solution for Glazed Terra Cotta: Dilute with water to concentration demonstrated by testing that does not etch or otherwise damage terra cotta surface, but not greater than that recommended by chemical-cleaner manufacturer.

1.3 EXECUTION

A. Protection

1. Protect persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm resulting from masonry restoration work.
 - a. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during course of restoration and cleaning work.
2. Comply with chemical-cleaner manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical-cleaning solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.



- a. Cover adjacent surfaces with materials that are proven to resist chemical cleaners used unless chemical cleaners being used will not damage adjacent surfaces. Use materials that contain only waterproof, UV-resistant adhesives. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
 - b. Keep wall wet below area being cleaned to prevent streaking from runoff.
 - c. Do not clean masonry during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
 - d. Neutralize and collect alkaline and acid wastes for disposal off the Owner's property.
 - e. Dispose of runoff from cleaning operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
3. Prevent mortar from staining face of surrounding masonry and other surfaces.
 - a. Cover sills, ledges, and projections to protect from mortar droppings.
 - b. Keep wall area wet below rebuilding and pointing work to discourage mortar from adhering.
 - c. Immediately remove mortar in contact with exposed masonry and other surfaces.
 - d. Clean mortar splatters from scaffolding at end of each day.
 4. Remove gutters and downspouts adjacent to masonry and store where indicated during masonry restoration and cleaning. Reinstall when masonry restoration and cleaning are complete.
 - a. Provide temporary rain drainage during work as indicated to direct water away from building.

B. Unused Anchor Removal

1. Remove masonry anchors, brackets, wood nailers, and other extraneous items no longer in use unless identified as historically significant or indicated to remain.
 - a. Remove items carefully to avoid spalling or cracking masonry.
 - b. Where directed, if an item cannot be removed without damaging surrounding masonry, do the following:
 - 1) Cut or grind off item approximately 3/4 inch (20 mm) beneath surface and core drill a recess of same depth in surrounding masonry as close around item as practical.
 - 2) Immediately paint exposed end of item with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended dry film thickness per coat. Keep paint off sides of recess.
 - c. Patch the hole where each item was removed unless directed to remove and replace the masonry unit.

C. Brick Removal And Replacement

1. At locations indicated, remove bricks that are damaged, spalled, or deteriorated or are to be reused. Carefully demolish or remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.
 - a. When removing single bricks, remove material from center of brick and work toward outside edges.
2. Support and protect remaining masonry that surrounds removal area. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.
3. Notify the Owner of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.
4. Remove in an undamaged condition as many whole bricks as possible.
 - a. Remove mortar, loose particles, and soil from brick by cleaning with hand chisels, brushes, and water.
 - b. Remove sealants by cutting close to brick with utility knife and cleaning with solvents.
 - c. Store brick for reuse. Store off ground, on skids, and protected from weather.
 - d. Deliver cleaned brick not required for reuse to the Owner unless otherwise indicated.
5. Clean bricks surrounding removal areas by removing mortar, dust, and loose particles in preparation for replacement.



6. Replace removed damaged brick with other removed brick and salvaged brick in good quality, where possible, or with new brick matching existing brick, including size. Do not use broken units unless they can be cut to usable size.
 7. Install replacement brick into bonding and coursing pattern of existing brick. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.
 - a. Maintain joint width for replacement units to match existing joints.
 - b. Use setting buttons or shims to set units accurately spaced with uniform joints.
 8. Lay replacement brick with completely filled bed, head, and collar joints. Butter ends with sufficient mortar to fill head joints and shove into place. Wet both replacement and surrounding bricks that have ASTM C 67 initial rates of absorption (suction) of more than 30 g/30 sq. in. per min. (30 g/194 sq. cm per min.). Use wetting methods that ensure that units are nearly saturated but surface is dry when laid.
 - a. Tool exposed mortar joints in repaired areas to match joints of surrounding existing brickwork.
 - b. Rake out mortar used for laying brick before mortar sets and point new mortar joints in repaired area to comply with requirements for repointing existing masonry, and at same time as repointing of surrounding area.
 - c. When mortar is sufficiently hard to support units, remove shims and other devices interfering with pointing of joints.
- D. Terra Cotta Removal And Replacement
1. At locations indicated, remove terra cotta units that are damaged, spalled, or deteriorated. Carefully demolish or remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.
 2. Support and protect remaining masonry that was supported by removed units. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.
 3. Notify the Owner of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.
 4. Clean masonry surrounding removal areas by removing mortar, dust, and loose particles in preparation for replacement.
 5. Install replacement units into bonding and coursing pattern of existing units.
 - a. Do not cut or grind glazed terra cotta.
 - b. If minor cutting of replacement brownstone terra cotta is required, use a motor-driven grinder or saw designed to cut masonry with clean, sharp, unchipped edges. Do not cut or grind more than 1/8 inch (3 mm) along any edge.
 - c. Use setting buttons or shims to set units accurately spaced with uniform joints.
 6. Set replacement units in a full bed of mortar. Replace existing anchors with new anchors of size and type indicated.
 - a. Embed anchors in mortar and fill voids behind units with mortar.
 - b. Tool exposed mortar joints in repaired areas to match joints of surrounding existing terra cotta.
 - c. Rake out mortar used for laying terra cotta before mortar sets and point new mortar joints in repaired area to comply with requirements for repointing existing masonry, and at same time as repointing of surrounding area.
 - d. When mortar is sufficiently hard to support units, remove shims and other devices interfering with pointing of joints.
- E. Reanchoring Veneers
1. Install masonry repair anchors in horizontal mortar joints and according to manufacturer's written instructions. Install at not more than 16 inches (400 mm) o.c. vertically and 32 inches (800 mm) o.c. horizontally unless otherwise indicated. Install at locations to avoid penetrating flashing.
 2. Recess anchors at least 5/8 inch (16 mm) from surface of mortar joint and fill recess with pointing mortar.
- F. Painting Steel Uncovered During The Work



1. Inspect steel exposed during masonry removal. Where the Owner determines that it is structural, or for other reasons cannot be totally removed, prepare and paint it as follows:
 - a. Remove paint, rust, and other contaminants according to SSPC-SP 2, "Hand Tool Cleaning" **OR** SSPC-SP 3, "Power Tool Cleaning" **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning", **as directed**, as applicable to meet paint manufacturer's recommended preparation.
 - b. Immediately paint exposed steel with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended rate of application (dry film thickness per coat).
2. If on inspection and rust removal, the cross section of a steel member is found to be reduced from rust by more than 1/16 inch (1.6 mm), notify the Owner before proceeding.

G. Masonry Unit Patching

1. Patch the following masonry units unless another type of replacement or repair is indicated:
 - a. Units indicated to be patched.
 - b. Units with holes.
 - c. Units with chipped edges or corners.
 - d. Units with small areas of deep deterioration.
2. Remove and replace existing patches unless otherwise indicated or approved by the Owner.
3. Patching Bricks:
 - a. Remove loose material from masonry surface. Carefully remove additional material so patch will not have feathered edges but will have square or slightly undercut edges on area to be patched and will be at least 1/4 inch (6 mm) thick, but not less than recommended by patching compound manufacturer.
 - b. Mask adjacent mortar joint or rake out for repointing if patch will extend to edge of masonry unit.
 - c. Mix patching compound in individual batches to match each unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.
 - d. Rinse surface to be patched and leave damp, but without standing water.
 - e. Brush-coat surfaces with slurry coat of patching compound according to manufacturer's written instructions.
 - f. Place patching compound in layers as recommended by patching compound manufacturer, but not less than 1/4 inch (6 mm) or more than 2 inches (50 mm) thick. Roughen surface of each layer to provide a key for next layer.
 - g. Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane or contour of the masonry unit. Shape and finish surface before or after curing, as determined by testing, to best match existing masonry unit.
 - h. Keep each layer damp for 72 hours or until patching compound has set.
4. Patching Terra Cotta:
 - a. Remove deteriorated material as determined by sounding gently with a small hammer. Carefully remove additional material so patch will not have feathered edges but will have square or slightly undercut edges on area to be patched and will be at least 1/4 inch (6 mm) thick, but not less than recommended by patching compound manufacturer.
 - b. Where mortar joints adjacent to patch are open, fill back of joints with pointing mortar and allow to cure before patching terra cotta. Leave space for pointing joints according to "Repointing Masonry" Article.
 - c. Mask adjacent mortar joint or rake out for repointing if patch will extend to edge of unit.
 - d. Rinse surface to be patched and leave damp, but without standing water.
 - e. Brush-coat surfaces with slurry coat of patching compound according to manufacturer's written instructions.
 - f. Place patching compound in layers as recommended by patching compound manufacturer, but not less than 1/4 inch (6 mm) or more than 2 inches (50 mm) thick. Roughen surface of each layer to provide a key for next layer.
 - g. Do not apply patching compound over mortar joints. If patching compound bridges mortar joints, cut out joints after patching compound hardens.



- h. Trowel, scrape, or carve surface of patch to match texture, details, and surrounding surface plane or contour of terra cotta. Shape and finish surface before or after curing, as determined by testing to best match existing terra cotta.
 - i. Keep each layer damp for 72 hours or until patching compound has set.
 - j. After final layer of patching compound has cured, apply glaze replacement according to manufacturer's written instructions. Apply two or more coats, as needed, to match glaze of adjacent terra cotta units.
- H. Widening Joints
- 1. Do not widen a joint, except where indicated or approved by the Owner.
 - 2. Location Guideline: Where an existing masonry unit abuts another or the joint is less than 1/8 inch (3 mm), widen the joint for length indicated and to depth required for repointing after obtaining the Owner's approval.
 - 3. Carefully perform widening by cutting, grinding, routing, or filing procedures demonstrated in an approved mockup.
 - 4. Widen joint to width equal to or less than predominant width of other joints on building. Make sides of widened joint uniform and parallel. Ensure that edges of units along widened joint are in alignment with joint edges at unaltered joints.
- I. Cleaning Masonry, General
- 1. Proceed with cleaning in an orderly manner; work from bottom to top **OR** top to bottom, **as directed**, of each scaffold width and from one end of each elevation to the other. Ensure that dirty residues and rinse water will not wash over cleaned, dry surfaces.
 - 2. Use only those cleaning methods indicated for each masonry material and location.
 - a. Do not use wire brushes or brushes that are not resistant to chemical cleaner being used. Do not use plastic-bristle brushes if natural-fiber brushes will resist chemical cleaner being used.
 - b. Use spray equipment that provides controlled application at volume and pressure indicated, measured at spray tip. Adjust pressure and volume to ensure that cleaning methods do not damage masonry.
 - 1) Equip units with pressure gages.
 - c. For chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with cone-shaped spray tip.
 - d. For water-spray application, use fan-shaped spray tip that disperses water at an angle of 25 to 50 degrees.
 - e. For high-pressure water-spray application, use fan-shaped spray tip that disperses water at an angle of at least 40 degrees.
 - f. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F (60 and 71 deg C) at flow rates indicated.
 - g. For steam application, use steam generator capable of delivering live steam at nozzle.
 - 3. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces.
 - 4. Water Application Methods:
 - a. Water-Soak Application: Soak masonry surfaces by applying water continuously and uniformly to limited area for time indicated. Apply water at low pressures and low volumes in multiple fine sprays using perforated hoses or multiple spray nozzles. Erect a protective enclosure constructed of polyethylene sheeting to cover area being sprayed.
 - b. Water-Spray Applications: Unless otherwise indicated, hold spray nozzle at least 6 inches (150 mm) from surface of masonry and apply water in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.
 - 5. Steam Cleaning: Apply steam to masonry surfaces at the very low pressures indicated for each type of masonry material. Hold nozzle at least 6 inches (150 mm) from surface of masonry and apply steam in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.



6. Chemical-Cleaner Application Methods: Apply chemical cleaners to masonry surfaces to comply with chemical-cleaner manufacturer's written instructions; use brush or spray application. Do not spray apply at pressures exceeding 50 psi (345 kPa). Do not allow chemicals to remain on surface for periods longer than those indicated or recommended by manufacturer.
 7. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.
 - a. Apply neutralizing agent and repeat rinse if necessary to produce tested pH of between 6.7 and 7.5.
 8. After cleaning is complete, remove protection no longer required. Remove tape and adhesive marks.
- J. Preliminary Cleaning
1. Removing Plant Growth: Completely remove visible plant, moss, and shrub growth from masonry surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing to dry as long as possible before removal. Remove loose soil and debris from open masonry joints to whatever depth they occur.
 2. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to cleaning methods being used. Extraneous substances include paint, calking, asphalt, and tar.
 - a. Carefully remove heavy accumulations of material from surface of masonry with a sharp chisel. Do not scratch or chip masonry surface.
 - b. Remove paint and calking with alkaline paint remover.
 - 1) Comply with requirements in "Paint Removal" Article.
 - 2) Repeat application up to two times if needed.
 - c. Remove asphalt and tar with solvent-type paint remover.
 - 1) Comply with requirements in "Paint Removal" Article.
 - 2) Apply paint remover only to asphalt and tar by brush without prewetting.
 - 3) Allow paint remover to remain on surface for 10 to 30 minutes.
 - 4) Repeat application if needed.
- K. Paint Removal
1. Paint Removal with Alkaline Paste Paint Remover:
 - a. Remove loose and peeling paint using low **OR** medium **OR** high, **as directed**, -pressure spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
 - b. Apply paint remover to dry, painted masonry with brushes.
 - c. Allow paint remover to remain on surface for period recommended by manufacturer.
 - d. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and paint residue.
 - e. Repeat process if necessary to remove all paint.
 - f. Apply acidic cleaner or manufacturer's recommended afterwash to masonry, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner or afterwash remain on surface as a neutralizing agent for period recommended by chemical cleaner or afterwash manufacturer.
 - g. Rinse with cold water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
 2. Paint Removal with Covered or Skin-Forming Alkaline Paint Remover:
 - a. Remove loose and peeling paint using low **OR** medium **OR** high, **as directed**, -pressure spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
 - b. Apply paint remover to dry, painted masonry with trowel, spatula, or as recommended by manufacturer.
 - c. Apply cover, if required by manufacturer, per manufacturer's written instructions.
 - d. Allow paint remover to remain on surface for period recommended by manufacturer or as determined in test panels.
 - e. Scrape off paint and remover and collect for disposal.



- f. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and paint residue.
- g. Use alkaline paste paint remover, according to "Paint Removal with Alkaline Paste Paint Remover" Paragraph, if necessary to remove remaining paint.
- h. Apply acidic cleaner or manufacturer's recommended afterwash to masonry, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner or afterwash remain on surface as a neutralizing agent for period recommended by chemical-cleaner or afterwash manufacturer.
- i. Rinse with cold water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
3. Paint Removal with Solvent-Type Paint Remover:
 - a. Remove loose and peeling paint using low **OR** medium **OR** high, **as directed**, -pressure spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
 - b. Apply thick coating of paint remover to painted masonry with natural-fiber cleaning brush, deep-nap roller, or large paint brush.
 - c. Allow paint remover to remain on surface for period recommended by manufacturer. Agitate periodically with stiff-fiber brush.
 - d. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and paint residue.
- L. Cleaning Brickwork
 1. Cold-Water Soak:
 - a. Apply cold water by intermittent spraying to keep surface moist.
 - b. Use perforated hoses or other means that will apply a fine water mist to entire surface being cleaned.
 - c. Apply water in cycles with at least 30 minutes between cycles.
 - d. Continue spraying until surface encrustation has softened sufficiently to permit its removal by water wash, as indicated by cleaning tests.
 - e. Continue spraying for 72 hours.
 - f. Remove soil and softened surface encrustation from masonry with cold water applied by low-pressure spray.
 2. Cold-Water Wash: Use cold water applied by low **OR** medium **OR** high, **as directed**, -pressure spray.
 3. Hot-Water Wash: Use hot water applied by low **OR** medium **OR** high, **as directed**, -pressure spray.
 4. Steam Cleaning: Apply steam at very low pressures not exceeding 30 psi (207 kPa) **OR** 80 psi (550 kPa), **as directed**. Remove dirt softened by steam with wood scrapers, stiff-nylon or -fiber brushes, or cold-water wash, as indicated by cleaning tests.
 5. Detergent Cleaning:
 - a. Wet masonry with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Scrub masonry with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that masonry surface remains wet.
 - c. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove detergent solution and soil.
 - d. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.
 6. Mold, Mildew, and Algae Removal:
 - a. Wet masonry with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Apply mold, mildew, and algae remover by brush or low-pressure spray.
 - c. Scrub masonry with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that masonry surface remains wet.



- d. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove mold, mildew, and algae remover and soil.
- e. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.
- 7. Nonacidic Gel Chemical Cleaning:
 - a. Wet masonry with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Apply nonacidic gel cleaner in 1/8-inch (3-mm) thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively so area will be uniformly covered with fresh cleaner and dwell time will be uniform throughout area being cleaned.
 - c. Let cleaner remain on surface for period indicated below:
 - 1) As recommended by chemical-cleaner manufacturer.
 - 2) As established by mockup.
 - d. Remove bulk of nonacidic gel cleaner by squeegeeing into containers for disposal.
 - e. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
 - f. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
- 8. Nonacidic Liquid Chemical Cleaning:
 - a. Wet masonry with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Apply cleaner to masonry in two applications, **as directed**, by brush or low-pressure spray. Let cleaner remain on surface for period indicated below:
 - 1) As recommended by chemical-cleaner manufacturer.
 - 2) As established by mockup.
 - 3) Two to three minutes.
 - c. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
 - d. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
- 9. Mild Acidic **OR** Acidic, **as directed**, Chemical Cleaning:
 - a. Wet masonry with cold water applied by low-pressure spray.
 - b. Apply cleaner to masonry in two applications, **as directed**, by brush or low-pressure spray. Let cleaner remain on surface for period indicated below:
 - 1) As recommended by chemical-cleaner manufacturer.
 - 2) As established by mockup.
 - 3) Two to three minutes.
 - c. Rinse with cold water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
 - d. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use a steam cleaning.

M. Cleaning Brownstone Terra Cotta

- 1. Cold-Water Soak:
 - a. Apply cold water by intermittent spraying to keep surface moist.
 - b. Use perforated hoses or other means that will apply a fine water mist to entire surface being cleaned.
 - c. Apply water in cycles with at least 30 minutes between cycles.
 - d. Continue spraying until surface encrustation has softened sufficiently to permit its removal by water wash, as indicated by cleaning tests.
 - e. Continue spraying for 72 hours.
 - f. Remove soil and softened surface encrustation from masonry with cold water applied by low-pressure spray.



2. Cold-Water Wash: Use cold water applied by low **OR** medium **OR** high, **as directed**, -pressure spray.
3. Hot-Water Wash: Use hot water applied by low **OR** medium **OR** high, **as directed**, -pressure spray.
4. Steam Cleaning: Apply steam at very low pressures not exceeding 30 psi (207 kPa) **OR** 80 psi (550 kPa), **as directed**. Remove dirt softened by steam with wood scrapers, stiff-nylon or -fiber brushes, or cold-water wash, as indicated by cleaning tests.
5. Detergent Cleaning:
 - a. Wet masonry with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Scrub masonry with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that masonry surface remains wet.
 - c. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove detergent solution and soil.
 - d. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.
6. Mold, Mildew, and Algae Removal:
 - a. Wet masonry with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Apply mold, mildew, and algae remover by brush or low-pressure spray.
 - c. Scrub masonry with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that masonry surface remains wet.
 - d. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove mold, mildew, and algae remover and soil.
 - e. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.
7. Nonacidic Gel Chemical Cleaning:
 - a. Wet masonry with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Apply nonacidic gel cleaner in 1/8-inch (3-mm) thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively so area will be uniformly covered with fresh cleaner and dwell time will be uniform throughout area being cleaned.
 - c. Let cleaner remain on surface for period indicated below:
 - 1) As recommended by chemical-cleaner manufacturer.
 - 2) As established by mockup.
 - d. Remove bulk of nonacidic gel cleaner by squeegeeing into containers for disposal.
 - e. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
 - f. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
8. Nonacidic Liquid Chemical Cleaning:
 - a. Wet masonry with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Apply cleaner to masonry in two applications, **as directed**, by brush or low-pressure spray. Let cleaner remain on surface for period indicated below:
 - 1) As recommended by chemical-cleaner manufacturer.
 - 2) As established by mockup.
 - 3) Two to three minutes.
 - c. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
 - d. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
9. Mild Acidic **OR** Acidic, **as directed**, Chemical Cleaning:
 - a. Wet masonry with cold water applied by low-pressure spray.



- b. Apply cleaner to masonry in two applications, **as directed**, by brush or low-pressure spray. Let cleaner remain on surface for period indicated below:
 - 1) As recommended by chemical-cleaner manufacturer.
 - 2) As established by mockup.
 - 3) Two to three minutes.
- c. Rinse with cold water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
- d. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use a steam cleaning.

N. Cleaning Glazed Terra Cotta

1. Hot-Water Wash: Use hot water applied by low **OR** medium **OR** high, **as directed**, -pressure spray.
2. Steam Cleaning: Apply steam at very low pressures not exceeding 30 psi (207 kPa) **OR** 80 psi (550 kPa), **as directed**. Remove dirt softened by steam with wood scrapers, stiff-nylon or -fiber brushes, or cold-water wash, as indicated by cleaning tests.
3. Nonacidic Gel Chemical Cleaning:
 - a. Wet terra cotta with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Apply nonacidic gel cleaner in 1/8-inch (3-mm) thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively so area will be uniformly covered with fresh cleaner and dwell time will be uniform throughout area being cleaned.
 - c. Let cleaner remain on surface for period indicated below:
 - 1) As recommended by chemical-cleaner manufacturer.
 - 2) As established by mockup.
 - d. Remove bulk of nonacidic gel cleaner by squeegeeing into containers for disposal.
 - e. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
 - f. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
4. Nonacidic Liquid Chemical Cleaning:
 - a. Wet terra cotta with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Apply cleaner to terra cotta in two applications, **as directed**. Let cleaner remain on surface for period indicated below:
 - 1) As recommended by chemical-cleaner manufacturer.
 - 2) As established by mockup.
 - 3) Two to three minutes.
 - c. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
 - d. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
5. Mild Acidic Chemical Cleaning:
 - a. Wet terra cotta with cold water applied by low-pressure spray.
 - b. Apply cleaner to terra cotta in two applications, **as directed**. Let cleaner remain on surface for period indicated below:
 - 1) As recommended by chemical-cleaner manufacturer.
 - 2) As established by mockup.
 - 3) Two to three minutes.
 - c. Rinse with cold water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
 - d. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.



6. Two-Part Chemical Cleaning:
 - a. Wet terra cotta with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Apply alkaline prewash cleaner to terra cotta by brush or roller. Let cleaner remain on surface for period recommended by chemical-cleaner manufacturer unless otherwise indicated.
 - c. Rinse with cold **OR** hot, **as directed**, water applied by medium-pressure spray to remove chemicals and soil.
 - d. Apply acidic afterwash cleaner to terra cotta in two applications, **as directed**, while surface is still wet, using low-pressure spray equipment, deep-nap roller or soft-fiber brush. Let neutralizer remain on surface for period recommended by manufacturer unless otherwise indicated.
 - e. Rinse with cold water applied by medium-pressure spray to remove chemicals and soil.
 - f. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

- O. Repointing Masonry
 1. Rake out and repoint joints to the following extent:
 - a. All joints in areas indicated.
 - b. Joints where mortar is missing or where they contain holes.
 - c. Cracked joints where cracks can be penetrated at least 1/4 inch (6 mm) by a knife blade 0.027 inch (0.7 mm) thick.
 - d. Cracked joints where cracks are 1/16 inch (1.6 mm) **OR** 1/8 inch (3 mm), **as directed**, or more in width and of any depth.
 - e. Joints where they sound hollow when tapped by metal object.
 - f. Joints where they are worn back 1/4 inch (6 mm) or more from surface.
 - g. Joints where they are deteriorated to point that mortar can be easily removed by hand, without tools.
 - h. Joints where they have been filled with substances other than mortar.
 - i. Joints indicated as sealant-filled joints.
 2. Do not rake out and repoint joints where not required.
 3. Rake out joints as follows, according to procedures demonstrated in approved mockup:
 - a. Remove mortar from joints to depth of joint width plus 1/8 inch (3 mm) **OR** 2 times joint width **OR** 2-1/2 times joint width, **as directed**, but not less than 1/2 inch (13 mm) or not less than that required to expose sound, unweathered mortar.
 - b. Remove mortar from masonry surfaces within raked-out joints to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
 - c. Do not spall edges of masonry units or widen joints. Replace or patch damaged masonry units as directed by the Owner.
 - 1) Cut out mortar by hand with chisel and resilient mallet. Do not use power-operated grinders without the Owner's written approval based on approved quality-control program.
 - 2) Cut out center of mortar bed joints using angle grinders with diamond-impregnated metal blades. Remove remaining mortar by hand with chisel and resilient mallet. Strictly adhere to approved quality-control program.
 4. Notify the Owner of unforeseen detrimental conditions including voids in mortar joints, cracks, loose masonry units, rotted wood, rusted metal, and other deteriorated items.
 5. Pointing with Mortar:
 - a. Rinse joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen joint surfaces before pointing.
 - b. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8 inch (9 mm) until a uniform depth is formed. Fully compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.

- c. After low areas have been filled to same depth as remaining joints, point all joints by placing mortar in layers not greater than 3/8 inch (9 mm). Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing masonry units have worn or rounded edges, slightly recess finished mortar surface below face of masonry to avoid widened joint faces. Take care not to spread mortar beyond joint edges onto exposed masonry surfaces or to featheredge the mortar.
 - d. When mortar is thumbprint hard, tool joints to match original appearance of joints as demonstrated in approved mockup. Remove excess mortar from edge of joint by brushing.
 - e. Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours including weekends and holidays.
 - 1) Acceptable curing methods include covering with wet burlap and plastic sheeting, periodic hand misting, and periodic mist spraying using system of pipes, mist heads, and timers.
 - 2) Adjust curing methods to ensure that pointing mortar is damp throughout its depth without eroding surface mortar.
 - f. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.
6. Pointing with Sealant:
- a. After raking out, keep joints dry and free of mortar and debris.
 - b. Clean and prepare joint surfaces according to Division 07 Section "Joint Sealants". Prime joint surfaces unless sealant manufacturer recommends against priming. Do not allow primer to spill or migrate onto adjoining surfaces.
 - c. Fill sealant joints with specified joint sealant according to Division 07 Section "Joint Sealants" and the following:
 - 1) Install cylindrical sealant backing beneath the sealant, except where space is insufficient. There, install bond-breaker tape.
 - 2) Install sealant using only proven installation techniques that will ensure that sealant will be deposited in a uniform, continuous ribbon, without gaps or air pockets, and with complete wetting of the joint bond surfaces equally on both sides. Fill joint flush with surrounding masonry and matching the contour of adjoining mortar joints.
 - 3) Install sealant as recommended by sealant manufacturer but within the following general limitations, measured at the center (thin) section of the bead:
 - a) Fill joints to a depth equal to joint width, but not more than 1/2 inch (13 mm) deep or less than 1/4 inch (6 mm) deep.
 - 4) Immediately after first tooling, apply ground-mortar aggregate to sealant, gently pushing aggregate into the surface of sealant. Retool sealant to form smooth, uniform beads, slightly concave. Remove excess sealant and aggregate from surfaces adjacent to joint.
 - 5) Do not allow sealant to overflow or spill onto adjoining surfaces, or to migrate into the voids of adjoining surfaces, particularly rough textures. Remove excess and spillage of sealant promptly as the work progresses. Clean adjoining surfaces by the means necessary to eliminate evidence of spillage, without damage to adjoining surfaces or finishes, as demonstrated in an approved mockup.
 - d. Cure sealant according to Division 07 Section "Joint Sealants".
7. Where repointing work precedes cleaning of existing masonry, allow mortar to harden at least 30 days before beginning cleaning work.
- P. Final Cleaning
1. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, spray applied at low pressure.
 - a. Do not use metal scrapers or brushes.
 - b. Do not use acidic or alkaline cleaners.
 2. Wash adjacent woodwork and other nonmasonry surfaces. Use detergent and soft brushes or cloths.



3. Clean mortar and debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.
4. Sweep and rake adjacent pavement and grounds to remove mortar and debris. Where necessary, pressure wash pavement surfaces to remove mortar, dust, dirt, and stains.

Q. Field Quality Control

1. Inspectors: Engage qualified independent inspectors to perform inspections and prepare test reports. Allow inspectors use of lift devices and scaffolding, as needed, to perform inspections.
2. the Owner's Project Representatives: the Owner will assign Project representatives to help carry out the Owner's responsibilities at the site, including observing progress and quality of portion of the Work completed. Allow the Owner's Project representatives use of lift devices and scaffolding, as needed, to observe progress and quality of portion of the Work completed.
3. Notify inspectors and the Owner's Project representatives in advance of times when lift devices and scaffolding will be relocated. Do not relocate lift devices and scaffolding until inspectors and the Owner's Project representatives have had reasonable opportunity to make inspections and observations of work areas at lift device or scaffold location.

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Task	Specification	Specification Description
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SECTION 04 01 40 52 - STONE RESTORATION AND CLEANING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for stone restoration and cleaning. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes maintenance of stone assemblies consisting of stone restoration and cleaning as follows:
 - a. Unused anchor removal.
 - b. Repairing stone masonry, including replacing whole and partial units.
 - c. Painting steel uncovered during the work.
 - d. Repointing joints.
 - e. Preliminary cleaning, including removing plant growth.
 - f. Cleaning exposed stone surfaces.
 - g. Stone consolidation treatment.

C. Definitions

1. Very Low-Pressure Spray: Under 100 psi (690 kPa).
2. Low-Pressure Spray: 100 to 400 psi (690 to 2750 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).
3. Medium-Pressure Spray: 400 to 800 psi (2750 to 5510 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).
4. High-Pressure Spray: 800 to 1200 psi (5510 to 8250 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).
5. Stone Terminology: ASTM C 119.
6. Face Bedding: Setting of stone with the natural bedding planes (strata) vertical and parallel to the wall plane rather than horizontal or "naturally bedded," which holds bedding planes together by gravity.

D. Preconstruction Testing

1. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on stone units as follows:
 - a. Existing Stone: Test each type of existing stone indicated for replacement, according to ASTM C 170 for compressive strength, wet and dry, perpendicular and parallel to rift; ASTM C 99 for modulus of rupture, wet and dry, perpendicular and parallel to rift; and ASTM C 97 for absorption and bulk specific gravity. Carefully remove five existing stones from locations designated by the Owner. Take testing samples from these stones.
 - b. Existing Mortar: Test according to ASTM C 295, modified as agreed by testing service and the Owner for Project requirements, to determine proportional composition of original ingredients, sizes and colors of aggregates, and approximate strength. Use X-ray diffraction, infrared spectroscopy, and differential thermal analysis as necessary to supplement microscopical methods. Carefully remove existing mortar from within joints at five locations designated by the Owner or testing service.
 - c. Temporary Patch: as directed by the Owner, provide temporary materials at locations from which existing samples were taken.
 - d. Replacement Stone: Test each proposed type of replacement stone, according to ASTM C 170 for compressive strength, ASTM C 99 for modulus of rupture, and ASTM C 97 for absorption and bulk specific gravity.

E. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For the following:

- a. Replacement stone units and their jointing, showing relation of existing to new units.
- b. Partial replacement stone units (dutchmen).
- c. Setting number of each new stone unit and its location on the structure in annotated plans and elevations.
- d. Provisions for expansion joints or other sealant joints.
- e. Provisions for flashing, lighting fixtures, conduits, and weep holes as required.
- f. Replacement and repair anchors, including drilled-in pins. Include details of anchors within individual stone units, with locations of anchors and dimensions of holes and recesses in stone required for anchors, including direction and angle of holes for pins.
3. Samples: For each exposed product and for each color and texture specified.
4. Preconstruction Test Reports.

F. Quality Assurance

1. Restoration Specialist Qualifications: Engage an experienced, preapproved stone restoration and cleaning firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience installing standard unit masonry or new stone masonry is not sufficient experience for stone restoration work.
 - a. At Contractor's option, work may be divided between two specialist firms: one for cleaning work and one for repair work.
 - b. Field Supervision: Restoration specialist firms shall maintain experienced full-time supervisors on Project site during times that stone restoration and cleaning work is in progress. Supervisors shall not be changed during Project except for causes beyond control of restoration specialist firm.
 - c. Restoration Worker Qualifications: Persons who are experienced and specialize in restoration work of types they will be performing. When stone units are being patched, assign at least one worker among those performing patching work who is trained and certified by manufacturer of patching compound to apply its products.
2. Mockups: Prepare mockups of restoration and cleaning to demonstrate aesthetic effects and set quality standards for materials and execution and for fabrication and installation.
 - a. Stone Repair: Prepare sample areas for each type of stone indicated to have repair work performed. If not otherwise indicated, size each mockup not smaller than 2 adjacent whole units or approximately 48 inches (1200 mm) in least dimension. Erect sample areas in existing walls unless otherwise indicated, to demonstrate quality of materials, workmanship, and blending with existing work. Include the following as a minimum:
 - 1) Replacement: Four stone units replaced.
 - 2) Partial Stone Replacement: Two partial stone replacements (dutchman repairs).
 - 3) Stone Plug Repair: Two stone plug repairs for each type of stone indicated to be plugged.
 - 4) Crack Injection: Apply crack injection in 2 separate areas, each approximately 36 inches (900 mm) long.
 - 5) Patching: Three small holes at least 1 inch (25 mm) in diameter.
 - b. Repointing: Rake out joints in 2 separate areas, each approximately 36 inches (900 mm) high by 48 inches (1200 mm) wide, for each type of repointing required and repoint one of the areas.
 - c. Consolidation: Apply stone consolidation treatment to an area approximately 4 sq. ft. (0.4 sq. m).
 - d. Cleaning: Clean an area approximately 25 sq. ft. (2.3 sq. m) for each type of stone and surface condition.
3. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling

1. Deliver stone units to Project site strapped together in suitable packs or pallets or in heavy-duty crates.



2. Deliver each piece of granite with code mark or setting number on unexposed face, corresponding to Shop Drawings, using nonstaining paint.
3. Deliver other materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
4. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
5. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.
6. Store lime putty covered with water in sealed containers.
7. Store sand where grading and other required characteristics can be maintained and contamination avoided.

H. Project Conditions

1. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit stone restoration and cleaning work to be performed according to manufacturers' written instructions and specified requirements.
2. Repair stone units and repoint mortar joints only when air temperature is between 40 and 90 deg F (4 and 32 deg C) and is predicted to remain so for at least 7 days after completion of the Work unless otherwise indicated.
3. Cold-Weather Requirements: Comply with the following procedures for stone repair and mortar-joint pointing unless otherwise indicated:
 - a. When air temperature is below 40 deg F (4 deg C), heat mortar ingredients, repair materials, and existing stone to produce temperatures between 40 and 120 deg F (4 and 49 deg C).
 - b. When mean daily air temperature is below 40 deg F (4 deg C), provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for 7 days after repair and pointing.
4. Hot-Weather Requirements: Protect stone repair and mortar-joint pointing when temperature and humidity conditions produce excessive evaporation of water from mortar and patching materials. Provide artificial shade and wind breaks and use cooled materials as required to minimize evaporation. Do not apply mortar to substrates with temperatures of 90 deg F (32 deg C) and above unless otherwise indicated.
5. For manufactured repair materials, perform work within the environmental limits set by each manufacturer.
6. Clean stone surfaces only when air temperature is 40 deg F (4 deg C) and above and is predicted to remain so for at least 7 days after completion of cleaning.
7. Apply stone consolidation treatment only when surface and air temperatures are between 50 and 90 deg F (10 and 32 deg C) and rain is not expected within 24 hours.

1.2 PRODUCTS

A. Stone Materials

1. Stone: Provide natural building stone of variety, color, texture, grain, veining, finish, size, and shape to match existing stone and with physical properties within 10 percent of those determined from preconstruction testing of selected existing stone.
 - a. For existing stone that exhibits a range of colors, texture, grain, veining, finishes, sizes, or shapes, provide stone that proportionally matches that range rather than stone that matches an individual color, texture, grain, veining, finish, size, or shape within that range.
2. Stone: Provide natural building stone of variety, color, texture, grain, veining, finish, and physical properties to match the Owner's sample. Match existing stone in size and shape.
 - a. For the Owner's sample that exhibits a range of colors, texture, grain, veining, finishes, sizes, or shapes, provide stone that proportionally matches that range rather than stone that matches an individual color, texture, grain, veining, finish, size, or shape within that range.



3. Quarrying New Stone: Have quarry clearly label the direction of bedding planes when rough stone is quarried, to facilitate cutting stones so that natural bedding planes will be as required in "Cutting New Stone" Paragraph.
4. Cutting New Stone: Regardless of how existing stone was cut and set, cut each new stone so that, when it is set in final position, natural bedding planes are essentially horizontal except for arches, where bedding planes are essentially radial or vertical, but perpendicular to the wall plane.
5. Salvaged Stone: Obtain salvaged stone from the Owner from location shown on Drawings. Clean off residual mortar.

B. Mortar Materials

1. Portland Cement: ASTM C 150, Type I or Type II, white or gray or both where required for color matching of exposed mortar.
 - a. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.
2. Hydrated Lime: ASTM C 207, Type S.
3. Factory-Prepared Lime Putty: ASTM C 1489.
4. Quicklime: ASTM C 5, pulverized lime.
5. Mortar Sand: ASTM C 144 unless otherwise indicated.
 - a. Color: Provide natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.
 - b. For pointing mortar, provide sand with rounded edges.
 - c. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
6. Mortar Pigments: Natural and synthetic iron oxides, compounded for mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars.
7. Water: Potable.

C. Manufactured Repair Materials

1. Stone Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching stone.
 - a. Use formulation that is vapor- and water permeable (equal to or more than the stone), exhibits low shrinkage, has lower modulus of elasticity than the stone units being repaired, and develops high bond strength to all types of stone.
 - b. Use formulation having working qualities and retardation control to permit forming and sculpturing where necessary.
 - c. Formulate patching compound in colors, textures, and grain to match stone being patched. Provide sufficient number of **OR** not less than three, **as directed**, colors to enable matching each piece of stone.
2. Cementitious Crack Filler: An ultrafine superplasticized grout that can be injected into cracks, is suitable for application to wet or dry cracks, exhibits low shrinkage, and develops high bond strength to all types of stone.
3. Stone-to-Stone Adhesive: 2-part polyester or epoxy-resin stone adhesive with a 15- to 45-minute cure at 70 deg F (21 deg C) or 1-part cementitious stone adhesive, recommended by adhesive manufacturer for type of stone repair indicated, and matching stone color.
4. Stone Consolidation Treatment: Ready-to-use product designed for consolidation of stone that has deteriorated due to weathering and exposure to pollutants. Treatment shall be composed of silicic-ethyl esters, a neutral catalyst, and solvents.
5. Stone Consolidation and Water-Repellent Treatment: Ready-to-use product designed for consolidation and water-repellent treatment of stone that has deteriorated due to weathering and exposure to pollutants. Treatment shall be composed of silicic-ethyl esters, a neutral catalyst, a silane water repellent, and solvents.

D. Paint Removers



1. Alkaline Paste Paint Remover: Manufacturer's standard alkaline paste formulation for removing paint coatings from masonry.
 2. Covered or Skin-Forming Alkaline Paint Remover: Manufacturer's standard covered or skin-forming alkaline formulation for removing paint coatings from masonry.
 3. Solvent-Type Paint Remover: Manufacturer's standard water-rinsable, solvent-type gel formulation for removing paint coatings from masonry.
 4. Low-Odor, Solvent-Type Paint Remover: Manufacturer's standard low-odor, water-rinsable solvent-type gel formulation, containing no methanol or methylene chloride, for removing paint coatings from masonry.
- E. Cleaning Materials
1. Water: Potable.
 2. Hot Water: Water heated to a temperature of 140 to 160 deg F (60 to 71 deg C).
 3. Job-Mixed Detergent Solution: Solution prepared by mixing 2 cups (0.5 L) of tetrasodium polyphosphate, 1/2 cup (125 mL) of laundry detergent, and 20 quarts (20 L) of hot water for every 5 gal. (20 L) of solution required.
 4. Job-Mixed Mold, Mildew, and Algae Remover: Solution prepared by mixing 2 cups (0.5 L) of tetrasodium polyphosphate, 5 quarts (5 L) of 5 percent sodium hypochlorite (bleach), and 15 quarts (15 L) of hot water for every 5 gal. (20 L) of solution required.
 5. Nonacidic Gel Cleaner: Manufacturer's standard gel formulation, with pH between 6 and 9, that contains detergents with chelating agents and is specifically formulated for cleaning masonry surfaces.
 6. Nonacidic Liquid Cleaner: Manufacturer's standard mildly alkaline liquid cleaner formulated for removing mold, mildew, and other organic soiling from ordinary building materials, including polished stone, brick, aluminum, plastics, and wood.
 7. Mild Acidic Cleaner: Manufacturer's standard mildly acidic cleaner containing no muriatic (hydrochloric), hydrofluoric, or sulfuric acid; or ammonium bifluoride or chlorine bleaches.
 8. Acidic Cleaner: Manufacturer's standard acidic masonry cleaner composed of hydrofluoric acid or ammonium bifluoride blended with other acids, detergents, wetting agents, and inhibitors.
 9. One-Part Limestone Cleaner: Manufacturer's standard one-part acidic formulation for cleaning limestone.
 10. Two-Part Limestone Cleaner: Manufacturer's standard system consisting of potassium or sodium hydroxide based, alkaline prewash cleaner and acidic afterwash cleaner that does not contain hydrofluoric acid.
- F. Accessory Materials
1. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, and polished stone surfaces from damaging effects of acidic and alkaline masonry cleaners.
 2. Stone Anchors and Pins: Type and size indicated or, if not indicated, to match existing anchors in size and type. Fabricate anchors and pins from Type 304 **OR** Type 316, **as directed**, stainless steel.
 3. Sealant Materials:
 - a. Provide manufacturer's standard chemically curing, elastomeric sealant(s) of base polymer and characteristics indicated below that comply with applicable requirements in Division 07 Section "Joint Sealants".
 - 1) Single-component, nonsag urethane sealant.
 - b. Colors: Provide colors of exposed sealants to match colors of stonework adjoining installed sealant unless otherwise indicated.
 - c. Ground-Mortar Aggregate: Custom crushed and ground pointing mortar sand or existing mortar retrieved from joints. Grind to a particle size that matches the adjacent mortar aggregate and color. Remove all fines passing the 100 sieve.
 4. Joint-Sealant Backing:
 - a. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) or Type B (bicellular material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

- b. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.
- 5. Setting Buttons: Resilient plastic buttons, nonstaining to stone, sized to suit joint thicknesses and bed depths of stone units without intruding into required depths of pointing materials.
- 6. Masking Tape: Nonstaining, nonabsorbent material, compatible with pointing mortar, joint primers, sealants, and surfaces adjacent to joints; that will easily come off entirely, including adhesive.
- 7. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer complying with MPI #79, Alkyd Anticorrosive Metal Primer **OR** SSPC-Paint 20 **OR** SSPC-Paint 29 zinc-rich coating, **as directed**.
 - a. Use coating requiring no better than SSPC-SP 2, "Hand Tool Cleaning" **OR** SSPC-SP 3, "Power Tool Cleaning" **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning", **as directed**, surface preparation according to manufacturer's literature or certified statement.
 - b. Use coating with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 8. Miscellaneous Products: Select materials and methods of use based on the following, subject to approval of a mockup:
 - a. Previous effectiveness in performing the work involved.
 - b. Little possibility of damaging exposed surfaces.
 - c. Consistency of each application.
 - d. Uniformity of the resulting overall appearance.
 - e. Do not use products or tools that could do the following:
 - 1) Remove, alter, or in any way harm the present condition or future preservation of existing surfaces, including surrounding surfaces not in contract.
 - 2) Leave a residue on surfaces.

G. Mortar Mixes

- 1. Preparing Lime Putty: Slake quicklime and prepare lime putty according to appendix to ASTM C 5 and manufacturer's written instructions.
- 2. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.
 - a. Mixing Pointing Mortar: Thoroughly mix cementitious materials and sand together before adding any water. Then mix again adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material.
- 3. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without the Owner's approval.
 - a. Mortar Pigments: Where mortar pigments are indicated, do not exceed a pigment-to-cement ratio of 1:10 by weight.
- 4. Do not use admixtures in mortar unless otherwise indicated.
- 5. Mortar Proportions: Mix mortar materials in the following proportions:
 - a. Pointing Mortar for Stone: 1 part white portland cement, 1 part lime, and 6 parts sand **OR** 1 part white portland cement, 2 parts lime, and 6 parts sand **OR** 1 part white portland cement, 6 parts lime, and 12 parts sand, **as directed**.
 - 1) Add mortar pigments to produce mortar colors required.
 - b. Rebuilding (Setting) Mortar: Same as pointing mortar except mortar pigments are not required, **as directed**.
 - c. Rebuilding (Setting) Mortar: 1 part white portland cement, 1 part lime, and 6 parts sand **OR** 1 part white portland cement, 2 parts lime, and 6 parts sand **OR** 1 part white portland cement, 6 parts lime, and 12 parts sand, **as directed**.



- d. Rebuilding (Setting) Mortar: Comply with ASTM C 270, Proportion Specification, Type N unless otherwise indicated, with cementitious material limited to portland cement and lime.

H. Chemical Cleaning Solutions

1. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended by chemical-cleaner manufacturer.
2. Acidic Cleaner Solution for Unpolished Stone: Dilute with water to produce hydrofluoric acid content of 3 percent or less, but not greater than that recommended by chemical-cleaner manufacturer.
 - a. Use only on unpolished granite, unpolished dolomite marble, and siliceous sandstone.
3. Acidic Cleaner for Polished Stone: Dilute with water to concentration demonstrated by testing that does not etch or otherwise damage polished surface, but not greater than that recommended by chemical-cleaner manufacturer.
 - a. Use only on polished granite and polished dolomite marble.

1.3 EXECUTION

A. Protection

1. Protect persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm resulting from stone restoration work.
 - a. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during course of restoration and cleaning work.
2. Comply with chemical-cleaner manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical cleaning solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.
 - a. Cover adjacent surfaces with materials that are proven to resist chemical cleaners used unless chemical cleaners being used will not damage adjacent surfaces. Use materials that contain only waterproof, UV-resistant adhesives. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
 - b. Keep wall wet below area being cleaned to prevent streaking from runoff.
 - c. Do not clean stone during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
 - d. Neutralize and collect alkaline and acid wastes for disposal off the Owner's property.
 - e. Dispose of runoff from cleaning operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
3. Prevent mortar from staining face of surrounding stone and other surfaces.
 - a. Cover sills, ledges, and projections to protect from mortar droppings.
 - b. Keep wall area wet below rebuilding and pointing work to discourage mortar from adhering.
 - c. Immediately remove mortar in contact with exposed stone and other surfaces.
 - d. Clean mortar splatters from scaffolding at end of each day.
4. Remove gutters and downspouts adjacent to stone and store where indicated during stone restoration and cleaning. Reinstall when stone restoration and cleaning are complete.
 - a. Provide temporary rain drainage during work as indicated to direct water away from building.

B. Unused Anchor Removal

1. Remove stone anchors, brackets, wood nailers, and other extraneous items no longer in use unless identified as historically significant or indicated to remain.
 - a. Remove items carefully to avoid spalling or cracking stone.



- b. Where directed, if an item cannot be removed without damaging surrounding stone, do the following:
 - 1) Cut or grind off item approximately 3/4 inch (20 mm) beneath surface and core drill a recess of same depth in surrounding stone as close around item as practical.
 - 2) Immediately paint exposed end of item with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended dry film thickness per coat. Keep paint off sides of recess.
- c. Patch **OR** Plug, **as directed**, the hole where each item was removed unless directed to remove and replace the stone unit.

C. Stone Removal And Replacement

1. At locations indicated, remove stone that has deteriorated or is damaged beyond repair or is to be reused. Carefully demolish or remove entire units from joint to joint, without damaging surrounding stone, in a manner that permits replacement with full-size units.
2. Support and protect remaining stonework that surrounds removal area. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.
3. Notify the Owner of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing stone or unit masonry backup, rotted wood, rusted metal, and other deteriorated items.
4. Remove in an undamaged condition as many whole stone units as possible.
 - a. Remove mortar, loose particles, and soil from stone by cleaning with hand chisels, brushes, and water.
 - b. Remove sealants by cutting close to stone with utility knife and cleaning with solvents.
 - c. Store stone for reuse. Store off ground, on skids, and protected from weather.
 - d. Deliver cleaned stone not required for reuse to the Owner unless otherwise indicated.
5. Clean stone surrounding removal areas by removing mortar, dust, and loose particles in preparation for replacement.
6. Replace removed damaged stone with other removed stone and salvaged stone in good quality, where possible, or with new stone matching existing stone, including size. Do not use broken units unless they can be cut to usable size.
7. Do not allow face bedding of stone. Before setting, inspect to verify that each stone has been cut so that, when it is set in final position, natural bedding planes are essentially horizontal except for arches, where bedding planes are essentially radial or vertical, but perpendicular to the wall. Reject and replace stone with vertical bedding planes except as required for arches, lintels, and copings.
8. Install replacement stone into bonding and coursing pattern of existing stone. If cutting is required, use a motor-driven saw designed to cut stone with clean, sharp, unchipped edges. Finish edges to blend with appearance of edges of existing stone.
 - a. Maintain joint width for replacement stone to match existing joints.
 - b. Use setting buttons or shims to set stone accurately spaced with uniform joints.
9. Set replacement stone with completely filled bed, head, and collar joints. Butter vertical joints for full width before setting and set units in full bed of mortar unless otherwise indicated. Replace existing anchors with new anchors of size and type indicated.
 - a. Tool exposed mortar joints in repaired areas to match joints of surrounding existing stonework.
 - b. Rake out mortar used for laying stone before mortar sets and point new mortar joints in repaired area to comply with requirements for repointing existing stone, and at same time as repointing of surrounding area.
 - c. When mortar is sufficiently hard to support units, remove shims and other devices interfering with pointing of joints.

D. Painting Steel Uncovered During The Work

1. Inspect steel exposed during stone removal. Where the Owner determines that it is structural, or for other reasons cannot be totally removed, prepare and paint it as follows:



- a. Remove paint, rust, and other contaminants according to SSPC-SP 2, "Hand Tool Cleaning" **OR** SSPC-SP 3, "Power Tool Cleaning" **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning", **as directed**, as applicable to meet paint manufacturer's recommended preparation.
 - b. Immediately paint exposed steel with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended rate of application (dry film thickness per coat).
2. If on inspection and rust removal, the cross section of a steel member is found to be reduced from rust by more than 1/16 inch (1.6 mm), notify the Owner before proceeding.

E. Partial Stone Replacement

1. Remove defective portion of existing stone unit (backing stone). Carefully remove defective portion of stone by making vertical and horizontal saw cuts at face of backing stone and demolishing defective material to depth required for fitting partial replacement (dutchman).
 - a. Make edges of backing stone at cuts smooth and square to each other and to finished surface; essentially rectangular. Make back of removal area flat and parallel to stone face.
 - b. Do not overcut at corners and intersections. Hand trim to produce clean sharp corners with no rounding and no damage to existing work to remain.
 - c. If existing stone that is to remain becomes damaged, remove damaged area and enlarge partial replacement as required.
2. Remove mortar from joints that abut area of stone removal to same depth as stone was removed. Remove loose mortar particles and other debris from surfaces to be bonded and surfaces of adjacent stone units that will receive mortar by cleaning with stiff-fiber brush.
3. Cut and trim partial replacement to accurately fit area where material was removed from backing stone. Fabricate to size required to produce joints between partial replacement and backing stone of no more than 1/16 inch (1.6 mm) in width, and joints between partial replacement and other stones that match existing joints between stones. Cut partial replacement so that, when it is set in final position, natural bedding planes will match the orientation of bedding planes of the backing stone unless otherwise indicated.
4. Pinning: Before applying adhesive, prepare for mechanical anchorage consisting of 1/4-inch- (6-mm-) diameter, plain **OR** threaded, **as directed**, stainless-steel pins set into 1/4-inch- (6-mm-) diameter holes drilled at a 45-degree downward angle through face of partial replacement and into backing stone. Center and space pins between 3 and 5 inches (75 and 125 mm) apart and at least 2 inches (50 mm) from any edge. Insert pins at least 2 inches (50 mm) into backing stone and 2 inches (50 mm) into partial replacement with end countersunk at least 3/4 inch (19 mm) from exposed face of partial replacement.
5. Concealed Pinning: Before applying adhesive, prepare for concealed mechanical anchorage consisting of 1/4-inch- (6-mm-) diameter, plain **OR** threaded, **as directed**, stainless-steel pins set into 1/4-inch- (6-mm-) diameter holes drilled into backing stone and into, but not through, the partial replacement. Center and space pins between 3 and 5 inches (75 and 125 mm) apart and at least 2 inches (50 mm) from any edge. Insert pins at least 2 inches (50 mm) into backing stone and 2 inches (50 mm) into partial replacement, but no closer than 3/4 inch (19 mm) from exposed face of partial replacement.
6. Apply stone-to-stone adhesive to comply with adhesive manufacturer's written instructions. Coat bonding surfaces of backing stone and partial replacement, completely filling all crevices and voids.
7. Apply partial replacement while adhesive is still tacky and hold securely in place until adhesive has cured. Use shims, clamps, wedges, or other devices as necessary to align face of partial replacement with face of backing stone.
8. Clean adhesive residue from exposed surfaces and patch chipped areas and exposed drill holes as specified in "Stone Patching" Article.

F. Stone Plug Repair

1. Remove cylindrical piece of damaged stone by core-drilling perpendicular to stone surface.
2. Prepare a replacement plug by core-drilling replacement stone. Use a drill sized to produce a core that will fit into hole drilled in damaged stone with only minimum gap necessary for



adhesive. Cut and install plug so that, when it is set in final position, natural bedding planes will match the orientation of bedding planes of the backing stone unless otherwise indicated.

3. Apply stone-to-stone adhesive to comply with adhesive manufacturer's written instructions. Coat bonding surfaces of existing stone and plug, completely filling all crevices and voids.
4. Apply plug while adhesive is still tacky and hold securely in place until adhesive has cured.
5. Clean adhesive residue from exposed surfaces.

G. Stone-Fragment Repair

1. Carefully remove cracked or fallen stone fragment indicated to be repaired. Reuse only stone fragment that is in sound condition.
2. Remove soil, loose particles, mortar, and other debris or foreign material, from fragment surfaces to be bonded and from parent stone where fragment had broken off, by cleaning with stiff-fiber brush.
3. Pinning: Before applying adhesive, prepare for mechanical anchorage consisting of 1/4-inch- (6-mm-) diameter, plain **OR** threaded, **as directed**, stainless-steel pins set into 1/4-inch- (6-mm-) diameter holes drilled at a 45-degree downward angle through face of fragment and into parent stone. Center and space pins between 3 and 5 inches (75 and 125 mm) apart and at least 2 inches (50 mm) from any edge. Insert pins at least 2 inches (50 mm) into parent stone and 2 inches (50 mm) into fragment with end countersunk at least 3/4 inch (19 mm) from exposed face of fragment.
4. Concealed Pinning: Before applying adhesive, prepare for concealed mechanical anchorage consisting of 1/4-inch- (6-mm-) diameter, plain **OR** threaded, **as directed**, stainless-steel pins set into 1/4-inch- (6-mm-) diameter holes drilled into parent stone and into, but not through, the fragment. Center and space pins between 3 and 5 inches (75 and 125 mm) apart and at least 2 inches (50 mm) from any edge. Insert pins at least 2 inches (50 mm) into parent stone and 2 inches (50 mm) into fragment, but no closer than 3/4 inch (19 mm) from exposed face of fragment.
5. Apply stone-to-stone adhesive to comply with adhesive manufacturer's written instructions. Coat bonding surfaces of fragment and parent stone, completely filling all crevices and voids.
6. Fit stone fragment onto parent stone while adhesive is still tacky and hold fragment securely in place until adhesive has cured. Use shims, clamps, wedges, or other devices as necessary to align face of fragment with face of parent stone.
7. Clean adhesive residue from exposed surfaces and patch chipped areas and exposed drill holes as specified in "Stone Patching" Article.

H. Crack Injection

1. General: Comply with cementitious crack-filler manufacturer's written instructions.
2. Drill 1/4-inch- (6-mm-) diameter injection holes as follows:
 - a. Transverse Cracks Less Than 3/8 inch (9 mm) Wide: Drill holes through center of crack at 12 to 18 inches (300 to 500 mm) o.c.
 - b. Transverse Cracks More Than 3/8 inch (9 mm) Wide: Drill holes through center of crack at 18 to 36 inches (500 to 900 mm) o.c.
 - c. Delaminations: Drill holes at approximately 18 inches (500 mm) o.c. both vertically and horizontally.
 - d. Drill holes 2 inches (50 mm) deep. Where possible drill holes in mortar joints.
3. Clean out drill holes and cracks with compressed air and water. Remove dirt and organic matter, loose material, sealants, and failed crack repair materials.
4. Place plastic injection ports in drilled holes and seal face of cracks between injection ports with clay or other nonstaining, removable plugging material. Leave openings at upper ends of cracks for air release.
5. Inject cementitious crack filler through ports sequentially, beginning at one end of area and working to opposite end; where possible, begin at lower end of injection area and work upward. Inject filler until it extrudes from adjacent ports. After port has been injected, plug with clay or other suitable material and begin injecting filler at adjacent port, repeating process until all ports have been injected.



6. Clean cementitious crack filler from face of stone before it sets by scrubbing with water.
7. After cementitious crack filler has set, remove injection ports, plugging material, and excess filler. Patch injection holes and surface of cracks as specified in "Stone Patching" Article.

I. Stone Patching

1. Patch the following stone units unless another type of replacement or repair is indicated:
 - a. Units indicated to be patched.
 - b. Units with holes.
 - c. Units with chipped edges or corners.
 - d. Units with small areas of deep deterioration.
2. Remove and replace existing patches unless otherwise indicated or approved by the Owner.
3. Remove deteriorated material and remove adjacent material that has begun to deteriorate. Carefully remove additional material so patch will not have feathered edges but will have square or slightly undercut edges on area to be patched and will be at least 1/4 inch (6 mm) thick, but not less than recommended by patching compound manufacturer.
4. Mask adjacent mortar joint or rake out for repointing if patch will extend to edge of stone unit.
5. Mix patching compound in individual batches to match each stone unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.
6. Brush-coat stone surfaces with slurry coat of patching compound according to manufacturer's written instructions.
7. Place patching compound in layers as recommended by patching compound manufacturer, but not less than 1/4 inch (6 mm) or more than 2 inches (50 mm) thick. Roughen surface of each layer to provide a key for next layer.
 - a. Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane or contour of the stone. Shape and finish surface before or after curing, as determined by testing, to best match existing stone.
 - b. Build patch up 1/4 inch (6 mm) above surrounding stone and carve surface to match adjoining stone after patching compound has hardened.
8. Keep each layer damp for 72 hours or until patching compound has set.
9. Remove and replace patches with hairline cracks or that show separation from stone at edges, and those that do not match adjoining stone in color or texture.

J. Cleaning Stone, General

1. Proceed with cleaning in an orderly manner; work from bottom to top **OR** top to bottom, **as directed**, of each scaffold width and from one end of each elevation to the other. Ensure that dirty residues and rinse water will not wash over cleaned, dry surfaces.
2. Use only those cleaning methods indicated for each stone material and location.
 - a. Do not use wire brushes or brushes that are not resistant to chemical cleaner being used. Do not use plastic-bristle brushes if natural-fiber brushes will resist chemical cleaner being used.
 - b. Use spray equipment that provides controlled application at volume and pressure indicated, measured at spray tip. Adjust pressure and volume to ensure that cleaning methods do not damage stone.
 - 1) Equip units with pressure gages.
 - c. For chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with cone-shaped spray tip.
 - d. For water-spray application, use fan-shaped spray tip that disperses water at an angle of 25 to 50 degrees.
 - e. For high-pressure water-spray application, use fan-shaped spray tip that disperses water at an angle of at least 40 degrees.
 - f. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F (60 and 71 deg C) at flow rates indicated.
 - g. For steam application, use steam generator capable of delivering live steam at nozzle.
3. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging stone surfaces.

4. Water Application Methods:
 - a. Water-Soak Application: Soak stone surfaces by applying water continuously and uniformly to limited area for time indicated. Apply water at low pressures and low volumes in multiple fine sprays using perforated hoses or multiple spray nozzles. Erect a protective enclosure constructed of polyethylene sheeting to cover area being sprayed.
 - b. Water-Spray Applications: Unless otherwise indicated, hold spray nozzle at least 6 inches (150 mm) from surface of stone and apply water in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.
5. Steam Cleaning: Apply steam to stone surfaces at the very low pressures indicated for each type of stonework. Hold nozzle at least 6 inches (150 mm) from surface of stone and apply steam in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.
6. Chemical-Cleaner Application Methods: Apply chemical cleaners to stone surfaces to comply with chemical-cleaner manufacturer's written instructions; use brush or spray application. Do not spray apply at pressures exceeding 50 psi (345 kPa), **unless directed otherwise**. Do not allow chemicals to remain on surface for periods longer than those indicated or recommended by manufacturer.
7. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.
 - a. Apply neutralizing agent and repeat rinse if necessary to produce tested pH of between 6.7 and 7.5.
8. After cleaning is complete, remove protection no longer required. Remove tape and adhesive marks.

K. Preliminary Cleaning

1. Removing Plant Growth: Completely remove visible plant, moss, and shrub growth from stone surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing to dry as long as possible before removal. Remove loose soil or debris from open joints to whatever depth they occur.
2. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to cleaning methods being used. Extraneous substances include paint, calking, asphalt, and tar.
 - a. Carefully remove heavy accumulations of material from surface of stone with sharp chisel. Do not scratch or chip stone surface.
 - b. Remove paint and calking with alkaline paint remover.
 - 1) Comply with requirements in "Paint Removal" Article.
 - 2) Repeat application up to two times if needed.
 - c. Remove asphalt and tar with solvent-type paint remover.
 - 1) Comply with requirements in "Paint Removal" Article.
 - 2) Apply paint remover only to asphalt and tar by brush without prewetting.
 - 3) Allow paint remover to remain on surface for 10 to 30 minutes.
 - 4) Repeat application if needed.

L. Paint Removal

1. Paint Removal with Alkaline Paste Paint Remover:
 - a. Remove loose and peeling paint using low **OR** medium **OR** high, **as directed**,-pressure spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
 - b. Apply paint remover to dry, painted stone with brushes.
 - c. Allow paint remover to remain on surface for period recommended by manufacturer.
 - d. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**,-pressure spray to remove chemicals and paint residue.
 - e. Repeat process if necessary to remove all paint.
 - f. Apply acidic cleaner or manufacturer's recommended afterwash to stone, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner or afterwash

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- joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that stone surface remains wet.
- c. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove detergent solution and soil.
 - d. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.
6. Mold, Mildew, and Algae Removal:
- a. Wet stone with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Apply mold, mildew, and algae remover by brush or low-pressure spray.
 - c. Scrub stone with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that stone surface remains wet.
 - d. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove mold, mildew, and algae remover and soil.
 - e. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.
7. Nonacidic Gel Chemical Cleaning:
- a. Wet stone with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Apply nonacidic gel cleaner in 1/8-inch (3-mm) thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively so area will be uniformly covered with fresh cleaner and dwell time will be uniform throughout area being cleaned.
 - c. Let cleaner remain on surface for period indicated below:
 - 1) As recommended by chemical-cleaner manufacturer.
 - 2) As established by mockup.
 - d. Remove bulk of nonacidic gel cleaner by squeegeeing into containers for disposal.
 - e. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
 - f. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
8. Nonacidic Liquid Chemical Cleaning:
- a. Wet stone with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Apply cleaner to stone in two applications, **as directed**, by brush or low-pressure spray. Let cleaner remain on surface for period indicated below:
 - 1) As recommended by chemical-cleaner manufacturer.
 - 2) As established by mockup.
 - 3) Two to three minutes.
 - c. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
 - d. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
9. Mild Acidic **OR** Acidic, **as directed**, Chemical Cleaning:
- a. Wet stone with cold water applied by low-pressure spray.
 - b. Apply cleaner to stone in two applications, **as directed**, by brush or low-pressure spray. Let cleaner remain on surface for period indicated below:
 - 1) As recommended by chemical-cleaner manufacturer.
 - 2) As established by mockup.
 - 3) Two to three minutes.
 - c. Rinse with cold water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
 - d. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.



10. One-Part Limestone Chemical Cleaning:
 - a. Wet stone with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Apply cleaner to stone by brush or low-pressure spray. Let cleaner remain on surface for period recommended by chemical-cleaner manufacturer.
 - c. Immediately repeat application of one-part limestone cleaner as indicated above over the same area.
 - d. Rinse with cold **OR** hot, **as directed**, water applied by medium-pressure spray to remove chemicals and soil.
 11. Two-Part Limestone Chemical Cleaning:
 - a. Wet stone with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Apply alkaline prewash cleaner to stone by brush or roller. Let cleaner remain on surface for period recommended by chemical-cleaner manufacturer unless otherwise indicated.
 - c. Rinse with cold **OR** hot, **as directed**, water applied by medium-pressure spray to remove chemicals and soil.
 - d. Apply acidic afterwash cleaner to stone in two applications, **as directed**, while surface is still wet, using low-pressure spray equipment, deep-nap roller or soft-fiber brush. Let neutralizer remain on surface for period recommended by manufacturer unless otherwise indicated.
 - e. Rinse with cold water applied by medium-pressure spray to remove chemicals and soil.
 - f. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once.
- N. Repointing Stonework
1. Rake out and repoint joints to the following extent:
 - a. All joints in areas indicated.
 - b. Joints where mortar is missing or where they contain holes.
 - c. Cracked joints where cracks can be penetrated at least 1/4 inch (6 mm) by a knife blade 0.027 inch (0.7 mm) thick.
 - d. Cracked joints where cracks are 1/16 inch (1.6 mm) **OR** 1/8 inch (3 mm), **as directed**, or more in width and of any depth.
 - e. Joints where they sound hollow when tapped by metal object.
 - f. Joints where they are worn back 1/4 inch (6 mm) or more from surface.
 - g. Joints where they are deteriorated to point that mortar can be easily removed by hand, without tools.
 - h. Joints where they have been filled with substances other than mortar.
 - i. Joints indicated as sealant-filled joints.
 2. Do not rake out and repoint joints where not required.
 3. Rake out joints as follows, according to procedures demonstrated in approved mockup:
 - a. Remove mortar from joints to depth of joint width plus 1/8 inch (3 mm) **OR** 2 times joint width **OR** 2-1/2 times joint width, **as directed**, but not less than 1/2 inch (13 mm) or not less than that required to expose sound, unweathered mortar.
 - b. Remove mortar from stone surfaces within raked-out joints to provide reveals with square backs and to expose stone for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
 - c. Do not spall edges of stone units or widen joints. Replace or patch damaged stone units as directed by the Owner.
 - 1) Cut out mortar by hand with chisel and resilient mallet. Do not use power-operated grinders without the Owner's written approval based on approved quality-control program.
 - 2) Cut out center of mortar bed joints using angle grinders with diamond-impregnated metal blades. Remove remaining mortar by hand with chisel and resilient mallet. Strictly adhere to approved quality-control program.
 4. Notify the Owner of unforeseen detrimental conditions including voids in mortar joints, cracks, loose stone, rotted wood, rusted metal, and other deteriorated items.
 5. Pointing with Mortar:

- a. Rinse joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen joint surfaces before pointing.
 - b. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8 inch (9 mm) until a uniform depth is formed. Fully compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.
 - c. After low areas have been filled to same depth as remaining joints, point all joints by placing mortar in layers not greater than 3/8 inch (9 mm). Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing stone has worn or rounded edges, slightly recess finished mortar surface below face of stone to avoid widened joint faces. Take care not to spread mortar beyond joint edges onto exposed stone surfaces or to featheredge the mortar.
 - d. When mortar is thumbprint hard, tool joints to match original appearance of joints as demonstrated in approved mockup. Remove excess mortar from edge of joint by brushing.
 - e. Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.
 - 1) Acceptable curing methods include covering with wet burlap and plastic sheeting, periodic hand misting, and periodic mist spraying using system of pipes, mist heads, and timers.
 - 2) Adjust curing methods to ensure that pointing mortar is damp throughout its depth without eroding surface mortar.
 - f. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.
6. Pointing with Sealant:
- a. After raking out, keep joints dry and free of mortar and debris.
 - b. Clean and prepare joint surfaces according to Division 07 Section "Joint Sealants". Prime joint surfaces unless sealant manufacturer recommends against priming. Do not allow primer to spill or migrate onto adjoining surfaces.
 - c. Fill sealant joints with specified joint sealant according to Division 07 Section "Joint Sealants" and the following:
 - 1) Install cylindrical sealant backing beneath the sealant except where space is insufficient. There, install bond-breaker tape.
 - 2) Install sealant using only proven installation techniques that will ensure that sealant will be deposited in a uniform, continuous ribbon, without gaps or air pockets, and with complete wetting of the joint bond surfaces equally on both sides. Fill joint flush with surrounding stonework and matching the contour of adjoining mortar joints.
 - 3) Install sealant as recommended by sealant manufacturer but within the following general limitations, measured at the center (thin) section of the bead:
 - a) Fill joints to a depth equal to joint width, but not more than 1/2 inch (13 mm) deep or less than 1/4 inch (6 mm) deep.
 - 4) Immediately after first tooling, apply ground-mortar aggregate to sealant, gently pushing aggregate into the surface of sealant. Retool sealant to form smooth, uniform beads, slightly concave. Remove excess sealant and aggregate from surfaces adjacent to joint.
 - 5) Do not allow sealant to overflow or spill onto adjoining surfaces, or to migrate into the voids of adjoining surfaces, particularly rough textures. Remove excess and spillage of sealant promptly as the work progresses. Clean adjoining surfaces by the means necessary to eliminate evidence of spillage, without damage to adjoining surfaces or finishes, as demonstrated in an approved mockup.
 - d. Cure sealant according to Division 07 Section "Joint Sealants".
7. Where repointing work precedes cleaning of existing stone, allow mortar to harden at least 30 days before beginning cleaning work.

O. Stone Consolidation Treatment



1. Apply treatment to clean, dry surfaces according to manufacturer's written instructions. Remove areas of blind exfoliation, delamination, and flaking before applying.
 2. Apply in cycles to small sections of stonework, not more than 100 sq. ft. (9 sq. m) in area. Each cycle shall consist of 3 successive saturating applications, applied at 5- to 15-minute intervals depending on drying conditions.
 3. Apply by low-pressure spray to point of rejection in each application. Apply from bottom of section to top.
 4. Apply 3 cycles, allowing treated surface to dry for 60 to 90 minutes between cycles.
 5. Protect treated surfaces from rain for 48 hours after treatment.
 6. Allow treated surfaces to dry for at least 21 days before repointing, patching, or applying water repellents or sealants.
- P. Final Cleaning
1. After mortar has fully hardened, thoroughly clean exposed stone surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, spray applied at low pressure.
 - a. Do not use metal scrapers or brushes.
 - b. Do not use acidic or alkaline cleaners.
 2. Wash adjacent woodwork and other nonstone surfaces. Use detergent and soft brushes or cloths.
 3. Clean mortar and debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.
 4. Sweep and rake adjacent pavement and grounds to remove mortar and debris. Where necessary, pressure wash pavement surfaces to remove mortar, dust, dirt, and stains.
- Q. Field Quality Control
1. Inspectors: Engage qualified independent inspectors to perform inspections and prepare test reports. Allow inspectors use of lift devices and scaffolding, as needed, to perform inspections.
 2. the Owner's Project Representatives: the Owner will assign Project representatives to help carry out the Owner's responsibilities at the site, including observing progress and quality of portion of the Work completed. Allow the Owner's Project representatives use of lift devices and scaffolding, as needed, to observe progress and quality of portion of the Work completed.
 3. Notify inspectors and the Owner's Project representatives in advance of times when lift devices and scaffolding will be relocated. Do not relocate lift devices and scaffolding until inspectors and the Owner's Project representatives have had reasonable opportunity to make inspections and observations of work areas at lift device or scaffold location.

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Task	Specification	Specification Description
04 01 40 52	04 01 20 51	Clay Masonry Restoration And Cleaning



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SECTION 04 01 40 91 - STONE MASONRY

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for stone masonry. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes the following applications of stone masonry:
 - a. Anchored or Adhered to concrete backup.
 - b. Anchored or Adhered to unit masonry backup.
 - c. Anchored or Adhered to wood framing and sheathing.
 - d. Anchored or Adhered to cold-formed metal framing and sheathing.

C. Submittals

1. Product Data: For each type of product indicated.
 - a. For stone varieties proposed for use on Project, include test data indicating compliance with physical properties specified or required by referenced ASTM standards.
2. Samples:
 - a. For each stone type indicated.
 - b. For each color of mortar required.

D. Delivery, Storage, And Handling

1. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
2. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
3. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
4. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

E. Project Conditions

1. Protection of Stone Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed stone masonry when construction is not in progress.
 - a. Extend cover a minimum of 24 inches (600 mm) down both sides and hold cover securely in place.
2. Stain Prevention: Immediately remove mortar and soil to prevent them from staining the face of stone masonry.
 - a. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on the ground and over the wall surface.
 - b. Protect sills, ledges, and projections from mortar droppings.
 - c. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - d. Turn scaffold boards near the wall on edge at end of each day to prevent rain from splashing mortar and dirt on completed stone masonry.
3. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace stone masonry damaged by

frost or freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

- a. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
4. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1.2 PRODUCTS

A. Granite

1. Granite: Comply with ASTM C 615.

B. Limestone

1. Limestone: Comply with ASTM C 568.

C. Quartz-Based Stone

1. Quartz-Based Stone: Comply with ASTM C 616, Classification I Sandstone **OR** II Quartzitic Sandstone **OR** III Quartzite, **as directed**.

D. Mortar Materials

1. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
 - a. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C 114.
2. Hydrated Lime: ASTM C 207, Type S.
3. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or III, and hydrated lime complying with ASTM C 207.
4. Mortar Cement: ASTM C 1329.
5. Masonry Cement: ASTM C 91.
6. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in stone masonry mortar.
7. Colored Cement Product: Packaged blend made from portland cement and lime **OR** masonry cement **OR** mortar cement, **as directed**, and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 - a. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
8. Aggregate: ASTM C 144 and as follows:
 - a. For pointing mortar, use aggregate graded with 100 percent passing No. 16 (1.18-mm) sieve.
 - b. White Aggregates: Natural white sand or ground white stone.
 - c. Colored Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.
9. Latex Additive: Manufacturer's standard **OR** acrylic-resin **OR** styrene-butadiene-rubber, **as directed**, water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement mortar bed, and not containing a retarder.
10. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
11. Water: Potable.

E. Veneer Anchors



1. Materials:
 - a. Hot-Dip Galvanized-Steel Wire: ASTM A 82, with ASTM A 153/A 153M, Class B-2.
 - b. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304 **OR** Type 316, **as directed**.
 - c. Hot-Dip Galvanized-Steel Sheet: ASTM A 1008/A 1008M, cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M, Class B-2.
 - d. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304 **OR** Type 316, **as directed**.
2. Size: Sufficient to extend at least halfway, but not less than 1-1/2 inches (38 mm), through stone masonry and with at least 5/8-inch (16-mm) cover on outside face.
3. Wire Veneer Anchors: Wire ties formed from W1.7 or 0.148-inch- (3.8-mm-) diameter, hot-dip galvanized **OR** stainless, **as directed**, steel wire.
4. Corrugated-Metal Veneer Anchors: Not less than 0.030-inch- (0.76-mm-) thick by 7/8-inch- (22-mm-) wide hot-dip galvanized **OR** stainless, **as directed**, steel sheet with corrugations having a wavelength of 0.3 to 0.5 inch (7.6 to 13 mm) and an amplitude of 0.06 to 0.10 inch (1.5 to 2.5 mm).
5. Adjustable, Screw-Attached Veneer Anchors: Units consisting of a wire tie section and a metal anchor section that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
 - a. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).
 - b. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, 2-3/4 inches (70 mm) wide by 3 inches (75 mm) high; with projecting tabs having slotted holes for inserting vertical legs of wire tie specially formed to fit veneer anchor section.
 - c. Anchor Section: Sheet metal plate, 1-1/4 inches (32 mm) wide by 6 inches (150 mm) **OR** 9 inches (225 mm), **as directed**, long, with screw holes top and bottom and with raised rib-stiffened strap, 5/8 inch (16 mm) wide by 3-5/8 inches (92 mm) **OR** 5-1/2 inches (140 mm), **as directed**, long, stamped into center to provide a slot between strap and plate for inserting wire tie.
 - d. Anchor Section: Gasketed sheet metal plate, 1-1/4 inches (32 mm) wide by 6 inches (150 mm) long, with screw holes top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation or sheathing; and raised rib-stiffened strap, 5/8 inch (16 mm) wide by 6 inches (150 mm) long, stamped into center to provide a slot between strap and plate for inserting wire tie. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and extend beyond pronged legs.
 - e. Anchor Section: Zinc-alloy barrel section with flanged head with eye and corrosion-resistant, self-drilling screw. Eye designed to receive wire tie and to serve as head for drilling fastener into framing. Barrel length to suit sheathing thickness, allowing screw to seat directly against framing with flanged head covering hole in sheathing.
 - f. Fabricate sheet metal anchor sections and other sheet metal parts from 0.067-inch- (1.7-mm-) thick, steel sheet, galvanized after fabrication **OR** 0.097-inch- (2.5-mm-) thick, steel sheet, galvanized after fabrication **OR** 0.078-inch- (2.0-mm-) thick, stainless-steel sheet **OR** 0.109-inch- (2.8-mm-) thick, stainless-steel sheet, **as directed**.
 - g. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.188-inch- (4.8-mm-) **OR** 0.25-inch- (6.4-mm-), **as directed**, diameter, hot-dip galvanized **OR** stainless, **as directed**, steel wire.
6. Seismic Veneer Anchors: Units consisting of a metal anchor section and a connector section designed to engage a continuous wire embedded in stone masonry mortar joint.
 - a. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).
 - b. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, 2-3/4 inches (70 mm) wide by 3 inches (75 mm) high; with projecting tabs having slotted holes for inserting vertical leg of connector section.



- c. Connector Section: Rib-stiffened, sheet metal bent plate with down-turned leg designed to fit in anchor section slot and with integral tabs designed to engage continuous wire. Size connector to extend at least halfway through stone masonry but with at least 5/8-inch (16-mm) cover on outside face.
 - d. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, 2-3/4 inches (70 mm) wide by 3 inches (75 mm) high; with projecting tabs having slotted holes for inserting vertical legs of wire tie specially formed to fit anchor section. Size wire tie to extend at least 1-1/2 inches (38 mm) into stone masonry but with at least 5/8-inch (16-mm) cover on outside face.
 - e. Connector Section: Sheet metal clip welded to wire tie with integral tabs designed to engage continuous wire.
 - f. Anchor Section: Gasketed sheet metal plate, 1-1/4 inches (32 mm) wide by 6 inches (150 mm) long, with screw holes top and bottom; top and bottom ends bent to form pronged legs to bridge insulation or sheathing and contact studs; and raised rib-stiffened strap, 5/8 inch (16 mm) wide by 6 inches (150 mm) long, stamped into center to provide a slot between strap and plate for inserting wire tie. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and extend beyond pronged legs.
 - g. Connector Section: Triangular wire tie and rigid PVC extrusion with snap-in grooves for inserting continuous wire.
 - h. Fabricate sheet metal anchor sections and other sheet metal parts from 0.067-inch- (1.7-mm-) thick, steel sheet, galvanized after fabrication **OR** 0.097-inch- (2.5-mm-) thick, steel sheet, galvanized after fabrication **OR** 0.078-inch- (2.0-mm-) thick, stainless-steel sheet **OR** 0.109-inch- (2.8-mm-) thick, stainless-steel sheet, **as directed**.
 - i. Fabricate wire connector sections from 0.188-inch- (4.8-mm-) **OR** 0.25-inch- (6.4-mm-), **as directed**, diameter, hot-dip galvanized, carbon **OR** stainless, **as directed**, steel wire.
 - j. Continuous Wire: 0.188-inch- (4.8-mm-) diameter, hot-dip galvanized **OR** stainless, **as directed**, steel wire.
7. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 (4.8-mm diameter) by length required to penetrate steel stud flange with not less than 3 exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.
 8. Stainless-Steel Drill Screws for Steel Studs: Proprietary fastener consisting of carbon-steel drill point and 300 Series stainless-steel shank, complying with ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 (4.8-mm diameter) by length required to penetrate steel stud flange with not less than three exposed threads.
 9. Polymer-Coated, Steel Drill Screws for Wood Studs: Self-drilling, bugle-head or wafer-head wood screws recommended by veneer anchor manufacturer for fastening to wood studs; not less than No. 10 (4.8-mm diameter), 1-1/2 inches (38 mm) long, and with organic polymer coating with salt-spray resistance to red rust of more than 500 hours per ASTM B 117.
 10. Polymer-Coated, Steel Tapping Screws for Concrete Masonry: Self-tapping screws with specially designed threads for tapping and wedging into masonry, with hex washer head and neoprene washer, 3/16-inch (4.8-mm) diameter by 1-1/2-inch (38-mm) length, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.

F. Stone Trim Anchors

1. Stone Trim Anchors: Units fabricated with tabs or dowels designed to engage kerfs or holes in stone trim units and holes for fasteners or postinstalled anchor bolts for fastening to substrates or framing as indicated.
2. Materials: Fabricate anchors from stainless steel, ASTM A 240/A 240M, Type 304. Fabricate dowels from stainless steel, ASTM A 276, Type 304.
3. Fasteners for Stone Trim Anchors: Annealed stainless-steel bolts, nuts, and washers; ASTM F 593 (ASTM F 738M) for bolts and ASTM F 594 (ASTM F 836M) for nuts, Alloy Group 1 (A1).



4. Postinstalled Anchor Bolts for Fastening Stone Trim Anchors: Chemical anchors **OR** torque-controlled expansion anchors **OR** undercut anchors, **as directed**, made from stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group A1 or A4) for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.
- G. Embedded Flashing Materials
1. Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with SMACNA's "Architectural Sheet Metal Manual **OR** Division 07 Section "Sheet Metal Flashing And Trim", **as directed**, and as follows:
 - a. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch (0.4 mm) thick.
 - b. Copper: ASTM B 370, Temper H00 or H01, cold-rolled copper sheet, 10-oz./sq. ft. (3-kg/sq. m) weight or 0.0135 inch (0.34 mm) thick for fully concealed flashing; 16-oz./sq. ft. (5-kg/sq. m) weight or 0.0216 inch (0.55 mm) thick elsewhere.
 - c. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.6 m). Provide splice plates at joints of formed, smooth metal flashing.
 - d. Fabricate through-wall metal flashing embedded in masonry from stainless steel **OR** copper, **as directed**, with ribs at 3-inch (75-mm) intervals along length of flashing to provide an integral mortar bond.
 - e. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
 - f. Fabricate through-wall flashing with drip edge where **OR** unless otherwise, **as directed**, indicated. Fabricate by extending flashing 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed, **as directed**.
 - g. Fabricate through-wall flashing with sealant stop where **OR** unless otherwise, **as directed**, indicated. Fabricate by bending metal back on itself 3/4 inch (19 mm) at exterior face of wall and down into joint 3/8 inch (10 mm) to form a stop for retaining sealant backer rod.
 - h. Fabricate metal drip edges and sealant stops for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3 inches (75 mm) into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam will shed water.
 - i. Metal Drip Edges: Fabricate from stainless steel. Extend at least 3 inches (75 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed, **as directed**.
 - j. Metal Flashing Terminations: Fabricate from stainless steel. Extend at least 3 inches (75 mm) into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch (19 mm) and down into joint 3/8 inch (10 mm) to form a stop for retaining sealant backer rod.
 - k. Metal Expansion-Joint Strips: Fabricate from stainless steel **OR** copper, **as directed**, to shapes indicated.
 2. Flexible Flashing: For flashing not exposed to the exterior, use one of the following unless otherwise indicated:
 - a. Copper-Laminated Flashing: 5-oz./sq. ft. (1.5-kg/sq. m) **OR** 7-oz./sq. ft. (2-kg/sq. m), **as directed**, copper sheet bonded with asphalt between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
 - b. Asphalt-Coated Copper Flashing: 5-oz./sq. ft. (1.5-kg/sq. m) **OR** 7-oz./sq. ft. (2-kg/sq. m), **as directed**, copper sheet coated with flexible asphalt. Use only where flashing is fully concealed in masonry.
 - c. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.030 inch (0.8 mm) **OR** 0.040 inch (1.0 mm), **as directed**.
 - d. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymers alloy as follows:
 - 1) Monolithic Sheet: Elastomeric thermoplastic flashing, 0.040 inch (1.0 mm) thick.

- 2) Self-Adhesive Sheet: Elastomeric thermoplastic flashing, 0.025 inch (0.6 mm) thick, with a 0.015-inch- (0.4-mm-) thick coating of rubberized-asphalt adhesive.
- 3) Self-Adhesive Sheet with Drip Edge: Elastomeric thermoplastic flashing, 0.025 inch (0.6 mm) thick, with a 0.015-inch- (0.4-mm-) thick coating of rubberized-asphalt adhesive. Where flashing extends to face of masonry, rubberized-asphalt coating is held back approximately 1-1/2 inches (38 mm) from edge.
 - a) Color: Gray **OR** White **OR** Tan/buff **OR** Black, **as directed**.
- 4) Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.
- e. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D 4637, 0.040 inch (1.0 mm) thick.
3. Solder and Sealants for Sheet Metal Flashings
 - a. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
 - b. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
 - c. Elastomeric Sealant: ASTM C 920, chemically curing urethane **OR** polysulfide **OR** silicone, **as directed**, sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
4. Adhesives, Primers, and Seam Tapes for Flexible Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

H. Miscellaneous Masonry Accessories

1. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene **OR** urethane **OR** PVC, **as directed**.
2. Cementitious Dampproofing: Cementitious formulations that are recommended by ILI and that are nonstaining to stone, compatible with joint sealants, and noncorrosive to veneer anchors and attachments.
3. Asphalt Dampproofing: Cut-back asphalt complying with ASTM D 4479, Type I **OR** asphalt emulsion complying with ASTM D 1227, Type III or IV, **as directed**.
4. Weep Hole/Vent Products: Use one of the following unless otherwise indicated:
 - a. Wicking Material: Absorbent rope, made from cotton **OR** UV-resistant synthetic fiber, **as directed**, 1/4 to 3/8 inch (6 to 10 mm) in diameter, in length required to produce 2-inch (50-mm) exposure on exterior and 18 inches (450 mm) in cavity behind stone masonry. Use only for weep holes.
 - b. Round Plastic Tubing: Medium-density polyethylene, 3/8-inch (10-mm) OD by thickness of stone masonry.
 - c. Rectangular Plastic Tubing: Clear butyrate, 3/8 by 1-1/2 inches (10 by 38 mm) by thickness of stone masonry.
 - d. Mesh Weep Holes/Vents: Free-draining mesh; made from polyethylene strands, full width of head joint and 2 inches (50 mm) high by thickness of stone masonry; in color selected from manufacturer's standard.
 - e. Aluminum Weep Holes/Vents: One-piece, L-shaped units made from sheet aluminum, designed to fit into head joint and consisting of vertical channel with louvers stamped in web and with top flap to keep mortar out of head joint; painted to comply with Division 07, before installation, in color approved to match that of mortar.
 - f. Vinyl Weep Holes/Vents: One-piece, offset, T-shaped units made from flexible, injection-molded PVC, designed to fit into head joint and consisting of louvered vertical leg, flexible wings to seal against ends of stone units, and top flap to keep mortar out of head joint; in color approved to match that of mortar.
5. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 - a. Provide one of the following configurations:



- 1) Strips, full-depth of cavity and 10 inches (250 mm) wide, with dovetail shaped notches 7 inches (175 mm) deep that prevent mesh from being clogged with mortar droppings.
 - 2) Strips, not less than 3/4 inch (19 mm) **OR** 1-1/2 inches (38 mm), **as directed**, thick and 10 inches (250 mm) wide, with dimpled surface designed to catch mortar droppings and prevent weep holes from being clogged with mortar.
 - 3) Sheets or strips full depth of cavity and installed to full height of cavity.
 - 4) Sheets or strips not less than 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick and installed to full height of cavity with additional strips 4 inches (100 mm) high at weep holes and thick enough to fill entire depth of cavity and prevent weep holes from being clogged with mortar.
6. Expanded Metal Lath: 3.4 lb/sq. yd. (1.8 kg/sq. m), self-furring, diamond-mesh lath complying with ASTM C 847. Fabricate from structural-quality, zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G60 (Z180).
 7. Woven-Wire Lath: ASTM C 1032, fabricated into 1-1/2-inch (38-mm) hexagonal-shaped mesh with minimum 0.0510-inch- (1.3-mm-) diameter, galvanized-steel wire.
 8. Welded-Wire Lath: ASTM C 933, fabricated into 2-by-2-inch (50-by-50-mm) mesh with minimum 0.0625-inch- (1.6-mm-) diameter, galvanized-steel wire.
 9. Lath Attachment Devices: Material and type required by ASTM C 1063 for installations indicated.
- I. Cavity-Wall Insulation
1. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV **OR** Type X, **as directed**, closed-cell product extruded with an integral skin.
 2. Extruded-Polystyrene Board Insulation with Increased R-Value: ASTM C 578, Type IV, but with an aged thermal resistance (R-value) for 1-inch (25-mm) thickness of 5.6 deg F x h x sq. ft./Btu at 75 deg F (1.0 K x sq. m/W at 24 deg C) at 5 years; closed-cell product with a carbon-black filler and extruded with an integral skin.
 3. Molded-Polystyrene Board Insulation: ASTM C 578, Type I.
 4. Polyisocyanurate Board Insulation: ASTM C 1289, Type I (aluminum-foil faced), Class 2 (glass-fiber reinforced).
 5. Adhesive: Type recommended by insulation board manufacturer for application indicated.
- J. Masonry Cleaners
1. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar and grout stains, efflorescence, and other new construction stains from stone masonry surfaces without discoloring or damaging masonry surfaces; expressly approved for intended use by cleaner manufacturer and stone producer.
- K. Mortar Mixes
1. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 - a. Do not use calcium chloride.
 - b. Limit cementitious materials in mortar to portland cement **OR** mortar cement, **as directed**, and lime.
 - c. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
 - d. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding water. Then mix again, adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for one to two hours. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material.
 2. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.



3. Mortar for Stone Masonry: Comply with ASTM C 270, Proportion **OR** Property, **as directed**, Specification.
 - a. Mortar for Setting Stone: Type S **OR** Type N, **as directed**.
 - b. Mortar for Pointing Stone: Type N **OR** Type O, **as directed**.
4. Latex-Modified Portland Cement Setting Mortar: Proportion and mix portland cement, aggregate, and latex additive to comply with latex-additive manufacturer's written instructions.
5. Cement-Paste Bond Coat: Mix either neat cement and water or cement, sand, and water to a consistency similar to that of thick cream.
 - a. For latex-modified portland cement setting-bed mortar, substitute latex admixture for part or all of water, according to latex-additive manufacturer's written instructions.
6. Mortar for Scratch Coat over Metal Lath: 1 part portland cement, 1/2 part lime, 5 parts loose damp sand, and enough water to produce a workable consistency.
7. Mortar for Scratch Coat over Unit Masonry: 1 part portland cement, 1 part lime, 7 parts loose damp sand, and enough water to produce a workable consistency.
8. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
 - a. Pigments shall not exceed 10 percent of portland cement by weight.
 - b. Pigments shall not exceed 5 percent of masonry cement **OR** mortar cement, **as directed**, by weight.
 - c. Mix to match sample.
9. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
 - a. Mix to match sample.

L. Fabrication

1. Fabricate stone to comply with sizes, shapes, and tolerances recommended by applicable stone association or, if none, by stone source, for faces, edges, beds, and backs.
 - a. For granite, comply with recommendations in NBGQA's "Specifications for Architectural Granite."
 - b. For limestone, comply with recommendations in ILI's "Indiana Limestone Handbook."
2. Cut **OR** Select, **as directed**, stone to produce pieces of thickness, size, and shape indicated, including details on Drawings. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated.
3. Cut and drill sinkages and holes in stone for anchors and supports.
4. Carefully inspect stone at quarry or fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units before shipment.
 - a. Clean sawed backs of stone to remove rust stains and iron particles.
5. Gage backs of stones for adhered veneer if more than 81 sq. in. (522 sq. cm) in area.
6. Thickness of Stone: Provide thickness indicated, but not less than the following:
 - a. Thickness for anchored veneer: 4 inches (100 mm) plus or minus 1/4 inch (6 mm) **OR** 1/2 inch (13 mm), **as directed**. Thickness does not include projection of pitched faces.
 - b. Thickness for adhered veneer: 1 inch (25 mm) plus or minus 1/8 inch (3 mm) **OR** 1/4 inch (6 mm), **as directed**.
7. Shape stone for type of masonry (pattern) as follows:
 - a. Sawed-bed, range ashlar with uniform course heights and uniform lengths as indicated on Drawings.
 - b. Sawed-bed, range ashlar with uniform course heights as indicated on Drawings and with random lengths.
 - c. Sawed-bed, broken-range ashlar with uniform course heights as indicated on Drawings and with random lengths.
 - d. Sawed **OR** Split, **as directed**, -bed, random-range ashlar with random course heights and random lengths (interrupted coursed).
 - e. Coursed rubble.
 - f. Uncoursed rubble (fieldstone).
 - g. Polygonal or mosaic.



8. Finish exposed faces and edges of stone to comply with requirements indicated for finish and to match approved samples and mockups.
 - a. Finish: Split face **OR** Rock face (pitched face) **OR** Natural cleft **OR** Mixed split face and seam face **OR** Mixed split face, seam face, and rock face (pitched face) **OR** Smooth **OR** Sand rubbed **OR** As indicated, **as directed**.
 - b. Finish for Sills: Smooth **OR** Sand rubbed **OR** Split face with sand-rubbed washes **OR** Rock face (pitched face) with sand-rubbed washes **OR** Rock face (pitched face) with tooled (boasted) washes, **as directed**
 - c. Finish for Lintels: Smooth **OR** Sand rubbed **OR** Split face **OR** Rock face (pitched face), **as directed**.
 - d. Finish for Copings: Smooth **OR** Sand rubbed **OR** Split faces **OR** Rock face (pitched face), front and back; sand-rubbed top **OR** Rock face (pitched face), front and back; tooled (boasted) top, **as directed**.
 - 1) Finish exposed ends of copings same as front and back faces.

1.3 EXECUTION

A. Preparation

1. Accurately mark stud centerlines on face of weather-resistant sheathing paper before beginning stone installation.
2. Coat concrete and unit masonry backup with asphalt dampproofing.
3. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

B. Setting Of Stone Masonry, General

1. Perform necessary field cutting and trimming as stone is set.
 - a. Use power saws to cut stone that is fabricated with saw-cut surfaces. Cut lines straight and true, with edges eased slightly to prevent snapping.
 - b. Use hammer and chisel to split stone that is fabricated with split surfaces. Make edges straight and true, matching similar surfaces that were shop or quarry fabricated.
 - c. Pitch face at field-split edges as needed to match stones that are not field split.
2. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.
3. Arrange stones in range ashlar pattern with course heights as indicated, uniform **OR** random, **as directed** lengths, and uniform joint widths, with offset between vertical joints as indicated.
4. Arrange stones in broken-range ashlar pattern with uniform course heights, random lengths, and uniform joint widths.
5. Arrange stones in three-course, random-range ashlar pattern with random course heights, random lengths (interrupted coursed), and uniform joint widths.
6. Arrange stones in coursed **OR** uncoursed, **as directed**, rubble pattern with joint widths within tolerances indicated. Insert small stones into spaces between larger stones as needed to produce joints as uniform in width as practical, **as directed**.
7. Arrange stones in polygonal (mosaic) pattern with uniform joint widths.
8. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.
9. Set stone to comply with requirements indicated on Drawings. Install supports, fasteners, and other attachments indicated or necessary to secure stone masonry in place. Set stone accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.
10. Maintain uniform joint widths except for variations due to different stone sizes and where minor variations are required to maintain bond alignment if any. Lay walls with joints not less than 1/4 inch (6 mm) **OR** 3/8 inch (10 mm), **as directed**, at narrowest points or more than 3/8 inch (10

- mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm) **OR** 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, at widest points.
11. Provide sealant joints of widths and at locations indicated.
 - a. Keep sealant joints free of mortar and other rigid materials.
 - b. Sealing joints is specified in Division 07 Section "Joint Sealants".
 12. Install metal expansion strips in sealant joints at locations indicated. Build flanges of expansion strips into masonry by embedding in mortar between stone masonry and backup wythe. Lap each joint 4 inches (100 mm) in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
 13. Install embedded flashing and weep holes, **as directed**, at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
 - a. At stud-framed walls, extend flashing through stone masonry, up the face of sheathing at least 8 inches (200 mm) **OR** 12 inches (300 mm) **OR** 16 inches (400 mm), **as directed**, and behind weather-resistant sheathing paper.
 - b. At multiwythe masonry walls, including cavity walls, extend flashing through stone masonry, turned up a minimum of 4 inches (100 mm) **OR** 8 inches (200 mm) **OR** 12 inches (300 mm) **OR** 16 inches (400 mm), **as directed**, and extend into or through inner wythe to comply with requirements in Division 04 Section "Unit Masonry".
 - c. At concrete backing, extend flashing through stone masonry, turned up a minimum of 4 inches (100 mm) **OR** 6 inches (150 mm) **OR** 8 inches (200 mm) **OR** 12 inches (300 mm), **as directed**, and insert in reglet. Reglets are specified Division 07 Section "Sheet Metal Flashing And Trim".
 - d. At lintels and shelf angles, extend flashing full length of angles but not less than 6 inches (150 mm) into masonry at each end.
 - e. At sills, extend flashing not less than 4 inches (100 mm) at ends.
 - f. At ends of head and sill flashing turn up not less than 2 inches (50 mm) to form end dams.
 - g. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches (38 mm) or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.
 - h. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.
 - i. Extend sheet metal flashing 1/2 inch (13 mm) beyond face of masonry at exterior and turn flashing down to form a drip.
 - j. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal drip edge.
 - k. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal flashing termination.
 - l. Cut flexible flashing flush with face of wall after masonry wall construction is completed.
 14. Coat limestone with cementitious dampproofing as follows:
 - a. Stone at Grade: Beds, joints, and back surfaces to at least 12 inches (300 mm) above finish-grade elevations.
 - b. Stone Extending below Grade: Beds, joints, back surfaces, and face surfaces below grade.
 - c. Allow cementitious dampproofing formulations to cure before setting dampproofed stone. Do not damage or remove dampproofing in the course of handling and setting stone.
 15. Place weep holes and vents in joints where moisture may accumulate, including at base of cavity walls, above shelf angles, and at flashing.
 - a. Use wicking material **OR** round plastic tubing **OR** rectangular plastic tubing **OR** mesh weep holes/vents **OR** aluminum weep holes/vents **OR** vinyl weep holes/vents **OR** open head joints, **as directed**, to form weep holes.



- b. Use wicking material to form weep holes above flashing in stone sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
 - c. Space weep holes 16 inches (400 mm) **OR** 24 inches (600 mm), **as directed**, o.c.
 - d. Space weep holes formed from plastic tubing **OR** wicking material, **as directed**, 16 inches (400 mm) o.c.
 - e. Trim wicking material used in weep holes flush with outside face of wall after mortar has set.
 - f. Place pea gravel in cavities as soon as practical to a height of not less than 2 inches (50 mm) above top of flashing, to maintain drainage.
 - g. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
16. Install vents in vertical head joints at the top of each continuous cavity at spacing indicated. Use round plastic tubing **OR** rectangular plastic tubing **OR** mesh weep holes/vents **OR** aluminum weep holes/vents **OR** vinyl weep holes/vents **OR** open head joints, **as directed**, to form vents.
- a. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

C. Construction Tolerances

- 1. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (10 mm in 6 m), or 1/2 inch in 40 feet (13 mm in 12 m) or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6 m) or 1/2 inch in 40 feet (13 mm in 12 m) or more.
- 2. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6 m) or 1/2 inch in 40 feet (13 mm in 12 m) or more.
- 3. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet (13 mm in 6 m) or 3/4 inch in 40 feet (19 mm in 12 m) or more.
- 4. For rough stone, measure variation from level, plumb, and position shown in plan as variation of the average plane of the face of each stone from level, plumb, or dimensioned plane.
- 5. Variation in Mortar-Joint Thickness: Do not vary from joint size range indicated.
- 6. Variation in Plane between Adjacent Stones for Rough Stone: Do not exceed one-half of tolerance specified for thickness of stone.

D. Installation Of Anchored Stone Masonry

- 1. Anchor stone masonry to concrete with corrugated-metal veneer anchors unless otherwise indicated. Secure anchors by inserting dovetailed ends into dovetail slots in concrete.
- 2. Anchor stone masonry to unit masonry with corrugated-metal **OR** individual wire, **as directed**, veneer anchors unless otherwise indicated. Embed anchors in unit masonry mortar joints or grouted cells for distance at least one-half of unit masonry thickness.
- 3. Anchor stone masonry to unit masonry with wire anchors unless otherwise indicated. Connect anchors to masonry joint reinforcement by inserting pintles into eyes of masonry joint reinforcement projecting from unit masonry.
- 4. Anchor stone masonry to unit masonry with wire anchors unless otherwise indicated. Connect anchors to masonry joint reinforcement with vertical rods inserted through anchors and through eyes of masonry joint reinforcement projecting from unit masonry.
- 5. Anchor stone masonry to unit masonry with adjustable, screw-attached **OR** seismic, **as directed**, veneer anchors unless otherwise indicated. Fasten anchors to unit masonry with two screws.
- 6. Anchor stone masonry to stud framing with adjustable, screw-attached **OR** seismic, **as directed**, veneer anchors unless otherwise indicated. Fasten anchors through sheathing to framing with two screws.
- 7. Anchor stone masonry to stud framing with screw-attached veneer anchors unless otherwise indicated.
- 8. Anchor stone masonry to wood stud framing with corrugated-metal veneer anchors unless otherwise indicated. Fasten anchors through sheathing to studs with corrosion-resistant roofing nails.

9. Anchor stone masonry to wood stud framing with wire anchors unless otherwise indicated. Fasten anchors through sheathing to wood studs with corrosion-resistant roofing nails.
10. Anchor stone masonry to metal stud framing with wire anchors unless otherwise indicated. Tie anchors to studs.
11. Embed veneer anchors in mortar joints of stone masonry at least halfway, but not less than 1-1/2 inches (38 mm), through stone masonry and with at least 5/8-inch (16-mm) cover on outside face.
 - a. Install continuous wire reinforcement in horizontal joints and attach to seismic veneer anchors as stone is set.
12. Space anchors to provide not less than 1 anchor per 2 sq. ft. (0.2 sq. m) of wall area. Install additional anchors within 12 inches (300 mm) of openings, sealant joints, and perimeter at intervals not exceeding 12 inches (300 mm).
13. Space anchors not more than 16 inches (400 mm) o.c. vertically and 24 inches (600 mm) o.c. horizontally. Install additional anchors within 12 inches (300 mm) of openings, sealant joints, and perimeter at intervals not exceeding 12 inches (300 mm).
14. Anchor stone trim with stone trim anchors where indicated. Install anchors by fastening to substrate and inserting tabs and dowels into kerfs and holes in stone units. Provide compressible filler in ends of dowel holes and bottoms of kerfs to prevent end bearing of dowels and anchor tabs on stone. Fill remainder of anchor holes and kerfs with mortar.
15. Set stone in full bed of mortar with full head joints unless otherwise indicated. Build anchors into mortar joints as stone is set.
16. Fill collar joint **OR** space between back of stone masonry and weather-resistant sheathing paper, **as directed**, with mortar as stone is set.
17. Provide 1-inch (25-mm) **OR** 2-inch (50-mm), **as directed**, cavity between stone masonry and backup construction unless otherwise indicated. Keep cavity free of mortar droppings and debris.
 - a. Place mortar spots in cavity at veneer anchors to maintain spacing.
 - b. Slope beds toward cavity to minimize mortar protrusions into cavity.
 - c. Do not attempt to trowel or remove mortar fins protruding into cavity.
18. Rake out joints for pointing with mortar to depth of not less than 1/2 inch (13 mm) **OR** 3/4 inch (19 mm), **as directed**, before setting mortar has hardened. Rake joints to uniform depths with square bottoms and clean sides.

E. Installation Of Adhered Stone Masonry Veneer

1. Install flashing over sheathing and behind weather-resistant sheathing paper by fastening through sheathing into framing.
2. Install lath over weather-resistant sheathing paper by fastening through sheathing into framing to comply with ASTM C 1063.
3. Install lath over unit masonry and concrete to comply with ASTM C 1063.
4. Install scratch coat over metal lath 3/8 inch (10 mm) thick to comply with ASTM C 926.
5. Coat backs of stone units and face of scratch coat **OR** masonry backup, **as directed**, with cement-paste bond coat, then butter both surfaces with setting mortar. Use sufficient setting mortar so a slight excess will be forced out the edges of stone units as they are set. Tap units into place, completely filling space between units and scratch coat **OR** masonry backup, **as directed**.
6. Rake out joints for pointing with mortar to depth of not less than 1/2 inch (13 mm) **OR** 3/4 inch (19 mm), **as directed**, before setting mortar has hardened. Rake joints to uniform depths with square bottoms and clean sides.

F. Pointing

1. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply pointing mortar in layers not more than 3/8 inch (10 mm) deep until a uniform depth is formed.
2. Point stone joints by placing and compacting pointing mortar in layers not more than 3/8 inch (10 mm) deep. Compact each layer thoroughly and allow to become thumbprint hard before applying next layer.



3. Tool joints, when pointing mortar is thumbprint hard, with a smooth jointing tool to produce the following joint profile:
 - a. Joint Profile: Concave **OR** Smooth, flat face slightly below edges of stone **OR** Smooth, flat face recessed 1/4 inch (6 mm) below edges of stone (raked joint) **OR** Flush, with a 3/8-inch (10-mm) half-round raised bead in middle of joint **OR** As indicated, **as directed**.
- G. Adjusting And Cleaning
1. Remove and replace stone masonry of the following description:
 - a. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved.
 - b. Defective joints.
 - c. Stone masonry not matching approved samples and mockups.
 - d. Stone masonry not complying with other requirements indicated.
 2. Replace in a manner that results in stone masonry matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.
 3. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.
 4. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:
 - a. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - b. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain approval of sample cleaning before cleaning stone masonry.
 - c. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
 - d. Wet wall surfaces with water before applying cleaner; remove cleaner promptly by rinsing thoroughly with clear water.
 - e. Clean stone masonry by bucket and brush hand-cleaning method described in BIA Technical Note No. 20 Revised II, using job-mixed detergent solution.
 - f. Clean stone masonry with proprietary acidic cleaner applied according to manufacturer's written instructions.
 - g. Clean limestone masonry to comply with recommendations in ILI's "Indiana Limestone Handbook."
- H. Excess Materials And Waste
1. Disposal as Fill Material: Dispose of clean masonry waste, including mortar and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.
 - a. Crush masonry waste to less than 4 inches (100 mm) in greatest dimension.
 - b. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 31 Section "Earth Moving".
 - c. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.
 2. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other waste, and legally dispose of off the Owner's property.

END OF SECTION 04 01 40 91



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Task	Specification	Specification Description
04 01 40 91	04 01 20 51	Clay Masonry Restoration And Cleaning
04 01 40 91	04 01 40 52	Stone Restoration And Cleaning
04 01 50 52	04 01 20 51	Clay Masonry Restoration And Cleaning



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SECTION 04 05 13 26 - UNIT MASONRY ASSEMBLIES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for unit masonry assemblies. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes unit masonry assemblies consisting of the following:
 - a. Concrete masonry units (CMUs).
 - b. Decorative concrete masonry units.
 - c. Pre-faced concrete masonry units.
 - d. Concrete brick.
 - e. Face brick.
 - f. Building (common) brick.
 - g. Hollow brick.
 - h. Glazed brick.
 - i. Structural-clay facing tile.
 - j. Firebox brick.
 - k. Clay flue lining units.
 - l. Stone trim units.
 - m. Mortar and grout.
 - n. Reinforcing steel.
 - o. Masonry joint reinforcement.
 - p. Ties and anchors.
 - q. Embedded flashing.
 - r. Miscellaneous masonry accessories.
 - s. Masonry-cell insulation.
 - t. Cavity-wall insulation.

C. Definitions

1. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

D. Performance Requirements

1. Provide structural unit masonry that develops indicated net-area compressive strengths (f'_m) at 28 days.
2. Determine net-area compressive strength (f'_m) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602 **OR** Table 21-D in the Uniform Building Code, **as directed**.
OR
 Determine net-area compressive strength (f'_m) of masonry by testing masonry prisms according to ASTM C 1314 **OR** UBC Standard 21-17, **as directed**.

E. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For reinforcing steel. Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
3. Samples for each type and color of exposed masonry units and colored mortars.



4. Material Certificates: For each type of product indicated. Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards.
5. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - a. For masonry units include material test reports substantiating compliance with requirements.
6. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

F. Quality Assurance

1. Preconstruction Testing Service: the Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by the Owner.
 - a. Clay Masonry Unit Test: For each type of unit required, per ASTM C 67.
 - b. Concrete Masonry Unit Test: For each type of unit required, per ASTM C 140.
 - c. Mortar Test (Property Specification): For each mix required, per ASTM C 780 **OR** UBC Standard 21-16, **as directed**.
 - d. Grout Test (Compressive Strength): For each mix required, per ASTM C 1019 **OR** UBC Standard 21-18, **as directed**.
2. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.
3. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects.
 - a. Build sample panels for each type of exposed unit masonry construction **OR** typical exterior wall, **as directed**, in sizes approximately 48 inches (1200 mm) long by 48 inches (1200 mm) high.

G. Delivery, Storage, And Handling

1. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
2. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
3. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
4. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
5. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

H. Project Conditions

1. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602 **OR** Section 2104.3 in the Uniform Building Code, **as directed**.
2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.



1.2 PRODUCTS

A. Concrete Masonry Units (CMUs)

1. Shapes: Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Integral Water Repellent: Provide units made with liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength for exposed units and where indicated.
3. Concrete Masonry Units: ASTM C 90 **OR** UBC Standard 21-4, **as directed**.
 - a. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa) **OR** 2150 psi (14.8 MPa) **OR** 2800 psi (19.3 MPa) **OR** 3050 psi (21.0 MPa), **as directed**.
 - b. Weight Classification: Lightweight **OR** Medium weight **OR** Normal weight, **as directed**.
4. Decorative Concrete Masonry Units: ASTM C 90 **OR** UBC Standard 21-4, **as directed**.
 - a. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa) **OR** 2150 psi (14.8 MPa) **OR** 2800 psi (19.3 MPa) **OR** 3050 psi (21.0 MPa), **as directed**.
 - b. Weight Classification: Lightweight **OR** Medium weight **OR** Normal weight, **as directed**.
 - c. Pattern and Texture:
 - 1) Standard pattern, ground finish.
 - 2) Standard pattern, split-face finish.
 - 3) Standard pattern, split-ribbed finish.
 - 4) Scored vertically, standard finish.
 - 5) Triple scored vertically, standard finish.
5. Pre-faced Concrete Masonry Units: Lightweight hollow **OR** solid, **as directed**, concrete units complying with ASTM C 90 **OR** UBC Standard 21-4, **as directed**, with manufacturer's standard smooth resinous facing complying with ASTM C 744.
 - a. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa) **OR** 2150 psi (14.8 MPa) **OR** 2800 psi (19.3 MPa) **OR** 3050 psi (21.0 MPa), **as directed**.
 - b. Size: Manufactured with pre-faced surfaces having 1/16-inch- (1.5-mm-) wide returns of facing to create 1/4-inch- (6.5-mm-) wide mortar joints with modular coursing.
6. Concrete Building Brick: ASTM C 55 **OR** UBC Standard 21-3, **as directed**.
 - a. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2500 psi (17.3 MPa) **OR** 3500 psi (24.1 MPa), **as directed**.
 - b. Weight Classification: Lightweight **OR** Medium weight **OR** Normal weight, **as directed**.

B. Concrete And Masonry Lintels

1. General: Provide either concrete or masonry lintels, at Contractor's option, complying with requirements below.
2. Concrete Lintels:
 - a. Precast units matching concrete masonry units and with reinforcing bars indicated or required to support loads indicated.
OR
Precast or formed-in-place concrete lintels complying with requirements in Division 03 Section "Cast-in-place Concrete".
3. Masonry Lintels: Made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout.

C. Brick

1. General: Provide shapes indicated and as follows:
 - a. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 - b. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.



2. Face Brick: ASTM C 216 **OR** UBC Standard 21-1, **as directed**, Grade SW **OR** MW or SW, **as directed**, Type FBX **OR** FBS **OR** FBA, **as directed**.
 - a. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3000 psi (20.7 MPa) **OR** 4400 psi (30.3 MPa) **OR** 5500 psi (37.9 MPa) **OR** 6400 psi (44.1 MPa) **OR** 8000 psi (55.2 MPa) **OR** 8400 psi (57.9 MPa), **as directed**.
 - b. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67.
 - c. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 - d. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet (3 m).
 - e. Size: **As directed**.
3. Building (Common) Brick: ASTM C 62 **OR** UBC Standard 21-1, **as directed**, Grade SW **OR** MW or SW **OR** NW, MW, or SW, **as directed**.
 - a. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3000 psi (20.7 MPa) **OR** 4400 psi (30.3 MPa) **OR** 5500 psi (37.9 MPa) **OR** 6400 psi (44.1 MPa) **OR** 8000 psi (55.2 MPa) **OR** 8400 psi (57.9 MPa), **as directed**.
 - b. Size: Match size of face brick.
4. Hollow Brick: ASTM C 652 **OR** UBC Standard 21-1, **as directed**, Grade SW **OR** MW or SW, **as directed**, Class H40V (void areas between 25 and 40 percent of gross cross-sectional area) **OR** H60V (void areas between 40 and 60 percent of gross cross-sectional area) , **as directed**, Type HBX **OR** HBS **OR** HBA **OR** HBB, **as directed**.
 - a. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3000 psi (20.7 MPa) **OR** 4400 psi (30.3 MPa) **OR** 5500 psi (37.9 MPa) **OR** 6400 psi (44.1 MPa) **OR** 8000 psi (55.2 MPa) **OR** 8400 psi (57.9 MPa), **as directed**.
 - b. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 - c. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet (3 m).
 - d. Size: **As directed**.
5. Glazed Face Brick: ASTM C 216 **OR** UBC Standard 21-1, **as directed**, Grade SW **OR** MW or SW, **as directed**, Type FBX **OR** FBS **OR** FBA, **as directed**; with glaze complying with ASTM C 126.
6. Glazed Face Brick: ASTM C 1405, Class Exterior **OR** Interior, **as directed**, Grade S (Select) **OR** SS (Select Sized or Ground Edge), **as directed**.
7. Glazed Face Brick: Either ASTM C 1405, Class Exterior **OR** Interior, **as directed**, Grade S (Select) or ASTM C 216 **OR** UBC Standard 21-1, **as directed**, Grade SW **OR** MW or SW, **as directed**, Type FBX; with glaze complying with ASTM C 126.
8. Glazed Hollow Brick: Hollow brick complying with ASTM C 652 **OR** UBC Standard 21-1, **as directed**, Grade SW **OR** MW or SW, **as directed**, Class H40V (void areas between 25 and 40 percent of gross cross-sectional area) **OR** H60V (void areas between 40 and 60 percent of gross cross-sectional area), **as directed**, Type HBX **OR** HBS **OR** HBA, **as directed**; with glaze complying with ASTM C 126.
 - a. Size: **As directed**.
 - b. Provide Type I (single-faced units) where only one finished face is exposed when units are installed, and Type II (double-faced units) where two opposite finished faces are exposed when units are installed.

D. Structural-Clay Facing Tile

1. General:
 - a. Provide solid, multicored, or hollow units, with shape and direction of cores optional, unless otherwise indicated.
 - b. Provide multicored units designed for use in reinforced, grouted masonry.



- c. Provide special shapes where required for corners, jambs, coved bases, sills, and other special conditions indicated that cannot be produced by sawing standard units.
 2. Glazed Structural-Clay Facing Tile: ASTM C 126, Grade S (Select) **OR** SS (Select Sized or Ground Edged), **as directed**.
 - a. Size: **As directed**.
 - b. Provide Type I (single-faced units) where only one finished face is exposed when units are installed, and Type II (double-faced units) where two opposite finished faces are exposed when units are installed.
 3. Unglazed Structural-Clay Facing Tile: ASTM C 212, Type FTX **OR** FTS, **as directed**, Standard **OR** Special-Duty, **as directed**, class.
 - a. Number of Faces: Single faced where only one finished face is exposed when units are installed **OR** Double faced where both finished faces are exposed when units are installed, **as directed**.
- E. Fireplace And Chimney Lining Units
 1. Firebox Brick: ASTM C 1261, size required to produce lining thickness indicated.
 2. Clay Flue Lining Units: ASTM C 315.
- F. Stone Trim Units
 1. Granite: ASTM C 615.
 - a. Description: Fine **OR** Medium, **as directed**, -grained, white **OR** pink **OR** gray **OR** black, **as directed**, stone. Uniform pattern, without veining.
 2. Limestone: ASTM C 568, Classification I Low **OR** II Medium **OR** III High, **as directed**, -Density.
 3. Marble: ASTM C 503, Classification I Calcite **OR** II Dolomite **OR** III Serpentine **OR** IV Travertine, **as directed**.
 - a. Description: Uniform, fine- to medium-grained, white stone with only slight veining.
 4. Quartz-Based Stone: ASTM C 616, Classification I Sandstone **OR** II Quartzitic Sandstone **OR** III Quartzite, **as directed**.
 5. Finish: Polished **OR** Honed **OR** Smooth **OR** Machine tooled, 4 bats per 1 inch (25 mm) **OR** Machine tooled, 6 bats per 1 inch (25 mm) **OR** Machine tooled, 8 bats per 1 inch (25 mm) **OR** Chat sawed **OR** Split face **OR** Rock face (pitched face), **as directed**.
 - a. Finish for Tops of Sills and Soffits of Lintels: Sand rubbed **OR** Split face, **as directed**.
 6. Provide stone units accurately shaped, with exposed faces dressed true, and with beds and joints at right angles to faces.
 - a. For granite, comply with recommendations in NBGQA's "Specifications for Architectural Granite."
 - b. For limestone, comply with recommendations in ILI's "Indiana Limestone Handbook."
 - c. For marble, comply with recommendations in MIA's "Dimensional Stone--Design Manual IV."
- G. Mortar And Grout Materials
 1. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction.
 2. Hydrated Lime: ASTM C 207 **OR** UBC Standard 21-13, **as directed**, Type S.
 3. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.
 4. Masonry Cement: ASTM C 91 **OR** UBC Standard 21-11, **as directed**.
 5. Mortar Cement: ASTM C 1329 **OR** UBC Standard 21-14, **as directed**.
 6. Mortar Pigments: Iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.
 7. Colored Cement Product: Packaged blend made from portland cement and lime or masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 - a. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
 - b. Pigments shall not exceed 10 percent of portland cement by weight.

- c. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
- 8. Aggregate for Mortar: ASTM C 144.
 - a. For joints less than 1/4 inch (6.5 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
 - b. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
 - c. White-Mortar Aggregates: Natural white sand or crushed white stone.
 - d. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- 9. Aggregate for Grout: ASTM C 404.
- 10. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for structural-clay tile facing units.
- 11. Refractory Mortar Mix: Ground fireclay or non-water-soluble, calcium aluminate, medium-duty refractory mortar that passes ASTM C 199 test; or an equivalent product acceptable to authorities having jurisdiction.
- 12. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
- 13. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.
- 14. Water: Potable.

H. Reinforcement

- 1. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).
- 2. Masonry Joint Reinforcement, General: ASTM A 951 **OR** UBC Standard 21-10, **as directed**.
 - a. Interior Walls: Mill- **OR** Hot-dip, **as directed**, galvanized, carbon steel.
 - b. Exterior Walls: Hot-dip galvanized, carbon **OR** Stainless, **as directed**, steel.
 - c. Wire Size for Side Rods: W1.7 or 0.148-inch (3.8-mm) **OR** W2.8 or 0.188-inch (4.8-mm), **as directed**, diameter.
 - d. Wire Size for Cross Rods: W1.7 or 0.148-inch (3.8-mm) **OR** W2.8 or 0.188-inch (4.8-mm), **as directed** diameter.
 - e. Wire Size for Veneer Ties: W1.7 or 0.148-inch (3.8-mm) **OR** W2.8 or 0.188-inch (4.8-mm), **as directed** diameter.
 - f. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
 - g. Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.
 - h. Multiwythe Masonry:
 - 1) Ladder type with 1 side rod at each face shell of hollow masonry units more than 4 inches (100 mm) in width, plus 1 side rod at each wythe of masonry 4 inches (100 mm) or less in width.
 - 2) Tab type, with 1 side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face.
 - 3) Adjustable (two-piece) type, with one side rod at each face shell of backing wythe and with ties that extend into facing wythe. Ties engage eyes or slots in reinforcement and extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face. Ties have hooks or clips to engage a continuous wire in the facing wythe.
 - i. Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.188-inch- (4.8-mm-) diameter, hot-dip galvanized, carbon-steel continuous wire.

I. Ties And Anchors

- 1. Materials:
 - a. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 641/A 641M, Class 1 coating.



- b. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.
 - c. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304 **OR** 316, **as directed**.
 - d. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 (Z180) zinc coating.
 - e. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M.
 - f. Stainless-Steel Sheet: ASTM A 666, Type 304 **OR** 316, **as directed**.
 - g. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - h. Stainless Steel bars: ASTM A 276 or ASTM a 666, Type 304.
- 2. Corrugated Metal Ties: Metal strips not less than 7/8 inch (22 mm) wide with corrugations having a wavelength of 0.3 to 0.5 inch (7.6 to 12.7 mm) and an amplitude of 0.06 to 0.10 inch (1.5 to 2.5 mm) made from steel sheet, galvanized after fabrication **OR** stainless-steel sheet, **as directed**, not less than 0.043 inch (1.1 mm) **OR** 0.053 inch (1.3 mm) **OR** 0.067 inch (1.7 mm) **OR** 0.097 inch (2.5 mm), **as directed**, thick. Ties made from galvanized steel sheet may be used in interior walls, unless otherwise indicated.
- 3. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches (50 mm) parallel to face of veneer.
- 4. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches (100 mm) wide.
 - a. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches (50 mm) long may be used for masonry constructed from solid units or hollow units laid with cells horizontal.
 - b. Where wythes do not align **OR** are of different materials, **as directed**, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches (32 mm).
 - c. Wire: Fabricate from 3/16-inch- (4.8-mm-) **OR** 1/4-inch- (6.4-mm-), **as directed**, diameter, hot-dip galvanized steel **OR** stainless-steel, **as directed**, wire. Mill-galvanized wire ties may be used in interior walls, unless otherwise indicated.
- 5. Adjustable Anchors for Connecting to Structure: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - a. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6.4-mm-) diameter, hot-dip galvanized steel **OR** stainless-steel, **as directed**, wire. Mill-galvanized wire may be used at interior walls, unless otherwise indicated.
 - b. Tie Section for Steel Frame: Triangular-shaped wire tie, sized to extend within 1 inch (25 mm) of masonry face, made from 0.188-inch- (4.8-mm-) **OR** 0.25-inch- (6.4-mm-), **as directed**, diameter, hot-dip galvanized steel **OR** stainless-steel, **as directed** wire. Mill-galvanized wire may be used at interior walls, unless otherwise indicated.
 - c. Connector Section for Concrete: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.053-inch- (1.3-mm-) thick, steel sheet, galvanized after fabrication **OR** 0.097-inch- (2.5-mm-) thick, steel sheet, galvanized after fabrication **OR** 0.062-inch- (1.6-mm-) thick, stainless-steel sheet **OR** 0.109-inch- (2.8-mm-) thick, stainless-steel sheet, **as directed**. 0.064-inch- (1.6-mm-) **OR** 0.108-inch- (2.7-mm-), **as directed**, thick, galvanized sheet may be used at interior walls, unless otherwise indicated.
 - d. Tie Section for Concrete: Corrugated metal ties with dovetail tabs for inserting into dovetail slots in concrete and sized to extend to within 1 inch (25 mm) of masonry face.
- 6. Partition Top anchors: 0.097-inch- (2.5-mm-) thick metal plate with 3/8-inch- (10-mm-) diameter metal rod 6 inches (150 mm) long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication **OR** stainless-steel, **as directed**.
- 7. Rigid Anchors: Fabricate from steel bars 1-1/2 inches (38 mm) wide by 1/4 inch (6.4 mm) thick by 24 inches (600 mm) long, with ends turned up 2 inches (50 mm) or with cross pins.
 - a. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M **OR** Epoxy coating 0.020 inch (0.51 mm) thick **OR** Rust-inhibitive paint, **as directed**.
- 8. Stone Anchors: Fabricate dowels, cramps, and other stone anchors from stainless steel.

9. Adjustable Masonry-Veneer Anchors

- a. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
 - 1) Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).
- b. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
 - 1) Anchor Section:
 - a) Rib-stiffened, sheet metal plate with screw holes top and bottom, and slotted holes for inserting wire tie.
 - b) Sheet metal plate with screw holes top and bottom and with raised rib-stiffened strap, stamped into center to provide a slot between strap and plate for inserting wire tie.
 - c) Gasketed sheet metal plate with screw holes top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation or sheathing; and raised rib-stiffened strap, stamped into center to provide a slot between strap and plate for inserting wire tie. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and extend beyond pronged legs.
 - 2) Fabricate sheet metal anchor sections and other sheet metal parts from 0.067-inch- (1.7-mm-) thick, steel sheet, galvanized after fabrication **OR** 0.097-inch- (2.5-mm-) thick, steel sheet, galvanized after fabrication **OR** 0.078-inch- (2.0-mm-) thick, stainless-steel sheet **OR** 0.109-inch- (2.8-mm-) thick, stainless-steel sheet, **as directed**.
 - 3) Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.188-inch- (4.8-mm-) **OR** 0.25-inch- (6.4-mm-), **as directed**, diameter, hot-dip galvanized steel **OR** stainless-steel, **as directed**, wire.
- c. Slip-in, Masonry-Veneer Anchors: Units consisting of a wire tie section and an anchor section designed to interlock with metal studs and be slipped into place as sheathing is installed.
 - 1) Wire-Type Anchor: Bent wire anchor section with an eye to receive the wire tie. Wire tie has a vertical leg that slips into the eye of anchor section and allows vertical adjustment. Both sections are made from 3/16-inch (4.8-mm), hot-dip galvanized wire.
 - 2) Strap-and-Wire Type Anchor: Flat metal strap with notch to interlock with flange of metal stud and two holes for inserting vertical legs of wire tie specially formed to fit anchor section. Strap is made from 0.067-inch- (1.7-mm-) thick, steel sheet, galvanized after fabrication; anchor wire tie is made from 3/16-inch (4.8-mm), hot-dip galvanized wire.
- d. Seismic Masonry-Veneer Anchors: Units consisting of a metal anchor section and a connector section designed to engage a continuous wire embedded in the veneer mortar joint.
 - 1) Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, and slotted holes for inserting connector section.
 - 2) Connector Section: Rib-stiffened, sheet metal bent plate; sheet metal clip; or wire tie and rigid extruded vinyl clip designed to engage continuous wire. Size connector to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face.
 - 3) Fabricate sheet metal anchor sections and other sheet metal parts from 0.067-inch- (1.7-mm-) thick, steel sheet, galvanized after fabrication **OR** 0.097-inch- (2.5-mm-) thick, steel sheet, galvanized after fabrication **OR** 0.078-inch- (2.0-mm-) thick, stainless-steel sheet **OR** 0.109-inch- (2.8-mm-) thick, stainless-steel sheet, **as directed**.



- 4) Fabricate wire connector sections from 0.188-inch- (4.8-mm-) **-OR** 0.25-inch- (6.4-mm-), **as directed**, diameter, hot-dip galvanized, carbon **OR** stainless, **as directed**, steel wire.
 - e. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 (4.8-mm) diameter by length required to penetrate steel stud flange with not less than 3 exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.
 - f. Stainless-Steel Drill Screws for Steel Studs: Proprietary fastener consisting of carbon-steel drill point and 300 Series stainless-steel shank, complying with ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 (4.8-mm) diameter by length required to penetrate steel stud flange with not less than three exposed threads.
- J. Miscellaneous Anchors
1. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.
 2. Dovetail Slots in Concrete: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.034-inch (0.9-mm), galvanized steel sheet.
 3. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.
 4. Postinstalled Anchors: Provide chemical or torque-controlled expansion anchors, with capability to sustain, without failure, a load equal to six times the load imposed when installed in solid or grouted unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
 - a. Corrosion Protection:
 - 1) Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).
 - 2) Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group 1 or 4) for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.
- K. Embedded Flashing Materials
1. Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with SMACNA's "Architectural Sheet Metal Manual OR Division 07 Section "Sheet Metal Flashing And Trim" as directed.
 - a. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch (0.4 mm) thick.
 - b. Copper: ASTM B 370, Temper H00 or H01, cold-rolled copper sheet, 10-oz./sq. ft. (3-kg/sq. m) weight or 0.0135 inch (0.34 mm) thick for fully concealed flashing; 16-oz./sq. ft. (5-kg/sq. m) weight or 0.0216 inch (0.55 mm) thick elsewhere.
 - c. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.6 m). Provide splice plates at joints of formed, smooth metal flashing.
 - d. Fabricate through-wall metal flashing embedded in masonry from stainless steel **OR** copper, **as directed**, with ribs at 3-inch (75-mm) intervals along length of flashing to provide an integral mortar bond.
 - e. Metal Drip Edges: Fabricate from stainless steel. Extend at least 3 inches (75 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
 - f. Metal Flashing Terminations: Fabricate from stainless steel. Extend at least 3 inches (75 mm) into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch (19 mm) and down into joint 3/8 inch (10 mm) to form a stop for retaining sealant backer rod.
 - g. Metal Expansion-Joint Strips: Fabricate from stainless steel **OR** copper, **as directed**, to shapes indicated.
 2. Flexible Flashing: For flashing not exposed to the exterior, use one of the following, unless otherwise indicated:



- a. Copper-Laminated Flashing: 5-oz./sq. ft. (1.5-kg/sq. m) **OR** 7-oz./sq. ft. (2-kg/sq. m), **as directed**, copper sheet bonded with asphalt between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
- b. Asphalt-Coated Copper Flashing: 5-oz./sq. ft. (1.5-kg/sq. m) **OR** 7-oz./sq. ft. (2-kg/sq. m), **as directed**, copper sheet coated with flexible asphalt. Use only where flashing is fully concealed in masonry.
- c. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.030 inch (0.8 mm) **OR** 0.040 inch (1.0 mm), **as directed**.
- d. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymers alloy 0.025 inch (0.6 mm) thick, with a 0.015-inch- (0.4-mm-) thick coating of rubberized-asphalt adhesive.
- e. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D 4637, 0.040 inch (1.0 mm) thick.
3. Single-Wythe CMU Flashing System: System of CMU cell flashing pans and interlocking CMU web covers made from high-density polyethylene incorporating chemical stabilizers that prevent UV degradation. Cell flashing pans have integral weep spouts that are designed to be built into mortar bed joints and weep collected moisture to the exterior of CMU walls and that extend into the cell to prevent clogging with mortar.
4. Solder and Sealants for Sheet Metal Flashings:
 - a. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
 - b. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
 - c. Elastomeric Sealant: ASTM C 920, chemically curing urethane **OR** polysulfide silicone **as directed**, sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
5. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer.
- L. Miscellaneous Masonry Accessories
 1. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; formulated from neoprene, urethane or PVC.
 2. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall.
 3. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
 4. Weep/Vent Products: Use one of the following, unless otherwise indicated:
 - a. Wicking Material: Absorbent rope, made from cotton or UV-resistant synthetic fiber, 1/4 to 3/8 inch (6 to 10 mm) in diameter, in length required to produce 2-inch (50-mm) exposure on exterior and 18 inches (450 mm) in cavity between wythes. Use only for weeps.
 - b. Round Plastic Weep/Vent Tubing: Medium-density polyethylene, 3/8-inch (9-mm) OD by 4 inches (100 mm) long.
 - c. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 inches (9 by 38 by 89 mm) long.
 - d. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.
 - e. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe; in color selected from manufacturer's standard.
 - f. Aluminum Weep Hole/Vent: One-piece, L-shaped units made from sheet aluminum, designed to fit into a head joint and consisting of a vertical channel with louvers stamped in web and with a top flap to keep mortar out of the head joint; painted before installation to



- comply with Division 09 Section(s) "Exterior Painting" OR "Interior Painting", in color approved to match that of mortar.
- g. Vinyl Weep Hole/Vent: One-piece, offset, T-shaped units made from flexible, injection-molded PVC, designed to fit into a head joint and consisting of a louvered vertical leg, flexible wings to seal against ends of masonry units, and a top flap to keep mortar out of the head joint; in color approved by Architect to match that of mortar.
5. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 - a. Provide one of the following configurations:
 - 1) Strips, full-depth of cavity and 10 inches (250 mm) wide, with dovetail shaped notches 7 inches (175 mm) deep.
 - 2) Strips, not less than 1-1/2 inches (38 mm) thick and 10 inches (250 mm) wide, with dimpled surface designed to catch mortar droppings and prevent weep holes from being clogged with mortar.
 - 3) Sheets or strips full depth of cavity and installed to full height of cavity.
 6. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch (3.6-mm) steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.
- M. Insulation
1. Loose-Granular Fill Insulation: Perlite complying with ASTM C 549, Type II (surface treated for water repellency and limited moisture absorption) or Type IV (surface treated for water repellency and to limit dust generation).
 2. Molded-Polystyrene Insulation Units: Rigid, cellular thermal insulation formed by the expansion of polystyrene-resin beads or granules in a closed mold to comply with ASTM C 578, Type I. Provide specially shaped units designed for installing in cores of masonry units.
 3. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV **OR X, as directed**, closed-cell product extruded with an integral skin.
 4. Molded-Polystyrene Board Insulation: ASTM C 578, Type I.
 5. Polyisocyanurate Board Insulation: ASTM C 1289, Type I (aluminum-foil-faced), Class 2 (glass-fiber-reinforced).
 6. Adhesive: Type recommended by insulation board manufacturer for application indicated.
- N. Masonry Cleaners
1. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains from new masonry without damaging masonry. Use product approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
- O. Mortar And Grout Mixes
1. General: Do not use admixtures, unless otherwise indicated.
 - a. Do not use calcium chloride in mortar or grout.
 - b. Limit cementitious materials in mortar for exterior and reinforced masonry to portland cement and lime.
 - c. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
 2. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
 3. Mortar for Unit Masonry: Comply with ASTM C 270 **OR** BIA Technical Notes 8A **OR** UBC Standard 21-15, **as directed**, Proportion Specification.
 4. Mortar for Unit Masonry: Comply with ASTM C 270 **OR** BIA Technical Notes 8A **OR** UBC Standard 21-15, **as directed**, Property Specification.
 - a. For masonry below grade or in contact with earth, use Type M **OR** S, **as directed**.
 - b. For reinforced masonry, use Type S **OR** N, **as directed**.
 - c. For mortar parge coats, use Type S or N.

- d. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
- e. For interior non-load-bearing partitions, Type O may be used instead of Type N.
- 5. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
 - a. Pigments shall not exceed 10 percent of portland cement by weight.
 - b. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
- 6. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
- 7. Grout for Unit Masonry: Comply with ASTM C 476 **OR** UBC Standard 21-19, **as directed**.
 - a. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 **OR** Table 21-C in the Uniform Building Code, **as directed**, for dimensions of grout spaces and pour height.
 - b. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.
- 8. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.

1.3 EXECUTION

A. Installation, General

- 1. Use full-size units without cutting if possible. If cutting is required, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- 2. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
- 3. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
- 4. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.
- 5. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
 - a. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
 - b. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.

B. Laying Masonry Walls

- 1. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- 2. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- 3. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- 4. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.
- 5. Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

C. Mortar Bedding And Jointing



1. Lay hollow brick and concrete masonry units as follows:
 - a. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - b. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - c. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 - d. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
2. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
3. Lay structural-clay tile as follows:
 - a. Lay vertical-cell units with full head joints, unless otherwise indicated. Provide bed joints with full mortar coverage on face shells and webs.
 - b. Lay horizontal-cell units with full bed joints, unless otherwise indicated. Keep drainage channels, if any, free of mortar. Form head joints with sufficient mortar so excess will be squeezed out as units are placed in position.
 - c. Maintain joint thicknesses indicated except for minor variations required to maintain bond alignment. If not indicated, lay walls with 1/4- to 3/8-inch- (6- to 10-mm-) thick joints.
 - d. Where epoxy-mortar pointed joints are indicated, rake out setting mortar to a uniform depth of 1/4 inch (6 mm) and point with epoxy mortar.
4. Set firebox brick in full bed of refractory mortar with full head joints. Form joints by buttering both surfaces of adjoining brick and sliding it into place. Make joints just wide enough to accommodate variations in size of brick, approximately 1/8 inch (3 mm). Tool joints smooth on surfaces exposed to fire or smoke.
5. Install clay flue liners to comply with ASTM C 1283. Install flue liners ahead of surrounding masonry. Set clay flue liners in full bed of refractory mortar 1/16 to 1/8 inch (1.6 to 3 mm) thick. Strike joints flush on inside of flue to provide smooth surface. Maintain expansion space between flue liner and surrounding masonry except where surrounding masonry is required to provide lateral support for flue liners.
6. Set stone **OR** cast-stone, **as directed**, trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
7. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
8. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

D. Composite Masonry

1. Bond wythes of composite masonry together using one of the following methods:
 - a. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 4.5 sq. ft. (0.42 sq. m) **OR** 2.67 sq. ft. (0.25 sq. m), **as directed**, of wall area spaced not to exceed 36 inches (914 mm) **OR** 24 inches (610 mm), **as directed**, o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (915 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.
 - 1) Where bed joints of wythes do not align, use adjustable (two-piece) type ties.
 - b. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
 - 1) Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes **OR** tab-type reinforcement, **as directed**.
 - 2) Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.
2. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.
3. Collar Joints in Clay Tile Masonry: After each course is laid, fill the vertical, longitudinal joint between wythes solidly with mortar at exterior walls, except cavity walls, and interior walls and partitions.

4. Corners: Provide interlocking masonry unit bond in each wythe and course at corners, unless otherwise indicated.
5. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:
 - a. Provide individual metal ties not more than 8 inches (203 mm) **OR** 16 inches (406 mm), **as directed**, o.c.
 - b. Provide continuity with masonry joint reinforcement by using prefabricated T-shaped units.
 - c. Provide rigid metal anchors not more than 24 inches (610 mm) **OR** 48 inches (1220 mm), **as directed**, o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

E. Cavity Walls

1. Bond wythes of cavity walls together using one of the following methods:
 - a. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 4.5 sq. ft. (0.42 sq. m) **OR** 2.67 sq. ft. (0.25 sq. m), **as directed**, of wall area spaced not to exceed 36 inches (914 mm) **OR** 24 inches (610 mm), **as directed**, o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (915 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.
 - b. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
 - 1) Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes **OR** tab-type reinforcement, **as directed**.
 - 2) Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.
 - 3) Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.
 - c. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.
2. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
3. Parge cavity face of backup wythe in a single coat approximately 3/8 inch (10 mm) thick. Trowel face of parge coat smooth.
OR
Coat cavity face of backup wythe to comply with Division 07 Section "Bituminous Dampproofing".

- #### F. Installing Cavity-Wall Insulation:
- Place small dabs of adhesive, spaced approximately 12 inches (300 mm) o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit insulation between wall ties and other confining obstructions, with edges butted tightly. Press units firmly against inside wythe of masonry.

G. Masonry-Cell Insulation

1. Pour granular insulation into cavities to fill void spaces. Maintain inspection ports to show presence of insulation at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of insulation to 1 story in height, but not more than 20 feet (6 m).
2. Install molded-polystyrene insulation units into masonry unit cells before laying units.

H. Masonry Joint Reinforcement

1. General: Install in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
2. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
3. Provide continuity at wall intersections by using prefabricated T-shaped units.
4. Provide continuity at corners by using prefabricated L-shaped units.



- I. Anchoring Masonry To Structural Members
 1. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
 - a. Provide an open space not less than 1/2 inch (13 mm) **OR** 1 inch (25 mm), **as directed**, in width between masonry and structural member, unless otherwise indicated.
 - b. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.
 - c. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.
- J. Anchoring Masonry Veneers
 1. Anchor masonry veneers to wall framing **OR** concrete and masonry backup, **as directed**, with seismic masonry-veneer anchors to comply with the following requirements:
 - a. Fasten screw-attached and seismic anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners.
 - b. Insert slip-in anchors in metal studs as sheathing is installed. Provide one anchor at each stud in each horizontal joint between sheathing boards.
 - c. Embed tie sections **OR** connector sections and continuous wire, **as directed**, in masonry joints. Provide not less than 2 inches (50 mm) of air space between back of masonry veneer and face of sheathing.
 - d. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 - e. Space anchors as indicated, but not more than 16 inches (406 mm) o.c. vertically and 32 inches (813 mm) **OR** 24 inches (610 mm), **as directed**, o.c. horizontally with not less than 1 anchor for each 3.5 sq. ft. (0.33 sq. m) **OR** 2.67 sq. ft. (0.25 sq. m), **as directed**, of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 36 inches (914 mm), around perimeter.
- K. Control And Expansion Joints
 1. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
 2. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 07 Section "Joint Sealants", but not less than 3/8 inch (10 mm).
 - a. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.
- L. Lintels
 1. Provide concrete or masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.
 2. Provide minimum bearing of 8 inches (200 mm) at each jamb, unless otherwise indicated.
- M. Flashing, Weep Holes, Cavity Drainage, And Vents
 1. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
 2. Install flashing as follows, unless otherwise indicated:
 - a. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing as recommended by flashing manufacturer.
 - b. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.

- c. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal drip edge.
- d. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal flashing termination.
- 3. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.
- 4. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- 5. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
 - a. Use specified weep/vent products or open head joints to form weep holes.
 - b. Space weep holes 24 inches (600 mm) o.c., unless otherwise indicated.
 - c. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.
- 6. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.
- 7. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products or open head joints to form vents.
 - a. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

N. Reinforced Unit Masonry Installation

- 1. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - a. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - b. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- 2. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602 **OR** Section 2104.5 in the Uniform Building Code, **as directed**.
 - a. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - b. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 **OR** Section 2104.6 in the Uniform Building Code, **as directed**, for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - c. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

O. Field Quality Control

- 1. Inspectors: the Owner will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.
 - a. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.
- 2. Testing Agency: the Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports:
 - a. Payment for these services will be made by the Owner.



3. Testing Frequency: One set of tests for each 5000 sq. ft. (465 sq. m) of wall area or portion thereof.
 4. Clay Masonry Unit Test: For each type of unit provided, per ASTM C 67.
 5. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140.
 6. Mortar Test (Property Specification): For each mix provided, per ASTM C 780 **OR** UBC Standard 21-16, **as directed**. Test mortar for mortar air content and compressive strength.
 7. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019 **OR** UBC Standard 21-18, **as directed**.
- P. Parging
1. Parge exterior faces of below-grade masonry walls, where indicated, in 2 uniform coats to a total thickness of 3/4 inch (19 mm) with a steel-trowel finish. Form a wash at top of parging and a cove at bottom. Damp-cure parging for at least 24 hours and protect parging until cured.
- Q. Cleaning
1. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
 2. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - a. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
 - b. Protect adjacent surfaces from contact with cleaner.
 - c. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - d. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 - e. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 - f. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
- R. Masonry Waste Disposal
1. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - a. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.
 - b. Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off the Owner's property.

END OF SECTION 04 05 13 26



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SECTION 04 05 14 00 - CSF MASONRY MORTARING AND GROUTING

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Clay Unit Masonry or Concrete Unit Masonry veneer is a part of the Work. EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information must be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Mortar and for unit masonry.
 2. Grout for unit masonry.
- B. Related Sections:
 1. Section 042100 - Clay Unit Masonry: Installation of mortar and grout, reinforcement and anchorages.
 2. Section 042200 - Concrete Unit Masonry: Installation of mortar and grout, reinforcement and anchorages.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 1. ASTM C 94 - Specification for Ready-Mixed Concrete.
 2. ASTM C 143 - Test Method for Slump of Hydraulic Cement Concrete.
 3. ASTM C 144 - Specification for Aggregate for Masonry Mortar.
 4. ASTM C 150 - Specification for Portland Cement.
 5. ASTM C 207 - Specification for Hydrated Lime for Masonry Purposes.
 6. ASTM C 270 - Specification for Mortar for Unit Masonry.
 7. ASTM C 387 - Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
 8. ASTM C 404 - Specification for Aggregates for Masonry Grout.
 9. ASTM C 476 - Specification for Grout for Masonry.
 10. ASTM C 1019 - Method of Sampling and Testing Grout.
 11. ASTM C 1142 - Specification for Extended Life Mortar for Unit Masonry.
- B. IMIAC - International Masonry Industry All-Weather Council: Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.



1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Samples: Submit two samples 3 inch x 3 inch in size illustrating mortar color and color range.
 - 2. Assurance/Control Submittals:
 - a. Design Data: Design mix in accordance with the Proportion specification of ASTM C 270 and required environmental conditions.
 - b. Test Reports: Submit the following reports directly to Contracting Officer from Testing Laboratory, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements.
 - 1) Conformance to Proportion specification of ASTM C 270.
 - 2) Test and evaluation reports to ASTM C 780.
 - c. Certificates: Submit manufacturer's certificate that Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Store sand for mortar on plastic sheeting to prevent contamination by extraneous chemicals in earth beneath.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements:
 - 1. Cold Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.
 - 2. Specific Cold Weather Requirements: When the ambient air temperature is below 40 degrees F, heat mixing water to maintain mortar temperature between 40 degrees F and 120 degrees F until placed. When the ambient air temperature is below 32 degrees F, heat the sand and water to maintain this mortar temperature.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portland Cement: ASTM C 150, normal-Type I or Type II; gray color. Fly ash, slag, and pozzolans not permitted as substitutes for Portland cement.
- B. Mortar Aggregate: ASTM C 144, standard masonry type; clean, dry, protected against dampness, freezing, and foreign matter.
- C. Grout Aggregate: ASTM C 404; use of blast furnace slag is not permitted. Maximum coarse aggregate size, 3/8 inch.



- D. Calcium chloride is not permitted in mortar or grout. Admixtures or other chemicals containing Thiocyanates, Calcium Chloride or more than 0.1 percent chloride ions are not permitted.
- E. Hydrated Lime: ASTM C 207, Type S.
- F. Water: Potable.
- G. Admixtures: Not permitted unless approved by Contracting Officer prior to construction.

2.2 MIXES - MORTAR

- A. Mortar: Type "N" or Type "S", as recommended by manufacturer, in accordance with the Proportion specification of ASTM C 270.
 - 1. Mixing of components on-site is acceptable.
 - 2. Mixing on-site water and packaged dry blended mix for mortar (ASTM C 387), that contains no masonry cement, is acceptable.
- B. Pointing Mortar: Duplicate original mortar proportions. Add aluminum tristearate, calcium stearate, or ammonium stearate equal to 2 Percent of Portland cement weight.

NOTE TO SPECIFIER

Edit below for mortar color:

- C. Mortar Color: [_____].

2.3 MIXING - MORTAR

- A. Thoroughly mix mortar ingredients in accordance with ASTM C 270, in quantities needed for immediate use.
 - 1. Maintain sand uniformly damp immediately before the mixing process.
 - 2. Provide uniformity of mix and coloration.
 - 3. Do not use anti-freeze compounds.
 - 4. If water is lost by evaporation, retemper only within 2 hours of mixing. Do not retemper mortar more than 2 hours after mixing.

2.4 MIXES - GROUT FILL

- A. Grout fill is for concrete masonry unit bond beams, lintels, and reinforced cells with reinforcing bars and embedded plates.
 - 1. Compressive Strength: 2000 psi minimum at 28 days, as determined in accordance with the provisions of ASTM C 1019.
 - 2. Slump: 8 inches, minimum; 10 inches, maximum, taken in accordance with ASTM C 143.
 - 3. Use coarse grout when grout space is equal to or greater than 4 inches in both directions.
 - 4. Use fine grout when grout space is smaller than 4 inches in either direction.
 - 5. Do not use air-entrainment admixtures.

2.5 MIXING - GROUT

- A. Grout: Batch and mix grout in accordance with ASTM C 94 or ASTM C476 for site batched and mixed grout. Do not use anti-freeze compounds to lower the freezing point of grout.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. After reinforcing of masonry is securely tied in place, plug cleanout holes with masonry units. Brace against wet grout pressure.
- B. Install mortar and grout under provisions of Section [042100] [042200].

3.3 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Procedures for testing.
- B. Testing - Masonry Grout: Conduct strength tests in accordance with ASTM C 1019.
 - 1. Take two strength samples for each 5000 square feet of masonry wall surface for each type of grout placed each day.
 - 2. Create test samples by forming with wood surface on bottom and concrete block on sides. The samples shall be 3 inches square and 6 inches high.
 - 3. Initial cure during first 48 hours. Protect samples from loss of moisture by covering with wet cloth and keeping moist. Protect from freezing and variations in temperature. Record maximum and minimum temperatures by using a max/min thermometer.
 - 4. Remove masonry units that form samples after 48 hours and transport grout samples to laboratory. Keep samples protected from vibration, freezing, and moisture loss during transportation.
 - 5. Test samples with test method ASTM C 39 at 28 days. Compressive strength shall be the average of the two samples and shall be adequate if it equals the designated compression strength as defined on the Drawings, but not less than 2000 psi.
- C. Testing - Masonry Mortar: Conduct strength tests in accordance with the following:
 - 1. Spread mortar on the masonry units 1/2 inch to 5/8 inch thick, and allow to stand for one minute.
 - 2. Remove mortar and place in a 2-inch by 4-inch cylinder in two layers, compressing the mortar into the cylinder using a flat-end stick or fingers. Lightly tap mold on opposite sides, level off and immediately cover molds and keep them damp until taken to the laboratory.
 - 3. After 48 hours' set, have the laboratory remove molds and place them in the fog room until tested in damp condition.



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SECTION 04 05 14 00 - MPF MASONRY MORTARING AND GROUTING

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information must be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Mortar and for unit masonry.
 - 2. Grout for unit masonry.
- B. Related Sections:
 - 1. Section 042100 - Clay Unit Masonry: Installation of mortar and grout, reinforcement and anchorages.
 - 2. Section 042200 - Concrete Unit Masonry: Installation of mortar and grout, reinforcement and anchorages.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM C 94 - Specification for Ready-Mixed Concrete.
 - 2. ASTM C 143 - Test Method for Slump of Hydraulic Cement Concrete.
 - 3. ASTM C 144 - Specification for Aggregate for Masonry Mortar.
 - 4. ASTM C 150 - Specification for Portland Cement.
 - 5. ASTM C 207 - Specification for Hydrated Lime for Masonry Purposes.
 - 6. ASTM C 270 - Specification for Mortar for Unit Masonry.
 - 7. ASTM C 387 - Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
 - 8. ASTM C 404 - Specification for Aggregates for Masonry Grout.
 - 9. ASTM C 476 - Specification for Grout for Masonry.
 - 10. ASTM C 1019 - Method of Sampling and Testing Grout.
 - 11. ASTM C 1142 - Specification for Extended Life Mortar for Unit Masonry.
- B. IMIAC - International Masonry Industry All-Weather Council: Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Samples: Submit two samples 3 inch x 3 inch in size illustrating mortar color and color range.
 - 2. Assurance/Control Submittals:
 - a. Design Data: Design mix in accordance with the Proportion specification of ASTM C 270 and required environmental conditions.



- b. Test Reports: Submit the following reports directly to Contracting Officer from Testing Laboratory, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements.
 - 1) Conformance to Proportion specification of ASTM C 270.
 - 2) Test and evaluation reports to ASTM C 780.
- c. Certificates: Submit manufacturer's certificate that Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Store sand for mortar on plastic sheeting to prevent contamination by extraneous chemicals in earth beneath.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements:
 - 1. Cold Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.
 - 2. Specific Cold Weather Requirements: When the ambient air temperature is below 40 degrees F, heat mixing water to maintain mortar temperature between 40 degrees F and 120 degrees F until placed. When the ambient air temperature is below 32 degrees F, heat the sand and water to maintain this mortar temperature.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portland Cement: ASTM C 150, normal-Type I or Type II; gray color. Fly ash, slag, and pozzolans not permitted as substitutes for Portland cement.
- B. Mortar Aggregate: ASTM C 144, standard masonry type; clean, dry, protected against dampness, freezing, and foreign matter.
- C. Grout Aggregate: ASTM C 404; use of blast furnace slag is not permitted. Maximum coarse aggregate size, 3/8 inch.
- D. Calcium chloride is not permitted in mortar or grout. Admixtures or other chemicals containing Thiocyanates, Calcium Chloride or more than 0.1 percent chloride ions are not permitted.
- E. Hydrated Lime: ASTM C 207, Type S.
- F. Water: Potable.



- G. Admixtures: Not permitted unless approved by Contracting Officer prior to construction.

2.2 MIXES - MORTAR

- A. Mortar: Type "N" or Type "S", as recommended by manufacturer, in accordance with the Proportion specification of ASTM C 270.
1. Mixing of components on-site is acceptable.
 2. Mixing on-site water and packaged dry blended mix for mortar (ASTM C 387), that contains no masonry cement, is acceptable.
- B. Pointing Mortar: Duplicate original mortar proportions. Add aluminum tristearate, calcium stearate, or ammonium stearate equal to 2 Percent of Portland cement weight.

NOTE TO SPECIFIER

Edit below for mortar color:

- C. Mortar Color: [_____].

2.3 MIXING - MORTAR

- A. Thoroughly mix mortar ingredients in accordance with ASTM C 270, in quantities needed for immediate use.
1. Maintain sand uniformly damp immediately before the mixing process.
 2. Provide uniformity of mix and coloration.
 3. Do not use anti-freeze compounds.
 4. If water is lost by evaporation, retemper only within 2 hours of mixing. Do not retemper mortar more than 2 hours after mixing.

2.4 MIXES - GROUT FILL

- A. Grout fill is for concrete masonry unit bond beams, lintels, and reinforced cells with reinforcing bars and embedded plates.
1. Compressive Strength: 2000 psi minimum at 28 days, as determined in accordance with the provisions of ASTM C 1019.
 2. Slump: 8 inches, minimum; 10 inches, maximum, taken in accordance with ASTM C 143.
 3. Use coarse grout when grout space is equal to or greater than 4 inches in both directions.
 4. Use fine grout when grout space is smaller than 4 inches in either direction.
 5. Do not use air-entrainment admixtures.

2.5 MIXING - GROUT

- A. Grout: Batch and mix grout in accordance with ASTM C 94 or ASTM C476 for site batched and mixed grout. Do not use anti-freeze compounds to lower the freezing point of grout.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.



- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. After reinforcing of masonry is securely tied in place, plug cleanout holes with masonry units. Brace against wet grout pressure.
- B. Install mortar and grout under provisions of Section 042200

3.3 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Procedures for testing.
- B. Testing - Masonry Grout: Conduct strength tests in accordance with ASTM C 1019.
 - 1. Take two strength samples for each 5000 square feet of masonry wall surface for each type of grout placed each day.
 - 2. Create test samples by forming with wood surface on bottom and concrete block on sides. The samples shall be 3 inches square and 6 inches high.
 - 3. Initial cure during first 48 hours. Protect samples from loss of moisture by covering with wet cloth and keeping moist. Protect from freezing and variations in temperature. Record maximum and minimum temperatures by using a max/min thermometer.
 - 4. Remove masonry units that form samples after 48 hours and transport grout samples to laboratory. Keep samples protected from vibration, freezing, and moisture loss during transportation.
 - 5. Test samples with test method ASTM C 39 at 28 days. Compressive strength shall be the average of the two samples and shall be adequate if it equals the designated compression strength as defined on the Drawings, but not less than 2000 psi.
- C. Testing - Masonry Mortar: Conduct strength tests in accordance with the following:
 - 1. Spread mortar on the masonry units 1/2 inch to 5/8 inch thick, and allow to stand for one minute.
 - 2. Remove mortar and place in a 2-inch by 4-inch cylinder in two layers, compressing the mortar into the cylinder using a flat-end stick or fingers. Lightly tap mold on opposite sides, level off and immediately cover molds and keep them damp until taken to the laboratory.
 - 3. After 48 hours' set, have the laboratory remove molds and place them in the fog room until tested in damp condition.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 6/29/2010

END OF SECTION 04 05 14 00



Task	Specification	Specification Description
04 05 16 26	04 05 13 26	Unit Masonry Assemblies
04 05 19 13	04 05 13 26	Unit Masonry Assemblies
04 05 19 16	04 05 13 26	Unit Masonry Assemblies
04 05 19 26	04 05 13 26	Unit Masonry Assemblies
04 05 23 13	04 05 13 26	Unit Masonry Assemblies
04 05 23 16	01 22 16 00	No Specification Required



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SECTION 04 05 26 00 - SCAFFOLDING TUBULAR STEEL**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of scaffolding-tubular steel. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS

- A. Tubular steel or aluminum scaffolding system shall comply with OSHA Safety and Health Standards, Section 29 CFR, 1926/1910.

1.3 EXECUTION - (Section not used.)

END OF SECTION 04 05 26 00



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Task	Specification	Specification Description
04 05 26 00	04 05 13 26	Unit Masonry Assemblies



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SECTION 04 21 00 00 - CSF CLAY UNIT MASONRY

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Clay Unit Masonry veneer is part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Facing Brick Masonry.
 2. Building Brick Masonry.
 3. Anchors and Reinforcement.
 4. Plastic Weep-Hole.
 5. Embedded Flashing.
 6. Cleaning of Brick.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 1. Section 040514 - Masonry Mortaring and Grouting
 2. Section 055000 - Metal Fabrications - Steel Lintels.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 1. ASTM A153, "Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware."
 2. ASTM C5, "Specification for Quicklime for Structural Purposes."
 3. ASTM C144, "Specification for Aggregate for Masonry Mortar."
 4. ASTM C150, "Specification for Portland Cement."
 5. ASTM C207, "Specification for Hydrated Lime for Masonry Purposes."

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.

1. Product Data:
 - a. Submit product data for each different masonry unit, accessory, and other manufactured products indicated.
2. Shop Drawings:
 - a. Reinforcement: Include masonry notes on shop drawings that concern proper placing of reinforcing and submit shop drawings for field use.
3. Samples:
 - a. Submit samples of each specified type of brick masonry.
 - b. Submit samples of proposed masonry for use in exposed work for preliminary approval by the Contracting Officer before assembling mock-ups.
 - c. Submit samples of mortar colors.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.
- B. Mock-Ups:
 1. Erect a sample wall panel of brick masonry which will be exposed to view in the finished project for approval by the Contracting Officer. Mock-ups shall be as follows:
 - a. Approximately 4 feet (1.2 m) long by 3 feet (1 m) high, showing the proposed color range, texture, bond, mortar and workmanship. All brick shipped for the sample shall be included in the panel.
 - b. Erect panel in the presence of the Contracting Officer before installation of materials.
 - c. When required, provide a separate panel for each type of brick or mortar.
 - d. Do not start work until Contracting Officer has accepted sample panel.
 - e. Use panel as standard of comparison for all masonry work built of same material.
 - f. Do not destroy or move panel until work is completed and accepted by Contracting Officer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Materials shall be delivered and stored so as to avoid damage from breakage, moisture, staining or damage of any kind.
- C. Storage of Materials: Store materials under cover in a dry place and in a manner to prevent damage or intrusion of foreign matter. During freezing weather protect all masonry units with tarpaulins or other suitable material. Store cement, lime and air-setting mortars in watertight sheds with elevated floors. Protect reinforcement from the elements; immediately before placing, reinforcement shall be free from loose rust, ice or other foreign coatings that will destroy or reduce the bond.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements:
 1. No masonry work shall be installed in an atmosphere with temperature less than 40 degrees F. unless work is protected in a manner previously approved by the Contracting Officer.



2. Hot Weather Construction - Protect masonry construction from direct exposure to wind and sun when erected in an ambient air temperature of 99 degrees F. in shade with relative humidity less than 50 percent.
3. Cover work at end of each day's work with non-staining waterproof material so as to prevent entrance of excess water at top of wall.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, product numbers, and availability at time of Project Manual preparation for Project. Face brick and mortar color should be selected by the architect during the design phase of the project. Modify sections to include selected materials.

2.1 MATERIALS

- A. General: Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- B. Face Brick: To be selected.
 1. Allowance: Per 1000 count, as directed by Contracting Officer.
- C. Colored Mortar: Mortar coloring shall be added and mixed into the brick mortar as directed by the Contracting Officer.
- D. Anchors and Ties: Anchors and ties shall be of zinc-coated steel or copper-coated steel. Except for steel wire, zinc coating shall conform to ASTM A153. Steel wire shall be zinc-coated in accordance with ASTM A116 for Class 2 coating. The extent and location of anchors and ties shall be as indicated on the drawings and as hereinafter specified under the laying requirements for the various items of masonry.
 1. Anchor shall be DW-10 anchors as manufactured by Hohmann & Barnard, Inc., or approved substitution. Anchors shall be constructed of 12 Ga. hot-dipped galvanized steel. Average tensile load of the anchor shall be 128 lb. Ties shall be 3/16-inch Vees with a hot-dipped finish. Length of ties depends on the location of the substrate.
- E. Joint Reinforcement: Steel reinforcement for use in every sixth horizontal bed joint of brick 8-inch thick masonry walls shall be prefabricated type formed of zinc-coated cold-drawn steel wire conforming to ASTM A116 for Class 2 coating. Side wires shall be formed of No. 9 gauge or larger and be deformed; cross rods shall be of No. 12 gauge or larger, smooth or deformed wire, butt welded to side wires in the same plane at contact points. Provide special formed pieces at corners and intersections of walls. Reinforcing shall be of proper widths for the partition and wall thicknesses shown. Reinforcing shall be Dur-O-Wall as manufactured by Southern Wire Mesh Company or approved substitution.
- F. Embedded Flashing:
 1. Copper-Fabric laminate: 5 oz./sq. ft. copper sheet bonded with asphalt between 2 layers of glass-fiber cloth, as manufactured by AFCO Products, Inc.
- G. Cavity Drainage Protection Mesh: Recycled polyester/polyethylene trapezoidal-shaped 90% open mesh. Thicknesses to fit wall in accordance with the manufacturer's recommendations. Height as recommended by manufacturer, but not to exceed height of the top of the flashing. Product as manufactured by Mortar Net USA, Limited.

NOTE TO SPECIFIER

Select one of the two paragraphs below.



- H. Weep-holes: Plastic tube type 3/8 inch O.D. x 3-1/2 inch long (round in cross section).
- I. Weep-hole Vent Filler: Three dimensional, ultraviolet resistant, weave of polyester. Size matching full head joint size of the masonry unit unless shown otherwise. Color selected by Contracting Officer to match mortar color. Product as manufactured by Mortar Net USA, Limited.
- J. Masonry Cleaner: All masonry work shall be thoroughly cleaned with Vana Trol Sure Klean as manufactured by the Process Solvent Co., Inc. or approved substitution.
- K. Mortar Materials: See Section 040514.
- L. Mortar for Masonry Units: See Section 040514.
- M. Mixing Mortar: See Section 040514
- N. Wire joint reinforcement for seismic zone design of brick veneer: ladder type, galvanized, 9 gauge wire.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 LAYING BRICK

- A. Lay brick in accordance with detailed drawings, using continuous stretcher bond except where otherwise noted with veneer securely anchored to back-up masonry as described under anchors.
- B. Lay all brick masonry straight, plumb and true to line with joints matching existing masonry.
- C. Lay each brick in full joint of mortar on its bed and ends. Slush and fill each joint with mortar each course of brick as work progresses.
- D. Take precautions to prevent mortar droppings in cavity or air space between face brick and concrete block. Install weep-hole ventilators at all waterproofed edges.
- E. Anchor brick veneer at a minimum of 16 inches horizontally and 16 inches vertically.
- F. Protect all freshly constructed masonry from injury of any kind. Replace injured work in a manner satisfactory to the Contracting Officer. Completely point and thoroughly wash all finished exposed masonry surfaces down with masonry cleaner in accordance with manufacturer's printed instructions.



3.3 JOINTS

- A. Nominal thickness shall be 3/8 inch and uniform.
- B. Shove vertical joints tight.
- C. Strike joints flush in surfaces to be covered.
- D. Tool joints slightly concave in surfaces to be exposed or painted.

3.4 BUILT-UP WORK

- A. Cooperate with other trades in building in items in masonry work.
- B. Grout solid around built-in items and in door frames.

3.5 LINTELS

- A. Install rebars and grout solid as indicated. Provide temporary shoring for openings wider than 36 inches.
- B. Lintels shall extend into side walls at jambs, minimum of 8 inches.
- C. Coordinate steel lintels with Section 055000.

3.6 FLASHING, WEEP HOLES, VENTS

- A. General: Install embedded flashing and weepholes in masonry at shelf angles, lintels, ledges, other obstructions to the downward flow of water in the wall, and where indicated.
- B. At masonry-veneer walls, extend flashing from exterior face of veneer, through the veneer, up face of sheathing at least 8 inches and behind air-infiltration/building paper.
 - 1. At lintels and shelf angles, extend flashing a minimum of 4 inches into masonry at each end. AT head and sills, extend flashing 4 inches at ends and turn up not less than 2 inches to form a pan.
 - 2. Cut off flashing flush with face of wall after masonry wall construction is completed.
- C. Install weep holes in the head joints in exterior wythes of the first course of masonry immediately above embedded flashing, and as follows:
 - 1. Space weep holes 24 inches o.c.
 - 2. In cavities, place pea gravel to a height equal to height of first course, but not less than 2 inches, immediately above top of flashing embedded in the wall, as masonry construction progresses, to splatter mortar droppings and to maintain drainage.

3.7 POINTING AND CLEANING

- A. Dry brush masonry surfaces after mortar has set, at end of each day's work and after final points.
- B. Cut out and repoint defective joints.
- C. At final completion of masonry work, fill holes in joints and tool to match adjacent work.
- D. Leave work and surrounding surfaces clean and free of mortar spots and droppings.



USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION 04 21 00 00



Task	Specification	Specification Description
04 21 13 00	04 05 13 26	Unit Masonry Assemblies
04 21 19 00	04 05 13 26	Unit Masonry Assemblies
04 21 26 00	04 05 13 26	Unit Masonry Assemblies
04 21 29 00	04 05 13 26	Unit Masonry Assemblies



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SECTION 04 22 00 00 - MPF CONCRETE UNIT MASONRY

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete unit masonry veneer.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 040514 - Masonry Mortaring and Grouting: Mortar and grout.

1.2 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 530 - Building Code Requirements for Masonry Structures.
 - 2. ACI 530.1 - Specifications for Masonry Structures.
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM A 615 - Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - 2. ASTM C 55 - Specification for Concrete Brick.
 - 3. ASTM C 129 - Specification for Non-Load Bearing Concrete Masonry Units
- C. International Masonry Industry All- Weather Council (IMIAC): Recommended Practices and Guide Specifications for Cold Weather Masonry construction.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Data for each masonry unit type, accessory, and other manufactured products indicated.
 - 2. Shop Drawings: Precast inserts and keys showing sizes, profiles, and locations of each precast unit required.
 - 3. Samples: Two samples of each masonry unit type to illustrate color, texture, and extremes of color range.
 - 4. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.



- b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
- 5. Submit layout of control joint placement for Contracting Officer's approval prior to starting any work.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 530 and ACI 530.1.
- B. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 - 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.
- C. Mock-Up:
 - 1. Construct a sample wall panel of block masonry which will be exposed to view in the finished project, for approval by the Contracting Officer. Mock-up shall be as follows:
 - a. Approximately 4 feet long by 3 feet (high, showing the proposed color range, texture, bond, mortar and workmanship. All block shipped for the sample shall be included in the panel.
 - b. Erect panel in the presence of the Contracting Officer before installation of materials.
 - c. When required, provide a separate panel for each type of block or mortar.
 - d. Do not start work until Contracting Officer has accepted sample panel.
 - e. Use panel as standard of comparison for all masonry work built of same material.
 - f. Do not destroy or move panel until work is completed and accepted by Contracting Officer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Materials shall be delivered and stored so as to avoid damage from breakage, moisture, staining or damage of any kind.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements:
 - 1. Cold Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.
 - 2. Hot Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Hot Weather Masonry Construction.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

- A. Lightweight units used for non-load bearing walls, meeting requirements of ASTM C129, Type I. Provide units meeting fire resistance ratings.
- B. Lightweight units used for load bearing walls, meeting requirements of ASTM C90, Grade N, Type I. Provide units meeting fire resistance ratings.



- C. Units to be high precision block or split face block. Sizes as designated on Drawings. Colors selected from standard manufacturer's colors.
- D. Special shaped units, U-blocks, etc., shall meet same specifications as adjacent units.

2.2 CONCRETE BUILDING BRICK

- A. Concrete brick shall be solid units meeting ASTM C55, Type I, Grade N.

2.3 MORTAR

- A. Specified in Section 040514.

2.4 REINFORCING

- A. Horizontal reinforcing for concrete masonry units shall be mill galvanized, ladder type with 9 gauge parallel wires in each face and 9 gauge cross members a maximum of 24 inches on center, butt welded to side rods. Provide prefabricated corners and tees.
- B. Reinforcing bars for lintels shall meet ASTM A615, Grade 60.

2.5 CONTROL JOINTS

- A. Joint filler shall be preformed neoprene or poly-vinyl chloride.
- B. Control joint placement in non-reinforced masonry:
 1. Vertical control joints shall be generally be located:
 - a. At major changes in wall height.
 - b. At changes in wall thickness.
 - c. At control joints in foundations, in roof, and in floors.
 - d. At chases and recesses for piping, columns, fixtures, etc.
 - e. At one or both sides of wall openings.
 - f. Near wall intersections.
 - g. Near return angles in L, T, and U-shaped structures.
 2. Maximum spacing of control joints shall be in no case exceed 24 feet.

2.6 CAVITY DRAINAGE PROTECTION MESH

- A. Recycled polyester/polyethylene trapezoidal-shaped 90% open mesh. Thicknesses to fit wall in accordance with the manufacturer's recommendations. Height as recommended by manufacturer, but not to exceed height of the top of the flashing. Product as manufactured by Mortar Net USA, Limited.

2.7 WEEP-HOLE VENT FILLER

- A. Three dimensional, ultraviolet resistant, weave of polyester. Size matching full head joint size of the masonry unit unless shown otherwise. [White] [Brown] [Tan] [Gray] [Red] [Almond] color. Product as manufactured by Mortar Net USA, Limited or equal.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Provide temporary bracing during installation of masonry Work. Maintain in place until building structure provides permanent bracing.
- B. Lay out work to avoid use of less than 8 inch x 8 inch faced units at jambs in exposed work.
- C. Lintel block shall extend into side walls at jambs, at least 8 inches.

3.3 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Procedures for testing.
- B. Test and evaluate grout in accordance with ASTM C1019. See Section 040514 - Masonry Mortaring and Grouting.

3.4 INSTALLATION

- A. CMU Base Drainage Course: Lay base drainage course of CMU, consisting of 2 wythes separated by a cavity sized to accommodate through-wall flashing and mesh.
- B. Weep-Vents: Set weep-hole vent filler in place, aligning front of weep vent with exterior face of CMU. Apply adequate mortar to remainder of head joint, carefully removing excess mortar to prevent plugging of weep vent with mortar.
 - 1. Install weep-hole vent filler at drainage courses at base of wall and at all lintels and bond beams where through-wall flashing is required.
 - 2. Install weep-hole vent filler at top of wall and below lintels and bond beams to provide continuous air ventilation within wall.
- C. Mesh
 - 1. Select correct thickness of mesh for size of single-wythe CMU wall and thickness of cavity formed by drainage course units.
 - 2. Set mesh in cavity of drainage base course on either side of vertical reinforcing approximately 3 inches (7.5 cm) from the reinforcing on both sides. Set mesh against outside wythe units. No fasteners, adhesives are required, and mortar need not have set.



3. Construct single-wythe CMU wall above the drainage course. Web-bed and face shell-bed the vertical grout cell to prevent migration of grout to adjoining cells.
 4. Grout reinforcing bar in place to within 1 inch (2.5 cm) of the top of the drainage course cavity. Install grout at reinforced cells in vertical lifts not to exceed 5 feet (1.5 m).
 5. Set mesh in similarly constructed drainage course at lintels and bond beams.
 6. Mesh may be compressed to allow insertion into cavities slightly smaller than its nominal thickness without affecting mesh or wall performance.
 7. When forcing mesh into a tight-fitting cavity, ensure that mortar has set sufficiently to allow masonry units to resist outward pressure from product.
 8. Protect installed product from damage during construction.
- D. Mortar shall be thoroughly mixed and kept moist but shall not be retempered for use after initial set.
 - E. Lay only dry masonry units.
 - F. Use masonry saw for cutting exposed surfaces. Cut units to provide 1/8 inch clearance around electrical boxes and similar items.
 - G. Do not use chipped, cracked or broken units.
 - H. Set units plumb, true to line, and level.
 - I. Adjust units to final position while mortar is soft and plastic. If unit is displaced after mortar has stiffened, remove unit, clean joints and unit of mortar and reset with fresh mortar.
 - J. When joining fresh work to set or partially set masonry clean exposed surface and remove loose mortar before laying fresh masonry.
 - K. When necessary to stop a horizontal, run rack back one-half block length in each course, do not tooth.
 - L. Unless indicated otherwise partitions shall extend from floor to bottom of floor or roof construction above.
 - M. Where rated partitions run perpendicular to deck, fill voids at deck with grout.

3.5 BOND

- A. Lay units in running bond with vertical joints centered on unit in course below unless indicated otherwise on drawings.

3.6 MORTAR BEDS

- A. Lay hollow units with full mortar coverage on horizontal and vertical face shells. Provide full mortar coverage on horizontal and vertical face shells and webs where adjacent to cells or cavities to be filled with grout and on starting courses.
- B. Lay block with full horizontal and vertical joints.

3.7 WIRE REINFORCEMENT

- A. Wire Reinforcements shall be placed as follows:
 1. Four inch concrete block walls with ends adjoining other partitions.
 - a. Concrete block on slab on grade - continuous horizontal reinforcements 24 inches on center vertically (every third course).

- b. Concrete block on slabs above grade - Continuous horizontal reinforcement 16 inches on center vertically (every other course).
 - 2. Eight inch concrete block walls
 - a. Concrete block walls on slab on grade - continuous horizontal reinforcement 16 inches on center vertically (every other course).
 - b. Concrete block walls on slabs above grade - continuous horizontal reinforcements 24 inches on center vertically (every third course).
 - 3. Wire reinforcement shall be completely embedded in mortar or grout. Joints with wire reinforcement shall be at least the thickness of the wire.
 - 4. Wire reinforcement shall be lapped at least 8 inches at splices and shall contain at least one cross wire of each piece of reinforcement in the lapped distance.

3.8 JOINTS

- A. Nominal thickness shall be 3/8 inch (9 mm) and uniform.
- B. Shove vertical joints tight.
- C. Strike joints flush in surfaces to be exposed or painted.
- D. Tool joints slightly concave in surfaces to be exposed or painted.

3.9 BUILT-UP WORK

- A. Cooperate with other trades in building in items in masonry work.
- B. Grout solid around built-in items and in door frames.

3.10 LINTELS

- A. Install rebars and grout solid as indicated. Provide temporary shoring for openings wider than 36 inches.
- B. Lintel blocks shall extend into side walls at jambs, minimum at 8 inches.

3.11 CLEANING AND POINTING

- A. Dry brush masonry surfaces after mortar has set, at end of each day's work and after final points.
- B. Cut out and repaint defective joints.
- C. At final completion of masonry work fill holes in joints and tool to match adjacent work.
- D. Leave work and surrounding surfaces clean and free of mortar spots and droppings.

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END OF SECTION 04 22 00 00



SECTION 04 22 00 00 - CSF CONCRETE UNIT MASONRY

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Concrete Masonry Unit Wall Veneer is part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete unit masonry veneer.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 040514 - Masonry Mortaring and Grouting: Mortar and grout.

1.2 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 530 - Building Code Requirements for Masonry Structures.
 - 2. ACI 530.1 - Specifications for Masonry Structures.
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM A 615 - Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - 2. ASTM C 55 - Specification for Concrete Brick.
 - 3. ASTM C 129 - Specification for Non-Load Bearing Concrete Masonry Units
- C. International Masonry Industry All- Weather Council (IMIAC): Recommended Practices and Guide Specifications for Cold Weather Masonry construction.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.



1. Product Data: Data for each masonry unit type, accessory, and other manufactured products indicated.
2. Shop Drawings: Precast inserts and keys showing sizes, profiles, and locations of each precast unit required.
3. Samples: Two samples of each masonry unit type to illustrate color, texture, and extremes of color range.
4. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
5. Submit layout of control joint placement for Contracting Officer's approval prior to starting any work.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 530 and ACI 530.1.
- B. Qualifications:
 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.
- C. Mock-Up:
 1. Construct a sample wall panel of block masonry which will be exposed to view in the finished project, for approval by the Contracting Officer. Mock-up shall be as follows:
 - a. Approximately 4 feet long by 3 feet (high, showing the proposed color range, texture, bond, mortar and workmanship. All block shipped for the sample shall be included in the panel.
 - b. Erect panel in the presence of the Contracting Officer before installation of materials.
 - c. When required, provide a separate panel for each type of block or mortar.
 - d. Do not start work until Contracting Officer has accepted sample panel.
 - e. Use panel as standard of comparison for all masonry work built of same material.
 - f. Do not destroy or move panel until work is completed and accepted by Contracting Officer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Materials shall be delivered and stored so as to avoid damage from breakage, moisture, staining or damage of any kind.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements:
 1. Cold Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.
 2. Hot Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Hot Weather Masonry Construction.



PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

- A. Lightweight units used for non-load bearing walls, meeting requirements of ASTM C129, Type I. Provide units meeting fire resistance ratings.
- B. Lightweight units used for load bearing walls, meeting requirements of ASTM C90, Grade N, Type I. Provide units meeting fire resistance ratings.
- C. Units to be high precision block or split face block. Sizes as designated on Drawings. Colors selected from standard manufacturer's colors.
- D. Special shaped units, U-blocks, etc., shall meet same specifications as adjacent units.

2.2 CONCRETE BUILDING BRICK

- A. Concrete brick shall be solid units meeting ASTM C55, Type I, Grade N.

2.3 MORTAR

- A. Specified in Section 040514.

2.4 REINFORCING

- A. Horizontal reinforcing for concrete masonry units shall be mill galvanized, ladder type with 9 gauge parallel wires in each face and 9 gauge cross members a maximum of 24 inches on center, butt welded to side rods. Provide prefabricated corners and tees.
- B. Reinforcing bars for lintels shall meet ASTM A615, Grade 60.

2.5 CONTROL JOINTS

- A. Joint filler shall be preformed neoprene or poly-vinyl chloride.
- B. Control joint placement in non-reinforced masonry:
 - 1. Vertical control joints shall be generally be located:
 - a. At major changes in wall height.
 - b. At changes in wall thickness.
 - c. At control joints in foundations, in roof, and in floors.
 - d. At chases and recesses for piping, columns, fixtures, etc.
 - e. At one or both sides of wall openings.
 - f. Near wall intersections.
 - g. Near return angles in L, T, and U-shaped structures.
 - 2. Maximum spacing of control joints shall be in no case exceed 24 feet.

2.6 CAVITY DRAINAGE PROTECTION MESH

- A. Recycled polyester/polyethylene trapezoidal-shaped 90% open mesh. Thicknesses to fit wall in accordance with the manufacturer's recommendations. Height as recommended by manufacturer, but



not to exceed height of the top of the flashing. Product as manufactured by Mortar Net USA, Limited or equal.

2.7 WEEP-HOLE VENT FILLER

- A. Three dimensional, ultraviolet resistant, weave of polyester. Size matching full head joint size of the masonry unit unless shown otherwise. [White] [Brown] [Tan] [Gray] [Red] [Almond] color. Product as manufactured by Mortar Net USA, Limited.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Provide temporary bracing during installation of masonry Work. Maintain in place until building structure provides permanent bracing.
- B. Lay out work to avoid use of less than 8 inch x 8 inch faced units at jambs in exposed work.
- C. Lintel block shall extend into side walls at jambs, at least 8 inches.

3.3 INSTALLATION

- A. CMU Base Drainage Course: Lay base drainage course of CMU, consisting of 2 wythes separated by a cavity sized to accommodate through-wall flashing and mesh.
- B. Weep-Vents: Set weep-hole vent filler in place, aligning front of weep vent with exterior face of CMU. Apply adequate mortar to remainder of head joint, carefully removing excess mortar to prevent plugging of weep vent with mortar.
 - 1. Install weep-hole vent filler at drainage courses at base of wall and at all lintels and bond beams where through-wall flashing is required.
 - 2. Install weep-hole vent filler at top of wall and below lintels and bond beams to provide continuous air ventilation within wall.
- C. Mesh
 - 1. Select correct thickness of mesh for size of single-wythe CMU wall and thickness of cavity formed by drainage course units.



2. Set mesh in cavity of drainage base course on either side of vertical reinforcing approximately 3 inches (7.5 cm) from the reinforcing on both sides. Set mesh against outside wythe units. No fasteners, adhesives are required, and mortar need not have set.
 3. Construct single-wythe CMU wall above the drainage course. Web-bed and face shell-bed the vertical grout cell to prevent migration of grout to adjoining cells.
 4. Grout reinforcing bar in place to within 1 inch (2.5 cm) of the top of the drainage course cavity. Install grout at reinforced cells in vertical lifts not to exceed 5 feet (1.5 m).
 5. Set mesh in similarly constructed drainage course at lintels and bond beams.
 6. Mesh may be compressed to allow insertion into cavities slightly smaller than its nominal thickness without affecting mesh or wall performance.
 7. When forcing mesh into a tight-fitting cavity, ensure that mortar has set sufficiently to allow masonry units to resist outward pressure from product.
 8. Protect installed product from damage during construction.
- D. Mortar shall be thoroughly mixed and kept moist but shall not be retempered for use after initial set.
- E. Lay only dry masonry units.
- F. Use masonry saw for cutting exposed surfaces. Cut units to provide 1/8 inch clearance around electrical boxes and similar items.
- G. Do not use chipped, cracked or broken units.
- H. Set units plumb, true to line, and level.
- I. Adjust units to final position while mortar is soft and plastic. If unit is displaced after mortar has stiffened, remove unit, clean joints and unit of mortar and reset with fresh mortar.
- J. When joining fresh work to set or partially set masonry clean exposed surface and remove loose mortar before laying fresh masonry.
- K. When necessary to stop a horizontal, run rack back one-half block length in each course, do not tooth.
- L. Unless indicated otherwise partitions shall extend from floor to bottom of floor or roof construction above.
- M. Where rated partitions run perpendicular to deck, fill voids at deck with grout.
- 3.4 BOND
- A. Lay units in running bond with vertical joints centered on unit in course below unless indicated otherwise on drawings.
- 3.5 MORTAR BEDS
- A. Lay hollow units with full mortar coverage on horizontal and vertical face shells. Provide full mortar coverage on horizontal and vertical face shells and webs where adjacent to cells or cavities to be filled with grout and on starting courses.
- B. Lay block with full horizontal and vertical joints.
- 3.6 WIRE REINFORCEMENT
- A. Wire Reinforcements shall be placed as follows:

1. Four inch concrete block walls with ends adjoining other partitions.
 - a. Concrete block on slab on grade - continuous horizontal reinforcements 24 inches on center vertically (every third course).
 - b. Concrete block on slabs above grade - Continuous horizontal reinforcement 16 inches on center vertically (every other course).
2. Eight inch concrete block walls
 - a. Concrete block walls on slab on grade - continuous horizontal reinforcement 16 inches on center vertically (every other course).
 - b. Concrete block walls on slabs above grade - continuous horizontal reinforcements 24 inches on center vertically (every third course).
3. Wire reinforcement shall be completely embedded in mortar or grout. Joints with wire reinforcement shall be at least the thickness of the wire.
4. Wire reinforcement shall be lapped at least 8 inches at splices and shall contain at least one cross wire of each piece of reinforcement in the lapped distance.

3.7 JOINTS

- A. Nominal thickness shall be 3/8 inch (9 mm) and uniform.
- B. Shove vertical joints tight.
- C. Strike joints flush in surfaces to be exposed or painted.
- D. Tool joints slightly concave in surfaces to be exposed or painted.

3.8 BUILT-UP WORK

- A. Cooperate with other trades in building in items in masonry work.
- B. Grout solid around built-in items and in door frames.

3.9 LINTELS

- A. Install rebars and grout solid as indicated. Provide temporary shoring for openings wider than 36 inches.
- B. Lintel blocks shall extend into side walls at jambs, minimum at 8 inches.

3.10 CLEANING AND POINTING

- A. Dry brush masonry surfaces after mortar has set, at end of each day's work and after final points.
- B. Cut out and repaint defective joints.
- C. At final completion of masonry work fill holes in joints and tool to match adjacent work.
- D. Leave work and surrounding surfaces clean and free of mortar spots and droppings.

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END OF SECTION 04 22 00 00



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Task	Specification	Specification Description
04 22 23 13	04 05 13 26	Unit Masonry Assemblies
04 22 23 23	04 05 13 26	Unit Masonry Assemblies
04 22 23 26	04 05 13 26	Unit Masonry Assemblies
04 22 23 29	04 05 13 26	Unit Masonry Assemblies
04 22 23 31	04 05 13 26	Unit Masonry Assemblies
04 23 13 00	04 05 13 26	Unit Masonry Assemblies
04 26 13 00	04 05 13 26	Unit Masonry Assemblies
04 41 00 00	04 01 40 91	Stone Masonry
04 42 43 00	04 01 40 91	Stone Masonry
04 43 00 00	01 22 16 00	No Specification Required
04 43 00 00	04 01 40 91	Stone Masonry
04 51 00 00	04 05 13 26	Unit Masonry Assemblies
04 72 00 00	04 05 13 26	Unit Masonry Assemblies



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Task	Specification	Specification Description
05 05 19 00	01 22 16 00	No Specification Required
05 05 23 00	01 22 16 00	No Specification Required



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SECTION 05 12 00 00 - MPF STRUCTURAL STEEL FRAMING

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information must be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Structural steel framing members, support members, with required bracing, welds, and fasteners.
 2. Base plates.
 3. Grouting under base plates.
- B. Related Sections:
 1. Section 033000 – Cast-In Place Concrete: Anchorages cast in concrete. Grouting base plates and bearing plates.
 2. Section 052100 - Steel Joist Framing: Steel bracing for joists and joist girders.
 3. Section 053100 - Steel Decking: Support framing for small openings in deck.
 4. Section 055000 - Metal Fabrications: Steel fabrications affecting structural steel work.

1.2 REFERENCES

- A. American Institute of Steel Construction (AISC):
 1. Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
 2. AISC - Code of Standard Practice - Manual of Steel Construction - Thirteenth Edition or latest enforceable AISC Manual.
 3. AISC - Section 10 - Architecturally Exposed Structural Steel.
- B. American Society for Testing and Materials (ASTM):
 1. ASTM A36/A36M - Specification for Structural Steel.
 2. ASTM A53 - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 3. ASTM A108 - Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality.
 4. ASTM A123 - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 5. ASTM A153 - Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.
 6. ASTM A242/A242M - Specification for High-Strength Low-Alloy Structural Steel.
 7. ASTM A 307 - Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
 8. ASTM A 325 - Specification for Structural Bolts, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 9. ASTM A449 - Specification for Quenched and Tempered Steel Bolts and Studs.
 10. ASTM A490 - Specification for Heat-Treated Steel Structural 150 ksi Minimum Tensile Strength.
 11. ASTM A 500 - Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 12. ASTM A 501 - Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.



13. ASTM A514/A514M - Specification for High-Yield Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding.
14. ASTM A529/A529M - Specification for High-Strength Carbon-Manganese Steel of Structural Quality.
15. ASTM A563 - Specification for Carbon and Alloy Steel Nuts.
16. ASTM A568/A568M - Specification for Steel, Sheet, Carbon and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
17. ASTM A572/A572M - Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.

C. American Welding Society (AWS):

1. AWS D1.1 - Structural Welding Code.
2. AWS A2.4 - Symbols for Welding, Brazing, and Nondestructive Examination.

D. Factory Mutual (FM):

1. FM - Roof Assembly Classifications.

E. Underwriters Laboratories, Inc. (UL):

1. UL - Fire Resistance Directory.

F. Steel Structures Painting Council (SSPC):

1. SSPC - Painting Manual.
2. SSPC-Paint 20 Type II - Zinc Rich Primers - Organic.
3. SSPC-Paint 22 - Epoxy Polyamide Paints.
4. SSPC-Paint 25 - Red Iron Oxide, Zinc Oxide, Raw Linseed Oil, and Alkyd Primer.
5. SSPC-SP 2 - Hand Tool Cleaning.
6. SSPC-SP 6 - Commercial Blast Cleaning.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

1. Shop Drawings:
 - a. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
 - b. Connections.
 - c. Cambers and loads.
 - d. Indicate welded connections with AWS A2.0 welding symbols. Indicate net weld lengths.
2. Assurance/Control Submittals:
 - a. Erection Procedure: Submit descriptive data to illustrate structural erection procedure including sequence of erection and temporary staying and bracing.
 - b. Field Welding Equipment: Submit descriptive data for field welding equipment including type, voltage, and amperage.
 - c. Test Reports: Submit the following reports directly to Contracting Officer from Testing Laboratory, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
 - 1) Welding inspection.
 - 2) Bolted connection inspection.
 - d. Certificates: Certify welders employed on Work, verifying AWS qualification within previous 12 months.
 - e. Qualification Documentation: Submit documentation of fabricator and erector experience indicating compliance with specified qualification requirements.



1.4 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Fabricator: Company specializing in performing the work of this section with minimum 5 years documented experience.
 - 2. Erector:
 - a. A company specialized in performing the work of this section with a minimum of 5 years documented experience.
 - b. A qualified company that participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CASE or CSE.
 - 3. Qualifications for Welding Work: Qualify welding operators in accordance with AWS Standard Qualification Procedures. Provide certification that welders employed in work have satisfactorily passed AWS qualification tests within previous 12 months. If rectification of welders is required, provide without additional cost to Owner.
- B. Fabricate structural steel members in accordance with AISC Code of Standard Practice.
- C. Perform Work in accordance with AISC Section 10.
- D. Design connections not detailed on the Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in State where Project is located.
- E. Survey: Employ a Registered Professional Surveyor registered in State in which Project is located, experienced in survey work, to establish permanent bench marks as shown and as necessary for accurate erection of structural steel. Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Owner. Do not proceed with erection until corrections have been made, or until compensating adjustments to structural steel work have been agreed upon with Owner.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Store steel above ground on platforms, skids, or other supports.
- C. Protect steel from corrosion.
- D. Store packaged materials in their original, unbroken packages or containers.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Structural Steel Shapes, Plates and Bars: ASTM A 36.
- B. Structural Tubing: ASTM A 500, Grade B.
- C. Bolts, Nuts, and Washers: AISC Specification Section 1.4.4.
 - 1. Unfinished Bolts: ASTM A 307.
 - 2. High Strength Bolts: ASTM A 325 or A 490.
 - 3. Anchor Bolts and Nuts: ASTM A 307 Grade A.
 - 4. High Strength Anchor Bolts: ASTM A 490.



- D. Welding Materials: AWS D1.1; type required for materials being welded or as indicated on Drawings.
- E. Rivets: AISC Specification Section 1.4.3.
 - 1. Steel Structural Rivets: ASTM A 502.
- F. Grout: Specified in Section 033000.
- G. Shop and Touch-Up Primer: AISC Specification Section 1-24.

2.2 FABRICATION

- A. Fabricate structural steel members in accordance with AISC Code Section 6 and AISC Specification.
- B. Connections not detailed on Drawings: Engineer by fabricator, which is subject to review.
- C. Fabricator's Responsibility:
 - 1. Errors of detailing, fabrications, and for correct fitting of structural steel members.
 - 2. Do not splice structural steel members. Members having splice not indicated on Drawings will be rejected.
- D. Continuously seal joined members by continuous welds. Grind exposed welds smooth.
- E. Fabricate connections for bolt, nut, and washer connectors.
- F. Develop required camber for members.

2.3 FINISH

- A. Clean, prepare, and shop prime structural steel members in accordance with SSPC - Painting Manual. Do not paint surfaces in contact with concrete, or surfaces specified to be galvanized.
- B. Shop prime structural steel members. Do not prime surfaces that will be field welded, in contact with concrete, and high strength bolted.

2.4 SOURCE QUALITY CONTROL AND TESTS

- A. Provide shop testing of structural steel sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.



- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Supply items required to be cast into concrete or embedded in masonry with setting diagrams to appropriate Sections.

3.3 ERECTION

- A. Erect structural steel in accordance with AISC Code, Section 7, and AISC Specification Section 1.25 except as specified herein.
- B. Make provision for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- C. Do not field cut or alter structural members without approval of the Engineer.
- D. Field weld components indicated on Drawings.
- E. Field connect members with threaded fasteners; torque to required resistance.
- F. After erection, prime welds, abrasions, and surfaces not shop painted that are to receive finish painting, except surfaces to be in contact with concrete. Use a primer consistent with shop coat.
- G. Anchor Bolts: Install anchor bolts and other connectors required for securing structural steel to foundations and other in-place work. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.
- H. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surfaces of base and bearing plates.
 - 1. Set loose and attached base plates and bearing plates for structural members on steel wedges or other adjusting devices.
 - 2. Tighten anchor bolts after the supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to grouting.
 - 3. Grout solidly between bearing surfaces and bases of plates immediately after erecting member and before additional load is placed on member. Finish exposed surfaces, protect installed materials, and allow to cure. For proprietary grout materials, comply with manufacturer's installation instructions.
 - 4. Slide bearings: Permanently affixed to member and support, respectively, by welding or bolting as indicated. Align and level member faces to maintain full contact between surfaces before completing installation.
- I. High-strength Bolting: Comply with specifications for Structural Joints using ASTM A 325 or A 490 Bolts.
- J. Erection Bolts:
 - 1. Comply with ASTM A 307.
 - 2. On exposed welded construction, remove erection bolts, fill holes with plug welds, and grind smooth at exposed surfaces.
- K. Touch-up Painting: Immediately after erection, clean exposed field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas with same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.



3.4 CONSTRUCTION

- A. Site Tolerances:
 - 1. Maximum Variation From Plumb: 1/4 inch.
 - 2. Maximum Offset From True Alignment: 1/4 inch.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Quality Assurance Program:
 - 1. AISC Code Section 8 and AISC Specification Section 1.26.
 - 2. AISC Quality Criteria and Inspection Standards, except as specified herein.
- C. Welding:
 - 1. AWS D1.1 Section 6.
 - 2. Inspectors: AWS Certified in accordance with AWS QCI, Standard for Qualifications and Certification of Welding Inspectors.

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END OF SECTION 05 12 00 00



SECTION 05 12 00 00 - CSF STRUCTURAL STEEL

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Structural Steel columns and beams are a part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information must be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Structural steel framing members, support members, with required bracing, welds, and fasteners.
 2. Base plates.
 3. Grouting under base plates.
- B. Related Sections:
 1. Section 033000 – Cast-In-Place Concrete: Anchorages cast in concrete. Grouting base plates and bearing plates.
 2. Section 052100 - Steel Joist Framing: Steel bracing for joists and joist girders.
 3. Section 053100 - Steel Decking: Support framing for small openings in deck.
 4. Section 055000 - Metal Fabrications: Steel fabrications affecting structural steel work.

1.2 REFERENCES

- A. American Institute of Steel Construction (AISC):
 1. Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
 2. AISC - Code of Standard Practice - Manual of Steel Construction - Allowable Stress Design (ASD).
 3. AISC - Section 10 - Architecturally Exposed Structural Steel.
- B. American Society for Testing and Materials (ASTM):
 1. ASTM A36/A36M - Specification for Structural Steel.
 2. ASTM A53 - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 3. ASTM A108 - Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality.
 4. ASTM A123 - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 5. ASTM A153 - Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.
 6. ASTM A242/A242M - Specification for High-Strength Low-Alloy Structural Steel.
 7. ASTM A 307 - Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.



8. ASTM A 325 - Specification for Structural Bolts, Heat Treated, 120/105 ksi Minimum Tensile Strength.
9. ASTM A449 - Specification for Quenched and Tempered Steel Bolts and Studs.
10. ASTM A490 - Specification for Heat-Treated Steel Structural 150 ksi Minimum Tensile Strength.
11. ASTM A 500 - Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
12. ASTM A 501 - Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
13. ASTM A514/A514M - Specification for High-Yield Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding.
14. ASTM A529/A529M - Specification for High-Strength Carbon-Manganese Steel of Structural Quality.
15. ASTM A563 - Specification for Carbon and Alloy Steel Nuts.
16. ASTM A568/A568M - Specification for Steel, Sheet, Carbon and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
17. ASTM A572/A572M - Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.

C. American Welding Society (AWS):

1. AWS D1.1 - Structural Welding Code.
2. AWS A2.4 - Symbols for Welding, Brazing, and Nondestructive Examination.

D. Factory Mutual (FM):

1. FM - Roof Assembly Classifications.

E. Underwriters Laboratories, Inc. (UL):

1. UL - Fire Resistance Directory.

F. Steel Structures Painting Council (SSPC):

1. SSPC - Painting Manual.
2. SSPC-Paint 20 Type II - Zinc Rich Primers - Organic.
3. SSPC-Paint 22 - Epoxy Polyamide Paints.
4. SSPC-Paint 25 - Red Iron Oxide, Zinc Oxide, Raw Linseed Oil, and Alkyd Primer.
5. SSPC-SP 2 - Hand Tool Cleaning.
6. SSPC-SP 6 - Commercial Blast Cleaning.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

1. Shop Drawings:
 - a. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
 - b. Connections.
 - c. Cambers and loads.
 - d. Indicate welded connections with AWS A2.0 welding symbols. Indicate net weld lengths.
2. Assurance/Control Submittals:
 - a. Erection Procedure: Submit descriptive data to illustrate structural erection procedure including sequence of erection and temporary staying and bracing.
 - b. Field Welding Equipment: Submit descriptive data for field welding equipment including type, voltage, and amperage.
 - c. Test Reports: Submit the following reports directly to Contracting Officer from Testing Laboratory, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
 - 1) Welding inspection.
 - 2) Bolted connection inspection.



- d. Certificates: Certify welders employed on Work, verifying AWS qualification within previous 12 months.
- e. Qualification Documentation: Submit documentation of fabricator and erector experience indicating compliance with specified qualification requirements.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Fabricator: Company specializing in performing the work of this section with minimum 5 years documented experience.
 - 2. Erector:
 - a. A company specialized in performing the work of this section with a minimum of 5 years documented experience.
 - b. A qualified company that participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CASE or CSE.
 - 3. Qualifications for Welding Work: Qualify welding operators in accordance with AWS Standard Qualification Procedures. Provide certification that welders employed in work have satisfactorily passed AWS qualification tests within previous 12 months. If rectification of welders is required, provide without additional cost to Owner.
- B. Fabricate structural steel members in accordance with AISC Code of Standard Practice.
- C. Perform Work in accordance with AISC Section 10.
- D. Design connections not detailed on the Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in State where Project is located.
- E. Survey: Employ Professional Engineer registered in State in which Project is located, experienced in survey work, to establish permanent bench marks as shown and as necessary for accurate erection of structural steel. Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Owner. Do not proceed with erection until corrections have been made, or until compensating adjustments to structural steel work have been agreed upon with Owner.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Store steel above ground on platforms, skids, or other supports.
- C. Protect steel from corrosion.
- D. Store packaged materials in their original, unbroken packages or containers.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Structural Steel Shapes, Plates and Bars: ASTM A 36.
- B. Structural Tubing: ASTM A 500, Grade B.



- C. Bolts, Nuts, and Washers: AISC Specification Section 1.4.4.
 - 1. Unfinished Bolts: ASTM A 307.
 - 2. High Strength Bolts: ASTM A 325 or A 490.
 - 3. Anchor Bolts and Nuts: ASTM A 307 Grade A.
 - 4. High Strength Anchor Bolts: ASTM A 490.
- D. Welding Materials: AWS D1.1; type required for materials being welded or as indicated on Drawings.
- E. Rivets: AISC Specification Section 1.4.3.
 - 1. Steel Structural Rivets: ASTM A 502.
- F. Grout: Specified in Section 033000.
- G. Shop and Touch-Up Primer: AISC Specification Section 1-24.

2.2 FABRICATION

- A. Fabricate structural steel members in accordance with AISC Code Section 6 and AISC Specification.
- B. Connections not detailed on Drawings: Engineer by fabricator, which is subject to review.
- C. Fabricator's Responsibility:
 - 1. Errors of detailing, fabrications, and for correct fitting of structural steel members.
 - 2. Do not splice structural steel members. Members having splice not indicated on Drawings will be rejected.
- D. Continuously seal joined members by continuous welds. Grind exposed welds smooth.
- E. Fabricate connections for bolt, nut, and washer connectors.
- F. Develop required camber for members.

2.3 FINISH

- A. Clean, prepare, and shop prime structural steel members in accordance with SSPC - Painting Manual. Do not paint surfaces in contact with concrete, or surfaces specified to be galvanized.
- B. Shop prime structural steel members. Do not prime surfaces that will be field welded, in contact with concrete, and high strength bolted.

2.4 SOURCE QUALITY CONTROL AND TESTS

- A. Provide shop testing of structural steel sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.



- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Supply items required to be cast into concrete or embedded in masonry with setting diagrams to appropriate Sections.

3.3 ERECTION

- A. Erect structural steel in accordance with AISC Code, Section 7, and AISC Specification Section 1.25 except as specified herein.
- B. Make provision for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- C. Do not field cut or alter structural members without approval of Contracting Officer.
- D. Field weld components indicated on Drawings.
- E. Field connect members with threaded fasteners; torque to required resistance.
- F. After erection, prime welds, abrasions, and surfaces not shop painted that are to receive finish painting, except surfaces to be in contact with concrete. Use a primer consistent with shop coat.
- G. Anchor Bolts: Install anchor bolts and other connectors required for securing structural steel to foundations and other in-place work. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.
- H. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surfaces of base and bearing plates.
 - 1. Set loose and attached base plates and bearing plates for structural members on steel wedges or other adjusting devices.
 - 2. Tighten anchor bolts after the supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to grouting.
 - 3. Grout solidly between bearing surfaces and bases of plates immediately after erecting member and before additional load is placed on member. Finish exposed surfaces, protect installed materials, and allow to cure. For proprietary grout materials, comply with manufacturer's installation instructions.
 - 4. Slide bearings: Permanently affixed to member and support, respectively, by welding or bolting as indicated. Align and level member faces to maintain full contact between surfaces before completing installation.
- I. High-strength Bolting: Comply with specifications for Structural Joints using ASTM A 325 or A 490 Bolts.
- J. Erection Bolts:
 - 1. Comply with ASTM A 307.



2. On exposed welded construction, remove erection bolts, fill holes with plug welds, and grind smooth at exposed surfaces.

- K. Touch-up Painting: Immediately after erection, clean exposed field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas with same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

3.4 CONSTRUCTION

- A. Site Tolerances:
 1. Maximum Variation From Plumb: 1/4 inch.
 2. Maximum Offset From True Alignment: 1/4 inch.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Quality Assurance Program:
 1. AISC Code Section 8 and AISC Specification Section 1.26.
 2. AISC Quality Criteria and Inspection Standards, except as specified herein.
- C. Welding:
 1. AWS D1.1 Section 6.
 2. Inspectors: AWS Certified in accordance with AWS QCI, Standard for Qualifications and Certification of Welding Inspectors.

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END OF SECTION 05 12 00 00



Task	Specification	Specification Description
05 14 16 00	01 22 16 00	No Specification Required



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SECTION 05 21 00 00 - MPF STEEL JOIST FRAMING

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Open web steel joists, with extended ends, and extended bottom chords.
 - 2. Bridging and bridging anchors.
 - 3. Headers and loose bearing plates.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 051200 - Structural Steel Framing: Building structural frame.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A 36 - Specification for Carbon Structural Steel.
 - 2. ASTM A 307 - Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
 - 3. ASTM A 325 - Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- B. American Welding Society (AWS):
 - 1. AWS D1.1 - Structural Welding Code.
- C. Steel Joist Institute (SJI):
 - 1. SJI - Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders.
- D. Steel Structures Painting Council (SSPC):
 - 1. SSPC SP 2 - Hand Tool Cleaning.
 - 2. SSPC Paint 15 - Steel Joist Shop Paint.

1.3 SUBMITTALS

- A. Section 013300 – Submittal Procedures: Procedures for submittals.
 - 1. Shop Drawings:
 - a. Indicate joist types using standard SJI designations, spacing, location, bridging, anchorages, and special conditions.



- b. Indicate welded field connections using standard AWS welding symbols.
- c. Indicate paint primer type, accessories, and installation details.
- d. Joist setting plans.
- 2. Assurance/Control Submittals:
 - a. Test Reports: Submit the following reports directly to Contracting Officer from testing laboratory, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
 - 1) Welding inspection.
 - 2) Bolted connection inspection.
 - b. Certificate: Manufacturer certificate, signed and sealed by a registered structural engineer, certifying that joists are designed in accordance to and comply with SJI specifications and are certified by SJI.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with SJI, Load Tables and Weight Tables.
- B. Qualifications:
 - 1. Fabricator: Company specializing in performing Work of this Section with minimum 5 years documented experience.
 - 2. Erector: Company specializing in performing Work of this Section with minimum 5 years documented experience, certified by AISC Quality Certification Program.
 - 3. Qualifications for Welding Work: Qualify welding operators in accordance with AWS Standard Qualification Procedures. Provide certification that welders employed in work have satisfactorily passed AWS qualification tests within previous 12 months. If recertification of welders is required, provide without additional cost to United States Postal Service.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Comply with recommendations of SJI Specifications.
- C. Protect from corrosion, deformation, and other damage.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Open Web Joist Members: SJI Type K Open Web.
- B. Bridging: ASTM A 36.
- C. Welding Materials: AWS D1.1; type required for materials being welded.
 - 1. Open Web Steel Joists: Conform to SJI Specifications for Open Web Steel Joists and to SJI Technical Digest No. 8, Welding of Open Web Steel Joists.
 - 2. Longspan and Deep Longspan Steel Joists and Joist Girders: Conform to applicable Welding Electrodes section in SJI Specifications.
- D. Anchor Bolts, Nuts, and Washers: ASTM A 307 and ASTM A 325.



- E. Primer: SSPC 15, Type 1, red oxide.
- F. Accessories: Provide anchors and fasteners required for installation and attachment of joists and bridging.
- G. Structural Steel Building Framing: Specified in Section 051200.

2.2 FABRICATION

- A. Design and fabricate joists, including headers and other supporting framing, in accordance with SJI Standard Specifications.
 - 1. Verify Drawing dimensions and field conditions before beginning fabrication.
 - 2. Provide for concentrated loads indicated on Drawings.
- B. Bottom Chord Extensions: Provide joist bottom chord extensions at columns, not framed in minimum two directions, with structural steel members. Connect to columns as indicated on Drawings.
- C. Extended Ends: Provide extended joist ends at locations indicated on Drawings. Comply with load tables and design loads indicated on Drawings.
- D. Bridging: Provide horizontal or diagonal type bridging for open web joists, including bridging anchors for ends of bridging lines ending at walls or beams.
- E. End Anchorage: Provide anchorages to connect joists to adjacent construction.
- F. Header Units: Provide header units to support tail joists at openings in roof system not framed with steel shapes.

2.3 FINISH

- A. Prepare joist component surfaces in accordance with SSPC SP 2.
- B. Shop prime joists. Do not prime surfaces that will be field welded and in contact with concrete.
 - 1. Apply one shop coat of primer to joists and joist accessories to provide a continuous dry film thickness of 0.50 mils.

2.4 SOURCE QUALITY CONTROL

- A. Inspection: Contracting Officer reserves the right to have Contracting Officer's Representative make a visual inspection of joists at fabricators' shop before shipment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.



- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 ERECTION

- A. Erect steel joists, joist girders, and bridging in accordance with SJI Standard Specifications and SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Girders.
- B. Do not start erection of joists until supporting Work is in place and connections made.
- C. Erect and bear joists on supports.
- D. Allow for erection loads. Provide temporary bracing to maintain joists safe, plumb, and in true alignment.
- E. Install bridging simultaneously with joist erection, before construction loads are applied. Connect ends of bridging lines at top and bottom chords terminating at walls or beams.
- F. After joist alignment and installation of framing, field weld joist seat to bearing member.
- G. Position and field weld joist chord extensions and wall attachments.
- H. Do not permit installation of roof decking until joists are braced, bridged, and secured or until completion of erection and installation of permanent bridging and bracing.
- I. Do not field cut or alter joists.
- J. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.3 CONSTRUCTION

- A. Interface with Other Work:
 - 1. Coordinate placement of anchorages in concrete and masonry construction for making connections to joists and joist girders, and for securing bearing plates.
 - 2. Furnish anchor bolts and other devices built into concrete and masonry construction to appropriate installer for installation.
- B. Site Tolerances:
 - 1. Minimum Variation From Plumb: 1/4 inch.
 - 2. Maximum Offset From True Alignment: 1/4 inch.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Testing laboratory will inspect bolted connections and field welds.
 - 1. Bolted: Visually inspected.
 - 2. Welded: Visually inspected.



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END OF SECTION 05 21 00 00



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SECTION 05 21 00 00 - CSF STEEL JOIST FRAMING

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items at end of Section.05 21 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Open web steel joists, with extended ends, and extended bottom chords.
 - 2. Bridging and bridging anchors.
 - 3. Headers and loose bearing plates.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 051200 - Structural Steel Framing: Building structural frame.
 - 2. Section 099100 - Painting: Field painting of exposed joists and roof deck.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A 36 - Specification for Carbon Structural Steel.
 - 2. ASTM A 307 - Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
 - 3. ASTM A 325 - Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- B. American Welding Society (AWS):
 - 1. AWS D1.1 - Structural Welding Code.
- C. Steel Joist Institute (SJI):
 - 1. SJI - Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders.
- D. Steel Structures Painting Council (SSPC):
 - 1. SSPC SP 2 - Hand Tool Cleaning.
 - 2. SSPC Paint 15 - Steel Joist Shop Paint.



1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Shop Drawings:
 - a. Indicate joist types using standard SJI designations, spacing, location, bridging, anchorages, and special conditions.
 - b. Indicate welded field connections using standard AWS welding symbols.
 - c. Indicate paint primer type, accessories, and installation details.
 - d. Joist setting plans.
 - 2. Assurance/Control Submittals:
 - a. Test Reports: Submit the following reports directly to Contracting Officer from testing laboratory, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
 - 1) Welding inspection.
 - 2) Bolted connection inspection.
 - b. Certificate: Manufacturer certificate, signed and sealed by a registered structural engineer, certifying that joists are designed in accordance to and comply with SJI specifications and are certified by SJI.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with SJI, Load Tables and Weight Tables.
- B. Qualifications:
 - 1. Fabricator: Company specializing in performing Work of this Section with minimum 5 years documented experience.
 - 2. Erector: Company specializing in performing Work of this Section with minimum 5 years documented experience, certified by AISC Quality Certification Program.
 - 3. Qualifications for Welding Work: Qualify welding operators in accordance with AWS Standard Qualification Procedures. Provide certification that welders employed in work have satisfactorily passed AWS qualification tests within previous 12 months. If recertification of welders is required, provide without additional cost to United States Postal Service.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Comply with recommendations of SJI Specifications.
- C. Protect from corrosion, deformation, and other damage.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Open Web Joist Members: SJI Type K Open Web.
- B. Bridging: ASTM A 36.
- C. Welding Materials: AWS D1.1; type required for materials being welded.



1. Open Web Steel Joists: Conform to SJI Specifications for Open Web Steel Joists and to SJI Technical Digest No. 8, Welding of Open Web Steel Joists.
 2. Longspan and Deep Longspan Steel Joists and Joist Girders: Conform to applicable Welding Electrodes section in SJI Specifications.
- D. Anchor Bolts, Nuts, and Washers: ASTM A 307 and ASTM A 325.
- E. Primer: SSPC 15, Type 1, red oxide.
- F. Accessories: Provide anchors and fasteners required for installation and attachment of joists and bridging.
- G. Structural Steel Building Framing: Specified in Section 051200.

2.2 FABRICATION

- A. Design and fabricate joists, including headers and other supporting framing, in accordance with SJI Standard Specifications.
1. Verify Drawing dimensions and field conditions before beginning fabrication.
 2. Provide for concentrated loads indicated on Drawings.
- B. Bottom Chord Extensions: Provide joist bottom chord extensions at columns, not framed in minimum two directions, with structural steel members. Connect to columns as indicated on Drawings.
- C. Extended Ends: Provide extended joist ends at locations indicated on Drawings. Comply with load tables and design loads indicated on Drawings.
- D. Bridging: Provide horizontal or diagonal type bridging for open web joists, including bridging anchors for ends of bridging lines ending at walls or beams.
- E. End Anchorage: Provide anchorages to connect joists to adjacent construction.
- F. Header Units: Provide header units to support tail joists at openings in roof system not framed with steel shapes.

2.3 FINISH

- A. Prepare joist component surfaces in accordance with SSPC SP 2.
- B. Shop prime joists. Do not prime surfaces that will be field welded and in contact with concrete.
1. Apply one shop coat of primer to joists and joist accessories to provide a continuous dry film thickness of 0.50 mils.
- C. Field Painting: Field paint joists, indicated on Drawings to receive paint finish, as specified in Section 099100.

2.4 SOURCE QUALITY CONTROL

- A. Inspection: Contracting Officer reserves the right to have Contracting Officer's Representative make a visual inspection of joists at fabricators' shop before shipment.



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 ERECTION

- A. Erect steel joists, joist girders, and bridging in accordance with SJI Standard Specifications and SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Girders.
- B. Do not start erection of joists until supporting Work is in place and connections made.
- C. Erect and bear joists on supports.
- D. Allow for erection loads. Provide temporary bracing to maintain joists safe, plumb, and in true alignment.
- E. Install bridging simultaneously with joist erection, before construction loads are applied. Connect ends of bridging lines at top and bottom chords terminating at walls or beams.
- F. After joist alignment and installation of framing, field weld joist seat to bearing member.
- G. Position and field weld joist chord extensions and wall attachments.
- H. Do not permit installation of roof decking until joists are braced, bridged, and secured or until completion of erection and installation of permanent bridging and bracing.
- I. Do not field cut or alter joists.
- J. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.3 CONSTRUCTION

- A. Interface with Other Work:
 - 1. Coordinate placement of anchorages in concrete and masonry construction for making connections to joists and joist girders, and for securing bearing plates.
 - 2. Furnish anchor bolts and other devices built into concrete and masonry construction to appropriate installer for installation.
- B. Site Tolerances:
 - 1. Minimum Variation From Plumb: 1/4 inch.



2. Maximum Offset From True Alignment: 1/4 inch.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Testing laboratory will inspect bolted connections and field welds.
 1. Bolted: Visually inspected.
 2. Welded: Visually inspected.

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END OF SECTION



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SECTION 05 31 00 00 - MPF STEEL DECKING**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 – GENERAL

1.1 SUMMARY

- A. Steel roof deck, form deck and composite deck.
- B. Deck accessories such as metal closure strips, pour stops, cant strips, cover plates, sump pans and closed cell foam rubber flute closures.

1.2 SUBMITTALS

- A. Shop Drawings: Required.

1.3 QUALITY ASSURANCE

- A. Design Requirements: Steel Deck Institute (SDI) Design Manual for Composite Decks, Form Decks, Roof Decks; and AISI Specification For the Design of Cold-Formed Steel Structural Members.
- B. Fabricate and install in accordance with Steel Deck Institute (SDI) standards.
- C. Fabricator shall be a member of the SDI.
- D. Certify welders employed on work, verifying AWS qualification within previous 12 months.

PART 2 – PRODUCTS

2.1 FABRICATION

- A. Non-cellular Decking: Fabricate from structural quality sheet steel.
 - 1. Shop primed underside and phosphatized/uncoated upperside.
- B. Span design: Multiple, where possible.
- C. Nominal height: 1-1/2 inch 38 mm., fluted profile.
- D. Formed sheet width: 24 to 36 inch.
- E. Gage: As required by design but not lighter than 22gage.
- F. Side joints: Lapped.
- G. Composite Deck: Ribbed for improved concrete bond.



1. Galvanized to a minimum G 60 coating weight.

H. Roof Decking – galvanized metal roof deck (G60 coating, minimum).

I. Shop/Factory finishing: Galvanized to a minimum G 60 coating weight.

2.2 FIELD QUALITY CONTROL

A. Field Tests: If required by State and local code.

B. Field Inspection: As required by code but not less than the following:

1. Select 6 random sheets for each type of deck used. Inspect for deck thickness, type, and material.
2. Inspect 10 percent of deck welds over entire roof area for quality, size and spacing.
3. Inspect 10 percent of side lap connectors over entire roof area for quality, type, size, and spacing of side lap connectors.

PART 3 – EXECUTION

3.1 Install all products in accordance with manufacturer's guidelines and printed instructions.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 3/31/2010

END OF SECTION 05 31 00 00



SECTION 05 31 00 00 - CSF STEEL DECKING

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items at end of Section.05 31 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel roof deck and accessories.
 - 2. Framed openings up to 10 inches by 10 inches.
 - 3. Welding, fasteners, and accessories for attachment of deck.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 051200 - Structural Steel Framing: Support framing for openings larger than 10 inches x 10 inches.
 - 2. Section 052100 - Steel Joist Framing: Support framing for steel decking.

1.2 REFERENCES

- A. American Iron and Steel Institute (AISI):
 - 1. Specification for the Design of Cold-Formed Steel Structural Members.
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM A 1008 - Specification for Structural Steel, Sheet, Carbon, Cold-Rolled.
 - 2. ASTM A 653 - Specification for Steel Sheet, Zinc Coated, Galvanized.
- C. American Welding Society (AWS):
 - 1. AWS D1.1 - Structural Welding Code.
 - 2. AWS D1.3 - Structural Welding Code - Sheet Steel.
- D. Steel Deck Institute (SDI):
 - 1. Design Manual for Composite Decks, Form Decks, Roof Decks, (Publication No. 25).
 - a. Code of Recommended Standard Practice.



- b. Specifications and Commentary for Steel Roof Deck.
- 2. SDI Diaphragm Design Manual 1st Edition.

E. Steel Structures Painting Council (SSPC):

- 1. SSPC-Paint 20 Type II - Zinc Rich Primers - Organic.
- 2. SSPC-Paint 25 - Red Iron Oxide, Zinc Oxide, Raw Linseed Oil, and Alkyd Primer.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

- 1. Product Data: Deck profile characteristics and dimensions, structural properties, and finishes.
- 2. Shop Drawings: Indicate deck plan, support locations, projections, openings and reinforcement, pertinent details, and accessories.
- 3. Assurance/Control Submittals:
 - a. Certificates: Certify welders employed on Work, verifying AWS qualification within previous 12 months.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

1.4 QUALITY ASSURANCE

A. Qualifications:

- 1. Fabricator: Company specializing in performing the work of this section with minimum 5 years documented experience.
- 2. Erector: Company specializing in performing the work of this section with minimum 5 years documented experience, certified by AISC Quality Certification Program.
- 3. Qualifications for Welding Work: Qualify welding operators in accordance with AWS Standard Qualification Procedures. Provide certification that welders employed in work have satisfactorily passed AWS qualification tests within previous 12 months. If recertification of welders is required, provide without additional cost to United States Postal Service.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Prevent damage to edges, ends and surfaces.
- C. Cut plastic wrap to encourage ventilation. Keep materials dry.
- D. Separate sheets and store materials on dry wood sleepers off ground or concrete; slope for positive drainage.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sheet Steel:

- 1. ASTM A 1008 structural quality; with G60 galvanized coating conforming to ASTM A 653.

B. Bearing Plates and Angles: ASTM A 36 steel.



- C. Welding Materials: AWS D1.1.
- D. Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide.
- E. Touch-Up Primer for Galvanized Surfaces: SSPC 20, Type 1, inorganic.
- F. Flute Closures: Closed cell foam rubber, 1 inch thick; profiled to fit tight to decking.
- G. Closure Strips, Cover Plates, and related Accessories: Fabricated of metal of same type and finish as deck.

NOTE TO SPECIFIER

EDIT THE FOLLOWING SECTIONS BY ADDING AND/OR DELETING TEXT BASED ON SPECIFIC PROJECT REQUIREMENTS.

- H. Screw Fasteners: Self-drilling, self tapping No. 12 HWH Tek's, by ITW-Buildex Corp., Itasca, IL, (800) 323-0720.
 - 1. Substitutions: Permitted
- I. Powder Actuated Fasteners: Minimum 0.145 inch diameter knurled hardened steel shank; minimum 0.5625 inch diameter washer; meet SDI design requirements.
 - 1. ENP2-21-L15, by Hilti, Inc., Tulsa, Oklahoma, (918) 252-6000, (800) 879-8000.
 - 2. Substitutions: Permitted.
- J. Air Actuated Fasteners: Minimum 0.130 inch diameter knurled hardened steel shank; minimum 0.500 inch diameter steel washer or head; meet SDI design requirements.
 - 1. X-EDNK22 HSN or X-EDN19 HSN, by Hilti, Inc., Tulsa, Oklahoma, (918) 252-6000.
 - 2. K-65056 or SDK-63075, by Pneutek, Inc., Hudson, New Hampshire, (603) 883-1660, (800) 431-8665.
 - 3. Substitutions: Permitted.
- K. Side Lap Fasteners: Self-drilling screws; #10-16 TEKS/1, by ITW-Buildex Corp., Itasca, IL, (800) 323-0720, or acceptable substitute.

2.2 FABRICATION

- A. Steel Roof Deck: Minimum gage sheet steel as indicated on Drawings, 1-1/2 inch high, fluted profile to SDI WR; multiple span; lapped joints.
- B. Fabricate metal decking in accordance with the SDI Design Manual for Composite Decks, Form Decks, Roof Decks, and AISI, to accommodate maximum working stress of 20,000 psi and maximum span deflection of 1/240.
- C. Fabricate roof sump pan of 14 gage sheet steel, flat bottom, sloped sides, recessed 1-1/2 inches below roof deck surface, bearing flange 3 inches wide, sealed watertight.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.



- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Erect metal decking and connect to structure in accordance with SDI Design Manual for Composite Decks, Form Decks, Roof Decks. Coordinate attachment sequence and procedure with placing of units; show on shop drawings.
- B. On steel support members provide 1-1/2 inch minimum bearing. On masonry support surfaces provide 3 inch minimum bearing.
- C. Align and level deck on supports.
- D. Provide welds, fasteners, and side lap connectors of size, spacing, and location as indicated on Drawings.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT BASED ON THE FASTENERS SELECTED FOR THE SPECIFIC PROJECT.

- E. Install Hilti powder actuated fasteners using the DX-450 or DX-750 decking system, by Hilti. Installed pin height shall be in accordance with manufacturer's recommendations, and verified with manufacturer approved inspection gage. Determine power level by jobsite testing.
- F. Install Hilti air actuated fasteners using the R4x12 decking system, by Hilti. Installed pin height shall be in accordance with manufacturer's recommendations, and verified with manufacturer approved inspection gage. Determine power level by jobsite testing.
- G. Install Pneutek air actuated fasteners using decking system, by Pneutek. Install pins in accordance with manufacturer's recommendations. Pin head shall clamp deck tightly to supporting member without gaps between underside of head and top side of deck. Pin shall not cause excessive dimpling of the deck greater than 1/2 the thickness of the pin head.
- H. Powder and air actuated fasteners shall be installed by a tool operator licensed by the pin manufacturer. A representative of the pin manufacturer shall be on site to verify proper installation of fasteners, and shall submit written verification to Owner.
- I. Welding: In accordance with AWS D1.1 and D1.3. Provide welding washers when welding 26 gauge or lighter steel deck.
- J. Install 6 inch wide sheet steel cover plates where deck changes direction. Spot weld in place 12 inches on center maximum. Install sheet steel closures and angle flashings to close openings between deck and walls, columns, and openings.
- K. Position roof sump pans with flange bearing on top surface of deck. Weld at each deck flute.



- L. Immediately after welding deck in place, touch-up welds, burned areas, and surface coating damage with compatible primer paint.

3.3 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Inspection:
 - 1. Select 6 random sheets for each type of deck used. Inspect for deck thickness, type, and material.
 - 2. Inspect 10 percent of deck welds over entire roof area for size and spacing (CWI to perform inspection).
 - 3. Inspect 10 percent of side lap connectors over entire roof area for type, size, and spacing of side lap connectors.

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Last revised: 4/12/2011

END OF SECTION



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SECTION 05 31 23 00 - R&A STEEL ROOF DECK REPAIR AND REPLACEMENT

NOTE TO SPECIFIER

*This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section. **Edit Section footer information only – do not edit Section contents.***

NOTE TO SPECIFIER

Include this Section for projects where roof replacement will occur over existing steel structural decks.

NOTE TO SPECIFIER

Section Formatting:

Consistent formatting of Sections gives the complete document a professional look. This Section uses a 10pt. Arial font, and is formatted as follows:

1. *Insert one 10pt. line after the Section Number. Section Number is in CAPS.*
2. *Insert two 10pt. lines after the Section Title. Section Title is in CAPS.*
3. *Insert one 10pt. line after a PART. PARTS are in CAPS. If a Section is not used, include NOT USED following the PART title as shown below.*
4. *Insert one 10pt. line after Article paragraphs. Articles are in CAPS.*
5. *Insert two 10pt. lines at the end of an Article.*
6. *Complete Section with END OF SETION.*
7. *No lines should be placed between paragraphs and sub-paragraphs, or between sub-paragraphs and other sub-paragraphs.*

Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED



Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

PART 1 - GENERAL

1.1 SUMMARY

- A. Steel deck repair and replacement associated with roof replacement.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 024100 – Roof Removal and Substrate Preparation
- D. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 UNIT PRICES

- A. Provide unit prices for the work described in paragraphs 3.3A, 3.3B, and Article 3.4.

1.4 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 - 1. Steel Deck Institute (SDI)
 - 2. Factory Mutual Global (FM)

1.5 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.6 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed to install the specified products and is eligible to receive a manufacturer's warranty. The firm shall have a minimum of 5 years documented experience performing work equal or similar to the specified work.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in



compliance with specified regulatory requirements.

- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform steel deck repair/replacement work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

PART 2 – PRODUCTS

2.1 STEEL DECK REPAIR/REPLACEMENT MATERIALS

- A. For use at "Steel Deck Brushing and Priming" outlined in paragraph 3.3A:
 - 1. "Rust-Oleum Industrial Enamel Quick Dry Primer" manufactured by Rust-Oleum Corporation, Vernon Hills, Illinois, "Carboline Carbocoat 150 Universal Primer," manufactured by Carboline, St. Louis, Missouri, or approved equal.
- B. For use at "Steel Deck Repair" outlined in paragraph 3.3B:
 - 1. Steel plate: 16-gauge galvanized with pre-drilled holes for fasteners.
 - 2. For securing steel plate to steel deck: No. 14 fluorocarbon-coated screws; length as necessary to penetrate minimum 1-inch depth through the deck.
 - 3. For securing steel plate to underlying structural steel (1/2-inch thick max.): 12-24 x 1-1/4 inch Hex Washer Head, Teks 5, or approved equal.



- C. For use at "Steel Deck Replacement" outlined in Article 3.4:
 - 1. Full sections to match existing in gauge, profile, and finish; as necessary to comply with requirements of applicable insurance agencies and local codes.
 - 2. Refer to paragraph 2.1B for fastener requirements.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.

3.2 STEEL DECK INSPECTION

- A. Inspect exposed steel decks for surface corrosion, severe corrosion, openings, and other defects.

3.3 STEEL DECK REPAIR

- A. Steel Deck Brushing and Priming (*Unit Price Work*): For use at areas of light corrosion, as determined by the Owner:
 - 1. Wire-brush or scrape the surface rust. Remove debris by power vacuum.
 - 2. Apply primer to the repair area; allow primer time to dry.
- B. Steel Deck Repair (*Unit Price Work*): For use to repair at openings caused by obsolete roof penetration removal or other defects less than 12" by 12" in size, as determined by the Owner:
 - 1. At locations encountered and other locations indicated by the Owner, cover the existing opening with 16-gauge steel plate stock. Lap the plate a minimum of 8-inches beyond the opening on all sides. Fasten the steel plate with specified fasteners and plates 6-inches on center. Secure the plate a minimum of 2-inches in from the outside edge of the repair plate.

3.4 STEEL DECK REPLACEMENT (*Unit Price Work*)

- A. Prior to the start of work, inspect the interior area below the area of damaged steel roof deck. Remove items from the replacement area that may be damaged during work activities. Provide adequate interior protection to protect interior surfaces and finishes from damage prior to the start of work. The Contractor shall provide an "Interior Protection Representative" during replacement work.
- B. At deck replacement locations, as indicated by the Owner: Remove defective steel deck panels and install full decking sections to match existing. Install new decking in accordance with the requirements of FM, Steel Deck Institute, and applicable local codes.

USPS CSF Specifications issued: 10/1/2013
Last revised: 3/6/2013

NOTE TO SPECIFIER



Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 05 31 23 00



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SECTION 05 40 00 00 - MPF COLD-FORMED METAL FRAMING

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Load-bearing and metal stud wall and partition framing, with anchorage and bracing.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 REFERENCES

- A. American Iron and Steel Institute (AISI)
 - 1. Specification for the Design of Cold-Formed Steel Structural Members .
 - 2. Cold-Formed Steel Design Manual (Latest).
- B. American National Standards Institute (ANSI)
 - 1. ANSI A58.1 - Roof, Wind and Snow Loads.
- C. American Society for Testing and Materials (ASTM):
 - 1. ASTM A653 - Standard Specification for Steel Sheet, Zinc-coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 2. ASTM A1101- Hot-Rolled Carbon Steel Sheet & Strip, Carbon Hot-Rolled Structural Quality.
 - 3. ASTM A1008- Standard Specification for Structural Steel Sheet, Carbon, Cold-Rolled.
 - 4. ASTM C955 - Standard Specification for Load Bearing Steel Studs, Runners (Track), Bracing, and Bridging for Screw Application of Gypsum Panel Products.
- D. American Welding Society (AWS):
 - 1. AWS D1.1 - Structural Welding Code and D1.3 - Specifications for Welding Sheet Steel in Structures.
 - 2. AWS - Standard Qualification Procedure.
- E. Federal Specification.
 - 1. FS TT-P-636C - Rust-Inhibitive Paint.
- F. Metal Lath/Steel Framing Association (ML/SFA) - Lightweight Steel Framing Systems Manual, Latest Edition.



1.3 SYSTEM DESCRIPTION

- A. Design Requirements: The supplier shall design and/or verify the size and strength of all light gauge cold-formed Metal Framing members and connections in accordance with the ML/SFA Lightweight Steel Framing Systems Manual.
1. Design shall use the superimposed design loads specified in the Design Criteria section of the Structural General Notes in the Contract Drawings.
 2. Design shall be based upon information shown on the drawings and specified herein.
 3. Additional Design Criteria - ANSI A58.1 or:
 - a. Load-bearing live loads:
 - 1) Load-bearing partitions:
 - i. Lateral pressures: 5 psf
 - 2) Non-load-bearing partitions:
 - i. Lateral pressures: 5 psf
 - 3) Exterior curtain walls:
 - i. Wind loads based on wind speeds of [] MPH.
 - 4) 4) Maximum allowable deflection with brick veneer:
 - i. Calculated on 18 ga. stud capacity alone: 1/600.
 4. Design shall conform to: AISI Specification for the Design of Cold-Formed Steel Structural Members. Wall bridging shall be designed to provide resistance to minor axis bending and rotation of wall studs. Designated selected exterior and/or interior walls shall be designed to provide frame stability and lateral load resistance. All connections (member to member, and member to structure) shall be designed and detailed.
 5. Qualification of Field Welding: Qualify welding process and welding operators in accordance with AWS Standard Qualification Procedure.
 6. Design non-axial load-bearing framing to accommodate 1/2 inch (13 mm) vertical deflection.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
1. All shop drawings and calculations must bear the seal and signature of an engineer registered in the jurisdiction where project is being constructed.
 2. Product Data:
 - a. Manufacturers' literature containing product and installation specifications and details.
 3. Shop Drawings:
 - a. Documents illustrating materials, shop coatings, steel thickness, details of fabrication and erection, details of attachment, spacing of fasteners, required accessories and critical installation procedures.
 4. Calculations:
 - a. Engineering calculations or data verifying the framing assembly's ability to meet or exceed design requirements as stated here-in and required by local codes, prepared under the supervision of a Professional Engineer.
 5. Assurance/Control Submittals:
 - a. Test Reports: Submit the following reports directly to Contracting Officer from Testing Laboratory, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
 - 1) Testing/Inspection reports conducted on shop and field-bolted and welded connections. Include data on type(s) of tests conducted and test results. Note inspection findings.
 - b. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - c. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.



1.5 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 - 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.
- B. Pre-Installation Meetings:
 - 1. Convene a pre-installation meeting one week prior to commencing Work of this Section. Notify the Architect and Contracting Officer of the meeting date and time at least 7 days prior.
 - 2. Require attendance of parties directly affecting Work of this Section.
 - 3. Review conditions of operations, procedures and coordination with related Work.
 - 4. Agenda:
 - a. Tour, inspect, and discuss conditions of installation of other work including door and window frames and mechanical and electrical work.
 - b. Review areas of potential interference and conflicts, and coordinate layout and support provisions for interfacing work.
 - c. Review required submittals, both completed and yet to be completed.
 - d. Review Drawings.
 - e. Review and finalize construction schedule related to cold formed metal framing installation and verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
 - f. Review required inspections, testing, certifying, and material usage accounting procedures.
 - g. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.
 - h. Review safety precautions relating to operations.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Protect metal framing units from rusting and damage. Deliver to project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade. Store off ground in a dry ventilated space or protect with suitable waterproof coverings and protect against mechanical damage to units. Store materials on a flat plane. Any damaged materials shall be removed from the site.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MATERIALS

- A. All studs and/or joists and accessories shall be of the type, size, gauge and spacing shown on the plans or as required by manufacturer design, if called for. Studs, runners (track), bracing, and bridging shall be manufactured per ASTM Specification C-955.
- B. All painted studs, joists and accessories shall be formed from steel that conforms to the requirements of ASTM A570 or A611, as set forth in Section 1.2 of the AISI Specification for the Design of Cold-Formed Steel Structural Members (latest edition).



- C. All galvanized studs, joists and accessories shall be formed from steel that conforms to the requirements of ASTM A653, as set forth in Section 1.2 of the AISI Specification for Design of Cold-Formed Steel Structural Members (latest edition).
- D. All painted studs, joists and accessories shall be prime-painted with a rust-inhibitive paint, FS TT-P-636C.
- E. All galvanized studs, joists and accessories shall have a minimum G-60 coating.
- F. All section properties shall be calculated in accordance with the AISI Specification for the Design of Cold-Formed Steel Structural Members (latest edition).
- G. Framing Accessories:
 - 1. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - a. B&D Industries, LLC, Albany, NY (800) 924-4807.
 - b. Deitrich, Pittsburgh, PA (800) 873-2443.
 - c. The Steel Network, Incorporated., Raleigh, NC (888) 474-4876.
 - 2. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
 - 3. Interior or Exterior non-axial-load-bearing Wall Head Condition Deflection Accessories:
 - a. Deitrich: Double-Deep-Leg Track.
 - b. The Steel Network: VertiClip® SLD (interior), SL (exterior).
 - 4. Exterior non-axial-load-bearing Wall Slab Bypass Deflection Accessories:
 - a. B&D: Quick Clip®.
 - b. The Steel Network: VertiClip® SLB or SLS Series.

2.2 FABRICATION

- A. General: Framing components may be prefabricated prior to erection. Fabricate components plumb, square, true to line and braced against racking with joints welded. Perform lifting of prefabricated components in a manner to prevent damage or distortion.
- B. Fastenings: Attach similar components by welding. Attach dissimilar components by bolting, or screw fasteners, as standard with manufacturer.
- C. Cutting of steel framing members may be accomplished with a saw or shear. Torch cutting of load carrying members is not permitted.
- D. Wire tying of framing components is not permitted.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.



- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION AND STUDWALLS

- A. Manufacturer's Instructions: Install metal framing systems in accordance with manufacturer's printed or written instructions and recommendations, unless otherwise indicated.
- B. Stud Walls:
 - 1. Runner Tracks: Install continuous tracks sized to match studs. Align tracks accurately to layout at base and tops of studs. Secure tracks as recommended by stud manufacturer for type of construction involved, except do not exceed 24 inches on center spacing for nail or power-driven fasteners, or 16 inches on center for other types of attachment. Provide fasteners at corners and ends of tracks.
 - 2. Position studs plumb in runners and space no greater than 16 inches and not more than 2 inches from abutting walls and at each side of openings. Connect studs to upper and lower tracks using self-drilling, screws or welding in accordance with Manufacturer's recommendations such that the connection meets or exceeds the design loads required at that connection.
 - 3. Brace all studs at mid-height for added strength, stiffness, and fire-stopping.
 - 4. Construct corners using minimum of three studs. Double studs at door, window, and sidelight jambs. Install intermediate studs above and below openings to match wall stud spacing.
 - 5. Provide deflection allowance below supported horizontal building framing in ceiling or head track for non-load-bearing framing in a method recommended by stud manufacturer.
 - a. Where walls and partitions must close out against the deck for smoke and fire separation provide a top track rigidly attached to vertical studs but free to move vertically in a 14 gauge break-formed deep leg track rigidly attached to deck with slack to accommodate structural live load deflections noted on drawings; or head condition vertical slide clips in coordination with alignment track (20 gage at exterior walls, 25 gage at interior walls).
 - b. Where wall or partition studs pass by the structural deck provide vertical slide clips welded or screw attached to the structural support but do not attach rigidly to studs.

3.3 INSTALLATION: PRE-FABRICATED AND PANELIZED CONSTRUCTION

- A. Panels shall be designed to resist construction and handling loads as well as service loads.

3.4 INSTALLATION: NON-PANELIZED (STICK-BUILT) MEMBERS

- A. Align track accurately at supporting structure and fasten to structure as shown on shop drawings.
- B. Track intersections shall butt evenly.
- C. Studs shall be plumbed, aligned, and securely attached to flanges or webs of upper and lower tracks. Axially loaded studs shall be seated squarely in both top and bottom tracks.

3.5 INSTALLATION: JOISTS

- A. Joist shall be located directly over bearing studs or a load distribution member shall be provided to transfer loads.



- B. Provide web stiffeners where necessary at reaction points, and at points of concentrated loads, as shown on the shop drawings.
- C. Bridging, either strap or solid, shall be provided as shown on the shop drawings.
- D. Provide additional joists under parallel partitions where the partition length exceeds 1/2 of the joist span.
- E. Provide additional joists around all floor/roof openings which are larger than the joist spacing and as noted on the shop drawings.
- F. End blocking shall be provided where joist ends are not otherwise restrained from rotation.

3.6 FASTENINGS AND ATTACHMENTS

- A. Anchorage of the tracks to the structure shall be with methods designed for the specific application of sheet to that surface. Size, penetration, type and spacing shall be determined by design.
- B. Welds shall conform to the requirements of AWS D1.1, AWS D1.3, and AISI Manual Section 4.2. Welds may be butt, fillet, spot, or groove type, the appropriateness of which shall be determined by, and within the design calculations. All welds shall be touched-up using zinc rich paint to galvanized members, and paint similar to that used by the manufacturer for painted members.
- C. Steel drill screws shall be of the minimum diameter indicated by the design of that particular attachment detail. Penetration through joined materials shall not be less than 3 exposed threads.
- D. Wire tying in structural applications is not permitted.

3.7 CONSTRUCTION

- A. Site Tolerances:
 - 1. Vertical alignment (plumbness) of studs shall be within 1/960th (1/8 inch in 10.0 inches) of the span.
 - 2. Horizontal alignment (levelness) of walls shall be within 1/960th (1/8 inch in 10.0 inches) of their respective lengths.
 - 3. Spacing of studs shall not be more than $\pm 1/8$ inch from the designed spacing providing that the cumulative error does not exceed the requirements of the finishing materials.
 - 4. Squareness - Prefabricated panels shall not be more than 1/8 inch out of square within the length of that panel.

3.8 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
 - 1. Inspect all work in order to assure strict conformance to the shop drawings at all phases of construction.
 - 2. All members shall be checked for proper alignment, bearing, completeness of attachments, proper placement, reinforcement, etc.
 - 3. All attachments shall be checked for conformance with the shop drawings. All welds shall be touched-up as specified herein.
 - 4. General Inspection of structure shall be completed prior to applying loads to those members.
 - 5. Inspections where and as required by local codes shall be controlled inspections.



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Last revised: 6/29/2010

END OF SECTION 05 40 00 00



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SECTION 05 40 00 00 - CSF COLD-FORMED METAL FRAMING

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items at end of Section.05 40 00 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Load-bearing and metal stud wall and partition framing, with anchorage and bracing.

NOTE TO SPECIFIER

Verify option with specific project

2. Skylight support framing.

- #### B. Related Documents:
- The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 REFERENCES

A. American Iron and Steel Institute (AISI)

1. Specification for the Design of Cold-Formed Steel Structural Members .
2. Cold-Formed Steel Design Manual (Latest).

B. American National Standards Institute (ANSI)

1. ANSI A58.1 - Roof, Wind and Snow Loads.

C. American Society for Testing and Materials (ASTM):

1. ASTM A653 - Standard Specification for Steel Sheet, Zinc-coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM A1101- Hot-Rolled Carbon Steel Sheet & Strip, Carbon Hot-Rolled Structural Quality.
3. ASTM A1008- Standard Specification for Structural Steel Sheet, Carbon, Cold-Rolled.
4. ASTM C955 - Standard Specification for Load Bearing Steel Studs, Runners (Track), Bracing, and Bridging for Screw Application of Gypsum Panel Products.

D. American Welding Society (AWS):



1. AWS D1.1 - Structural Welding Code and D1.3 - Specifications for Welding Sheet Steel in Structures.
2. AWS - Standard Qualification Procedure.

E. Federal Specification.

1. FS TT-P-636C - Rust-Inhibitive Paint.

F. Metal Lath/Steel Framing Association (ML/SFA) - Lightweight Steel Framing Systems Manual, Latest Edition.

1.3 SYSTEM DESCRIPTION

A. Design Requirements: The supplier shall design and/or verify the size and strength of all light gauge cold-formed Metal Framing members and connections in accordance with the ML/SFA Lightweight Steel Framing Systems Manual.

1. Design shall use the superimposed design loads specified in the Design Criteria section of the Structural General Notes in the Contract Drawings.
2. Design shall be based upon information shown on the drawings and specified herein.
3. Additional Design Criteria - ANSI A58.1 or:
 - a. Load-bearing live loads:
 - 1) Load-bearing partitions:
 - i. Lateral pressures: 5 psf
 - 2) Non-load-bearing partitions:
 - i. Lateral pressures: 5 psf

NOTE TO SPECIFIER

Enter design wind speed below

- 3) Exterior curtain walls:
 - i. Wind loads based on wind speeds of [] MPH.
- 4) Maximum allowable deflection with brick veneer:
 - i. Calculated on 18 ga. stud capacity alone: 1/600.
4. Design shall conform to: AISI Specification for the Design of Cold-Formed Steel Structural Members. Wall bridging shall be designed to provide resistance to minor axis bending and rotation of wall studs. Designated selected exterior and/or interior walls shall be designed to provide frame stability and lateral load resistance. All connections (member to member, and member to structure) shall be designed and detailed.
5. Qualification of Field Welding: Qualify welding process and welding operators in accordance with AWS Standard Qualification Procedure.
6. Design non-axial load-bearing framing to accommodate 1/2 inch (13 mm) vertical deflection.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

1. All shop drawings and calculations must bear the seal and signature of an engineer registered in the jurisdiction where project is being constructed.
2. Product Data:
 - a. Manufacturers' literature containing product and installation specifications and details.
3. Shop Drawings:
 - a. Documents illustrating materials, shop coatings, steel thickness, details of fabrication and erection, details of attachment, spacing of fasteners, required accessories and critical installation procedures.



4. Calculations:
 - a. Engineering calculations or data verifying the framing assembly's ability to meet or exceed design requirements as stated here-in and required by local codes, prepared under the supervision of a Professional Engineer.
5. Assurance/Control Submittals:
 - a. Test Reports: Submit the following reports directly to Contracting Officer from Testing Laboratory, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
 - 1) Testing/Inspection reports conducted on shop and field-bolted and welded connections. Include data on type(s) of tests conducted and test results. Note inspection findings.
 - b. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - c. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

1.5 QUALITY ASSURANCE

- A. Qualifications:
 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.
- B. Pre-Installation Meetings:
 1. Convene a pre-installation meeting one week prior to commencing Work of this Section. Notify the Architect and Contracting Officer of the meeting date and time at least 7 days prior.
 2. Require attendance of parties directly affecting Work of this Section.
 3. Review conditions of operations, procedures and coordination with related Work.
 4. Agenda:
 - a. Tour, inspect, and discuss conditions of installation of other work including door and window frames and mechanical and electrical work.
 - b. Review areas of potential interference and conflicts, and coordinate layout and support provisions for interfacing work.
 - c. Review required submittals, both completed and yet to be completed.
 - d. Review Drawings.
 - e. Review and finalize construction schedule related to cold formed metal framing installation and verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
 - f. Review required inspections, testing, certifying, and material usage accounting procedures.
 - g. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.
 - h. Review safety precautions relating to operations.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Protect metal framing units from rusting and damage. Deliver to project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade. Store off ground in a dry ventilated space or protect with suitable waterproof coverings and protect against mechanical damage to units. Store materials on a flat plane. Any damaged materials shall be removed from the site.



PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MATERIALS

- A. All studs and/or joists and accessories shall be of the type, size, gauge and spacing shown on the plans or as required by manufacturer design, if called for. Studs, runners (track), bracing, and bridging shall be manufactured per ASTM Specification C-955.
- B. All painted studs, joists and accessories shall be formed from steel that conforms to the requirements of ASTM A570 or A611, as set forth in Section 1.2 of the AISI Specification for the Design of Cold-Formed Steel Structural Members (latest edition).
- C. All galvanized studs, joists and accessories shall be formed from steel that conforms to the requirements of ASTM A653, as set forth in Section 1.2 of the AISI Specification for Design of Cold-Formed Steel Structural Members (latest edition).
- D. All painted studs, joists and accessories shall be prime-painted with a rust-inhibitive paint, FS TT-P-636C.
- E. All galvanized studs, joists and accessories shall have a minimum G-60 coating.
- F. All section properties shall be calculated in accordance with the AISI Specification for the Design of Cold-Formed Steel Structural Members (latest edition).
- G. Framing Accessories:
 - 1. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - a. B&D Industries, LLC, Albany, NY (800) 924-4807.
 - b. Deitrich, Pittsburgh, PA (800) 873-2443.
 - c. The Steel Network, Incorporated., Raleigh, NC (888) 474-4876.
 - 2. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
 - 3. Interior or Exterior non-axial-load-bearing Wall Head Condition Deflection Accessories:
 - a. Deitrich: Double-Deep-Leg Track.
 - b. The Steel Network: VertiClip® SLD (interior), SL (exterior).
 - 4. Exterior non-axial-load-bearing Wall Slab Bypass Deflection Accessories:
 - a. B&D: Quick Clip®.
 - b. The Steel Network: VertiClip® SLB or SLS Series.

2.2 FABRICATION

- A. General: Framing components may be prefabricated prior to erection. Fabricate components plumb, square, true to line and braced against racking with joints welded. Perform lifting of prefabricated components in a manner to prevent damage or distortion.
- B. Fastenings: Attach similar components by welding. Attach dissimilar components by bolting, or screw fasteners, as standard with manufacturer.



- C. Cutting of steel framing members may be accomplished with a saw or shear. Torch cutting of load carrying members is not permitted.
- D. Wire tying of framing components is not permitted.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION AND STUDWALLS

- A. Manufacturer's Instructions: Install metal framing systems in accordance with manufacturer's printed or written instructions and recommendations, unless otherwise indicated.
- B. Stud Walls:
 - 1. Runner Tracks: Install continuous tracks sized to match studs. Align tracks accurately to layout at base and tops of studs. Secure tracks as recommended by stud manufacturer for type of construction involved, except do not exceed 24 inches on center spacing for nail or power-driven fasteners, or 16 inches on center for other types of attachment. Provide fasteners at corners and ends of tracks.
 - 2. Position studs plumb in runners and space no greater than 16 inches and not more than 2 inches from abutting walls and at each side of openings. Connect studs to upper and lower tracks using self-drilling screws or welding in accordance with Manufacturer's recommendations such that the connection meets or exceeds the design loads required at that connection.
 - 3. Brace all studs at mid-height for added strength, stiffness, and fire-stopping.
 - 4. Construct corners using minimum of three studs. Double studs at door, window, and sidelight jambs. Install intermediate studs above and below openings to match wall stud spacing.
 - 5. Provide deflection allowance below supported horizontal building framing in ceiling or head track for non-load-bearing framing in a method recommended by stud manufacturer.
 - a. Where walls and partitions must close out against the deck for smoke and fire separation provide a top track rigidly attached to vertical studs but free to move vertically in a 14 gauge break-formed deep leg track rigidly attached to deck with slack to accommodate structural live load deflections noted on drawings; or head condition vertical slide clips in coordination with alignment track (20 gage at exterior walls, 25 gage at interior walls).
 - b. Where wall or partition studs pass by the structural deck provide vertical slide clips welded or screw attached to the structural support but do not attach rigidly to studs.

3.3 INSTALLATION: PRE-FABRICATED AND PANELIZED CONSTRUCTION

- A. Panels shall be designed to resist construction and handling loads as well as service loads.



3.4 INSTALLATION: NON-PANELIZED (STICK-BUILT) MEMBERS

- A. Align track accurately at supporting structure and fasten to structure as shown on shop drawings.
- B. Track intersections shall butt evenly.
- C. Studs shall be plumbed, aligned, and securely attached to flanges or webs of upper and lower tracks. Axially loaded studs shall be seated squarely in both top and bottom tracks.

3.5 INSTALLATION: JOISTS

- A. Joist shall be located directly over bearing studs or a load distribution member shall be provided to transfer loads.
- B. Provide web stiffeners where necessary at reaction points, and at points of concentrated loads, as shown on the shop drawings.
- C. Bridging, either strap or solid, shall be provided as shown on the shop drawings.
- D. Provide additional joists under parallel partitions where the partition length exceeds 1/2 of the joist span.
- E. Provide additional joists around all floor/roof openings which are larger than the joist spacing and as noted on the shop drawings.
- F. End blocking shall be provided where joist ends are not otherwise restrained from rotation.

3.6 FASTENINGS AND ATTACHMENTS

- A. Anchorage of the tracks to the structure shall be with methods designed for the specific application of sheet to that surface. Size, penetration, type and spacing shall be determined by design.
- B. Welds shall conform to the requirements of AWS D1.1, AWS D1.3, and AISI Manual Section 4.2. Welds may be butt, fillet, spot, or groove type, the appropriateness of which shall be determined by, and within the design calculations. All welds shall be touched-up using zinc rich paint to galvanized members, and paint similar to that used by the manufacturer for painted members.
- C. Steel drill screws shall be of the minimum diameter indicated by the design of that particular attachment detail. Penetration through joined materials shall not be less than 3 exposed threads.
- D. Wire tying in structural applications is not permitted.

3.7 CONSTRUCTION

- A. Site Tolerances:
 - 1. Vertical alignment (plumbness) of studs shall be within 1/960th (1/8 inch in 10.0 inches) of the span.
 - 2. Horizontal alignment (levelness) of walls shall be within 1/960th (1/8 inch in 10.0 inches) of their respective lengths.
 - 3. Spacing of studs shall not be more than $\pm 1/8$ inch from the designed spacing providing that the cumulative error does not exceed the requirements of the finishing materials.
 - 4. Squareness - Prefabricated panels shall not be more than 1/8 inch out of square within the length of that panel.



3.8 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field testing and inspection.

1. Inspect all work in order to assure strict conformance to the shop drawings at all phases of construction.
2. All members shall be checked for proper alignment, bearing, completeness of attachments, proper placement, reinforcement, etc.
3. All attachments shall be checked for conformance with the shop drawings. All welds shall be touched-up as specified herein.
4. General Inspection of structure shall be completed prior to applying loads to those members.
5. Inspections where and as required by local codes shall be controlled inspections.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

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Task	Specification	Specification Description
05 43 00 00	01 22 16 00	No Specification Required



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SECTION 05 50 00 00 - CSF METAL FABRICATIONS**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items at end of Section.05 50 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel lintels for masonry openings.
 - 2. Counter and equipment supports.
 - 3. Miscellaneous framing and supports.
 - 4. Security grilles for ductwork over 8 inches square penetrating the roof or wall structure.
 - 5. Pipe Bollards.
 - 6. Pipe bollard plastic covers.
 - 7. Access Ladders.
 - 8. Angular steel floor guides for the Bulk Mail Containers or General Post Mail Containers, (where applicable).
 - 9. Alternating tread stair
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 REFERENCES

- A. American Institute of Steel Construction (AISC):
 - 1. Specifications for the Design, Fabrication and Erection of Structural Steel for Building
- B. American National Standards Institute (ANSI):
 - 1. ANSI A14.3, "Ladders, Fixed, Safety Requirements."
- C. American Society for Testing and Materials (ASTM):
 - 1. ASTM A36, "Structural Steel."
 - 2. ASTM A53, "Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless."
 - 3. ASTM A123, "Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products."



4. ASTM A153, "Zinc Coating (Hot-Dip) on Iron and Steel Hardware."
5. ASTM A307, "Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength."
6. ASTM A500, "Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes."
7. ASTM A568, "Specification for General Requirements for Steel Sheet, Carbon, and High-Strength, Low Alloy Hot-Rolled and Cold Rolled."
8. ASTM A627, "Specification for Homogeneous Tool-Resisting Steel Bars for Security Applications."
9. ASTM A780, "Practice for Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings."
10. ASTM B221, "Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tube."

D. American Welding Society (AWS):

1. AWS D1.1 - Structural Welding Code.

E. Steel Structures Painting Council Specification (SSPC):

1. Steel Structures Painting Manual.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

1. Product Data:
 - a. Submit complete descriptive data for all stock items.
2. Shop Drawings:
 - a. Prepare Shop Drawings under seal of professional structural engineer registered in state where Project is located for products requiring structural engineering.
 - b. Include profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners and accessories, erection drawings, elevations, welded connections using standard AWS welding symbol with net weld lengths.
 - c. Take field measurements prior to preparation of shop drawings and fabrication when possible. Allow for trimming and fitting whenever taking of field measurements before fabrication might delay construction.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MATERIALS

- A. Steel plates, angles, and other structural shapes shall conform to ASTM A36.
- B. Steel pipe shall conform to ASTM A53, Grade B, Schedule 40.
- C. Galvanized steel pipe and tube shall conform to ASTM A53.



- D. Steel Tubing shall conform to ASTM A500.
- E. Sheet Steel, Galvanized: ASTM A446.
- F. Sheet and Strip Steel, Hot Rolled: ASTM A568.
- G. Extruded Aluminum: ASTM B221.
- H. Anchors and Fasteners for Aluminum: Stainless steel.
- I. Welding Materials: AWS D1.1; type required for materials being welded.
- J. Anchors
 - 1. Threaded Type Concrete Inserts: Galvanized malleable iron or cast steel capable of receiving 3/4 inch diameter machine bolts.
 - 2. Slotted Type Concrete Inserts: Welded box type fabricated with minimum 1/8 inch thick galvanized pressed steel plate with slot to receive 3/4 inch diameter square head bolt and knockout cover.
 - 3. Expansion Shield for Masonry Anchorage: FS FF-2-325.
 - 4. Toggle Bolts: FS FF-B-588.
- K. Fasteners
 - 1. Bolts, Nuts and Washers for Exterior Locations: ASTM A307, galvanized in accordance with ASTM A153.
 - 2. Bolts, Nuts and Washers for Interior Locations: ASTM A307, Grade A, regular hexagon head.
 - 3. Bolts, Round Head: ANSI B-18.5
 - 4. Wood Screws, Flat Head Carbon Steel: ANSI B-18.6.1.
 - 5. Plain Washers, Helical Spring Type Carbon Steel: FS FF-W-84.

NOTE TO SPECIFIER

"REQUIRED Article (Security Grilles) follows. Do not revise this Article, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, Contracting Officer."

- L. Security Grilles:
 - 1. All grilles are to be factory fabricated of 1/2 inch (1.25 cm) diameter tool-resistant, round steel bars spaced a maximum eight inches (20 cm) on center each direction. The bars are to be framed with a minimum 1/8 inch (0.625 cm) by 1 inch (2.5 cm) flat steel.
 - 2. Grilles must be securely fastened to the structural framing around the opening with welded or non-removable fasteners at a maximum 6 inches (15.25 cm) on center.
- M. Primers:
 - 1. Primer for Painting: One of following:
 - a. Tnemec, Kansas City, MO, (816) 474-3400: No. 99 red primer.
 - b. Chessman-Elliott Company: Ceko No. 15 Primox.
 - c. Rowe Products, Inc.: No. 7-C-19.
 - d. Section 016000 – Product Substitutions. Substitutions: Permitted.
 - 2. Touch-Up Primer for Galvanized Surfaces: FS TT-P-641.

2.2 FABRICATION

- A. Fabricate steel items according to approved shop drawings and to applicable portions of AISC Specifications. Conceal welds where possible; grind exposed welds smooth and flush with adjacent finished surface. Ease exposed edges to small uniform radius.



- B. Pre-assemble products in shop to greatest extent possible. Disassemble units to extent necessary for shipping and handling. Clearly mark units for re-assemble and installation.
- C. For exposed to view fabrications, use materials which are smooth and free of surface blemishes including pitting, seams marks, roller marks, roller trade names and roughness. Remove blemishes by grinding or by welding and grinding, prior to cleaning, treating and application of surface finishes including zinc coating.
- D. Fabricate items with joints tightly fitted and secured.
- E. Fit and shop assemble in largest practical sections for delivery to Project site.
- F. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of structure, except where specifically noted otherwise.
- G. Make exposed joints butt tight, flush and hairline.
- H. Fabricate anchorage and related components of same material and finish as metal fabrication, unless indicated otherwise.

2.3 ROUGH HARDWARE

- A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 sections.
- B. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

2.4 LOOSE STEEL LINTELS

- C. Fabricate loose structural steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.
- D. Weld adjoining members together to form a single unit where indicated.
- E. Size loose lintels for equal bearing of one inch per foot of clear span but not less than 8 inches bearing at each side of openings, unless otherwise indicated.
- F. Galvanize all surfaces of loose steel lintels located in exterior walls.

2.4 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports for applications indicated or which are not a part of structural steel framework, as required to complete work.
- B. Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent other construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 - 1. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.



- a. Except as otherwise indicated, space anchors 24 inches on center and provide minimum anchor units in the form of steel straps 1-1/4 inch x 8 inches long.

NOTE TO SPECIFIER

Use Paragraph below if suspended (ceiling hung) toilet partitions are part of the Work. Delete if floor-mounted partitions are provided. Processing and Distribution Centers and CSF Medium Buildings typically use suspended (ceiling hung); CSF Small Buildings typically use floor-mounted.

- C. Fabricate support for suspended toilet partitions as follows:
1. Beams: Continuous steel shapes of size required to limit deflection to L/360 between hangers, but use not less than C 8 x 11.5 channels or another shape with equivalent structural properties.
 2. Hangers: Steel rods, 1/2 inch in diameter, spaced not more than 36 inches on center. Thread rods to receive anchor and stop nuts. Fit hangers with wedge shape washers for full bearing on sloping flanges of support beam.
 3. Braces and Angels: Steel angles of size required for rigid support of beam and for secure anchorage.

2.5 MISCELLANEOUS STEEL TRIM

- A. Provide shapes and sizes indicated for profiles shown. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings, and anchorages as required for coordination of assembly and installation with other work.
- B. Galvanize miscellaneous framing and supports in the following locations:
1. Exterior locations.

2.6 SHELF AND RELIEVING ANGLES

- A. Fabricate shelf and relieving angles from steel angles of sizes indicated and for attachment to concrete farming. Provide slotted holes to receive 3/4 inch bolts, spaced not more than 6 inches from ends and not more than 24 inches on center, unless otherwise indicated.
- B. Galvanize shelf angles to be installed on exterior concrete framing.

2.7 PIPE BOLLARDS

NOTE TO SPECIFIER

Select article below, and delete the paragraph titled "PIPE BOLLARD PLASTIC COVERS" for painted finish bollards.

- A. Fabricate pipe bollards from Schedule 80 steel pipe. Exterior bollards to be galvanized. Fill bollards with concrete rounded off at top. Paint bollards per Section 099100.

NOTE TO SPECIFIER

Select article below for plastic covered bollards.

- B. Fabricate pipe bollards from Schedule 80 steel pipe. Exterior bollards are to be galvanized. Fill bollards with concrete flush at top. Do not paint bollards. Install pipe bollard plastic cover.



- C. Fabricate sleeves for bollard anchorage from steel pipe with 1/4 inch thick steel plate welded to bottom of sleeve. Exterior sleeves are to be galvanized.

2.8 PIPE BOLLARD PLASTIC COVERS

- A. Exterior shell cover of low density polyethylene and interior steel sleeve. Covers are to be 1/4 inch nominal wall thickness with ultraviolet and anti-static additives and a dome top. Install over steel pipe posts as indicated on Drawings. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Ideal Shield, L.L.C., Detroit, MI (313) 842-7290, (800) 731-1722.
 2. Liberty Equipment Sales, Houston, TX (281) 987-8708, (888) 987-8708.

NOTE TO SPECIFIER

Use if Access Ladders are required.

2.9 ACCESS LADDERS

- A. General: Fabricate ladders for the locations shown, with dimensions, spacings, details and anchorages as indicated. Comply with requirements of ANSI A14.3.
- B. Siderails: Continuous steel flat bars, with eased edges.
- C. Bar Rungs: Square steel bars.
- D. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.
- E. Support each ladder at top and bottom and at intermediate points spaced not more than 5 feet on center. by means of welded or bolted steel brackets.
1. Size brackets to support design dead and live loads indicated and to hold centerline of ladder rungs clear of the wall surface by not less than 7 inches.
- F. Provide non-slip surface on top of each rung, either by coating the rung with aluminum oxide granules set in epoxy resin adhesive, or by using a type of manufactured rung which is filled with aluminum oxide grout.

2.10 ALTERNATING STAIRS

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Basis of Design: Lapeyre Stair, Inc., (800) 535-7631
 2. Section 016000 – Product Substitutions. Substitutions: Permitted.
- B. Performance Requirements:
1. Stair Treads: Treads shall be capable of withstanding a concentrated load of 1000 lbs. without deformation.
 2. Handrail: Handrails shall be capable of withstanding a load of 200 lbs. applied in any direction at any point on the rail.
- C. Material: Carbon Steel
- D. Finish: Safety Yellow powder coat finish



- E. Angle of Incline: 56 deg or 68 deg from horizontal, to be determined by Architect.

2.11 FINISHES, GENERAL

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.
- B. Finish metal fabrications after assembly.

2.12 STEEL AND IRON FINISHES

- A. Galvanizing: For those items indicated for galvanizing, apply zinc-coating by the hot-dip process compliance with the following requirements:
 - 1. ASTM A153 for galvanizing iron and steel hardware.
 - 2. ASTM A123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch thick and heavier.
- B. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
 - 1. Interiors (SSPC Zone 1A): SSPC-SP3 "Power Tool Cleaning":
- C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finish or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA1 "Paint Application Specification No. 1" for shop painting.

2.13 SHOP PAINTING AND PROTECTIVE COATING

- A. Conform to Steel Structures Painting Council Specification 15-68T, Type 1, including preparation for painting.
- B. Hot-Dip galvanizing and zinc coatings applied on products fabricated from rolled, pressed, and forged steel shapes, plates, bars and strips shall comply with ASTM Specification A123. Galvanized surfaces for which a shop coat of paint is specified shall be chemically treated to provide a bond for the paint. Except for bolts and nuts, all galvanizing shall be done after fabrication.
- C. Clean surfaces of rust, scale, grease and foreign matter in accordance with SSPC SP-1 solvent cleaning, prior to finishing. Prepare surfaces for painting in accordance with SSPC-SP2 Hand Tool Cleaning, SSPC-SP3 Power Tool Cleaning or SSPC SP-7 Brush Off Blast Cleaning.
- D. Do not prime surfaces in direct contact bond with concrete or where field welding is required.
- E. Prime paint items scheduled with one coat.
- F. Protect aluminum surfaces in contact with steel with zinc chromate primer.



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.3 INSTALLATION

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.
- D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.
- E. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.



3.4 INSTALLATION - SECURITY GRILLES

- A. Securely fasten to structural framing around opening with tamper-proof fasteners.

3.5 INSTALLATION - BOLLARDS

- F. Anchor bollards in concrete by means of pipe sleeves preset and anchored into concrete. After bollards have been inserted into sleeves, fill annular space between bollard and sleeve solid with nonshrink, nonmetallic grout, mixed and placed to comply with grout manufacturer's directions.
- G. Install pipe bollard plastic covers per manufacturer's recommendation.

3.4 ADJUSTING AND CLEANING

- A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touch-up of field painted surfaces.
 - 1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

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END OF SECTION



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SECTION 05 50 00 00 - MPF METAL FABRICATIONS**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Major Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 – GENERAL

1.1. SUMMARY

- A. Miscellaneous steel that is not covered in Section 051200.
- B. Door frames for special doors.
- C. Stairs, landing sand associated guardrails and handrails.
- D. Ladders.
- E. Loose lintels and shelf angles.
- F. Pipe bollards.
- G. Metal joint covers.
- H. Interior pedestrian guardrails
- I. Pipe bollard plastic covers

1.2 SUBMITTALS

- A. Shop Drawings: Required
- B. Samples: Required
- C. Product Data: Required

1.3 QUALITY ASSURANCE

- A. Quality Standards: Comply with ASTM and AISC requirements.
- B. Regulatory Requirements:
 - 1. Design stair assembly to support live load of 100 pounds per square foot with deflection of stringer or landing framing not to exceed 1/240 of span.
 - 2. Design guardrail system for the following loads applied to the top rail:
 - a. Uniform load of 50 pounds per linear foot applied horizontally and concurrently with uniform load of 100 pounds per linear foot applied vertically downward.
 - b. Concentrated load of 250 pounds applied at any point and in any direction.
 - c. Concentrated and uniform loadings shall not be applied simultaneously.



3. Design handrails for the following loads:
 - a. Uniform load of 50 pounds per linear foot applied in any direction.
 - b. Concentrated load of 250 pounds applied at any point and in any direction.
 - c. Concentrated and uniform load shall not be applied concurrently.
4. Conform to applicable Building Code and OSHA requirements.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Structural Steel Members: Conform to ASTM A 36.
- B. Tubing, Pipe: Conform to ASTM A 53.
- C. Sheet: Conform to ASTM A 568.
- D. Welding: Conform to AWS D1.1 “Structural Welding Code.”
- E. Bolts, Nuts and Washers: Conform to ASTM A 307.
- F. Handrail Fittings: Cast or Machined steel.
- G. Pipe Bollard: 6” dia., Schedule 40 pipe, concrete filled with end cap.
- H. Extruded Aluminum: ASTM B 221
- I. Interior Pedestrian Guardrail: W beam rail elements fabricated from corrugated sheet steel conforming to AASHTO M 180, Type 3, Class A with W6 x 9 post and base plate for bolted connection to slab.
- J. Anchors and Fasteners for Aluminum: Stainless Steel, ASTM A 304
- K. Pipe Bollard Plastic Covers: Exterior shell cover of low density polyethylene and interior steel sleeve. Covers are to be 1/4 inch nominal wall thickness with ultraviolet and anti-static additives and a dome top. Install over steel pipe posts as indicated on Drawings. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. Ideal Shield, L.L.C., Detroit, MI (313) 842-7290, (800) 731-1722.
 2. Liberty Equipment Sales, Houston, TX (281) 987-8708, (888) 987-8708.

2.2 FABRICATION

- A. Stairs and Landings:
 1. Closed risers and concrete filled metal pan treads construction.
 2. Form treads, landings, and riser of sheet steel stock.
 3. Form stringers with rolled steel channels or rectangular hollow sections.
- B. Handrails:
 1. Form posts and railings from steel pipe sections.
- C. Shop/Factory Finishing:
 1. Interior components: Prime painted.
 2. Exterior components: Galvanized.

2.3 FIELD QUALITY CONTROL

- A. Field Test: If required by Local codes.



- B. Field Inspection: If required by Local codes.

2.4 SCHEDULES

- A. Door Frames for Exterior Overhead Door Openings: Channel sections; galvanized finish.
- B. Frames for Interior Impact, Overhead Coiling and Rapid Roll-up Doors: Channel sections; primed finish.
- C. Dock leveler edge angles: Galvanized finish.
- D. Dock edge channels: Galvanized finish.
- E. Pipe bollards: Primed finish for interior and galvanized finish for exterior.
- F. Interior Pedestrian Guardrails: primed finish with safety yellow top coat.
- G. Interior ladders: Primed finish.
- H. Exterior ladders: Galvanized finish.
- I. Stair nosings at concrete stairs: Provide cast non-corrosive metal safety nosing (minimum 3" x 3/8") with cross-hatched abrasive surface and integrally cast anchors at each exposed concrete stair tread.
- J. Expansion joint covers: Extruded aluminum clear anodized finish.
- K. Loose steel lintels in masonry openings: Galvanized finish, exterior; primed finish, interior.
- L. Shelf angles: Galvanized finish.

PART 3 – EXECUTION

- 3.1 Install all products in accordance with manufacturer's guidelines and printed instructions.

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Last revised: 3/31/2010

END OF SECTION 05 50 00 00



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SECTION 05 52 13 00 - CSF PIPE AND TUBE RAILINGS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

This specification is for steel handrail and railing, specification should be modified if aluminum rail is used in the project for coastal and cold climate sites due to salt contents in the air or ground.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items at end of Section.05 52 13 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel pipe handrails.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 099100 - Painting: Field paint finish.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A 53 - Specification for Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.
 - 2. ASTM 123 - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 3. ASTM E 894 - Test Method for Anchorage of Permanent Metal Railing Systems and Rails for Buildings.
 - 4. ASTM E 935 - Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
 - 5. ASTM E 985 - Permanent Metal Railing Systems and Rails for Buildings.
- B. Steel Structures Painting council (SSPC):
 - 1. SSPC Paint 15 - Type 1, Red Oxide.
 - 2. SSPC Paint 20 - Type 1 Inorganic Zinc Rich.

1.3 SYSTEM DESCRIPTION



- A. Design Requirements:
 - 1. Design, engineer, fabricate and install handrails and railing systems to comply with requirements of ASTM E 985 for structural performance based on testing performed in accordance with ASTM E 894 and E 935.
 - 2. Railing assembly, wall rails, and attachments to comply with local code requirements and to resist minimum lateral force according to IBC or more stringent local building code at any point without damage or permanent set.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
 - 2. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Pipe: ASTM A 53, Grade B Schedule 80.
- B. Rails and Posts: Steel pipe; with welded joints, of sizes and shapes as indicated on Drawings.
- C. Fittings: Elbows, T-shapes, wall brackets, escutcheons; machined steel.
- D. Mounting on Concrete Floor: Steel sleeves, sized to receive railing post with 1/4 inch clearance.
- E. Mounting on Masonry or Concrete Walls: Brackets with anchors for building in masonry.
- F. Mounting on Stud Walls: Brackets and anchor plates, predrilled to receive bolts.
- G. Splice Connectors: Steel threaded collars.

2.2 FABRICATION

- A. Fit and shop assemble sections in largest practical sizes, for delivery to site and installation.
- B. Supply components required for secure anchorage of handrails and railings.
- C. Fully weld joints. Grind exposed welds smooth and flush with adjacent surfaces.
- D. Wake exposed joint butt tight, flush, and hairline.



- E. Accurately form components required for anchorage of railings to each other and to building structure.
- F. Prime railings which will be exposed.

2.3 FINISH

- A. At Building Exterior:
 - 1. Galvanizing: ASTM A123; provide minimum 2.0 ounces per square foot.
 - 2. Touch-Up Primer for Galvanized Surfaces: SSPC 20 Type I Inorganic zinc rich.
- B. At Building Interior: SSPC 15, Type 1, red oxide.
- C. Field paint as specified in Section 099100.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify field dimensions prior to shop fabrication.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Furnish items required to be cast into concrete, embedded in masonry, placed in partitions with setting templates, to appropriate Sections.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's published instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects.
- C. Anchor railings to structure with anchors in conformance with ASTM E 985.
- D. Field weld anchors as indicated on Drawings. Touch-up welds with primer. Grind welds smooth.
- E. Insert railing posts in sleeves and pack sleeves with non-shrink grout.

3.4 CONSTRUCTION



- A. Site Tolerances:
 - 1. Maximum Variation From Plumb: 1/4 inch.
 - 2. Maximum Offset From True Alignment: 1/4 inch.
 - 3. Maximum Out-of-Position: 1/4 inch.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Inspect railings and handrail installation and attachment to structure.
- C. Inspect paint finish applied to surfaces.

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END OF SECTION



SECTION 05 52 13 00 - MPF PIPE AND TUBE RAILINGS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification.

This specification is for steel handrail and railing, specification should be modified if aluminum rail is used in the project for coastal and cold climate sites due to salt contents in the air or ground

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information must be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel pipe handrails.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 099100 - Painting: Field paint finish.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A 53 - Specification for Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.
 - 2. ASTM 123 - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 3. ASTM E 894 - Test Method for Anchorage of Permanent Metal Railing Systems and Rails for Buildings.
 - 4. ASTM E 935 - Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
 - 5. ASTM E 985 - Permanent Metal Railing Systems and Rails for Buildings.
- B. Steel Structures Painting council (SSPC):
 - 1. SSPC Paint 15 - Type 1, Red Oxide.
 - 2. SSPC Paint 20 - Type 1 Inorganic Zinc Rich.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Design, engineer, fabricate and install handrails and railing systems to comply with requirements of ASTM E 985 for structural performance based on testing performed in accordance with ASTM E 894 and E 935.



2. Railing assembly, wall rails, and attachments to comply with local code requirements and to resist minimum lateral force according to IBC or more stringent local building code at any point without damage or permanent set.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 1. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
 2. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Pipe: ASTM A 53, Grade B Schedule 80.
- B. Rails and Posts: Steel pipe; with welded joints, of sizes and shapes as indicated on Drawings.
- C. Fittings: Elbows, T-shapes, wall brackets, escutcheons; machined steel.
- D. Mounting on Concrete Floor: Steel sleeves, sized to receive railing post with 1/4 inch clearance.
- E. Mounting on Masonry or Concrete Walls: Brackets with anchors for building in masonry.
- F. Mounting on Stud Walls: Brackets and anchor plates, predrilled to receive bolts.
- G. Splice Connectors: Steel threaded collars.

2.2 FABRICATION

- A. Fit and shop assemble sections in largest practical sizes, for delivery to site and installation.
- B. Supply components required for secure anchorage of handrails and railings.
- C. Fully weld joints. Grind exposed welds smooth and flush with adjacent surfaces.
- D. Wake exposed joint butt tight, flush, and hairline.
- E. Accurately form components required for anchorage of railings to each other and to building structure.
- F. Prime railings which will be exposed.



2.3 FINISH

- A. At Building Exterior:
 - 1. Galvanizing: ASTM A123; provide minimum 2.0 ounces per square foot.
 - 2. Touch-Up Primer for Galvanized Surfaces: SSPC 20 Type I Inorganic zinc rich.
- B. At Building Interior: SSPC 15, Type 1, red oxide.
- C. Field paint as specified in Section 099100.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify field dimensions prior to shop fabrication.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Furnish items required to be cast into concrete, embedded in masonry, placed in partitions with setting templates, to appropriate Sections.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's published instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects.
- C. Anchor railings to structure with anchors in conformance with ASTM E 985.
- D. Field weld anchors as indicated on Drawings. Touch-up welds with primer. Grind welds smooth.
- E. Insert railing posts in sleeves and pack sleeves with non-shrink grout.

3.4 CONSTRUCTION

- A. Site Tolerances:
 - 1. Maximum Variation From Plumb: 1/4 inch.
 - 2. Maximum Offset From True Alignment: 1/4 inch.
 - 3. Maximum Out-of-Position: 1/4 inch.



3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Inspect railings and handrail installation and attachment to structure.
- C. Inspect paint finish applied to surfaces.

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Last revised: 3/5/2012

END OF SECTION 05 52 13 00



SECTION 05 53 13 00 - GRATINGS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for gratings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Metal bar gratings.
 - b. Expanded-metal gratings.
 - c. Formed-metal plank gratings.
 - d. Extruded-aluminum plank gratings.
 - e. Glass-fiber-reinforced plastic gratings.
 - f. Metal frames and supports for gratings.

C. Performance Requirements

1. Delegated Design: Design gratings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Structural Performance: Gratings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
 - a. Loads in subparagraphs below are examples based on the 2006 International Building Code and ASCE/SEI 7. Adjust to local Project requirements.
 - 1) Floors (light manufacturing): Uniform load of 125 lbf/sq. ft. (6.00 kN/sq. m) or concentrated load of 2000 lbf (8.90 kN), whichever produces the greater stress.
 - 2) Floors (heavy manufacturing): Uniform load of 250 lbf/sq. ft. (11.97 kN/sq. m) or concentrated load of 3000 lbf (13.40 kN), whichever produces the greater stress.
 - 3) Walkways and Elevated Platforms Other Than Exits: Uniform load of 60 lbf/sq. ft. (2.87 kN/sq. m).
 - 4) Walkways and Elevated Platforms Used as Exits: Uniform load of 100 lbf/sq. ft. (4.79 kN/sq. m).
 - 5) Sidewalks and Vehicular Driveways, Subject to Trucking: Uniform load of 250 lbf/sq. ft. (11.97 kN/sq. m) or concentrated load of 8000 lbf (35.60 kN), whichever produces the greater stress.
 - 6) Limit deflection to L/240 **OR** L/360, **as directed**, or 1/4 inch (6.4 mm), whichever is less.
3. Seismic Performance: Provide gratings capable of withstanding the effects of earthquake motions determined according to ASCE/SEI 7.

D. Submittals

1. Product Data: For the following:
 - a. Formed-metal plank gratings.
 - b. Extruded-aluminum plank gratings.
 - c. Glass-fiber-reinforced plastic gratings.
 - d. Clips and anchorage devices for gratings.
 - e. Paint products.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: Indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
3. Shop Drawings: Include plans, sections, details, and attachments to other work.



4. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
5. Qualification Data: For qualified professional engineer.
6. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.
7. Welding certificates.
8. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

E. Quality Assurance

1. Metal Bar Grating Standards: Comply with NAAMM MBG 531, "Metal Bar Grating Manual" and NAAMM MBG 532, "Heavy-Duty Metal Bar Grating Manual."
2. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - c. AWS D1.3, "Structural Welding Code - Sheet Steel."
 - d. AWS D1.6, "Structural Welding Code - Stainless Steel."

F. Project Conditions

1. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication.

G. Coordination

1. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
2. Coordinate installation of anchorages for gratings, grating frames, and supports. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.2 PRODUCTS

A. Ferrous Metals

1. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
2. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
3. Steel Bars for Bar Gratings: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.
4. Wire Rod for Bar Grating Crossbars: ASTM A 510 (ASTM A 510M).
5. Uncoated Steel Sheet: ASTM A 1011/A 1011M, structural steel, Grade 30 (Grade 205).
6. Galvanized-Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 33 (Grade 230), with G90 (Z275) coating.
7. Expanded-Metal Carbon Steel: ASTM F 1267, Class 1.
8. Expanded-Metal Galvanized Steel: ASTM F 1267, Class 2, Grade A.
9. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304 **OR** Type 316, **as directed**.
10. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304 **OR** Type 316, **as directed**.
11. Expanded-Metal Stainless Steel: ASTM F 1267, Class 3, made from stainless-steel sheet, ASTM A 666, Type 304 **OR** Type 316, **as directed**.

B. Aluminum



1. Aluminum, General: Provide alloy and temper recommended by aluminum producer for type of use indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.
 2. Extruded Bars and Shapes: ASTM B 221 (ASTM B 221M), alloys as follows:
 - a. 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
 - b. 6061-T1, for grating crossbars.
 3. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 5052-H32.
- C. Fasteners
1. General: Unless otherwise indicated, provide Type 304 **OR** Type 316, **as directed**, stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - a. Provide stainless-steel fasteners for fastening aluminum.
 - b. Provide stainless steel fasteners for fastening stainless steel.
 2. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
 3. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts, and, where indicated, flat washers; ASTM F 593 (ASTM F 738M) for bolts and ASTM F 594 (ASTM F 836M) for nuts, Alloy Group 1 (A1) **OR** Group 2 (A4), **as directed**.
 4. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
 - a. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
 5. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).
 6. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).
 7. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - a. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
 - b. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 (A1) **OR** Group 2 (A4), **as directed**, stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
- D. Miscellaneous Materials
1. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy that is welded.
 2. Shop Primers: Provide primers that comply with Division 07 **OR** Division 09 Section(s) "High-performance Coatings" **OR** Division 07 **AND** Division 09 Section(s) "High-performance Coatings", **as directed**.
 3. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - a. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
 4. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
 5. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
 6. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. Fabrication
1. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling



limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

2. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
3. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.
4. Fit exposed connections accurately together to form hairline joints.
5. Welding: Comply with AWS recommendations and the following:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
6. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.
 - a. Fabricate toeplates to fit grating units and weld to units in shop unless otherwise indicated.
OR
Fabricate toeplates for attaching in the field.
 - b. Toeplate Height: 4 inches (100 mm) unless otherwise indicated.

F. Metal Bar Gratings

1. Welded Steel Grating:
 - a. Bearing Bar Spacing: 7/16 or 1/2 inch (11 or 13 mm) **OR** 11/16 inch (17 mm) **OR** 15/16 inch (24 mm) **OR** 1-3/16 inches (30 mm) **OR** 1-3/8 inches (35 mm) **OR** 1-7/8 inches (48 mm) **OR** 2-3/8 inches (60 mm), **as directed**, o.c.
 - b. Bearing Bar Depth: 3/4 inch (19 mm) **OR** 1 inch (25 mm) **OR** 1-1/4 inches (32 mm) **OR** 1-1/2 inches (38 mm) **OR** 1-3/4 inches (44 mm) **OR** 2 inches (51 mm) **OR** 2-1/4 inches (57 mm) **OR** 2-1/2 inches (64 mm) **OR** 3 inches (76 mm) **OR** 3-1/2 inches (89 mm) **OR** 4 inches (102 mm) **OR** 4-1/2 inches (114 mm) **OR** 5 inches (127 mm) **OR** As required to comply with structural performance requirements, **as directed**.
 - c. Bearing Bar Thickness: 1/8 inch (3.2 mm) **OR** 3/16 inch (4.8 mm) **OR** 1/4 inch (6.4 mm) **OR** 3/8 inch (9.5 mm) **OR** As required to comply with structural performance requirements, **as directed**.
 - d. Crossbar Spacing: 2 inches (51 mm) **OR** 4 inches (102 mm), **as directed**, o.c.
 - e. Grating Mark W-11-4 (1 x 3/16) STEEL: 1-by-3/16-inch (25-by-4.8-mm) bearing bars at 11/16 inch (18 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - f. Grating Mark W-15-4 (1 x 1/8) STEEL: 1-by-1/8-inch (25-by-3.2-mm) bearing bars at 15/16 inch (24 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - g. Grating Mark W-19-4 (1-1/4 x 3/16) STEEL: 1-1/4-by-3/16-inch (32-by-4.8-mm) bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - h. Grating Mark W-19-4 (1-1/2 x 3/16) STEEL: 1-1/2-by-3/16-inch (38-by-4.8-mm) bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - i. Grating Mark W-19-4 (2 x 1/4) STEEL: 2-by-1/4-inch (51-by-6.4-mm) bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - j. Grating Mark W-30-4 (5 x 3/8) STEEL: 5-by-3/8-inch (127-by-9.5-mm) bearing bars at 1-7/8 inches (60 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - k. Grating Mark: As indicated.
 - l. Traffic Surface: Plain **OR** Serrated **OR** Knurled **OR** Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive **OR** As indicated, **as directed**.
 - m. Steel Finish: Shop primed **OR** Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. (550 g/sq. m) of coated surface, **as directed**.
2. Pressure-Locked Steel Grating: Fabricated by pressing rectangular flush-top crossbars into slotted bearing bars or swaging crossbars between bearing bars.



- a. Bearing Bar Spacing: 7/16 or 1/2 inch (11 or 13 mm) **OR** 11/16 inch (17 mm) **OR** 15/16 inch (24 mm) **OR** 1-3/16 inches (30 mm), **as directed**, o.c.
 - b. Bearing Bar Depth: 3/4 inch (19 mm) **OR** 1 inch (25 mm) **OR** 1-1/4 inches (32 mm) **OR** 1-1/2 inches (38 mm) **OR** 1-3/4 inches (44 mm) **OR** 2 inches (51 mm) **OR** 2-1/4 inches (57 mm) **OR** 2-1/2 inches (64 mm) **OR** As required to comply with structural performance requirements, **as directed**.
 - c. Bearing Bar Thickness: 1/8 inch (3.2 mm) **OR** 3/16 inch (4.8 mm) **OR** As required to comply with structural performance requirements, **as directed**.
 - d. Crossbar Spacing: 2 inches (51 mm) **OR** 4 inches (102 mm), **as directed**, o.c.
 - e. Grating Mark P-11-4 (1 x 3/16) STEEL: 1-by-3/16-inch (25-by-4.8-mm) bearing bars at 11/16 inch (18 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - f. Grating Mark P-15-4 (1-1/4 x 1/8) STEEL: 1-1/4-by-1/8-inch (32-by-3.2-mm) bearing bars at 15/16 inch (24 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - g. Grating Mark P-19-4 (1-1/2 x 3/16) STEEL: 1-1/2-by-3/16-inch (38-by-4.8-mm) bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - h. Grating Mark: As indicated.
 - i. Traffic Surface: Plain **OR** Serrated **OR** Knurled **OR** Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive **OR** As indicated, **as directed**.
 - j. Steel Finish: Shop primed **OR** Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. (550 g/sq. m) of coated surface, **as directed**.
3. Riveted Steel Grating:
- a. Bearing Bar Spacing: 3/4 inch (19 mm) **OR** 1-1/8 inches (29 mm) **OR** 2-5/16 inches (59 mm), **as directed**, clear.
 - b. Bearing Bar Depth: 3/4 inch (19 mm) **OR** 1 inch (25 mm) **OR** 1-1/4 inches (32 mm) **OR** 1-1/2 inches (38 mm) **OR** 1-3/4 inches (44 mm) **OR** 2 inches (51 mm) **OR** 2-1/4 inches (57 mm) **OR** 2-1/2 inches (64 mm) **OR** 3 inches (76 mm) **OR** 3-1/2 inches (89 mm) **OR** 4 inches (102 mm) **OR** 4-1/2 inches (114 mm) **OR** 5 inches (127 mm) **OR** As required to comply with structural performance requirements, **as directed**.
 - c. Bearing Bar Thickness: 1/8 inch (3.2 mm) **OR** 3/16 inch (4.8 mm) **OR** 1/4 inch (6.4 mm) **OR** 3/8 inch (9.5 mm) **OR** As required to comply with structural performance requirements, **as directed**.
 - d. Rivet Spacing: 3-1/2 inches (89 mm) **OR** 5 inches (127 mm) **OR** 7 inches (178 mm), **as directed**, o.c. along bearing bar.
 - e. Grating Mark R-12-3-1/2 (1 x 1/8) STEEL: 1-by-1/8-inch (25-by-3.2-mm) bearing bars with 3/4-inch (19-mm) clear space between bearing bars, and rivets at 3-1/2 inches (89 mm) o.c. along bearing bar.
 - f. Grating Mark R-18-7 (1-1/2 x 3/16) STEEL: 1-1/2-by-3/16-inch (38-by-4.8-mm) bearing bars with 1-1/8-inch (29-mm) clear space between bearing bars, and rivets at 7 inches (178 mm) o.c. along bearing bar.
 - g. Grating Mark R-37-5 (4 x 1/4) STEEL: 4-by-1/4-inch (102-by-6.4-mm) bearing bars with 2-5/16-inch (59-mm) clear space between bearing bars, and rivets at 5 inches (127 mm) o.c. along bearing bar.
 - h. Grating Mark R-37-5 (5 x 3/8) STEEL: 5-by-3/8-inch (127-by-9.5-mm) bearing bars with 2-5/16-inch (59-mm) clear space between bearing bars, and rivets at 5 inches (127 mm) o.c. along bearing bar.
 - i. Grating Mark: As indicated.
 - j. Traffic Surface: Plain **OR** Serrated **OR** Knurled **OR** Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive **OR** As indicated, **as directed**.
 - k. Steel Finish: Shop primed **OR** Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. (550 g/sq. m) of coated surface, **as directed**.
4. Pressure-Locked, Stainless-Steel Grating: Fabricated by pressing rectangular flush-top crossbars into slotted bearing bars or swaging crossbars between bearing bars, **as directed**.
- a. Bearing Bar Spacing: 7/16 or 1/2 inch (11 or 13 mm) **OR** 11/16 inch (17 mm) **OR** 15/16 inch (24 mm) **OR** 1-3/16 inches (30 mm) **OR** 1-3/8 inches (35 mm) **OR** 1-7/8 inches (48 mm) **OR** 2-3/8 inches (60 mm), **as directed**, o.c.



- b. Bearing Bar Depth: 3/4 inch (19 mm) **OR** 1 inch (25 mm) **OR** 1-1/4 inches (32 mm) **OR** 1-1/2 inches (38 mm) **OR** 1-3/4 inches (44 mm) **OR** 2 inches (51 mm) **OR** 2-1/4 inches (57 mm) **OR** 2-1/2 inches (64 mm) **OR** 3 inches (76 mm) **OR** 3-1/2 inches (89 mm) **OR** 4 inches (102 mm) **OR** 4-1/2 inches (114 mm) **OR** 5 inches (127 mm) **OR** As required to comply with structural performance requirements, **as directed**.
 - c. Bearing Bar Thickness: 1/8 inch (3.2 mm) **OR** 3/16 inch (4.8 mm) **OR** 1/4 inch (6.4 mm) **OR** 3/8 inch (9.5 mm) **OR** As required to comply with structural performance requirements, **as directed**.
 - d. Crossbar Spacing: 2 inches (51 mm) **OR** 4 inches (102 mm), **as directed**, o.c.
 - e. Grating Mark P-11-4 (1 x 3/16) STAINLESS STEEL: 1-by-3/16-inch (25-by-4.8-mm) bearing bars at 11/16 inch (18 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - f. Grating Mark P-15-2 (1 x 1/8) STAINLESS STEEL: 1-by-1/8-inch (25-by-3.2-mm) bearing bars at 15/16 inch (24 mm) o.c., and crossbars at 2 inches (51 mm) o.c.
 - g. Grating Mark P-19-4 (1-1/2 x 3/16) STAINLESS STEEL: 1-1/2-by-3/16-inch (38-by-4.8-mm) bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - h. Grating Mark P-30-4 (3 x 3/8) STAINLESS STEEL: 3-by-3/8-inch (76-by-9.5-mm) bearing bars at 1-7/8 inches (48 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - i. Grating Mark: As indicated.
 - j. Traffic Surface: Plain **OR** Serrated **OR** Knurled **OR** Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive **OR** As indicated, **as directed**.
 - k. Finish: Mill finish **OR** Abrasive blasted **OR** Electropolished, **as directed**.
5. Pressure-Locked, Rectangular Bar Aluminum Grating: Fabricated by pressing rectangular flush-top crossbars into slotted bearing bars or swaging crossbars between bearing bars.
- a. Bearing Bar Spacing: 7/16 or 1/2 inch (11 or 13 mm) **OR** 11/16 inch (17.5 mm) **OR** 15/16 inch (24 mm) **OR** 1-3/16 inches (30 mm), **as directed**, o.c.
 - b. Bearing Bar Depth: 1 inch (25 mm) **OR** 1-1/4 inches (32 mm) **OR** 1-1/2 inches (38 mm) **OR** 1-3/4 inches (44 mm) **OR** 2 inches (51 mm) **OR** 2-1/4 inches (57 mm) **OR** 2-1/2 inches (64 mm) **OR** As required to comply with structural performance requirements, **as directed**.
 - c. Bearing Bar Thickness: 1/8 inch (3.2 mm) **OR** 3/16 inch (4.8 mm) **OR** 1/4 inch (6.4 mm) **OR** As required to comply with structural performance requirements, **as directed**.
 - d. Crossbar Spacing: 2 inches (51 mm) **OR** 4 inches (102 mm), **as directed**, o.c.
 - e. Grating Mark P-7-4 (1 x 1/8) ALUMINUM: 1-by-1/8-inch (25-by-3.2-mm) bearing bars at 7/16 inch (11 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - f. Grating Mark P-11-4 (1 x 3/16) ALUMINUM: 1-by-3/16-inch (25-by-4.8-mm) bearing bars at 11/16 inch (18 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - g. Grating Mark P-15-4 (1-1/2 x 3/16) ALUMINUM: 1-1/2-by-3/16-inch (38-by-4.8-mm) bearing bars at 15/16 inch (24 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - h. Grating Mark P-19-4 (2 x 3/16) ALUMINUM: 2-by-3/16-inch (51-by-4.8-mm) bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - i. Grating Mark: As indicated.
 - j. Traffic Surface: Plain **OR** Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive **OR** As indicated, **as directed**.
 - k. Aluminum Finish: Mill finish **OR** Class I, clear, anodized finish, **as directed**.
6. Pressure-Locked, Aluminum I-Bar Grating: Fabricated by swaging crossbars between bearing bars.
- a. Bearing Bar Spacing: 7/16 or 1/2 inch (11 or 13 mm) **OR** 11/16 inch (17 mm) **OR** 15/16 inch (24 mm) **OR** 1-3/16 inches (30 mm), **as directed**, o.c.
 - b. Bearing Bar Depth: 1 inch (25 mm) **OR** 1-1/4 inches (32 mm) **OR** 1-1/2 inches (38 mm) **OR** 1-3/4 inches (44 mm) **OR** 2 inches (51 mm) **OR** 2-1/4 inches (57 mm) **OR** 2-1/2 inches (64 mm) **OR** As required to comply with structural performance requirements, **as directed**.
 - c. Bearing Bar Flange Width: 1/4 inch (6.4 mm).
 - d. Crossbar Spacing: 2 inches (51 mm) **OR** 4 inches (102 mm), **as directed**, o.c.
 - e. Grating Mark P-11-4 (1 I-Bar) ALUMINUM: 1-inch (25-mm) I-bar bearing bars at 11/16 inch (18 mm) o.c., and crossbars at 4 inches (102 mm) o.c.



- f. Grating Mark P-15-2 (1 I-Bar) ALUMINUM: 1-inch (25-mm) I-bar bearing bars at 15/16 inch (24 mm) o.c., and crossbars at 2 inches (51 mm) o.c.
- g. Grating Mark P-19-4 (1-1/2 I-Bar) ALUMINUM: 1-1/2-inch (38-mm) I-bar bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
- h. Grating Mark: As indicated.
- i. Traffic Surface: Plain **OR** Grooved **OR** Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive **OR** As indicated, **as directed**.
- j. Aluminum Finish: Mill finish **OR** Class I, clear, anodized finish, **as directed**.
7. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.
 - a. Provide no fewer than four weld lugs for each heavy-duty grating section, with each lug shop welded to two bearing bars.
 - b. Provide no fewer than four saddle clips for each grating section composed of rectangular bearing bars 3/16 inch (4.8 mm) or less in thickness and spaced 15/16 inch (24 mm) or more o.c., with each clip designed and fabricated to fit over two bearing bars.
 - c. Provide no fewer than four weld lugs for each grating section composed of rectangular bearing bars 3/16 inch (4.8 mm) or less in thickness and spaced less than 15/16 inch (24 mm) o.c., with each lug shop welded to three or more bearing bars. Interrupt intermediate bearing bars as necessary for fasteners securing grating to supports.
 - d. Provide no fewer than four flange blocks for each section of aluminum I-bar grating, with block designed to fit over lower flange of I-shaped bearing bars.
 - e. Furnish threaded bolts with nuts and washers for securing grating to supports.
 - f. Furnish self-drilling fasteners with washers for securing grating to supports.
 - g. Furnish galvanized malleable-iron flange clamp with galvanized bolt for securing grating to supports. Furnish as a system designed to be installed from above grating by one person.
8. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
 - a. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.
9. Do not notch bearing bars at supports to maintain elevation.
- G. Expanded-Metal Gratings
 1. Provide expanded-metal gratings in material, finish, style, size, thickness, weight, and type indicated or, if not indicated, as recommended by manufacturer for indicated applications and as needed to support indicated loads.
 - a. Material: Steel **OR** Stainless steel **OR** Aluminum, **as directed**.
 - b. Steel Finish: Unfinished, oiled **OR** Shop primed **OR** Galvanized, **as directed**.
 - c. Stainless-Steel Finish: Mill finish, as fabricated.
 - d. Aluminum Finish: Mill finish, as fabricated.
 - e. Style Designation (for steel): 4.27 lb **OR** 3/4 number 9, **as directed**.
 - f. Style Designation (for stainless steel): 1-1/2 number 9 **OR** 3/4 number 9, **as directed**.
 - g. Size (for aluminum): 2 lb **OR** 3/4 0.188 **OR** 1-1/2 0.125, **as directed**.
 - h. Type: I, expanded **OR** II, expanded and flattened, **as directed**.
 2. Fabricate cutouts in grating sections for penetrations of sizes and at locations indicated. Cut openings neatly and accurately to size. Edge-band openings with bars having a thickness not less than overall grating thickness at contact points.
 3. Where gratings are pierced by pipes, ducts, and structural members, cut openings neatly and accurately to size and weld a strap collar not less than 1/8 inch (3 mm) thick to the cut ends. Divide panels into sections only to extent required for installation where grating platforms and runways are to be placed around previously installed pipe, ducts, and structural members.
- H. Formed-Metal Plank Gratings
 1. C-shaped channels rolled from heavy sheet metal of thickness indicated, and punched in serrated diamond shape to produce raised slip-resistant surface and drainage holes.



- a. Channel Width: 4-3/4 inches (121 mm) **OR** 7 inches (178 mm) **OR** 9-1/2 inches (241 mm) **OR** 11-3/4 inches (298 mm) **OR** 18-3/4 inches (476 mm) **OR** 24 inches (610 mm) **OR** As indicated **OR** As required to comply with structural performance requirements, **as directed**.
 - b. Channel Depth: 1-1/2 inches (38 mm) **OR** 2 inches (51 mm) **OR** 2-1/2 inches (64 mm) **OR** 3 inches (76 mm) **OR** As indicated **OR** As required to comply with structural performance requirements, **as directed**.
 - c. Material: 0.074-inch- (1.9-mm-) thick steel sheet, shop primed **OR** 0.104-inch- (2.65-mm-) thick steel sheet, shop primed **OR** 0.079-inch- (2.0-mm-) thick, hot-dip galvanized-steel sheet **OR** 0.108-inch- (2.8-mm-) thick, hot-dip galvanized-steel sheet **OR** 0.074-inch- (1.9-mm-) thick steel sheet, hot-dip galvanized after fabrication **OR** 0.104-inch- (2.65-mm-) thick steel sheet, hot-dip galvanized after fabrication **OR** 0.062-inch- (1.6-mm-) thick, stainless-steel sheet **OR** 0.078-inch- (2.0-mm-) thick, stainless-steel sheet **OR** 0.080-inch- (2.0-mm-) thick aluminum sheet **OR** 0.100-inch- (2.5-mm-) thick aluminum sheet, **as directed**.
2. Fabricate cutouts in grating sections for penetrations of sizes and at locations indicated. Cut openings neatly and accurately to size. Edge-band openings with metal sheet or bars having a thickness not less than grating material.
 3. Where gratings are pierced by pipes, ducts, and structural members, cut openings neatly and accurately to size and weld a strap collar not less than 1/8 inch (3 mm) thick to the cut ends. Divide panels into sections only to extent required for installation where grating platforms and runways are to be placed around previously installed pipe, ducts, and structural members.
- I. Extruded-Aluminum Plank Gratings
1. Provide extruded-aluminum plank gratings in type, size, and finish indicated or, if not indicated, as recommended by manufacturer for indicated applications and as needed to support indicated loads.
 - a. Type: Extruded-aluminum planks approximately 6 inches (152 mm) wide with multiple flanges approximately 1.2 inches (30 mm) o.c., acting as bearing bars connected by a web that serves as a walking surface. Top surface has raised ribs to increase slip resistance.
 - b. Depth: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (51 mm) **OR** As required to comply with structural performance requirements, **as directed**.
 - c. Perforations: None **OR** Rectangular, 19/32 by 3 inches (15 by 76 mm), with adjacent rows staggered **OR** 19/32 inch (15 mm) square, with adjacent rows aligned, **as directed**.
 - d. Finish: Mill finish, as fabricated.
 2. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
- J. Glass-Fiber-Reinforced Plastic Gratings
1. Molded Glass-Fiber-Reinforced Gratings: Bar gratings made by placing glass-fiber strands that have been saturated with thermosetting plastic resin in molds in alternating directions to form interlocking bars without voids and with a high resin content.
 - a. Configuration: 1-1/2-inch- (38-mm-) square mesh, 1 inch (25 mm) thick **OR** 1-1/2-inch- (38-mm-) square mesh, 1-1/4 inches (32 mm) thick **OR** 1-1/2-inch- (38-mm-) square mesh, 1-1/2 inches (38 mm) thick **OR** 2-inch- (51-mm-) square mesh, 2 inches (51 mm) thick **OR** 1-1/2-inch- (38-mm-) square mesh, thickness as required to comply with structural performance requirements **OR** As required to comply with structural performance requirements, **as directed**.
 - b. Weight: 2.5 lb/sq. ft. (12.2 kg/sq. m) **OR** 2.7 lb/sq. ft. (13.2 kg/sq. m) **OR** 3.2 lb/sq. ft. (15.6 kg/sq. m) **OR** 3.5 lb/sq. ft. (17.1 kg/sq. m) **OR** 3.7 lb/sq. ft. (18.1 kg/sq. m) **OR** 4.1 lb/sq. ft. (20.0 kg/sq. m) **OR** 5.0 lb/sq. ft. (24.4 kg/sq. m), **as directed**.
 - c. Resin: Polyester **OR** Vinylester, **as directed**.
 - 1) Flame-Spread Index: 25 or less when tested according to ASTM E 84.
 - 2) U.S.D.A. Acceptance: Accepted for food-processing applications.
 - d. Color: Beige **OR** Gray **OR** Green **OR** Orange **OR** Yellow **OR** Manufacturer's standard, **as directed**.
 - e. Traffic Surface: Plain, meniscus **OR** Applied abrasive finish **OR** As indicated, **as directed**.



2. Pultruded Glass-Fiber-Reinforced Gratings: Bar gratings assembled from components made by simultaneously pulling glass fibers and extruding thermosetting plastic resin through a heated die under pressure to produce a product without voids and with a high glass-fiber content.
 - a. Configuration: I4010; 1-inch (25-mm) I-bars spaced 1 inch (25 mm) o.c. (40 percent open) **OR** I6010; 1-inch (25-mm) I-bars spaced 1-1/2 inches (38 mm) o.c. (60 percent open) **OR** I4015; 1-1/2-inch (38-mm) I-bars spaced 1 inch (25 mm) o.c. (40 percent open) **OR** I6015; 1-1/2-inch (38-mm) I-bars spaced 1-1/2 inches (38 mm) o.c. (60 percent open) **OR** T3320; 2-inch (51-mm) T-bars spaced 1-1/2 inches (38 mm) o.c. (33 percent open) **OR** T5020; 2-inch (51-mm) T-bars spaced 2 inches (51 mm) o.c. (50 percent open) **OR** As required to comply with structural performance requirements, **as directed**.
 - b. Weight: 2.35 lb/sq. ft. (11.5 kg/sq. m) **OR** 2.83 lb/sq. ft. (13.8 kg/sq. m) **OR** 3.10 lb/sq. ft. (15.1 kg/sq. m) **OR** 3.41 lb/sq. ft. (16.6 kg/sq. m) **OR** 4.10 lb/sq. ft. (20.0 kg/sq. m) **OR** 4.13 lb/sq. ft. (20.2 kg/sq. m), **as directed**.
 - c. Resin Type: Polyester **OR** Vinylester, **as directed**.
 - 1) Flame-Spread Index: 25 or less when tested according to ASTM E 84.
 - 2) U.S.D.A. Acceptance: Accepted for food processing applications.
 - d. Color: Beige **OR** Gray **OR** Green **OR** Orange **OR** Yellow **OR** Manufacturer's standard, **as directed**.
 - e. Traffic Surface: Plain, grooved **OR** Applied abrasive finish **OR** As indicated, **as directed**.
 3. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
- K. Grating Frames And Supports
1. Frames and Supports for Metal Gratings: Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.
 - a. Unless otherwise indicated, fabricate from same basic metal as gratings.
 - b. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors 24 inches (600 mm) o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches (32 mm) wide by 1/4 inch (6 mm) thick by 8 inches (200 mm) long.
 2. Frames and Supports for Glass-Fiber-Reinforced Plastic Gratings: Fabricate from glass-fiber-reinforced plastic shapes of sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.
 - a. Unless otherwise indicated, use shapes made from same resin as gratings.
 - b. Equip units indicated to be cast into concrete or built into masonry with integral anchors.
 3. Galvanize steel frames and supports in the following locations:
 - a. Exterior.
 - b. Interior, where indicated.
- L. Aluminum Finishes
1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 2. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
- M. Steel Finishes
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 2. Finish gratings, frames, and supports after assembly.
 3. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.



- a. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
4. Shop prime gratings, frames and supports not indicated to be galvanized unless otherwise indicated.
 - a. Shop prime with universal shop primer **OR** primers specified in Division 07, **as directed**, unless zinc-rich primer is **OR** primers specified in Division 09 Section "High-performance Coatings" are, **as directed**, indicated.
5. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning" **OR** SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning" **OR** requirements indicated below, **as directed**:
 - a. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - b. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - c. Items Indicated to Receive Primers Specified in Division 9 Section "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - d. Other Items: SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
6. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1.3 EXECUTION

A. Installation, General

1. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
2. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
3. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
4. Fit exposed connections accurately together to form hairline joints.
 - a. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
5. Attach toeplates to gratings by welding at locations indicated.
6. Field Welding: Comply with the following requirements:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
7. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Installing Metal Bar Gratings

1. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.
2. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.
3. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.



- C. Installing Expanded-Metal Gratings
 - 1. General: Comply with manufacturer's written instructions for installing gratings.
 - 2. Place units with straight edge of bond up and with long direction of diamond-shaped openings parallel to direction of span.
 - 3. Attach removable units to supporting members by bolting at 6-inch (150-mm) intervals.
 - 4. Attach nonremovable units to supporting members by welding unless otherwise indicated. Space welds at 6-inch (150-mm) intervals.
 - 5. Attach aluminum units to steel supporting members by bolting at 6-inch (150-mm) intervals.
 - 6. Butt edges parallel to long direction of diamond-shaped openings and weld at every second bond point. Place individual grating sections so diamonds of one piece are aligned with those of adjacent sections.
- D. Installing Metal Plank Gratings
 - 1. General: Comply with manufacturer's written instructions for installing gratings. Use manufacturer's standard anchor clips and hold-down devices for bolted connections.
 - 2. Attach removable units to supporting members by bolting at every point of contact.
 - 3. Attach nonremovable units to supporting members by welding unless otherwise indicated. Comply with manufacturer's written instructions for size and spacing of welds.
 - 4. Attach aluminum units to steel supporting members by bolting at side channels at every point of contact and by bolting intermediate planks at each end on alternate sides. Bolt adjacent planks together at midspan.
- E. Installing Glass-Fiber-Reinforced Plastic Gratings
 - 1. Comply with manufacturer's written instructions for installing gratings. Use manufacturer's standard stainless-steel anchor clips and hold-down devices for bolted connections.
- F. Adjusting And Cleaning
 - 1. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

OR

Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 07.
 - 2. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05 53 13 00



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Task	Specification	Specification Description
05 53 13 00	01 22 16 00	No Specification Required



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SECTION 05 58 16 00 - ORNAMENTAL FORMED METAL

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for ornamental formed metal. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Beam wraps.
 - b. Closures and trim.
 - c. Column covers.
 - d. Decorative-metal-clad, hollow-metal doors and frames.
 - e. Elevator cab and entrance finishes.
 - f. Escalator enclosures.
 - g. Filler panels at demountable partitions and/or between dissimilar construction.
 - h. Heating-cooling unit enclosures.
 - i. Lighting coves.
 - j. Metal base.
 - k. Mullion cladding.
 - l. Pipe system covers.
 - m. Pockets for window treatment.
 - n. Window stools.
 - o. Exterior fins.
 - p. Exterior formed-metal-shaped panels.
 - q. Exterior sunshades.
 - r. Exterior trellises.
 - s. Exterior window covers.
 - t. Metal shapes as part of roof construction.

C. Performance Requirements

1. Delegated Design: Design exterior decorative formed metal items, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Structural Performance: Decorative formed metal items, including anchors and connections, shall withstand the effects of gravity loads and the following loads and stresses without exceeding the allowable design working stress of materials involved and without exhibiting permanent deformation in any components:
 - a. Wind Loads on Exterior Items: As indicated on Drawings **OR** 20 lbf/sq. ft. (957 Pa) **OR** 30 lbf/sq. ft. (1436 Pa) **OR** As required to meet local Project requirements.
 - b. Live Loads on Heating-Cooling Unit Enclosures: 100 lbf/sq. ft. (4.8 kN/sq. m) or a concentrated load of 300 lbf (1.3 kN) on an area of 4 sq. in. (26 sq. cm), whichever produces the greater stress.
3. Seismic Performance: Exterior decorative formed metal items, including anchors and connections, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. Component Importance Factor is 1.0.
4. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.



- a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
5. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

D. Submittals

1. Product Data: For each type of product indicated. Include finishing materials.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
 - b. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
3. Shop Drawings: Show fabrication and installation details for decorative formed metal.
 - a. Include plans, elevations, component details, and attachments to other work.
 - b. Indicate materials and profiles of each decorative formed metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.
4. Samples: For each type of exposed finish required, prepared on 6-inch- (150-mm-) square Samples of metal of same thickness and material indicated for the Work.
5. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
6. Coordination Drawings: For decorative formed metal elements that house items specified in other Sections. Show dimensions of housed items, including locations of housing penetrations and attachments, and necessary clearances.
7. Qualification Data: For qualified Installer, fabricator, organic-coating applicator, anodic finisher, powder-coating applicator and professional engineer.
8. Mill Certificates: Signed by stainless-steel manufacturers certifying that products furnished comply with requirements.
9. Welding certificates.
10. Maintenance Data: For mirrorlike stainless-steel finish and statuary conversion coating copper-alloy finish to include in maintenance manuals.

E. Quality Assurance

1. Fabricator Qualifications: A firm experienced in producing decorative formed metal similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
2. Organic-Coating Applicator Qualifications: A firm experienced in successfully applying organic coatings of type indicated to metals of types indicated and that employs competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.
3. Anodic Finisher Qualifications: A firm experienced in successfully applying anodic finishes of type indicated and that employs competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.
4. Powder-Coating Applicator Qualifications: A firm experienced in successfully applying powder coatings of type indicated to metals of types indicated and that employs competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.
5. Installer Qualifications: Fabricator of products.
6. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - c. AWS D1.3, "Structural Welding Code - Sheet Steel."
 - d. AWS D1.6, "Structural Welding Code - Stainless Steel."



7. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling

1. Deliver decorative formed metal products wrapped in protective coverings and strapped together in suitable packs or in heavy-duty cartons. Remove protective coverings before they stain or bond to finished surfaces.
2. Store products on elevated platforms in a dry location.

G. Project Conditions

1. Field Measurements: Verify actual locations of walls, columns, beams, and other construction contiguous with decorative formed metal by field measurements before fabrication and indicate measurements on Shop Drawings.

H. Coordination

1. Coordinate installation of anchorages for decorative formed metal items. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
2. Coordinate installation of decorative formed metal with adjacent construction to ensure that wall assemblies, flashings, trim, and joint sealants, are protected against damage from the effects of weather, age, corrosion, and other causes.

1.2 PRODUCTS

A. Sheet Metal

1. General: Provide sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.
2. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
3. Aluminum Sheet: Flat sheet complying with ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of Alloy 5005-H32.
4. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating, either commercial steel or forming steel.
5. Steel Sheet: Uncoated, cold-rolled, ASTM A 1008/A 1008M, commercial steel, exposed or electrolytic zinc-coated, ASTM A 879/A 879M, with steel sheet substrate complying with ASTM A 1008/A 1008M, commercial steel, exposed.
6. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304 **OR** Type 316, **as directed**, stretcher-leveled standard of flatness.
7. Bronze Sheet: ASTM B 36/B 36M, Alloy UNS No. C28000 (muntz metal, 60 percent copper) or Alloy UNS No. C23000 (red brass, 85 percent copper).
8. Brass Sheet: ASTM B 36/B 36M, Alloy UNS No. C26000 (cartridge brass, 70 percent copper).
9. Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 temper.
10. Titanium Sheet: ASTM B 265, Grade 1.

B. Miscellaneous Materials

1. Gaskets: As required to seal joints in decorative formed metal and remain airtight **OR** weathertight, **as directed**; as recommended in writing by decorative formed metal manufacturer.
 - a. ASTM D 1056, Type 1, Class A, grade as recommended by gasket manufacturer to obtain seal for application indicated.
 - b. Closed-cell polyurethane foam, adhesive on two sides, release paper protected.
2. Sealants, Exterior: ASTM C 920; elastomeric silicone **OR** polyurethane **OR** polysulfide, **as directed**, sealant; of type, grade, class, and use classifications required to seal joints in



- decorative formed metal and remain weathertight; and as recommended in writing by decorative formed metal manufacturer.
3. Sealants, Interior: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834; of type and grade required to seal joints in decorative formed metal; and as recommended in writing by decorative formed metal manufacturer.
 - a. Use sealant that has a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 4. Filler Metal and Electrodes: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded or brazed and as necessary for strength, corrosion resistance, and compatibility in fabricated items.
 - a. Use filler metals that will match the color of metal being joined and will not cause discoloration.
 5. Fasteners: Fabricated from same basic metal and alloy as fastened metal unless otherwise indicated. Do not use metals that are incompatible with materials joined.
 - a. Provide concealed fasteners for interconnecting decorative formed metal items and for attaching them to other work unless otherwise indicated **OR** exposed fasteners are unavoidable or are the standard fastening method, **as directed**.
 - b. Provide Phillips **OR** tamper-resistant **OR** square or hex socket, **as directed**, flat-head machine screws for exposed fasteners unless otherwise indicated.
 6. Structural Anchors: For applications indicated to comply with certain design loads, provide chemical or torque-controlled expansion anchors with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
 7. Nonstructural Anchors: For applications not indicated to comply with design loads, provide powder-actuated fasteners **OR** metal expansion sleeve anchors **OR** metal-impact expansion anchors, **as directed**, of type, size, and material necessary for type of load and installation indicated, as recommended by manufacturer, unless otherwise indicated.
 8. Anchor Materials:
 - a. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
 - b. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) **OR** Group 2 (A4), **as directed**, stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
 9. Sound-Deadening Materials:
 - a. Insulation: Unfaced, mineral-fiber blanket insulation complying with ASTM C 665, Type I, and passing ASTM E 136 test.
 - b. Mastic: Cold-applied asphalt emulsion complying with ASTM D 1187.
 10. Backing Materials: Provided or recommended by decorative formed metal manufacturer.
 11. Laminating Adhesive: Adhesive recommended by metal fabricator that will fully bond metal to metal and that will prevent telegraphing and oil canning and is compatible with substrate and noncombustible after curing.
 - a. Contact Adhesive: VOC content of not more than 80 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Metal-to-Metal Adhesive: VOC content of not more than 30 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - c. Multipurpose Construction Adhesive: VOC content of not more than 70 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - d. Special-Purpose Contact Adhesive: (Contact adhesive used to bond melamine-covered board, metal, unsupported vinyl, ultrahigh molecular weight polyethylene, and rubber or wood veneer, 1/16 inch thick or less, to any surface): 250 g/L.
 12. Isolation Coating: Manufacturer's standard alkali-resistant coating **OR** bituminous paint **OR** epoxy coating, **as directed**.



C. Paints And Coatings

1. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
2. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
3. Lacquer for Copper Alloys: Clear, acrylic lacquer specially developed for coating copper-alloy products.
4. Shop Primers: Comply with Division 07 OR Division 09 Section(s) "High-performance Coatings", **as directed**.
5. Universal Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - a. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
6. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
7. Shop Primer for Galvanized Steel: Cementitious galvanized metal primer complying with MPI#26 **OR** Vinyl wash primer complying with MPI#80 **OR** Water-based galvanized metal primer complying with MPI#134, **as directed**.
8. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

D. Fabrication, General

1. Shop Assembly: Preassemble decorative formed metal items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
2. Coordinate dimensions and attachment methods of decorative formed metal items with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned unless otherwise indicated.
3. Form metal to profiles indicated, in maximum lengths to minimize joints. Produce flat, flush surfaces without cracking or grain separation at bends. Fold back exposed edges of unsupported sheet metal to form a 1/2-inch- (12-mm-) wide hem on the concealed side, or ease edges to a radius of approximately 1/32 inch (1 mm) and support with concealed stiffeners.
4. Increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as needed to provide surface flatness equivalent to stretcher-leveled standard of flatness and sufficient strength for indicated use.
 - a. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.
5. Build in straps, plates, and brackets as needed to support and anchor fabricated items to adjoining construction. Reinforce decorative formed metal items as needed to attach and support other construction.
6. Provide support framing, mounting and attachment clips, splice sleeves, fasteners, and accessories needed to install decorative formed metal items.
7. Where welding or brazing is indicated, weld or braze joints and seams continuously. Grind, fill, and dress to produce smooth, flush, exposed surfaces in which joints are not visible after finishing is completed.
 - a. Use welding and brazing procedures that will blend with and not cause discoloration of metal being joined.

E. Beam Wraps

1. Form beam wraps from metal of type and thickness indicated below. Fabricate to fit tightly to adjoining construction.
 - a. Aluminum Sheet: 0.063 inch (1.60 mm) **OR** Thickness required to comply with performance requirements, **as directed**.
 - 1) Finish: Baked enamel or powder coat **OR** Siliconized polyester **OR** High-performance organic coating **OR** Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
 - b. Steel Sheet: 0.060 inch (1.52 mm) **OR** Thickness required to comply with performance requirements, **as directed**.
 - 1) Finish: Factory primed **OR** Baked enamel **OR** Powder coat, **as directed**.



- c. Stainless-Steel Sheet: 0.050 inch (1.27 mm) **OR** Thickness required to comply with performance requirements, **as directed**.
 - 1) Finish: No. 2B **OR** No. 4 **OR** No. 6 **OR** No. 7 **OR** No. 8, **as directed**.
- 2. Fabricate with calk stop angle to retain backer rod and sealant.

F. Closures And Trim

- 1. Form closures and trim from metal of type and thickness indicated below. Fabricate to fit tightly to adjoining construction, with weathertight joints at exterior installations.
 - a. Aluminum Sheet: 0.063 inch (1.60 mm) **OR** Thickness required to comply with performance requirements, **as directed**.
 - 1) Finish: Baked enamel or powder coat **OR** Siliconized polyester **OR** High-performance organic coating **OR** Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
 - b. Galvanized-Steel Sheet: 0.052 inch (1.32 mm) **OR** Thickness required to comply with performance requirements, **as directed**.
 - 1) Finish: Factory primed **OR** Baked enamel **OR** Siliconized polyester **OR** High-performance organic coating **OR** Powder coat, **as directed**.
 - c. Steel Sheet: 0.048 inch (1.21 mm) **OR** Thickness required to comply with performance requirements, **as directed**.
 - 1) Finish: Factory primed **OR** Baked enamel **OR** Powder coat, **as directed**.
 - d. Closures and trim may be fabricated from prefinished metal sheet in lieu of finishing after fabrication provided unfinished edges are concealed from view and not exposed to weather.
- 2. Conceal fasteners where possible; otherwise, locate where they are as inconspicuous as possible. Size fasteners to support closures and trim, with fasteners spaced to prevent buckling or waviness in finished surfaces.
- 3. Drill and tap holes needed for securing closures and trim to other surfaces.
- 4. Incorporate gaskets where indicated or needed for concealed, continuous seal at abutting surfaces.
- 5. Miter or cope trim members at corners and reinforce with bent metal splice plates to form tight joints.

G. Column Covers

- 1. Spackled-Seam Type: Form column covers from 0.125-inch (3.2-mm) aluminum, rolled to radii indicated. Taper edges of adjoining pieces of column covers, for taping and spackling, to 0.094-inch (2.4-mm) thickness in approximately 1 inch (25 mm) of width. Punch tapered edges for gypsum board screws at 1/2 inch (12 mm) o.c., and mill grooves in tapered edge to improve bond with joint compound.
 - a. Support Framing: At vertical joints, provide 1-1/2-by-3-5/8-inch (38-by-89-mm) steel channel support posts formed from 0.040-inch (1.0-mm) galvanized steel.
 - b. Joint Treatment Materials: Provide joint treatment compounds and reinforcing tape complying with requirements in Division 9 Section "Gypsum Board."
- 2. Snap-Together Type: Form column covers to shapes indicated from metal of type and minimum thickness indicated below. Return vertical edges and bend to form hook that will engage continuous mounting clips.
 - a. Aluminum Sheet: 0.063 inch (1.60 mm) **OR** Thickness required to comply with performance requirements, **as directed**.
 - 1) Finish: Baked enamel or powder coat **OR** Siliconized polyester **OR** High-performance organic coating **OR** Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
 - b. Steel Sheet: 0.060 inch (1.52 mm) **OR** Thickness required to comply with performance requirements, **as directed**.
 - 1) Finish: Factory primed **OR** Baked enamel **OR** Powder coat, **as directed**.
 - c. Stainless-Steel Sheet: 0.050 inch (1.27 mm) **OR** Thickness required to comply with performance requirements, **as directed**.



- 1) Finish: No. 2B **OR** No. 4 **OR** No. 6 **OR** No. 7 **OR** No. 8, **as directed**.
 - d. Bronze Sheet: 0.051 inch (1.29 mm) **OR** Thickness required to comply with performance requirements, **as directed**.
 - 1) Finish: Buffed finish, lacquered **OR** Hand-rubbed finish, lacquered **OR** Statuary conversion coating over satin finish, **as directed**.
 - e. Brass Sheet: 0.051 inch (1.29 mm) **OR** Thickness required to comply with performance requirements, **as directed**.
 - 1) Finish: Buffed **OR** Hand-rubbed, **as directed**, finish, lacquered.
 - f. Column covers may be fabricated from prefinished metal sheet in lieu of finishing after fabrication provided unfinished edges are concealed from view.
 - g. Form returns at vertical joints to provide hairline V-joints.

OR

Form returns at vertical joints to provide 1/2-inch- (12-mm-) **OR** 3/4-inch- (18-mm-), **as directed**, wide reveal at joints. Provide snap-in metal filler strips at reveals that leave reveals 1/2 inch (12 mm) deep **OR** flush, **as directed**.

OR

Form returns at vertical joints to accommodate backer rod and sealant.
 - h. Fabricate column covers with hairline horizontal V-joints produced by forming returns on mating ends of column cover sections. Locate horizontal joints as indicated.

OR

Fabricate column covers without horizontal joints.

OR

Fabricate column covers with horizontal butt joints, tightly fitted and backed with a sleeve for field splicing with adhesive.

OR

Fabricate column covers with 1/2-inch- (12-mm-) wide, **as directed**, reveals at horizontal joints produced by forming returns on mating ends of column cover sections. Provide snap-in metal filler strips at reveals matching reveals at vertical joints. Locate horizontal joints as indicated.
 - i. Fabricate base **OR** ceiling, **as directed**, ring to match **OR** contrast with, **as directed**, column covers.
 - j. Fabricate with calk stop/stiffener ring.
 - k. Apply manufacturer's recommended sound-deadening insulation **OR** mastic, **as directed**, to backs of column covers.
- H. Decorative-Metal-Clad Doors And Frames
1. Laminate metal sheets, of type and thickness indicated below, to faces of hollow-metal doors and frames and elevator entrances where indicated:
 - a. Bronze Sheet: 0.040 inch (1.02 mm).
 - 1) Finish: Buffed finish, lacquered **OR** Hand-rubbed finish, lacquered **OR** Statuary conversion coating over satin finish, lacquered, **as directed**.
 - b. Brass Sheet: 0.040 inch (1.02 mm).
 - 1) Finish: Buffed **OR** Hand-rubbed, **as directed**, finish lacquered.
 - c. Stainless-Steel Sheet: 0.038 inch (0.95 mm).
 - 1) Finish: No. 2B **OR** No. 4 **OR** No. 6 **OR** No. 7 **OR** No. 8, **as directed**.
 - d. Titanium Sheet: 0.025 inch (0.64 mm).
 - 1) Finish: Dull **OR** Bright, **as directed**, matte.
- I. Escalator Enclosures
1. Form escalator enclosures from metal of type and thickness indicated below. Coordinate size of enclosures, location of cutouts, and method of attachment to adjoining construction.
 - a. Stainless-Steel Sheet: 0.062 inch (1.59 mm) **OR** Thickness required to comply with performance requirements, **as directed**.
 - 1) Finish: No. 2B **OR** No. 4 **OR** No. 6 **OR** No. 7 **OR** No. 8, **as directed**.
 - b. Bronze Sheet: 0.081 inch (2.05 mm) **OR** Thickness required to comply with performance requirements, **as directed**.



- 1) Finish: Buffed finish, lacquered **OR** Hand-rubbed finish, lacquered **OR** Statuary conversion coating over satin finish, **as directed**.

J. Filler Panels

1. Form filler panels for closing ends of partition systems and for other applications indicated. Form from two sheets of metal of type and thickness indicated below, separated by channels formed from the same material, producing a panel of same thickness as partitions **OR** mullions, **as directed**, unless otherwise indicated. Incorporate reveals, trim, and concealed anchorages for attaching to adjacent surfaces.
 - a. Galvanized-Steel Sheet: 0.064 inch (1.63 mm).
 - 1) Finish: Factory primed **OR** Baked enamel **OR** Siliconized polyester **OR** High-performance organic coating **OR** Powder coat, **as directed**.
 - b. Steel Sheet: 0.060 inch (1.52 mm).
 - 1) Finish: Factory primed **OR** Baked enamel **OR** Powder coat, **as directed**.
 - c. Filler panels may be fabricated from prefinished metal sheet in lieu of finishing after fabrication provided unfinished edges are concealed from view.
2. Fill interior of panel with sound-deadening insulation permanently attached to inside panel faces.
3. Adhesively attach gaskets to filler panel edges where they abut mullions or glazing. Use 1-inch- (25-mm-) square material, unless otherwise indicated, set approximately 1/4 inch (6 mm) into channeled edge of filler panel.
OR
Attach gaskets to all edges of panels that abut adjacent surfaces to form a continuous seal. Use compressible gaskets or mastic sealing tape, applied to center of panel edges to be concealed from view, unless otherwise indicated.
4. Do not mechanically fasten filler panels to mullions.

K. Heating-Cooling Unit Enclosures

1. Fabricate heating-cooling unit enclosures from metal of type and thickness indicated below:
 - a. Galvanized-Steel Sheet:
 - 1) Framing: 0.108 inch (2.74 mm) **OR** Thickness required to comply with performance requirements.
 - 2) Sills and Stools: 0.079 inch (2.01 mm) **OR** Thickness required to comply with performance requirements, **as directed**.
 - 3) Front Panels and Bases: 0.064 inch (1.63 mm).
 - 4) Concealed Panels and Trim: 0.040 inch (1.02 mm).
 - 5) Finish: Factory primed **OR** Baked enamel **OR** Siliconized polyester **OR** High-performance organic coating **OR** Powder coat, **as directed**.
 - b. Steel Sheet:
 - 1) Framing: 0.105 inch (2.66 mm) **OR** Thickness required to comply with performance requirements, **as directed**.
 - 2) Sills and Stools: 0.075 inch (1.90 mm) **OR** Thickness required to comply with performance requirements, **as directed**.
 - 3) Front Panels and Bases: 0.060 inch (1.52 mm).
 - 4) Concealed Panels and Trim: 0.036 inch (0.91 mm).
 - 5) Finish: Factory primed **OR** Baked enamel **OR** Powder coat, **as directed**.
2. Weld seams and connections unless otherwise indicated or unless other methods are necessary for access to heating and cooling equipment.
3. Incorporate stiffeners or laminated backing using noncombustible materials as needed for strength and rigidity.
 - a. Fill space between stiffeners with sound-deadening insulation attached to face sheet with insulation adhesive unless otherwise indicated.
OR
Coat concealed faces of metal panels more than 6 inches (150 mm) wide with a heavy coating of sound-deadening mastic applied at the minimum rate of 20 sq. ft./gal. (0.5 sq. m/L).



4. Provide louvers and grilles of size, type, and materials indicated.
 - a. For removable grilles, use modular units with recessed openings formed into surfaces of enclosures and without blank filler panels between grilles, so face panels and stools are continuous. Fabricate removable grilles and openings to precise tolerances to produce well-fitted assemblies free of warp or rattle, with grilles supported continuously along parallel edges and with tops flush with top of enclosure.
 5. Incorporate removable tops and fronts where indicated or needed for access to heating-cooling units and to piping, ductwork, controls, and electrical service, with panels and openings as follows:
 - a. Fabricate with a fitting tolerance of not less than 1/32 inch (0.8 mm) and not more than 1/16 inch (1.6 mm) at each edge, with face of panels flush with adjoining fixed surfaces of enclosure.
 - b. Form panels for easy removal without interfering with adjoining construction or furniture. Hold panels in place with concealed clips and hardware that prevent warp and rattle.
 6. Incorporate hinged access panels in enclosures for access to heating-cooling unit controls, as either separate elements or integrated with grille openings, as indicated or needed.
 7. Coordinate construction, configuration, and dimensions of enclosures with those of heating-cooling units. Provide support for heating-cooling units and controls where indicated. Provide blind knockouts and supports for piping, ductwork, control lines, electrical conduit, and wiring where indicated or needed.
 8. Locate fixed surfaces of enclosure to coincide precisely with window mullions and partition system terminations. Provide closures at ends of units, at recessed openings in base of units, and at other locations where needed to conceal unfinished wall or floor surfaces, piping, conduit, ductwork, or heating-cooling units.
 - a. Provide built-in partitions (bulkheads) within enclosures between heating-cooling units, located to coincide with mullions and partition system terminations. Seal partitions to faces of enclosures with compressible gaskets or mastic sealing tape, and cover both sides of partitions with sound-deadening insulation attached to partitions with insulation adhesive.
- L. Lighting Coves
1. Form lighting coves from metal of type and thickness indicated below. Coordinate size of coves, location of cutouts for electrical wiring, and method of attachment to adjoining construction.
 - a. Aluminum Sheet: 0.063 inch (1.60 mm).
 - 1) Finish: Baked enamel or powder coat **OR** Siliconized polyester **OR** High-performance organic coating **OR** Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
 - b. Galvanized-Steel Sheet: 0.052 inch (1.32 mm).
 - 1) Finish: Factory primed **OR** Baked enamel **OR** Siliconized polyester **OR** High-performance organic coating **OR** Powder coat, **as directed**.
 - c. Steel Sheet: 0.048 inch (1.21 mm).
 - 1) Finish: Factory primed **OR** Baked enamel **OR** Powder coat, **as directed**.
 - d. Fabricate light coves with hairline butt joints **OR** tapered edges for taping and spackling, **as directed**.
 - e. Provide mitered corners, factory welded with backplates **OR** factory endcaps, **as directed**.
 - f. Lighting coves may be fabricated from prefinished metal sheet in lieu of finishing after fabrication provided unfinished edges are concealed from view.
- M. Metal Base
1. Form metal base from metal of type and thickness indicated below:
 - a. Aluminum Sheet: 0.063 inch (1.60 mm).
 - 1) Finish: Baked enamel or powder coat **OR** Siliconized polyester **OR** High-performance organic coating **OR** Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
 - b. Stainless-Steel Sheet: 0.050 inch (1.27 mm).
 - 1) Finish: No. 2B **OR** No. 4 **OR** No. 6 **OR** No. 7 **OR** No. 8, **as directed**.

**N. Mullion Cladding**

1. Form mullion cladding from metal of type and thickness indicated below. Fabricate to fit tightly to adjoining construction.
 - a. Aluminum Sheet: 0.063 inch (1.60 mm).
 - 1) Finish: Baked enamel or powder coat **OR** Siliconized polyester **OR** High-performance organic coating **OR** Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
 - b. Galvanized-Steel Sheet: 0.052 inch (1.32 mm).
 - 1) Finish: Factory primed **OR** Baked enamel **OR** Siliconized polyester **OR** High-performance organic coating **OR** Powder coat, **as directed**.
 - c. Stainless-Steel Sheet: 0.050 inch (1.27 mm).
 - 1) Finish: No. 2B **OR** No. 4 **OR** No. 6 **OR** No. 7 **OR** No. 8, **as directed**.

O. Pipe System Covers

1. Form pipe system covers from metal of type and thickness indicated below. Coordinate size of covers, location of cutouts for piping, and method of attachment to adjoining construction.
 - a. Galvanized-Steel Sheet: 0.052 inch (1.32 mm).
 - 1) Finish: Factory primed **OR** Baked enamel **OR** Siliconized polyester **OR** High-performance organic coating **OR** Powder coat, **as directed**.
 - b. Steel Sheet: 0.048 inch (1.21 mm).
 - 1) Finish: Factory primed **OR** Baked enamel **OR** Powder coat, **as directed**.

P. Pockets For Window Treatment

1. Form pockets from metal of type and thickness indicated below, with end closures. Coordinate dimensions and attachment methods with window treatment equipment, window frames, ceiling suspension system, and other related construction to produce a coordinated, closely fitting assembly.
 - a. Aluminum Sheet: 0.063 inch (1.60 mm).
 - 1) Finish: Baked enamel or powder coat **OR** Siliconized polyester **OR** High-performance organic coating **OR** Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
 - b. Galvanized-Steel Sheet: 0.052 inch (1.32 mm).
 - 1) Finish: Factory primed **OR** Baked enamel **OR** Siliconized polyester **OR** High-performance organic coating **OR** Powder coat, **as directed**.
 - c. Steel Sheet: 0.048 inch (1.21 mm).
 - 1) Finish: Factory primed **OR** Baked enamel **OR** Powder coat, **as directed**.
 - d. Pockets for window treatment may be fabricated from prefinished metal sheet in lieu of finishing after fabrication provided unfinished edges are concealed from view.
2. Reinforce pockets for attaching window treatment equipment and hardware, or increase metal thickness.
3. Divide continuous pockets with built-in partitions located to separate adjoining drapery and blind units, to coincide with window mullions, and to receive filler panels at ends of partitions.

Q. Window Stools

1. Form window stools from metal of type and thickness indicated below, with end closures:
 - a. Aluminum Sheet: 0.063 inch (1.60 mm).
 - 1) Finish: Baked enamel or powder coat **OR** Siliconized polyester **OR** High-performance organic coating **OR** Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
 - b. Galvanized-Steel Sheet: 0.052 inch (1.32 mm).
 - 1) Finish: Factory primed **OR** Baked enamel **OR** Siliconized polyester **OR** High-performance organic coating **OR** Powder coat, **as directed**.
 - c. Stainless-Steel Sheet: 0.050 inch (1.27 mm) **OR** 1.3 mm, **as directed**.
 - 1) Finish: No. 2B **OR** No. 4 **OR** No. 6 **OR** No. 7 **OR** No. 8, **as directed**.
 - d. Bronze Sheet: 0.051 inch (1.29 mm).



- 1) Finish: Buffed finish, lacquered **OR** Hand-rubbed finish, lacquered **OR** Statuary conversion coating over satin finish, **as directed**.
 2. Weld seams at end closures.
OR
Braze seams at end closures.
 3. Apply sound-deadening insulation **OR** mastic, **as directed**, to underside of window stools.
- R. General Finish Requirements
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 2. Complete mechanical finishes of flat sheet metal surfaces before fabrication where possible. After fabrication, finish all joints, bends, abrasions, and other surface blemishes to match sheet finish.
 3. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
 4. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
 5. Finish items indicated on Drawings after assembly.
 6. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- S. Aluminum Finishes
1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 2. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
 3. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
 - a. Color: Champagne **OR** Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As selected from full range of industry colors and color densities, **as directed**.
 4. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 5. Siliconized Polyester Finish: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 6. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 **OR** AAMA 2605, **as directed**, and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

OR

High-Performance Organic Finish: Three **OR** Four, **as directed**, -coat fluoropolymer finish complying with AAMA 2605 and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

 - b. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.



T. Galvanized-Steel Sheet Finishes

1. Preparing Galvanized Items for Factory Priming: Thoroughly clean galvanized decorative formed metal of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
2. Preparing Galvanized Items for Factory Finishing: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
3. Repairing Galvanized Surfaces: Clean welds and abraded areas and repair galvanizing to comply with ASTM A 780.
4. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply shop primer to prepared surfaces of items unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
5. Factory-Painted Finish: Comply with Division 09 Section(s) "Exterior Painting" OR "High-performance Coatings", **as directed**.
 - a. Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
6. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
7. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm). Prepare, treat, and coat metal to comply with resin manufacturer's written instructions.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
8. Siliconized-Polyester Coating: Immediately after cleaning and pretreating, apply manufacturer's standard epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
9. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 **OR** AAMA 2605, **as directed**, and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

OR

High-Performance Organic Finish: Three **OR** Four, **as directed**, -coat fluoropolymer finish complying with AAMA 2605 and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

- a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

U. Steel Sheet Finishes

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."
2. Pretreatment: Immediately after cleaning, apply a conversion coating of type suited to organic coating applied over it.



3. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply shop primer to prepared surfaces of items unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 4. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 5. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm). Prepare, treat, and coat metal to comply with resin manufacturer's written instructions.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
- V. Stainless-Steel Finishes
1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 3. Bright, Cold-Rolled, Unpolished Finish: No. 2B.
 4. Directional Satin Finish: No. 4.
 5. Dull Satin Finish: No. 6.
 6. Satin, Reflective, Directional Polish: No. 7.
 7. Mirrorlike Reflective, Nondirectional Polish: No. 8 finish.
 8. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- W. Copper-Alloy Finishes
1. Finish designations for copper alloys comply with the system established for designating copper-alloy finish systems defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products."
 2. Buffed Finish: M21 (Mechanical Finish: buffed, smooth specular).
 3. Hand-Rubbed Finish: M31-M34 (Mechanical Finish: directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed).
 4. Medium-Satin Finish: M32 (Mechanical Finish: directionally textured, medium satin).
 5. Fine-Matte Finish: M42 (Mechanical Finish: nondirectional finish, fine matte).
 6. Buffed Finish, Lacquered: M21-O6x (Mechanical Finish: buffed, smooth specular; Coating: clear organic, air drying, as specified below).
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
 7. Hand-Rubbed Finish, Lacquered: M31-M34-O6x (Mechanical Finish: directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed; Coating: clear organic, air drying, as specified below).
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
 8. Medium-Satin Finish, Lacquered: M32-O6x (Mechanical Finish: directionally textured, medium satin; Coating: clear organic, air drying, as specified below).
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
 9. Fine-Matte Finish, Lacquered: M42-O6x (Mechanical Finish: nondirectional finish, fine matte; Coating: clear organic, air drying, as specified below).



- a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
- 10. Statuary Conversion Coating over Satin Finish: M31-C55 (Mechanical Finish: directionally textured, fine satin; Chemical Finish: conversion coating, sulfide), with color matching the Owner's sample.
- 11. Statuary Conversion Coating over Satin Finish, Lacquered: M31-C55-O6x (Mechanical Finish: directionally textured, fine satin; Chemical Finish: conversion coating, sulfide; Coating: clear, organic, air drying, as specified below) , with color matching the Owner's sample:
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).

X. Titanium Finishes

- 1. General: Fabricate items from finished titanium sheet, taking care not to damage finish during fabrication. Protect finish as needed during fabrication by applying a strippable, temporary protective covering.
- 2. Dull Matte Finish: Pickled and annealed.
- 3. Bright Matte Finish: Vacuum annealed.

1.3 EXECUTION

A. Examination

- 1. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative formed metal.
- 2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation

- 1. Locate and place decorative formed metal items level and plumb and in alignment with adjacent construction. Perform cutting, drilling, and fitting required to install decorative formed metal.
 - a. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.
- 2. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where needed to protect metal surfaces and to make a weathertight connection.
- 3. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.
- 4. Install concealed gaskets, joint fillers, insulation, sealants, and flashings, as the Work progresses, to make exterior decorative formed metal items weatherproof.
- 5. Install concealed gaskets, joint fillers, sealants, and insulation, as the Work progresses, to make interior decorative formed metal items soundproof or lightproof as applicable to type of fabrication indicated.
- 6. Corrosion Protection: Apply bituminous paint or other permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with substrate materials that are incompatible or could result in corrosion or deterioration of either material or finish.
- 7. Install decorative-formed-metal-clad doors and frames to comply with requirements specified in Division 08 Section "Hollow Metal Doors And Frames".
- 8. Apply joint treatment at joints of spackled-seam-type metal column covers. Comply with requirements in Division 09 Section "Gypsum Board".

C. Adjusting And Cleaning

- 1. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.



2. Clean copper alloys according to metal finisher's written instructions in a manner that leaves an undamaged and uniform finish matching approved Sample.
 3. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
 4. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 07 OR Division 09 Section(s) "High-performance Coatings" **OR** Division 07 AND Division 09 Section(s) "High-performance Coatings", **as directed**.
 5. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.
- D. Protection
1. Protect finishes of decorative formed metal items from damage during construction period. Remove temporary protective coverings at time of Final Completion.

END OF SECTION 05 58 16 00



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Task	Specification	Specification Description
05 59 65 00	01 22 16 00	No Specification Required
05 75 00 00	05 58 16 00	Ornamental Formed Metal



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SECTION 06 01 20 91 - WOOD RESTORATION

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for wood restoration. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Work Included

1. Provide labor, materials and equipment necessary to complete the work of this Section including, but not limited to the following:
 - a. Removal of exterior finish systems at areas of wood restoration or repair
 - b. Preservation and sealing of seams and joints
 - c. Removal of decayed and contaminated wood
 - d. Installation of borate wood preservatives
 - e. Installation of wood repair compound materials
2. Extent of wood restoration work is as required to meet Project requirements.

C. Submittals:

1. Product data, installation instructions, and general recommendations from manufacturer for types of repair required including technical data sheets defining performance properties.
2. Restoration Schedule: Submit schedule for each window, door, cornice, or area of wood trim to be restored, outlining in detail proposed restoration work to be performed on each component. Obtain written approval prior to commencement of repair work.
3. Certification that materials comply with local VOC limitations.
4. Qualification data for firms and persons specified in the "Quality Assurance" article to demonstrate their capabilities and experience. Include a list of completed projects with project name, address, names of Architects and Owners, and information specified.
 - a. Five (5) business days after bid opening, submit a written qualification and experience of all lead personnel for work on the Project. List project manager or foreman's name and experience relative to this Project.
 - b. All work shall be performed by persons whose qualifications have been submitted and approved.

D. Quality Assurance

1. Restorations Specialist: Work must be performed by a firm having not less than (5) years successful experience in comparable wood restoration work including work on at least three (3) buildings listed in the National Register of Historic Places under the direction of federal and state preservation agencies in the last five (5) years and employing personnel skilled in the restoration process and operations indicated.
 - a. Restoration Specialist firm must be acceptable to, or certified by, manufacturer of primary restoration materials.
 - b. Work associated with work of this section, including (but limited to) paint removal and substrate preparation, is to be performed by Installer of the work.
 - c. Only skilled workers who are thoroughly trained and experienced in wood repairs and restoration work at areas as noted, have the skills required for the work of this section, and are completely familiar with the materials and methods specified shall be used for wood restoration work.
 - d. At least one skilled worker shall be present at all times during the execution of the work and shall personally direct the wood repairs and restoration work.
 - e. In acceptance or rejection of the wood restoration work, no allowance will be made for lack of skill on the part of the workers.



2. Manufacturer: Obtain primary repair materials from a single manufacturer. Provide secondary materials as recommended by the manufacturer of the primary materials.

E. Delivery Storage And Handling

1. Deliver all materials in original unopened containers labeled with the manufacturer's name, brand name, item name and installation instructions.
2. Store materials in compliance with the manufacturer's requirements for temperature, maximum and minimum, and other conditions. Keep all materials under cover and dry. Protect against exposure to the weather.
3. Discard and remove from the job site any materials damaged in handling or storage and any materials that have been subjected to conditions contrary to the manufacturer's recommendations or whose maximum shelf life has expired.

F. Project Conditions

1. Lead: Existing paint may contain lead. Take all necessary precautions to ensure the safety of all persons engaged in removing lead-based paint and dispose of all residues generated from lead-based paint stripping in a legal manner in accordance with all local, state and federal codes.
2. Coordination: Coordinate wood repair with paint stripping so that the effected surfaces are exposed for a minimal time to avoid further damage to bare wood. Coordinate with painting so that all restored surfaces are primed as soon as possible after repair.
3. Weather: Proceed with the work of this section only when existing and foreseen weather conditions permit the work to be performed in accordance with the manufacturer's recommendations for temperature and humidity range, minimum and maximum.
4. Substrate Conditions: Do not proceed with product applications until substrates have been inspected and are determined to be in satisfactory conditions. Substrate moisture content shall not be in excess of 18% during preparation and application.
 - a. Remove all decayed wood to a clean, sound, unaffected substrate.
 - b. Remove all built up paints, and other debris to a clean sound substrate.
 - c. Remove all wood sawdust to a clean sound substrate.
5. Protection:
 - a. Use all necessary means to protect interior of building from all damage caused by precipitation and other environmental conditions during the work of the Section.
 - b. Protect all adjacent building surfaces from damage, staining or deterioration resulting from wood restoration work.
 - c. Protect the restoration work in progress to prevent further deterioration exposed wood surfaces. Protect the completed work until the time of final inspection and acceptance by the Owner.
6. Safety: Contractor shall use all means necessary to ensure that no person (whether involved in the work of the Section or not) is harmed or injured due to the work of this Section. Comply with all applicable laws codes and regulations.
7. Security: Coordinate work with the Owner's project manager to ensure that the building is secured at the end of each work period. Review security procedures with the Owner prior to proceeding with the work in this Section.

1.2 PRODUCTS

A. General

1. Compatibility: provide products recommended by the manufacturers to be fully compatible with indicated substrate.

B. Epoxy Repair Products

1. Epoxy repair materials shall consist of 2 separate systems, a 2 part low viscosity epoxy primer/coupling agent and a 2 part thixotropic paste meeting the manufacturer's criteria.
2. Manufacturer of Repair Products and Equipment



- a. Manufacturer: Subject to compliance with the requirements, provide product of the following or approved equal.
 - 1) Advanced Repair Technology
Cherry Valley, NY
 - 2) Window Care Systems
Pembroke, MA
 - 3) or approved equal
- C. Repair Products
 - 1. Low viscosity epoxy coupling/bonding agent
 - 2. Epoxy repair compound
 - 3. Injectable Borate gel
 - 4. Borate rods
- D. Paint Strippers
 - 1. Chemical Stripping Agent. Methylene chloride based, Thixotropic stripper
 - 2. Products: Subject to compliance with requirements, provide the following, or approved equal
 - a. 509 Stripper
 - b. ProSoCo
 - c. or approved equal
 - 3. Low Temperature heat gun or heat plate, no open flame.

1.3 EXECUTION

- A. Inspection
 - 1. Inspect all wood surfaces determine the extent of restoration and methods to be used.
 - a. The decision regarding the extent of required repair, and extent of profile replication work shall be final.
 - b. In wood surfaces where decay is present, determine the methods and treatment of repair.
 - c. Areas that do not attach existing profiles, determine the level of restoration and replication to be achieved.
 - 2. Joints, Joinery and edges: Check wood members at joints, seams and edges for:
 - a. Any open seams or failed conditions.
 - b. Wood moisture content.
 - c. The presence of wood decay, by probing surfaces.
 - 3. Sills and Trim
 - a. Inspect wood surfaces for natural defects (knots) cracks and checks.
 - b. Determine wood moisture content.
 - c. Probe for the presence for wood decay.
- B. Removal
 - 1. Removal of Finishes:
 - a. Remove all peeling and loose paint by scraping, taking care not to damage sound wood and profiles.
 - b. Strip all painted wood surface to bare wood, taking care not to damage sound wood and profiles by the application of stripping paste or by the use of a heat gun or plate
 - 1) Remove stripper and finishes as directed by manufacturer.
 - 2) Dispose of debris in accordance with approved methods.
 - c. Wash all surfaces with recommended neutralizing agents to remove any foreign particle, dust and chemical residue, allow surface to thoroughly dry.
- C. Preventative Systems
 - 1. Preservation and Sealing of seams and joints. Repair of wood "checking" due to weathering.
 - a. Open or failed seams and checks shall be dilated to a width of 3/16" and depth of 1/2".
 - b. Remove all decayed, soft and weathered wood.



- c. Check the moisture content and hardness of wood at and around the repair, maximum allowable moisture content 18%/0.
- d. Sand bare wood to remove all loose fibers, paint, compounds. Remove all sawdust and dirt.
- e. Pre-treat bare and sanded wood thoroughly with low viscosity epoxy coupling/bonding agent
- f. Allow coupling agent to penetrate wood surface for a minimum of 10 minutes and maximum of 30 minutes, or as recommended by the manufacturer. Avoid applying in direct sunlight
- g. Remove any excess bonding agent with absorbing paper
- h. Apply epoxy repair compound over epoxy bonding agent while still tacky.
- i. Epoxy compound shall have optimal contact with wood
- j. Avoid inclusion of air pockets during application
- k. Fill joints fill, even and smooth in one application
- l. Allow full cure time as specified by manufacturer before application of paint or varnish.
- m. After curing, sand surface even and smooth. Transitions and irregularities between wood and epoxy shall not be visible after sanding
- n. If required, smooth any remaining irregularities with an additional application of epoxy repair compound. Always sand between coats.

D. Curative Systems

1. Preservation and Repair of Damaged/Decayed Wood:
 - a. Remove all paint and other coatings from area to be repaired.
 - b. Remove all decayed soft and discolored wood, to sound bright unaffected material
 - c. Check area of removal to determine complete elimination of decayed material.
 - 1) Remaining wood should be even color without red-brown and/or gray spots.
 - 2) No soft wood, existing brittle compound, or other previous repair materials should remain.
 - d. Check moisture content and hardness of the wood in and around the repair area
 - 1) Moisture content of wood to be 18%/0 or less
 - e. Sand bare wood to remove all loose fibers, paint, compounds. Remove all sawdust and dirt.
 - f. Drill holes in effected area to receive borate gel and rods. Follow manufacturer's dose recommendations for dimensional lumber.
 - g. Inject recommended dose of borate gel. Gel should not come in contact with exposed wood surface.
 - h. Install borate rod in same hole as gel. Gel should not come in contact with exposed wood surface.
 - i. Pre-treat bare and sanded wood thoroughly with low viscosity epoxy coupling/bonding agent.
 - 1) Allow coupling/bonding agent to penetrate wood surface for a minimum of 10 minutes and maximum of 30 minutes, or as recommended by the manufacturer. Avoid applying in direct sunlight
 - 2) Remove any excess bonding agent with absorbing paper.
 - j. Apply epoxy repair compound over the uncured epoxy coupling agent.
 - 1) Epoxy fill shall have optimal contact with wood
 - 2) Avoid inclusion of air pockets during application
 - 3) Fill joints fill, even and smooth in one application
 - 4) Allow full cure time as specified by manufacturer before preparing for finishes.
 - k. After curing, sand surface even and smooth. Transitions and irregularities between wood and epoxy shall not be visible after sanding.
 - l. If required, smooth any remaining irregularities with an additional application of epoxy repair compound. Always sand between coats.

E. Adjustments: Repair or replace all defective work at no additional cost to the Owner.



END OF SECTION 06 01 20 91



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Task	Specification	Specification Description
06 05 73 13	01 22 16 00	No Specification Required



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SECTION 06 05 73 33 - WOOD DECKING

1.1 GENERAL

- A. Description Of Work
 - 1. This specification covers the furnishing and installation of materials for wood decking. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.
- B. Summary
 - 1. Section Includes:
 - a. Solid-sawn wood roof and floor decking.
 - b. Glued-laminated wood roof and floor decking.
- C. Submittals
 - 1. Product Data: For each type of product indicated.
 - a. For glued-laminated wood decking, include installation instructions and data on lumber, adhesives, and fabrication.
 - b. For preservative-treated wood products, include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
 - 2. LEED Submittals:
 - a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood used for decking complies with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
 - 1) Include statement indicating costs for each certified wood product.
 - b. Product Data for Credit EQ 4.1: For sealants and installation adhesives, including printed statement of VOC content.
 - c. Product Data for Credit EQ 4.4: For laminating adhesive used for glued-laminated decking, indicating that product contains no urea formaldehyde.
- D. Quality Assurance
 - 1. Standard for Solid-Sawn Wood Decking: Comply with AITC 112.
 - 2. Forest Certification: Provide wood decking produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- E. Delivery, Storage, And Handling
 - 1. Schedule delivery of wood decking to avoid extended on-site storage and to avoid delaying the Work.
 - 2. Store materials under cover and protected from weather and contact with damp or wet surfaces. Provide for air circulation within and around stacks and under temporary coverings. Stack wood decking with surfaces that are to be exposed in the final Work protected from exposure to sunlight.

1.2 PRODUCTS

- A. Wood Decking, General
 - 1. General: Comply with DOC PS 20 and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.
 - 2. Moisture Content: Provide wood decking with 15 **OR** 19, **as directed**, percent maximum moisture content at time of dressing.



B. Solid-Sawn Wood Decking

1. Decking Species: Alaska cedar **OR** Balsam fir **OR** Douglas fir-larch or Douglas fir-larch (North) **OR** Eastern spruce **OR** Hem-fir or hem-fir (North) **OR** Southern pine, **as directed**.
2. Decking Nominal Size: 2x6 **OR** 2x8 **OR** 3x6 **OR** 4x6, **as directed**.
3. Decking Grade:
 - a. Select(ed) **OR** Commercial, **as directed**, Decking.
OR
 Dense Standard **OR** Dense Select **OR** Select **OR** Dense Commercial **OR** Commercial, **as directed**, Decking.
OR
 Select(ed) Decking or Select Dex **OR** Commercial Decking or Commercial Dex, **as directed**.
4. Grade Stamps: Factory mark each item with grade stamp of grading agency. Apply grade stamp to surfaces that will not be exposed to view.
5. Face Surface: Rough sanded or wire brushed **OR** Saw textured **OR** Smooth, **as directed**.
6. Edge Pattern: Beaded edge **OR** Bullnosed **OR** Channel grooved **OR** Vee grooved, **as directed**.
7. Preservative Treatment: Pressure treat solid-sawn wood decking according to AWPAC31 with inorganic boron (SBX) and redry wood to 15 **OR** 19, **as directed**, percent maximum moisture content.

C. Glued-Laminated Wood Decking

1. Face Species: Alaska cedar **OR** Douglas fir-larch or Douglas fir-larch (North) **OR** Ponderosa pine **OR** Southern pine **OR** Western cedars or western cedars (North), **as directed**.
2. Decking Nominal Size: 2x6 **OR** 2x8 **OR** 3x6 **OR** 3x8 **OR** 4x6 **OR** 4x8 **OR** 5x6 **OR** 5x8, **as directed**.
3. Decking Configuration: For glued-laminated wood decking indicated to be of diaphragm design and construction, provide tongue-and-groove configuration that complies with research/evaluation report.
4. Face Grade:
 - a. Custom or Supreme: Clear face is required. Occasional pieces may contain a small knot or minor characteristic that does not detract from the overall appearance.
OR
 Decorative: Sound knots and natural characteristics are allowed, including chipped edge knots, short end splits, seasoning checks, and some pin holes. Face knot holes, stain, end splits, skip, roller split, and planer burn are not allowed.
OR
 Service: Face knot holes, stain, end splits, skip, roller split, planer burn, and other nonstrength-reducing characteristics are allowed. Strength-reducing characteristics are not allowed.
5. Face Surface: Rough sanded or wire brushed **OR** Saw textured **OR** Smooth, **as directed**.
6. Edge Pattern: Beaded edge **OR** Bullnosed **OR** Channel grooved **OR** Vee grooved, **as directed**.
7. Laminating Adhesive: Wet-use type complying with ASTM D 2559.
 - a. Use adhesive that contains no urea-formaldehyde resins.
8. Preservative Treatment: Pressure treat lumber before gluing according to AWPAC28 for aboveground use.
 - a. Use oxine copper (copper-8-quinolinolate) in a light petroleum solvent.
OR
 Use copper naphthenate in a light petroleum solvent.
OR
 Use waterborne preservative that is acceptable to authorities having jurisdiction and that contains no arsenic or chromium. After treating, redry wood to 15 **OR** 19, **as directed**, percent maximum moisture content.
OR
 Use preservative solution without water repellents or substances that might interfere with application of indicated finishes.

**OR**

After dressing and fabricating decking, apply copper naphthenate according to AWP A M4 to surfaces cut to a depth of more than 1/16 inch (1.5 mm).

D. Accessory Materials

1. Fasteners for Solid-Sawn Decking: Provide fastener size and type complying with decking standard for thickness of deck used.
2. Fasteners for Glued-Laminated Decking: Provide fastener size and type complying with requirements in "Installation" Article for installing laminated decking.
3. Nails: Common; complying with ASTM F 1667, Type I, Style 10.
4. Spikes: Round; complying with ASTM F 1667, Type III, Style 3.
5. Fastener Material: Hot-dip galvanized **OR** Stainless, **as directed**, steel.
6. Bolts for Anchoring Decking to Walls:
 - a. Carbon steel; complying with ASTM A 307 (ASTM F 568M) with ASTM A 563/A 563M hex nuts and, where indicated, flat washers, all hot-dip zinc coated, **as directed**.

OR

- a. Stainless steel; complying with ASTM F 593, Alloy Group 1 or 2 (ASTM F 738M, Grade A1 or A4); with ASTM F 594, Alloy Group 1 or 2 (ASTM F 836M, Grade A1 or A4) hex nuts and, where indicated, flat washers.
7. Installation Adhesive: For glued-laminated wood decking indicated to be of diaphragm design and construction, provide adhesive that complies with research/evaluation report.
 - a. Use adhesive that has a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
8. Sealant: Latex sealant compatible with substrates **OR** Elastomeric joint sealant complying with requirements in Division 07 Section "Joint Sealants" for Use NT (nontraffic) and for Uses M, G, A, and, as applicable to joint substrates indicated, O joint substrates, **as directed**.
 - a. Use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. Penetrating Sealer: Clear sanding sealer complying with Division 09 Section "Staining And Transparent Finishing" and compatible with topcoats specified for use over it.

E. Fabrication

1. Shop Fabrication: Where preservative-treated decking is indicated, complete cutting, trimming, surfacing, and sanding before treating.
2. Predrill decking for lateral spiking to adjacent units to comply with referenced decking standard.
3. Seal Coat: After fabricating and surfacing decking, apply a saturation coat of penetrating sealer in fabrication shop, **as directed**.

1.3 EXECUTION**A. Installation**

1. Install solid-sawn wood decking to comply with referenced decking standard.
 - a. Locate end joints for two-span continuous lay-up **OR** combination simple and two-span continuous lay-up **OR** controlled random lay-up **OR** lay-up indicated, **as directed**.
2. Install laminated wood decking to comply with manufacturer's written instructions.
 - a. Locate end joints for two-span continuous lay-up **OR** combination simple and two-span continuous lay-up **OR** controlled random lay-up **OR** lay-up indicated, **as directed**.
 - b. Nail each course of glued-laminated wood decking at each support with one nail slant nailed above the tongue and one nail straight nailed through the face.
 - 1) Use 12d nails for 2x6 and 2x8 decking.
 - 2) Use 30d nails for 3x6 and 3x8 decking.
 - 3) Use 60d nails for 4x6 and 4x8 decking. Predrill decking to prevent splitting.
 - 4) Use 30d tongue nails in bottom tongue and 3/8-inch (10-mm) face spikes for 5x6 and 5x8 decking. Predrill decking at spikes to prevent splitting.



- c. Slant nail each course of glued-laminated wood decking to the tongue of the adjacent course at 30 inches (750 mm) o.c. and within 12 inches (300 mm) of the end of each unit. Stagger nailing in adjacent courses 15 inches (380 mm).
 - 1) Use 6d nails for 2x6 and 2x8 decking.
 - 2) Use 8d nails for 3x6 and 3x8 decking.
 - 3) Use 10d nails for 4x6 and 4x8 decking.
 - 4) Use 16d nails for 5x6 and 5x8 decking.
 - d. Glue adjoining decking courses together by applying a 3/8-inch (10-mm) bead of adhesive on the top of tongues according to research/evaluation report.
 - 3. Anchor wood roof decking, where supported on walls, with bolts as indicated.
 - 4. Where preservative-treated decking must be cut during erection, apply a field-treatment preservative to comply with AWP A M4.
 - a. For solid-sawn decking, use inorganic boron (SBX).
 - b. For laminated decking, use copper naphthenate.
 - 5. Apply joint sealant to seal roof decking at exterior walls at the following locations:
 - a. Between decking and supports located at exterior walls.
 - b. Between decking and exterior walls that butt against underside of decking.
 - c. Between tongues and grooves of decking over exterior walls and supports at exterior walls.
- B. Adjusting
- 1. Repair damaged surfaces and finishes after completing erection. Replace damaged decking if repairs are not approved by the Owner.
- C. Protection
- 1. Provide temporary waterproof covering as the Work progresses to protect roof decking until roofing is applied.

END OF SECTION 06 05 73 33



SECTION 06 10 00 00 - CSF ROUGH CARPENTRY

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items at end of Section.06 10 00 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concealed blocking behind wall mounted items.
2. Sheathing material.
3. Wood treatment.
4. Building paper.

B. Section Includes:

1. Wood Framing.
2. Concealed blocking behind wall mounted items.
3. Sheathing material.
4. Wood treatment.
5. Building paper.

- C. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

D. Related Sections:

1. Section 061753 - Shop-Fabricated Wood Trusses: Roof trusses.

1.2 REFERENCES

A. American Lumber Standards Committee (ALSC):

1. Softwood Lumber Standards.

B. American Plywood Association (APA):

1. Grades and Standards.

C. American Society for Testing and Materials (ASTM):

1. ASTM A307 - Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
2. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

- D. American Wood Preservers Association(AWPA):
 - 1. AWP - C1 - All Timber Products - Preservative Treatment by Pressure Process.
 - 2. AWP - C15 - Wood for Commercial-Residential Construction Preservative Treatment by Pressure Processes.
 - 3. AWP - C20 - Structural Lumber - Fire-Retardant Treatment by Pressure Processes.
 - 4. AWP - C27 - Plywood - Fire-Retardant Treatment by Pressure Processes.
 - 5. AWP - P5 - Waterborne Preservatives.
- E. Underwriters' Laboratories, Inc. (UL):
 - 1. UL FR S - Fire Rated Treated Wood with Flame Spread and Smoke Developed Ratings of 25 or less in accordance with ASTM E84.
 - 2. UL 723 - Test for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Assurance/Control Submittals:
 - a. Certificates:
 - 1) Pressure Treated Wood: Certification from treating plant stating chemicals and process used and net amount of preservative retained are in conformance with specified standards.
 - 2) Preservative Treated Wood: Certification for water-borne preservative that moisture content was reduced to 19 percent maximum, after treatment.
 - 3) Fire-Retardant Treated Wood: Certification from treating plant stating that fire-retardant treatment materials comply with governing code, ordinances and requirements of local authority having jurisdiction, and treatment will not bleed through finished surfaces.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with the following agencies:
 - 1. Lumber Grading Agency: Certified by ALSC.
 - 2. Plywood Grading Agency: Certified by APA.
- B. Regulatory Requirements: Conform to applicable codes for fire-retardant treatment of wood surfaces for flame/smoke ratings.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
 - 1. Inspect wood materials for conformance to specified grades, species, and treatment at time of delivery to Project Site.
 - 2. Reject and return unsatisfactory wood materials.
- B. Provide facilities for handling and storage of materials to prevent damage to edges, ends and surfaces.
- C. Keep materials dry. Stack materials off ground minimum 12 inches or, if on concrete slab-on-grade, minimum 1-1/2 inches, fully protected from weather. Provide for air circulation within and around stacks and under temporary coverings.



- D. For materials pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Environmental Impact:
1. Formaldehyde: Products containing urea-formaldehyde will not be permitted.
 2. Wood pressure treatment products: Products containing chromium will not be permitted. Products containing arsenic will not be permitted.
 3. Use exterior plywood only. Interior plywood is not permitted.

NOTE TO SPECIFIER

Add FSC certification of products requirement where available and commonly specified.

4. All wood products to be FSC Certified.

PART 2 - PRODUCTS

2.1 LUMBER MATERIALS

- A. Lumber, finished 4 sides, 15 percent maximum moisture content. Each piece of lumber to be factory marked with type, grade, mill and grading agency.
1. Light framing: Construction grade Douglas fir or southern pine, appearance grade where exposed.
 2. Structural framing and timbers: No. 2 grade Douglas Fir, Southern Pine, or Spruce, appearance grade where exposed.
 3. Boards: Construction grade.

2.2 NAILERS, BLOCKING, FURRING AND SLEEPERS

- A. Wood for nailers, blocking, furring and sleepers: Construction grade, finished 4 sides, 15 percent maximum moisture content. Pressure preservative treat items in contact with roofing, flashing, waterproofing, masonry, concrete or the ground.

2.3 SHEATHING MATERIALS

- A. Plywood, APA rated for use and exposure:
1. Exterior wall sheathing: APA C-D rated 32/16 Sheathing, 1/2 inch minimal thickness, exterior type.
 2. Roof sheathing: APA rated 48/24 sheathing, 5/8 inch minimum thickness, exterior type.
 3. Backing panels: APA C-D plugged, 3/4 inch thick, exterior type.
 4. Security Ceiling: APA rated 48/24 sheathing, 5/8 inch minimum thickness, tongue and groove, exterior type.

2.4 BUILDING PAPER

- A. Asphalt saturated felt, non-perforated.



2.5 FASTENERS

- A. Fasteners: Provide manufacturers recommended power tools for each type of fastener.
1. Bolts, Nuts, Washers, Lag Screws, and Wood Screws: ASTM A307, Medium carbon steel; size and type to suit application; galvanized for treated wood; plain finish for other interior locations, of size and type to suit application, unless otherwise noted.
 2. Expansion Shield Fasteners: For anchorage of non-structural items to solid masonry and concrete.
 3. Powder or Pneumatically Activated Fasteners: For anchorage of non-structural items to steel.
 4. Fasteners for Wood and Plywood (over 1/2 inch) to Light Gage Metal Framing and Metal Deck (up to 1/8 inch thick):
 - a. Hilti PWH #3 with wings.
 - b. ITW TEKS/4 with wings.
 - c. Substitutions: Permitted
 5. Fasteners for Wood and Plywood (up to 2 inches thick) to Metal (from 1/8 inch to 1/4 inch thick):
 - a. Hilti PFH #4 with wings.
 - b. ITW TEKS/4 with wings.
 - c. Substitutions: Permitted
 6. Fasteners for Non-Structural Wood Members to Masonry: 1/4 inch diameter x 3-1/4 inch with phillips flat head.
 - a. Tapcon masonry anchors, by ITW Buildex.
 - b. Kwik-Con II fastener, by Hilti.
 - c. Substitutions: Permitted
 7. Fasteners for preservative treated lumber must be hot dipped galvanized, type 304 or 316 stainless steel, or zinc-polymer coated.

2.6 WOOD TREATMENT

NOTE TO SPECIFIER

Type B ACQ is primarily used for west coast species such as Douglas Fir and Western Hemlock due to ability to penetrate these denser woods. Type D ACQ is primarily used for pine species such as Southern Yellow Pine.

- A. Preservative Pressure Treated Lumber, Alkaline Copper Quat (ACQ): Type B, Ammoniacal Copper Quat or Type D, Amine Copper Quat.
1. Manufacturers:
 - a. Chemical Specialties, Incorporated, Charlotte, NC (800) 421-8661.
 - b. Arch Wood Protection, Inc., Smyrna, GA (770) 801-6600
 - c. Osmose Inc., Griffin, GA, (800) 241-0240
 2. Products:
 - a. CSI: "Preserve".
 - b. Arch Wood: "Natural Select"
 - c. Osmose: "Nature Wood"
 3. Impregnate lumber with preservative treatment conforming to AWPAC Standard C1 and P5. Apply the preservative in a closed cylinder by pressure process in accordance with AWPAC Standard C15.
 4. Retention of preservative:
 - a. Moderate service conditions (weather exposure): 0.25 pounds per cubic foot (oxide basis).
 - b. Severe conditions (constant contact with ground or water): 0.40 pounds per cubic foot (oxide basis).
 5. Remove excess moisture where shrinkage is a serious fault or where treated lumber will be in contact with plaster, or stucco, and where water-borne treated lumber is to be painted or stained.
 6. Lumber shall be dried to 15 to 19 percent moisture content after treatment, and material to be painted or stained shall have knots and pitch streaks sealed as with untreated wood.



7. Liberally brush freshly cut surfaces, bolt holes and machined areas with the same preservative in accordance with AWWPA Standard M4.
 8. Treatment material shall provide protection against termites and fungal decay and shall be registered for use as a wood preservative by the U. S. Environmental Protection Agency.
- B. Fire Retardant Treatment:
1. Manufacturers:
 - a. Chemical Specialties, Incorporated, Charlotte, NC (800) 421-8661.
 - b. Hickson Corporation, Smyrna, GA: (770) 801-6600.
 - c. Hoover Treated Wood Products, Incorporated, Thomson, GA: (800) 832-9663.
 2. Products:
 - a. CSI: "D-Blaze".
 - b. Hickson: "Dricon".
 - c. Hoover: "Pyro-Guard".
 3. Lumber and plywood shall be treated as follows:
 - a. Each piece of treated material shall bear the UL FR-S rating (flamespread and smoke developed less than 25) indicating compliance with an extended 30 minute tunnel test in accordance with ASTM E84 or UL 723.
 - b. After treatment, all lumber shall be dried to an average moisture content of 19 percent or less.
 - c. After treatment, all plywood, shall be dried to an average moisture content of 15 percent or less.
 - d. All treated material shall meet interior Type A requirements in AWWPA standard C-20 for lumber and C-27 for plywood.
 - e. Chemicals used to treat material shall be free of halogens, sulfates and formaldehyde.
- C. Wood Requiring Treatment:
1. Lumber, Preservative Treated: Nailers, blocking, stripping, and similar items in conjunction with roofing, flashing, and other construction. Sills, blocking, furring, stripping, and similar items in contact with masonry or concrete.

NOTE TO SPECIFIER

OPTION 1 AND 3: Use for CSF Medium Building and RSD.

2. Lumber, Fire Retardant Treated: Interior framing, furring, blocking, nailers, and miscellaneous exposed wood. Do not treat furring in contact with masonry or concrete.
3. Interior Plywood, Fire Retardant Treated: Exterior type plywood backing for electrical and telephone equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 1. Verify that spacing, direction and details of supports are correct to accommodate installation of blocking, backing, stripping, furring and nailing strips.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.



- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION - FRAMING

- A. Set structural members level and plumb, in correct position.
- B. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- C. Place horizontal members, crown side up.
- D. Construct load bearing framing and curb members full length without splices.
- E. Double members at openings as indicated on Drawings. Space short studs over and under opening to stud spacing.
- F. Construct double joist headers at ceiling openings and under wall stud partitions that are parallel to roof trusses. Frame rigidly into roof trusses.
- G. Bridge roof trusses as specified in Section 061753. Fit solid bridging at ends of members.
- H. Place full width continuous sill flashings under framed walls on cementitious foundations. Lap flashing joint 4 inches.
- I. Place sill gasket directly on sill flashing. Puncture gasket clean and fit tight to protruding foundation anchor bolts.
- J. Coordinate installation of wood decking and prefabricated wood trusses.
- K. Install miscellaneous blocking, nailing strips and framing where required as backing for attachment of wall mounted fixtures, cabinetwork, and other items, and as detailed on Drawings. Coordinate to allow proper attachment of work of other Sections.
 - 1. Secure in place using fasteners specified. Use only recommended power tools for placement of fasteners.
 - 2. Recess heads of fasteners below surface of wood members.
- L. Secure in place with appropriate fasteners. Use fasteners of correct size that will not penetrate members where opposite side will be exposed to view or require finishing. Do not split wood with fasteners; set panel products to allow expansion at joints.
- M. Construct members of continuous pieces of longest possible lengths.

3.3 INSTALLATION - PLYWOOD

- A. Secure roof sheathing with longer edge perpendicular to framing members and with ends staggered and sheet ends over bearing.
- B. Use sheathing clips between sheets between roof framing members or provide solid edge blocking between sheets.
- C. Secure wall sheathing with long dimension perpendicular to wall studs, with ends over firm bearing and staggered.



- D. Install plywood in combination single and two span continuous.
- E. Install telephone and electrical panel back boards with plywood sheathing material where required. Size the back board by 12 inches (25 cm) beyond size of electrical panel.

3.4 INSTALLATION - AIR INFILTRATION SEAL

- A. Place material horizontally over wall sheathing, minimum 2 inch (5 cm) overlap and 6 inch (15 cm) endlap; weather lap edges and ends; fasten to sheathing with corrosion resistant fasteners.

3.5 SITE TREATMENT OF WOOD MATERIALS

- A. Apply preservative treatment in accordance with manufacturer's published instructions.
- B. Brush apply two coats of preservative treatment on wood in contact with cementitious materials and roofing and related metal flashings. Treat site-sawn cuts.
- C. Allow preservative to dry prior to erecting members.

3.6 CONSTRUCTION

- A. Site Tolerances:
 - 1. Framing Members: 1/4 inch from true position, maximum.

3.7 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection.
- B. Framing Inspection:
 - 1. Inspect wood framing installation and connections at completion of each phase of wood construction for correct installation, nailing, connections, and fasteners.
 - 2. Inspect and verify that types and spacing of fasteners are installed in locations specified or indicated on Drawings.
 - 3. Inspect types, locations, and fasteners for structural metal framing connectors.
 - 4. Inspect types, locations, and connections of hold-down anchors.
 - 5. Inspect wood to steel beam connections.

NOTE TO SPECIFIER

Nailing Schedule below is taken from Table in Uniform Building Code. Nailing indicated is minimum, edit and modify as required for specific Project and authority having jurisdiction. Indicate nailing for other conditions and requirements on the Drawings and Framing Details.

3.8 SCHEDULE - NAILING

CONNECTION	NAILING
Joist to sill or girder, toenail	3 - 8d
Bridging to joist, toenail each end	2 - 8d
Bottom Plate to joist or blocking, face nail	16d at 16 inches o.c.
Top plate to stud, end nail	2-16d
Stud to bottom plate	4-8d, toenail or



	2-16d, end nail
Double studs, face nail	16d at 24 inches o.c.
Double top plates, face nail	16d at 16 inches o.c.
Top plates, laps and intersections, face nail	2 - 16d
Continuous header, two pieces	16d at 16 inches o.c. along each edge
Ceiling joists to plate, toenail	3 - 8d
Continuous header to stud, toenail	4 - 8d
Ceiling joists, laps over partitions, face nail	3 - 16d
Ceiling joists to parallel rafters, face nail	3 - 16d
Rafter to plate, toenail	3 - 16d
Built-up corner studs	16d at 24 inches o.c.
Built-up beams	20d at 32 inches o.c. at top and bottom staggered 2 - 20d at ends and at each splice

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



SECTION 06 10 53 00 - R&A MISCELLANEOUS ROUGH CARPENTRY FOR ROOF REPLACEMENT

MISCELLANEOUS ROUGH CARPENTRY FOR ROOF REPLACEMENT

NOTE TO SPECIFIER

*This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section. **Edit Section footer information only – do not edit Section contents.***

NOTE TO SPECIFIER

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7. No lines should be placed between paragraphs and sub-paragraphs, or between sub-paragraphs and other sub-paragraphs.

Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED



Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

PART 1 - GENERAL

1.1 SUMMARY

- A. Miscellaneous rough carpentry associated with roof replacement.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 024100 – Roof Removal and Substrate Preparation
- D. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 UNIT PRICES

- A. Provide unit prices for removal and replacement of existing damaged or deteriorated wood nailers and blocking not included in the Base Proposal.

1.4 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 - 1. American Wood Preservers Association (AWPA)
 - 2. American Wood Preservers Institute (AWPI)
 - 3. American National Standard Institute (ANSI)
 - 4. Western Wood Products Association (WWPA)

1.5 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.6 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed to install the specified products and is eligible to receive a manufacturer's warranty. The firm shall have a minimum of 5 years documented experience performing work equal or similar to the specified work.



- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather.
- B. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

PART 2 – PRODUCTS

2.1 WOOD NAILERS AND WOOD BLOCKING

- A. Species and Grade (for non-exposed use): Douglas Fir or Yellow Pine; WWPA Structural Joist and Plank Class, No. 2 Grade.
- B. For exposed wood blocking (such as rooftop conduit and pipe support):
 - 1. Preservative treated lumber: ACQ-treated or pressure-treated.
- C. Dimensions: As indicated on drawings or required by conditions encountered.

2.2 PLYWOOD

- A. Standards: PS 1/ANSI A199.1 for plywood panels.



- B. Grade: C-C EXT-APA.
- C. Dimensions: Thickness as indicated in drawings or specifications.

2.3 FASTENERS

- A. For securing wood to masonry: 1/4-inch diameter "Tapcon" screws or other fastener type suitable to adequately secure the wood to the building wall.
- B. For securing wood to wood: No. 14 fluorocarbon-coated screws, or double-dipped galvanized nails; length as necessary to penetrate minimum 1-1/4-inch depth into wood for screws and 1-1/2 inches into wood for nails.
- C. For fastening to ACQ-treated lumber: Stainless steel screws; size as necessary for conditions encountered.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.

3.2 WOOD NAILER AND BLOCKING INSPECTION/REPLACEMENT

- A. During roof removal, inspect exposed wood nailers and blocking for damage, deterioration, and other defects.
- B. To the extent indicated by the Owner, remove and discard damaged, deteriorated, or otherwise defective wood nailers and blocking and install new wood nailers and blocking to match the adjacent nailers and blocking in size and shape. Refer to Article 3.3 of this Section.

3.3 WOOD NAILER AND BLOCKING INSTALLATION

- A. Provide new wood nailers and blocking as follows:
 - 1. Where indicated on drawings.
 - 2. Where wood nailers and blocking were removed and discarded.
 - 3. Where conditions allow, for support beneath rooftop conduit and pipes.
 - 4. As necessary for other conditions encountered, such as raising curb heights to allow for minimum 8-inch flashing height.
- B. Wood securement to wood deck and building construction:
 - 1. Secure wood members with the specified fasteners at not more than 18-inches o.c., and, in addition, within 6 inches of each end, to adequately secure nailers to the deck or building construction.
- C. Wood securement to other wood nailers and blocking: Secure the top nailer(s) to the lower secured nailer with the specified nails or screws, of sufficient length to penetrate a minimum of 1-1/2 inches into the lower wood nailer (for nails) and 1-1/4 inches into the wood (for screws). Fasteners shall be spaced 18 inches o.c. and staggered. In addition, provide fasteners within 6



inches of all ends of nailers.

1. Within 10 feet of any outside building corner, reduce the indicated fastener spacing by one-half.

3.4 PLYWOOD INSTALLATION

- A. Install plywood at locations indicated on drawings or as required by conditions encountered.

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Last revised: 3/6/2013

NOTE TO SPECIFIER

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END OF SECTION 06 10 53 00



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Task	Specification	Specification Description
06 11 16 00	01 22 16 00	No Specification Required
06 15 13 00	06 05 73 33	Wood Decking



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SECTION 06 15 16 00 - R&A WOOD ROOF DECK REPAIR AND REPLACEMENT

NOTE TO SPECIFIER

*This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section. **Edit Section footer information only – do not edit Section contents.***

NOTE TO SPECIFIER

Include this Section for projects where roof replacement will occur over existing wood structural decks.

NOTE TO SPECIFIER

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SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
1. Sub-Paragraph
- a. Sub-Paragraph
- 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED



Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

PART 1 - GENERAL

1.1 SUMMARY

- A. Wood deck repair and replacement associated with roof replacement.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 024100 – Roof Removal and Substrate Preparation
- D. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 UNIT PRICES

- A. Provide unit prices for the work described in Articles 3.2 and 3.3.

1.4 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 - 1. American Wood Preservers Association (AWPA)
 - 2. American Wood Preservers Institute (AWPI)
 - 3. American National Standard Institute (ANSI)
 - 4. Western Wood Products Association (WWPA)

1.5 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.6 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed to install the specified products and is eligible to receive a manufacturer's warranty. The firm shall have a minimum of 5 years documented experience performing work equal or similar to the specified work.



- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.7 PRODUCT DELIVERY, HANDLING AND STORAGE

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform wood deck repair/replacement work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

PART 2 – PRODUCTS

2.1 WOOD DECK REPAIR/REPLACEMENT MATERIALS

- A. For use at "Wood Deck Inspection/Repair" outlined in Article 3.2:
 - 1. Steel plate: 16-gauge galvanized with pre-drilled holes for fasteners and plates.
 - 2. For securing wood to wood and wood to steel: No. 14 fluorocarbon-coated screws; length as necessary to penetrate minimum 1-inch depth through the deck.
 - 3. For securing wood to underlying structural steel (1/2-inch thick max.): 12-24 x 1-1/4 inch Hex Washer Head, Teks 5, or approved equal.
- B. For use at "Wood Deck Inspection/Replacement" outlined in Article 3.3:
 - 1. Replacement wood plank:



- a. Wood plank dimensions and type: As required by conditions encountered; Type, grade and species to match dimensions and type of existing wood plank deck.
- 2. Replacement plywood:
 - a. Plywood dimensions and type: As required by conditions encountered; Type, grade and species to match dimensions and type of existing wood plank deck.
- 3. Fasteners:
 - a. For securing wood to wood and wood to steel: No. 14 fluorocarbon-coated screws; length as necessary to penetrate minimum 1-inch depth through the deck.
 - b. For securing wood to underlying structural steel (1/2-inch thick max.): 12-24 x 1-1/4 inch Hex Washer Head, Teks 5, or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.

3.2 WOOD DECK INSPECTION AND REPAIR (*Unit Price Work*)

- A. Repair at openings caused by obsolete roof penetration removal or other defects less than 12" by 12" in size:
 - 1. At locations encountered and other locations indicated by the Owner, cover the existing opening with 16-gauge steel plate stock. Lap the plate a minimum of 8-inches beyond the opening on all sides. Fasten the steel plate with specified fasteners and plates 6-inches on center. Secure the plate a minimum of 2-inches in from the outside edge of the repair plate.

3.3 WOOD DECK INSPECTION AND REPLACEMENT (*Unit Price Work*)

- A. Prior to the start of work, inspect the interior area below the area of damaged wood roof deck. Remove items from the replacement area that may be damaged during work activities. Provide adequate interior protection to protect interior surfaces and finishes from damage prior to the start of work. The Contractor shall provide an "Interior Protection Representative" during replacement work.
- B. Inspect deck for structurally unsound or otherwise defective areas and for fastening deficiencies. Perform treatments as indicated:
 - 1. Remove defective decking and repair resultant openings:
 - a. Install replacement decking with the long dimension across the supports. Leave a 1/8-inch gap at all edges and end joints. Install shims as necessary between the replacement decking and the structural members to ensure that the replacement decking is flush with adjacent decking.
 - b. Mechanically attach the new wood decking to the underlying supports using the specified fasteners.
 - 2. Install additional fasteners where the existing fasteners missed the underlying supports or where the number of fasteners installed does not meet minimum code requirements.
 - 3. Remove loose or protruding nails or hammer them down flush with the deck surface.
- B. Sweep deck clean before installing new materials.



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NOTE TO SPECIFIER

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END OF SECTION 06 15 16 00



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SECTION 06 16 23 00 - SHEATHING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for sheathing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Wall sheathing.
 - b. Roof sheathing.
 - c. Composite nail base insulated roof sheathing.
 - d. Subflooring.
 - e. Underlayment.
 - f. Building paper.
 - g. Building wrap.
 - h. Sheathing joint-and-penetration treatment.
 - i. Flexible flashing at openings in sheathing.

C. Submittals

1. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - a. Include data for wood-preserved treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
 - b. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
 - c. For fire-retardant treatments specified to be High-Temperature (HT) type, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
 - d. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - e. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
 - f. For building wrap, include data on air-/moisture-infiltration protection based on testing according to referenced standards.
2. LEED Submittals:
 - a. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
 - b. Product Data for Credit EQ 4.4: For composite-wood products, documentation indicating that product contains no urea formaldehyde.
 - c. Certificates for Credit MR 7: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
 - 1) Include statement indicating costs for each certified wood product.
3. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
 - a. Preservative-treated plywood.
 - b. Fire-retardant-treated plywood.



- c. Foam-plastic sheathing.
- d. Building wrap.

D. Quality Assurance

1. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
2. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":
 - a. Plywood.
 - b. Oriented strand board.
 - c. Fiberboard wall sheathing.
 - d. Particleboard underlayment.
 - e. Hardboard underlayment.

E. Delivery, Storage, And Handling

1. Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

1.2 PRODUCTS

A. Wood Panel Products, General

1. Plywood: DOC PS 1 **OR** Either DOC PS 1 or DOC PS 2, unless otherwise indicated, **as directed**.
2. Oriented Strand Board: DOC PS 2.
3. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
4. Factory mark panels to indicate compliance with applicable standard.

B. Preservative-Treated Plywood

1. Preservative Treatment by Pressure Process: AWWA C9.
 - a. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
3. Application: Treat all plywood, unless otherwise indicated **OR** Treat items indicated on Drawings, **as directed**, and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

C. Fire-Retardant-Treated Plywood

1. General: Comply with performance requirements in AWWA C27.
 - a. Use treatment that does not promote corrosion of metal fasteners.
 - b. Use Exterior type for exterior locations and where indicated.
 - c. Use Interior Type A, High Temperature (HT) for roof sheathing and where indicated.
 - d. Use Interior Type A, unless otherwise indicated.
2. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
3. Identify fire-retardant-treated plywood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
4. Application: Treat all plywood, unless otherwise indicated **OR** Treat plywood indicated on Drawings, and the following, **as directed**:
 - a. Roof and wall sheathing within 48 inches (1220 mm) of fire **OR** party, **as directed**, walls.



- b. Roof sheathing.
 - c. Subflooring and underlayment for raised platforms.
- D. Wall Sheathing
- 1. Plywood Wall Sheathing: Exterior, Structural I **OR** Exterior **OR** Exposure 1, Structural I **OR** Exposure 1, **as directed**, sheathing.
 - 2. Oriented-Strand-Board Wall Sheathing: Exposure 1, Structural I **OR** Exposure 1, **as directed**, sheathing.
 - 3. Paper-Surfaced Gypsum Wall Sheathing: ASTM C 79/C 79M or ASTM C 1396/C 1396M, gypsum sheathing; with water-resistant-treated core and with water-repellent paper bonded to core's face, back, and long edges.
 - a. Type and Thickness: Regular, 1/2 inch (13 mm) **OR** Type X, 5/8 inch (15.9 mm), **as directed**, thick.
 - 4. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
 - a. Type and Thickness: Regular, 1/2 inch (13 mm) **OR** Type X, 5/8 inch (15.9 mm), **as directed**, thick.
 - 5. Cellulose Fiber-Reinforced Gypsum Sheathing: ASTM C 1278/C 1278M, gypsum sheathing.
 - a. Type and Thickness: Regular, 1/2 inch (13 mm) **OR** Type X, 5/8 inch (15.9 mm), **as directed**, thick.
 - 6. Fiberboard Wall Sheathing: ASTM C 208, Type IV, Grade 1 (Regular) **OR** 2 (Structural), **as directed**, cellulosic fiberboard sheathing with square edges, 1/2 inch (13 mm) **OR** 25/32 inch (20 mm), **as directed**, thick.
 - 7. Extruded-Polystyrene-Foam Wall Sheathing: ASTM C 578, Type IV, in manufacturer's standard lengths and widths with tongue-and-groove or shiplap long edges as standard with manufacturer.
 - a. Thickness: 3/4 inch (19 mm) **OR** 1 inch (25 mm) **OR** As indicated, **as directed**.
 - 8. Foil-Faced, Polyisocyanurate-Foam Wall Sheathing: ASTM C 1289, Type I, Class 2, aluminum-foil-faced, glass-fiber-reinforced, rigid, cellular, polyisocyanurate thermal insulation. Foam-plastic core and facings shall have a flame-spread index of 25 or less when tested individually.
 - a. Thickness: 7/16 inch (11.1 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (15.9 mm) **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm) **OR** As indicated, **as directed**.
- E. Roof Sheathing
- 1. Plywood Roof Sheathing: Exterior, Structural I **OR** Exterior **OR** Exposure 1, Structural I **OR** Exposure 1, **as directed**, sheathing.
 - 2. Oriented-Strand-Board Roof Sheathing: Exposure 1, Structural I **OR** Exposure 1, **as directed**, sheathing.
- F. Composite Nail Base Insulated Roof Sheathing
- 1. Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing: Rigid, cellular, polyisocyanurate thermal insulation with oriented strand board laminated to one face complying with ASTM C 1289, Type V.
 - 2. Vented, Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing:
 - a. Rigid, cellular, polyisocyanurate thermal insulation complying with ASTM C 1289, Type II, Class 1, with oriented strand board adhered to spacers on one face.
OR
Rigid, cellular, polyisocyanurate thermal insulation with oriented strand board laminated to one face complying with ASTM C 1289, Type V. Oriented-strand-board face has a second layer of oriented strand board adhered to it with spacers between.
 - 1) Polyisocyanurate-Foam Thickness: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 2-1/2 inches (64 mm) **OR** 3 inches (76 mm) **OR** 3-1/2 inches (89 mm) **OR** 4 inches (102 mm), **as directed**.
 - 2) Oriented-Strand-Board Nominal Thickness: 7/16 inch (11.1 mm) **OR** 5/8 inch (15.9 mm), **as directed**.
 - 3) Spacers: Wood furring strips or blocks not less than 3/4 inch (19 mm) thick and spaced not more than 12 inches (300 mm) **OR** 16 inches (400 mm) **OR** 24 inches (600 mm), **as directed**, o.c.



G. Subflooring And Underlayment

1. Plywood Combination Subfloor-Underlayment: DOC PS 1, Exterior, Structural I, C-C Plugged **OR** Exterior, C-C Plugged **OR** Exposure 1, Structural I, Underlayment **OR** Exposure 1, Underlayment, **as directed**, single-floor panels.
2. Oriented-Strand-Board Combination Subfloor-Underlayment: Exposure 1 single-floor panels.
3. Plywood Subflooring: Exterior, Structural I **OR** Exterior **OR** Exposure 1, Structural I **OR** Exposure 1, **as directed**, single-floor panels or sheathing.
4. Oriented-Strand-Board Subflooring: Exposure 1, Structural I sheathing **OR** single-floor panels or sheathing, **as directed**.
5. Underlayment, General: Provide underlayment in nominal thicknesses indicated or, if not indicated, not less than 1/4 inch (6.4 mm) over smooth subfloors and not less than 3/8 inch (9.5 mm) over board or uneven subfloors.
6. Plywood Underlayment for Resilient Flooring: DOC PS 1, Exterior A-C **OR** Exterior B-C **OR** Exterior, C-C Plugged **OR** Exposure 1 Underlayment, **as directed**, with fully sanded face.
7. Plywood Underlayment for Ceramic Tile: DOC PS 1, Exterior, C-C Plugged, not less than 5/8-inch (15.9-mm) nominal thickness, for ceramic tile set in organic **OR** epoxy, **as directed**, adhesive.
8. Plywood Underlayment for Carpet: DOC PS 1, Exterior, C-C Plugged **OR** Exposure 1, Underlayment **OR** Interior, Underlayment, **as directed**.
9. Particleboard Underlayment: ANSI A208.1, Grade PBU **OR** M-2, Exterior Glue, complying with dimensional tolerances and thickness swell requirements of Grade PBU, **as directed**.
10. Hardboard Underlayment: AHA A135.4, Class 4 (Service), Surface S1S; with back side sanded.

H. Fasteners

1. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - a. For roof and wall, **as directed**, sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M **OR** of Type 304 stainless steel, **as directed**.
2. Nails, Brads, and Staples: ASTM F 1667.
3. Power-Driven Fasteners: NES NER-272.
4. Wood Screws: ASME B18.6.1.
5. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
 - a. For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
6. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
 - a. For steel framing less than 0.0329 inch (0.835 mm) thick, attach sheathing to comply with ASTM C 1002.
 - b. For steel framing from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick, attach sheathing to comply with ASTM C 954.
7. Screws for Fastening Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117. Provide washers or plates if recommended by sheathing manufacturer.

I. Weather-Resistant Sheathing Paper

1. Building Paper:
 - a. ASTM D 226, Type 1 (No. 15 asphalt-saturated organic felt), unperforated.**OR**



- UBC Standard 14-1, Grade D (water-vapor-permeable, kraft building paper), except that water resistance shall be not less than 1 hour and water-vapor transmission shall be not less than 75 g/sq. m x 24 h.
2. Building Wrap: ASTM E 1677, Type I air retarder; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
 - a. Water-Vapor Permeance: Not less than 535 **OR** 152 **OR** 125 **OR** 63, **as directed**, g through 1 sq. m of surface in 24 hours per ASTM E 96, Desiccant Method (Procedure A).
 - b. Allowable UV Exposure Time: Not less than three months.
 3. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.
- J. Sheathing Joint-And-Penetration Treatment Materials
1. Sealant for Paper-Surfaced **OR** Glass-Mat, **as directed**, Gypsum Sheathing Board:
 - a. Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated, and complying with requirements for elastomeric sealants specified in Division 07 Section "Joint Sealants".

OR

Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing, and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
 2. Sheathing Tape for Glass-Mat Gypsum Sheathing Board: Self-adhering glass-fiber tape, minimum 2 inches (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing board and with a history of successful in-service use.
 3. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.
- K. Miscellaneous Materials
1. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 **OR** ASTM D 3498, **as directed**, that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.
 - a. Use adhesives that have a VOC content of 50 **OR** 70, **as directed**, g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.025 inch (0.6 mm) **OR** 0.030 inch (0.8 mm) **OR** 0.040 inch (1.0 mm), **as directed**.
 3. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.

1.3 EXECUTION

- A. Installation, General
1. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
 2. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.
 3. Securely attach to substrate by fastening as indicated, complying with the following:
 - a. NES NER-272 for power-driven fasteners.
 - b. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
 - c. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's "Uniform Building Code."



- d. Table 2305.2, "Fastening Schedule," in BOCA's "BOCA National Building Code."
- e. Table 2306.1, "Fastening Schedule," in SBCCI's "Standard Building Code."
- f. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."
- g. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's "International One- and Two-Family Dwelling Code."
- 4. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- 5. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- 6. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- 7. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

B. Wood Structural Panel Installation

- 1. General: Comply with applicable recommendations in APA Form No. E30S, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- 2. Fastening Methods: Fasten panels as indicated below:
 - a. Combination Subfloor-Underlayment:
 - 1) Glue and nail **OR** Nail, **as directed**, to wood framing.
 - 2) Screw to cold-formed metal framing.
 - 3) Space panels 1/8 inch (3 mm) apart at edges and ends.
 - b. Subflooring:
 - 1) Glue and nail **OR** Nail **OR** Nail or staple, **as directed**, to wood framing.
 - 2) Screw to cold-formed metal framing.
 - 3) Space panels 1/8 inch (3 mm) apart at edges and ends.
 - c. Wall and Roof Sheathing:
 - 1) Nail **OR** Nail or staple, **as directed**, to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
 - 2) Screw to cold-formed metal framing.
 - 3) Space panels 1/8 inch (3 mm) apart at edges and ends.
 - d. Underlayment:
 - 1) Nail **OR** Nail or staple, **as directed**, to subflooring.
 - 2) Space panels 1/32 inch (0.8 mm) apart at edges and ends.
 - 3) Fill and sand edge joints of underlayment receiving resilient flooring right before installing flooring.

C. Gypsum Sheathing Installation

- 1. Comply with GA-253 and with manufacturer's written instructions.
 - a. Fasten gypsum sheathing to wood framing with nails **OR** screws, **as directed**.
 - b. Fasten gypsum sheathing to cold-formed metal framing with screws.
 - c. Install boards with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
 - d. Install boards with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- 2. Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.
- 3. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not



- less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.
 - a. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards.
 - b. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- 4. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
 - a. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards.
 - b. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- D. Fiberboard Sheathing Installation
 - 1. Comply with ASTM C 846 and with manufacturer's written instructions.
 - 2. Fasten fiberboard sheathing panels to intermediate supports and then at edges and ends. Use galvanized roofing nails or galvanized staples, **as directed**; comply with manufacturer's recommended spacing and referenced fastening schedule. Drive fasteners flush with surface of sheathing and locate perimeter fasteners at least 3/8 inch (9.5 mm) from edges and ends.
 - 3. Install sheathing vertically with long edges parallel to, and centered over, studs. Install solid wood blocking where end joints do not occur over framing. Allow 1/8-inch (3-mm) open space between edges and ends of adjacent units. Stagger horizontal joints if any.
 - 4. Cover sheathing as soon as practical after installation to prevent deterioration from wetting.
- E. Foam-Plastic Sheathing Installation
 - 1. Comply with manufacturer's written instructions.
 - 2. Foam-Plastic Wall Sheathing: Install vapor-relief strips or equivalent for permitting escape of moisture vapor that otherwise would be trapped in stud cavity behind sheathing.
- F. Particleboard Underlayment Installation
 - 1. Comply with the National Particleboard Association's recommendations for type of subfloor indicated. Fill and sand gouges, gaps, and chipped edges. Sand uneven joints flush.
 - a. Fastening Method: Glue and nail **OR** Nail **OR** Nail or staple, **as directed**, underlayment to subflooring.
- G. Hardboard Underlayment Installation
 - 1. Comply with AHA's "Application Instructions for Basic Hardboard Products" and with hardboard manufacturer's written instructions for preparing and applying hardboard underlayment.
 - a. Fastening Method: Nail **OR** Nail or staple, **as directed**, underlayment to subflooring.
- H. Weather-Resistant Sheathing-Paper Installation
 - 1. General: Cover sheathing with weather-resistant sheathing paper as follows:
 - a. Cut back barrier 1/2 inch (13 mm) on each side of the break in supporting members at expansion- or control-joint locations.
 - b. Apply barrier to cover vertical flashing with a minimum 4-inch (100-mm) overlap, unless otherwise indicated.
 - 2. Building Paper: Apply horizontally with a 2-inch (50-mm) overlap and a 6-inch (150-mm) end lap; fasten to sheathing with galvanized staples or roofing nails.
 - 3. Building Wrap: Comply with manufacturer's written instructions.
 - a. Seal seams, edges, fasteners, and penetrations with tape.
 - b. Extend into jambs of openings and seal corners with tape.
- I. Sheathing Joint-And-Penetration Treatment



1. Seal sheathing joints according to sheathing manufacturer's written instructions.
 - a. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient quantity of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
 - b. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.
 - c. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

J. Flexible Flashing Installation

1. Apply flexible flashing where indicated to comply with manufacturers written instructions.
 - a. Prime substrates as recommended by flashing manufacturer.
 - b. Lap seams and junctures with other materials at least 4 inches (100 mm), except that at flashing flanges of other construction, laps need not exceed flange width.
 - c. Lap flashing over weather-resistant building paper at bottom and sides of openings.
 - d. Lap weather-resistant building paper over flashing at heads of openings.
 - e. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

K. Protection

1. Paper-Surfaced Gypsum Sheathing: Protect sheathing by covering exposed exterior surface of sheathing with weather-resistant sheathing paper securely fastened to framing. Apply covering immediately after sheathing is installed.

END OF SECTION 06 16 23 00



Task	Specification	Specification Description
06 16 33 00	06 16 23 00	Sheathing
06 16 43 00	06 16 23 00	Sheathing



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**SECTION 06 17 53 00 - CSF SHOP-FABRICATED WOOD TRUSSES****

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items at end of Section.06 17 53 00

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes:
 - 1. Shop fabricated wood trusses for roof framing.
 - 2. Bridging, bracing, and anchorage.
 - 3. Wood treatment.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

NOTE TO SPECIFIER

Edit DESIGN REQUIREMENTS below for roof live and dead loads.

1.2 DESIGN REQUIREMENTS

- A. Design Roof Live and Dead Load: [____] pounds per square foot with deflection limited to [1/240] [____] of span including ceiling load.
- B. Maximum Truss Clear Span: 60 feet.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Metal plate connectors and metal framing connectors.
 - 2. Shop Drawings: Indicate sizes and spacing of trusses and associated components, web and cord sizes, plate sizes, fastener descriptions and spacings, loads and truss cambers, lifting points, and framed openings. Include truss elevation showing chords, connection plates, bracing requirements and support conditions.



- a. Drawings signed and sealed by Professional Engineer licensed in State where Project is located.
- 3. Assurance/Control Submittals:
 - a. Design Data: Design calculations.
 - 1) Calculations signed and sealed by Professional Engineer licensed in State where Project is located
 - b. Inspection Report: Submit the following reports directly to Contracting Officer form Delegated Engineer, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements.
 - 1) Preparatory.
 - 2) Initial.
 - c. Certificate: Fabricator certificate indicating that Products meet or exceed specified requirements.
 - d. Qualification Documentation: Truss fabricator documentation of experience indicating compliance with specified qualification requirements.

1.4 QUALITY ASSURANCE

- A. Fabricator Experience: Company specializing in manufacture of prefabricated open web wood trusses with three years minimum experience.
- B. Regulatory Requirements: Conform to applicable local code for loads, seismic zoning, other governing load criteria, and fire retardant requirements.
- C. Truss Design, Fabrication, and Installation: In accordance with Truss Plate Institute I-95, DSB-89, HET-80, and HIB-91.
- D. Lumber Grading Agency: Certified by ALSC.
- E. Design trusses under direct supervision of Professional Structural Engineer experienced in design of this Work and licensed in State where Project is located.

NOTE TO SPECIFIER

Add FSC certification of products requirement where available and commonly specified.

- F. All wood products to be FSC Certified

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Handle and erect trusses in accordance with TPI HIB-91.
- C. Transport and store trusses in vertical position resting on bearing ends.
- D. Protect trusses from moisture, warpage, and distortion during transit and when stored. Stack materials off ground a minimum of 12 inches or concrete slab-on-grade a minimum of 1-1/2 inches on level, flat forms.
- E. Do not erect members until preparations to receive are completed including installation of miscellaneous metal and connecting hardware.



PART 2 - PRODUCTS

2.1 MATERIALS

- A. Lumber: PS 20; S4S.
 - 1. Non-Structural Framing (2 inches to 4 inches thick, 2 inches to 4 inches wide): Construction Grade, any species available in grade; maximum moisture content of 19 percent.
 - 2. Trusses: Douglas Fir, Hem-Fir graded by WWPA or WCLIB; Western Larch graded by WWPA or WCLIB; Southern Pine graded by SPIB or Spruce Pine graded by NLGA. Provide trusses all of the same species. Any grade of lumber fulfilling requirements indicated for species and stress ratings. Maximum moisture content of 19 percent for 2x at time of dressing.
- B. Fasteners: Galvanized for exterior, high humidity, and at treated wood locations; plain finish elsewhere; size and type to suit condition.
- C. Connector Plate Material: Steel complying with following requirements unless otherwise indicated; not less than 0.036 inch galvanized, coated thickness.
 - 1. Truss Connection Plates: Conform to TPI standards.
 - 2. Galvanized sheet steel: ASTM A 153.
 - 3. Electrolytic Zinc Coated Steel Sheet: ASTM A 591, Coating Class C, with minimum structural quality equivalent to ASTM A 153, Grade A.
- D. Truss Bridging: Type, size, and spacing recommended by truss manufacturer.

2.2 FABRICATION

- A. Fabricate trusses to achieve structural requirements specified.
- B. Brace wood trusses for support in accordance with TPI DSB-89.
- C. Cut truss members to accurate lengths, angles, and sizes to produce close fitting joints with wood-to-wood bearing in assembled units.
- D. Fabricate metal connector plates to size, configuration, thickness, and anchorage details required for types of joint design indicated.
- E. Assemble truss members in design configuration indicated using jigs or other means to ensure uniformity and accuracy of assembly with close fitting joints. Position members to produce design camber indicated. Provide camber in accordance with TPI standards.
- F. Connect truss members by means of metal connector plates accurately located and securely fastened to wood members by approved fasteners.

2.3 WOOD TREATMENT

- A. Wood Preservative (Pressure Treatment): AWPAC Treatment C2 using water borne preservative with 0.25 percent retainage. Non-corrosive to connector plates.
 - 1. Pressure treat items in contact with roofing, flashing, or masonry.
- B. Fire Retardant: AWPAC Treatment C20, Interior Type, chemically treated and pressure impregnated; capable of providing a maximum flame spread.
 - 1. Fire Retardant: Treat where indicated and where required by local code.



PART 3 - EXECUTION

3.1 ERECTION

- A. Install trusses in accordance with manufacturer's instructions, and TPI HIB-91, at spacing indicated on Drawings.
- B. Set members level and plumb, in correct position.
- C. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure plumb, and in true alignment until completion of erection and installation of permanent bracing.
- D. Place permanent bridging, bracing, and anchors to maintain trusses straight and in correct position before inducing loads.
- E. Do not field cut trusses.
- F. Place headers and supports to frame openings required.
- G. Frame openings between trusses with lumber.
- H. Coordinate placement of roof decking with work of this Section.

3.2 CONSTRUCTION

- A. Site Tolerances:
 - 1. Framing Members: 1/2 inch maximum from true position.

NOTE TO SPECIFIER

****REQUIRED ARTICLE (FIELD QUALITY CONTROL) IS INCLUDED BELOW. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

3.3 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Field Inspection:
 - 1. Delegated Engineer: Perform two inspections at Project Site.
 - a. Inspect building structure ready to receive roof truss erection just prior to start of roof truss erection.
 - b. Inspect at time roof trusses are being erected.
- C. Inspect roof truss installation, alignment, blocking and bridging, and connection to structure.

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Last revised: 4/12/2011



END OF SECTION



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Task	Specification	Specification Description
06 18 13 00	06 05 73 33	Wood Decking



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SECTION 06 20 00 00 - CSF FINISH CARPENTRY**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items at end of Section.06 20 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Interior running and standing trim.
 - 2. Adjustable shelving, shelf standards, and brackets.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 REFERENCES

- A. American Woodworking Institute (AWI):
 - 1. AWI AWQS - Architectural Woodwork Quality Standards, 6th Edition Version 1.0.
- B. United States Department of Commerce Product Standard (PS):
 - 1. PS 20 - American Softwood Lumber Standard.

1.3 QUALITY ASSURANCE

- A. Perform work in accordance with AWI Custom quality.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.

NOTE TO SPECIFIER

REQUIRED ARTICLE (Environmental Requirements) follows. Do not revise this Article, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer.



1.5 ENVIRONMENTAL REQUIREMENTS

A. Environmental Impact:

1. Formaldehyde: Products containing formaldehyde will not be permitted.

NOTE TO SPECIFIER

Add FSC certification of products requirement where available and commonly specified.

2. All wood products to be FSC Certified.

1.6 SITE ENVIRONMENTAL PROCEDURES

A. Indoor Air Quality:

1. Temporary ventilation: As specified in Section 013543 - Environmental Procedures.

PART 2 - PRODUCTS

2.1 ADJUSTABLE SHELVING

- A. Standards: adjustable, flush mount shelf standards. Style [], Finish [], MFR [].
- B. Standards: Brackets. Style [], Finish [], MFR [].
- C. Sheathing for Shelves: 3/4 inch thick x 24 inches deep in maximum possible length. Formaldehyde free board product sanded smooth and painted each side and each edge as specified in Section 099100 - Painting.
 1. PrimeBoard, Incorporated, Wahpeton, ND (701) 642-1152.
 2. Medite, Roseville, CA (800) 676-3339.
 3. Naturall Fibre Board, Minneapolis, KS (785) 392-9922.
 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- D. Fasteners: Size and type to suit application.

2.2 INTERIOR FINISH CARPENTRY

- A. Trim and boards for transparent finish: Rift sawn oak.
- B. Trim for painted finish: Softwood suitable for exposure and use.
- C. Sheathing : Formaldehyde free board product sanded smooth and painted each exposed side and each exposed edge as specified in Section 099100 - Painting.
 1. PrimeBoard, Incorporated, Wahpeton, ND (701) 642-1152.
 2. Medite, Roseville, CA (800) 676-3339.
 3. Naturall Fibre Board, Minneapolis, KS (785) 392-9922.
 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.



2.3 ACCESSORIES

- A. Adhesive: Type recommended by AWI to suit application. Low VOC
 - 1. Titebond by Franklin International, Columbus, OH, (800) 877-4583.
 - 2. Famowood/Famobond by Eclectic Products (800) 767-4667.
 - 3. Almighty Adhesive by American Formulating & Manufacturing (619) 239-0321.
 - 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Fasteners: Size and type to suit application.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions under provisions of Section 013100 – Project Management and Coordination.
- B. Site Verification of Conditions:
 - 1. Examine areas in which Work of this Section is to be performed.
 - 2. Verify that surfaces and site conditions are ready to receive Work.
- C. Report in writing to Construction Manager prevailing conditions that will adversely affect satisfactory execution of Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Install work in accordance with AWI AWQS, Section 1700 - Installation of Woodwork.
- B. Install Work plumb, level, and straight without distortion; use concealed shims. Scribe and cut Work to fit adjoining work. Anchor Work items to nailers or blocking or directly to substrate using concealed fasteners.
- C. Install shelving units, standards, and brackets at locations as indicated on Drawings.

3.3 ADJUSTING

- A. Adjust installed work. Test installed work for rigidity and ability to support loads.
- B. Adjust moving or operating parts to function smoothly and correctly.

3.4 CLEANING

- A. Section 017300 - Execution: Cleaning installed work.
- B. Clean shelves, hardware, fittings, and fixtures.



3.5 SITE ENVIRONMENTAL PROCEDURES

- A. Indoor Air Quality:
 - 1. Temporary ventilation: As specified in Section 013543 - Environmental Procedures.

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END OF SECTION



SECTION 06 25 16 00 - PANELING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for paneling. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Board paneling.
 - b. Flush wood paneling.
 - c. Plastic-laminate-clad flush paneling.
 - d. Stile and rail wood paneling.

C. Definitions

1. Paneling includes wood furring, blocking, and shims for installing paneling, unless concealed within other construction before paneling installation.

D. Submittals

1. Product Data: For each type of product indicated, including finishing materials and processes.
 - a. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
2. Shop Drawings: Show location of paneling, large-scale details, attachment devices, and other components. Include dimensioned plans and elevations.
 - a. For paneling produced from premanufactured sets, show finished panel sizes, set numbers, sequence numbers within sets, and method of cutting panels to produce indicated sizes.
 - b. For paneling veneered in fabrication shop, show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
 - c. Apply WI-certified compliance label to first page of Shop Drawings, **as directed**.
3. Samples:
 - a. Lumber and panel products for transparent finish, for each species and cut, finished on one side and one edge.
 - b. Veneer leaves representative of and selected from flitches to be used for transparent-finished paneling.
 - c. Veneer-faced panel products with or for transparent finish, for each species and cut. Include at least one face-veneer seam and finish as specified.
 - d. Lumber and panel products with shop-applied opaque finish, for each finish system and color, with 1/2 of exposed surface finished.
 - e. Plastic laminates, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish, with 1 sample applied to core material.
 - f. Corner pieces for stile and rail paneling, 18 inches (450 mm) high by 18 inches (450 mm) wide by 6 inches (150 mm) deep.
4. LEED Submittals:
 - a. Product Data for Credit EQ 4.1: For installation adhesives, including printed statement of VOC content.
 - b. Product Data for Credit EQ 4.4: For composite-wood products and fabrication adhesives, documentation indicating that products contain no urea formaldehyde.



- c. Product Data for Credit(s) MR 4.1 and MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
- d. Certificates for Credit MR 7: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
 - 1) Include statement indicating costs for each certified wood product.
- 5. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates **OR** WIC-certified compliance certificates, **as directed**.

E. Quality Assurance

- 1. Installer Qualifications: Fabricator of products.
- 2. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" **OR** WIC's "Manual of Millwork," **as directed**.
 - a. Provide AWI Quality Certification Program labels and certificates for woodwork, including installation.
 - b. Provide WIC-certified compliance labels and certificates for woodwork, including installation.
- 3. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.
- 4. Forest Certification: Provide paneling produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- 5. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling

- 1. Do not deliver paneling until painting and similar operations that could damage paneling have been completed in installation areas. If paneling must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

G. Project Conditions

- 1. Environmental Limitations: Do not deliver or install paneling until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.2 PRODUCTS

A. Materials

- 1. General: Provide materials that comply with requirements of AWI's **OR** WIC's, **as directed**, quality standard for quality grade specified, unless otherwise indicated.
- 2. Wood Products: Comply with the following:
 - a. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
 - b. Particleboard: ANSI A208.1, Grade M-2 **OR** M-2-Exterior Glue, **as directed**.
 - c. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.



- d. Softwood Plywood: DOC PS 1, Medium Density Overlay.
 - e. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.
 3. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.
 4. Adhesives: Do not use adhesives that contain urea formaldehyde.
 5. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement **OR** Contact cement **OR** PVA **OR** Urea formaldehyde **OR** Resorcinol, **as directed**.
 - a. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.
 6. VOC Limits for installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Wood Glues: 30 g/L.
 - b. Panel Adhesives: 50 g/L.
 - c. Contact Adhesive: 80 g/L.
 - d. Special Purpose Contact Adhesive (contact adhesive that is used to bond melamine covered board, metal, unsupported vinyl, Teflon, ultra-high molecular weight polyethylene, rubber or wood veneer 1/16 inch or less in thickness to any surface): 250 g/L.
- B. Fire-Retardant-Treated Materials
1. General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and that comply with requirements in this Article and with fire-test-response characteristics specified.
 - a. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or otherwise defective.
 - b. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 - c. Identify fire-retardant-treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
 2. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with performance requirements of AWWA C20 (lumber) and AWWA C27 (plywood). Use the following treatment type:
 - a. Exterior Type: Organic-resin-based formulation thermally set in wood by kiln drying.
 - b. Interior Type A: Low-hygroscopic formulation.
 - c. Mill lumber after treatment, within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking plant certified by testing and inspecting agency.
 - d. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
 - e. Kiln-dry materials before and after treatment to levels required for untreated materials.
 3. Fire-Retardant Particleboard: Panels complying with the following requirements, made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.
 4. Fire-Retardant Fiberboard: Medium-density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.
- C. Installation Materials
1. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, fire-retardant-treated, **as directed**, kiln-dried to less than 15 percent moisture content.



2. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

D. Fabrication, General

1. Paneling Grade: Provide Premium **OR** Custom **OR** Economy, **as directed**, grade paneling complying with referenced quality standard.
2. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
3. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
4. Arrange paneling in shop or other suitable space in proposed sequence for examination by the Owner. Mark units with temporary sequence numbers to indicate position in proposed layout.
 - a. Lay out one elevation at a time if approved by the Owner.
 - b. Notify the Owner seven days in advance of the date and time when layout will be available for viewing.
 - c. Provide lighting of similar type and level as that of final installation for viewing layout, unless otherwise approved by the Owner.
 - d. Rearrange paneling as directed by the Owner until layout is approved.
 - e. Do not trim end units and other nonmodular size units to less than modular size until after the Owner's approval of layout. Indicate trimming by masking edges of units with nonmarking material.
 - f. Obtain the Owner's approval of layout before start of assembly. Mark units and Shop Drawings with assembly sequence numbers based on approved layout.
5. Complete fabrication, including assembly and finishing, **as directed**, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
6. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

E. Board Paneling For Transparent Finish

1. Grade: Provide Premium **OR** Custom **OR** Economy, **as directed**.
2. Wood Species and Cut: Hickory, quarter sawn **OR** Red gum, plain sawn **OR** Western white pine, plain sawn **OR** Cypress, plain sawn, **as directed**.
3. Pattern: 1-by-6, vee joint, tongue and groove, 5-1/16-inch (129-mm) coverage **OR** 1-by-8, pickwick paneling (WWPA Pattern WP-2), 6-3/4-inch (172-mm) coverage **OR** 1-by-4, beaded ceiling, 3-3/16-inch (81-mm) coverage **OR** As indicated, **as directed**.
4. Shop fabricate board paneling in lengths to provide pieces that are uninterrupted by joints **OR** random-lengths, **as directed**. Machine edges of boards to provide joint profiles indicated.
5. Preassemble board paneling into largest units that can be delivered into installation areas using permanent or temporary backing members as indicated. To maximum extent possible, fabricate units in sizes determined by field measurements of existing conditions and that will avoid fitting in the field; make provision for separate scribing pieces to be fitted to adjoining finished surfaces. Provide shop-prepared detachable pieces for forming joints with other units at Project site and with other types of architectural woodwork.

F. Board Paneling For Opaque Finish

1. Grade: Provide Premium **OR** Custom **OR** Economy, **as directed**.
2. Wood Species: Eastern white pine, sugar pine, or western white pine **OR** Any closed-grain hardwood, **as directed**.



3. Pattern: 1-by-6, vee joint, tongue and groove, 5-1/16-inch (129-mm) coverage **OR** 1-by-8, pickwick paneling (WWPA Pattern WP-2), 6-3/4-inch (172-mm) coverage **OR** 1-by-4, beaded ceiling, 3-3/16-inch (81-mm) coverage **OR** As indicated, **as directed**.
 4. Shop fabricate board paneling in lengths to provide pieces that are uninterrupted by joints **OR** random-lengths, **as directed**. Machine edges of boards to provide joint profiles indicated.
 5. Preassemble board paneling into largest units that can be delivered into installation areas using permanent or temporary backing members as indicated. To maximum extent possible, fabricate units in sizes determined by field measurements of existing conditions and that will avoid fitting in the field; make provision for separate scribing pieces to be fitted to adjoining finished surfaces. Provide shop-prepared detachable pieces for forming joints with other units at Project site and with other types of architectural woodwork.
- G. Flush Wood Paneling For Transparent Finish
1. Grade: Provide Premium **OR** Custom **OR** Economy, **as directed**.
 2. Wood Species and Cut: White oak, rift sliced **OR** Cherry, plain sliced **OR** Butternut, plain sliced **OR** Avodire, quarter sliced, **as directed**.
 - a. Lumber Trim and Edges: At paneling fabricator's option, trim and edges indicated as solid wood (except moldings) may be either lumber or veneered construction of same species and cut as panel faces and compatible with grain and color of panel faces.
 3. Matching of Adjacent Veneer Leaves: Book **OR** Slip **OR** Random, **as directed** match.
 4. Matching within Panel Face: Running **OR** Balance **OR** Center-balance, **as directed**, match.
 5. Panel-Matching Method:
 - a. No matching is required between panels. Select and arrange panels for similarity of grain pattern and color between adjacent panels.
OR
Premanufactured sets used full width **OR** Premanufactured sets selectively reduced in width **OR** Sequence-matched, uniform-size sets **OR** Blueprint-matched panels and components, **as directed**, within each separate area.
 6. Vertical Panel-Matching Method: Continuous match; veneer leaves of upper panels are continuations of veneer leaves of lower panels **OR** Vertical book match; veneer leaves are individually book matched from lower panels to upper panels **OR** Vertical slip match; veneer leaves are individually slip matched from lower panels to upper panels **OR** Panel vertical book match; panels are book matched from lower panels to upper panels **OR** Panel vertical slip match; panels are slip matched from lower panels to upper panels, **as directed**.
 7. Panel Core Construction: Hardwood veneer-core plywood **OR** Particleboard or medium-density fiberboard **OR** Fire-retardant particleboard or fire-retardant, medium-density fiberboard, **as directed**.
 8. Exposed Panel Edges: Solid wood or wood veneer matching faces **OR** Legs of metal channels forming reveals **OR** Bronze flat bars 1/16 inch (1.6 mm) thick by depth of panels, **as directed**.
 9. Panel Reveals: Matte black plastic laminate **OR** Bronze sheet **OR** Stainless-steel sheet **OR** Bronze channels, 1 by 1 by 1/8 inch (25.4 by 25.4 by 3.2 mm) thick **OR** Stainless-steel channels, 1 by 1 by 1/16 inch (25.4 by 25.4 by 1.6 mm) thick, **as directed**.
 10. Fire-Retardant-Treated Paneling: Provide panels consisting of wood-veneer and fire-retardant particleboard or fire-retardant, medium-density fiberboard. Panels shall have a flame-spread index of 75 **OR** 25, **as directed**, or less and a smoke-developed index of 450 or less per ASTM E 84.
 - a. Provide paneling of 3/4-inch (19-mm) minimum thickness.
- H. Plastic-Laminate-Clad Flush Paneling
1. Grade: Provide Premium **OR** Custom **OR** Economy, **as directed**.
 2. Plastic-Laminate Cladding: High-pressure decorative laminate, in the following grades:
 - a. Faces: Grade HGS **OR** VGS **OR** SGF **OR** HGF **OR** VGF, **as directed**.
 - b. Backs: Grade BKH **OR** BKV **OR** BKL, **as directed**.
 - c. Exposed Edges: Same as faces or Grade VGS.
 3. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed surfaces complying with the following requirements:



- a. As indicated by manufacturer's designations.
 - b. Match the Owner's samples.
 - c. As selected by the Owner from laminate manufacturer's full range in the following categories:
 - 1) Solid colors, gloss **OR** matte, **as directed**, finish.
 - 2) Solid colors with core same color as surface, gloss **OR** matte, **as directed**, finish.
 - 3) Wood grains, gloss **OR** matte, **as directed**, finish.
 - 4) Patterns, gloss **OR** matte, **as directed**, finish.
 4. Panel Core Construction: Particleboard or medium-density fiberboard **OR** Fire-retardant particleboard or fire-retardant, medium-density fiberboard, **as directed**.
 5. Fire-Retardant-Treated Paneling: Provide panels consisting of fire-retardant plastic laminate and fire-retardant particleboard or fire-retardant, medium-density fiberboard. Panels shall have a flame-spread index of 75 **OR** 25, **as directed**, or less and a smoke-developed index of 450 or less per ASTM E 84.
 - a. Provide paneling of 3/4-inch (19-mm) minimum thickness.
- I. Stile And Rail Wood Paneling For Transparent Finish
1. Grade: Premium **OR** Custom **OR** Economy, **as directed**.
 2. Wood Species: White oak, rift sawn/sliced **OR** Figured English ash, quarter sawn/sliced **OR** Butternut, plain sawn/sliced **OR** Figured red gum, plain-sawn/sliced panels, quarter-sawn/sliced stiles and rails, **as directed**.
 3. Stiles and Rails: At fabricator's option, stiles and rails may be either lumber or veneered construction with edges banded or with lumber moldings, as indicated, to conceal core and veneer joints.
 4. Panels: Flat panels **OR** Raised panels with veneered faces and solid lumber rims **OR** Raised panels with veneered faces extending across rims **OR** Raised panels made from edge-glued solid lumber, **as directed**.
 5. Insert Panels:
 - a. Blueprint matched in a horizontal sequence for adjacent panels and doors, with continuous vertical matching between adjacent panels. Book and balance **OR** Book, balance, and center, **as directed**, match face-veneer leaves within each panel.
OR
 Cut panels from premanufactured, sequence-matched sets of book-matched veneered panels. Cut panels with an even **OR** even or odd, **as directed**, number of veneer leaves centered in each panel and with each of the remainders at least half as wide as the full veneer leaves, **as directed**. Cut panels with continuous matching between vertically adjacent panels; veneer leaves of upper panels are continuations of veneer leaves of panels below them.
OR
 Book and balance match face veneers within panels. No matching is required between adjacent panels; select and arrange panels for similarity of grain pattern and color between adjacent panels.
 6. Shop assemble stile and rail paneling into largest units practical for delivery and installation. Provide shop-prepared detachable joints for necessary field connections. Sand and pull joints tight in shop so field joints will comply with joint tolerances for specified grade. Unless otherwise indicated, provide continuous mortise-and-tenon joints between panel units and provide removable temporary protection for joints during handling and delivery.
 - a. Outside Corner of Stile and Rail Paneling: Shop prepare using lock-mitered or mitered-and-splined construction. Assemble, sand, and glue in shop, if site conditions permit.
- J. Stile And Rail Wood Paneling For Opaque Finish
1. Grade: Premium **OR** Custom **OR** Economy, **as directed**.
 2. Wood Species: Any closed-grain hardwood **OR** Eastern white pine, ponderosa pine, sugar pine, or western white pine, **as directed**.



3. Stiles and Rails: Either solid lumber or particleboard, shop filled on face, with veneered or lumber-banded edges, at paneling fabricator's option.
 4. Flat Insert Panels: Medium-density fiberboard or particleboard with shop-filled face.
 5. Raised Insert Panels: Medium-density overlaid softwood plywood (Exterior) APA MDO EXT, machined to profile indicated and shop filled on exposed machined surfaces **OR** Medium-density fiberboard, machined to profile indicated, **as directed**.
 6. Provide fire-retardant treatment of stile and rail paneling as indicated below. For components of paneling fabricated from solid lumber, mill pieces before treatment.
 - a. For stiles and rails, use fire-retardant-treated lumber or fire-retardant medium-density fiberboard.
 - b. For built-up stiles and rails, use fire-retardant particleboard with fire-retardant lumber edge-bands or fire-retardant medium-density fiberboard.
 - c. For insert panels, use fire-retardant medium-density fiberboard.

OR

For insert panels, use fire-retardant particleboard with closed-grain hardwood veneer on face and back.
 7. Shop assemble stile and rail paneling into largest units practical for delivery and installation. Provide shop-prepared detachable joints for necessary field connections. Sand and pull joints tight in shop so field joints will comply with joint tolerances for specified grade. Unless otherwise indicated, provide continuous mortise-and-tenon joints between panel units and provide removable temporary protection for joints during handling and delivery.
 - a. Outside Corner of Stile and Rail Paneling: Shop prepare using lock-mitered or mitered-and-splined construction. Assemble, sand, and glue in shop, if site conditions permit.
- K. Shop Finishing
1. Grade: Provide finishes of same grades as paneling to be finished.
 2. General:
 - a. Finish paneling at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

OR

Shop finish transparent-finished paneling at fabrication shop as specified in this Section. Refer to Division 07 for finishing of opaque-finished paneling.

OR

Drawings indicate paneling that is required to be shop finished. Finish such paneling at fabrication shop as specified in this Section. Refer to Division 07 for finishing paneling not indicated to be shop finished.
 3. Shop Priming: Shop apply the prime coat including backpriming, if any, for transparent-finished paneling specified to be field finished. Refer to Division 07 for material and application requirements.
 4. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing paneling, as applicable to each unit of work.
 - a. Backpriming: Apply two coats of sealer or primer, compatible with finish coats, to concealed surfaces of paneling. Concealed surfaces of plastic-laminate-clad paneling do not require backpriming when surfaced with plastic laminate.
 5. Transparent Finish:
 - a. Grade: Premium **OR** Custom **OR** Economy, **as directed**.
 - b. AWI Finish System: TR-0, synthetic penetrating oil **OR** TR-3, cellulose acetate butyrate or water-reducible acrylic lacquer **OR** TR-4, conversion varnish **OR** TR-5, catalyzed vinyl lacquer, **as directed**.
 - c. WIC Finish System: 2, water-reducible acrylic lacquer **OR** 3b., catalyzed vinyl lacquer **OR** 4, conversion varnish **OR** 6, penetrating oil, **as directed**.
 - d. Staining: None required **OR** Match approved sample for color **OR** Match the Owner's sample, **as directed**.
 - e. Wash Coat for Stained Finish: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.



- f. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
- g. Filled Finish for Open-Grain Woods: After staining (if any), apply paste wood filler to open-grain woods and wipe off excess. Tint filler to match stained wood.
 - 1) Apply wash-coat sealer after staining and before filling.
- h. Sheen: Flat, 15-30 **OR** Satin, 31-45 **OR** Semigloss, 46-60 **OR** Gloss, 61-100, **as directed**, gloss units measured on 60-degree gloss meter per ASTM D 523.
- 6. Opaque Finish: Comply with requirements indicated below for grade, finish system, color, effect, and sheen, with sheen measured on 60-degree gloss meter per ASTM D 523.
 - a. Grade: Premium **OR** Custom **OR** Economy, **as directed**.
 - b. AWI Finish System: OP-4, conversion varnish **OR** OP-5, catalyzed vinyl, **as directed**.
 - c. WIC Finish System: 3b., catalyzed vinyl lacquer **OR** 4, conversion varnish **OR** 7a., synthetic enamel, **as directed**.
 - d. Color: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
 - e. Sheen: Flat, 10-25 **OR** Satin, 30-50 **OR** Semigloss, 55-75 **OR** Gloss, 80-100, **as directed**, gloss units.

1.3 EXECUTION

A. Preparation

- 1. Before installation, condition paneling to average prevailing humidity conditions in installation areas.
- 2. Before installing paneling, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

B. Installation

- 1. Grade: Install paneling to comply with requirements for same grade specified in Part 1.2 for fabrication of type of paneling involved.
- 2. Install paneling level, plumb, true, and straight with no distortions. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm). Install with no more than 1/16 inch in 96-inch (1.6 mm in 2400-mm) vertical cup or bow and 1/8 inch in 96-inch (3 mm in 2400-mm) horizontal variation from a true plane.
 - a. For flush paneling with revealed joints, install with variations in reveal width, alignment of top and bottom edges, and flushness between adjacent panels not exceeding 1/32 inch (0.8 mm) **OR** 1/16 inch (1.5 mm), **as directed**.
- 3. Scribe and cut paneling to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- 4. Anchor paneling to supporting substrate with concealed panel-hanger clips **OR** splined connection strips **OR** blind nailing, **as directed**. Do not use face fastening unless covered by trim **OR** otherwise indicated, **as directed**.
- 5. Complete finishing work specified in this Section to extent not completed at shop or before installation of paneling. Fill nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are applied in shop.
- 6. Refer to Division 07 for final finishing of installed paneling.

C. Adjusting And Cleaning

- 1. Repair damaged and defective paneling, where possible, to eliminate functional and visual defects; where not possible to repair, replace paneling. Adjust for uniform appearance.
- 2. Clean paneling on exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 25 16 00



SECTION 06 41 16 00 - MPF PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

The section includes miscellaneous non Postal case work such as cabinets in the Lunch Room.

PART 1 – GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Custom wood casework with plastic laminate finish.

1.2 REFERENCES

- A. Architectural Woodwork Quality Standards (AWI)
 - 1. AWI Quality Standard: "Architectural Woodwork Quality Standards" of the Architectural Woodwork Institute.
- B. ANSI
 - 1. ANSI 161.2-79: Performance Standard for Fabricated High Pressure Decorative Laminate Countertops.

1.3 SUBMITTALS

- A. Product Data: Required for all manufactured products.
- B. Shop Drawings: Required for all fabricated sections of millwork.
- C. Samples: Required of all manufactured products.

1.4 QUALITY ASSURANCE

- A. AWI Section 400 requirements for custom grade finish overlay laminate – clad cabinets and countertops.
- B. Fabricator: Company specializing in fabrication of millwork with a minimum of 5 years documented experience.

PART 2 – PRODUCTS

2.1 MANUFACTURERS



- A. All materials to be in compliance with AWI 400 requirements.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Execution Requirements: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install all millwork to AWI tolerances and requirements.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 03/31/2010

END OF SECTION 06 41 16 00



Task	Specification	Specification Description
06 42 13 00	06 25 16 00	Paneling
06 42 16 00	06 25 16 00	Paneling



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SECTION 06 42 19 00 - PLASTIC PANELING

1.1 GENERAL

- A. Description Of Work
 - 1. This specification covers the furnishing and installation of materials for plastic paneling. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.
- B. Summary
 - 1. Section includes glass-fiber reinforced plastic (FRP) wall paneling and trim accessories.
- C. Submittals
 - 1. Product Data: For each type of product indicated.
 - 2. LEED Submittals:
 - a. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content and chemical components.
 - b. Product Data for Credit EQ 4.4: For laminating adhesive and composite wood products used in factory-laminated plastic panels, indicating that product contains no urea formaldehyde.
 - 3. Samples: For plastic paneling and trim accessories.
- D. Quality Assurance
 - 1. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 **OR** 200, **as directed**, or less.
 - b. Smoke-Developed Index: 450 or less.
 - c. Testing Agency: Acceptable to authorities having jurisdiction **OR** FM Approvals **OR** UL, **as directed**.

1.2 PRODUCTS

- A. Plastic Sheet Paneling
 - 1. General: Gelcoat-finished, glass-fiber reinforced plastic panels complying with ASTM D 5319.
 - a. Nominal Thickness: Not less than 0.075 inch (1.9 mm) **OR** 0.09 inch (2.3 mm) **OR** 0.12 inch (3.0 mm), **as directed**.
 - b. Surface Finish: Smooth **OR** Molded pebble texture **OR** Smooth surface with filled grooves at 4 inches (102 mm) o.c. to resemble tile **OR** As selected by the Owner from manufacturer's full range, **as directed**.
 - c. Color: White **OR** As selected by the Owner from manufacturer's full range, **as directed**.
- B. Factory-Laminated Plastic Panels
 - 1. General: Gelcoat-finished, glass-fiber reinforced plastic panels complying with ASTM D 5319, laminated to plywood **OR** oriented strand board **OR** fire-retardant particleboard **OR** gypsum board **OR** high-impact gypsum board **OR** moisture- and mold-resistant gypsum board, **as directed**.
 - a. Glass-Fiber Reinforced Plastic Panel Nominal Thickness: Not less than 0.03 inch (0.76 mm) **OR** 0.05 inch (1.3 mm) **OR** 0.075 inch (1.9 mm) **OR** 0.09 inch (2.3 mm), **as directed**.
 - b. Surface Finish: Smooth **OR** Molded pebble texture **OR** Smooth surface with filled grooves at 4 inches (102 mm) o.c. to resemble tile **OR** As selected by the Owner from manufacturer's full range, **as directed**.
 - c. Color: White **OR** As selected by the Owner from manufacturer's full range, **as directed**.



- d. Plywood: DOC PS 1, Exterior B-C, 1/4 inch (6.4 mm) **OR** 3/8 inch (9.5 mm) **OR** 1/2 inch (12.7 mm) **OR** 5/8 inch (15.9 mm) **OR** 3/4 inch (19.1 mm), **as directed**, thick.
- e. Oriented Strand Board: DOC PS 2, 1/4 inch (6.4 mm) **OR** 3/8 inch (9.5 mm) **OR** 1/2 inch (12.7 mm) **OR** 3/4 inch (19.1 mm), **as directed**, thick.
- f. Fire-Retardant Particleboard: Product complying with ANSI A208.1, Grade M-S, except for modulus of rupture; with flame-spread index of 25 or less per ASTM E 84; and 3/8 inch (9.5 mm) **OR** 1/2 inch (12.7 mm), **as directed**, thick.
- g. Gypsum Board: ASTM C 1396/C 1396M, Regular, 1/2 inch (12.7 mm) **OR** Type X, 5/8 inch (15.9 mm), **as directed**.
- h. High-Impact Gypsum Board: ASTM C 1396/C 1396M, 5/8 inch (15.9 mm), with Type X core, and 0.010-inch (0.254-mm) **OR** 0.020-inch (0.508-mm) **OR** 0.030-inch (0.762-mm) **OR** 0.081-inch (2.057-mm), **as directed**, plastic film laminated to back side for greater resistance to through penetration (impact resistance).
- i. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M or ASTM C 1178/C 1178M, 5/8 inch (15.9 mm), Type X, with moisture- and mold-resistant core and surfaces.
- j. Laminating Adhesive: Manufacturers standard adhesive that does not contain urea formaldehyde.

C. Accessories

- 1. Trim Accessories: Manufacturer's standard one-piece **OR** two-piece, snap-on, **as directed**, vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
 - a. Color: White **OR** Match panels **OR** As selected by the Owner from manufacturer's full range, **as directed**.
- 2. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.
- 3. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.
- 4. Adhesive: As recommended by plastic paneling manufacturer.
 - a. VOC Content: 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 5. Sealant: Single-component, mildew-resistant, neutral-curing silicone **OR** Single-component, mildew-resistant, acid-curing silicone **OR** Latex, **as directed**, sealant recommended by plastic paneling manufacturer and complying with requirements in Division 07 Section "Joint Sealants".
 - a. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1.3 EXECUTION

A. Preparation

- 1. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.
- 2. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- 3. Clean substrates of substances that could impair bond of adhesive, including oil, grease, dirt, and dust.
- 4. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.
- 5. Lay out paneling before installing. Locate panel joints where indicated **OR** to provide equal panels at ends of walls not less than half the width of full panels **OR** so that trimmed panels at corners are not less than 12 inches (300 mm) wide, **as directed**.
 - a. Mark plumb lines on substrate at trim accessory **OR** panel joint, **as directed**, locations for accurate installation.



- b. Locate trim accessories **OR** panel joints, **as directed**, to allow clearance at panel edges according to manufacturer's written instructions.

B. Installation

- 1. Install plastic paneling according to manufacturer's written instructions.
 - OR**
 - Install panels in a full spread of adhesive.
 - OR**
 - Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.
 - a. Drill oversized fastener holes in panels and center fasteners in holes.
 - b. Apply sealant to fastener holes before installing fasteners.
- 2. Install factory-laminated panels using concealed mounting splines in panel joints.
- 3. Install trim accessories with adhesive and nails or staples. Do not fasten through panels.
- 4. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in a bead of sealant.
- 5. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- 6. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.
- 7. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 06 42 19 00



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Task	Specification	Specification Description
06 42 19 00	06 25 16 00	Paneling
06 46 19 00	01 22 16 00	No Specification Required



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SECTION 06 51 13 00 - PLASTIC LUMBER

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of plastic lumber. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Basic Uses

1. For both residential and municipal applications, high-density polyethylene (HDPE) products are well suited for decking, porch flooring, docks, piers, furnishings, fencing, and lawn and garden items. HDPE products are cost-effective alternatives for ground contact and animal contact, wet, and environmentally harsh conditions.

C. Limitations

1. Plastic lumber has less rigidity (modulus of elasticity) and greater elongation than wood lumber. Therefore, it is not recommended for use as a true structural member. Examples of applications that are inappropriate would be load-bearing walls, deck framing, and floor joists. It is recommended that an engineering study be performed prior to use of HDPE products if the application involves structural requirements. For commercial applications where the system design calls for concentrated loads, structural plastic lumber should be considered.
2. When utilizing HDPE products for decking or flooring, pay careful attention to joist spacing and joist spans. Consult manufacturer for allowable live loads, deflection limits, joist spacing, and joist spans.

D. Quality Assurance

1. Plastic lumber shall meet applicable standards established by ASTM for recycled plastic lumber and hygrothermal testing.
2. Plastic lumber shall pass testing by UL and meet flammability standards established by ASTM.

1.2 PRODUCTS

A. Materials

1. High-density polyethylene (HDPE), UV-inhibited pigment systems, foaming compounds, and selected process additives, shall be derived from post-consumer bottle waste, such as milk and detergent bottles, then compounded into a rigid board stock material, with the resulting finished product containing minimum 75% recycled plastic by weight.
2. Plastic lumber shall have exceptional resistance to corrosive substances, oil and fuels, insects, fungi, salt spray, and other environmental stresses. They shall not absorb moisture; nor shall they rot, splinter, or crack.
3. HDPE products shall be manufactured in standard dimensional lumber sizes, and shapes.
4. Color of plastic lumber shall be selected from manufacturer's standard colors.

1.3 EXECUTION

A. Installation

1. HDPE products shall have the capability of being fabricated and installed with the same tools used to work wood lumber. The product shall cut and drill very cleanly, as there is no grain to split or chip. It shall not be necessary to pre-drill the plastic lumber when fastening. Stainless steel or coated decking nails and screws are recommended for use with HDPE products. Screws



offer the best form of attachment; however, nails and staples may also be utilized in some applications.

2. The use of full length boards is suggested to avoid unattractive butt-to-butt joints.
3. HDPE products offer multiple deck board attachment options to accommodate expansion and contraction concerns in different climatic conditions and to address specific installation parameters. These options include:
 - a. Tongue and groove deck board attachment with toe screwing options.
 - b. Direct screw attachment with feature strip options.
 - c. Floating attachment with clip options.
 - d. Floating attachment with groove & groove options.

B. Maintenance

1. HDPE products are unaffected by most corrosive substances and will not absorb moisture. To maintain the original finish, clean the lumber with soap and water. No sealing or painting is required; as a general rule, paint will not adhere to HDPE products.
2. Clean graffiti from the plastic lumber with the use of a conventional all-purpose cleaner or petroleum-based cleaner.
3. If the skin or surface layer of an HDPE product becomes marred or blemished, sand off the top skin. The surface can also be buffed to eliminate abrasions.

END OF SECTION 06 51 13 00

SECTION 06 51 13 00a - COMPOSITE PLASTIC LUMBER**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of composite plastic lumber. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Basic Uses

1. Composite plastic lumber or boards are well designed for deck, porch, boardwalk, dock, and similar applications. These boards may also be used for many lumber applications, where a non-load bearing member is required. This material is particularly well suited for outdoor uses due to its durability characteristics. Composite boards have many beneficial properties for decking applications, including:
 - a. Low moisture absorption.
 - b. No rotting, splitting or splintering.
 - c. Inherent termite and UV resistance.
 - d. Excellent dimensional stability and wet/dry traction.
 - e. No toxic compounds (CCA) to leach into soil or groundwater.
 - f. Workability and appearance of natural lumber products.

C. Limitations

1. Composite plastic lumber has less rigidity (modulus of elasticity) than wood lumber and is more flexible. Therefore, this material should not be employed as a structural component unless an engineering study indicates that its use is appropriate. These boards are not intended to be used as joists, beams, studs, columns or stringers.
2. When utilizing composite plastic lumber products for decking, pay careful attention to joist spacing and joist spans. Consult manufacturer for allowable live loads, deflection limits, joist spacing, and joist spans.

D. Quality Assurance

1. Composite plastic lumber shall meet applicable standards established by ASTM for recycled plastic lumber.
2. Plastic lumber shall meet flammability standards established by ASTM.

E. Handling

1. This material is more flexible and more dense than wood, which should be considered when handling boards.
2. Storing boards on uneven or unsupported surfaces may lead to deformation of the material. Therefore, always store boards on a flat surface, or support with dunnage on centers of 24" or less.

1.2 PRODUCTS**A. Materials**

1. Composite plastic lumber products shall be composed of approximately 65% recycled wood/natural fiber and 35% recycled plastic, with selected process additives. The plastic raw material utilized in this product is recycled plastic. It shall be processed to a uniform feedstock, compounded with recovered fibers and extruded into a rigid board product.
2. Colors and sizes of composite plastic lumber shall be selected from manufacturer's standard.



1.3 EXECUTION

A. Installation

1. Composite plastic lumber products shall have the capability of being fabricated and installed with the same tools used to work wood lumber. The product shall cut and drill very cleanly, as there is no grain to split or chip. For best results, use carbide-tipped blades and bits.
2. For optimum water drainage, allow a gap of 3/16" to 1/4" between boards.
3. Both nails and screws may be used to attach USPL composite boards; stainless steel or coated screw type fasteners are recommended.
4. #8, 2 1/2" stainless steel or ceramic-coated deck screws are recommended for 5/4x6 boards, and #10, 3" stainless steel or ceramic-coated deck screws are recommended for 2x6 boards for best results.
5. In cold weather, consider pre-drilling screw holes. Do not use fasteners within 3/4" of the edge of a board. Pneumatic nail guns work with this material.

B. Maintenance

1. Composite boards will weather to a lighter hue during the first few months; fading may take much longer in shaded areas.
2. To clean dirt and most stains from the deck boards, use common deck cleaners available in hardware stores, home centers and lumberyards. Oil stains from grills and foods may require the use of a degreasing cleaner or light sanding to remove the stain. Mold and mildew are common on many exterior surfaces, and they may form on composite plastic lumber. Use common deck washes that contain sodium hypochlorite for best cleaning results.

END OF SECTION 06 51 13 00a



SECTION 06 51 13 00b - STRUCTURAL PLASTIC LUMBER

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of structural plastic lumber. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Basic Uses

1. Structural plastic lumber products are used in a variety of commercial and marine applications and are often the product of choice for exterior applications where resistance to salt and fresh water, marine borers, and other environmentally harsh conditions is required. Due to the unique composition of structural plastic lumber, the product can be used for a number of structural members in commercial and shoreline timberwork.
2. It is well suited for:
 - a. Dock and deck planks
 - b. Wale timbers
 - c. Sheet piling
 - d. Camels
 - e. Pilings
 - f. Fenders
 - g. Channel markers
 - h. Posts, beams, and joists

C. Limitations

1. This type of plastic lumber product has a significantly higher modulus of elasticity (MOE) than conventional forms of plastic lumber. However, the MOE of structural plastic lumber is lower than wood timber in good condition; therefore, it is important to evaluate the suitability of this product for specific uses. It is recommended that an engineering study be performed prior to use of structural plastic lumber products for structural applications. Building code regulations vary by region, so all users should consult local building and safety codes prior to installation for specific requirements.

D. Quality Assurance

1. Structural plastic lumber shall meet applicable standards established by ASTM for recycled plastic lumber and hygrothermal testing.
2. Plastic lumber shall meet flammability standards established by ASTM.

1.2 PRODUCTS

A. Materials

1. Structural plastic lumber shall be a high-performance construction material consisting of a patented formula of recycled plastic, fiberglass, and selected additives. The plastic raw material utilized in structural plastic lumber is derived from post-consumer bottle waste such as milk and detergent bottles. This material is compounded into a consistent, reinforced plastic timber product using reactive compatibilizers, creating a strong and stable plastic/fiber matrix.
2. Colors, sizes, and shapes of structural plastic lumber shall be selected from manufacturer's standard.

1.3 EXECUTION



A. Installation

1. Structural plastic lumber can be fabricated and installed with the same tools used to work wood lumber. The product will cut and drill very cleanly, as there is no grain to split or chip, or knots to bind tools and bend fasteners. It is reinforced with glass fibers, and precautions should be taken when fabricating this product. Maintain adequate ventilation when generating fabrication dust, and personal respiratory protection such as dust masks should be employed during fabrication, as well as safety glasses or goggles.
2. Pilings and sheet piling products can be driven with piledriving equipment such as vibratory hammers, land-based or barge-mounted drop hammers, or waterjets. For sheet piling installations, backfill soils should always be analyzed to determine that the proper amount of force would be exerted on the sheet piling system. For shoreline timberwork applications, structural plastic lumber is used with conventional hardware such as stainless or galvanized bolts, tie rods, nuts, washers, and anchor systems.
3. When utilizing structural plastic lumber products for decking, pay careful attention to joist spacing and joist spans. Consult manufacturer for allowable live loads, deflection limits, joist spacing, and joist spans.

B. Maintenance

1. Structural plastic lumber products are unaffected by most corrosive substances and will not absorb moisture. To maintain the original finish, clean the lumber with soap and water. No sealing or painting is required; as a general rule, paint will not adhere well to these products.
2. Clean graffiti from the plastic lumber with the use of a conventional all-purpose cleaner or petroleum-based cleaner. If the skin or surface layer of plastic lumber becomes marred or blemished, sand off the top skin. The surface can also be buffed to eliminate abrasions.

END OF SECTION 06 51 13 00b



SECTION 06 74 13 00 - PULTRUDED FIBERGLASS INDUSTRIAL GRATING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for pultruded fiberglass industrial grating. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Shop drawings of all fabricated gratings and accessories in accordance with the provisions of this Section.
2. Manufacturer's shop drawings clearly showing material sizes, types, styles, part or catalog numbers, complete details for the fabrication of and erection of components including, but not limited to, location, lengths, type and sizes of fasteners, clip angles, member sizes, and connection details.
3. Manufacturer's published literature including structural design data, structural properties data, grating load/deflection tables, corrosion resistance tables, certificates of compliance, test reports as applicable, concrete anchor systems and their allowable load tables, and design calculations for systems not sized or designed in the contract documents.
4. Sample pieces of each item specified herein for acceptance as to quality and color. Sample pieces shall be manufactured by the method to be used in the work.

C. Quality Assurance

1. All items to be provided under this Section shall be furnished only by manufacturers having experience in the design and manufacture of similar products and systems. If requested, experience shall be demonstrated by a record of at least five (5) previous, separate, similar successful installations in the last five (5) years.

D. Product Delivery And Storage

1. Delivery of Materials: Manufactured materials shall be delivered in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Adhesives, resins and their catalysts and hardeners shall be crated or boxed separately and noted as such to facilitate their movement to a dry indoor storage facility.
2. Storage of Products: All materials shall be carefully handled to prevent them from abrasion, cracking, chipping, twisting, other deformations, and other types of damage. Store items in an enclosed area and free from contact with soil and water. Store adhesives, resins and their catalysts and hardeners in dry indoor storage facilities between 70 and 85 degrees Fahrenheit (21 to 29 degrees Celsius) until they are required.

1.2 PRODUCTS

A. General

1. All FRP items furnished under this Section shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions as specified or required.
2. Fiberglass reinforcement shall be a combination of continuous roving, continuous strand mat, and surfacing veil in sufficient quantities as needed by the application and/or physical properties required.
3. Resins shall be vinyl ester or isophthalic with chemical formulations as necessary to provide the corrosion resistance, strength and other physical properties as required.



4. All finished surfaces of FRP items and fabrications shall be smooth, resin-rich, free of voids and without dry spots, cracks, crazes or unreinforced areas. All glass fibers shall be well covered with resin to protect against their exposure due to wear or weathering.
5. All pultruded structural shapes shall be further protected from ultraviolet (UV) light with 1) integral UV inhibitors in the resin and 2) a synthetic surfacing veil to help produce a resin rich surface.
6. All FRP products shall have a tested flame spread rating of 15 or less per ASTM E-84 Tunnel Test. Gratings shall also have a tested burn time of less than 30 seconds and an extent of burn rate of less than or equal to 10 millimeters per ASTM D-635.
7. All grating clips shall be manufactured of Type 316SS (stainless steel).

B. Pultruded Grating

1. **Manufacture:** Grating components shall be high strength and high stiffness pultruded elements having a maximum of 70% and a minimum of 60% glass content (by weight) of continuous roving and continuous strand mat fiberglass reinforcements. The finished surface of the product shall be provided with a surfacing veil to provide a resin rich surface which improves corrosion resistance and resistance to ultraviolet degradation. Bearing bars shall be interlocked and epoxied in place with a two piece cross rod system to provide a mechanical and chemical lock.
2. **Non-slip surfacing:** Grating shall be provided with a quartz grit bonded and baked to the top surface of the finished grating product.
3. **Fire rating:** Grating shall be fire retardant with a tested flame spread rating of 15 or less when tested in accordance with ASTM E 84. Manufacturer may be required to provide certification of ASTM E84 test on grating panels from an independent testing laboratory. Certification shall be dated within the past two years. Test data shall be from full scale testing of actual production grating, of the same type and material supplied on the project. Test data performed only on the base resin shall not be acceptable.
4. **Resin system:** The resin system used in the manufacture of the grating shall be VEFR, vinyl ester or ISOFR, isophthalic. Manufacturer may be required to submit corrosion data from tests performed on actual grating products in standard chemical environments. Corrosion resistance data of the base resin from the manufacturer is not a true indicator of grating corrosion resistance and shall not be accepted.
5. **Color:** Gray or Yellow.
6. **Depth:** 2" deep load bars with a tolerance of plus or minus 1/32".
7. **Mesh Configuration:** 2" load bar spacing, 6" tie bar spacing on centers.
8. **Load/Deflection:** Grating shall meet manufacturer's published safe recommended loadings with deflection not to exceed the following:
 - a. Uniform distributed load over a 66" span: 50 pounds per square foot, with a maximum deflection of 0.13".
9. **Substitutions:** Other products of equal strength, stiffness, corrosion resistance and overall quality may be submitted with the proper supporting data to the engineer for approval.

C. Grating Fabrication

1. **Measurements:** Grating supplied shall meet the minimum dimensional requirements as shown or specified. The Contractor shall provide and/or verify measurements in field for work fabricated to fit field conditions as required by grating manufacturer to complete the work.
 - a. Determine correct size and locations of required holes or cutouts from field dimensions before grating fabrication.
2. **Layout:** Each grating section shall be readily removable, except where indicated on drawings. Manufacturer to provide openings and holes where located on the contract drawings. Grating supports shall be provided at openings in the grating by contractor where necessary to meet load/deflection requirements specified herein. Grating openings which fit around protrusions (pipes, cables, machinery, etc.) shall be discontinuous at approximately the centerline of opening so each section of grating is readily removable. Gratings shall be fabricated free from warps, twists, or other defects which affect appearance and serviceability.



3. Sealing: All shop fabricated grating cuts shall be coated with vinyl ester resin to provide maximum corrosion resistance. All field fabricated grating cuts shall be coated similarly by the contractor in accordance with the manufacturer's instructions.
4. Hardware: Type 316 stainless steel hold-down clips shall be provided and spaced at a maximum of four feet apart with a minimum of four per piece of grating, or as recommended by the manufacturer.

1.3 EXECUTION

A. Inspection

1. Shop inspection is authorized as required by the Owner and shall be at Owner's expense. The fabricator shall give ample notice to Contractor prior to the beginning of any fabrication work so that inspection may be provided.
2. The grating shall be as free, as commercially possible, from visual defects such as foreign inclusions, delamination, blisters, resin burns, air bubbles and pits.

B. Installation

1. Contractor shall install gratings in accordance with manufacturer's assembly drawings. Lock grating panels securely in place with hold-down fasteners as specified herein. Field cut and drill fiberglass reinforced plastic products with carbide or diamond tipped bits and blades. Seal cut or drilled surfaces in accordance with manufacturer's instructions. Follow manufacturer's instructions when cutting or drilling fiberglass products or using resin products; provide adequate ventilation.

END OF SECTION 06 74 13 00



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Task	Specification	Specification Description
06 74 13 00	05 53 13 00	Gratings



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SECTION 06 81 13 00 - PULTRUDED FIBERGLASS STRUCTURAL SHAPES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of pultruded fiberglass structural shapes. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Shop drawings of all fabricated structural systems and accessories.
2. Manufacturer's shop drawings clearly showing material sizes, types, styles, part or catalog numbers, complete details for the fabrication of and erection of components including, but not limited to, location, lengths, type and sizes of fasteners, clip angles, member sizes, and connection details.
3. Manufacturer's published literature including structural design data, structural properties data, corrosion resistance tables, certificates of compliance, test reports as applicable, and design calculations for systems not sized or designed in the contract documents, sealed by a Professional Engineer.
4. Sample pieces of each item specified herein for acceptance as to quality and color. Sample pieces shall be manufactured by the method to be used in the work.

C. Quality Assurance

1. All items to be provided under this Section shall be furnished only by manufacturers having experience in the design and manufacture of similar products and systems. If requested, experience shall be demonstrated by a record of at least five (5) previous, separate, similar successful installations in the last five (5) years.

D. Product Delivery and Storage

1. Delivery of Materials: Manufactured materials shall be delivered in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Adhesives, resins and their catalysts and hardeners shall be crated or boxed separately and noted as such to facilitate their movement to a dry indoor storage facility.
2. Storage of Products: All materials shall be carefully handled to prevent them from abrasion, cracking, chipping, twisting, other deformations, and other types of damage. Store items in an enclosed area and free from contact with soil and water. Store adhesives, resins and their catalysts and hardeners in dry indoor storage facilities between 70 and 85 degrees Fahrenheit (21 to 29 degrees Celsius) until they are required.

1.2 PRODUCTS

A. Materials

1. All structural shapes shall be manufactured by the pultrusion process with a glass content minimum of 45%, maximum of 55% by weight for maximum sunlight and chemical resistance. The structural shapes shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions as specified in the Contract Documents.
2. Fiberglass reinforcement shall be a combination of continuous roving, continuous strand mat, and surfacing veil in sufficient quantities as needed by the application and/or physical properties required.
3. Resins shall be ISO, non-fire retardant isophthalic polyester; ISOFR, fire retardant isophthalic polyester or VEFR, vinyl ester, with chemical formulation necessary to provide the corrosion resistance, strength and other physical properties as required.



4. All finished surfaces of FRP items and fabrications shall be smooth, resin-rich, free of voids and without dry spots, cracks, crazes or unreinforced areas. All glass fibers shall be well covered with resin to protect against their exposure due to wear or weathering.
5. All pultruded structural shapes shall be further protected from ultraviolet (UV) attack with 1) integral UV inhibitors in the resin and 2) a synthetic surfacing veil to help produce a resin rich surface.
6. All FRP products shall have a tested flame spread rating of 25 or less per ASTM E-84 Tunnel Test.

B. Pultruded structural shapes shall have the minimum longitudinal mechanical properties listed below:

Property	ASTM Method	Value	Units
Tensile Strength	D-638	30,000 (206)	psi (MPa)
Tensile Modulus	D-638	2.5×10^6 (17.2)	psi (GPa)
Flexural Strength	D-790	30,000 (206)	psi (MPa)
Flexural Modulus	D-790	1.8×10^6 (12.4)	psi (GPa)
Flexural Modulus (Full Section)	N/A	2.8×10^6 (19.3)	psi (GPa)
Short Beam Shear (Transverse)	D-2344	4,500 (31)	psi (MPa)
Shear Modulus (Transverse)	N/A	4.5×10^5 (3.1)	psi (GPa)
Coefficient of Thermal Expansion	D-696	8.0×10^{-6} (1.4×10^{-6})	in/in/°F (cm/cm/°C)
Flame Spread	E-84	25 or less	N/A

1.3 EXECUTION

A. Fabrication

1. Measurements: Structural Shapes supplied shall meet the minimum dimensional requirements as shown or specified. The Contractor shall provide and/or verify measurements in field for work fabricated to fit field conditions as required by manufacturer to complete the work. Determine correct size and locations of required holes or coping from field dimensions before structural shape fabrication.
2. Sealing: All shop fabricated cuts or drilling shall be coated with vinyl ester resin to provide maximum corrosion resistance. All field fabricated cuts or drilling shall be coated similarly by the contractor in accordance with the manufacturer's instructions.
3. Hardware: Type 316 stainless steel connection hardware shall be provided.

B. Inspection

1. Shop inspection shall be authorized as required by the Owner and shall be at Owner's expense. The fabricator shall give ample notice to Contractor prior to the beginning of any fabrication work so that inspection may be provided.
2. The structural shapes shall be as free, as commercially possible, from visual defects such as foreign inclusions, delamination, blisters, resin burns, air bubbles and pits.

END OF SECTION 06 81 13 00



Task	Specification	Specification Description
06 85 00 00	06 81 13 00	Pultruded Fiberglass Structural Shapes



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SECTION 07 01 51 00 - R&A BITUMINOUS ROOFING REPAIR

NOTE TO SPECIFIER

This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this Section where roofing repairs are specified for bituminous roofing systems, such as modified bitumen and built-up roof membranes. For single-ply roofing repairs, use Section 070152 – SINGLE-PLY ROOFING REPAIR.

NOTE TO SPECIFIER

Section Formatting:

Consistent formatting of Sections gives the complete document a professional look. This Section uses a 10pt. Arial font, and is formatted as follows:

1. *Insert one 10pt. line after the Section Number. Section Number is in CAPS.*
2. *Insert two 10pt. lines after the Section Title. Section Title is in CAPS.*
3. *Insert one 10pt. line after a PART. PARTS are in CAPS. If a Section is not used, include NOT USED following the PART title as shown below.*
4. *Insert one 10pt. line after Article paragraphs. Articles are in CAPS.*
5. *Insert two 10pt. lines at the end of an Article.*
6. *Complete Section with END OF SETION.*
7. *No lines should be placed between paragraphs and sub-paragraphs, or between sub-paragraphs and other sub-paragraphs.*

Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED



Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

PART 1 - GENERAL

NOTE TO SPECIFIER

Review available field data. EDIT Article 1.1 SUMMARY below to reflect actual roofing membrane types being repaired, and the roof areas specified for repair on this project. DELETE roofing membrane types not applicable to this project.

1.1 SUMMARY

- A. This Section includes built-up and modified bitumen roofing repair procedures and requirements for specified roofing repairs within Roof Areas XX, XX, XX and XX.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 024100 – Roof Removal and Substrate Preparation
- D. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

NOTE TO SPECIFIER

Provide a mechanism for contractors to submit unit prices, add or deduct, for bituminous roofing repairs listed in Article 3.2.

1.3 UNIT PRICES

- A. Provide unit prices for the repair work described in Item 3.2.

NOTE TO SPECIFIER

EDIT Article 1.4 – REFERENCES below, to reflect references applicable to bituminous roofing repairs applicable to this project. DELETE references that are not applicable. Refer to PART 2 – PRODUCTS.

Re-letter/number paragraphs and sub-paragraphs after editing.

1.4 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 1. American Society for Testing and Materials (ASTM)



- a. ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements
- b. ASTM D 2824 - Standard Specification for Aluminum-Pigmented Asphalt Roof Coatings
- c. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
- d. ASTM D 1668 - Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
- e. ASTM D 4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free
- f. ASTM D 312 - Standard Specification for Asphalt Used in Roofing
- g. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
- 2. National Roofing Contractors Association (NRCA)
- 3. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
 - a. SMACNA Architectural Sheet Metal Manual, 7th Edition

1.5 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.6 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.



- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp. Protect foam insulation from direct sunlight exposure. Store roll materials standing on end.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
 - 1. When the outside temperature is forecast to fall below 32°F (°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives and primers should be maintained at a temperature of 50°F (10°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 - 2. Refer to the roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

NOTE TO SPECIFIER

A two-year contractor guarantee is recommended for bituminous roofing repairs.

1.9 CONTRACTOR GUARANTEE

- A. The Contractor shall provide a two-year contractor guarantee. At a minimum, the contractor guarantee shall include the following:
 - 1. Contractor name, address, phone number and project contact name.
 - 2. The project completion date, and date of guarantee expiration.
 - 3. The contractor guarantee shall include, in writing, all project work, workmanship, and/or all materials installed by the contractor or subcontractors to be of a quality that will comply with all project specific requirements of the Construction Documents and other Contract Documents governing the Work and workmanship through the guarantee period.
 - 4. The contractor shall investigate roof leaks during the guarantee period within a reasonable time period, but in no instance greater than 24-hours after notification of a leak. The contractor shall repair leaks determined to be the cause of the Work at no cost to the Owner.

NOTE TO SPECIFIER

EDIT PART 2 - PRODUCTS below, to reflect products applicable to bituminous roofing repairs specified for this project. ADD and/or DELETE products as necessary.

Re-letter/number paragraphs and sub-paragraphs after editing.

PART 2 – PRODUCTS**2.1 BITUMEN**

- A. Asphalt: ASTM D 312, Type III.

2.2 ROOFING FELTS, SHEETS, AND FABRICS

- A. Modified bitumen flashing stripping sheet:
1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, minimum nominal 130 mil thickness; ASTM D 6164, Type I, Grade G.
 - a. Color: To match existing, or as determined by Owner.
- B. For use at roof sump flashings and elsewhere as may be indicated: Asphalt treated woven glass fabric, ASTM D 1668, Type I.

2.3 ADHESIVES, CEMENTS, PRIMERS AND COATINGS

- A. Roofing cement: ASTM D 4586, Type I, (summer grade or winter grade as applicable to season).
- B. Modified bitumen flashing cement (For use at granule surfaced flashing sheets and other locations required by the roofing membrane manufacturer): Product compatible with modified bitumen roofing surfacing flashing sheet and approved by the roofing membrane manufacturer.
- C. Metal roof primer: "Rust-Oleum Industrial Enamel Quick Dry Primer" manufactured by Rust-Oleum Corporation, Vernon Hills, Illinois, "Carboline Carbocoat 150 Universal Primer," manufactured by Carboline, St. Louis, Missouri, or approved equal.
- D. Asphalt primer: ASTM D 41.
- E. Aluminum coating: Fibrated aluminum coating; ASTM D 2824, Type III.

2.4 FASTENERS

- A. Roofing membrane and flashing fasteners: Unless otherwise indicated, types acceptable for the substrate encountered.
- B. Sheet metal fasteners:
1. For galvanized: Galvanized or cadmium-plated steel fasteners. Where fastener heads are exposed, provide gasketed washers.
 2. For copper: Copper or bronze fasteners.
 3. For securing aluminum anchor bar: Fasteners appropriate for substrate encountered, and approved by the roofing manufacturer.

2.5 AGGREGATE

- A. Gravel, ASTM D 1863, Size No. 67; clean and dry.
- B. Slag, ASTM D 1863, Size No. 67; clean and dry.

2.6 MISCELLANEOUS MATERIALS

- A. Miscellaneous sheet metal accessories:



1. For terminating flashing: Anchor bar: 1-inch x 1/8-inch extruded aluminum with slotted holes spaced 6 inches o.c. Do not fabricate with a caulk slot.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.
- B. Refer to Article 3.2 for repair identification and procedures. Refer to Article 3.3 for repair quantities and locations.
- C. Roof repair locations shall be identified on the roof prior to the start of work.

NOTE TO SPECIFIER

Article 3.2 ROOF REPAIR SUMMARY contains examples of typical repairs associated with bituminous roofing systems. EDIT Article 3.2 below, to reflect repair procedures applicable to bituminous roofing repairs specified for this project. ADD and/or DELETE repairs as necessary. Re-letter/number paragraphs and sub-paragraphs after editing.

NOTE TO SPECIFIER

Repairs listed below may or may not be Unit Price Work. If repair work is included as part of the Base Proposal, DELETE "(Unit Price Work)" from Article 3.2. If repair work is included only as Unit Price Work, with repair quantities to be determined at a later date, do not edit.

3.2 ROOF REPAIR SUMMARY (Unit Price Work)

- A. Repair No. B1 – Base Flashing Vertical Lap Repair (LF)
 1. Remove dirt, debris, and existing loose or deteriorated repair materials from the base flashing vertical lap area.
 2. Prime the repair area with asphalt primer prior to application of stripping.
 3. Install a 3-course stripping, using woven glass fabric and modified bitumen flashing cement, over the defect.
 4. Apply a continuous and uniform application of aluminum coating over the roof flashing in repair area. Delay the application of aluminum coating 30 days to allow for proper curing of the repair.
- B. Repair No. B2 – Roof Membrane Coating (SF)
 1. Remove dust, dirt and existing loose or disbanded coating material from the existing flashing surface.
 2. Prior to coating application, inspect the roof surface. If additional defects are observed requiring the attention of the Owner, contact the Owner for further instruction.
 3. Thoroughly mix the aluminum coating to a uniform consistency prior to application.
 4. Apply **two** continuous and uniform applications of fibrated aluminum coating over the membrane surface.
- C. Repair No. B3 – Perimeter Edge Metal Repair (LF)
 1. Remove dust and dirt from the repair area. If aggregate exists, spud back aggregate 12-inches, minimum from the roof edge.
 2. Remove loose and/or deteriorated stripping materials.

3. Inspect securement of the existing perimeter edge metal. Add fasteners as necessary to provide securement of the perimeter edge metal flange 3-inches o.c., minimum.
 4. Apply asphalt primer to the repair area.
 5. Apply a 3-course stripping of modified bitumen flashing cement and woven glass fabric over the flange. Apply a modified bitumen flashing cap sheet set in modified bitumen flashing cement over the completed 3-course stripping. Extend the flashing cap sheet onto the roofing membrane 6-inches, minimum.
- D. Repair No. B4 – Metal Roof Repair (SF)
1. Wire-brush the roof surface. After completion of wire brushing work, remove dust and dirt from the repair area.
 2. Prior to primer and coating application, inspect the roof surface. If additional defects are observed requiring the attention of the Owner, contact the Owner for further instruction.
 3. Apply primer to the repair area. Allow the primer time to dry, following the requirements and recommendations of the primer manufacturer.
 4. Thoroughly mix the aluminum coating to a uniform consistency prior to application.
 5. Apply **two** continuous and uniform application of fibrated aluminum coating over the metal roof surface.
- E. Repair No. B5 – Flood Coat and Aggregate Installation (SF)
1. Within the repair area, sweep loose aggregate from the roof surface.
 2. Inspect the roofing membrane for defects. If defects are observed, contact the Owner immediately.
 3. Apply asphalt primer to the roofing membrane. Install primer at a rate of one gallon per square.
 4. Aggregate application: Embed aggregate uniformly into a pour coat of hot and fluid asphalt applied at a rate not less than 70 pounds per square. Apply gravel at the rate of 400 pounds per square. Apply slag at the rate of 300 pounds per square. Ensure that a minimum of half of the aggregate layer is fully adhered in the top pour coat.
- F. Repair No. B6 – Base Flashing Replacement (LF)
1. At perimeters, temporarily displace sheet metal edge cover metal.
 2. Remove aggregate for a distance of 12-inches from the bottom edge of base flashing. Remove loose or deteriorated base flashing repair materials.
 3. Prime the repair area with asphalt primer prior to installation of repair materials.
 4. Install a modified bitumen surfacing sheet over the repair area. Extend the sheet onto the horizontal roof membrane surface 4-inches, minimum beyond the existing flashing sheet. Extend the flashing up the vertical wall to an elevation equal to or greater than the existing flashing elevation.
 5. Secure the flashing using roofing mails with 1" metal caps, 6-inches o.c., or aluminum termination bar, secured 12-inches o.c. max. Apply a 3-course stripping of roofing cement and woven glass fabric to the top edge of flashing.
 6. Re-embed aggregate into a top coating of roofing cement in the repair area. Ensure that gravel is clean and embeds soundly into roofing cement. If aggregate is not clean and does not embed, replace with new aggregate.
- G. Repair No. B7 – Roof Sump Flashing Repair (EA)
1. Remove and discard of existing roof sump gravel stops.
 2. Temporarily displace and remove the roof drain strainer and clamping ring.
 3. Clean the existing roof sump area of debris, dirt and dust. Apply asphalt primer at the rate of one gallon per square in the sump area. Allow the primer time to dry.
 4. Inspect and clean the clamping ring. If the drain assembly, strainer, and/or clamping ring are damaged, provide replacement components (*Unit Price Work*). Refer to Section 024100.



5. Re-flash the roof sump area using two 36-inch by 36-inch layers of woven glass fabric set in, and coated with, roofing cement. Extend the flashing materials into the roof drain clamping ring. Tightly secure the flashing materials with the clamping ring.
6. Remove existing aggregate as necessary to install a new copper gravel stop and stripping at sump areas around roof drains. Prior to installation, prime both sides of the gravel stop flange with asphalt primer and allow the primer time to dry.
7. Set the flange in roofing cement and strip in the flange to the roofing membrane with a 5-course stripping of woven glass fabric and roofing cement. Apply aggregate to the top of the gravel stop flange stripping.
8. Apply a continuous and uniform application of aluminum coating over the roof drain sump area. Delay the application of aluminum coating 30 days to allow for proper curing of the repair.

NOTE TO SPECIFIER

Article 3.3 ROOF REPAIR QUANTITIES AND LOCATIONS contains a roof area listing for the project, and specified quantities of individual roofing repairs identified in Article 3.2, per roof area. EDIT Article 3.3 below, to reflect actual roof areas specified for repair, and base proposal quantities for each roof area. Re-letter/number paragraphs and sub-paragraphs after editing.

3.3 ROOF REPAIR QUANTITIES AND LOCATIONS

- A. The following repair quantities are to be completed in the indicated roof area. Refer to Article 3.2 for specific repair procedures:

Roof Area XX:

Repair B1:	X,000 LF
Repair B2:	X,000 SF
Repair B3:	X,000 LF
Repair B4:	X,000 SF
Repair B5:	X,000 SF
Repair B6:	X,000 LF
Repair B7:	X,000 EA

USPS CSF Specifications issued: 10/1/2013

Last revised: 3/6/2013

NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 01 51 00



SECTION 07 01 52 00 - R&A SINGLE-PLY ROOFING REPAIR

NOTE TO SPECIFIER

This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this section where roofing repairs are specified for bituminous roofing systems, such as modified bitumen and built-up roof membranes. For bituminous roofing repairs, use Section 070151 – BITUMINOUS ROOFING REPAIR.

NOTE TO SPECIFIER

Section Formatting:

Consistent formatting of Sections gives the complete document a professional look. This Section uses a 10pt. Arial font, and is formatted as follows:

1. *Insert one 10pt. line after the Section Number. Section Number is in CAPS.*
2. *Insert two 10pt. lines after the Section Title. Section Title is in CAPS.*
3. *Insert one 10pt. line after a PART. PARTS are in CAPS. If a Section is not used, include NOT USED following the PART title as shown below.*
4. *Insert one 10pt. line after Article paragraphs. Articles are in CAPS.*
5. *Insert two 10pt. lines at the end of an Article.*
6. *Complete Section with END OF SETION.*
7. *No lines should be placed between paragraphs and sub-paragraphs, or between sub-paragraphs and other sub-paragraphs.*

Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED



Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

PART 1 - GENERAL

NOTE TO SPECIFIER

Review available field data. EDIT Article 1.1 SUMMARY below to reflect actual roofing membrane types being repaired, and the roof areas specified for repair on this project. DELETE roofing membrane types not applicable to this project. EDIT Section 079100 title, choosing "Repair" or "Replacement and Repair".

1.1 SUMMARY

- A. This Section includes EPDM, TPO and PVC roofing repair procedures and requirements for specified roofing repairs within Roof Areas XX, XX, XX and XX.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 024100 – Roof Removal and Substrate Preparation
- D. Section 079201 – Sealants for Roof Replacement
- E. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

NOTE TO SPECIFIER

Provide a mechanism for contractors to submit unit prices, add or deduct, for single-ply roofing repairs listed in Article 3.2.

1.3 UNIT PRICES

- A. Provide unit prices for the repair work described in Article 3.2.

NOTE TO SPECIFIER

EDIT Article 1.4 – REFERENCES below, to reflect references applicable to single-ply roofing repairs applicable to this project. DELETE references that are not applicable. Refer to PART 2 – PRODUCTS.

Re-letter/number paragraphs and sub-paragraphs after editing.

1.4 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:



1. American Society for Testing and Materials (ASTM)
 - a. ASTM D 4637 - Standard Specification for EPDM Sheet Used In Single-Ply Roof Membrane
 - b. ASTM D 4434 - Standard Specification for Polyvinyl Chloride (PVC) Sheet Roofing
 - c. ASTM D 6878 - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing
2. National Roofing Contractors Association (NRCA)
3. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
 - a. SMACNA Architectural Sheet Metal Manual, 7th Edition

1.5 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.6 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp. Protect foam insulation from direct sunlight exposure. Store roll materials standing on end.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store



materials on previously completed roofing.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
 - 1. NOTE: Do not install EPDM roofing at temperatures below 35°F (2°C).
 - 2. When the outside temperature is forecast to fall below 40°F (5°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives, primers and pressure-sensitive flashings should be maintained at a temperature of 40°F (5°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 - 3. Be aware of potential condensation formation on the EPDM roof surface during application/flash-off of adhesives and primer. Remove condensation using a heat gun prior to adhesion to the insulation or cover board substrate. Do not use an open flame to remove condensation from the roof membrane or flashing materials.
 - 4. Refer to the EPDM roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

NOTE TO SPECIFIER

A two-year contractor guarantee is recommended for single-ply roofing repairs.

1.9 CONTRACTOR GUARANTEE

- A. The Contractor shall provide a two-year contractor guarantee. At a minimum, the contractor guarantee shall include the following:
 - 1. Contractor name, address, phone number and project contact name.
 - 2. The project completion date, and date of guarantee expiration.
 - 3. The contractor guarantee shall include, in writing, all project work, workmanship, and/or all materials installed by the contractor or subcontractors to be of a quality that will comply with all project specific requirements of the Construction Documents and other Contract Documents governing the Work and workmanship through the guarantee period.
 - 4. The contractor shall investigate roof leaks during the guarantee period within a reasonable time period, but in no instance greater than 24-hours after notification of a leak. The contractor shall repair leaks determined to be the cause of the Work at no cost to the Owner.

NOTE TO SPECIFIER

EDIT PART 2 - PRODUCTS below, to reflect products applicable to single-ply roofing repairs specified for this project. ADD and/or DELETE products as necessary.

Re-letter/number paragraphs and sub-paragraphs after editing.



PART 2 – PRODUCTS

2.1 EPDM ROOFING MEMBRANE AND FLASHING

NOTE TO SPECIFIER

Per discussions between the designer and USPS Project Manager, determine the EPDM roofing membrane mil thickness required for the project. EDIT paragraph 2.2A below to reflect the specified thickness.

- A. EPDM roofing membrane; fire resistant, cured, non-reinforced, minimum 90-mil thickness, black color; in compliance with ASTM D 4637. Meeting or exceeding the standards established by the following test methods:
- B. EPDM flashing membrane:
 - 1. Cured: fire-resistant, non-reinforced, minimum 60-mil or 90-mil thickness, black color; in compliance with ASTM D 4637. Meeting or exceeding the standards listed in paragraph 2.2A.
 - 2. Uncured: Non-reinforced, minimum 60-mil thickness, black color. Type approved by roofing manufacturer for specific flashing conditions encountered.

2.2 EPDM MEMBRANE SPLICE SYSTEM

- A. Cleaner/primer: Product approved by roofing membrane manufacturer.
- B. In-seam splice tape: Splice tape; minimum 6-inch width, product approved by the roofing membrane manufacturer.
- C. Reinforced perimeter fastening strip: Product approved by the roofing membrane manufacturer.

2.3 EPDM OUTERSEAM AND PERIMETER EDGE METAL FLASHING AND STRIPPINGS

- A. EPDM pressure-sensitive flashing product, 5-inch, 6-inch and 9-inch width(s). Product approved by the EPDM flashing manufacturer for application as an outerseam flashing at field-fabricated seams.

2.4 RELATED EPDM REPAIR PRODUCTS

- A. Adhesives, cements, sealants, water cut-off mastics, prefabricated accessories, and other related items: Unless otherwise indicated, products manufactured by, or approved by the roofing membrane manufacturer.

2.5 INSULATION FOR REPAIR:

- A. For use at Repair No. S9 – Localized Roof Replacement: Type, thickness and configuration to match existing.
- B. For use at Repair No. S6 – Roof Drain Flashing Repair: Tapered edge strips: ASTM C208; 1-1/2 inches thick x 18 inches wide.
- C. For use at Repair No. S6 – Roof Drain Flashing Repair: Tapered insulation: insulation as necessary to allow for proper drainage to roof drains; ASTM C1289, Type II, Class 1; Minimum 20 psi.

2.6 SHEET METAL FLASHING AND ACCESSORIES FOR REPAIR:

- A. Roofing membrane and flashing fasteners: Unless otherwise indicated, types as required by the roofing membrane manufacturer.
- B. For securing sheet metal flashings: Fasteners appropriate for the substrate encountered, and compatible with the sheet metal type to be secured. Where fastener heads are exposed, provide neoprene washers.
- C. For securing aluminum anchor bar: Fasteners appropriate for substrate encountered, and approved by the roofing manufacturer.

2.7 SEALANTS

- A. Refer to Section 079201.

2.8 MISCELLANEOUS REPAIR MATERIALS

- A. Walkway pads: Product approved by the roofing manufacturer.
- B. Splashblocks: Concrete; size as necessary to accommodate existing condition.
- C. Pitch pan fill materials:
 - 1. Non-shrink grout (for bottom fill): Quick-set, fast-drying grout; product acceptable to roofing manufacturer.
 - 2. Pourable sealer (for top fill): Two-part pourable elastomeric sealer, product acceptable to roofing manufacturer.
- D. Conduit and pipe supports:
 - 1. For pipes with a diameter up to 6-inches:
 - a. Adjustable prefabricated support such as Pipe Pier 150, manufactured by Pipe Pier Support Systems, Hamel, MN, or approved equal.
 - b. Product approved by the roofing manufacturer for this application.
 - c. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
 - 2. For pipes with a diameter greater than 6-inches:
 - a. Product approved by the roofing manufacturer for this application.
 - b. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
- E. Pre-fabricated plumbing vent pipe extensions:
 - 1. For use where necessary to achieve the 8-inch minimum flashing height:
 - a. Pre-fabricated plumbing vent extensions, such as Tubos Pre-Fabricated Pipe Extension, by Tubos, Inc., Clearwater, FL.
 - b. Product approved by the roofing manufacturer for this application.
 - c. Size and configuration of extension as necessary to match existing pipe diameter, providing the 8-inch minimum flashing height, and allowing for flashing as show on the drawings.
- F. Acrylic elastomeric coating (or use with Repair S13):



1. Coating product such as "GAF Matrix 531 Weathercote", manufactured by GAF Materials Corporation, Wayne, NJ, or equal product approved by Owner.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.
- B. Refer to Article 3.2 for repair identification and procedures. Refer to Article 3.3 for repair quantities and locations.
- C. Roof repair locations shall be identified on the roof prior to the start of work.

NOTE TO SPECIFIER

Article 3.2 ROOF REPAIR SUMMARY contains examples of typical repairs associated with bituminous roofing systems. EDIT Article 3.2 below, to reflect repair procedures applicable to single-ply roofing repairs specified for this project. ADD and/or DELETE repairs as necessary. Re-letter/number paragraphs and sub-paragraphs after editing.

NOTE TO SPECIFIER

Repairs listed below may or may not be Unit Price Work. If repair work is included as part of the Base Proposal, DELETE "(Unit Price Work)" from Article 3.2. If repair work is included only as Unit Price Work, with repair quantities to be determined at a later date, do not edit Article 3.2.

3.2 ROOF REPAIR SUMMARY (Unit Price Work)

- A. Repair No. S1 – Field Seam Repair (LF)
 1. Clean the repair area with soap and water, rinse with clean water, and dry the area.
 2. Apply primer over the prepared area.
 3. Install 5-inch outer seam tape to seam following manufacturers requirements for installation.
 4. Install lap sealant to all cut edges of the pressure-sensitive flashing.
- B. Repair No. S2 – Roof perimeter stripping repair (LF)
 1. Remove damaged and deteriorated EPDM stripping materials at perimeter metal flanges.
 2. Inspect existing fasteners at exposed flanges. Remove "backed out" fasteners. Reposition the flange and install fasteners to achieve a stagger-nailed pattern, 3 inches o.c.
 3. Clean the repair area free of dirt and debris. Wash the repair area with EPDM splice cleaner. Apply the splice cleaner from the lip of the perimeter edge to a minimum distance of 8 inches out from the edge of the flange. Also extend the cleaner a minimum 3 inches onto adjacent stripping materials. Allow the cleaner time to dry. Apply primer in the prepared area in accordance with the EPDM manufacturer's requirements.
 4. Install 9-inch pressure-sensitive flashing, centered full-width, over the prepared flange area. Install the flashing tape in accordance with the requirements and recommendations of the flashing manufacturer.
 5. Install lap sealant to all cut edges of the pressure-sensitive flashing.
- C. Repair No. S3 – Roof wall/curb flashing repair (LF)



1. Where indicated, cut roofing membrane at the roof-to-wall transition, leaving sufficient material to allow the existing membrane to relax and be re-secured.
 2. Install a perimeter fastening strip beneath the existing membrane. Secure with plates and fasteners 12-inches o.c.
 3. Remove wall flashing minimum 12-inches up wall.
 4. Fully adhere EPDM roof membrane in the repair area. Extend roof membrane a minimum of 6-inches onto the roof surface, and extend up the wall to meet the existing wall flashing. Install the specified membrane splice system to laps, and install outerseam flashing over the completed splice.
- D. Repair No. S4 - Remove debris and vegetation (SF)
1. Remove and discard of existing debris and/or vegetation on the roof membrane.
 2. Inspect the underlying roof membrane for damage. If defects are observed, contact Owner for further instruction.
- E. Repair No. S5 - Replace damaged/missing roof drain strainer (EA)
1. Install new cast iron roof drain strainer where existing is missing or broken.
- F. Repair No. S6 – Roof drain flashing repair (EA)
1. Loosen roof drain components as necessary to allow for removal of roof drain flashing materials. Exercise caution to avoid damage to roofing membrane plies.
 2. At the roof drain, remove and discard of a 4-foot by 4-foot area of roof membrane and underlying insulation components down to the structural deck.
 3. Inspect and clean the clamping ring. If the clamping ring is damaged, provide a replacement clamping ring (*Unit Price Work*).
 4. Re-flash the roof sump area using insulation to match existing. Provide tapered edge strips/tapered insulation to provide a flush transition into the sump area, and a minimum 36-inch by 36-inch tapered sump area. Install new EPDM roof membrane over the repair area, following industry standards for roof drain flashing requirements. Install the specified membrane splice system to laps, and install outerseam flashing over the completed splice.
 5. Install water cutoff mastic beneath the membrane at the clamping ring prior to re-installation. Tightly secure the roof membrane with the clamping ring.
 6. Re-install the roof drain strainer after completion of work.
- G. Repair No. S7 – Roof drain debris removal (EA)
1. Remove and discard of existing debris and/or vegetation at roof drain strainers.
- H. Repair No. S8 – Gas Line/Conduit Support Repair (EA)
1. Temporarily displace existing gas line/conduit support.
 2. Remove and discard existing damaged or deteriorated supports
 3. Install adjustable prefabricated pipe supports at rooftop conduit and pipes.
 4. Space pipe supports at intervals recommended by the support manufacturer, as determined by the diameter and weight of the conduit or pipe.
 5. Separate the support from the roof surface by installing the support over roof walkway pads, installed as specified.
 6. Reinstall existing gas line/conduit support to its original location.
- I. Repair No. S9 – Localized roof replacement (SF)
1. Within the repair area, remove and discard of the roof membrane and underlying insulation components down to the structural deck.
 2. Inspect the underlying structural deck for damage and deterioration. If damage or deterioration of the structural deck is observed, contact the Owner immediately.
 3. Install new insulation components to match existing in the repair area. Secure to the deck with appropriate fasteners.



4. Fully-adhere EPDM roof membrane over the repair area, following industry standards and manufacturer requirements and recommendations for installation. Install the specified membrane splice system to laps, and install outerseam flashing over the completed splice.
 5. Flash penetrations, roof drains, walls and other components within the repair area, following industry standards and roofing membrane manufacturer requirements and recommendations for installation.
- J. Repair No. S10 - Replace missing walkpad (EA)
1. At locations indicated, install walkpad(s). Adhere walkpad to roof surface with approved adhesive or primer.
 2. At locations where walkpads are being installed under supports, re-install existing conduit/pipe and wood supports onto new walkpad(s).
- K. Repair No. S11 – Expansion joint flashing repair (LF)
1. Remove existing disbonded and deteriorated flashing materials from the repair area.
 2. Clean the repair area with soap and water, rinse the area with clean water, and dry the area.
 3. Fully adhere EPDM roof membrane over the existing expansion joint. Install pressure-sensitive flashing over resulting field seams.
 4. Tie-in repair ends to adjacent vertical walls and edges using pressure-sensitive flashing and/or sheet metal counterflashing. Ensure completed condition is watertight.
- L. Repair No. S12 – Sheet metal cover/expansion joint lap repair (EA)
1. If existing, remove failed joint covers at parapet cap joint/expansion joint cap laps.
 2. Clean the repair area with soap and water, rinse the area with clean water, and dry the area.
 3. Cut the pressure sensitive EPDM patching material to dimensions to cover the joint and extend a minimum of 3-inches on both sides of the existing joint. Prime the repair area and pressure sensitive EPDM patching material.
 4. Install the pressure-sensitive EPDM patching membrane and seal all edges with lap sealant.
- M. Repair No. S13 – Capped curb repair (EA)
1. Clean obsolete sheet metal cap free of debris, dirt and dust.
 2. Apply sealant to holes in cap.
 3. Apply elastomeric coating to the horizontal and vertical cap surfaces, following the recommendations and requirements of the coating manufacturer.
- N. Repair No. S14 – Expansion joint cover replacement (LF)
1. Remove and discard of existing deteriorated or damaged expansion joint cover. Do not damage underlying EPDM flashing.
 2. Install new cover, following the requirements and recommendations of the cover manufacturer.
 3. Tie-in cover ends to adjacent cover and vertical wall using pressure-sensitive flashing and/or sheet metal counterflashing. Ensure completed condition is watertight.
- O. Repair No. S15 – Counterflashing sealant repair (LF)
1. Remove loose or deteriorated sealant, repair materials and other contaminants from the surface-mounted counterflashing caulk lip.
 2. Clean surfaces immediately before installation of sealants to provide surfaces suitable for the installation of sealant,
 3. Apply primer if required by the sealant manufacturer for the type of sealant and conditions encountered. Apply primer in accordance with the sealant manufacturers' requirements and recommendations. Do not allow primer to spill onto adjacent surfaces.



4. Install sealant in accordance with the requirements and recommendations of the sealant manufacturer. Tool the joint immediately after installation.
- P. Repair No. S16 – Repair clogged roof drain (EA)
1. At clogged roof drains, mechanically clear roof drains to ensure that they are free of debris. Obtain the services of a licensed plumber to perform this work. The plumber shall provide a letter certifying that all such penetrations have been checked and that they are free of debris.
- Q. Repair No. S17 – Perimeter base securement flashing repair (LF)
1. Remove damaged and deteriorated EPDM stripping materials at roof-to-wall securement flashings and strippings.
 2. Clean the repair area free of dirt and debris. Wash the repair area with EPDM splice cleaner. Apply the splice cleaner to the repair area. Allow the cleaner time to dry. Apply primer in the prepared area in accordance with the EPDM manufacturer's requirements.
 3. Install 9-inch pressure-sensitive flashing, centered full-width, over the existing securement stripping. Install the flashing in accordance with the requirements and recommendations of the flashing manufacturer.
 4. Install lap sealant to all cut edges of the pressure-sensitive flashing.
- R. Repair No. S18 – Replace missing counterflashing (LF)
1. Where existing counterflashing is missing, install new counterflashing.
 2. Secure counterflashing with gasketed fasteners appropriate for the underlying substrate encountered. Secure counterflashing 12-inches o.c., and within 2-inches of each end.
- S. Repair No. S19 – Re-secure loose counterflashing (LF)
1. Where existing counterflashing is loose or displaced, remove displaced or obsolete fasteners. Re-position counterflashing to its original location.
 2. Secure counterflashing with gasketed fasteners appropriate for the underlying substrate encountered. Secure counterflashing 12-inches o.c., and within 2-inches of each end.

NOTE TO SPECIFIER

Article 3.3 ROOF REPAIR QUANTITIES AND LOCATIONS contains a roof area listing for the project, and specified quantities of individual roofing repairs identified in Article 3.2, per roof area. EDIT Article 3.3 below, to reflect actual roof areas specified for repair, and base proposal quantities for each roof area. Re-letter/number paragraphs and sub-paragraphs after editing.

3.3 ROOF REPAIR QUANTITIES AND LOCATIONS

- A. The following repair quantities are to be completed in the indicated roof area. Refer to Article 3.2 for specific repair procedures:

Roof Area XX:

Repair S1:	X,000 LF
Repair S2:	X,000 LF
Repair S3:	X,000 LF
Repair S4:	X,000 SF
Repair S5:	X,000 EA
Repair S6:	X,000 EA
Repair S7:	X,000 EA
Repair S8:	X,000 EA
Repair S9:	X,000 SF
Repair S10:	X,000 EA



Repair S11: X,000 LF
 Repair S12: X,000 EA
 Repair S13: X,000 EA
 Repair S14: X,000 LF
 Repair S15: X,000 LF
 Repair S16: X,000 EA
 Repair S17: X,000 LF
 Repair S18: X,000 LF
 Repair S19: X,000 LF

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NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 01 52 00



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SECTION 07 11 13 00 - CSF BITUMINOUS DAMPPROOFING

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Bituminous Dampproofing is part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.07 11 13 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Cold applied asphalt bitumen dampproofing.
 2. Application on masonry or concrete surfaces behind veneer finish material.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 1. ASTM D 41 - Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
 2. ASTM D 1227 - Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 1. Product Data: Provide properties of primer, bitumen, and mastics.
 2. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

1.4 QUALITY ASSURANCE



- A. Qualifications: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements: Maintain ambient temperatures above 40 degrees F for 24 hours before and during application until membrane has cured.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 1. ChemRex Incorporated; Shakopee, MN. (800) 433-9517.
 2. Karnak Chemical Corporation, Clark, NJ. (800) 526-4236.
 3. W.R. Meadows Incorporated, Hampshire, IL. (800) 342-5976.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 COLD-APPLIED ASPHALT EMULSION DAMPPROOFING

- A. Primer: ASTM D 41 asphalt, compatible with substrate.
- B. Trowel Grade: Emulsified asphalt mastic, prepared with mineral-colloid emulsifying agents and containing fibers other than asbestos, complying with ASTM D 1227, Type III or IV.
 1. ChemRex: Hydrocide 700 Mastic.
 2. Karnak: 920 Fibrated (Trowel Grade) Dampproofing.
 3. Meadows: Sealmastic Type 3 - Trowel Grade.
- C. Spray Grade: Emulsified asphalt, prepared with mineral-colloid emulsifying agents without fibrous reinforcement, complying with ASTM 1227, Type III.
 1. ChemRex: Hydrocide 600.
 2. Karnak: 100 non-Fibrated Emulsion Coating.
 3. Meadows: Sealmastic Type I - Spray Grade.
- D. Semimastic Grade: Emulsified asphalt semimastic, prepared with mineral-colloid emulsifying agents and containing fibers other than asbestos, complying with ASTM D 1227, Type III or IV.
 1. ChemRex: Hydrocide 700B Semimastic.



2. Karnak: 220 AF Fibrated Dampproofing.
3. Meadows: Sealmastic Type 2 - Brush-On or Spray Grade.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 1. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing.
 2. Verify items which penetrate surfaces to receive dampproofing are securely installed.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Protect adjacent surfaces not designated to receive dampproofing.
- B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's published instructions.
- C. Apply mastic to seal penetrations, small cracks or minor honeycomb in substrate.

3.3 INSTALLATION

- A. Prime surfaces in accordance with manufacturer's published instructions.
- B. Trowel Grade: Trowel apply at minimum rate of 7 gallons per 100 square feet to produce a minimum dry film thickness of 60 mils.
- C. Spray Grade: Spray apply at rate of 1.5 to 2.5 gallons per 100 square feet, depending on substrate texture, to produce a minimum dry-film thickness of 15 mils. Apply in two coats, if necessary, to obtain required thickness. Allow first coat to completely dry before application of second coat.
- D. Semimastic: Brush or spray apply at a rate of 5 gallons to produce minimum dry film thickness of 30 mils.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Inspect dampproofing application and test for minimum dry film thickness specified.



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Last revised: 4/12/2011

END OF SECTION



SECTION 07 19 00 00 - CSF WATER REPELLENTS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Clear Waterproofing over masonry is a part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.07 19 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Zero VOC water repellent coating applied to exterior masonry surfaces.
- B. Related Sections:
 - 1. Section 042200 - Concrete Unit Masonry: Substrate for application of water repellent.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Product description, tests performed, limitations to coating, and VOC content.
 - 2. Assurance/Control Submittals:
 - a. Test Reports: Manufacturer's Material Safety Data Sheets (MSDS).
 - b. Certificates: Manufacturer certificate that Products meet or exceed specified requirements.
 - c. Manufacturer's Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.
 - d. Qualification Documentation: Submit manufacturer and applicator documentation of experience indicating compliance with specified qualification requirements.

1.3 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 - 2. Applicator: Company specializing in performing the work of this Section with minimum 5 years documented experience.



- B. Regulatory Requirements: Comply with applicable rules and regulations of Pollution-Control Regulatory Agency having jurisdiction regarding volatile organic compounds (VOC) and use of hydrocarbon solvents.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Protect coating liquid from freezing.

1.5 PROJECT CONDITIONS

- A. Environmental Requirements: Do not apply Product during the following conditions;
 - 1. Ambient temperature below 40 degrees F.
 - 2. Substrate surfaces have cured less than 30 days.
 - 3. Rain or temperatures below 40 degrees F are predicted for a period of 24 hours.
 - 4. Surfaces not dry for minimum 24 hours.
 - 5. Substrate frozen or surface temperature is below 40 degrees F.

1.6 WARRANTY

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Warranty:
 - 1. Submit written warranty signed by water repellent manufacturer and applicator agreeing to repair or reapply materials that fail to provide water repellency because of failure of Product or improper application.
 - 2. Warranty Period: 3 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. The Euclid Chemical Company, Cleveland, OH (216) 531-9222, (800) 321-7628
 - 2. H&C Concrete Protection, Cleveland, OH, (800) 867-8246.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

- A. Siloxane: Clear penetrating water repellent. Alkylalkoxysiloxanes that are oligomeric with alcohol, ethanol, water, or other proprietary carrier.
- B. Products:
 - 1. Euclid: Loxon Siloxane.
 - 2. H&C: SX-7.



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify joint sealants are installed and cured.
 - 2. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of coating.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Remove loose particles and foreign matter. Remove oil or foreign substance with a cleaning agent which will not affect coating.
- B. Scrub and rinse surfaces with water, and let dry.
- C. Protect adjacent surfaces not scheduled to receive coating. If applied on unscheduled surfaces, remove immediately, by approved method.
- D. Protect landscaping, property, and vehicles from over spray and drift.

3.3 APPLICATION

- A. Delay work until masonry mortar is cured for seven days.
- B. Apply coating in accordance with manufacturer's published instructions, using appropriate method and coverage rate.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



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SECTION 07 21 00 00 - MPF THERMAL INSULATION

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 – GENERAL

1.1 SUMMARY

- A. Perimeter and cavity wall insulation.
- B. Loose insulation.
- C. Batt insulation.
- D. Fiberglass board insulation

1.2 SUBMITTALS

- A. Product Data: Required.
- B. Samples: Required.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements: Conform to ASTM E 119 and ASTM E 84 for Fire-Resistance Ratings and Surface Burning Characteristics respectively.
- B. Products containing Urea- Formaldehyde are prohibited.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Source: Celotex, Certainteed, Owens-Corning or approved equal.
- B. Perimeter and Cavity Wall Insulation: Extruded cellular type polystyrene insulation board complying with ASTM C578 Type 25PSI R value 5.0 (per inch of thickness).
- C. Loose Insulation: No CFCs allowed.
 - 1. Granular Insulation: Vermiculite perlite type, water repellent, fire resistant.
 - 2. Beaded Polystyrene: Loose polystyrene beads.
 - 3. Insulation Inserts: Rigid Polysterene inserted in factory.
- D. Batt Fiberglass Insulation with 25% recycled glass: Foil faced glass fiber batts complying with ASTM C-578 Type III R of 11.0 (per 3-inch thickness).
- E. Fiberglass Board Insulation: Thermal insulation complying with ASTM C612, Type IA or Type IA and IB, nominal density of 4 lb./cu. ft.



Adhesive: Type recommended by insulation manufacturer.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Foundation perimeter-board insulation:
 - 1. Install boards on foundation perimeter with adhesive.
 - 2. Tape insulation board joints.
- B. Exterior walls - board insulation:
 - 1. Install boards on wall surface.
 - 2. Tape insulation board joints.
- C. Exterior walls - loose fill insulation:
 - 1. Place in lifts not exceeding 6 feet pouring height.
- D. Perimeter Insulation: Extruded polystyrene, adhesive application, plus ½ inch (13 mm) thick protection board or applied interior without protection.
- E. Vermiculite or polystyrene insulation is to be placed in masonry cores when required to meet the minimum U - Value requirements.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 3/31/2010

END OF SECTION 07 21 00 00



SECTION 07 21 00 00 - CSF THERMAL INSULATION**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.07 21 00 00

PART 1 - GENERAL

1.1 SUMMARY

NOTE TO SPECIFIER

Select type of insulation used for Project.

- A. Section Includes:
 1. Batt Insulation in exterior wall [and ceiling] construction.
 2. [Board Insulation [under slab and] at foundation perimeter.]
 3. [Vapor retardant.]
 4. [Air infiltration seal.]
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 1. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
 2. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 3. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
 4. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. Federal Specifications (FS):
 1. FS HH-I-1972/GEN - Insulation Board, Thermal, Faced, Polyurethane or Polyisocyanurate.



1.3 SUBMITTALS

- A. Section 013300 – Submittal Procedures: Procedures for submittals.
- a. Product Data: Indicate product characteristics, performance criteria, and limitations.

NOTE TO SPECIFIER

Use QUALITY ASSURANCE below for projects in California.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Conform to insulation flame spread and smoke developed requirements of local authority having jurisdiction.
- B. Certification: For projects California provide Products certified by manufacturer that meet California Quality Standards for Insulating Materials.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Protect insulation from moisture, soiling and other damaging items.
- C. Store in dry location protected from sunlight.

NOTE TO SPECIFIER

“REQUIRED Article (Environmental Requirements) follows. Do not revise this Article, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer.”

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Resource Management:
1. Recycled Content: Provide fiberglass insulation manufactured from minimum 30 percent recycled glass.
- B. Environmental Impact:
1. Only Greenguard indoor air quality certified products will be permitted.
 2. Chlorofluorocarbons (CFCs): Products and equipment requiring or using CFCs during the manufacturing process will not be permitted.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.



2.1 BATT INSULATION

- A. Manufacturers:
1. Johns Manville Corporation, Denver, Co (800) 654-3103.
 2. Knauf Fiberglass, Shelbyville, IN (317) 398-4434, (800) 825-4434.
 3. Owens-Corning Fiberglass Corporation, Toledo, OH (419) 248-8000, (800) 438-7465.
 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Materials: Fiberglass insulation manufactured from minimum 30 percent recycled glass.
1. Unfaced Glass Fiber: ASTM C 665, Type I, unfaced. Thermal resistance R-value as indicated on Drawings.
 2. Faced Glass Fiber: ASTM C 665, Type III, Class A, with reflective covering one side. Thermal resistance R-value as indicated on Drawings.

NOTE TO SPECIFIER

Use BOARD INSULATION below when Project conditions require foundation insulation.

2.2 BOARD INSULATION

- A. Manufacturers:
1. Tenneco Building Products, Smyrna, GA (800) 241-4402.
 2. Owens Corning, Toledo, OH (800) 828-7155.
 3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Materials:
1. Extruded Polystyrene: ASTM C578, Type IV (density 1.6 pcf minimum); square edges. Thermal resistance R-value as indicated on Drawings.
 - a. Tenneco: Amofoam.
 - b. Owens Corning: Foamular 250.
 2. Thickness:
 - a. Under Floor Slab: 2 inches (5.08 cm).
 - b. Foundation Perimeter: 1 inch (2.54 cm).

NOTE TO SPECIFIER

Use VAPOR RETARDANT below when Project conditions require Vapor Retardant building envelope.

2.3 VAPOR RETARDANT

- A. ASTM D 4397, 6 mils thick, maximum permeance rating of 0.13 perm.
- B. Vapor Retardant Tape: Pressure-sensitive of type recommended by vapor retardant manufacturer for sealing joints and penetrations in vapor retardant.

NOTE TO SPECIFIER

Use AIR INFILTRATION SEAL below when Project conditions require an Air Infiltration Barrier around building envelope.



2.4 AIR INFILTRATION SEAL

- A. Manufacturer:
 - 1. Tenneco Building Products, Smyrna, GA (800) 241-4402.
 - 2. DuPont, Wilmington, DE (800) 448-9835.
 - 3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Materials: One of the following two types of materials:
 - 1. 15 pound, type 1, grade D, 10 minute unperforated asphalt saturated organic felt in accordance with ASTM D22.
 - 2. Coated, cross-woven polyethylene or polypropylene fabric:
 - a. Tenneco: Amowrap Housewrap.
 - b. DuPont: Tyvek Housewrap.
 - c. Air Infiltration Seal Tape: Pressure sensitive of type recommended by vapor retardant manufacturer for sealing joints and penetrations in air infiltration seal.

2.5 ACCESSORIES

- A. Tape: Polyethylene or polyester self-adhering type; 2 inches (5.08 cm) wide.
- B. Adhesive: Waterproof type, acceptable to manufacturer of insulation board.
- C. Wire Mesh: Galvanized steel, hexagonal wire mesh.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Batt Insulation:
 - a. Verify adjacent materials are dry and ready to receive installation.
 - b. Verify mechanical and electrical services within walls have been installed and tested.

NOTE TO SPECIFIER

Use paragraph below when BOARD INSULATION is a part of the Work.

- 2. Board Insulation:
 - a. Verify substrate and adjacent materials and insulation boards are dry and ready to receive insulation and adhesive.
 - b. Verify insulation boards are unbroken, free of damage.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.



3.2 INSTALLATION - BATT INSULATION

- A. Install batt insulation in accordance with manufacturer's instructions, without gaps or voids.
- B. Trim insulation neatly to fit spaces. Use batts free of damage. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation.
- C. Install insulation with factory applied membrane facing warm side of building spaces. Lap ends and side flanges of membrane. Attach insulation in place to framing; tape seal butt ends and lapped side flanges. Tape seal tears or cuts in membrane.

NOTE TO SPECIFIER

Use paragraph below when FOUNDATION PERIMETER BOARD INSULATION is a part of the Work.

3.3 INSTALLATION - BOARD INSULATION FOUNDATION PERIMETER

- A. Apply adhesive in three continuous beads to board insulation.
- B. Install boards on foundation wall or grade beam perimeter. Place boards by method to maximize contact bedding. Stagger joints. Butt edges and ends tight to adjacent board and to protrusions.
- C. Extend boards over joints, unbonded to foundation 2 inches (5.08 cm) both sides of joint. Backfill carefully to prevent damage to insulation boards.

NOTE TO SPECIFIER

Use paragraph below when BOARD INSULATION UNDER CONCRETE SLAB is a part of the Work.

3.4 INSTALLATION - BOARD INSULATION UNDER CONCRETE SLAB

- A. Place insulation under slabs on grade after base for slab has been compacted.
- B. Prevent insulation from being displaced or damaged while placing slab.

NOTE TO SPECIFIER

Use paragraph below for Small Standard Buildings when VAPOR BARRIER or AIR INFILTRATION BARRIER is a part of the Work. NOT USED for CSF Medium Buildings and StorCADD (Postal Retail Stores.)

3.5 INSTALLATION - [VAPOR RETARDANT] [AIR INFILTRATION SEAL]

- A. Install [vapor retardant] [air infiltration seal] over entire building exterior walls and adjacent surfaces
- B. Seal vertical joints over framing by lapping minimum 2 stud spaces. Fasten to framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints.
- C. Seal joints caused by pipes, conduits, electrical boxes, and similar items with manufacturer's sealing tape. Seal penetrations air-tight.



NOTE TO SPECIFIER

Coordinate the following items with Contract Drawings:

DRAWING COORDINATION ITEMS

Drawings should indicate the following information related to this Section.

1. *Extent of each type of building insulation, using specified generic names.*
2. *Required thermal resistance R-value of each insulation location.*
3. *Where a Vapor Barrier is required thoroughly detail barrier conditions throughout entire envelope. Any penetrations not sealed or causing a break in the barrier will defeat the barrier envelope.*

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



SECTION 07 22 15 00 - R&A INSULATION UNDERLAYMENT FOR ROOF REPLACEMENT

NOTE TO SPECIFIER

This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Include this Section for projects where roof replacement will occur over existing concrete, gypsum concrete, cementitious wood fiber, lightweight insulating concrete (remaining in place), and/or wood decks, and an insulation underlayment is specified.

NOTE TO SPECIFIER

Section Formatting:

Consistent formatting of Sections gives the complete document a professional look. This Section uses a 10pt. Arial font, and is formatted as follows:

1. *Insert one 10pt. line after the Section Number. Section Number is in CAPS.*
2. *Insert two 10pt. lines after the Section Title. Section Title is in CAPS.*
3. *Insert one 10pt. line after a PART. PARTS are in CAPS. If a Section is not used, include NOT USED following the PART title as shown below.*
4. *Insert one 10pt. line after Article paragraphs. Articles are in CAPS.*
5. *Insert two 10pt. lines at the end of an Article.*
6. *Complete Section with END OF SETION.*
7. *No lines should be placed between paragraphs and sub-paragraphs, or between sub-paragraphs and other sub-paragraphs.*

Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION



NOT USED

Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

PART 1 - GENERAL

NOTE TO SPECIFIER

EDIT paragraph 1.1A to reflect the actual deck types present. DELETE references to deck types not present on the project.

1.1 SUMMARY

- A. Installation of insulation underlayment over concrete, cementitious wood fiber, gypsum concrete, lightweight insulating concrete and wood structural roof decks.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 024100 – Roof Removal and Substrate Preparation
- D. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

NOTE TO SPECIFIER

Review available field data. EDIT Article 1.4 – REFERENCES below, based on the existing structural deck type(s), and underlayment(s) specified.

1. Over existing concrete structural decks, where a single-ply or cold-applied roofing membrane is specified, a self-adhering underlayment is recommended. DELETE sub-paragraphs 1.3.A.1.a, b, c and d.
2. Over existing concrete structural decks, where a hot-applied roofing membrane is specified, a two-ply underlayment consisting of asphalt felts is recommended. DELETE sub-paragraph 1.3.A.1.b.
3. Over existing gypsum concrete, cementitious wood fiber and lightweight insulating concrete structural decks, a mechanically-attached, asphalt-coated base sheet is recommended. DELETE sub-paragraphs 1.3.A.1.a, c and d.
4. Over existing wood structural decks, where a single-ply or cold-applied roofing membrane is specified, an underlayment of red rosin paper is recommended. DELETE sub-paragraphs 1.3.A.1.a, b, c and d.
5. Over existing wood structural decks, where a hot-applied roofing membrane is specified, an underlayment of a mechanically-attached, asphalt-coated base sheet over red rosin paper is recommended. DELETE sub-paragraphs 1.3.A.1.a, c and d.

Re-letter/number paragraphs and sub-paragraphs after editing.



1.3 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products of this Section:
 - 1. American Society for Testing and Materials (ASTM)
 - a. ASTM D 2178 - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing
 - b. ASTM D 4601 - Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing
 - c. ASTM D 312 - Standard Specification for Asphalt Used in Roofing
 - d. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
 - e. ASTM D 4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free
 - 2. American Society of Civil Engineers (ASCE)
 - a. ASCE 7 Minimum Design Loads of Buildings and Other Structures

1.4 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.5 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.



- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp. Store roll materials standing on end.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

EDIT paragraph 2.1 to reflect underlayment(s) and roof system(s) specified for this project. DELETE references to underlayment(s) not specified for this project. Re-letter/number paragraphs and sub-paragraphs after editing.

2.1 INSULATION UNDERLAYMENT

- A. At concrete structural decks (for use with cold-applied and single-ply roof membranes):
 - 1. Self-adhering modified bitumen base sheet; product type acceptable to roofing manufacturer.
 - a. The submitted product shall have a minimum thickness of 70 mils.
 - b. The submitted product shall be approved for use by the roofing membrane manufacturer on concrete decks, and as an underlayment for application of polyisocyanurate insulation with low-rise urethane foam adhesive.
 - c. The submitted product shall be capable of achieving the specified wind uplift requirements within the specified roof system assembly.
- B. At concrete structural decks (for use with hot-applied roof membranes):
 - 1. Asphalt-saturated glass fiber felt; Type IV, ASTM D 2178, product type acceptable to roofing membrane manufacturer.
- C. At cementitious wood fiber, gypsum concrete, and lightweight insulating concrete structural decks (cold-applied, hot-applied, and single-ply roof membranes):
 - 1. Asphalt-coated base sheet, glass fiber reinforced; No. 43, ASTM D 4601, Type II; product type acceptable to the roofing membrane manufacturer.
- D. At wood structural decks (for use with cold-applied and single-ply roof membranes):
 - 1. Red rosin paper; 36-inch width, minimum; 3 pounds per 100 square feet, minimum.
- E. At wood structural decks (for use with hot-applied roof membranes):
 - 1. Asphalt-coated base sheet, glass fiber reinforced; No. 43, ASTM D 4601, Type II; product type acceptable to the roofing membrane manufacturer.



- F. At acoustical steel decks:
1. Red rosin paper; 36-inch width, minimum; 3 pounds per 100 square feet, minimum.

NOTE TO SPECIFIER

EDIT Article 2.2 to reflect fasteners required for specified underlayment(s). DELETE references to underlayment(s) not specified for this project. Re-letter/number paragraphs and sub-paragraphs after editing.

2.2 FASTENERS

- A. For securing red rosin paper and asphalt-saturated base sheet to wood structural deck:
1. Large-headed roofing nails with a 1-inch diameter metal cap. Fastener length as necessary to penetrate 1-inch, minimum, into wood deck.
- B. For securing asphalt-coated base sheet to cementitious wood fiber, gypsum concrete and lightweight insulating concrete:
1. Locking impact nail-type fastener with integrated plate/tube assembly and locking barbs/wires. Plate and tube shall be fabricated of galvalume or galvanized steel.
 - a. The submitted fastener length shall be as necessary to achieve the wind uplift requirements for the project location, based on the fastening patterns provided in Sections 072221 and 072223.
 - b. The submitted fastener shall have a minimum plate diameter of 2-5/8 inches.
 - c. The submitted fastener shall be approved for use by the roofing membrane manufacturer in the specified application.

NOTE TO SPECIFIER

EDIT Article 2.3 to reflect fasteners required for specified underlayment(s). DELETE references to underlayment(s) not specified for this project. Do not delete paragraph 2.3C. Re-letter/number paragraphs and sub-paragraphs after editing.

2.3 ADHESIVES, PRIMERS AND CEMENTS

- A. For adhering self-adhering underlayment associated with cold-applied and single-ply roofing membranes:
1. Primer and adhesive recommended by the product manufacturer for adhesion to the existing substrate.
- B. For adhering asphalt-saturated glass fiber felt underlayment to concrete deck associated with hot-applied roofing membranes:
1. Asphalt primer: ASTM D 41.
 2. Asphalt; ASTM D 312, Type III.
- C. For sealing roof penetrations and roof-to-wall transitions:
1. Flashing cement: ASTM D 4586, Type I.

PART 3 - EXECUTION

3.1 GENERAL



- A. Prior to installation, inspect the existing roof deck. Ensure that the roof deck has been prepared as required in Section 024100, and is ready and acceptable to receive insulation underlayment materials.

NOTE TO SPECIFIER

EDIT paragraph 3.2 to reflect underlayment(s) specified for this project. DELETE references to underlayment(s) not specified for this project. Re-letter/number paragraphs and sub-paragraphs after editing.

3.2 INSULATION UNDERLAYMENT INSTALLATION

- A. Installation of asphalt-saturated glass fiber felts over concrete structural deck associated with hot-applied roofing membranes:
1. Apply asphalt primer over any bare areas of the concrete deck at the rate of one gallon per square; allow primer time to dry.
 2. Install two plies of asphalt-saturated glass fiber roofing felt in full and uniform moppings of hot and fluid Type III asphalt applied at a rate of 25 pounds per square. Install the felts with 19-inch side laps and 6-inch end laps.
 3. Seal roof penetrations and roof-to-wall terminations (including roof-to-wall and roof-to-roof curb terminations) with roofing cement.

NOTE TO SPECIFIER

Review available field data. Two options are available for paragraph 3.2B:

1. *For project locations with field wind uplift pressures calculated less than or equal to 45 psf per ASCE 7-05, RETAIN sub-paragraph 3.2.B.1 below as-is.*
2. *For project locations with field wind uplift pressures calculated at greater than 45 psf per ASCE 7-05, enhancements to the design must be made. Refer to qualified testing and inspection agencies, and the roofing membrane manufacturer for direction. REVISE the fastener spacing and patterns listed in sub-paragraph 3.2.B.1 below as necessary to achieve the required wind uplift rating for calculated wind uplift pressures.*

- B. Mechanical attachment of bottom layer of asphalt-coated base sheet over cementitious wood fiber, gypsum concrete and lightweight insulating concrete:
1. Mechanically fasten the asphalt-coated base sheet into the deck. Refer to the roofing manufacturer for instructions related to fastening pattern requirements. At a minimum, install fasteners at the following rates:
 - a. Field of roof: Fasten laps 9-inches o.c., and 18-inches o.c. in two equally spaced, staggered rows between laps.
 - b. At perimeters: Fasten laps 6-inches o.c., and 9-inches o.c. in two equally spaced, staggered rows between laps.
 - c. At corners Fasten laps 7-inches o.c., and 7-inches o.c. in three equally spaced, staggered rows between laps.
- C. Installation of asphalt-coated base sheet over wood structural decks:
1. Attach the underlayment in a manner recommended by the manufacturer, and sufficient to hold the base sheet in place during installation of the overlying insulation and roofing system.
- D. Installation of self-adhering underlayments over concrete structural decks:
1. If required by the product manufacturer, apply primer or adhesive to the substrate encountered. Allow primer time to dry.



2. Install the self-adhering underlayment, following the requirements and recommendations of the product manufacturer.
 3. Seal roof penetrations and roof-to-wall terminations (including roof-to-wall and roof-to-roof curb terminations) with roofing cement.
- E. Installation of red rosin paper over wood structural decks:
1. Attach the underlayment in a manner recommended by the manufacturer, and sufficient to hold the red rosin paper in place during installation of the overlying insulation and roofing system.
- F. Installation of red rosin paper over acoustical steel structural decks:
1. Loose-lay the underlayment on the deck. Tack in place, if necessary, in a manner sufficient to hold the red rosin paper in place during installation of the overlying insulation and roofing system.

USPS CSF Specifications issued: 10/1/2013
Last revised: 3/6/2013

NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 22 15 00



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SECTION 07 22 21 00 - R&A ROOF INSULATION AND COVER BOARD OVER INSULATION UNDERLAYMENT

NOTE TO SPECIFIER

This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this Section where rigid board polyisocyanurate insulation and a cover board are being installed over an existing concrete, gypsum concrete, cementitious wood fiber, and/or lightweight insulating concrete structural deck. Where rigid board polyisocyanurate insulation and a cover board are being installed over an existing steel or wood structural deck, use Section 072223 – ROOF INSULATION AND COVER BOARD OVER STEEL AND WOOD DECKS.

NOTE TO SPECIFIER

Section Formatting:

Consistent formatting of Sections gives the complete document a professional look. This Section uses a 10pt. Arial font, and is formatted as follows:

1. Insert one 10pt. line after the Section Number. Section Number is in CAPS.
2. Insert two 10pt. lines after the Section Title. Section Title is in CAPS.
3. Insert one 10pt. line after a PART. PARTS are in CAPS. If a Section is not used, include NOT USED following the PART title as shown below.
4. Insert one 10pt. line after Article paragraphs. Articles are in CAPS.
5. Insert two 10pt. lines at the end of an Article.
6. Complete Section with END OF SETION.
7. No lines should be placed between paragraphs and sub-paragraphs, or between sub-paragraphs and other sub-paragraphs.

Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED



PART 3 – EXECUTION

NOT USED

Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

PART 1 - GENERAL

NOTE TO SPECIFIER

EDIT paragraph 1.1A to reflect the actual deck types present. DELETE references to deck types not present on the project.

NOTE TO SPECIFIER

Review available field data. If existing low flashing heights, existing masonry wall weep locations, or other conditions create a situation where a completed finish roof membrane slope of 1/4-inch will not be practical, consideration may be given to allowing a completed finished roof membrane slope of 1/8-inch per foot. The USPS Roofing Design Standards require a finish roof slope of 1/4-inch per foot; a specified finished roof slope of 1/8-inch per foot will require a deviation. Only in circumstances where a 1/4-inch slope is not practical may this be considered. EDIT paragraph 1.1B below, if necessary.

1.1 SUMMARY

- A. Installation of roof insulation and cover board over underlayment in roof areas with existing concrete, gypsum concrete, cementitious wood fiber, and lightweight insulating concrete structural roof decks.
- B. **NOTE:** This project requires a minimum completed finish roof membrane slope of 1/4-inch per foot to existing drainage components.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 024100 – Roof Removal and Substrate Preparation
- D. Section 030150 – Concrete Roof Deck Repair
- E. Section 035113 – Cementitious Wood Fiber Roof Deck Repair and Replacement
- F. Section 035116 – Gypsum Concrete Roof Deck Repair and Replacement
- G. Section 035216 – Lightweight Insulating Concrete Repair and Replacement
- H. Section 072215 – Insulation Underlayment



- I. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 REFERENCES

NOTE TO SPECIFIER

EDIT Article 1.4 – REFERENCES, based on the system specified.

1. *If a hot-applied or other roofing system is specified requiring a wood fiber cover board, DELETE “ASTM C 1177 - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing and ASTM C 1278 - Standard Specification for Fiber-Reinforced Gypsum Panel from the reference list.*
2. *If a cold-applied roofing system is specified, do not edit the reference list.*
3. *If a single-ply thermoplastic or thermoset roofing system is chosen, DELETE “ASTM C 208 - Standard Specification for Cellulosic Fiber Insulating Board” from the reference list.*

Re-letter/number paragraphs and sub-paragraphs after editing.

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
1. American Society for Testing and Materials (ASTM)
 - a. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
 - b. ASTM C 208 - Standard Specification for Cellulosic Fiber Insulating Board
 - c. ASTM D 312 - Standard Specification for Asphalt Used in Roofing
 - d. ASTM C 1177 - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
 - e. ASTM C 1278 - Standard Specification for Fiber-Reinforced Gypsum Panel
 2. Factory Mutual Global (FM)
 3. Florida Building Code
 4. Miami-Dade County
 5. American Society of Civil Engineers (ASCE)
 - a. ASCE 7 Minimum Design Loads of Buildings and Other Structures

1.4 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.5 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in



compliance with specified regulatory requirements.

- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp. Protect foam insulation from direct sunlight exposure.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

PART 2 – PRODUCTS

2.1 ROOF INSULATION

NOTE TO SPECIFIER

Within paragraphs 2.1A and 2.1B below, two options are listed:

1. List project roof areas located over conditioned space within sub-paragraphs 2.1A.1 and 2.2B.1. These roof areas will require a minimum R-value of 20 per ASHRAE requirements and the USPS Roofing Design Standards.
2. List project roof areas located over unconditioned space within sub-paragraphs 2.1A.2 and 2.2B.2. These roof areas will not require a minimum R-value of 20 per ASHRAE requirements and the USPS Roofing Design Standards.



3. If roof areas over conditioned/unconditioned space are not applicable to the project, **DELETE** the non-applicable sub-item from both Articles 2.1A.2 and 2.2B.2 below.

Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

NOTE TO SPECIFIER

Review available field data. If existing low flashing heights, existing weep hole locations, or other conditions create a situation where a completed finish roof membrane slope of 1/4-inch will not be practical, consideration may be given to allowing a minimum completed finish roof membrane slope of 1/8-inch per foot. The USPS Roofing Design Standards require a finish roof slope of 1/4-inch per foot. Only in circumstances where a 1/4-inch slope is not practical may this be considered. Discuss any deviation from the USPS Roofing Design Standards with the USPS Project Manager for this project. **EDIT** paragraphs 2.1A, 2.1B, 2.1B.1.a and 2.1B.2.a below, if necessary.

- A. For existing deck slopes greater than or equal to 1/4-inch: Polyisocyanurate roof insulation; ASTM C 1289, Type II, Class 1, Grade 2 (20 psi); HCFC-Free and Zero Ozone Depletion Potential (ODP); product type acceptable to the roofing membrane manufacturer.
 - 1. Roof Areas (List Applicable Roof Areas):
 - a. Thickness: One layer of 2-inch thick insulation over one layer of 2-inch thick insulation (4-inches total).
 - b. Long Term Thermal Resistance (LTTR) Value: 6.0 minimum per inch.
 - c. Board Size:
 - 1) Bottom layer (2-inch thick): 4-feet by 4-feet.
 - 2) Top layer (2-inch thick): 4-feet by 4-feet.
 - 2. Roof Areas (List Applicable Roof Areas):
 - a. Thickness: One layer of 1-1/2 inch thick insulation.
 - b. Long Term Thermal Resistance (LTTR) Value: 6.0 minimum per inch.
 - c. Board Size: 4-feet by 4-feet.
- B. For existing deck slopes less than 1/4-inch: Tapered polyisocyanurate roof insulation system; ASTM C 1289, Type II, Class 1, Grade 2 (20 psi); HCFC-Free and Zero Ozone Depletion Potential (ODP); product type acceptable to the roofing manufacturer.
 - 1. Roof Areas (List Applicable Roof Areas):
 - a. Slope and Thickness: Tapered insulation, 1/4-inch per foot slope, starting thickness of 1/2-inch, over one layer of 2-inch thick insulation.
 - b. Long Term Thermal Resistance (LTTR) Value: 6.0 minimum per inch.
 - c. Board Size: 4-feet by 4-feet.
 - 2. Roof Areas (List Applicable Roof Areas):
 - a. Slope and Thickness: Tapered insulation, 1/4-inch per foot slope, starting thickness of 1-1/2 inch.
 - b. Long Term Thermal Resistance (LTTR) Value: 6.0 minimum per inch.
 - c. Board Size: 4-feet by 4-feet.

2.2 ROOF COVER BOARD

NOTE TO SPECIFIER

EDIT Article 2.2 – ROOF COVER BOARD, based on the system specified.

- 1. If a hot-applied or other roofing system is specified requiring a wood fiber cover board, **DELETE** paragraphs 2.2A, 2.2B and 2.2C below.
- 2. If a cold-applied roofing system is specified, **DELETE** paragraphs 2.2D, 2.2E and 2.2F below.
- 3. If a single-ply thermoplastic or thermoset roofing system is specified, **DELETE** paragraphs 2.2D, 2.2E and 2.2F below.

Re-letter/number items after editing.



- A. Type: Glass-mat or gypsum-fiber cover board with the meeting the following requirements:
 - 1. Approved for roofing applications.
 - 2. Approved by the roofing membrane manufacturer for use within the assembly.
 - 3. Conforming to ASTM C 1177 or C 1278.
 - 4. Achieving the specified wind uplift requirements within the specified roof assembly.
- B. Thickness: 1/2-inch.
- C. Board Size: 4-feet by 8-feet or 4-feet by 4-feet; as recommended by the roofing membrane manufacturer.
- D. Type: Wood fiber cover board; ASTM C 208, Type II, Grade 1. Cover board approved by the roofing manufacturer and capable of achieving the specified wind uplift requirements within the specified roof assembly. Fiberboard containing bagasse fibers (sugarcane or sorghum stocks) will not be accepted.
- E. Thickness: 1/2-inch.
- F. Board Size: 4-feet by 4-feet.

2.3 CRICKET AND SADDLE INSULATION

- A. Tapered polyisocyanurate roof insulation as necessary to achieve slopes and dimensions indicated in Article 3.3 and on the drawings, and as necessary to allow for proper drainage to existing drainage accessories; ASTM C 1289, Type II, Class 1; Minimum 20 psi; HCFC-Free and Zero Ozone Depletion Potential (ODP); product type acceptable to the roofing manufacturer.

2.4 TAPERED EDGE AND CANT STRIPS

NOTE TO SPECIFIER

Revise Article 2.4 – TAPERED EDGE AND CANT STRIPS, based on the system specified.

- 1. *If a hot-applied or cold-applied other roofing system is specified, do not edit the list below.*
- 2. *If a single-ply thermoplastic or thermoset roofing system is specified, DELETE paragraph 2.4B.*

Re-letter/number paragraph/sub-paragraph after editing.

- A. Tapered Edge Strips: Fiberboard, ASTM C 208; 1-1/2 inches thick x 18 inches wide (or as indicated by conditions shown in drawings); product type acceptable to the roofing manufacturer.
- B. Cant Strips: Fiberboard, ASTM C208; minimum 4-inch face except as indicated on the drawings.

NOTE TO SPECIFIER

Article 2.5 – BATT INSULATION AND POLYETHYLENE, may be deleted if batt insulation will not be required on this project.

Re-letter/number Articles after editing.

2.5 BATT INSULATION AND POLYETHYLENE

- A. Batt fiberglass insulation; 25 percent recycled glass content, R-Value of 3.1 per inch, minimum.



- B. Polyethylene film: 6-mil thickness.

2.6 ADHESIVE

NOTE TO SPECIFIER

EDIT Article 2.6 – ADHESIVE, based on the system specified.

1. *If a hot-applied roofing system is specified, where asphalt may be used to adhere layers of insulation above the bottom layer of insulation, and the overlying cover board, DELETE paragraph 2.6B below.*
2. *If a cold-applied roofing system is specified, where low-rise urethane foam may be used to adhere layers of insulation above the bottom layer of insulation, and the overlying cover board, DELETE paragraph 2.6A below.*

Re-letter/number paragraph/sub-paragraphs after editing.

- A. For adhering cover board, insulation, and tapered insulation used in saddle and cricket construction: Asphalt: ASTM D 312, Type III.
- B. For adhering cover board, insulation, and tapered insulation used in saddle and cricket construction: Urethane foam adhesive; product acceptable to the roofing manufacturer and is capable of meeting wind uplift requirements for the project location.

PART 3 - EXECUTION

3.1 GENERAL

- A. Ensure that the substrate has been prepared as necessary, and is ready and acceptable to receive insulation materials. Refer to Section 024100 for material removals and general work and substrate preparation requirements.

NOTE TO SPECIFIER

Review available field data. EDIT paragraph 3.1B as necessary:

1. *If project roof areas do not have an existing underlying concrete deck, DELETE references to Section 030150 within paragraph 3.1B below.*
2. *If project roof areas do not have an existing underlying cementitious wood fiber deck, DELETE references to Section 035113 within paragraph 3.1B below.*
3. *If project roof areas do not have an existing underlying gypsum concrete deck, DELETE references to Section 035116 within paragraph 3.1B below.*
4. *If project roof areas do not have an existing underlying lightweight insulating concrete deck, DELETE references to Section 035216 within paragraph 3.1B below.*
5. *If project areas contain all listed deck types, do not edit paragraph 3.1B.*

- B. Refer to Sections 030150, 035113, 035116 and 035216 for deck repair and replacement requirements.

NOTE TO SPECIFIER

Review available field data. EDIT paragraph 3.1B as necessary:

1. *If an underlayment will not be used on the project, delete paragraph 3.1C below. Please note that underlayment's are typically required on USPS projects with the listed deck types applicable to this Section. If an underlayment will not be used, contact the USPS Project Manager to*



determine if a deviation is required.

2. *If project roof areas will include an underlayment, do not edit paragraph 3.1C.*

Re-letter/number paragraph/sub-paragraphs after editing.

- C. Refer to Section 072215 for underlayment requirements specific to the existing structural deck type.

NOTE TO SPECIFIER

Review available field data. Revise paragraph 3.1D as necessary:

1. *If all project roof areas are over conditioned space, DELETE paragraph 3.1D.2.a below.*
2. *If this project includes roof areas over unconditioned space, edit paragraph 3.1D.2.a as necessary. Project roof areas over unconditioned spaces shall not be subject to this requirement.*

- D. Using the specified insulation, provide a completed insulation system that results in the following:
1. A roof system with a minimum completed **finish slope** of 1/4-inch per foot.
 2. An insulation system resulting in an average polyisocyanurate insulation thickness of 4-inches, minimum.
 - a. Roof Areas (list applicable roof areas over unconditioned space) are not subject to the requirement for an average polyisocyanurate thickness of 4-inches, minimum.

3.2 INSULATION INSTALLATION

- A. Closely butt the insulation boards and roof cover boards.
- B. Stagger board joints by the maximum dimensions possible.
- C. Neatly cut insulation and roof cover boards to fit around all penetrations through the roof deck. At locations where less than a full-sized sheet of insulation or cover board is required, use the largest size practical to fill in the area. Do not install numerous small sections of cover board or insulation at these locations.
- D. Fill gaps between boards, and between boards and walls, curbs, blocking, and equipment with additional insulation material.
- E. Protect all insulation and cover board from weather and standing water at all times. Install no more product than can be completely covered with the roofing membrane on the same day.
- F. Install temporary water cut-offs at the edges of insulation at the end of each workday.
- G. Prior to installing the insulation, inspect the underside of the roof deck to determine if objects, such as sprinklers, lights, conduits, fans, or gas lines are attached to the deck. Exercise caution to ensure that insulation fasteners do not penetrate these objects.

NOTE TO SPECIFIER

Review available field data. Two options are available for paragraph 3.2H:

1. *For project locations with field wind uplift pressures calculated less than or equal to 45 psf per ASCE 7-05, RETAIN sub-paragraph 3.2.H.1 below, and DELETE sub-paragraphs 3.2.H.2 and 3.*
2. *For project locations with field wind uplift pressures calculated at greater than 45 psf per ASCE 7-05, enhancements to the design must be made. Refer to the listed qualified testing and inspection agencies listed below, and the roofing membrane manufacturer for direction. At a*



minimum, RETAIN sub-paragraphs 3.2.H.2 and 3 below or REVISE sub-paragraph 3.2.H.1 to achieve the necessary securement for calculated wind uplift pressures.

Re-letter/number paragraph/sub-paragraphs after editing.

- H. Adhesion of intermediate and top layer(s) of insulation, and cover board:
1. Adhere insulation and cover board, using the specified urethane foam adhesive. Refer to the roofing manufacturer for application instructions and requirements. At a minimum, apply the adhesive at the following rates:
 - a. Field of roof: 3/4-inch wide bands of adhesive, 12-inches o.c.
 - b. At perimeters: 3/4-inch bands of adhesive, 6-inches o.c.
 - c. At corners: 3/4-inch wide bands of adhesive, 4-inches o.c.
 2. Adhere the insulation and cover board using the submitted adhesive in a manner that has been successfully tested by a qualified testing and inspecting agency such as FM Global, Florida Building Code or Miami-Dade County. Roof systems must resist uplift pressures calculated according to ASCE 7-05 for the field, perimeters and corners. The specified approval rating must incorporate a safety factor of 2 over the maximum calculated uplift pressure in foot-pound units. Provide documentation from the roofing manufacturer that indicates the submitted system meets wind uplift pressure that the system meets the specified wind uplift pressure requirements within the field, perimeters and corners.
 3. Provide recommended enhancements at perimeters and corners, as determined by a qualified testing agency.

3.3 INSULATION SADDLE AND CRICKET INSTALLATION

- A. Install insulation saddles and crickets to provide positive drainage to drainage accessories, and where indicated on the drawings. Ensure width of saddles is one-half their length, minimum, or as shown on the drawing (whichever is greater). Use tapered insulation material with a slope that is double the existing finish slope of the roof area, creating insulation saddles and crickets with a **finish slope** equal to or greater than the slope in the field of the roof area. Adhere saddles and crickets using the specified adhesive.

NOTE TO SPECIFIER

Article 3.4 – BATT INSULATION INSTALLATION, may be deleted if batt insulation will not be required on this project.

Re-letter/number Articles after editing.

3.4 BATT INSULATION INSTALLATION

- A. Install polyethylene sheathing at locations indicated on the drawings. Drape sheathing into expansion joints as shown on drawings. Secure sheathing with fasteners spaced 12-inches o.c., maximum. Install unfaced batt insulation into the space created.

USPS CSF Specifications issued: 10/1/2013

Last revised: 3/6/2013

NOTE TO SPECIFIER



*Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to **black text**. Review the footer information with the USPS Project Manager for accuracy.*

END OF SECTION 07 22 21 00



SECTION 07 22 23 00 - R&A ROOF INSULATION AND COVER BOARD OVER STEEL AND WOOD ROOF DECKS

NOTE TO SPECIFIER

This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section.

NOTE TO SPECIFIER

Use this Section where rigid board polyisocyanurate insulation and a cover board are being installed over existing steel and/or wood structural roof decks. Where rigid board polyisocyanurate insulation and a cover board are being installed over an underlayment over an existing concrete, gypsum concrete, cementitious wood fiber, and/or lightweight insulating concrete structural deck, use Section 072221 – ROOF INSULATION AND COVER BOARD OVER UNDERLAYMENT.

NOTE TO SPECIFIER

Section Formatting:

Consistent formatting of Sections gives the complete document a professional look. This Section uses a 10pt. Arial font, and is formatted as follows:

1. Insert one 10pt. line after the Section Number. Section Number is in CAPS.
2. Insert two 10pt. lines after the Section Title. Section Title is in CAPS.
3. Insert one 10pt. line after a PART. PARTS are in CAPS. If a Section is not used, include NOT USED following the PART title as shown below.
4. Insert one 10pt. line after Article paragraphs. Articles are in CAPS.
5. Insert two 10pt. lines at the end of an Article.
6. Complete Section with END OF SETION.
7. No lines should be placed between paragraphs and sub-paragraphs, or between sub-paragraphs and other sub-paragraphs.

Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED



PART 3 – EXECUTION

NOT USED

Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

NOTE TO SPECIFIER

Edit the Section title and footer as necessary to reflect the actual deck types present. If steel deck is not present, remove references to steel deck from the title and footer. If wood deck is not present, remove references to wood deck from the title and footer.

PART 1 - GENERAL

NOTE TO SPECIFIER

EDIT paragraph 1.1A to reflect the actual deck types present. DELETE references to deck types not present on the project.

NOTE TO SPECIFIER

Review available field data. If existing low flashing heights, existing masonry wall weep locations, or other conditions create a situation where a completed finish roof membrane slope of 1/4-inch will not be practical, consideration may be given to allowing a completed finished roof membrane slope of 1/8-inch per foot. The USPS Roofing Design Standards require a finish roof slope of 1/4-inch per foot; a specified finished roof slope of 1/8-inch per foot will require a deviation. Only in circumstances where a 1/4-inch slope is not practical may this be considered. EDIT paragraph 1.1B below, if necessary.

1.1 SUMMARY

- A. Installation of roof insulation and cover board over existing steel and wood structural roof decks.
- B. **NOTE:** This project requires a minimum completed finish roof membrane slope of 1/4-inch per foot to existing drainage components.

NOTE TO SPECIFIER

Review available field data:

1. *For projects that do not include roof areas with underlying steel decks, DELETE paragraph 1.2D from the list below.*
2. *For projects that do not include roof areas with underlying wood decks, DELETE paragraph 1.2E from the list below.*
3. *For projects that include roof areas with both underlying steel and wood decks, do not edit the list below.*

Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures



- B. Section 016000 – Product Requirements
- C. Section 024100 – Roof Removal and Substrate Preparation
- D. Section 053123 – Steel Roof Deck Repair and Replacement
- E. Section 061516 – Wood Roof Deck Repair and Replacement
- F. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 REFERENCES

NOTE TO SPECIFIER

EDIT Article 1.4 – REFERENCES, based on the system specified.

1. *If a hot-applied or other roofing system is specified requiring a wood fiber cover board, DELETE “ASTM C 1177 - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing and ASTM C 1278 - Standard Specification for Fiber-Reinforced Gypsum Panel from the reference list.*
2. *If a cold-applied roofing system is specified, do not edit the reference list.*
3. *If a single-ply thermoplastic or thermoset roofing system is chosen, DELETE “ASTM C 208 - Standard Specification for Cellulosic Fiber Insulating Board” from the reference list.*

Re-letter/number paragraphs and sub-paragraphs after editing.

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 1. American Society for Testing and Materials (ASTM)
 - a. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
 - b. ASTM C 208 - Standard Specification for Cellulosic Fiber Insulating Board
 - c. ASTM C 1177 - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
 - d. ASTM C 1278 - Standard Specification for Fiber-Reinforced Gypsum Panel
 2. Factory Mutual Global (FM)
 3. Florida Building Code
 4. Miami-Dade County
 5. American Society of Civil Engineers (ASCE)
 - a. ASCE 7 Minimum Design Loads of Buildings and Other Structures

1.4 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.5 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing

R&A ROOF INSULATION AND COVER BOARD OVER STEEL
AND WOOD ROOF DECKS



system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.

- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp. Protect foam insulation from direct sunlight exposure.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

PART 2 – PRODUCTS

2.1 ROOF INSULATION

NOTE TO SPECIFIER

Within paragraphs 2.1A and 2.1B below, two options are listed:

R&A ROOF INSULATION AND COVER BOARD OVER
STEEL AND WOOD ROOF DECKS

2014



1. List project roof areas located over conditioned space within sub-paragraphs 2.1A.1 and 2.2B.1. These roof areas will require a minimum R-value of 20 per ASHRAE requirements and the USPS Roofing Design Standards.
2. List project roof areas located over unconditioned space within sub-paragraphs 2.1A.2 and 2.2B.2. These roof areas will not require a minimum R-value of 20 per ASHRAE requirements and the USPS Roofing Design Standards.
3. If roof areas over conditioned/unconditioned space are not applicable to the project, DELETE the non-applicable sub-item from both Articles 2.1A.2 and 2.2B.2 below.

Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

NOTE TO SPECIFIER

Review available field data. If existing low flashing heights, existing weep hole locations, or other conditions create a situation where a completed finish roof membrane slope of 1/4-inch will not be practical, consideration may be given to allowing a minimum completed finish roof membrane slope of 1/8-inch per foot. The USPS Roofing Design Standards require a finish roof slope of 1/4-inch per foot. Only in circumstances where a 1/4-inch slope is not practical may this be considered. Discuss any deviation from the USPS Roofing Design Standards with the USPS Project Manager for this project. EDIT paragraphs 2.1A, 2.1B, 2.1B.1.a and 2.1B.2.a below, if necessary.

- A. For existing deck slopes greater than or equal to 1/4-inch: Polyisocyanurate roof insulation; ASTM C 1289, Type II, Class 1, Grade 2 (20 psi); HCFC-Free and Zero Ozone Depletion Potential (ODP); product type acceptable to the roofing membrane manufacturer.
 1. Roof Areas (List Applicable Roof Areas):
 - a. Thickness: One layer of 2-inch thick insulation over one layer of 2-inch thick insulation (4-inches total).
 - b. Long Term Thermal Resistance (LTTR) Value: 6.0 minimum per inch.
 - c. Board Size:
 - 1) Bottom layer (2-inch thick): 4-feet by 8-feet.
 - 2) Top layer (2-inch thick): 4-feet by 4-feet.
 2. Roof Areas (List Applicable Roof Areas):
 - a. Thickness: One layer of 1-1/2 inch thick insulation.
 - b. Long Term Thermal Resistance (LTTR) Value: 6.0 minimum per inch.
 - c. Board Size: 4-feet by 8-feet.
- B. For existing deck slopes less than 1/4-inch: Tapered polyisocyanurate roof insulation system; ASTM C 1289, Type II, Class 1, Grade 2 (20 psi); HCFC-Free and Zero Ozone Depletion Potential (ODP); product type acceptable to the roofing manufacturer.
 1. Roof Areas (List Applicable Roof Areas):
 - a. Slope and Thickness: Tapered insulation, 1/4-inch per foot slope, starting thickness of 1/2-inch; over one layer of 2-inch thick insulation.
 - b. Long Term Thermal Resistance (LTTR) Value: 6.0 minimum per inch.
 - c. Board Size: 4-feet by 4-feet.
 2. Roof Areas (List Applicable Roof Areas):
 - a. Slope and Thickness: Tapered insulation, 1/4-inch per foot slope, starting thickness of 1-1/2 inch.
 - b. Long Term Thermal Resistance (LTTR) Value: 6.0 minimum per inch.
 - c. Board Size: 4-feet by 4-feet.

2.2 ROOF COVER BOARD

NOTE TO SPECIFIER

EDIT Article 2.2 – ROOF COVER BOARD, based on the system specified.

R&A ROOF INSULATION AND COVER BOARD OVER STEEL
AND WOOD ROOF DECKS



1. *If a hot-applied or other roofing system is specified requiring a wood fiber cover board, DELETE paragraphs 2.2A, 2.2B and 2.2C below.*
2. *If a cold-applied roofing system is specified, DELETE paragraphs 2.2D, 2.2E and 2.2F below.*
3. *If a single-ply thermoplastic or thermoset roofing system is specified, DELETE paragraphs 2.2D, 2.2E and 2.2F below.*

Re-letter/number items after editing.

- A. Type: Glass-mat or gypsum-fiber cover board with the meeting the following requirements:
 1. Approved for roofing applications.
 2. Approved by the roofing membrane manufacturer for use within the assembly.
 3. Conforming to ASTM C 1177 or C 1278.
 4. Achieving the specified wind uplift requirements within the specified roof assembly.
- B. Thickness: 1/2-inch.
- C. Board Size: 4-feet by 8-feet or 4-feet by 4-feet; as recommended by the roofing membrane manufacturer.
- D. Type: Wood fiber cover board; ASTM C 208, Type II, Grade 1. Cover board approved by the roofing manufacturer and capable of achieving the specified wind uplift requirements within the specified roof assembly. Fiberboard containing bagasse fibers (sugarcane or sorghum stocks) will not be accepted.
- E. Thickness: 1/2-inch.
- F. Board Size: 4-feet by 4-feet.

2.3 CRICKET AND SADDLE INSULATION

- A. Tapered polyisocyanurate roof insulation as necessary to achieve slopes and dimensions indicated in Article 3.3 and on the drawings, and as necessary to allow for proper drainage to existing drainage accessories; ASTM C 1289, Type II, Class 1; Minimum 20 psi; HCFC-Free and Zero Ozone Depletion Potential (ODP); product type acceptable to the roofing manufacturer.

2.4 TAPERED EDGE AND CANT STRIPS

NOTE TO SPECIFIER

Revise Article 2.4 – TAPERED EDGE AND CANT STRIPS, based on the system specified.

1. *If a hot-applied or cold-applied other roofing system is specified, do not edit the list below.*
2. *If a single-ply thermoplastic or thermoset roofing system is specified, DELETE paragraph 2.4B.*

Re-letter/number paragraph/sub-paragraph after editing.

- A. Tapered Edge Strips: Fiberboard, ASTM C 208; 1-1/2 inches thick x 18 inches wide (or as indicated by conditions shown in drawings); product type acceptable to the roofing manufacturer.
- B. Cant Strips: Fiberboard, ASTM C208; minimum 4-inch face except as indicated on the drawings.

NOTE TO SPECIFIER

Article 2.5 – BATT INSULATION AND POLYETHYLENE, may be deleted if batt insulation will not be required on this project.



Re-letter/number Articles after editing.

2.5 BATT INSULATION AND POLYETHYLENE

- A. Batt fiberglass insulation; 25 percent recycled glass content, R-Value of 3.1 per inch, minimum.
- B. Polyethylene film: 6-mil thickness.

2.6 INSULATION FASTENERS AND PLATES

NOTE TO SPECIFIER

EDIT Sub-paragraphs 2.6.A.1 and 2.6.A.2 based on the required wind uplift.

- 1. *At high-wind locations, consider use of insulation plates with a diameter greater than 3-inches, if available. Consult with the roofing membrane manufacturer.*
- 2. *At high-wind locations, consider use of heavy-duty, minimum No. 14 fasteners. Consult with the roofing membrane manufacturer.*

- A. For securing polyisocyanurate insulation: FM-approved fluorocarbon coated or galvanized self-drilling screw and plate system; product type acceptable to the roofing manufacturer. Fastener length as necessary to penetrate through the bottom layer of insulation and through the top deck flange a minimum of 3/4-inch and a maximum of 1-inch for steel decks, and a penetration of 1-inch into wood decks.
 - 1. Minimum insulation plate diameter: 3-inches.
 - 2. Minimum fastener size: No. 12.

NOTE TO SPECIFIER

EDIT Article 2.7 – ADHESIVE, based on the system specified.

- 1. *If a hot-applied roofing system is specified, where asphalt may be used to adhere layers of insulation above the bottom layer of insulation, and the overlying cover board, DELETE paragraph 2.2B below.*
- 2. *If a cold-applied roofing system is specified, where low-rise urethane foam may be used to adhere layers of insulation above the bottom layer of insulation, and the overlying cover board, DELETE paragraph 2.2A below.*

Re-letter/number paragraph/sub-paragraphs after editing.

2.7 ADHESIVE

- A. For adhering cover board and top and intermediate layer(s) of polyisocyanurate insulation: Asphalt: ASTM D 312, Type III.
- B. For adhering cover board, top and intermediate layers of insulation, and tapered insulation used in saddle and cricket construction: Urethane foam adhesive; product acceptable to the roofing manufacturer and is capable of meeting the specified wind uplift requirements.

PART 3 - EXECUTION

3.1 GENERAL

**NOTE TO SPECIFIER**

Review available field data. *EDIT* paragraph 3.1A as necessary:

1. If project roof areas do not have an existing underlying steel deck, *DELETE* references to Section 053123 within paragraph 3.1A below.
2. If project roof areas do not have an existing underlying wood deck, *DELETE* references to Section 061516 within paragraph 3.1A below.
3. If project areas contain both steel and wood decks, do not edit paragraph 3.1A.

- A. Ensure that the substrate has been prepared as necessary, and is ready and acceptable to receive insulation materials. Refer to Section 024100 for material removals and general work and substrate preparation requirements. Refer to Sections 053123 and 061516 for deck repair and replacement requirements.

NOTE TO SPECIFIER

Review available field data. *Revise* paragraph 3.1B as necessary:

1. If all project roof areas are over conditioned space, *DELETE* paragraph 3.1B.2.a below.
2. If this project includes roof areas over unconditioned space, edit paragraph 3.1B.2.a as necessary. Project roof areas over unconditioned spaces shall not be subject to this requirement.

- B. Using the specified insulation, provide a completed insulation system that results in the following:
 1. A roof system with a minimum completed **finish slope** of 1/4-inch per foot.
 2. An insulation system resulting in an average polyisocyanurate insulation thickness of 4-inches, minimum.
 - a. Roof Areas (list applicable roof areas over unconditioned space) are not subject to the requirement for an average polyisocyanurate thickness of 4-inches, minimum.

3.2 INSULATION INSTALLATION

- A. Closely butt the insulation boards and roof cover boards.
- B. Stagger board joints by the maximum dimensions possible.
- C. Neatly cut insulation and roof cover boards to fit around all penetrations through the roof deck. At locations where less than a full-sized sheet of insulation or cover board is required, use the largest size practical to fill in the area. Do not install numerous small sections of cover board or insulation at these locations.
- D. Fill gaps between boards, and between boards and walls, curbs, blocking, and equipment with additional insulation material.
- E. Protect all insulation and cover board from weather and standing water at all times. Install no more product than can be completely covered with the roofing membrane on the same day.
- F. Install temporary water cut-offs at the edges of insulation at the end of each workday.
- G. Prior to installing the insulation, inspect the underside of the roof deck to determine if objects, such as sprinklers, lights, conduits, fans, or gas lines are attached to the deck. Exercise caution to ensure that insulation fasteners do not penetrate these objects.

**NOTE TO SPECIFIER**

Review available field data. Two options are available for paragraph 3.2H:

1. For project locations with field wind uplift pressures calculated less than or equal to 45 psf per ASCE 7-05, **RETAIN** sub-paragraph 3.2.H.1 below, and **DELETE** sub-paragraphs 3.2.H.2 and 3.
2. For project locations with field wind uplift pressures calculated at greater than 45 psf per ASCE 7-05, enhancements to the design must be made. Refer to the listed qualified testing and inspection agencies listed below, and the roofing membrane manufacturer for direction. At a minimum, **RETAIN** sub-paragraphs 3.2.H.2 and 3 below or **REVISE** sub-paragraph 3.2.H.1 to achieve the necessary securement for calculated wind uplift pressures.

Re-letter/number paragraph/sub-paragraphs after editing.

NOTE TO SPECIFIER

Review available field data. Revise paragraphs 3.2H and 3.2I as necessary:

1. If project roof areas are located over unconditioned space, such as canopies, consideration may be given to mechanical attachment of all insulation layers and cover board, if necessary, to achieve the required wind uplift ratings.

H. Mechanical attachment of bottom layer of polyisocyanurate insulation:

1. Mechanically fasten the insulation into the deck, penetrating a minimum of 3/4-inch and a maximum of 1-inch into steel deck, and 1-inch into wood deck. Refer to the roofing manufacturer for instructions related to fastening pattern requirements. At a minimum, install fasteners at the following rates:
 - a. Field of roof: One fastener per 4.00 square feet (8 fasteners per 4-foot x 8-foot board).
 - b. At perimeters: One fastener per 1.33 square feet (24 fasteners per 4-foot x 8-foot board).
 - c. At corners: One fastener per 1.00 square feet (32 fasteners per 4-foot x 8-foot board).
2. Mechanically attach the bottom layer of insulation, using the submitted fasteners and plates in a manner that has been successfully tested by a qualified testing and inspecting agency such as FM Global, Florida Building Code or Miami-Dade County. Roof systems must resist uplift pressures calculated according to ASCE 7 for the field, perimeters and corners. The specified approval rating must incorporate a safety factor of 2 over the maximum calculated uplift pressure in foot-pound units. Provide documentation from the roofing manufacturer that indicates the submitted system meets wind uplift pressure that the system meets the specified wind uplift pressure requirements within the field, perimeters and corners.
3. Provide recommended enhancements at perimeters and corners, as determined by a qualified testing agency.

NOTE TO SPECIFIER

Review available field data. Two options are available for paragraph 3.2I:

1. For project locations with field wind uplift pressures calculated less than or equal to 45 psf per ASCE 7-05, **RETAIN** sub-paragraph 3.2.I.1 below, and **DELETE** sub-paragraphs 3.2.I.2 and 3.
2. For project locations with field wind uplift pressures calculated at greater than 45 psf per ASCE 7-05, enhancements to the design must be made. Refer to the listed qualified testing and inspection agencies listed below, and the roofing membrane manufacturer for direction. At a minimum, **RETAIN** sub-paragraphs 3.2.I.2 and 3 below or **REVISE** sub-paragraph 3.2.I.1 to achieve the necessary securement for calculated wind uplift pressures.

Re-letter/number paragraph/sub-paragraphs after editing.

I. Adhesion of intermediate and top layer(s) of insulation, and cover board:

1. Adhere insulation and cover board, using the specified urethane foam adhesive. Refer



to the roofing manufacturer for application instructions and requirements. At a minimum, apply the adhesive at the following rates:

- a. Field of roof: 3/4-inch wide bands of adhesive, 12-inches o.c.
 - b. At perimeters: 3/4-inch bands of adhesive, 6-inches o.c.
 - c. At corners: 3/4-inch wide bands of adhesive, 4-inches o.c.
2. Adhere the insulation and cover board using the submitted adhesive in a manner that has been successfully tested by a qualified testing and inspecting agency such as FM Global, Florida Building Code or Miami-Dade County. Roof systems must resist uplift pressures calculated according to ASCE 7-05 for the field, perimeters and corners. The specified approval rating must incorporate a safety factor of 2 over the maximum calculated uplift pressure in foot-pound units. Provide documentation from the roofing manufacturer that indicates the submitted system meets wind uplift pressure that the system meets the specified wind uplift pressure requirements within the field, perimeters and corners.
 3. Provide recommended enhancements at perimeters and corners, as determined by a qualified testing agency.

3.3 INSULATION SADDLE AND CRICKET INSTALLATION

- A. Install insulation saddles and crickets to provide positive drainage to drainage accessories, and where indicated on the drawings. Ensure width of saddles is one-half their length, minimum, or as shown on the drawing (whichever is greater). Use tapered insulation material with a slope that is double the existing finish slope of the roof area, creating insulation saddles and crickets with a **finish slope** equal to or greater than the slope in the field of the roof area. Adhere saddles and crickets using the specified adhesive.

NOTE TO SPECIFIER

Article 3.4 – BATT INSULATION INSTALLATION, may be deleted if batt insulation will not be required on this project.

Re-letter/number Articles after editing.

3.4 BATT INSULATION INSTALLATION

- A. Install polyethylene sheathing at locations indicated on the drawings. Drape sheathing into expansion joints as shown on drawings. Secure sheathing with fasteners spaced 12-inches o.c., maximum. Install unfaced batt insulation into the space created.

USPS CSF Specifications issued: 10/1/2013

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NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.



END OF SECTION 07 22 23 00



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SECTION 07 24 13 00 - WATER-DRAINAGE EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)**1.1 GENERAL****A. Description Of Work:**

1. This specification covers the furnishing and installation of materials for water drainage exterior insulation and finish system (EIFS). Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes water-drainage exterior insulation and finish system (EIFS) applied over water-resistant coating over sheathing, weather-resistant sheathing paper over sheathing, weather-resistant sheathing paper over exterior cement board, and exterior cement board over weather-resistant sheathing paper.

C. System Description

1. Class PB EIFS: A non-load-bearing, exterior wall cladding system that consists of an insulation board attached adhesively, mechanically, or both to the substrate; an integrally reinforced base coat; and a textured protective finish coat.
2. Water-Drainage EIFS: EIFS with a means that allows water entering into an EIFS assembly to drain to the exterior.

D. Performance Requirements

1. EIFS Performance: Comply with the following:
 - a. Bond Integrity: Free from bond failure within EIFS components or between system and supporting wall construction, resulting from exposure to fire, wind loads, weather, or other in-service conditions.
 - b. Weathertightness: Resistant to water penetration from exterior into water-drainage EIFS and assemblies behind it or through them into interior of building that results in deterioration of thermal-insulating effectiveness or other degradation of EIFS and assemblies behind it, including substrates, supporting wall construction, and interior finish, and including a means that allows water entering into an EIFS assembly to drain to the exterior.
2. Class PB EIFS: Provide EIFS having physical properties and structural performance that comply with the following:
 - a. Abrasion Resistance: Sample consisting of 1-inch- (25.4-mm-) thick EIFS mounted on 1/2-inch- (12.7-mm-) thick gypsum board; cured for a minimum of 28 days; and showing no cracking, checking, or loss of film integrity after exposure to 528 quarts (500 L) of sand when tested per ASTM D 968, Method A.
 - b. Absorption-Freeze Resistance: No visible deleterious effects and negligible weight loss after 60 cycles per EIMA 101.01.
 - c. Accelerated Weathering: Five samples per ICC-ES AC235 showing no cracking, checking, crazing, erosion, rusting, blistering, peeling, delamination, or other characteristics that might affect performance as a wall cladding after testing for 2000 hours when viewed under 5 times magnification per ASTM G 153 or ASTM G 154 **OR** ASTM G 153 or ASTM G 155, **as directed**.
 - d. Freeze-Thaw: No surface changes, cracking, checking, crazing, erosion, rusting, blistering, peeling, or delamination, or indications of delamination between components when viewed under 5 times magnification after 60 cycles per EIMA 101.01 **OR** 10 cycles per ICC-ES AC235, **as directed**.



- e. Mildew Resistance of Finish Coat: Sample applied to 2-by-2-inch (50.8-by-50.8-mm) clean glass substrate, cured for 28 days, and showing no growth when tested per ASTM D 3273 and evaluated according to ASTM D 3274.
- f. Salt-Spray Resistance: No deleterious affects when tested according to ICC-ES AC235.
- g. Tensile Adhesion: No failure in the EIFS, adhesive, base coat, or finish coat when tested per EIMA 101.03 **OR** ICC-ES AC235, **as directed**.
- h. Water Penetration: Sample consisting of 1-inch- (25.4-mm-) thick EIFS mounted on 1/2-inch- (12.7-mm-) thick gypsum board, cured for 28 days, and showing no water penetration into the plane of the base coat to expanded polystyrene board interface of the test specimen after 15 minutes at 6.24 lbf/sq. ft. (299 Pa) of air pressure difference or 20 percent of positive design wind pressure, whichever is greater, across the specimen during a test period when tested per EIMA 101.02.
- i. Water Resistance: Three samples, each consisting of 1-inch- (25.4-mm-) thick EIFS mounted on 1/2-inch- (12.7-mm-) thick gypsum board; cured for 28 days; and showing no cracking, checking, crazing, erosion, rusting, blistering, peeling, or delamination after testing for 14 days per ASTM D 2247.
- j. Impact Resistance: Sample consisting of 1-inch- (25.4-mm-) thick EIFS when constructed, conditioned, and tested per EIMA 101.86; and meeting or exceeding the following:
 - 1) Standard Impact Resistance: 25 to 49 inch-lb (2.8 to 5.6 J).
 - 2) Medium Impact Resistance: 50 to 89 inch-lb (5.7 to 10.1 J).
 - 3) High Impact Resistance: 90 to 150 inch-lb (10.2 to 17 J).
 - 4) Ultra-High Impact Resistance: More than 150 inch-lb (17 J).
- k. Drainage: According to ICC-ES AC24 **OR** ICC-ES AC235, **as directed**.
- l. Structural Performance Testing: EIFS assembly and components shall comply with ICC-ES AC235 when tested per ASTM E 330.

E. Submittals

- 1. Product Data: For each type and component of EIFS indicated.
- 2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For adhesives and sealants used inside the weatherproofing system, including printed statement of VOC content.
- 3. Shop Drawings: For EIFS. Include plans, elevations, sections, details of components, details of penetration and termination, flashing details, joint locations and configurations, fastening and anchorage details including mechanical fasteners, and connections and attachments to other work.
- 4. Samples: For each exposed product and for each color and texture specified.
- 5. Material or product certificates.
- 6. Product test reports.
- 7. Compatibility and Adhesion Test Reports: For joint sealants from sealant manufacturer indicating the following:
 - a. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - b. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- 8. Field quality-control reports and special inspection reports.
- 9. Evaluation reports
- 10. Maintenance data.

F. Quality Assurance

- 1. Installer Qualifications: An installer who is certified in writing by EIFS manufacturer as qualified to install manufacturer's system using trained workers.
- 2. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as compatible with system components.



3. Fire-Test-Response Characteristics: Provide EIFS and system components with the following fire-test-response characteristics as determined by testing identical EIFS and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
 - a. Fire-Resistance Characteristics: Per ASTM E 119.
 - b. Full-Scale Multistory Fire Test: Per UBC Standard 26-4.
 - c. Full-Scale Diversified Fire Test: Per ASTM E 108 modified for testing vertical walls.
 - d. Intermediate-Scale Multistory Fire Test: Per FPA 285 **OR** UBC Standard 26-9, **as directed**.
 - e. Radiant Heat Exposure: No ignition of EIFS when tested according to NFPA 268.
 - f. Potential Heat: Acceptable level when tested according to NFPA 259.
 - g. Surface-Burning Characteristics: Provide insulation board, adhesives, base coats, and finish coats with flame-spread index of 25 or less and smoke-developed index of 450 or less, per ASTM E 84 **OR** UBC Standard 8-1, **as directed**.
4. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling

1. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.
2. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.
 - a. Stack insulation board flat and off the ground.
 - b. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
 - c. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

H. Project Conditions

1. Weather Limitations: Maintain ambient temperatures above 40 deg F (4.4 deg C) for a minimum of 24 hours before, during, and after adhesives or coatings are applied. Do not apply EIFS adhesives or coatings during rainfall. Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

1.2 PRODUCTS

A. Materials

1. Compatibility: Provide water-resistive coating, adhesive, fasteners, board insulation, reinforcing meshes, base- and finish-coat systems, sealants, and accessories that are compatible with one another and with substrates and approved for use by EIFS manufacturer for Project.
2. Exterior Cement Board: Not less than 5/16-inch- (8-mm-) **OR** 7/16-inch- (11-mm-), **as directed** thick, fiber cement board complying with ASTM C 1186, Type A, for exterior applications.
 - a. Fasteners: Wafer-head or flat-head steel drill screws complying with ASTM C 954, with an organic-polymer coating or other corrosion-protective coating having a salt-spray resistance of more than 500 hours per ASTM B 117.
 - 1) Size and Length: As recommended by sheathing manufacturer for type and thickness of sheathing board to be attached.
3. Water-Resistive Coatings: EIFS manufacturer's standard formulation and accessories for use as water/weather-resistive barriers, compatible with substrate, and complying with physical and performance criteria of ICC-ES AC209 **OR** ICC-ES AC212, **as directed**.



- a. Sheathing Joint Tape **OR** Compound and Tape, **as directed**: Type recommended by EIFS manufacturer for sealing joints between and penetrations through sheathing.
 - b. VOC Content of Coatings Used as Insulation Adhesive: 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Primer/Sealer: EIFS manufacturer's standard substrate conditioner with VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), designed to seal substrates from moisture penetration and to improve the bond between substrate of type indicated and adhesive used for application of insulation.
5. Flexible-Membrane Flashing: Cold-applied, fully self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.
6. Drainage Mat: Three-dimensional, nonwoven, entangled filament, nylon or plastic **OR** Woven or fused, self-furring, PVC mesh lath, **as directed**, mat designed to drain incidental moisture by gravity; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer with manufacturer's standard corrosion-resistant mechanical fasteners suitable for intended substrate.
7. Spacers: Closed-cell polyethylene **OR** Woven or fused, self-furring, PVC mesh lath, **as directed** furring strips; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer with manufacturer's standard corrosion-resistant mechanical fasteners suitable for intended substrate.
8. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; compatible with substrate; with VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24); and complying with one of the following:
 - a. Job-mixed formulation of portland cement complying with ASTM C 150, Type I, and polymer-based adhesive specified for base coat.
 - b. Factory-blended dry formulation of portland cement, dry polymer admixture, and fillers specified for base coat.
 - c. Factory-mixed noncementitious formulation designed for adhesive attachment of insulation to substrates of type indicated, as recommended by EIFS manufacturer.
9. Molded, Rigid Cellular Polystyrene Board Insulation: Comply with ASTM C 578, Type I; EIFS manufacturer's requirements; and EIMA's "EIMA Guideline Specification for Expanded Polystyrene (EPS) Insulation Board" for most stringent requirements for material performance and qualities of insulation, including dimensions and permissible variations, and the following:
 - a. Aging: Before cutting and shipping, age insulation in block form by air drying for not less than six weeks or by another method approved by EIMA that produces equivalent results.
 - b. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, per ASTM E 84.
 - c. Dimensions: Provide insulation boards not more than 24 by 48 inches (610 by 1219 mm) and in thickness indicated but not more than 4 inches (102 mm) thick or less than thickness allowed by ASTM C 1397.
 - d. Channeled Board Insulation: EIFS manufacturer's standard factory-fabricated profile with linear, vertical drainage channels, slots, or waves on the back side of board.
 - e. Board Insulation Closure Blocks: EIFS manufacturer's standard density, size, and configuration.
 - f. Foam Shapes: Provide with profiles and dimensions indicated on Drawings.
10. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multiend strands with retained mesh tensile strength of not less than 120 lbf/in. (21 dN/cm) per ASTM E 2098 **OR** EIMA 105.01, **as directed**; complying with ASTM D 578 and the following:
 - a. Standard-Impact Reinforcing Mesh: Not less than 4.0 oz./sq. yd. (136 g/sq. m).
 - b. Intermediate-Impact Reinforcing Mesh: Not less than 10 oz./sq. yd. (339 g/sq. m) **OR** 12.0 oz./sq. yd. (407 g/sq. m), **as directed**.
 - c. High-Impact Reinforcing Mesh: Not less than 15 oz./sq. yd. (509 g/sq. m).
 - d. Heavy-Duty Reinforcing Mesh: Not less than 20 oz./sq. yd. (678 g/sq. m).



- e. Strip Reinforcing Mesh: Not less than 3.75 oz./sq. yd. (127 g/sq. m).
- f. Detail Reinforcing Mesh: Not less than 4.0 oz./sq. yd. (136 g/sq. m).
- g. Corner Reinforcing Mesh: Not less than 7.2 oz./sq. yd. (244 g/sq. m).
- 11. Base-Coat Materials: EIFS manufacturer's standard mixture complying with one of the following requirements:
 - a. Job-mixed formulation of portland cement complying with ASTM C 150, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.
 - b. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.
 - c. Factory-blended dry formulation of portland cement, dry polymer admixture, and inert fillers to which only water is added at Project site.
 - d. Factory-mixed noncementitious formulation of polymer-emulsion adhesive and inert fillers that is ready to use without adding other materials.
- 12. Waterproof Adhesive/Base-Coat Materials: EIFS manufacturer's standard waterproof formulation with VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with one of the following:
 - a. Job-mixed formulation of portland cement complying with ASTM C 150, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.
 - b. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.
- 13. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.
- 14. Finish-Coat Materials: EIFS manufacturer's standard acrylic-based coating **OR** standard acrylic-based coating with enhanced mildew resistance **OR** siliconized acrylic-based coating, **as directed**, complying with the following:
 - a. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
 - b. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, and fillers used with stone particles for embedding in finish coat to produce an applied-aggregate finish.
 - 1) Aggregate: Marble chips of size and as selected by the Owner from manufacturer's full range.
 - c. Sealer: Manufacturer's waterproof, clear acrylic-based sealer for protecting finish coat.
 - d. Colors: As selected by the Owner from manufacturer's full range.
- 15. Water: Potable.
- 16. Mechanical Fasteners: EIFS manufacturer's standard corrosion-resistant fasteners consisting of thermal cap, standard washer and shaft attachments, and fastener indicated below; selected for properties of pullout, tensile, and shear strength required to resist design loads of application indicated; capable of pulling fastener head below surface of insulation board; and of the following description:
 - a. For attachment to steel studs from 0.033 to 0.112 inch (0.84 to 2.84 mm) in thickness, provide steel drill screws complying with ASTM C 954.
 - b. For attachment to light-gage steel framing members not less than 0.0179 inch (0.45 mm) in thickness, provide steel drill screws complying with ASTM C 1002.
 - c. For attachment to wood framing members and plywood sheathing, provide steel drill screws complying with ASTM C 1002, Type W.
 - d. For attachment to masonry and concrete substrates, provide sheathing dowel in form of a plastic wing-tipped fastener with thermal cap, sized to fit insulation thickness indicated and to penetrate substrate to depth required to secure anchorage.
 - e. For attachment, provide manufacturer's standard fasteners suitable for substrate.
- 17. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D 1784, manufacturer's standard Cell Class for use intended, and ASTM C 1063.



- a. Casing Bead: Prefabricated, one-piece type for attachment behind insulation, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
- b. Drip Screed/Track: Prefabricated, one-piece type for attachment behind insulation with face leg extended to form a drip, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
- c. Weep Screed/Track: Prefabricated, one-piece type for attachment behind insulation with perforated face leg extended to form a drip and weep holes in track bottom, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg; designed to drain incidental moisture that gets into wall construction to the exterior at terminations of EIFS with drainage.
- d. Expansion Joint: Prefabricated, one-piece V profile; designed to relieve stress of movement.
- e. Window Sill Flashing: Prefabricated type for both flashing and sloping sill over framing beneath windows; with end and back dams; designed to direct water to exterior.
- f. Parapet Cap Flashing: Type for both flashing and covering parapet top with design complying with ASTM C 1397.

B. Elastomeric Sealants

1. Elastomeric Sealant Products: Provide EIFS manufacturer's listed and recommended chemically curing, elastomeric sealant that is compatible with joint fillers, joint substrates, and other related materials, and complies with requirements for products and testing indicated in ASTM C 1481 and with requirements in Division 07 Section "Joint Sealants" for products corresponding to description indicated below:
 - a. Multicomponent, nonsag urethane sealant.
 - b. Single-component, nonsag, neutral-curing silicone sealant.
 - c. Provide sealants, for use inside the weatherproofing system, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Preformed Foam Sealant Products: Provide sealant compatible with adjacent materials and complying with requirements in Division 07 Section "Joint Sealants".
3. Sealant Color: As selected by the Owner from manufacturer's full range.

C. Mixing

1. General: Comply with EIFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.

1.3 EXECUTION

A. Preparation

1. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.
2. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind drainage plane of EIFS and deterioration of substrates.
3. Prepare and clean substrates to comply with EIFS manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.

B. Exterior Cement-Board Installation

1. Exterior Cement Board: Install on metal framing to comply with cement-board manufacturer's written instructions and evaluation report acceptable to authorities having jurisdiction. Install



board with steel drill screws spaced no more than 8 inches (203 mm) o.c. along framing with perimeter fasteners at least 3/8 inch (9.6 mm) but less than 5/8 inch (15.9 mm) from edges of boards.

C. EIFS Installation, General

1. Comply with EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate indicated.

D. Substrate Protection Application

1. Primer/Sealer: Apply over gypsum sheathing substrates to protect substrates from degradation and where required by EIFS manufacturer for improving adhesion of insulation to substrate.
2. Water-Resistive Coatings: Apply over substrates to protect substrates from degradation and to provide water-/weather-resistive barrier.
 - a. Tape and seal joints, exposed edges, terminations, and inside and outside corners of sheathing unless otherwise indicated by EIFS manufacturer's written instructions.
3. Waterproof Adhesive/Base Coat: Apply over sloped surfaces **OR** window sills **OR** parapets **OR** where indicated on Drawings, **as directed**, to protect substrates from degradation.
4. Flexible-Membrane Flashing: Install over weather-resistive barrier, applied and lapped to shed water; seal at openings, penetrations, terminations, and where indicated by EIFS manufacturer's written instructions to protect wall assembly from degradation. Prime substrates, if required, and install flashing to comply with EIFS manufacturer's written instructions and details.

E. Trim Installation

1. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints, at window sills, and elsewhere as indicated, according to EIFS manufacturer's written instructions. Coordinate with installation of insulation.
 - a. Weep Screed/Track: Use at bottom termination edges, at window and door heads, and at floor line expansion joints of water-drainage EIFS unless otherwise indicated.
 - b. Window Sill Flashing: Use at windows unless otherwise indicated.
 - c. Expansion Joint: Use where indicated on Drawings.
 - d. Casing Bead: Use at other locations.
 - e. Parapet Cap Flashing: Use where indicated on Drawings.

F. Drainage Mat Installation

1. Drainage Mat: Apply wrinkle free, continuously, with edges butted **OR** overlapped, **as directed**, and adhesively secured **OR** mechanically secured with fasteners, **as directed**, over water-/weather-resistive barrier according to manufacturer's written instructions.

G. Insulation Installation

1. Board Insulation: Adhesively **OR** Mechanically **OR** Adhesively and mechanically, **as directed**, attach insulation to substrate in compliance with ASTM C 1397, EIFS manufacturer's written instructions, and the following:
 - a. Apply adhesive to insulation by notched-trowel method in a manner that results in coating the entire surface of sheathing with adhesive once insulation is adhered to sheathing unless EIFS manufacturer's written instructions specify using primer/sealer with ribbon-and-dab method. Apply adhesive to a thickness of not less than 1/4 inch (6.4 mm) for factory mixed and not less than 3/8 inch (9.6 mm) for field mixed, measured from surface of insulation before placement.
 - b. Apply adhesive to insulation by notched-trowel method in a manner that results in coating the entire surface of drainage mat with adhesive once insulation is adhered to drainage mat.
 - c. Apply adhesive to ridges on back of insulation by notched-trowel method in a manner that results in full adhesive contact over the entire surface of ridges, leaving channels free of adhesive once insulation is adhered to substrate.



- d. Press and slide insulation into place. Apply pressure over the entire surface of insulation to accomplish uniform contact, high initial grab, and overall level surface.
- e. Allow adhered insulation to remain undisturbed for period recommended by EIFS manufacturer, but not less than 24 hours, before installing mechanical fasteners, beginning rasping and sanding insulation, or applying base coat and reinforcing mesh.
- f. Mechanically attach insulation to substrate by method complying with EIFS manufacturer's written instructions. Install top surface of fastener heads flush with plane of insulation. Install fasteners into or through substrates with the following minimum penetration:
 - 1) Steel Framing: 5/16 inch (8 mm).
 - 2) Wood Framing: 1 inch (25 mm).
 - 3) Concrete and Masonry: 1 inch (25 mm).
- g. Apply insulation over drainage mat and dry substrates in courses with long edges of boards oriented horizontally.
- h. Begin first course of insulation from a level base line and work upward.
- i. Begin first course of insulation from screed/track and work upward. Work from perimeter casing beads toward interior of panels if possible.
- j. Stagger vertical joints of insulation boards in successive courses to produce running bond pattern. Locate joints so no piece of insulation is less than 12 inches (300 mm) wide or 6 inches (150 mm) high. Offset joints not less than 6 inches (150 mm) from corners of window and door openings and not less than 4 inches (100 mm) from aesthetic reveals.
 - 1) Adhesive Attachment: Offset joints of insulation not less than 6 inches (150 mm) from horizontal and 4 inches (100 mm) from vertical joints in sheathing.
 - 2) Mechanical Attachment: Offset joints of insulation from horizontal joints in sheathing.
- k. Place insulation with adhesive strips and channels, slots, or waves aligned in the vertical position for drainage. Align drainage channels, slots, or waves with channels, slots, or waves in insulation boards above and below.
- l. Interlock ends at internal and external corners.
- m. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than 1/16 inch (1.6 mm) occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.
- n. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.
- o. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than 1/32 inch (0.8 mm) **OR** 1/16 inch (1.6 mm), **as directed**, from surface of insulation and to remove yellowed areas due to sun exposure; do not create depressions deeper than 1/16 inch (1.6 mm).
- p. Cut aesthetic reveals in outside face of insulation with high-speed router and bit configured to produce grooves, rabbets, and other features that comply with profiles and locations indicated. Do not reduce insulation thickness at aesthetic reveals to less than 3/4 inch (19 mm).
- q. Install foam shapes and attach to sheathing **OR** structure, **as directed**.
- r. Interrupt insulation for expansion joints where indicated.
- s. Install insulation closure blocks using ribbon-and-dab method to create air zones where indicated.
- t. Form joints for sealant application by leaving gaps between adjoining insulation edges and between insulation edges and dissimilar adjoining surfaces. Make gaps wide enough to produce joint widths indicated after encapsulating joint substrates with base coat and reinforcing mesh.
- u. Form joints for sealant application with back-to-back casing beads for joints within EIFS and with perimeter casing beads at dissimilar adjoining surfaces. Make gaps between casing beads and between perimeter casing beads and adjoining surfaces of width indicated.



- v. After installing insulation and before applying field-applied reinforcing mesh, fully wrap board edges. Cover edges of board and extend encapsulating mesh not less than 2-1/2 inches (64 mm) over front and back face unless otherwise indicated on Drawings.
 - w. Treat exposed edges of insulation as follows:
 - 1) Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and finish coat.
 - 2) Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.
 - 3) At edges trimmed by accessories, extend base coat, reinforcing mesh, and finish coat over face leg of accessories.
 - x. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and water-/weather-resistive barrier.
 - 2. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer, and as follows:
 - a. At expansion joints in substrates behind EIFS.
 - b. Where EIFS adjoin dissimilar substrates, materials, and construction, including other EIFS.
 - c. At floor lines in multilevel wood-framed construction.
 - d. Where wall height or building shape changes.
 - e. Where EIFS manufacturer requires joints in long continuous elevations.
- H. Base-Coat Installation
- 1. Base Coat: Apply to exposed surfaces of insulation and foam shapes in minimum thickness recommended in writing by EIFS manufacturer, but not less than 1/16-inch (1.6-mm) dry-coat thickness.
 - 2. Reinforcing Mesh: Embed type indicated below in wet base coat to produce wrinkle-free installation with mesh continuous at corners and overlapped not less than 2-1/2 inches (64 mm) or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions. Do not lap reinforcing mesh within 8 inches (204 mm) of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are not visible.
 - a. Standard-impact reinforcing mesh unless otherwise indicated.
 - b. Intermediate-impact reinforcing mesh where indicated.
 - c. High-impact reinforcing mesh where indicated.
 - d. Heavy-duty reinforcing mesh where indicated.
 - 3. Double-Layer Reinforcing Mesh Application: Where indicated, apply second base coat and second layer of standard-impact **OR** intermediate-impact, **as directed**, reinforcing mesh, overlapped not less than 2-1/2 inches (64 mm) or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions in same manner as first application. Do not apply until first base coat has cured.
 - 4. Additional Reinforcing Mesh: Apply strip reinforcing mesh around openings extending 4 inches (100 mm) beyond perimeter. Apply additional 9-by-12-inch (230-by-300-mm) strip reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch- (200-mm-) wide strip reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches (100 mm) on each side of corners.
 - a. At aesthetic reveals, apply strip reinforcing mesh not less than 8 inches (200 mm) wide.
 - b. Embed strip reinforcing mesh in base coat before applying first layer of reinforcing mesh.
 - 5. Foam Shapes: Fully embed reinforcing mesh in base coat.
 - 6. Double Base-Coat Application: Where indicated, apply second base coat in same manner and thickness as first application except without reinforcing mesh. Do not apply until first base coat has cured.
- I. Finish-Coat Installation
- 1. Primer: Apply over dry base coat according to EIFS manufacturer's written instructions.



2. Finish Coat: Apply over dry primed base coat, maintaining a wet edge at all times for uniform appearance, in thickness required by EIFS manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.
 - a. Texture: As selected by the Owner from manufacturer's full range.
 - b. Embed aggregate in finish coat according to EIFS manufacturer's written instructions to produce a uniform applied-aggregate finish of color and texture matching approved sample.
3. Sealer Coat: Apply over dry finish coat, in number of coats and thickness required by EIFS manufacturer.

J. Installation Of Joint Sealants

1. Prepare joints and apply sealants, of type and at locations indicated, to comply with applicable requirements in Division 07 Section "Joint Sealants" and in ASTM C 1481.
 - a. Apply joint sealants after base coat has cured but before applying finish coat.
 - b. Clean surfaces to receive sealants to comply with indicated requirements and EIFS manufacturer's written instructions.
 - c. Apply primer recommended in writing by sealant manufacturer for surfaces to be sealed.
 - d. Install sealant backing to control depth and configuration of sealant joint and to prevent sealant from adhering to back of joint.
 - e. Apply masking tape to protect areas adjacent to sealant joints. Remove tape immediately after tooling joints, without disturbing joint seal.
 - f. Recess sealant sufficiently from surface of EIFS so an additional sealant application, including cylindrical sealant backing, can be installed without protruding beyond EIFS surface.

K. Field Quality Control

1. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
 - a. According to ICC-ES AC24 **OR** ICC-ES AC235, **as directed**.
2. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
3. EIFS Tests and Inspections: For the following:
 - a. According to ICC-ES AC24 **OR** ICC-ES AC235, **as directed**.
4. Remove and replace EIFS where test results indicate that EIFS do not comply with specified requirements.
5. Prepare test and inspection reports.

L. Cleaning And Protection

1. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive EIFS coatings.

END OF SECTION 07 24 13 00



SECTION 07 31 00 00 - CSF SHINGLES AND SHAKES

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.07 31 00 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

NOTE TO SPECIFIER

Edit below for type of Shingle selected for this Project.

1. [Glass fiber reinforced shingles] [Mineral fiber cement shingles] [Wood shingles].
2. Underlayment, eave, valley, and ridge protection.
3. Associated flashings and accessories.

- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 QUALITY ASSURANCE

A. Perform Work in accordance with NRCA Steep Roofing Manual.

NOTE TO SPECIFIER

Use paragraph below for FIBERGLASS and MINERAL FIBER CEMENT Shingles. NOT USED for Wood Shingles.

1.3 ENVIRONMENTAL REQUIREMENTS

- A. Roof shingles supplied must be listed on the DOE's ENERGY STAR Roof Products Qualified Products List.



PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, model numbers, and availability at time of Project Manual preparation for Project.

NOTE TO SPECIFIER

Use MANUFACTURERS for FIBERGLASS and MINERAL FIBER CEMENT Shingles. NOT USED for Wood Shingles.

2.1 MANUFACTURERS

NOTE TO SPECIFIER

OPTION 1: Use Manufacturers below for FIBERGLASS Shingles.

- A. Subject to compliance with Project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. CertainTeed Corporation, Valley Forge, PA (800) 233-8990.
 2. GAF Materials Corporation, Wayne, NJ (800) 766-3411.
 3. Owens/Corning Fiberglass, Toledo, OH (800) 438-7465.

NOTE TO SPECIFIER

OPTION 2: Use Manufacturers below for MINERAL FIBER CEMENT Shingles.

- B. Subject to compliance with Project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Supradur Manufacturing Corporation, Rye, NY (800) 223-1948.
 2. Eternit Incorporated, Reading, PA (800) 233-3155
- C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

NOTE TO SPECIFIER

OPTION 1: Use MATERIALS below for FIBERGLASS Shingles.

2.2 MATERIALS

- A. Shingles:
1. CertainTeed: Landmark.
 2. GAF: Timberline.
 3. Owens/Corning: Oakridge.
- B. Description: ASTM D 3018 Class A with Type I - Self Sealing; UL Rating of A and Wind Resistance Label, glass fiber mat base, mineral granule surface dimensional type shingle; nominal 12 inch x 36 inch, 5 inch exposure; self sealing type; laminated overlay type.

NOTE TO SPECIFIER

Edit below for color name and number for each manufacturer.



- C. Color:
1. CertainTeed: [_____].
 2. GAF: [_____].
 3. Owens/Corning: [_____].

NOTE TO SPECIFIER

OPTION 2: Use MATERIALS below for MINERAL FIBER CEMENT Shingles.

2.3 MATERIALS

- A. Shingles:
1. Supradur: Supra-Slate II.
 2. Eternit: Continental Slates.
- B. Description: Mineral fiber cement, UL Class A, rectangular, approximate size 10 inches x 16 inches, approximate exposure 6 to 7 inches with special shapes for valley, ridge, rake, eave, and other conditions.

NOTE TO SPECIFIER

Edit below for color name and number for each manufacturer.

- C. Color:
1. Supradur: [_____].
 2. Eternit: [_____].

NOTE TO SPECIFIER

OPTION 3: Use MATERIALS below for WOOD Shingles.

2.4 MATERIALS

- A. Shingles: RCHSHSB sized and graded, No. 1 Blue Label, 18 inches long, 0.45 inch thick at butt, sawn and kiln dried, fire-retardant, pressure-treated, bearing UL Class C label.
- B. Hips and Ridge Caps: Prefabricated lapped single ply units to match shingles.

2.5 ACCESSORIES

- A. Sheet Metal Flashing: Specified in Section 076200.
- B. Underlayment: ASTM D 226, No. 30 unperforated asphalt saturated felts.
- C. Nails: Hot-dipped zinc-coated steel, type recommended for use with shingle type, length sufficient to penetrate roof deck.
- D. Plastic Cement: ASTM D 2822, asphalt type with mineral fiber components.
- E. Lap Cement: Fibrated cutback asphalt type.
- F. Bituminous Paint: Acid and alkali resistant type; black color.



- G. Eave, Ice Dam, Valley and Ridge Protection: Sheet barrier of rubberized asphalt bonded to sheet polyethylene, 40 mil total thickness, with strippable treated release paper.
- H. Ridge Vent: Metal, specified in Section 076200.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install shingles in accordance with manufacturer's published instructions, NRCA Steep Roofing Manual, and to meet requirements of Underwriter's Laboratories class ratings indicated.
- B. Coordinate roofing with installation of roof mounted components or work projecting through roof.
- C. Install shingles square with building lines and parallel with roof slope.
- D. Installation to provide weathertight service.
- E. Underlayment:
 - 1. Place one ply of underlayment perpendicular to slope of roof, over area not protected by eave membrane, with ends and edges weatherlapped a minimum of 4 inches. Nail protective underlayment in place.
 - 2. Weather lap underlayment over eave membrane and seal items projecting through or mounted on roof with plastic cement.
- F. Flashings:
 - 1. Weather lap joints and seal weathertight with plastic cement. Nail in place. Conceal fastenings.
 - 2. Flash and seal work projecting through or mounted on roofing, including ridge or slope vents, with plastic cement.

NOTE TO SPECIFIER

OPTION 1: Use FIBERGLASS SHINGLES below for Fiberglass Shingles.

- G. Glass Fiber Shingles:
 - 1. Install shingles in straight coursing pattern over entire roof area starting with first course at bottom of slope as recommended by manufacturer.
 - 2. Project first course of shingles 3/4 inch beyond roof decking.
 - 3. Cap hips and nonvented section of ridge with individual shingles, maintaining recommended weather exposure.
 - 4. Place two daubs of plastic cement, one inch in diameter, under each shingle corner exposed to weather on roof slopes less than 4 in 12.

NOTE TO SPECIFIER

OPTION 2: Use MINERAL FIBER CEMENT SHINGLES below for Mineral Fiber Cement Shingles.

- H. Mineral Fiber Cement Shingles:
 - 1. Attach shingles with nails flush with shingle pre-drilled fastener hole. Do not overdrive or underdrive nails.
 - 2. Cap hips and ridges with individual shingles, maintaining 5 inch weather exposure. Place to avoid exposed nails.



3. After installation, place one inch diameter installation of plastic cement under each individual shingle exposed to weather, to prevent lifting.

NOTE TO SPECIFIER

OPTION 3: Use WOOD SHINGLES below for Wood Shingles.

- I. Wood Shingles:
 1. Install shingles in accordance with RCSHSB requirements to produce straight coursing pattern with 5 1/2 inch weather exposure to produce double thickness over roof area.
 2. Provide double course at eaves.
 3. Project first course 1-1/2 inches beyond face of gables and fascias.

- J. Eave and Ice Dam Protection:
 1. Place eave and ice dam edge flashing tight with fascia boards. Weather lap joints and seal with plastic cement. Secure flange with nails.
 2. Bond rubberized-asphalt protection sheet to roof sheathing by removing release paper; seal seams with compatible sealant. Position lap seal over firm bearing.
 3. Extend protection membrane up roof slope a minimum 4 feet beyond interior face of exterior walls.

- K. Ridge and Valley Protection:
 1. Place one layer of roll roofing centered over valleys. Nail in place.
 2. Apply lap cement along each edge of first layer and embed layer of roll roofing centered over first layer. Place with mineral surface side up.
 3. Install shingles on ridge vents in accordance with Section 076200.

USPS CSF Specifications issued: 10/1/2013

Last revised: 3/31/2011

END OF SECTION



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SECTION 07 31 13 00 - R&A ASPHALT SHINGLE ROOFING

NOTE TO SPECIFIER

This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this section where asphalt shingle roofing is selected as the roofing system in a roof replacement application. Per the United States Postal Service Roofing Design Standard, asphalt shingles are acceptable with restrictions for steep slope applications at facilities with a "Critical" or "Non-Critical" building designation. Discuss the use of asphalt shingle roofing with the USPS Project Manager prior to specifying. An approved deviation letter may be required prior to specifying an asphalt shingle roofing system.

NOTE TO SPECIFIER

Section Formatting:

Consistent formatting of Sections gives the complete document a professional look. This Section uses a 10pt. Arial font, and is formatted as follows:

1. *Insert one 10pt. line after the Section Number. Section Number is in CAPS.*
2. *Insert two 10pt. lines after the Section Title. Section Title is in CAPS.*
3. *Insert one 10pt. line after a PART. PARTS are in CAPS. If a Section is not used, include NOT USED following the PART title as shown below.*
4. *Insert one 10pt. line after Article paragraphs. Articles are in CAPS.*
5. *Insert two 10pt. lines at the end of an Article.*
6. *Complete Section with END OF SETION.*
7. *No lines should be placed between paragraphs and sub-paragraphs, or between sub-paragraphs and other sub-paragraphs.*

Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED

Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to the installation of asphalt shingle roofing, flashings, and related accessories.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 024100 – Roof Removal and Substrate Preparation
- D. Section 079201 – Sealants for Roof Replacement
- E. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 - 1. American Society for Testing and Materials (ASTM)
 - a. ASTM D 1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
 - b. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
 - c. ASTM D 4869 - Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing
 - d. ASTM D 3462 - Standard Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules
 - e. ASTM E 108 - Standard Test Methods for Fire Tests of Roof Coverings
 - f. ASTM D 3161 - Standard Test Method for Wind-Resistance of Asphalt Shingles (Fan-Induced Method)
 - g. ASTM F 1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples
 - h. ASTM D 4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free
 - i. ASTM B 370 - Standard Specification for Copper Sheet and Strip for Building Construction
 - 2. American National Standards Institute (ANSI)



3. Asphalt Roofing Manufacturers Association (ARMA)
 - a. ARMA Residential Asphalt Roofing Manual, 5th Edition
4. National Roofing Contractors Association (NRCA)
 - a. NRCA Roofing and Waterproofing Manual, 5th Edition
5. Underwriters Laboratories, Inc. (UL)
 - a. UL 790 - Exterior Exposure, Standard Test Methods for Fire Tests of Roof Coverings
 - b. UL 997 - Wind Resistance of Prepared Roof Covering Materials

1.4 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.5 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp. Store roll materials standing on end.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.



1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
 - 1. NOTE: Do not install asphalt shingles at temperatures below 40°F (5°C).
 - 2. When the outside temperature is forecast to fall below 40°F (5°C), store unused materials in a heated location. Remove these materials only when ready for installation.
 - 3. Use caution when handling bundles of or individual asphalt shingles. Do not throw or bend shingles. Inspect shingles for cracks prior to installation. Remove damaged shingles from the site.
 - 4. When possible, avoid walking on installed asphalt shingles.
 - 5. Do not install self-adhering membrane when the temperature of the outside air, self-adhering membrane, or roof deck are below 40°F (5°C).
 - 6. Refer to the asphalt shingle roofing manufacturer and NRCA requirements and recommendations for additional cold weather application requirements and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

NOTE TO SPECIFIER

Per discussions between the designer and USPS Project Manager, determine the warranty requirements for the project. Choose from the following warranty options and actions:

- 1. *If an alternate price for a "Limited Lifetime Warranty" is specified, do not edit paragraph 1.9A.*
- 2. *If a "Limited Lifetime Warranty" will be included in the base proposal, DELETE "an alternate price for" from paragraph 1.9A.*
- 3. *If no warranty is specified, EDIT the title of Article 1.9 (DELETE the words "MANUFACTURER WARRANTY AND"), and DELETE paragraph 1.9A. The two-year contractor guarantee shall remain in place.*

Re-letter/number paragraphs and sub-paragraphs after editing.

1.8 CONTRACTOR GUARANTEE

- A. The Contractor shall provide a two-year contractor guarantee. At a minimum, the contractor guarantee shall include the following:
 - 1. Contractor name, address, phone number and project contact name.
 - 2. The project completion date, and date of guarantee expiration.
 - 3. The contractor guarantee shall include, in writing, all project work, workmanship, and/or all materials installed by the contractor or subcontractors to be of a quality that will comply with all project specific requirements of the Construction Documents and other documents governing the Work and workmanship through the guarantee period.
 - 4. The contractor shall investigate roof leaks during the guarantee period within a reasonable time period, but in no instance greater than 24-hours after notification of a leak. The contractor shall repair leaks determined to be the cause of the Work at no cost to the Owner.

PART 2 – PRODUCTS



2.1 ASPHALT SHINGLE ROOF SYSTEM SUMMARY

- A. Acceptable asphalt shingle roofing manufacturers and systems include those identified in Articles 2.2 and 2.3, and meeting the requirements listed within those Articles.
- B. Selected products, when used within the specified roof assembly, must meet the requirements for the specified warranty.

2.2 UNDERLAYMENTS

- A. For use at eaves, rakes, ridges, penetrations, valleys, skylights, dormers, behind apron and step flashings, locations indicated on the drawings and other locations required by the asphalt shingle manufacturer: Self-adhering underlayment; butyl-rubber based, approved for use by the asphalt shingle manufacturer, and meeting the following criteria:
 - 1. Meeting the requirements of ASTM D 1970.
 - 2. Approved by the selected asphalt shingle manufacturer for use as a self-adhering underlayment for asphalt shingle roofing. Acceptable products include:
 - a. StormGuard Leak Barrier, manufactured by GAF Corporation.
 - b. WinterGuard, manufactured by CertainTeed Corporation.
 - c. Weatherlock Flex Ice and Water Barrier, manufactured by Owens Corning Corporation.
 - d. Other self-adhering underlayments approved by the selected asphalt shingle manufacturer, and meeting the requirements listed in paragraphs 2.2.A and 2.2.A.1.
- B. For use in the field of the roof: Synthetic, polymer-based roofing underlayment, meeting the following criteria:
 - 1. Meeting or exceeding the physical requirements of ASTM D 226 and ASTM D 4869.
 - 2. A recommended exposure limit of 120 days, minimum.
 - 3. Approved by the selected asphalt shingle manufacturer for use as an underlayment for asphalt shingle roofing. Acceptable products include:
 - a. Deck Armor Synthetic Underlayment, manufactured by GAF Corporation.
 - b. Diamond Deck High Performance Synthetic Underlayment, manufactured by CertainTeed Corporation.
 - c. Deck Defense High Performance Underlayment, manufactured by Owens Corning Corporation.
 - d. Other synthetic underlayments approved by the selected asphalt shingle manufacturer, and meeting requirements listed in paragraphs 2.2.B, 2.2.B.1 and 2.2.B.2.

NOTE TO SPECIFIER

Four options are available for asphalt shingles:

- 1. *If the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a DOE Energy Star qualified asphalt shingle is required. DELETE paragraph 2.3B.*
- 2. *If the project is located in ASHRAE Climate Zones 5, 6 or 7, a DOE Energy Star qualified asphalt shingle is not required. DELETE paragraph 2.3A.*

Determine the required outcome from the list above. Choose one option only. Re-letter/number Articles, paragraphs and sub-paragraphs after editing.

2.3 ASPHALT SHINGLES

- A. For use within ASHRAE Climate Zones 1 through 4:



1. Type: ASTM D 3462; Glass-fiber reinforced, architectural laminated shingle. Acceptable asphalt shingle manufacturers and shingles:
 - a. Timberline Cool Series, manufactured by GAF Corporation, Wayne, NJ, (973) 628-3000.
 - b. Landmark Solaris, manufactured by CertainTeed Corporation, Valley Forge, PA, (800) 233-8990.
 - c. Duration Premium Cool, manufactured by Owens Corning, Toledo, OH, (800) 438-7465.
 - d. Other asphalt shingle systems, meeting the requirements of this Article, and approved by the Owner.
 2. Fire Resistance: ASTM E 108 or ANSI/UL 790, Class A.
 3. Wind Uplift Rating: ASTM D 3161, Class F, or UL 997. The installed asphalt shingle system shall have a minimum wind rating of 130 miles per hour.
 4. Energy Rating: DOE Energy Star qualified, with an Initial Solar Reflectance of 0.25 or greater, and meeting or exceeding the requirements listed in paragraphs 2.3.A.2 and 2.3.A.3.
 5. Color: As determined by Owner.
 6. Starter course shingles: Use starter course shingles manufactured by the asphalt shingle manufacturer or specified shingles trimmed following the manufacturer's requirements.
 7. Ridge, hip and other specialty shingles: Use shingles manufactured by the asphalt shingle manufacturer or specified shingles trimmed following the manufacturer's requirements.
- B. For use within ASHRAE Climate Zones 5 through 7:
1. Type: ASTM D 3462; Glass-fiber reinforced, architectural laminated shingle. Acceptable asphalt shingle manufacturers and shingles:
 - a. Timberline American Harvest, manufactured by GAF Corporation, Wayne, NJ, (973) 628-3000.
 - b. Landmark Pro, manufactured by CertainTeed Corporation, Valley Forge, PA, (800) 233-8990.
 - c. TruDefinition Duration, manufactured by Owens Corning, Toledo, OH, (800) 438-7465.
 - d. Other asphalt shingle systems, meeting the requirements of this Article, and approved by the Owner.
 2. Fire Resistance: ASTM E 108 or ANSI/UL 790, Class A.
 3. Wind Uplift Rating: ASTM D 3161, Class F, or UL 997. The installed asphalt shingle system shall have a minimum wind rating of 130 miles per hour.
 4. Color: As determined by Owner.
 5. Starter course shingles: Use starter course shingles manufactured by the asphalt shingle manufacturer or specified shingles trimmed following the manufacturer's requirements.
 6. Ridge, hip and other specialty shingles: Use shingles manufactured by the asphalt shingle manufacturer or specified shingles trimmed following the manufacturer's requirements.

2.4 ASPHALT SHINGLE ROOF FASTENERS

- A. For fastening underlayment:
1. Roofing nails with smooth, flat, minimum 3/8-inch head and 1" minimum metal cap; hot-dipped galvanized steel or equivalent corrosion-resistance, No. 11 or No. 12 gauge with barbed shanks and conventional sharp point; ASTM F 1667, Type 1, Style 20. Length as necessary to penetrate through the underside of deck (at plywood decks) or minimum 3/4-inch into substrate (at wood plank decks).
- B. For fastening asphalt shingles:



1. Roofing nails with smooth, flat, minimum 3/8-inch head; hot-dipped galvanized steel or equivalent corrosion-resistance, No. 11 or No. 12 gauge with barbed shanks and conventional sharp point; ASTM F 1667, Type 1, Style 20. Length as necessary to penetrate through the underside of deck (at plywood decks) or minimum 3/4-inch into substrate (at wood plank decks).

2.5 ROOFING CEMENT

- A. Type: ASTM D 4586 Asphalt Roofing Cement, Type II (asbestos free); product manufactured by, or approved by the roofing membrane manufacturer.

NOTE TO SPECIFIER

Article 2.6 may be edited to reflect sheet metal flashing requirements for a specific project. EDIT Article 2.6 as necessary. Re-letter/number paragraphs and sub-paragraphs after editing.

2.6 SHEET METAL AND FLASHING ACCESSORIES

- A. Prefinished galvanized steel: Kynar 500 coating, 24-gauge; color as selected by Owner; use the following metal components where indicated:
 1. Drip edges, perimeter fascia and fascia extensions: Fabricate drip edges and fascias with a minimum 4-inch flange. Fabricate face of drip edges and fascias to dimensions and configurations indicated on drawings. Fabricate fascia extensions to the dimensions and configurations indicated on the drawings.
 - a. Continuous cleats associated with drip edges, perimeter fascias and fascia extensions: Galvanized steel; 22-gauge, minimum.
 2. Counterflashings and step flashings: Fabricate to the dimensions and configurations indicated on the drawings.
 3. Gutter fascia extensions: Fabricate to the dimensions and configurations indicated on the drawings.
 4. Apron and backer/cricket flashings: Field verify dimensions of chimneys, curbs and other rooftop penetrations where apron and backer/cricket flashings will be necessary. Fabricate to dimensions required to properly flash these penetrations.
 5. Step flashing: Fabricate step flashing with a minimum 4-inch horizontal flange and minimum 4-inch vertical leg. Fabricate step flashing in minimum 7-inch widths to allow for minimum 2-inch headlap over downslope step flashing piece.
- B. Gutters: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating. Fabricate gutters to match dimensions indicated on the drawings; fabricate in 10-foot sections, with a 4-inch flange with a 1/2-inch hug at the inner edge of the gutter flange.
 1. Gutter spacers: Painted galvanized steel, 1-inch wide by 1/8-inch thick; seal and secure to gutter as shown on drawings. Paint color to match gutter.
- C. Gutter liners:
 1. Stainless steel, 22-gauge. Fabricate gutter liners to the dimensions and configurations shown on the drawings, and in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition". Solder all seams watertight.
- D. Through-fascia, through-wall and overflow scuppers:
 1. Scupper liners: Stainless steel, 22-gauge. Fabricate scupper flashings in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-26, 1-28, 1-29 and 1-30. Provide a 4-inch flange with a 1/2-inch hug at the inner edge of the scupper flange. Solder all seams watertight.



2. Conductor boxes and scupper closure plates: Stainless steel, 22-gauge. Solder all seams watertight. Fabricate these components in accordance with the drawings, and the requirements outlined in the "SMACNA Architectural Sheet Metal Manual, 7th Edition".
- E. Conductor box fascia covers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by the Owner.
- F. Downspouts, associated with gutters and scuppers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by Owner. Fabricate downspouts with a "Pittsburgh Lock" seam, and in accordance with the drawings and "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-32B and 1-32F; size the hangers to match downspouts.
- G. Plumbing vent and tubular penetration flashings: Metal flashing with flanged sleeve with hood, prefabricated flashing with elastomeric collar, or other product type manufactured by, or approved by the asphalt shingle roofing manufacturer.
 1. For sheet metal plumbing vent and tubular penetration flashings with flange and sleeve and hood:
 - a. Stainless steel, 24-gauge.
 - b. Clamp: Stainless steel plumber's clamp, size as necessary to tightly secure elastomeric collar or hood.

2.7 MISCELLANEOUS MATERIALS

- A. Ridge Vents: Vents providing 16 square inches of net free area per lineal foot of vent, minimum. Acceptable ridge vents:
 1. Cobra Ridge Vent, manufactured by GAF Corporation.
 2. VentSure 4-Foot Strip Heat and Moisture Ridge Vent with Weather PROtector Moisture Barrier, manufactured by Owens Corning Corporation.
 3. ShingleVent II, manufactured by Air Vent, Inc., Dallas, TX, (800) 247-8368.
- B. Other ventilation accessories, including soffit vents and other rooftop vents:
 1. Provide accessories manufactured by, or approved by, the asphalt shingle roofing manufacturer.
- C. For use at sheet metal flashing strip-ins, and where indicated on drawings:
 1. Pressure-sensitive EPDM flashing material; non-reinforced, nominal 60-mil thickness, black color. Type acceptable to asphalt shingle roofing manufacturer for specific flashing conditions encountered. Minimum 5-inch width.
 2. Primer: Type compatible with pressure-sensitive EPDM flashing and acceptable to the asphalt shingle roofing manufacturer.
- D. Butyl tape: for use behind counterflashing flanges and other locations indicated where indicated on the drawings. Width and thickness as necessary to create a seal between the existing substrate and secured counterflashing.

2.8 SEALANT

- A. Refer to Section 079201.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.

3.2 UNDELAYMENT INSTALLATION

- A. Install self-adhering underlayment eaves, rakes, ridges, penetrations, valleys, skylights, dormers, behind apron and step flashings, locations indicated on the drawings and other locations required by the asphalt shingle manufacturer.
1. Except as modified by these specifications and drawings, follow the written installation requirements of the self-adhering underlayment manufacturer.
 2. Lay self-adhering underlayment flat, wrinkle free. Install the underlayment at locations indicated. At eaves, install underlayment parallel to the eave edge. At rake edges, install the underlayment beneath the flange of the rake edge metal. Refer to the project drawings.
 3. Extend self-adhering underlayment 24-inches beyond interior wall of the building envelope, minimum.
 4. Side laps shall be overlapped 4-inches, minimum. Ends laps shall be overlapped 8-inches, minimum.
 5. Using a roller, roll underlayment to ensure proper adhesion to structural deck.
 6. If overnight exposure is anticipated, tack self-adhering membrane in place.
- B. Install synthetic underlayment at all locations not covered by self-adhering membrane. Follow written installation requirements of the underlayment manufacturer.
1. Except as modified by these specifications and drawings, follow the written installation requirements of the synthetic underlayment manufacturer.
 2. Unroll the underlayment parallel with the eave edge. Lay underlayment flat, wrinkle free. Do not over stretch during installation.
 3. Secure the underlayment with the specified nails affixed with metal caps. At underlayment perimeters, secure 6-inches on center, minimum, and 1-inch from sheet edges. Stagger capped nails in the field of the underlayment sheet as shown in the project drawings. Ensure capped nails are driven flat; remove improperly driven nails and re-secure.
 4. Side laps shall be overlapped 4-inches, minimum. Ends laps shall be overlapped 8-inches, minimum.

3.3 ASPHALT SHINGLE ROOFING INSTALLATION

- A. Asphalt shingle roof system general installation instructions:
1. Except as may be modified by these specifications and drawings, install the specified asphalt shingle roofing system, including self-adhering membranes and underlayments, in accordance with the requirements and recommendations of the asphalt shingle roofing manufacturer, using the manufacturer's current printed instructions, and the recommendations outlined in the NRCA "Roofing and Waterproofing Manual, 5th Edition", and ARMA "Residential Asphalt Roofing Manual, 5th Edition".
 2. Use chalk lines as visible guides to ensure the proper exposure, coverage, and horizontal and vertical alignment of the shingles.
 3. Apply shingles across and diagonally up the roof, using the "6 Inch Pattern", as defined in the NRCA "Roofing and Waterproofing Manual, 5th Edition".
 4. If metric shingles are used, dimensions referred to in this specification must be proportionally modified to accommodate metric dimensions.
 5. Install **six** nails per full length shingle. Do not nail into or above the factory-applied adhesive strips. Refer to asphalt shingle roofing manufacturer printed instructions for recommended location of nails. Remove any underdriven nails, and repair and damage



- caused by defective fastening with roofing cement. If severe damage occurs during nail removal, replace the full shingle.
6. Provide a 5-inch shingle exposure.
- B. Starter course shingle installation:
1. At eaves, install one row of starter strip shingles.
 - a. Fasten the starter strip shingles in accordance with the requirements of the asphalt shingle roofing manufacturer. Overhang the eave consistently by 1/4-inch to 3/4-inch.
- C. First and succeeding courses:
1. During installation, check installation of shingle courses to ensure proper alignment of cutouts, and correct horizontal and vertical orientation of course.
 2. Bond the tabs of the first shingle course to the starter strip, using a quarter-sized dab of roofing cement placed on the starter strip 12-inches o.c. Press the first course firmly into the roofing cement.
 3. On steep slope roofs exceeding 12-inches per foot in slope, in areas defined as "high wind areas", or when required by the asphalt shingle roofing manufacturer, bond shingle tabs by "hand tabbing", placing a quarter-sized dab of roofing cement 12-inches o.c. and pressing the overlying shingle firmly into the roofing cement.
- D. Valley and hip flashing:
1. Valley flashings:
 - a. Install valleys following the "Woven Valley Method", as defined in the NRCA "Roofing and Waterproofing Manual, 5th Edition".
 2. Hip flashings:
 - a. Install shingles manufactured by the asphalt shingle manufacturer or specified shingles trimmed following the manufacturer's requirements, following the printed instructions of the asphalt shingle roofing manufacturer.

NOTE TO SPECIFIER

Article 3.4 may be edited to reflect sheet metal flashing requirements for a specific project. EDIT Article 3.4 as necessary. Re-letter/number paragraphs and sub-paragraphs after editing.

3.4 SHEET METAL FLASHING INSTALLATION

- A. Drip edges, perimeter fascia and fascia extensions:
1. Continuous cleats: Provide continuous cleats where indicated on drawings. Secure the horizontal flange and vertical face of the continuous cleat with ring shank coated nails 12-inches o.c., max. Decrease fastener spacing to 6-inches o.c., max. within 10-feet of a building corner.
 2. Drip edges and fascias: Place the drip edge, fascia or fascia extension. Hook the fascia to the underlying continuous cleat. Secure the flange with nails 3-inches o.c. in two staggered rows as indicated on the drawings.
 3. Fascia extensions: Hook fascia extensions to the underlying cleat, if present. Secure fascia extensions with ring shank coated nails 12-inches o.c., max., or fasteners appropriate for, and approved by the Owner for, the substrate condition encountered, 12-inches o.c. max.
- B. Gutters and downspouts:
1. Install the specified gutter spacers 24-inches o.c. Seal and secure the spacers to the gutter assembly as indicated on the drawings.



2. Overlap individual gutter sections 1-1/2 inches. Seal overlap, and pop-rivet sections together with two rows of pop rivets. Space pop rivets 1/2-inch min., and 3/4-inches max. in each row. Completed gutter sections shall not exceed 50-feet in length.
 3. Secure the flange with nails 3-inches o.c. in two staggered rows.
 4. Gutter expansion joints: Provide gutter expansion joints at locations recommended by SMACNA; fabricated following the recommendations of SMACNA.
 5. Downspouts: Install downspouts at locations indicated on drawings. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
- C. Gutter liners:
1. Install gutter liners at built-in and interior gutter locations indicated on the drawings. Install liners following the requirements and recommendations of SMACNA.
- D. Scupper liners, closure plates, conductor boxes and downspouts:
1. Scupper liners: Install scupper liners at through-fascia, through-wall, and overflow scupper locations indicated on the drawings. Install scupper liners following the requirements and recommendations of SMACNA.
 2. Cover plates: At the exterior face of the scupper, install cover plates. Install scupper cover plates as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 3. Conductor boxes: Where indicated on the drawings, install conductor boxes as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 4. Downspouts: Install downspouts at conductor boxes. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
 5. Install conductor box fascia covers as indicated on the drawings. Fully clip fascia covers to stainless steel conductor boxes, or secure to substrate with fasteners appropriate for the substrate encountered.
- E. Counterflashings: Install counterflashings at locations indicated on the drawings as follows:
1. Install continuous butyl tape behind vertical face of counterflashing.
 2. Secure counterflashings with fasteners spaced as indicated on drawings.
 3. Provide a continuous bead of sealant along the top edge of surface-mounted counterflashings to shed water and provide a watertight seal.
- F. Slip counterflashings: Install slip counterflashings at locations where existing sheet metal counterflashings cannot be lifted or removed, and at other locations indicated on the drawings as follows:
1. Install continuous butyl tape behind vertical face of counterflashing.
 2. Secure counterflashings with fasteners spaced as indicated on drawings.
- G. Apron, backer and cricket flashings:
1. Install apron and backer/cricket flashings at roof curbs, chimneys, wall terminations, locations indicated on drawings, and at locations recommended by the asphalt shingle roofing manufacturer.
 - a. At penetrations greater than 24-inches, roof slopes greater than 6:12 (27 degrees), when a large volume of snow or ice could accumulate behind a roof penetration or when the average January temperature is 30°F (-1°C) or lower, install cricket flashings in lieu of backer flashings behind roof penetrations.
 - b. Where cricket widths exceed 18-inches, provide wood framing and plywood support beneath sheet metal cricket flashing.



- c. Secure apron and backer/cricket flashings to the underlying substrate with fasteners appropriate to the substrate.
- H. Step flashings:
 - 1. Install step flashings at roof curbs, chimneys, wall terminations, locations indicated on drawings, and at locations recommended by the asphalt shingle roofing manufacturer.
 - a. At the locations indicated above, install step flashing at the end of each shingle course. Install step flashing with a minimum headlap of 2-inches, and a 4-inch extension onto the underlying shingle.
 - b. Secure step flashings to the underlying substrate with fasteners appropriate to the substrate.
- I. Tubular penetration flashing: Flash round pipe penetrations with a manufacturer recommended pipe flashing boot and specified watertight hood.
 - 1. Flash tubular penetration where indicated on drawings. Follow asphalt shingle manufacturer recommendations and requirements.
 - 2. Hood and drawband: Where a flanged sleeve sheet metal flashing is used, install a stainless steel hood over the flanged sleeve; solder all seams watertight. Secure a stainless steel drawband around the top of each hood to secure the hood to the penetration. Seal the top of the drawband and hood.

3.5 MISCELLANEOUS INSTALLATIONS/TREATMENTS

- A. Install ventilation accessories, including ridge vents, soffit vents and other rooftop vents at locations recommended by the asphalt shingle roofing manufacturer following the printed instructions of the manufacturer.
- B. Sheet metal flashing strip-ins:
 - 1. Install specified strip-in where indicated on drawings.
- C. Butyl tape:
 - 1. Install specified butyl tape behind counterflashings where indicated on drawings.

USPS CSF Specifications issued: 10/1/2013

Last revised: 3/6/2013

NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 31 13 00



Task	Specification	Specification Description
07 31 29 17	01 22 16 00	No Specification Required



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SECTION 07 31 33 00 - COMPOSITE RUBBER SHINGLES**1.1 GENERAL****A. Description Of Work:**

1. This specification covers the furnishing and installation of materials for composite rubber shingles. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.
2. Furnish and install this Majestic Slate Tile Roof System in strict accordance with specifications and drawings approved by EcoStar.
3. Metal flashing work is not covered in this specification since EcoStar does **NOT** warrant metal flashing. EcoStar advises that metal flashing and securement of metal should be to industry standards (SMACNA) to prevent the metal from pulling free or buckling. EcoStar also suggests that all flashing metal be copper, stainless steel or an equally long-term material.
4. EcoStar Attic Guard Ridge Ventilation product must be used on those projects that will be using a ridge ventilation system. If a ridge ventilation system is not to be used on the project, another form of ventilation may be used, but will not be covered by any EcoStar warranties. EcoStar advises that a ridge style venting system be utilized to insure the best possible air movement and to provide the best aesthetic appearance to the roofing system.

B. Definitions

1. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

C. Submittals

1. Submit an "EcoStar Gold Star Project Survey" to EcoStar Technical Department for approval **PRIOR** to the job start to enable the Technical Department to approve and assign a job number to the project.
2. The "EcoStar Gold Star Project Survey Form" must be filled out completely and accurately to include any prior deviations approved from this specification, including a roof drawing showing all dimensions, all penetrations, and roof slope.
3. When an EcoStar Gold Star Warranty is desired, EcoStar must be contacted **PRIOR** to project bid and installation. Information may be required for wind design and slope requirements.
4. Product Data: For each type of product indicated.
5. Samples: For the following products, of sizes indicated.
 - a. Composite Rubber Shingle: Full size, of each color, size, texture, and shape.
 - b. Ridge Vent System: 12 inches (300 mm) long.
 - c. Fasteners: Three fasteners of each type, length, and finish.
 - d. Underlayment: 12 inches (300 mm) square.

D. Quality Assurance

1. To qualify for an EcoStar Gold Star Warranty, an authorized EcoStar Gold Star Applicator must install system.
2. There shall be no deviation made from this specification without written approval from EcoStar prior to the start of the roofing project.
3. For an EcoStar Gold Star Warranty, upon completion of the installation, an inspection must be conducted by a Technical Representative of EcoStar to ascertain that the roofing system has been installed according to EcoStar's most current published specifications and details. This inspection is not intended to be a Final Inspection for the benefit of the Owner, but for the benefit of EcoStar to determine whether a warranty shall be issued.
4. Class C Testing Requirements:
 - a. Fire Resistance - UL 790 Test Standard
 - b. Class 4 Impact Resistance - UL 2218 Test Standard



- c. 110 mph wind load - PA100-95 Test Standard
- d. Wind uplift - 105 lbs / sq ft - UL 1897 Test Standard
- 5. Class A Testing Requirements:
 - a. Fire Resistance - UL 790 Test Standard
 - b. Class 4 Impact Resistance - UL 2218 Test Standard

E. Product Delivery, Storage And Handling

- 1. Deliver materials in original unopened packages.
- 2. Packages shall be labeled with manufacturer's name, brand name, installation instructions and identification of various items.
- 3. All tile materials must be stored between 45° F. and 80° F. If exposed to lower temperatures, restore to 45° F minimum temperature before using.
- 4. Store all materials in a dry protected area. Damaged materials must **NOT** be used. Installed materials found to be damaged shall be replaced at Gold Star Authorized Applicator's expense.

F. Job Conditions (Cautions And Warnings)

- 1. Contact EcoStar Technical Department for procedures when installing a Majestic Slate Tile Roof System during temperatures less than 45° F.
- 2. Do not install the Majestic Slate Tile Roof System directly over existing asphalt shingles or existing tile roof systems. All existing roof materials **MUST** be removed prior to installation of the Majestic Slate Tile System.
- 3. Roofing surface must be free of ice, water, or snow prior to and during the roofing project.

G. Warranty

- 1. Roofing materials manufacturer will provide the warranty for those materials supplied by the manufacturer when the project is completed by a manufacturer's authorized applicator and all required materials have been utilized within the roof system.
- 2. Only when a manufacturer's technical representative has inspected and approved the completed installation will a warranty be issued.
- 3. The warranty is available for all types of buildings and structures.
- 4. The warranty period is expressed on the warranty certificate, which reflects the inclusive dates of coverage.
- 5. The warranty does **NOT** cover the aesthetic appearance of the Majestic Slate - Tiles. Care should be taken by the authorized applicator to ensure that proper blending of the tiles occurs. When improper blending occurs the aesthetic appearance of the roof can be effected negatively. Blending should occur from a minimum of seven bundles from each pallet. It is highly suggested that all material be on site to blend from.
- 6. Only products supplied by EcoStar, a Division of Carlisle SynTec Incorporated, are included in the warranty unless otherwise specified and approved in writing by EcoStar, a Division of Carlisle SynTec Incorporated.

1.2 PRODUCTS

A. Manufacturer

- 1. All Components of the Majestic Slate - Tile Roof System are to be products manufactured or supplied by EcoStar, a Division of Carlisle SynTec Incorporated, or approved equivalent.

B. Class C Tile Roofing System

- 1. Slate Tiles/Shingles: Tiles made of Starloy™, 100% recycled rubber and plastic compound, 12" wide by 18" long with a nominal thickness of 1/4". Weight shall be determined by the following acceptable tile exposures:

7"	241 - 258 lbs per square
6-1/2"	259 - 278 lbs per square
6"	280 - 300 lbs per square



- a. Color: As selected from manufacturer's standard colors, unless directed otherwise.
 - 2. Underlayment
 - a. AquaGuard - a roofing underlayment recognized for use as an alternative to Type 30 roofing underlayment, consisting of spunbonded polypropylene coated with a layer of U.V. stabilized polypropylene on both sides, meeting requirements of ASTM D2626, referred to as 30 lb and without perforations.
 - b. Glacier Guard ice and water underlayment - Granular Surface (55 mil), Smooth Surface (40 mil), or Smooth Surface High Temperature (40 mil), a composite membrane consisting of fiberglass reinforced rubberized asphalt laminated to an impermeable polyethylene film layer (Smooth Surface and Smooth Surface High Temperature) or coated with a granular surface providing maximum skid resistance (Granular Surface).
- C. Class A Tile Roofing System
 - 1. Slate Tiles/Shingles: Tiles made of Starloy™, 100% recycled rubber and plastic compound, 12" wide by 18" long with a nominal thickness of 1/4". Weight shall be determined by the following acceptable tile exposures:

7"	258 - 276 lbs per square
6-1/2"	278 - 294 lbs per square
6"	300 - 321 lbs per square

 - a. Color: As selected from manufacturer's standard colors, unless directed otherwise.
 - 2. Underlayment
 - a. VersaShield - One layer of Elk VersaShield meeting or exceeding the requirements of ASTM D226.
 - b. Glacier Guard ice & water underlayment - Granular Surface (55 mil), Smooth Surface (40 mil), or Smooth Surface High Temperature (40 mil), a composite membrane consisting of fiberglass reinforced rubberized asphalt laminated to an impermeable polyethylene film layer (Smooth Surface and Smooth Surface High Temperature) or coated with a granular surface providing maximum skid resistance (Granular Surface).
- D. Fasteners
 - 1. AquaGuard/VersaShield
 - a. Roofing nails with one inch (1") diameter round or square head, plastic or metal, and 3/4" long shank. Metal parts of fastener are to be corrosion resistant.
 - 2. Tile Fasteners
 - a. EcoStar Roofing Nail with a 3/8" diameter head and a minimum of 1-1/2" long shank made from stainless steel. Nails can be supplied either as a hand drive style or in coils for use in pneumatic tools.

1.3 EXECUTION

- A. Substrate Criteria
 - 1. The Building owner or Owner's Representative is responsible for providing and determining that the substrate is suitable to receive the Majestic Slate Tile Roof System and the authorized EcoStar Gold Star Applicator should not proceed until all defects have been corrected.
 - 2. The Majestic Slate Roof System may only be applied over:
 - a. Minimum 1/2" plywood or OSB decking
 - b. Minimum 1" tongue and groove wood decking
 - c. Approved metal deck systems - for specifics contact roofing materials manufacturer.
 - 3. Minimum slope of substrate for installation of Majestic Slate Roof System shall be a minimum of 3/12 for 6" exposure installation and a minimum of 6/12 for 7" exposure installation. Contact the EcoStar Technical Department for approval of applications on lower slopes or exceptions to this requirement.
- B. Substrate Preparation



1. The Building Owner or Owner's Representative is responsible for ensuring that all wet or damaged substrate has been removed in a re-roofing application.
2. Existing roof material **MUST** be removed and a clean substrate free of foreign material be provided prior to the installation of the Majestic Slate Tile Roof System. Majestic Slate Tiles may **NOT** be installed directly over any existing roof material or system.

C. Installation

1. Flashing and Sheet Metal:
 - a. Install sheet metal and flashing metal in all valleys and where required on projections furnish in accordance with Division 07 Section "Sheet Metal Flashing And Trim".
 - b. Where required, install metal starter strip at all eaves and roof edges. Furnish metal in accordance with Division 07 Section "Sheet Metal Flashing And Trim".
 - c. The roofing materials manufacturer suggests that all metal work be made from copper, stainless steel or an equally long-term material.
2. Underlayment:
 - a. AquaGuard:
 - 1) Apply 41.5" wide sheet over complete deck, lapping the area covered with Glacier Guard ice and water underlayment. Lap end joints 6" and side joints 4" and double through valleys.
 - 2) Do not leave exposed to weather more than 90 days after beginning of installation without written approval of owner.
 - 3) Do not leave any fastener heads exposed. Nail only in areas to be covered by lapping of underlayment.
 - b. VersaShield:
 - 1) Apply 42" wide sheet over complete deck, covering the entire roof deck **INCLUDING** those areas with Glacier Guard Ice & Water underlayment. Lap end joints 4" and side joints 6".
 - 2) Lap the VersaShield 6" from both sides over all hips, valleys, and ridges.
 - 3) Where the roof meets a vertical surface, carry the VersaShield 3" to 4" up the surface.
 - 4) Do not leave exposed to weather more than **60** days after beginning of installation without written approval of owner.
 - 5) Do not leave any fastener heads exposed. Nail only in areas to be covered by lapping of underlayment.
 - c. Glacier Guard Ice and water underlayment:
 - 1) Lap end joints 6" and side joints 3.5"
 - 2) Apply continuous 36" wide sheet in valley centered over valley.
 - 3) Apply rows of 36" wide sheets along all eaves and rakes. Lap end joints 6" and side joints 3.5".
 - 4) Apply rows of 36" wide sheets along and around all dormers and roof projections. Lap end joints 6" and side joints 3.5".
 - 5) When applicable install as far as it can be installed on any head walls or vertical walls a minimum of 12".
 - 6) Do not leave Glacier Guard Granular Surface exposed to weather more than 14 days after beginning of installation. Do not leave Glacier Guard Smooth Surface exposed to weather more than 30 days after beginning of installation. Do not leave Glacier Guard Smooth Surface High Temp exposed to the weather more than 60 days after the beginning of installation.
3. Tile/Shingle Installation
 - a. After installing underlayment and before installing the tiles, clean the surface of debris and dirt.
 - b. Beginning at the eave, install a layer of tiles gapped a minimum of 3/8" between tiles and any projections, with two roofing fasteners per tile (in location shown on tiles). This layer of tiles will become the starter row. Install another layer of tiles in the same manner as the first with the exception of the second layer having a 1/2 tile offset to the first layer.



- c. Continue installing tiles per the chosen exposure.
- d. Care must be taken to place tiles so color variations are evenly distributed over the entire roof area. Tiles between bundles and pallets **MUST** be shuffled to insure even distribution of color variations. "Patchy" or "Blotching" in appearance is not acceptable and the applicator will be required to correct. It is recommended that work not begin until all roofing materials have been delivered to the job site.
- e. It is the responsibility of the applicator to ensure that all tiles are bent back in a downward curve prior to installation. **Do not install tiles with an upward curve.**
- f. Either an open or closed valley design may be used.
 - 1) With an open valley design leave a minimum of 2" on each side of the center of the valley exposed and uncovered by the roof tiles. A V-Style or W-Style Valley metal may be used.
 - 2) With a closed valley design cut the tiles in a straight line to fit no closer than 3/8" against tile of adjoining roof slope.
- g. Minimum Fastening - No less than 2 approved fasteners per tile, with a minimum length of 1-1/2", shall be used.
- h. CAUTION: When using a pneumatic nailer, care shall be taken to ensure that nails are not over driven causing the tiles to curl upward. If tiles have been installed with over-driven nails causing the ends of the tile to curve upward, tiles will never lay flat. Over-driven tiles must be removed and re-nailed properly.
- i. Install EcoStar Attic Guard ridge vent system per the manufacturer's application instructions, and then place the Majestic Slate - Universal Hip/Ridge Tile over the ridge vent. A minimum 2.5" stainless steel, hand-driven EcoStar fastener should be used on a ventilated hip/ridge to fasten the hip/ridge tile to the deck. A minimum 2" stainless steel, hand-driven EcoStar fastener should be used on an unventilated hip/ridge to fasten the hip/ridge tile to the deck. Place fasteners in the location marked on the tile. Majestic Slate - Universal Hip/Ridge Tile must be installed with 6" exposure.
- j. Tiles may not be installed if the tiles have been stored in temperatures lower than 45° F. If tiles have been stored in temperatures below 45° F., tiles must be brought back to an ambient material temperature of 45° F. As the temperature rises, tiles will expand beyond the designed installation pattern if the product is installed while cold or frozen.
- k. Do not install tiles directly adjacent to each other. A minimum gap of 3/8" must be maintained between installed tiles.
- l. After the initial row of tiles has been installed, it is recommended that a chalk line be placed parallel to the roof edge and running perpendicular to the first row of tiles. This chalk line will ensure that the tiles stay true and plumb to the roof edge throughout installation.
- m. Care must be taken to minimize foot traffic over completed areas of the roof. Tiles will show mud and dirt and cause appearance problems. The removal of dirt and debris is the responsibility of the applicator.
- n. Tiles can be slippery when wet, caution should be exhibited with early morning dew and after rain. The tile manufacturer suggests the use of toe boards and OSHA approved harnesses and safety equipment at all time.
- o. Upon completion of the roof system installation, inspect and remove all debris from roof, sweep clean and wash with a mild, non-bleaching detergent.

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SECTION 07 41 13 00 - CSF METAL ROOF PANELS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Standing Seam Metal Roofing is part of the Work.

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.07 41 13 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Standing seam metal roofing.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 SYSTEM DESCRIPTION

- A. This section covers the metal roof system required for the "Platform" and "Carrier Loading" and includes the panels, panel clips, flashing, panel splices, ridge material, fascias, gutter and downspouts, and all necessary fasteners for the above. Not included are the structural roof supports. Metal roof system must meet ENERGY STAR solar reflectance requirements.

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM).
 - 1. ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.
 - 2. ASTM A 792 - Specification for Steel Sheet, 55% Aluminum-Zinc Alloy Coated by the Hot Dip Process.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.



1. Shop Drawings: Erection/shop drawings for each product specified showing all erection procedures and accessories required. Field measure and verify dimensions prior to fabrication of metal roofing.
2. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

1.5 QUALITY ASSURANCE

- A. Qualifications:
 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.6 WARRANTY

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Special Warranty:
 1. Submit written warranty, without monetary limitation, signed by roofing system manufacturer agreeing to promptly repair leaks in roof panels and base flashings resulting from defects in materials and workmanship.
 2. Manufacturer shall warrant to correct defects in paint finish for 20 years following Substantial Completion.

NOTE TO SPECIFIER

20 year Warranty and other Warranty requirements indicated as a requirement in USPS "CSF Small and CSF Medium Design Criteria." Verify 20 year requirement with USPS Contracting Officer.

3. Warranty Period: [20] [____] years.
4. Include materials and workmanship for the following items within Warranty:
 - a. Metal panels.
 - b. Flashings, including metal flashings and accessories supplied by roofing membrane manufacturer.
 - c. Insulation.
 - d. Fasteners.
 - e. Adhesives.
5. Include the following items within Warranty:
 - a. Roofing inspection by Manufacturer's Roofing Quality Control Inspector between 22 and 24 months after date of Final Acceptance.
 - b. Roofing manufacturer will provide unlimited repairs on warranted items during warranty period with no cost limitation.
 - c. Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions. USPS must immediately notify roofing manufacturer of such repairs.
 - d. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Project Roofing Specification Section to Warranty.
6. Wind Coverage
 - a. Warranty shall cover wind gusts up to 72 miles per hour.



PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Amerimax 1.AEP/SPAN Dallas, TX (800) 527-2503.
 - 2. Amerimax Building Products, Plano TX, (800) 258-8295.
 - 3. ATAS International, Incorporated, Allentown, PA (610) 395-8445.
 - 4. Tremco Inc., Beachwood OH (800) 852-6013.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

- A. Base Metal:
 - 1. Material: Steel.
 - 2. Manufacturing Standard: ASTM A-653.
 - 3. Yield Strength: Minimum 40 ksi.
 - 4. Thickness: Minimum 24 gauge.
 - 5. Protective Coating: ASTM A792,. Galvalume.
 - 6. Protective Coating Components by Weight: 45 percent zinc and 55 percent aluminum alloy.
 - 7. Protective Coating Thickness: 1.9 mils.
- B. Configuration:
 - 1. Pattern: Standing Seam.
 - 2. Seam Spacing: Nominal 14-1/2 inches.
 - 3. Seam Height: Nominal 1-9/16 inches.
 - 4. Panel Width: Nominal 14-1/2 inches.
 - 5. Panel Length: Longest practical.
- C. Exterior Finish:
 - 1. Primer: Baked on epoxy, minimum 0.2 mil thick.
 - 2. Finish Material: Kynar 500.
 - 3. Finish Color: From manufacturer's standard colors meeting ENERGY STAR requirements for initial and maintained solar reflectance.
- D. Fasteners: Non-corrosive, concealed, as recommended by metal roof panel manufacturer.
- E. Sealant: As recommended by metal roof panel manufacturer.
- F. Trim and Flashing:
 - 1. Gable, eave and parapet wall flashing details matching metal roof panels as recommended by panel manufacturer, and as per approved shop drawing.
 - 2. Provide high eave flashing and flashing parallel to the roof panels to accommodate the thermal expansion and contraction of the roof without damage to the roof panels or flashing.
 - 3. Provide flexible membranes, as recommended by the panel manufacturer.



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install in conformance with manufacturer's published instructions.
- B. Remove any strippable protective coating on the panels and flashings prior to installation and in any case do not allow the strippable coating to remain on the panels in extreme heat, cold, or in direct sunlight or other UV source.
- C. Caulk, seal and fasten so as to provide as complete weathertight installation.
- D. Install starter and edge flashings prior to panels.
- E. Install panels with true and level horizontal lines and plumb verticals.
- F. Do not allow panels or trim to come into contact with dissimilar metals.
- G. Do not expose edges of roof panels.
 - 1. Provide caps, fascia, and trim as indicated and as per approved shop drawings.
- H. Space clips on panels at 18 inches on center.
- I. When horizontal joints are necessary, use splice plates or lap pans at least 4 inches for 3:12 slopes or greater. Increase laps for slopes less than 3:12.
- J. Touch up minor scratches and abrasions. Replace defective material with good material.

3.3 CLEAN UP

- A. Leave work areas clean, free from grease, finger marks and stains.
- B. Remove scrap and debris from surrounding areas and grounds.



3.4 FIELD QUALITY CONTROL

- A. Inspect manufactured wall panel installation, alignment, attachment, joint seals, flashing, trim, fascia, and accessories.
- B. Correct deficiencies in Work which inspections indicate are not in compliance with Contract Documents.

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SECTION 07 46 00 00 - CSF SIDING

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Wood Siding or Vinyl Siding is part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.07 46 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Exterior wood siding.
 2. Exterior vinyl siding.
 3. Exterior cement siding.
 4. Vinyl soffit
 5. Aluminum soffit
 6. Related trim, accessories, and fastenings.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 1. Product Data:
 - a. Provide data indicating materials, component profiles, fastening methods, jointing details, sizes, surface texture, finishes, and accessories.

PART 2 - PRODUCTS

2.1 WOOD SIDING

- A. Western red or clear cedar plain bevel siding, WCLB grade 'Clear VG Heart' for stain finish; grade 'B' for paint finish; 1/2" x 6", 4" exposed; maximum variation from level: 1/4" in 10 ft.; Georgia Pacific Corp. or equal.



1. Nails- Use high quality hot dipped galvanized nails at each stud. Nail should penetrate 1-1/2" beyond siding. Avoid over-driving nails.

NOTE TO SPECIFIER

CSF Small use trim even at masonry walls.

2.2 TRIM

- A. Wood trim: Flat grooved board wood siding shall be Clear Cedar boards. Locate cut boards over bearing surfaces.
- B. Vinyl trim: Size as indicated on drawings.

2.3 FLASHING

- A. - metal for wood siding, as per manufacturer for vinyl.

2.4 VINYL SIDING

A. Manufacturers

1. Alcoa Building Products, Sidney, OH, (800) 962-6973.
2. Alside, Inc, Akron, OH, (800) 922-6009.
3. CertainTeed Corp., Vinyl Building Products Group, Valley Forge, PA, (800) 233-8990.
4. Georgia-Pacific Corp, Atlanta, GA, (800) 284-5347.
5. Wolverine Technologies, Inc, Valley Forge, PA, (800) 838-8100.
6. Substitutions: Permitted.

B. Formed Vinyl Siding - Solid vinyl siding and accessories fabricated by extrusion from a polyvinyl chloride compound complying with ASTM D 3679, and as follows:

1. Exposure: 8-inch exposure
2. Exposure: 8-inch exposure in double 4-inch style
3. Exposure: 8-inch exposure in triple 2-2/3 inch style
4. Exposure: 9-inch exposure in double 4-1/2 inch style
5. Exposure: 9-inch exposure in triple 3-inch style
6. Exposure: 10-inch exposure in double 5-inch style
7. Exposure: 12-inch exposure in double 6-inch style
8. Texture: Plain
9. Texture: Woodgrain
10. Texture: Profiled.

C. Colors, Textures, and Patterns - Where manufacturer's standard products are indicated, provide siding with the following requirements:

1. Match Architect's samples
2. Match colors, textures, and patterns indicated by reference to manufacturer's standard designations for these characteristics.
3. Provide selections made by Architect from manufacturer's full range of standard colors, textures, and patterns for vinyl siding indicated.

D. Comply with siding manufacturer's installation instructions and recommendations. Center nails in elongated nailing slots without binding siding to allow for thermal movement. Install trim and accessories in accordance with manufacturer's recommendations. Overlap butt joints to shed water away from direction of prevailing wind. Isolate dissimilar metals.



2.5 CEMENT SIDING

- A. Manufacturers
 - 1. James Hardie Building Products, Inc, Mission Viejo, CA, Commercial: (866) 274-3464
 - 2. CertainTeed Corporation, Valley Forge, PA • 800.233.8990
- B. Non-asbestos fiber-cement plank siding and trim complying with National Evaluation Report No. NER 405 (BOCA, ICBO, SBCCI).
- C. Size, Exposure, Colors, Textures, and Patterns - Where manufacturer's standard products are indicated, provide siding with the following requirements:
 - 1. Match Architect's samples
 - 2. Match colors, textures, and patterns indicated by reference to manufacturer's standard designations for these characteristics.
 - 3. Provide selections made by Architect from manufacturer's full range of standard colors, textures, and patterns for vinyl siding indicated.
- D. Comply with siding manufacturer's installation instructions and recommendations.

2.6 SOFFIT

- A. Vinyl Soffit: Solid vinyl soffit and accessories complying with ASTM D 4477.
 - 1. Pattern: 6-inch exposure
 - 2. Pattern: 6-inch exposure in triple 2-inch beaded edge style
 - 3. Pattern: 8-inch exposure in double 4-inch style
 - 4. Pattern: 10-inch exposure in double 5-inch style
 - 5. Pattern: 12-inch exposure in double 6-inch style
 - 6. Pattern: 12-inch exposure in triple 4-inch style
 - 7. Ventilation: Provide perforated soffit.
- B. Aluminum Soffit: Aluminum soffit complying with AAMA 1402, fabricated from aluminum sheet in alloy recommended by siding manufacturer, and as follows:
 - 1. Pattern: 6-inch exposure
 - 2. Pattern: 10-inch exposure in double 5-inch style
 - 3. Pattern: 12-inch exposure in double 6-inch style
 - 4. Pattern: 16-inch exposure in triple 5-1/3 inch style
 - 5. Pattern: 16-inch exposure in quadruple 4-inch style
 - 6. Ventilation: Provide perforated soffit
 - 7. Thickness: 0.024 inch nominal.
 - 8. Finish: Manufacturer's standard

2.7 ACCESSORIES

- A. Siding Accessories: Provide starter strips, edge trim, window head flashing, corner cap, and other items as recommended by manufacturer for building configuration; match type of siding.
- B. Decorative Accessories: Provide the following types of decorative accessories as indicated:
 - 1. Door and window casings.
 - 2. Louvers.
 - 3. Fasciae.
 - 4. Moldings and trim.



PART 3 - EXECUTION

3.1 INSTALLATION

A. Wood

1. Install siding horizontally with edges and ends over firm bearing.
2. Nail sheet siding 16 inches (400 mm) oc. Butt joints tight. Fasten siding in place, level and plumb. Arrange for orderly nailing pattern. Blind nail except on cover trim.
3. Position cut ends over bearing surfaces. Sand cut edges smooth and clean.
4. Miter external and internal corners. Install corner strips, closures, and trim.
5. Install flashings at internal and external corners, sills and heads of wall openings.

B. Vinyl Siding

1. Install vinyl siding, soffit and accessories, according to ASTM D 4756

C. Aluminum

1. Install aluminum siding, soffit and accessories according to AAMA 1402

D. CEMENT SIDING

- A. Install materials in strict accordance with manufacturer's installation instructions.
- B. Starting: Install a minimum 1/4 inch (6 mm) thick lath starter strip at the bottom course of the wall. Apply planks horizontally with minimum 1-1/4 inches (32 mm) wide laps at the top. The bottom edge of the first plank overlaps the starter strip.
- C. Allow minimum vertical clearance between the edge of siding and any other material in strict accordance with the manufacturer's installation instructions.
- D. Align vertical joints of the planks over framing members.
- E. Maintain clearance between siding and adjacent finished grade.
- F. Locate splices at least one stud cavity away from window and door openings.
- G. Use off-stud metal joiner in strict accordance with manufacturer's installation instructions.
- H. Wind Resistance: Where a specified level of wind resistance is required install lap siding to framing members and secured with fasteners described in Table No. 2 in National Evaluation Service Report No. NER-405.

3.2 INSTALLATION TOLERANCES

- A. Maximum Variation From Level: 1/4 inch per 10 feet (6 mm/3 m).
- B. Maximum Offset From Joint Alignment: 1/16 inch (1.5 mm).

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Last revised: 4/12/2011



END OF SECTION



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SECTION 07 46 16 00 - METAL WALL PANELS**1.1 GENERAL****A. Description Of Work:**

1. This specification covers the furnishing and installation of materials for metal wall panels. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Exposed-fastener, lap-seam metal wall panels.
 - b. Concealed-fastener, lap-seam metal wall panels.
 - c. Metal liner panels.
 - d. Metal soffit panels.

C. Definition

1. Metal Wall Panel Assembly: Metal wall panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight wall system.

D. Performance Requirements

1. General Performance: Metal wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
2. Delegated Design: Design metal wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
3. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of wall area when tested according to ASTM E 283 at the following test-pressure difference:
 - a. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa).
4. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
 - a. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa) which is equivalent to a 50-mph (80-km/h) wind.
5. Water Penetration under Dynamic Pressure: No evidence of water leakage when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. (300 Pa) (which is equivalent to a 50-mph (80-km/h) wind) and not more than 12 lbf/sq. ft. (575 Pa).
 - a. Water Leakage: As defined according to AAMA 501.1.
OR
Water Leakage: Uncontrolled water infiltrating the system or appearing on system's normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.
6. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:
 - a. Wind Loads: Determine loads based on the following minimum design wind pressures:
 - 1) Uniform pressure of 20 lbf/sq. ft. (957 Pa) **OR** 30 lbf/sq. ft. (1436 Pa), **as directed**, acting inward or outward.
OR
Uniform pressure as indicated on Drawings.



- b. Deflection Limits: Metal wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/180 **OR** 1/240, **as directed**, of the span.
- 7. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

E. Submittals

- 1. Product Data: For each type of product indicated.
- 2. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory-, shop- and field-assembled work.
- 3. Samples: For each type of exposed finish required.
- 4. Delegated-Design Submittal: For metal wall panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- 5. Coordination Drawings: Exterior elevations drawn to scale and coordinating penetrations and wall-mounted items.
- 6. Product Test Reports.
- 7. Field quality-control reports.
- 8. Maintenance Data.
- 9. Warranties: Sample of special warranties.

F. Quality Assurance

- 1. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- 2. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- 3. Fire-Resistance Ratings: Where indicated, provide metal wall panels identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- 4. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling

- 1. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.
- 2. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.
- 3. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.
- 4. Retain strippable protective covering on metal wall panel for period of metal wall panel installation.
- 5. Protect foam-plastic insulation as follows:
 - a. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - b. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
 - c. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

H. Warranty



1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period: Two years from date of Final Completion.
2. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - a. Finish Warranty Period:
 - 1) 20 years from date of Final Completion for fluoropolymer finish.
 - 2) 10 years from date of Final Completion for siliconized polyester.

1.2 PRODUCTS

A. Panel Materials

1. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
 - b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.
 - c. Surface: Smooth, flat **OR** Embossed, **as directed**, finish.
 - d. Exposed Coil-Coated Finish:
 - 1) 2-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2) 3-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 3) 4-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 4) Mica Fluoropolymer: AAMA 621. 2-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 5) Metallic Fluoropolymer: AAMA 621. 3-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 6) FEVE Fluoropolymer: AAMA 621. 2-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 7) Siliconized-Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 - 8) Plastisol: Epoxy primer and vinyl plastisol topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 3.8 mil (0.97 mm) for topcoat.
 - e. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).



2. Aluminum Sheet: Coil-coated sheet, ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
 - a. Surface: Smooth, flat **OR** Embossed, **as directed**, finish.
 - b. Exposed Coil-Coated Finish:
 - 1) 2-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2) 3-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 3) 4-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 4) Mica Fluoropolymer: AAMA 620. 2-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 5) Metallic Fluoropolymer: AAMA 620. 3-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 6) FEVE Fluoropolymer: AAMA 620. 2-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 7) Siliconized-Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 - 8) Plastisol: Epoxy primer and vinyl plastisol topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 3.8 mil (0.97 mm) for topcoat.
 - c. Exposed Anodized Finish:
 - 1) Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
 - 2) Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
 - d. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).
3. Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 temper.
 - a. Exposed Finish: Apply the following finish, as specified or indicated on Drawings.
 - 1) Natural finish.
 - 2) Brushed Satin: CDA M32-06x (Mechanical Finish: directionally textured, medium satin; Coating: clear organic, air drying, as specified below):
 - a) Clear, Organic Coating: Clear, air-drying, acrylic lacquer specially developed for coating copper-alloy products, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
 - 3) Mirror Polished: CDA M22-06x (Mechanical Finish: buffed, specular; Coating: clear organic, air drying, as specified below):
 - a) Clear, Organic Coating: Clear, air-drying, acrylic lacquer specially developed for coating copper-alloy products, applied by air spray in two coats per



- manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
- 4) Pre-patinated: ASTM B 882. Copper sheets artificially aged by chemical reaction to convert surface to inorganic crystalline structure with color range and durability of naturally-formed patina.
4. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304 **OR** 316, **as directed**, fully annealed.
 - a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 - b. Polished Finish: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1) Run grain of directional finishes with long dimension of each piece.
 - 2) When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 3) Directional Satin Finish: No. 4.
 - c. Bright, Cold-Rolled, Unpolished Finish: No. 2B.
 5. Panel Sealants:
 - a. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
 - b. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.
 - c. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.
- B. Field-Installed Thermal Insulation
1. Unfaced, Polyisocyanurate Board Insulation: ASTM C 591, Type II, compressive strength of 35 psi (241 kPa), with maximum flame-spread index of 75 and smoke-developed index of 450.
 2. Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I (foil facing), Class 1 or 2 **OR** Type II (asphalt felt or glass-fiber mat facing), Class 2 or 3, Grade 3, **as directed**, with maximum flame-spread index of 75 and smoke-developed index of 450, based on tests performed on unfaced core.
 3. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.60-lb/cu. ft. (26-kg/cu. m), with maximum flame-spread index of 75 and smoke-developed index of 450.
 4. Molded-Polystyrene Board Insulation: ASTM C 578, Type I, 0.9 lb/cu. ft. (15 kg/cu. m) **OR** Type II, 1.35 lb/cu. ft. (22 kg/cu. m), **as directed**, with maximum flame-spread index of 75 and smoke-developed index of 450.
 5. Unfaced, Glass-Fiber Board Insulation: ASTM C 612, Type IA or Types IA and IB; with maximum flame-spread index of 25 and smoke-developed index of 50, and with a nominal density of 3 lb/cu. ft. (48 kg/cu. m).
 6. Mineral-Fiber-Blanket Insulation: ASTM C 665, type indicated below; consisting of fibers manufactured from glass **OR** slag or rock wool, **as directed**.
 - a. Type I (blankets without membrane covering), passing ASTM E 136 for combustion characteristics.
 - b. Type II (blankets with nonreflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).
 - c. Type III (blankets with reflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).
 7. Metal Building Insulation: ASTM C 991, Type I; or NAIMA 202 **OR** ASTM C 991, Type II, **as directed**, glass-fiber-blanket insulation; 0.5-lb/cu. ft. (8-kg/cu. m) density; 2-inch- (50-mm-) wide, continuous, vapor-tight edge tabs; and with a flame-spread index of 25 or less.
 - a. Vapor-Retarder Facing: ASTM C 1136, with permeance not greater than 0.02 perm (1.15 ng/Pa x s x sq. m) when tested according to ASTM E 96, Desiccant Method:
 - 1) Composition: Polypropylene faced, scrim reinforced, and kraft-paper backing **OR** Foil faced, scrim reinforced, and kraft-paper backing with vapor-retarder coating **OR** Polypropylene faced, scrim reinforced, and foil backing **OR** Vinyl faced, scrim reinforced, and foil backing **OR** Vinyl faced, scrim reinforced, and polyester backing, **as directed**.



- b. Insulation Retainer Strips: 0.019-inch- (0.48-mm-) thick, formed galvanized steel or PVC retainer clips colored to match insulation facing.

C. Miscellaneous Metal Framing

1. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G40 (Z120) hot-dip galvanized **OR** ASTM A 653/A 653M, G60 (Z180) hot-dip galvanized, **as directed**, or coating with equivalent corrosion resistance unless otherwise indicated.
2. Subgirts: Manufacturer's standard C- or Z-shaped sections, 0.064-inch (1.63-mm) nominal thickness.
3. Zee Clips: 0.079-inch (2.01-mm) nominal thickness.
4. Base or Sill Angles **OR** Channels, **as directed**: 0.079-inch (2.01-mm) nominal thickness.
5. Hat-Shaped, Rigid Furring Channels:
 - a. Nominal Thickness: As indicated **OR** As required to meet performance requirements **OR** 0.025 inch (0.64 mm) **OR** 0.040 inch (1.02 mm), **as directed**.
 - b. Depth: As indicated **OR** 7/8 inch (22 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
6. Cold-Rolled Furring Channels: Minimum 1/2-inch- (13-mm-) wide flange.
 - a. Nominal Thickness: As indicated **OR** As required to meet performance requirements **OR** 0.064 inch (1.63 mm), **as directed**.
 - b. Depth: As indicated **OR** 3/4 inch (19 mm), **as directed**.
 - c. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with 0.040-inch (1.02-mm) nominal thickness.
 - d. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.57-mm-) diameter wire, or double strand of 0.048-inch- (1.22-mm-) diameter wire.
7. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), and depth required to fit insulation thickness indicated.
 - a. Nominal Thickness: As indicated **OR** As required to meet performance requirements **OR** 0.025 inch (0.64 mm), **as directed**.
8. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

D. Miscellaneous Materials

1. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

E. Exposed-Fastener, Lap-Seam Metal Wall Panels

1. General: Provide factory-formed metal wall panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.
2. Corrugated-Profile, Exposed-Fastener Metal Wall Panels: Formed with alternating curved ribs spaced at 2.67 inches (68 mm) o.c. across width of panel.
 - a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.



- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
- 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- d. Panel Coverage: 21.3 inches (541 mm) **OR** 29.3 inches (744 mm) **OR** 34.6 inches (881 mm) **OR** 37.3 inches (947 mm) **OR** 42.6 inches (1084 mm) **OR** 45.3 inches (1151 mm), **as directed**.
- e. Panel Height: 0.5 inch (13 mm) **OR** 0.875 inch (22 mm), **as directed**.
3. Tapered-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between major ribs.
 - a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - d. Major-Rib Spacing: 6 inches (152 mm) **OR** 8 inches (203 mm) **OR** 9 inches (229 mm) **OR** 12 inches (305 mm), **as directed**, o.c.
 - e. Panel Coverage: 24 inches (610 mm) **OR** 36 inches (914 mm), **as directed**.
 - f. Panel Height: 0.625 inch (16 mm) **OR** 0.75 inch (19 mm) **OR** 1.0 inch (25 mm) **OR** 1.25 inches (32 mm) **OR** 1.5 inches (38 mm), **as directed**.
4. Reverse-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with recessed, trapezoidal major valleys and intermediate stiffening valleys symmetrically spaced **OR** flat pan, **as directed**, between major valleys.
 - a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.



- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
- 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- c. Major-Rib Spacing: 12 inches (305 mm) o.c.
- d. Panel Coverage: 36 inches (914 mm).
- e. Panel Height: 1.25 inches (32 mm).
5. Vee-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, V-shaped ribs and recesses that are approximately same size, evenly spaced across panel width, and with rib/recess sides angled at approximately 45 degrees.
 - a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm) **OR** 0.064-inch (1.63-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm) **OR** 0.064-inch (1.63-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - d. Rib Spacing: 5.3 inches (135 mm) **OR** 7.2 inches (183 mm) **OR** 12 inches (305 mm), **as directed**, o.c.
 - e. Panel Coverage: 30 inches (762 mm) **OR** 32 inches (813 mm) **OR** 36 inches (914 mm) **OR** 40 inches (1016 mm), **as directed**.
 - f. Panel Height: 1.375 inches (35 mm) **OR** 1.5 inches (38 mm) **OR** 1.75 inches (44 mm) **OR** 2.0 inches (51 mm) **OR** 3.0 inches (76 mm), **as directed**.
6. Box-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, box-shaped ribs, evenly spaced across panel width, and with rib/recess sides angled 60 degrees or more.
 - a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.



- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
- 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- d. Rib Spacing: 2.67 inches (68 mm) **OR** 4.0 inches (102 mm) **OR** 5.3 inches (135 mm) **OR** 6.0 inches (152 mm), **as directed**, o.c.
- e. Panel Coverage: 24 inches (610 mm) **OR** 28 inches (711 mm) **OR** 30 inches (762 mm) **OR** 32 inches (813 mm) **OR** 36 inches (914 mm), **as directed**.
- f. Panel Height: 0.625 inch (16 mm) **OR** 1.0 inch (25 mm) **OR** 1.5 inches (38 mm) **OR** 2.0 inches (51 mm), **as directed**.
7. Deep-Box-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, box-shaped ribs, evenly spaced across panel width, and with rib/recess sides angled more than 60 degrees.
 - a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm) **OR** 0.064-inch (1.63-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm) **OR** 0.064-inch (1.63-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - d. Rib Spacing: 12 inches (305 mm) o.c.
 - e. Panel Coverage: 24 inches (610 mm).
 - f. Panel Height: 3.0 inches (76 mm) **OR** 4.0 inches (102 mm), **as directed**.



- F. Concealed-Fastener, Lap-Seam Metal Wall Panels
1. General: Provide factory-formed metal wall panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.
 2. Flush-Profile, Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between panel edges; with flush joint between panels.
 - a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - d. Panel Coverage: 12 inches (305 mm), **as directed**.
 - e. Panel Height: 1.0 inch (25 mm) **OR** 1.5 inches (38 mm), **as directed**.
 3. Reveal-Joint, Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between panel edges; with narrow reveal joint between panels.
 - a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.



- fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
- 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- d. Panel Coverage: 12 inches (305 mm).
- e. Panel Height: 1.0 inch (25 mm) **OR** 1.5 inches (38 mm), **as directed**.
4. Wide-Reveal-Joint, Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and stepped profile between panel edges resulting in wide reveal joint between panels.
- a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
- 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
- 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
- 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- d. Panel Coverage: 12 inches (305 mm).
- e. Panel Height: 1.5 inches (38 mm).
5. V-Groove-Profile, Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between panel edges.
- a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
- 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) nominal thickness.
- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
- 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- c. Panel Coverage: 6 inches (152 mm) **OR** 8 inches (203 mm) **OR** 12 inches (305 mm), **as directed**.
- d. Panel Height: 0.625 inch (16 mm) **OR** 1.25 inches (32 mm), **as directed**.
6. Tapered-Rib-Profile, Concealed-Fastener Metal Wall Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between major ribs.



- a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - c. Panel Coverage: 12 inches (305 mm) **OR** 14 inches (356 mm), **as directed**.
 - d. Panel Height: 1.0 inch (25 mm) **OR** 1.5 inches (38 mm), **as directed**.
7. Curved-Rib-Profile, Concealed-Fastener Metal Wall Panels: Formed with raised, curved-side major ribs and flat pan between major ribs; with reveal joint between panels.
 - a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - d. Panel Coverage: 12 inches (305 mm).
 - e. Panel Height: 0.875 inch (22 mm) **OR** 1.5 inches (38 mm), **as directed**.
8. Creased-Profile, Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and center-creased pan between panel edges; with flush joint between panels.
 - a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.



- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
- 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- d. Panel Coverage: 12 inches (305 mm).
- e. Panel Height: 1.5 inches (38 mm).
9. Creased-Rib-Profile, Concealed-Fastener Metal Wall Panels: Formed with raised, center-creased, trapezoidal major ribs; with reveal joint between panels.
 - a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - d. Panel Coverage: 12 inches (305 mm).
 - e. Panel Height: 0.875 inch (22 mm) **OR** 1.5 inches (38 mm), **as directed**.
- G. Metal Liner Panels
 1. General: Provide factory-formed metal liner panels designed for interior side of metal wall panel assemblies and field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for a complete installation.
 2. Flush-Profile Metal Liner Panels: Solid **OR** Perforated, **as directed**, panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between panel edges; with flush joint between panels.
 - a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.



- 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- d. Panel Coverage: 12 inches (305 mm) **OR** 16 inches (406 mm) **OR** 24 inches (610 mm) **OR** 36 inches (914 mm), **as directed**.
- e. Panel Height: 1.5 inches (38 mm) **OR** 2.0 inches (51 mm) **OR** 3.0 inches (76 mm), **as directed**.
- f. Acoustical Performance: Where sound-absorption requirement is indicated, fabricate interior liner panels with 1/8-inch- (3-mm-) diameter holes uniformly spaced approximately 1000 holes/sq. ft. (10 750 holes/sq. m).
 - 1) NRC of not less than 0.65 **OR** 0.85 **OR** 1.00, **as directed**, when tested according to ASTM C 423.

H. Metal Soffit Panels

1. General: Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.
2. Metal Soffit Panels: Match profile and material of metal wall panels.
 - a. Finish: Match finish and color of metal wall panels **OR** As indicated on Drawings, **as directed**.
 - b. Sealant: Factory applied within interlocking joint.
3. Flush-Profile Metal Soffit Panels: Solid **OR** Perforated, **as directed**, panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between panel edges; with flush joint between panels.
 - a. Material: Same material, finish, and color as metal wall panels.
 - b. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: Match finish and color of metal wall panels **OR** As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - c. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.



- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
- 2) Color: Match finish and color of metal wall panels **OR** As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- d. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - 2) Color: Match finish and color of metal wall panels **OR** As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- e. Material: Copper sheet, 16-oz./sq. ft. weight (0.55-mm thickness) **OR** 20-oz./sq. ft. weight (0.68-mm thickness), **as directed**.
 - 1) Exterior Finish: Brushed satin (lacquered) **OR** Mirror polished, **as directed**.
- f. Panel Coverage: 8 inches (203 mm) **OR** 12 inches (305 mm) **OR** 16 inches (406 mm) **OR** 20 inches (508 mm), **as directed**.
- g. Panel Height: 0.875 inch (22 mm) **OR** 1.0 inch (25 mm) **OR** 1.5 inches (38 mm) **OR** 3.0 inches (76 mm), **as directed**.
- h. Sealant: Factory applied within interlocking joint.
4. Reveal-Joint-Profile Metal Soffit Panels: Solid **OR** Perforated, **as directed**, panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between panel edges; with recessed reveal joint between panels.
 - a. Material: Same material, finish, and color as metal wall panels.
 - b. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: Match finish and color of metal wall panels **OR** As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - c. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: Match finish and color of metal wall panels **OR** As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - d. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - 2) Color: Match finish and color of metal wall panels **OR** As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - e. Panel Coverage: 8 inches (203 mm) **OR** 12 inches (305 mm) **OR** 16 inches (406 mm) **OR** 20 inches (508 mm), **as directed**.



- f. Panel Height: 0.75 inch (19 mm) **OR** 1.0 inch (25 mm) **OR** 1.5 inches (38 mm), **as directed**.
- 5. V-Groove-Profile Metal Soffit Panels: Solid **OR** Perforated, **as directed**, panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between panel edges; with V-groove joint between panels.
 - a. Material: Same material, finish, and color as metal wall panels.
 - b. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: Match finish and color of metal wall panels **OR** As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - c. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: Match finish and color of metal wall panels **OR** As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - d. Material: Aluminum sheet, 0.024 inch (0.65 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**
 - 2) Color: Match finish and color of metal wall panels **OR** As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - e. Panel Coverage: 6 inches (152 mm) **OR** 12 inches (305 mm) **OR** 14 inches (356 mm), **as directed**.
 - f. Panel Height: 0.375 inch (10 mm) **OR** 0.44 inch (11 mm) **OR** 0.50 inch (13 mm) **OR** 0.625 inch (16 mm), **as directed**.

I. Accessories

- 1. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.
 - a. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
 - b. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 - c. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- 2. Flashing and Trim: Formed from 0.018-inch (0.46-mm) minimum thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.



J. Fabrication

1. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
2. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
3. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
4. Fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, and that will minimize noise from movements within panel assembly.
5. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
 - a. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - b. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - c. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - d. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
 - e. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - f. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.
 - 1) Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

K. General Finish Requirements

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
3. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

1.3 EXECUTION

A. Preparation

1. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorages according to ASTM C 754 and metal wall panel manufacturer's written recommendations.
 - a. Soffit Framing: Wire-tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

B. Thermal Insulation Installation

1. Board Insulation: Extend insulation in thickness indicated to cover entire wall. Comply with installation requirements in Division 07 Section "Thermal Insulation".



- a. Erect insulation horizontally and hold in place with Z-shaped furring members spaced 24 inches (610 mm) o.c. Attach furring members to substrate with screws spaced 24 inches (610 mm) o.c.
 - b. Retain insulation in place by metal clips and straps or integral pockets within panels, spaced at intervals according to insulation manufacturer's instructions. Maintain cavity width between insulation and metal liner panel of dimension indicated.
2. Blanket Insulation: Install insulation concurrently with metal wall panel installation, in thickness indicated to cover entire wall, according to manufacturer's written instructions and as follows:
 - a. Set vapor-retarder-faced insulation with vapor-retarder facing building exterior **OR** building interior **OR** as indicated on Drawings, **as directed**. Do not obstruct ventilation spaces, except for firestopping.
 - b. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
 - c. Install insulation straight and true in one-piece lengths. Comply with the following installation method:
 - 1) Over-Framing Installation: Extend insulation over and perpendicular to top flange of framing members.
 - d. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with framing to hold insulation in place.

C. Metal Wall Panel Installation

1. General: Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - a. Commence metal wall panel installation and install minimum of 300 sq. ft. (27.8 sq. m.) in presence of factory-authorized representative.
 - b. Shim or otherwise plumb substrates receiving metal wall panels.
 - c. Flash and seal metal wall panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
 - d. Install screw fasteners in predrilled holes.
 - e. Locate and space fastenings in uniform vertical and horizontal alignment.
 - f. Install flashing and trim as metal wall panel work proceeds.
 - g. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - h. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
 - i. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 - j. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.
2. Fasteners:
 - a. Steel Wall Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized steel fasteners for surfaces exposed to the interior.
 - b. Aluminum Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized steel fasteners for surfaces exposed to the interior.
 - c. Copper Wall Panels: Use copper, stainless-steel or hardware-bronze fasteners.
 - d. Stainless-Steel Wall Panels: Use stainless-steel fasteners.
3. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal wall panel manufacturer.
4. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.



- a. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
 - b. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants".
 5. Lap-Seam Metal Wall Panels: Fasten metal wall panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
 - a. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
 - b. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal wall panels.
 - c. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 - d. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
 - e. Provide sealant tape at lapped joints of metal wall panels and between panels and protruding equipment, vents, and accessories.
 - f. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps; on side laps of nesting-type panels; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weathertight.
 - g. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.
 6. Zee Clips: Provide Zee clips of size indicated or, if not indicated, as required to act as standoff from subgirts for thickness of insulation indicated. Attach to subgirts with fasteners.
 7. Metal Liner Panels: Install panels on exterior side of girts with girts exposed to the interior **OR** interior side of girts with flush appearance on the inside **OR** girts as indicated on Drawings, **as directed**.
 8. Fire-Rated Metal Wall Panel Assemblies: Install metal liner panels on exterior side of girts, fastening through faces of panels, with girts exposed to the interior. Install subgirts horizontally, fastened to legs of metal liner panels. Install substrate board as indicated in Division 06 Section "Sheathing", in number of layers required for fire rating, over subgirts, attached with board fasteners. Install second set of subgirts horizontally, fastened through substrate board into first set of subgirts. Install exterior metal wall panels, fastened to second set of subgirts.
 - a. Comply with UL **OR** FMG, **as directed**, requirements for fire-rated construction.
- D. Metal Soffit Panel Installation
1. In addition to complying with requirements of "Metal Wall Panel Installation, General" Article, install metal soffit panels to comply with the requirements of this article.
 2. Metal Soffit Panels: Provide metal soffit panels full width of soffits. Install panels perpendicular to support framing.
 - a. Flash and seal panels with weather closures where metal soffit panels meet walls and at perimeter of all openings.
- E. Accessory Installation
1. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
 - a. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 2. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - a. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form



hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.

- b. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (605 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

F. Field Quality Control

1. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports, **as directed by the Owner**.
2. Water Penetration: Test areas of installed system indicated on Drawings for compliance with system performance requirements according to ASTM E 1105 at minimum differential pressure of 20 percent of inward-acting, wind-load design pressure as defined by SEI/ASCE 7, but not less than 6.24 lbf/sq. ft. (300 Pa).
3. Water-Spray Test: After completing the installation of 75-foot- (23-m-) by-2-story minimum area of metal wall panel assembly, test assembly for water penetration according to AAMA 501.2 in a 2-bay area directed by the Owner.
4. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect and test completed metal wall panel installation, including accessories.
5. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.
6. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

G. Cleaning And Protection

1. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.
2. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
3. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 46 16 00



SECTION 07 46 16 00a - METAL PLATE WALL PANELS

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for metal plate wall panels. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes metal plate wall panels.

C. Definition

1. Metal Plate Wall Panel Assembly: Metal plate wall panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weathertight wall system.

D. Performance Requirements

1. General Performance: Metal plate wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
2. Delegated Design: Design metal plate wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
3. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of wall area when tested according to ASTM E 283 at the following test-pressure difference:
 - a. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa) which is equivalent to a 25-mph (40-km/h) wind.
4. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
 - a. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa) which is equivalent to a 50-mph (80-km/h) wind.
5. Water Penetration under Dynamic Pressure: No evidence of water leakage when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. (300 Pa) {which is equivalent to a 50-mph (80-km/h) wind} and not more than 12 lbf/sq. ft. (575 Pa).
 - a. Water Leakage: As defined according to AAMA 501.1.
OR
 Water Leakage: Uncontrolled water infiltrating the system or appearing on system's normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.
6. Structural Performance: Provide metal plate wall panel assemblies capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:
 - a. Wind Loads: Determine loads based on the following minimum design wind pressures:
 - 1) Uniform pressure of 20 lbf/sq. ft. (957 Pa) **OR** 30 lbf/sq. ft. (1436 Pa), **as directed**, acting inward or outward.
OR
 Uniform pressure as indicated on Drawings.
 - b. Deflection Limits: Metal plate wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/180 **OR** 1/240, **as directed**, of the span.



7. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

E. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Show fabrication and installation layouts of metal plate wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish among factory-, shop-, and field-assembled work.
3. Samples: For each type of exposed finish required.
4. Delegated-Design Submittal: For metal plate wall panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
5. Coordination Drawings: Exterior elevations, drawn to scale and coordinating penetrations and wall-mounted items.
6. Product Test Reports.
7. Field quality-control reports.
8. Maintenance Data.
9. Warranties: Sample of special warranties.

F. Quality Assurance

1. Installer Qualifications: An employer of workers trained and approved by manufacturer.
2. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
3. Fire-Resistance Ratings: Where indicated, provide metal plate wall panels identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
4. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling

1. Deliver components, metal plate wall panels, and other manufactured items so as not to be damaged or deformed. Package panels for protection during transportation and handling.
2. Unload, store, and erect metal plate wall panels in a manner to prevent bending, warping, twisting, and surface damage.
3. Stack metal plate wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store panels to ensure dryness, with positive slope for drainage of water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.
4. Retain strippable protective covering on metal plate wall panel for period of installation.
5. Protect foam-plastic insulation as follows:
 - a. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - b. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
 - c. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

H. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal plate wall panel assemblies that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period: Two years from date of Final Completion.



2. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal plate wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - a. Finish Warranty Period:
 - 1) 20 years from date of Final Completion for fluoropolymer finish.
 - 2) 10 years from date of Final Completion for siliconized polyester.

1.2 PRODUCTS

A. Panel Materials

1. Aluminum Plate: ASTM B 209 (ASTM B 209M). Alloy and temper as recommended by manufacturer for application.
2. Copper Plate: ASTM B 152/B 152M, solid copper alloy.
3. Panel Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal plate wall panels and remain weathertight; and as recommended in writing by panel manufacturer.

B. Miscellaneous Metal Framing

1. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G40 (Z120) hot-dip galvanized **OR** ASTM A 653/A 653M, G60 (Z180) hot-dip galvanized, **as directed**, or coating with equivalent corrosion resistance unless otherwise indicated.
2. Subgirts: Manufacturer's standard C- or Z-shaped sections, 0.064-inch (1.63-mm) nominal thickness.
3. Zee Clips: 0.079-inch (2.01-mm) nominal thickness.
4. Base or Sill Angles **OR** Channels, **as directed**: 0.079-inch (2.01-mm) nominal thickness.
5. Hat-Shaped, Rigid Furring Channels:
 - a. Nominal Thickness: As indicated **OR** As required to meet performance requirements **OR** 0.025 inch (0.64 mm) **OR** 0.040 inch (1.02 mm), **as directed**.
 - b. Depth: As indicated **OR** 7/8 inch (22 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
6. Cold-Rolled Furring Channels: Minimum 1/2-inch- (13-mm-) wide flange.
 - a. Nominal Thickness: As indicated **OR** As required to meet performance requirements **OR** 0.064 inch (1.63 mm), **as directed**.
 - b. Depth: As indicated **OR** 3/4 inch (19 mm), **as directed**.
 - c. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with nominal thickness of 0.040 inch (1.02 mm).
 - d. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.57-mm-) diameter wire, or double strand of 0.048-inch- (1.22-mm-) diameter wire.
7. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

C. Miscellaneous Materials

1. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use and finish indicated.
2. Panel Fasteners: Self-tapping screws; bolts and nuts; self-locking rivets and bolts; end-welded studs; and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

D. Metal Plate Wall Panels

1. Metal Plate Wall Panels: Provide factory-formed, metal plate wall panels fabricated from single sheets of metal formed into profile for installation method indicated. Include attachment system components, panel stiffeners, and accessories required for weathertight system.



- a. Material: Tension-leveled, smooth aluminum sheet, ASTM B 209 (ASTM B 209M), 0.120 inch (3.05 mm) **OR** 0.125 inch (3.18 mm) **OR** 0.1875 inch (4.76 mm) **OR** 0.190 inch (4.82 mm), **as directed**, thick.
 - b. Panel Depth: 2 inches (51 mm) **OR** As indicated on Drawings, **as directed**.
 - c. Exterior Finish: Two-coat fluoropolymer **OR** Three-coat fluoropolymer **OR** Four-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Clear anodized **OR** Color anodized, **as directed**.
 - 1) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 2. Attachment System Components: Formed from extruded aluminum.
 - a. Provide internal drainage system that allows individual panels to be installed and removed without disturbing adjacent panels.
 - b. Include manufacturer's standard subgirts, perimeter extrusions, tracks, and drainage channels, panel stiffeners, panel clips and anchor channels, **as applicable**.
 - c. Alignment Pins: Stainless steel.
- E. Accessories
1. Metal Plate Wall Panel Accessories: Provide components required for a complete metal plate wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of panels unless otherwise indicated.
 2. Flashing and Trim: Same material, finish, and color as adjacent metal plate wall panels, minimum 0.030 inch (0.76 mm) thick unless otherwise indicated.
- F. Fabrication
1. General: Fabricate and finish metal plate wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
 2. Fabricate metal plate wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
 3. Metal Plate Wall Panels: Fabricate panels with panel stiffeners as required to comply with deflection limits. Weld and grind panel corners smooth. Fabricate panels to the following dimensional tolerances:
 - a. Length and Width: Plus or minus 0.032 inch (0.81 mm) up to 48 inches (1219 mm); 0.064 inch (1.63 mm) more than 48 inches (1219 mm).
 - b. Diagonal: Plus or minus 0.1875 inch (4.76 mm).
 - c. Panel Bow: Not more than 0.2 percent of panel width or length up to 0.1875 inch (4.76 mm) maximum.
 - d. Thickness: Plus or minus 0.008 inch (0.2 mm).
 - e. Squareness: 0.1875-inch (4.76-mm) difference between diagonal measurements.
 - f. Camber: 0.032 inch (0.81 mm).
 4. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - a. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - b. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - c. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - d. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.



- e. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
- f. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal plate wall panel manufacturer.
 - 1) Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal plate wall panel manufacturer for application, but not less than thickness of metal being secured.

G. General Finish Requirements

- 1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- 2. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- 3. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

H. Aluminum Finishes

- 1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
- 2. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
- 3. Four-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
- 4. Mica Fluoropolymer: AAMA 2605. 2-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
- 5. Metallic Fluoropolymer: AAMA 2605. 3-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
- 6. FEVE Fluoropolymer: AAMA 2605. 2-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
- 7. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
- 8. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
- 9. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

I. Copper-Alloy Finishes

- 1. Exposed Finish: Mill.
- 2. Exposed Finish: Finish designations prefixed by CDA comply with the system established by the Copper Development Association for designating copper-alloy finish systems.
 - a. Brushed Satin: CDA M32-06x (Mechanical Finish: directionally textured, medium satin; Coating: clear organic, air drying, as specified below):



- 1) Clear, Organic Coating: Clear, air-drying, acrylic lacquer specially developed for coating copper-alloy products, applied by air spray in 2 coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
- b. Mirror Polished: CDA M22-06x (Mechanical Finish: buffed, specular; Coating: clear organic, air drying, as specified below):
 - 1) Clear, Organic Coating: Clear, air-drying, acrylic lacquer specially developed for coating copper-alloy products, applied by air spray in 2 coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).

1.3 EXECUTION

A. Preparation

1. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous metal plate wall panel support members and anchorage according to ASTM C 754 and panel manufacturer's written instructions.

B. Metal Plate Wall Panel Installation

1. General: Install metal plate wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - a. Commence metal plate wall panel installation and install minimum of 300 sq. ft. (27.8 sq. m) in presence of factory-authorized representative.
 - b. Shim or otherwise plumb substrates receiving metal plate wall panels.
 - c. Flash and seal metal plate wall panels with weather closures at perimeter of all openings. Do not begin installation until weather barrier and flashings that will be concealed by panels are installed.
 - d. Install flashing and trim as metal plate wall panel work proceeds.
 - e. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
 - f. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.
2. Fasteners:
 - a. Aluminum Plate Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
 - b. Copper Plate Wall Panels: Use copper, stainless-steel, or hardware-bronze fasteners.
3. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal plate wall panel manufacturer.
4. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall plate panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by panel manufacturer.
 - a. Seal metal plate wall panel end laps with double beads of sealant, full width of panel. Seal side joints where recommended by panel manufacturer.
 - b. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants".
5. Attachment System, General: Install attachment system required to support metal plate wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
 - a. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
6. Flange-Attachment Installation: Attach metal plate wall panels, formed with extended perimeter flanges, to supports at locations, spacings, and with fasteners recommended by manufacturer.



- a. Seal horizontal and vertical joints between adjacent panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Division 07 Section "Joint Sealants".
 - b. Seal horizontal and vertical joints between adjacent panels with manufacturer's standard gaskets.
7. Clip Installation: Attach panel clips to supports at locations, spacings, and with fasteners recommended by manufacturer. Attach flanges of metal plate wall panels to panel clips with fasteners **OR** by welding, **as directed**, as recommended by manufacturer.
 - a. Seal horizontal and vertical joints between adjacent metal plate wall panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Division 07 Section "Joint Sealants".
 - b. Seal horizontal and vertical joints between adjacent metal plate wall panels with manufacturer's standard gaskets.
8. Subgirt-and-Spline Installation: Provide manufacturer's standard subgirts and splines that provide support and complete secondary drainage system, draining to the exterior at horizontal joints. Install support system at locations, spacings, and with fasteners recommended by manufacturer. Attach metal plate wall panels by interlocking perimeter extrusions attached to panels with subgirts and splines. Fully engage integral subgirt-and-spline gaskets and leave horizontal and vertical joints with open reveal. Terminate edge of panels flush with perimeter extrusions.
 - a. Install metal plate wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.
 - b. Do not apply sealants to joints unless otherwise indicated on Drawings.
9. Track-Support Installation: Provide manufacturer's standard horizontal tracks and vertical tracks **OR** drain channels, **as directed**, that provide support and complete secondary drainage system, draining to the exterior at horizontal joints through drain tube. Install support system at locations, spacings, and with fasteners recommended by manufacturer. Attach metal plate wall panels to tracks by interlocking panel edges with manufacturer's standard "T" clips.
 - a. Install metal plate wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.
 - b. Seal horizontal and vertical joints between adjacent metal plate wall panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Division 07 Section "Joint Sealants".
10. Rail-Support Installation: Provide manufacturer's standard interlocking rails that provide support and complete secondary drainage system, draining to the exterior at horizontal joints. Install rails at locations, spacings, and with fasteners recommended by manufacturer. Attach metal plate wall panels by overlapping and interlocking support rails with perimeter rails attached to panels. Apply sealant, foam sealant, and tape sealant at locations recommended by manufacturer. Leave horizontal and vertical joints with open reveal.
 - a. Install metal plate wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.
 - b. Install backer plates before installing support rails.
 - c. Do not apply sealants to joints unless otherwise indicated on Drawings.
11. Rainscreen-Principle Installation: Provide manufacturer's standard pressure-equalized, rainscreen-principle system with vertical channel that provides support and complete secondary drainage system, draining at base of wall. Notch vertical channel to receive support pins. Install vertical channels supported by channel brackets or adjuster angles and at locations, spacings, and with fasteners recommended by manufacturer. Attach metal plate wall panels by engaging horizontal support pins into notches in vertical channels and into flanges of panels. Leave horizontal and vertical joints with open reveal.
 - a. Install metal plate wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.
 - b. Do not apply sealants to joints unless otherwise indicated on Drawings.

C. Accessory Installation



1. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
 - a. Install components required for a complete metal plate wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
2. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - a. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 - b. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

D. Erection Tolerances

1. Installation Tolerances: Shim and align metal plate wall panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

E. Field Quality Control

1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Water Penetration: Test areas of installed system indicated on Drawings for compliance with system performance requirements according to ASTM E 1105 at minimum differential pressure of 20 percent of inward-acting, wind-load design pressure as defined by SEI/ASCE 7, but not less than 6.24 lbf/sq. ft. (300 Pa).
3. Water-Spray Test: After completing the installation of 75-foot- (23-m-) by-2-story minimum area of metal plate wall panel assembly, test assembly for water penetration according to AAMA 501.2 in a 2-bay area directed by the Owner.
4. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust completed metal plate wall panel installation, including accessories.
5. Metal plate wall panels will be considered defective if they do not pass tests and inspections.
6. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
7. Prepare test and inspection reports.

F. Cleaning

1. Remove temporary protective coverings and strippable films, if any, as metal plate wall panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal plate wall panel installation, clean finished surfaces as recommended by panel manufacturer. Maintain in a clean condition during construction.
2. After metal plate wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
3. Replace metal plate wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 46 16 00a



Task	Specification	Specification Description
07 46 19 00	07 46 16 00	Metal Wall Panels
07 46 19 00	07 46 16 00a	Metal Plate Wall Panels
07 46 23 00	06 16 23 00	Sheathing
07 46 29 00	06 16 23 00	Sheathing
07 46 46 00	01 22 16 00	No Specification Required



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SECTION 07 46 63 00 - INSULATED-CORE METAL WALL PANELS

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for insulated-core metal wall panels. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Foamed-insulation-core metal wall panels.
 - b. Laminated-insulation-core metal wall panels.
 - c. Honeycomb-core metal wall panels.

C. Definitions

1. Metal Wall Panel Assembly: Insulated-core metal wall panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weathertight wall system.

D. Performance Requirements

1. General Performance: Metal wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
2. Delegated Design: Design metal wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
3. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of wall area when tested according to ASTM E 283 at the following test-pressure difference:
 - a. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa) which is equivalent to a 25-mph (40-km/h) wind.
4. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
 - a. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa) which is equivalent to a 50-mph (80-km/h) wind.
5. Water Penetration under Dynamic Pressure: No evidence of water leakage when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. (299 Pa) and not more than 12 lbf/sq. ft. (575 Pa).
 - a. Water Leakage: As defined according to AAMA 501.1.
OR
Water Leakage: Uncontrolled water infiltrating the system or appearing on system's normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.
6. Structural Performance: Metal wall panel assemblies shall withstand the effects the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:
 - a. Wind Loads: Determine loads based on the following minimum design wind pressures:
 - 1) Uniform pressure of 20 lbf/sq. ft. (958 Pa) **OR** 30 lbf/sq. ft. (1436 Pa), **as directed**, acting inward or outward.
OR
Uniform pressure as indicated on Drawings.



- b. Deflection Limits: Metal wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/180 **OR** 1/240, **as directed**, of the span.
- 7. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- 8. Thermal Performance: Provide insulated metal wall panel assemblies with thermal-resistance value (R-value) indicated when tested according to ASTM C 518.

E. Submittals

- 1. Product Data: For each type of product indicated.
- 2. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory-, shop-, and field-assembled work.
- 3. Samples: For each type of exposed finish required.
- 4. Delegated-Design Submittal: For metal wall panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- 5. Coordination Drawings: Exterior elevations, drawn to scale, and coordinating penetrations and wall-mounted items.
- 6. Product Test Reports.
- 7. Field quality-control reports.
- 8. Maintenance Data.
- 9. Warranties: Sample of special warranties.

F. Quality Assurance

- 1. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- 2. Fire-Test-Response Characteristics: Provide metal wall panels and system components with the following fire-test-response characteristics as determined by testing identical panels and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
 - a. Fire-Resistance Characteristics: Provide materials and construction tested for fire resistance per ASTM E 119.
 - b. Intermediate-Scale Multistory Fire Test: Tested mockup, representative of completed multistory wall assembly of which wall panel is a part, complies with NFPA 285 for test method and required fire-test-response characteristics of exterior non-load-bearing wall panel assemblies.
 - c. Radiant Heat Exposure: No ignition when tested according to NFPA 268.
 - d. Potential Heat: Acceptable level when tested according to NFPA 259.
 - e. Surface-Burning Characteristics: Provide wall panels with flame-spread index of 25 or less and smoke-developed index of 450 or less, per ASTM E 84.
- 3. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling

- 1. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.
- 2. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.
- 3. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for

- drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.
4. Retain strippable protective covering on metal wall panels for period of metal wall panel installation.

H. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period: Two years from date of Final Completion.
2. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - a. Finish Warranty Period:
 - 1) 20 years from date of Final Completion for fluoropolymer finish.
 - 2) 10 years from date of Final Completion for siliconized polyester.

1.2 PRODUCTS

A. Panel Materials

1. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
 - b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.
 - c. Surface: Smooth, flat **OR** Embossed, **as directed**, finish.
 - d. Exposed Coil-Coated Finish:
 - 1) Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2) Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 3) Four-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 4) Mica Fluoropolymer: AAMA 621. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 5) Metallic Fluoropolymer: AAMA 621. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 6) FEVE Fluoropolymer: AAMA 621. Two-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.



- 7) Siliconized-Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
- 8) Plastisol: Epoxy primer and vinyl plastisol topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 3.8 mil (0.097 mm) for topcoat.
- e. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).
2. Aluminum Sheet: Coil-coated sheet, ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
 - a. Surface: Smooth, flat **OR** Embossed, **as directed**, finish.
 - b. Exposed Coil-Coated Finishes:
 - 1) Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2) Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 3) Four-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 4) Mica Fluoropolymer: AAMA 620. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 5) Metallic Fluoropolymer: AAMA 620. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 6) FEVE Fluoropolymer: AAMA 620. Two-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 7) Siliconized-Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 - 8) Plastisol: Epoxy primer and vinyl plastisol topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 3.8 mil (0.097 mm) for topcoat.
 - c. Exposed Anodized Finish:
 - 1) Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
 - 2) Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
 - d. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).
3. Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 temper.
 - a. Exposed Finish: Apply the following finish, as specified or indicated on Drawings.
 - 1) Natural finish.



- 2) Brushed Satin: CDA M32-06x (Mechanical Finish: directionally textured, medium satin; Coating: clear organic, air drying, as specified below):
 - a) Clear, Organic Coating: Clear, air-drying, acrylic lacquer specially developed for coating copper-alloy products, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
 - 3) Mirror Polished: CDA M22-06x (Mechanical Finish: buffed, specular; Coating: clear organic, air drying, as specified below):
 - a) Clear, Organic Coating: Clear, air-drying, acrylic lacquer specially developed for coating copper-alloy products, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
 - 4) Pre-patinated: ASTM B 882. Copper sheets artificially aged by chemical reaction to convert surface to inorganic crystalline structure with color range and durability of naturally-formed patina.
 4. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304 **OR** 316, **as directed**, fully annealed.
 - a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 - b. Polished Finish: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1) Run grain of directional finishes with long dimension of each piece.
 - 2) When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 3) Directional Satin Finish: No. 4.
 - c. Bright, Cold-Rolled, Unpolished Finish: No. 2B.
 5. Panel Sealants:
 - a. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
 - b. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.
 - c. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.
- B. Insulation For Panel Cores
1. Polyisocyanurate Insulation: Closed cell, modified polyisocyanurate foam using a non-CFC blowing agent, foamed-in-place **OR** board, **as directed**, type, with maximum flame-spread index of 25 and smoke-developed index of 450.
 - a. Closed-Cell Content: 90 percent when tested according to ASTM D 2856.
 2. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.60-lb/cu. ft. (26-kg/cu. m) minimum density, unless otherwise indicated; with maximum flame-spread index of 25 and smoke-developed index of 450.
 3. Molded-Polystyrene Board Insulation: ASTM C 578, Type I, 0.9 lb/cu. ft. (14 kg/cu. m) **OR** Type II, 1.35 lb/cu. ft. (22 kg/cu. m), Class 2 or 3, Grade 3, **as directed**, with maximum flame-spread index of 25 and smoke-developed index of 450.
- C. Miscellaneous Metal Framing
1. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G40 (Z120) hot-dip galvanized **OR** ASTM A 653/A 653M, G60 (Z180) hot-dip galvanized, **as directed**, or coating with equivalent corrosion resistance unless otherwise indicated.
 2. Subgirts: Manufacturer's standard C- or Z-shaped sections, 0.064-inch (1.63-mm) nominal thickness.
 3. Zee Clips: 0.079-inch (2.01-mm) nominal thickness.
 4. Base or Sill Angles **OR** Channels, **as directed**: 0.079-inch (2.01-mm) nominal thickness.
 5. Hat-Shaped, Rigid Furring Channels:



- a. Nominal Thickness: As indicated **OR** As required to meet performance requirements **OR** 0.025 inch (0.64 mm) **OR** 0.040 inch (1.02 mm), **as directed**.
 - b. Depth: As indicated **OR** 7/8 inch (21 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
 6. Cold-Rolled Furring Channels: Minimum 1/2-inch- (13-mm-) wide flange.
 - a. Nominal Thickness: As indicated **OR** As required to meet performance requirements **OR** 0.064 inch (1.63 mm), **as directed**.
 - b. Depth: As indicated **OR** 3/4 inch (19 mm), **as directed**.
 - c. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with 0.040-inch (1.02-mm) nominal thickness.
 7. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.52-mm-) diameter wire, or double strand of 0.048-inch- (1.22-mm-) diameter wire.
 8. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.
- D. Miscellaneous Materials
 1. Panel Fasteners: Self-tapping screws; bolts and nuts; self-locking rivets and bolts; end-welded studs; and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.
 2. Backer Board: Hardboard complying with AHA A135.4, Class 1 tempered, 1/8 inch (3 mm) **OR** 1/4 inch (6 mm), **as directed**, thick unless otherwise indicated.
- E. Foamed-Insulation-Core Metal Wall Panels
 1. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and insulation core foamed in place during fabrication, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.
 - a. Panel Performance:
 - 1) Flatwise Tensile Strength: 30 psi (207 kPa) when tested according to ASTM C 297.
 - 2) Humid Aging: Volume increase not greater than 6.0 percent and no delamination or metal corrosion when tested for 7 days at 140 deg F (60 deg C) and 100 percent relative humidity according to ASTM D 2126.
 - 3) Heat Aging: Volume increase not greater than 2.0 percent and no delamination, surface blistering, or permanent bowing when tested for 7 days at 200 deg F (93 deg C) according to ASTM D 2126.
 - 4) Cold Aging: Volume decrease not more than 1.0 percent and no delamination, surface blistering, or permanent bowing when tested for 7 days at minus 20 deg F (29 deg C) according to ASTM D 2126.
 - 5) Fatigue: No evidence of delamination, core cracking, or permanent bowing when tested to a 20-lbf/sq. ft. (958-kPa) positive and negative wind load and with deflection of L/180 for 2 million cycles.
 - 6) Autoclave: No delamination when exposed to 2-psi (13.8-kPa) pressure at a temperature of 212 deg F (100 deg C) for 2-1/2 hours.
 - b. Polyisocyanurate Insulation-Core Performance:
 - 1) Density: 2.0 to 2.6 lb/cu. ft. (32 to 42 kg/cu. m) when tested according to ASTM D 1622.
 - 2) Compressive Strength: Minimum 20 psi (138 kPa) when tested according to ASTM D 1621.
 - 3) Shear Strength: 26 psi (179 kPa) when tested according to ASTM C 273.
 2. Exposed-Fastener, Foamed-Insulation-Core Metal Wall Panels: Formed with raised, trapezoidal major rib at panel edge and two intermediate stiffening ribs symmetrically spaced between major rib and panel edge; designed for lapping side edges of adjacent panels and mechanically attaching to supports using exposed fasteners in side laps.
 - a. Facings: Fabricate panel with exterior and interior facings of same material and thickness.



- 1) Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 2) Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 3) Backer Board: On back side of exterior facing.
 - 4) Exterior Facing Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - a) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - 5) Interior Facing Finish: Manufacturer's standard white polyester.
 - b. Snap-On Batten: Same material, finish, and color as exterior facings of wall panels.
 - c. Panel Coverage: 36 inches (914 mm) **OR** 40 inches (1016 mm), **as directed**, nominal.
 - d. Panel Thickness: 1.0 inch (25 mm) **OR** 1.5 inches (38 mm) **OR** 2.0 inches (51 mm) **OR** 2.5 inches (64 mm) **OR** 3.0 inches (76 mm) **OR** 4.0 inches (102 mm) **OR** 5.0 inches (127 mm), **as directed**.
 - e. Thermal-Resistance Value (R-Value): as directed by the Owner.
3. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels: Formed with tongue-and-groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.
- a. Facings: Fabricate panel with exterior and interior facings of same material and thickness.
 - 1) Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 2) Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 3) Material: Stainless-steel sheet, 0.031 inch (0.79 mm) **OR** 0.038 inch (0.97 mm), **as directed**, thick with No. 4 **OR** 2B, **as directed**, finish.
 - 4) Backer Board: On back side of exterior facing.
 - 5) Exterior Facing Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - a) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - 6) Interior Facing Finish: Manufacturer's standard siliconized polyester.
 - 7) Exterior Surface: Smooth, flat **OR** Striated **OR** Shallow ribs **OR** Shallow V grooves, **as directed**.
 - b. Panel Coverage: 24 inches (610 mm) **OR** 30 inches (762 mm) **OR** 36 inches (914 mm) **OR** 39.37 inches (1000 mm) **OR** 42 inches (1067 mm), **as directed**, nominal.
 - c. Panel Thickness: 2.0 inches (51 mm) **OR** 2.5 inches (64 mm) **OR** 3.0 inches (76 mm) **OR** 4.0 inches (102 mm) **OR** 5.0 inches (127 mm) **OR** 6.0 inches (152 mm), **as directed**.
 - d. Thermal-Resistance Value (R-Value): as directed by the Owner.
- F. Laminated-Insulation-Core Metal Wall Panels
1. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and core material laminated or otherwise securely bonded to facing sheets during fabrication without use of contact adhesives, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.
 - a. Panel Performance:
 - 1) Flatwise Tensile Strength: 27 psi (186 kPa) when tested according to ASTM C 297.
 - 2) Humid Aging: Volume increase not greater than 6.0 percent and no delamination or metal corrosion when tested for 7 days at 140 deg F (60 deg C) and 100 percent relative humidity according to ASTM D 2126.
 - 3) Heat Aging: Volume increase not greater than 2.0 percent and no delamination, surface blistering, or permanent bowing when tested for 7 days at 200 deg F (93 deg C) according to ASTM D 2126.



- 4) Cold Aging: Volume decrease not more than 1.0 percent and no delamination, surface blistering, or permanent bowing when tested for 7 days at minus 20 deg F (29 deg C) according to ASTM D 2126.
- 5) Fatigue: No evidence of delamination, core cracking, or permanent bowing when tested to a 20-lbf/sq. ft. (958-kPa) positive and negative wind load and with deflection of L/180 for 2 million cycles.
- 6) Autoclave: No delamination when exposed to 2-psi (13.8-kPa) pressure at a temperature of 212 deg F (100 deg C) for 2-1/2 hours.
- b. Polyisocyanurate Insulation-Core Performance:
 - 1) Density: 1.8 to 2.3 lb/cu. ft. (29 to 37 kg/cu. m) when tested according to ASTM D 1622.
 - 2) Compressive Strength: Minimum 20 psi (138 kPa) when tested according to ASTM D 1621.
 - 3) Shear Strength: 24 psi (164 kPa) when tested according to ASTM C 273.
2. Wrapped-Edge, Laminated-Insulation-Core Metal Wall Panels: Formed with flush exterior panel facing wrapped over panel edges; designed for independent installation by mechanically attaching panels to supports using staggered, concealed side clips engaging panel edges **OR** through extended panel edges to supports using concealed fasteners, **as directed**; with sealant **OR** gasketed, **as directed**, joints.
 - a. Exterior Facing:
 - 1) Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 2) Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 3) Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm) **OR** 0.063 inch (1.60 mm) **OR** 0.080 inch (2.03 mm), **as directed**, thick.
 - 4) Surface: Smooth, flat **OR** Embossed, **as directed**.
 - 5) Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - a) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - b. Interior Facing:
 - 1) Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 2) Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 3) Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
 - 4) Finish: Manufacturer's standard primer or white polyester.
 - c. Core Material: Polyisocyanurate **OR** Extruded-polystyrene **OR** Expanded-polystyrene, **as directed**, board insulation.
 - 1) Backer Board: 0.125-inch- (3-mm-) **OR** 0.250-inch- (6-mm-), **as directed**, thick hardboard behind exterior facing for increased impact resistance.
 - d. Clips: Manufacturer's standard one piece, formed from zinc-coated (galvanized) steel **OR** aluminum-zinc alloy-coated steel **OR** stainless steel, **as directed**.
 - e. Gaskets: Extruded, dry seal silicone.
 - f. Sealant: Manufacturer's standard silicone.
 - g. Panel Thickness: 1.0 inch (25 mm) **OR** 2.0 inches (51 mm) **OR** 3.0 inches (76 mm) **OR** 4.0 inches (102 mm) **OR** 5.0 inches (127 mm) **OR** 6.0 inches (152 mm), **as directed**.
 - h. Thermal-Resistance Value (R-Value): as directed by the Owner.



3. Shiplap-Edge, Laminated-Insulation-Core Metal Wall Panels: Formed with flush exterior panel facing and with shiplap edges; designed for sequential installation by mechanically attaching panels to supports using concealed clips and fasteners; with factory-applied sealant **OR** gaskets, **as directed**, in side laps.
 - a. Exterior Facing:
 - 1) Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 2) Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 3) Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm) **OR** 0.063 inch (1.60 mm), **as directed**, thick.
 - 4) Surface: Smooth, flat **OR** Embossed, **as directed**.
 - 5) Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - a) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - b. Interior Facing:
 - 1) Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 2) Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 3) Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 4) Finish: Manufacturer's standard primer or white polyester.
 - c. Core Material: Polyisocyanurate **OR** Extruded-polystyrene **OR** Expanded-polystyrene, **as directed**, board insulation.
 - 1) Backer Board: 0.125-inch- (3-mm-) **OR** 0.250-inch- (6-mm-), **as directed**, thick hardboard behind exterior facing for increased impact resistance.
 - d. Clips: Manufacturer's standard one piece, formed from zinc-coated (galvanized) steel **OR** aluminum-zinc alloy-coated steel **OR** stainless steel, **as directed**.
 - e. Gaskets: Extruded, dry seal silicone.
 - f. Sealant: Manufacturer's standard silicone.
 - g. Panel Thickness: 1.0 inch (25 mm) **OR** 2.0 inches (51 mm) **OR** 3.0 inches (76 mm) **OR** 4.0 inches (102 mm) **OR** 5.0 inches (127 mm) **OR** 6.0 inches (152 mm), **as directed**.
 - h. Thermal-Resistance Value (R-Value): as directed by the Owner.
4. Framed-Edge, Laminated-Insulation-Core Metal Wall Panels: Formed with flush exterior panel facing and integral, extruded edge members; designed for independent installation by mechanically attaching panels to supports through edge framing using concealed fasteners; with gasketed joints.
 - a. Exterior Facing:
 - 1) Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 2) Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71 mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 3) Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm) **OR** 0.063 inch (1.60 mm) **OR** 0.080 inch (2.03 mm), **as directed**, thick.
 - 4) Surface: Smooth, flat **OR** Embossed, **as directed**.
 - 5) Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - a) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.



- b. Interior Facing:
 - 1) Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 2) Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 3) Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 4) Finish: Manufacturer's standard primer or white polyester.
- c. Core Material: Polyisocyanurate **OR** Extruded-polystyrene **OR** Expanded-polystyrene, **as directed**, board insulation.
 - 1) Backer Board: 0.125-inch- (3.18-mm-) **OR** 0.250-inch- (6-mm-), **as directed**, thick hardboard behind exterior facing for increased impact resistance.
- d. Edge Members: Extruded aluminum, not less than 0.063-inch (1.60-mm) wall thickness.
- e. Gaskets: Extruded, dry seal silicone.
- f. Panel Thickness: 1.0 inch (25 mm) **OR** 2.0 inches (51 mm) **OR** 3.0 inches (76 mm) **OR** 4.0 inches (102 mm) **OR** 5.0 inches (127 mm) **OR** 6.0 inches (152 mm), **as directed**.
- g. Thermal-Resistance Value (R-Value): as directed by the Owner.

G. Honeycomb-Core Metal Wall Panels

- 1. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and honeycomb-core material laminated or otherwise securely bonded to facing sheets during fabrication without use of contact adhesives or pinch rollers, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.
 - a. Panel Performance:
 - 1) Fatigue: No evidence of delamination, core cracking, or permanent bowing when tested to a 20-lbf/sq. ft. (958-kPa) positive and negative wind load and with deflection of L/180 for 2 million cycles.
 - 2) Autoclave: No delamination when exposed to 2-psi (13.8-kPa) pressure at a temperature of 212 deg F (100 deg C) for 2-1/2 hours.
- 2. Wrapped-Edge, Honeycomb-Core Metal Wall Panels: Formed with flush exterior panel facing wrapped over panel edges; designed for independent installation by mechanically attaching panels to supports using staggered, concealed side clips engaging panel edges **OR** through extended panel edges to supports using concealed fasteners, **as directed**; with sealant **OR** gasketed, **as directed**, joints.
 - a. Facings: Fabricate panel with exterior and interior facings of same material and thickness.
 - 1) Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 2) Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 3) Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm) **OR** 0.063 inch (1.60 mm), **as directed**, thick.
 - 4) Exterior Facing Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - a) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - 5) Interior Facing Finish: Manufacturer's standard primer or polyester.
 - b. Kraft-Paper Honeycomb Core: Manufacturer's standard phenolic-resin impregnated paper, with not less than 15 percent resin content by weight and chemically treated for fire resistance; with maximum 1/2-inch (13-mm) cell size.
 - c. Aluminum Honeycomb Core: Manufacturer's standard 0.003-inch- (0.08-mm-) thick, commercial grade aluminum with maximum 3/4-inch (19-mm) cell size.



- d. Clips: Manufacturer's standard one piece, formed from zinc-coated (galvanized) steel **OR** aluminum-zinc alloy-coated steel **OR** stainless steel, **as directed**.
- e. Gaskets: Extruded, dry seal silicone.
- f. Sealant: Manufacturer's standard silicone.
- g. Panel Thickness: 0.25 inch (6 mm) **OR** 1.0 inch (25 mm) **OR** 2.0 inches (51 mm) **OR** 3.0 inches (76 mm) **OR** 4.0 inches (102 mm), **as directed**.
- 3. Shiplap-Edge, Honeycomb-Core Metal Wall Panels: Formed with flush exterior panel facing and with shiplap edges; designed for sequential installation by mechanically attaching panels to supports using concealed clips and fasteners; with factory-applied sealant **OR** gaskets, **as directed**, in side laps.
 - a. Facings: Fabricate panel with exterior and interior facings of same material and thickness.
 - 1) Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 2) Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 3) Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm) **OR** 0.063 inch (1.60 mm), **as directed**, thick.
 - 4) Exterior Facing Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - a) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - 5) Interior Facing Finish: Manufacturer's standard primer or polyester.
 - b. Kraft-Paper Honeycomb Core: Manufacturer's standard phenolic-resin-impregnated paper, with not less than 15 percent resin content by weight and chemically treated for fire resistance; with maximum 1/2-inch (13-mm) cell size.
 - c. Aluminum Honeycomb Core: Manufacturer's standard 0.003-inch- (0.08-mm-) thick, commercial grade aluminum with maximum 3/4-inch (19-mm) cell size.
 - d. Clips: Manufacturer's standard one piece, formed from zinc-coated (galvanized) steel **OR** aluminum-zinc alloy-coated steel **OR** stainless steel, **as directed**.
 - e. Gaskets: Extruded, dry seal silicone.
 - f. Sealant: Manufacturer's standard silicone.
 - g. Panel Thickness: 1.0 inch (25 mm) **OR** 1.25 inches (32 mm) **OR** 2.0 inches (51 mm), **as directed**.
- 4. Framed-Edge, Honeycomb-Core Metal Wall Panels: Formed with flush exterior panel facing and integral, extruded edge members; designed for independent installation by mechanically attaching panels to supports through edge framing using concealed fasteners; with gasketed joints.
 - a. Facings: Fabricate panel with exterior and interior facings of same material and thickness.
 - 1) Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) nominal thickness.
 - 2) Material: Aluminum sheet, 0.040 inch (1.02 mm) **OR** 0.063 inch (1.60 mm), **as directed**, thick.
 - 3) Exterior Facing Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - a) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - 4) Interior Facing Finish: Manufacturer's standard primer or polyester.
 - b. Kraft-Paper Honeycomb Core: Manufacturer's standard phenolic-resin-impregnated paper, with not less than 15 percent resin content by weight and chemically treated for fire resistance; with maximum 1/2-inch (13-mm) cell size.
 - c. Aluminum Honeycomb Core: Manufacturer's standard 0.003-inch- (0.08-mm-) thick, commercial grade aluminum with maximum 3/4-inch (19-mm) cell size.



- d. Edge Members: Extruded aluminum, not less than 0.063-inch (1.6-mm) wall thickness.
- e. Gaskets: Extruded, dry seal silicone.
- f. Panel Thickness: 1.0 inch (25 mm) **OR** 2.0 inches (51 mm) **OR** 3.0 inches (76 mm), **as directed**.

H. Accessories

1. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
 - a. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
 - b. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 - c. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
2. Flashing and Trim: Formed from 0.018-inch- (0.46-mm-) minimum thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

I. Fabrication

1. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
2. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
3. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
4. Fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will minimize noise from movements within panel assembly.
5. Honeycomb-Core Metal Wall Panels: Fabricate panels using manufacturer's standard thermosetting structural adhesive in a lamination process that bonds panel under minimum 10-psi (69-kPa) pressure. Use of contact adhesives with pinch-roll process is not acceptable.
 - a. Panel Bow Tolerance: Not more than 0.5 percent of panel width or length.
6. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
 - a. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - b. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - c. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - d. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
 - e. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.



- f. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.
 - 1) Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

J. General Finish Requirements

- 1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- 2. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- 3. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

1.3 EXECUTION

A. Preparation

- 1. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorages according to ASTM C 754 and metal wall panel manufacturer's written recommendations.

B. Metal Wall Panel Installation, General

- 1. General: Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - a. Commence metal wall panel installation and install minimum of 300 sq. ft. (27.9 sq. m.) in presence of factory-authorized representative.
 - b. Shim or otherwise plumb substrates receiving metal wall panels.
 - c. Flash and seal metal wall panels with weather closures at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
 - d. Install screw fasteners in predrilled holes.
 - e. Locate and space fastenings in uniform vertical and horizontal alignment.
 - f. Install flashing and trim as metal wall panel work proceeds.
 - g. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - h. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
 - i. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 - j. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.
- 2. Fasteners:
 - a. Steel Wall Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized steel fasteners for surfaces exposed to the interior.
 - b. Aluminum Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized steel fasteners for surfaces exposed to the interior.
 - c. Copper Wall Panels: Use copper, stainless-steel, or hardware-bronze fasteners.
 - d. Stainless-Steel Wall Panels: Use stainless-steel fasteners.
- 3. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal wall panel manufacturer.



4. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.
 - a. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
 - b. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants".

C. Insulated-Core Metal Wall Panel Installation

1. General: Apply continuous ribbon of sealant to panel joint on concealed side of insulated-core metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels for weather seal.
 - a. Fasten insulated-core metal wall panels to supports with fasteners at each lapped joint at location and spacing and with fasteners recommended by manufacturer.
 - b. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
 - c. Provide metal-backed washers under heads of exposed fasteners on weather side of insulated metal wall panels.
 - d. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 - e. Provide sealant tape at lapped joints of insulated metal wall panels and between panels and protruding equipment, vents, and accessories.
 - f. Apply a continuous ribbon of sealant tape to panel side laps and elsewhere as needed to make panels weathertight.
 - g. Apply snap-on battens to exposed-fastener, insulated-core metal wall panel seams to conceal fasteners.
2. Foamed-Insulation-Core Metal Wall Panels: Fasten metal wall panels to supports with concealed clips at each joint at location and spacing and with fasteners recommended by manufacturer. Fully engage tongue and groove of adjacent panels.
 - a. Install clips to supports with self-tapping fasteners.
3. Laminated-Insulation-Core Metal Wall Panels:
 - a. Wrapped-Edge Panels: Mechanically attach wall panels to supports using staggered, concealed side clips engaging wrapped panel edges. Install clips to supports with self-tapping fasteners. Seal joints with backer rod and sealant **OR** manufacturer's standard gaskets, **as directed**.
 - b. Wrapped-Edge Panels: Mechanically attach wall panels through extended edge of panels to supports using self-tapping fasteners. Seal joints with backer rod and sealant **OR** manufacturer's standard gaskets, **as directed**.
 - c. Shiplap-Edge Panels: Mechanically attach wall panels to supports using staggered, concealed side clips engaging tongue-and-groove panel edges. Install clips to supports with self-tapping fasteners.
 - 1) Horizontal Joints: Maintain reveal joint of consistent width **OR** Seal joints with backer rod and sealant **OR** Seal joints with manufacturer's standard gaskets, **as directed**.
 - 2) Vertical Joints: Maintain reveal joint of consistent width **OR** Seal joints with backer rod and sealant **OR** Seal joints with manufacturer's standard gaskets, **as directed**.
 - d. Framed-Edge Panels: Mechanically attach wall panels through integral, extruded edge members to supports using self-tapping fasteners. Seal joints with manufacturer's standard gaskets.
4. Honeycomb-Core Metal Wall Panels:
 - a. Wrapped-Edge Panels: Mechanically attach wall panels to supports using staggered, concealed side clips engaging wrapped panel edges. Install clips to supports with self-tapping fasteners. Seal joints with backer rod and sealant **OR** manufacturer's standard gaskets, **as directed**.



- b. Wrapped-Edge Panels: Mechanically attach wall panels through extended edge of panels to supports using self-tapping fasteners. Seal joints with backer rod and sealant **OR** manufacturer's standard gaskets, **as directed**.
 - c. Shiplap-Edge Panels: Mechanically attach wall panels to supports using staggered, concealed side clips engaging tongue-and-groove panel edges. Install clips to supports with self-tapping fasteners.
 - 1) Horizontal Joints: Maintain reveal joint of consistent width **OR** Seal joints with backer rod and sealant **OR** Seal joints with manufacturer's standard gaskets, **as directed**.
 - 2) Vertical Joints: Maintain reveal joint of consistent width **OR** Seal joints with backer rod and sealant **OR** Seal joints with manufacturer's standard gaskets, **as directed**.
 - d. Framed-Edge Panels: Mechanically attach wall panels through integral, extruded edge members to supports using self-tapping fasteners. Seal joints with manufacturer's standard gaskets.
- D. Accessory Installation
 - 1. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
 - a. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 - 2. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - a. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 - b. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (605 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).
- E. Field Quality Control
 - 1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 - 2. Water Penetration: Test areas of installed system indicated on Drawings for compliance with system performance requirements according to ASTM E 1105 at minimum differential pressure of 20 percent of inward-acting, wind-load design pressure as defined by SEI/ASCE 7, but not less than 6.24 lbf/sq. ft. (299 Pa).
 - 3. Water-Spray Test: After completing the installation of 75-foot- (23-m-) by-2-story minimum area of metal wall panel assembly, test assembly for water penetration according to AAMA 501.2 in a 2-bay area directed by the Owner.
 - 4. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect and test completed metal wall panel installation, including accessories.
 - 5. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.
 - 6. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- F. Cleaning And Protection
 - 1. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed unless otherwise indicated in manufacturer's written installation instructions. On



- completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.
2. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
 3. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 46 63 00



Task	Specification	Specification Description
07 46 63 00	07 46 16 00	Metal Wall Panels



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SECTION 07 51 13 00 - CSF BUILT-UP ASPHALT ROOFING**

NOTE TO SPECIFIER

Editing is needed for each individual project; modify as needed for project specific requirements. Included "NOTE TO SPECIFIER" instructions provide guidance concerning required editing, and options have been included requiring action on the part of the specifier/designer. Select the option appropriate for the project and delete option(s) not selected.

NOTE TO SPECIFIER

EDIT Section footer as necessary to reflect the project name and location, USPS Project number, and required date of the technical specification document. Coordinate this project specific information with the USPS Project Manager. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this section where an aggregate-surfaced, hot asphalt-applied four-ply roofing membrane is selected as the roofing system.

Per the United States Postal Service Roofing Design Standards, an aggregate-surfaced, hot asphalt-applied four-ply roofing membrane system is an acceptable roofing system over facilities with a Critical or Non-Critical building designation.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to the installation of an aggregate-surfaced built-up asphalt roofing membrane, including flashings, and related accessories.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 072100 – Thermal Insulation
- D. Section 076200 – Sheet Metal Flashings and Trim
- E. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 ALTERNATES

- A. Provide an alternate price for the 20-Year Total System Warranty described in Article 1.9A.

1.4 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
1. American Society for Testing and Materials (ASTM)
 - a. ASTM D 312 - Standard Specification for Asphalt Used in Roofing
 - b. ASTM D 2178 - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing
 - c. ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements
 - d. ASTM D 1668 - Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
 - e. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
 - f. ASTM D 4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free
 - g. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
 - h. ASTM D 2824 - Standard Specification for Aluminum-Pigmented Asphalt Roof Coatings, Non-fibered, Asbestos Fibered, and Fibered without Asbestos
 - i. ASTM D 1863 - Standard Specification for Mineral Aggregate Used on Built-Up Roofs
 - j. ASTM D 1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
 2. Factory Mutual Global (FM)
 3. Underwriters Laboratories (UL)
 4. National Roofing Contractors Association (NRCA)
 5. American Society of Civil Engineers (ASCE)
 - a. ASCE 7 Minimum Design Loads of Buildings and Other Structures

1.5 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.6 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.



- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp. Store roll materials standing on end.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
 - 1. When the outside temperature is forecast to fall below 32°F (°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives and primers should be maintained at a temperature of 50°F (10°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 - 2. When applying hot asphalt, reduce mop lead distance to 2-feet or less.
 - 3. If a minimum asphalt temperature of 420°F (216°C) cannot be maintained at the point of application, discontinue work.
 - 4. Refer to the asphalt roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

1.9 MANUFACTURER WARRANTY AND CONTRACTOR GUARANTEE

- A. Provide an alternate price for a manufacturer 20-Year Total System, Non-Pro-Rated Warranty (including insulation, roofing membrane, and flashings) covering materials and labor. The warranty shall include the following additional items:
 - 1. The warranty shall include a wind rider for the design wind speed at the specific project location.
 - 2. Roofing inspection by a technical representative of the roofing membrane manufacturer 22-24 months after date of Final Acceptance.



3. Roofing manufacturer will provide unlimited repairs during warranty period with no cost limitation.
 4. Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions.
 5. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Record Built-Up Asphalt Roofing Specification Section to Warranty.
- B. The Contractor shall provide a two-year contractor guarantee. At a minimum, the contractor guarantee shall include the following:
1. Contractor name, address, phone number and project contact name.
 2. The project completion date, and date of guarantee expiration.
 3. The contractor guarantee shall include, in writing, all project work, workmanship, and/or all materials installed by the contractor or subcontractors to be of a quality that will comply with all project specific requirements of the Construction Documents and other documents governing the Work and workmanship through the guarantee period.
 4. The contractor shall investigate roof leaks during the guarantee period within a reasonable time period, but in no instance greater than 24-hours after notification of a leak. The contractor shall repair leaks determined to be the cause of the Work at no cost to the Owner.

PART 2 – PRODUCTS

2.1 BUILT-UP ASPHALT ROOFING SYSTEM SUMMARY

- A. The complete roofing membrane system assembly shall consist of a built-up, four-ply roof system consisting of the specified asphalt saturated felts identified in paragraph 2.3A set in hot, fluid applications of asphalt. Aggregate surfacing shall be applied to the completed roof membrane.

NOTE TO SPECIFIER

***NOTE:** In high wind areas, such as those with a calculated wind uplift pressure of greater than 45 psf in the roof field, enhancements to the roof system may be required and must be considered by the design professional/specifier. Consult with the roofing membrane manufacturer and qualified testing agencies for further information and guidance related to possible roof system enhancements in high wind areas.*

- B. The complete roofing system assembly shall resist uplift pressures calculated according to ASCE 7-05 for the field, perimeters and corners. The specified approval rating must incorporate a safety factor of 2 over the maximum calculated uplift pressure in foot-pound units.
- C. The complete roofing system assembly shall achieve an FM or UL Class A fire rating.

2.2 BITUMEN

- A. Asphalt: ASTM D 312, Type III.

2.3 ROOFING FELTS, SHEETS, AND FABRICS

- A. Roofing membrane plies: Asphalt-saturated Type VI ply felt meeting ASTM D 2178; manufactured by the roofing membrane manufacturer.
- B. Base flashings:



1. Inner ply: Modified bitumen flashing sheet, polyester reinforced, minimum nominal 85 mil thickness; ASTM D 6164, Type I, Grade S.
2. Outer ply: Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, minimum nominal 130 mil thickness; ASTM D 6164, Type I, Grade G.
 - a. Color: White or light gray; as determined by Owner.
- C. For use at roof sump flashings and elsewhere as may be indicated: Asphalt treated woven glass fabric, ASTM D 1668, Type I.
- D. For use at temporary overnight tie-ins: Asphalt-saturated organic felt, No. 15, non-perforated, ASTM D 226, Type 1.

2.4 ADHESIVES, CEMENTS, PRIMERS AND COATINGS

- A. Roofing and flashing cement: ASTM D 4586, Type I, (summer grade or winter grade as applicable to season).
- B. Modified bitumen cement (For use at granule surfaced flashing sheets and other locations required by the roofing membrane manufacturer): Product compatible with modified bitumen roofing surfacing flashing sheet and approved by the roofing membrane manufacturer.
- C. Asphalt primer: ASTM D 41.
- D. Aluminum coating (for flashings): Fibrated aluminum coating; ASTM D 2824, Type III. Product type approved by the roofing membrane manufacturer.

2.5 AGGREGATE

- A. Gravel, ASTM D 1863, Size No. 67; clean and dry.
- B. Slag, ASTM D 1863, Size No. 67; clean and dry.

2.6 FASTENERS

- A. Roofing membrane and flashing fasteners: Unless otherwise indicated, types as required by the roofing membrane manufacturer.

NOTE TO SPECIFIER

EDIT items in Article 2.7 to reflect actual project conditions and requirements. Re-letter/number paragraphs and sub-paragraphs after editing.

2.7 MISCELLANEOUS MATERIALS

- A. Walkway pads: Product approved by the roofing manufacturer.
- B. Splashblocks: Concrete; size as necessary to accommodate existing condition.
- C. Pitch pan fill materials:
 1. Non-shrink grout (for bottom fill): Quick-set, fast-drying grout; product acceptable to roofing manufacturer.



2. Pourable sealer (for top fill): Two-part pourable elastomeric sealer, product acceptable to roofing manufacturer.
- D. Conduit and pipe supports:
1. For pipes with a diameter up to 6-inches:
 - a. Adjustable prefabricated support such as Pipe Pier 150 manufactured by Pipe Pier Support Systems, Hamel, MN, or approved equal.
 - b. Product approved by the roofing manufacturer for this application.
 - c. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
 2. For pipes with a diameter greater than 6-inches:
 - a. Product approved by the roofing manufacturer for this application.
 - b. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
- E. Self-adhering membrane (for use over parapet walls beneath coping caps, and at other locations indicated on the drawings): Product approved for use beneath sheet metal by the membrane manufacturer, and meeting the following criteria:
1. Meeting the requirements of ASTM D 1970.
 2. Approved for use as an underlayment for standing seam sheet metal roofing.
 3. A 40-mil minimum membrane thickness.
- F. Roof hatch:
1. Roof hatch, such as "Type E" or "Type S", manufactured by The Bilco Company, New Haven, CT, or approved equal.
 - a. Size and configuration as necessary.
 - b. Product approved by the roofing manufacturer for this application.
- G. Extendable ladder-mounted safety post, such as "LadderUP Safety Post", manufactured by The Bilco Company, New Haven, CT, or approved equal.
1. Size and configuration as necessary to accommodate and new roof hatch.
 2. Product approved by the roofing manufacturer for this application.
- H. Acrylic elastomeric coating (for use at roof penetrations and other locations indicated on the project drawings). Product approved for use by the membrane manufacturer for this application, and meeting the following criteria:
1. Meeting the requirements of ASTM D 6083.
 2. White color.
- I. Rooftop unit support curbs: Product such as "Pate Equipment Supports" manufactured by The Pate Company, Lombard, IL, or approved equal.
1. Size and configuration as necessary to accommodate rooftop unit.
 2. Fabricated from 18 ga. galvanized steel, minimum, with welded seams; and a nominal 2-inch thick nailer affixed atop the curb support.
 3. Fabricated to allow for a minimum flashing height of 8-inches, minimum.
 4. Product approved by the roofing manufacturer for this application.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.



NOTE TO SPECIFIER

Review available field data. Edit required Section references based on structural deck types present on the project.

- B. Ensure that the insulation and cover board substrate is installed as specified in Section 072100 are suitable to receive roofing membrane materials.

3.2 BITUMEN KETTLE OPERATION

- A. Operator Preparation – Kettle operation requires an individual who is trained in the use of such equipment and use of the kettle requires a designate operator who will remain at the kettle during its use. Under no circumstance shall the kettle be unmanned. Never allow any untrained person to operate the kettle. Kettle temperature shall be recorded a minimum of twice per day.
- B. Kettle operator must be dressed accordingly; including, but not limited to, the following items:
 1. Long-sleeved shirt, buttoned at the cuffs.
 2. Long pants without cuffs.
 3. Gloves, snug fitting at the cuffs.
 4. Heavy shoes with high tops.
- C. Site Preparation – The kettle should be located close enough to the building to allow for proper setup of thin-wall tubing. Care must be taken to protect building, by use of tarpaulins. However, be aware of the possible hazards from locating too close, such as splashing of asphalt or the spread of fire.
- D. Avoid locating kettle near openings and air intakes on the building to lessen the effect of fumes on the people inside.
- E. Select a clear, level area with firm ground. Locate kettle away from all flammable materials and away from all electrical lines. Chock wheels front and back when kettle is in operation. Make sure the kettle is level and stable from rocking. Place non-flammable material underneath kettle to protect the ground from spillage. Set up a warning line system around the entire kettle working area. Keep unauthorized people away from the area. If LP fuel is being used, secure the cylinder(s) so that it cannot tip over. Locate cylinder(s) at least ten feet from the burners. Keep all fuel upwind from the kettle and away from open flames. Place asphalt to be used for the day in a location convenient for loading the kettle.
- F. Ground protection (plywood and EPDM membrane) is required at kettle site. Comply with all Local Fire Codes or requirements set forth by Local Fire Marshall.

3.3 BITUMEN FUME CONTROL

- A. The Contractor shall include the cost of providing a fume recovery system such as Fumeguard Asphalt & Pitch Fume Control System as manufactured by the Garlock Equipment Company or approved equal in all projects where asphalt is specified.
- B. Fumes from paint, adhesives, or any other sources are prohibited from entering the building interior. Contractor must provide proper ventilation and take necessary precautions to prevent fume permeation including covering intake vents, providing and installing carbon filters, arranging for HVAC equipment shut down, or any other necessary means to prevent fumes from entering the building.

3.4 ROOFING MEMBRANE INSTALLATION

- A. Except as may be modified by these specifications and drawings, install roofing membrane in accordance with the requirements and recommendations of the roofing membrane manufacturer, using the manufacturer's current printed instructions.
- B. Chalk lining: Beginning at the low points or drains, chalk line the cover board surface to serve as guides for the proper mopping and laying of the roofing membrane plies.
- C. Felt direction: Install roofing membrane felts perpendicular to the roof slope.
- D. Broom or press each ply into place, full width.
- E. Provide non-perforated asphalt organic felt envelopes at perimeter edges, and metal pitch dams at roof openings, and at other locations required by the roofing membrane manufacturer to prevent coal-tar pitch drip.
- F. Install only as much roofing as can be completed in a work day, including flashing and detail work. All installed roofing shall be sealed to a watertight condition prior to leaving the site daily.
- G. Sequence roofing work to eliminate the use of installed roofing as a walkway, or as a storage platform for materials.
- H. Where wheeled or excessive traffic over new or existing roofing work is unavoidable, provide and use 3/4-inch plywood, set over a minimum of two-inch thick rigid board insulation to protect roofing components in place.
- I. Overnight tie-in: Care should be exercised to ensure that water does not flow beneath any completed sections of the roof by temporarily sealing the loose edge of the membrane at the end of each work day and when the weather is threatening. The roofing membrane manufacturer's requirements should be followed closely.
- J. Remove debris from the roof daily prior to leaving the site. Inspect the site at ground level. Remove any roof replacement related debris from the ground.

3.5 BASE FLASHINGS

- A. Curb height: Unless otherwise indicated provide an 8-inch minimum flashing height above the finished roofing surface. Refer to Section 061053 for wood blocking requirements related to raising of rooftop curbs.
- B. Ensure that all flashing substrates are suitable to receive new base flashing materials.
- C. Install base flashings at vertical walls and curbs in accordance with the roofing membrane manufacturer's requirements and recommendations, with the following exceptions/clarifications:
 - 1. Flashing Securement:
 - a. If the flashing substrate is wood or wood nailers are present, secure the flashing top edge with roofing nails and 1-inch metal cap fasteners spaced 6-inches on center, maximum.
 - b. At all other substrates, secure the top edge of flashing with an aluminum anchor bar, secured 12-inches o.c., max., or as recommended by the roofing membrane manufacturer; whichever is less. Refer to Section 076202 for aluminum anchor bar requirements.



2. Flashing stripping: Use woven glass fabric and roofing cement to seal vertical laps and the flashing top edge of the flashing (including anchor bars, if applicable).
3. Flashing and stripping coating: Apply the specified aluminum coating over base flashings and strippings. Apply the coating in accordance with the requirements and recommendations of the roofing membrane manufacturer. Ensure that the surface coating is uniform in color and appearance. Do not apply coating during cold weather, or immediately after the application of strippings. If necessary, allow strippings time to "flash off", as recommended by the coating manufacturer.

NOTE TO SPECIFIER

Hot-air welding of flashing base ply and surfacing ply seams, using a flameless welding machine, is required.

- D. Hot-air welded seams: Using a heat gun, hot-air weld flashing base ply and surfacing ply seams. Do not use torches to hot-air weld seams.

3.6 ROOF SUMP FLASHINGS

- A. Prior to installation of the base ply, install a three-course stripping of woven glass fabric and roofing cement over the cover board/insulation substrate.
- B. Ensure that the roofing membrane plies extend into the roof sump.
- C. Install a three-course stripping of woven glass fabric and roofing cement over the roofing plies.
- D. Install a lead sheet flashing over the roofing plies in the sump; refer to Section 076202. Prime both sides of the lead sheet prior to installation.
- E. Install two plies of woven glass fabric, each ply set in roofing cement, over the lead flashing sheet.
- F. Ensure that the roofing membrane felts, lead flashing sheet, and woven glass fabric flashing plies extend under the clamping ring and into the drain bowl. Tightly secure the clamping ring.
- G. Apply the specified aluminum coating over the roof sump flashings. Apply the coating in accordance with the requirements and recommendations of the coating manufacturer. Ensure that the surface coating is uniform in color and appearance.
- H. Install a roof sump gravel stop as indicated in Section 076202.

3.7 METAL FLASHINGS AND ACCESSORIES

- A. Refer to Section 076202.

3.8 SHEET METAL FLANGE STRIPPINGS

- A. At sheet metal flanges associated with roof sump area gravel stops, tubular penetrations, pitch pans and perimeter edge sheet metal fascia flashings:
 1. Prime the top and bottom of the sheet metal flange. Allow the primer time to dry.
 2. Set flange in a full bed of roofing cement.
 3. Install strippings in accordance with the drawings and the requirements and recommendations of the modified bitumen roofing membrane manufacturer.



3.9 SEALANTS

- A. Refer to Section 079200.

3.10 AGGREGATE SURFACING

- A. Roofing membrane inspection/repair: Repair all fishmouths, wrinkles, ridges, disbonded or dry membrane laps, or any other defects in the new roof membrane in accordance with the recommendations of the roofing membrane manufacturer prior to the aggregate surfacing application.
- B. Aggregate application:
1. Embed aggregate uniformly into a top pour coat of hot and fluid asphalt applied at a rate not less than 70 pounds per square. Apply gravel at the rate of 400 pounds per square. Apply slag at the rate of 300 pounds per square. Ensure that a minimum of half of the aggregate layer is fully adhered in the top pour coat.

NOTE TO SPECIFIER

EDIT items in Article 3.11 to reflect actual project conditions and requirements. Re-letter/number paragraphs and sub-paragraphs after editing.

3.11 MISCELLANEOUS INSTALLATIONS/TREATMENTS

- A. Install mechanical ventilator units in position and secure to the existing curbs with EPDM-gasketed screws. Provide a minimum of one fastener on each side of the curb and a minimum of one fastener every 12-inches o.c.
- B. Connect all electrical, plumbing, gas line and ventilation connections required for mechanical units. Retain a qualified, licensed electrical subcontractor to connect electrical equipment. Retain a qualified, licensed mechanical subcontractor to connect gas lines and ventilation connections.
- C. Walkway pads: Install walkway pads at locations indicated on drawings. Install the pads in accordance with the requirements and recommendations of the roofing manufacturer. Extend the pads a minimum of 4-inches in all directions beyond wood blocking.
- D. Install splashblocks set on walkpads at locations indicated on the drawings.
- E. Rooftop conduit and pipe supports:
1. Install adjustable prefabricated pipe supports at rooftop conduit and pipes.
 2. Space pipe supports at intervals recommended by the support manufacturer, as determined by the diameter and weight of the conduit or pipe.
 3. Separate the support from the roof surface by installing the support over roof walkway pads, installed as specified.
- F. Pre-fabricated plumbing vent pipe extensions:
1. Refer to manufacturer requirements and recommendations for installation.
- G. Install self-adhering underlayment beneath coping caps, and at other locations indicated on the drawings.
1. Refer to manufacturer requirements and recommendations for installation.



- H. Roof hatch installation:
 - 1. Provide wood nailers beneath roof hatch flanges, if necessary, to match insulation thickness.
 - 2. Install new roof hatch following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- I. Extendable safety post installation:
 - 1. Install new safety post following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- J. Application of elastomeric coating to rooftop penetrations:
 - 1. Prepare substrate in a manner that is acceptable to the coating manufacturer. Substrate preparation includes, but is not limited to: treatment of excessive gaps, repair of damaged or loose sheet metal components, repair of holes, cleaning of roof penetrations, treatment of surface rust, treatment of residual asphalt, and priming (if required by the roof coating manufacturer).
 - 2. Coat the indicated penetrations following the recommendations and requirements of the coating manufacturer.
- K. Installation of equipment support curbs:
 - 1. Install support curbs where indicated on the project drawings. Flash curbs into the roof system as indicated on the project drawings.
 - 2. Refer to manufacturer requirements and recommendations for installation.

USPS CSF Specifications, issued: 10/1/2013
 Last revised: 9/16/2013

NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 51 13 00



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SECTION 07 51 13 00 - R&A BUILT-UP ASPHALT ROOFING

NOTE TO SPECIFIER

This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this section where an aggregate-surfaced, hot asphalt-applied four-ply roofing membrane is selected as the roofing system in a roof replacement application. Per the United States Postal Service Roofing Design Standards, an aggregate-surfaced, hot asphalt-applied four-ply roofing membrane system is an acceptable roofing system over facilities with a Critical or Non-Critical building designation.

NOTE TO SPECIFIER

Section Formatting:

Consistent formatting of Sections gives the complete document a professional look. This Section uses a 10pt. Arial font, and is formatted as follows:

1. *Insert one 10pt. line after the Section Number. Section Number is in CAPS.*
2. *Insert two 10pt. lines after the Section Title. Section Title is in CAPS.*
3. *Insert one 10pt. line after a PART. PARTS are in CAPS. If a Section is not used, include NOT USED following the PART title as shown below.*
4. *Insert one 10pt. line after Article paragraphs. Articles are in CAPS.*
5. *Insert two 10pt. lines at the end of an Article.*
6. *Complete Section with END OF SETION.*
7. *No lines should be placed between paragraphs and sub-paragraphs, or between sub-paragraphs and other sub-paragraphs.*

Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION



NOT USED

Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to the installation of an aggregate-surfaced built-up asphalt roofing membrane, including flashings, and related accessories.

NOTE TO SPECIFIER

Review available field data. For roof areas consisting of an underlying concrete, gypsum concrete, cementitious wood fiber, and/or lightweight insulating concrete structural deck, include Section 072221 – Insulation and Cover Board over Underlayment within 1.2 RELATED SECTIONS below. For roof areas consisting of an underlying steel and/or wood deck, include Section 072223 – Roof Insulation and Cover Board over Steel and Wood Deck within the 1.2 RELATED SECTIONS below. For projects containing structural deck types applicable to both Sections 072221 and 072223, include both Sections. Re-letter paragraphs and sub-paragraphs after editing.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 024100 – Roof Removal and Substrate Preparation
- D. Section 061053 – Miscellaneous Rough Carpentry for Roof Replacement
- E. Section 072221 – Roof Insulation and Cover Board over Underlayment
- F. Section 072223 – Roof Insulation and Cover Board over Steel and Wood Roof Decks
- G. Section 076202 – Sheet Metal for Built-Up Roofing
- H. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

NOTE TO SPECIFIER

Per discussions between the designer and USPS Project Manager, determine the warranty requirements for the project. Choose from the following warranty options and actions:

1. *If an alternate price for a 20-year "Total System Warranty" is specified, Leave Article 1.3 unchanged.*
2. *If a 20-year "Total System Warranty" will be included in the base proposal, or if no warranty is specified, remove Article 1.3.*

Re-letter/number items after editing.



1.3 ALTERNATES

- A. Provide an alternate price for the 20-Year Total System Warranty described in paragraph 1.9A.

1.4 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
1. American Society for Testing and Materials (ASTM)
 - a. ASTM D 312 - Standard Specification for Asphalt Used in Roofing
 - b. ASTM D 2178 - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing
 - c. ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements
 - d. ASTM D 1668 - Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
 - e. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
 - f. ASTM D 4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free
 - g. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
 - h. ASTM D 2824 - Standard Specification for Aluminum-Pigmented Asphalt Roof Coatings, Non-fibred, Asbestos Fibred, and Fibred without Asbestos
 - i. ASTM D 1863 - Standard Specification for Mineral Aggregate Used on Built-Up Roofs
 - j. ASTM D 1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
 2. Factory Mutual Global (FM)
 3. Underwriters Laboratories (UL)
 4. National Roofing Contractors Association (NRCA)
 5. American Society of Civil Engineers (ASCE)
 - a. ASCE 7 Minimum Design Loads of Buildings and Other Structures

1.5 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.6 QUALITY ASSURANCE PROCEDURES

- A. **Applicator Qualifications:** A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. **Single Source Responsibility:** Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.



- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp. Store roll materials standing on end.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
 - 1. When the outside temperature is forecast to fall below 32°F (°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives and primers should be maintained at a temperature of 50°F (10°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 - 2. When applying hot asphalt, reduce mop lead distance to 2-feet or less.
 - 3. If a minimum asphalt temperature of 420°F (216°C) cannot be maintained at the point of application, discontinue work.
 - 4. Refer to the asphalt roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

NOTE TO SPECIFIER

Per discussions between the designer and USPS Project Manager, determine the warranty requirements for the project. Choose from the following warranty options and actions:



1. *If an alternate price for a 20-year "Total System, Non-Pro-Rated Warranty" is specified, do not edit paragraph 1.9A.*
2. *If a 20-year "Total System, Non-Pro-Rated Warranty" will be included in the base proposal, DELETE "an alternate price for" from paragraph 1.9A.*
3. *If no warranty is specified, EDIT the title of Article 1.9 (DELETE the words "MANUFACTURER WARRANTY AND"), and DELETE paragraph 1.9A. The two-year contractor guarantee shall remain in place.*

Re-letter/number paragraphs and sub-paragraphs after editing.

1.9 MANUFACTURER WARRANTY AND CONTRACTOR GUARANTEE

- A. Provide an alternate price for a manufacturer 20-Year Total System, Non-Pro-Rated Warranty (including insulation, roofing membrane, and flashings) covering materials and labor. The warranty shall include the following additional items:
 1. The warranty shall include a wind rider for the design wind speed at the specific project location.
 2. Roofing inspection by a technical representative of the roofing membrane manufacturer 22-24 months after date of Final Acceptance.
 3. Roofing manufacturer will provide unlimited repairs during warranty period with no cost limitation.
 4. Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions.
 5. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Record Built-Up Asphalt Roofing Specification Section to Warranty.
- B. The Contractor shall provide a two-year contractor guarantee. At a minimum, the contractor guarantee shall include the following:
 1. Contractor name, address, phone number and project contact name.
 2. The project completion date, and date of guarantee expiration.
 3. The contractor guarantee shall include, in writing, all project work, workmanship, and/or all materials installed by the contractor or subcontractors to be of a quality that will comply with all project specific requirements of the Construction Documents and other documents governing the Work and workmanship through the guarantee period.
 4. The contractor shall investigate roof leaks during the guarantee period within a reasonable time period, but in no instance greater than 24-hours after notification of a leak. The contractor shall repair leaks determined to be the cause of the Work at no cost to the Owner.

PART 2 – PRODUCTS

2.1 BUILT-UP ASPHALT ROOFING SYSTEM SUMMARY

- A. The complete roofing membrane system assembly shall consist of a built-up, four-ply roof system consisting of the specified asphalt saturated felts identified in paragraph 2.3A set in hot, fluid applications of asphalt. Aggregate surfacing shall be applied to the completed roof membrane.

NOTE TO SPECIFIER

NOTE: In high wind areas, such as those with a calculated wind uplift pressure of greater than 45 psf in the roof field, enhancements to the roof system may be required and must be considered by the design professional/specifier. Consult with the roofing membrane manufacturer and qualified testing agencies such as FM and Miami-Dade County for further information and guidance related to possible roof system enhancements in high wind areas.



- B. The complete roofing system assembly shall resist uplift pressures calculated according to ASCE 7-05 for the field, perimeters and corners. The specified approval rating must incorporate a safety factor of 2 over the maximum calculated uplift pressure in foot-pound units.
- C. The complete roofing system assembly shall achieve an FM or UL Class A fire rating.

2.2 BITUMEN

- A. Asphalt: ASTM D 312, Type III.

2.3 ROOFING FELTS, SHEETS, AND FABRICS

- A. Roofing membrane plies: Asphalt-saturated Type VI ply felt meeting ASTM D 2178; manufactured by the roofing membrane manufacturer.
- B. Base flashings:
 - 1. Inner ply: Modified bitumen flashing sheet, polyester reinforced, minimum nominal 85 mil thickness; ASTM D 6164, Type I, Grade S.
 - 2. Outer ply: Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, minimum nominal 130 mil thickness; ASTM D 6164, Type I, Grade G.
 - a. Color: White or light gray; as determined by Owner.
- C. For use at roof sump flashings and elsewhere as may be indicated: Asphalt treated woven glass fabric, ASTM D 1668, Type I.
- D. For use at temporary overnight tie-ins: Asphalt-saturated organic felt, No. 15, non-perforated, ASTM D 226, Type 1.

2.4 ADHESIVES, CEMENTS, PRIMERS AND COATINGS

- A. Roofing and flashing cement: ASTM D 4586, Type I, (summer grade or winter grade as applicable to season).
- B. Modified bitumen cement (For use at granule surfaced flashing sheets and other locations required by the roofing membrane manufacturer): Product compatible with modified bitumen roofing surfacing flashing sheet and approved by the roofing membrane manufacturer.
- C. Asphalt primer: ASTM D 41.
- D. Aluminum coating (for flashings): Fibrated aluminum coating; ASTM D 2824, Type III. Product type approved by the roofing membrane manufacturer.

2.5 AGGREGATE

- A. Gravel, ASTM D 1863, Size No. 67; clean and dry.
- B. Slag, ASTM D 1863, Size No. 67; clean and dry.

2.6 FASTENERS



- A. Roofing membrane and flashing fasteners: Unless otherwise indicated, types as required by the roofing membrane manufacturer.

2.7 MISCELLANEOUS MATERIALS

- A. Walkway pads: Product approved by the roofing manufacturer.
- B. Splashblocks: Concrete; size as necessary to accommodate existing condition.
- C. Pitch pan fill materials:
 - 1. Non-shrink grout (for bottom fill): Quick-set, fast-drying grout; product acceptable to roofing manufacturer.
 - 2. Pourable sealer (for top fill): Two-part pourable elastomeric sealer, product acceptable to roofing manufacturer.
- D. Conduit and pipe supports:
 - 1. For pipes with a diameter up to 6-inches:
 - a. Adjustable prefabricated support such as Pipe Pier 150 manufactured by Pipe Pier Support Systems, Hamel, MN, or approved equal.
 - b. Product approved by the roofing manufacturer for this application.
 - c. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
 - 2. For pipes with a diameter greater than 6-inches:
 - a. Product approved by the roofing manufacturer for this application.
 - b. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
- E. Pre-fabricated plumbing vent pipe extensions:
 - 1. For use where necessary to achieve the 8-inch minimum flashing height:
 - a. Pre-fabricated plumbing vent extensions, such as Tubos Pre-Fabricated Pipe Extension, by Tubos, Inc., Clearwater, FL.
 - b. Product approved by the roofing manufacturer for this application.
 - c. Size and configuration of extension as necessary to match existing pipe diameter, providing the 8-inch minimum flashing height, and allowing for flashing as show on the drawings.
- F. Self-adhering membrane (for use over parapet walls beneath coping caps, and at other locations indicated on the drawings): Product approved for use beneath sheet metal by the membrane manufacturer, and meeting the following criteria:
 - 1. Meeting the requirements of ASTM D 1970.
 - 2. Approved for use as an underlayment for standing seam sheet metal roofing.
 - 3. A 40-mil minimum membrane thickness.
- G. Replacement roof hatch:
 - 1. Roof hatch, such as "Type E" or "Type S", manufactured by The Bilco Company, New Haven, CT, or approved equal.
 - a. Size and configuration as necessary to match existing roof hatch.
 - b. Product approved by the roofing manufacturer for this application.
- H. Extendable ladder-mounted safety post, such as "LadderUP Safety Post", manufactured by The Bilco Company, New Haven, CT, or approved equal.
 - 1. Size and configuration as necessary to accommodate existing ladder and new roof hatch.
 - 2. Product approved by the roofing manufacturer for this application.
- I. Acrylic elastomeric coating (for use at roof penetrations and other locations indicated on the



project drawings). Product approved for use by the membrane manufacturer for this application, and meeting the following criteria:

1. Meeting the requirements of ASTM D 6083.
 2. White color.
- J. Rooftop unit support curbs: Product such as "Pate Equipment Supports" manufactured by The Pate Company, Lombard, IL, or approved equal.
1. Size and configuration as necessary to accommodate existing rooftop unit.
 2. Fabricated from 18 ga. galvanized steel, minimum, with welded seams; and a nominal 2-inch thick nailer affixed atop the curb support.
 3. Fabricated to allow for a minimum flashing height of 8-inches, minimum.
 4. Product approved by the roofing manufacturer for this application.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.

NOTE TO SPECIFIER

Review available field data. For roof areas consisting of an underlying concrete, gypsum concrete or cementitious wood fiber structural deck, include Section 072221 within paragraph 3.1B below. For roof areas consisting of an underlying steel or wood deck, include Section 072223 within paragraph 3.1B below. For projects containing structural deck types applicable to both Sections 072221 and 072223, include both Sections.

- B. Ensure that the insulation and cover board substrate is installed as specified in Sections 072221 and 072223 are suitable to receive roofing membrane materials.

3.2 BITUMEN KETTLE OPERATION

- A. Operator Preparation – Kettle operation requires an individual who is trained in the use of such equipment and use of the kettle requires a designate operator who will remain at the kettle during its use. Under no circumstance shall the kettle be unmanned. Never allow any untrained person to operate the kettle. Kettle temperature shall be recorded a minimum of twice per day.
- B. Kettle operator must be dressed accordingly; including, but not limited to, the following items:
1. Long-sleeved shirt, buttoned at the cuffs.
 2. Long pants without cuffs.
 3. Gloves, snug fitting at the cuffs.
 4. Heavy shoes with high tops.
- C. Site Preparation – The kettle should be located close enough to the building to allow for proper setup of thin-wall tubing. Care must be taken to protect building, by use of tarpaulins. However, be aware of the possible hazards from locating too close, such as splashing of asphalt or the spread of fire.
- D. Avoid locating kettle near openings and air intakes on the building to lessen the effect of fumes on the people inside.
- E. Select a clear, level area with firm ground. Locate kettle away from all flammable materials and away from all electrical lines. Chock wheels front and back when kettle is in operation. Make sure the kettle is level and stable from rocking. Place non-flammable material underneath kettle



to protect the ground from spillage. Set up a warning line system around the entire kettle working area. Keep unauthorized people away from the area. If LP fuel is being used, secure the cylinder(s) so that it cannot tip over. Locate cylinder(s) at least ten feet from the burners. Keep all fuel upwind from the kettle and away from open flames. Place asphalt to be used for the day in a location convenient for loading the kettle.

- F. Ground protection (plywood and EPDM membrane) is required at kettle site. Comply with all Local Fire Codes or requirements set forth by Local Fire Marshall.

3.3 BITUMEN FUME CONTROL

- A. The Contractor shall include the cost of providing a fume recovery system such as Fumeguard Asphalt & Pitch Fume Control System as manufactured by the Garlock Equipment Company or approved equal in all projects where asphalt is specified.
- B. Fumes from paint, adhesives, or any other sources are prohibited from entering the building interior. Contractor must provide proper ventilation and take necessary precautions to prevent fume permeation including covering intake vents, providing and installing carbon filters, arranging for HVAC equipment shut down, or any other necessary means to prevent fumes from entering the building.

3.4 ROOFING MEMBRANE INSTALLATION

- A. Except as may be modified by these specifications and drawings, install roofing membrane in accordance with the requirements and recommendations of the roofing membrane manufacturer, using the manufacturer's current printed instructions.
- B. Chalk lining: Beginning at the low points or drains, chalk line the cover board surface to serve as guides for the proper mopping and laying of the roofing membrane plies.
- C. Felt direction: Install roofing membrane felts perpendicular to the roof slope.
- D. Broom or press each ply into place, full width.
- E. Provide non-perforated asphalt organic felt envelopes at perimeter edges, and metal pitch dams at roof openings, and at other locations required by the roofing membrane manufacturer to prevent coal-tar pitch drippage.
- F. Install only as much roofing as can be completed in a work day, including flashing and detail work. All installed roofing shall be sealed to a watertight condition prior to leaving the site daily.
- G. Sequence roofing work to eliminate the use of installed roofing as a walkway, or as a storage platform for materials.
- H. Where wheeled or excessive traffic over new or existing roofing work is unavoidable, provide and use 3/4-inch plywood, set over a minimum of two-inch thick rigid board insulation to protect roofing components in place.
- I. Overnight tie-in: Care should be exercised to ensure that water does not flow beneath any completed sections of the roof by temporarily sealing the loose edge of the membrane at the end of each work day and when the weather is threatening. The roofing membrane manufacturer's requirements should be followed closely.
- J. Remove debris from the roof daily prior to leaving the site. Inspect the site at ground level.



Remove any roof replacement related debris from the ground.

3.5 BASE FLASHINGS

- A. Curb height: Unless otherwise indicated or not possible due to existing conditions encountered, provide an 8-inch minimum flashing height above the finished roofing surface. Refer to Section 061053 for wood blocking requirements related to raising of rooftop curbs.
- B. Ensure that all flashing substrates are suitable to receive new base flashing materials.
- C. Install base flashings at vertical walls and curbs in accordance with the roofing membrane manufacturer's requirements and recommendations, with the following exceptions/clarifications:
 - 1. Flashing Securement:
 - a. If the flashing substrate is wood or wood nailers are present, secure the flashing top edge with roofing nails and 1-inch metal cap fasteners fasteners spaced 6-inches on center, maximum.
 - b. At all other substrates, secure the top edge of flashing with an aluminum anchor bar, secured 12-inches o.c., max., or as recommended by the roofing membrane manufacturer; whichever is less. Refer to Section 076202 for aluminum anchor bar requirements.
 - 2. Flashing stripping: Use woven glass fabric and roofing cement to seal vertical laps and the flashing top edge of the flashing (including anchor bars, if applicable).
 - 3. Flashing and stripping coating: Apply the specified aluminum coating over base flashings and strippings. Apply the coating in accordance with the requirements and recommendations of the roofing membrane manufacturer. Ensure that the surface coating is uniform in color and appearance. Do not apply coating during cold weather, or immediately after the application of strippings. If necessary, allow strippings time to "flash off", as recommended by the coating manufacturer.

NOTE TO SPECIFIER

Hot-air welding of flashing base ply and surfacing ply seams, using a flameless welding machine, is required. Use of torches during roof replacement application is not allowed.

- D. Hot-air welded seams: Using a heat gun, hot-air weld flashing base ply and surfacing ply seams. Do not use torches to hot-air weld seams.

3.6 ROOF SUMP FLASHINGS

- A. Prior to installation of the base ply, install a three-course stripping of woven glass fabric and roofing cement over the cover board/insulation substrate.
- B. Ensure that the roofing membrane plies extend into the roof sump.
- C. Install a three-course stripping of woven glass fabric and roofing cement over the roofing plies.
- D. Install a lead sheet flashing over the roofing plies in the sump; refer to Section 076202. Prime both sides of the lead sheet prior to installation.
- E. Install two plies of woven glass fabric, each ply set in roofing cement, over the lead flashing sheet.
- F. Ensure that the roofing membrane felts, lead flashing sheet, and woven glass fabric flashing plies



extend under the clamping ring and into the drain bowl. Tightly secure the clamping ring.

- G. Apply the specified aluminum coating over the roof sump flashings. Apply the coating in accordance with the requirements and recommendations of the coating manufacturer. Ensure that the surface coating is uniform in color and appearance.
- H. Install a roof sump gravel stop as indicated in Section 076202.

3.7 METAL FLASHINGS AND ACCESSORIES

- A. Refer to Section 076202.

3.8 SHEET METAL FLANGE STRIPPINGS

- A. At sheet metal flanges associated with roof sump area gravel stops, tubular penetrations, pitch pans and perimeter edge sheet metal fascia flashings:
 1. Prime the top and bottom of the sheet metal flange. Allow the primer time to dry.
 2. Set flange in a full bed of roofing cement.
 3. Install strippings in accordance with the drawings and the requirements and recommendations of the modified bitumen roofing membrane manufacturer.

3.9 SEALANTS

- A. Refer to Section 079200.

3.10 AGGREGATE SURFACING

- A. Roofing membrane inspection/repair: Repair all fishmouths, wrinkles, ridges, disbanded or dry membrane laps, or any other defects in the new roof membrane in accordance with the recommendations of the roofing membrane manufacturer prior to the aggregate surfacing application.
- B. Aggregate application:
 1. Embed aggregate uniformly into a top pour coat of hot and fluid asphalt applied at a rate not less than 70 pounds per square. Apply gravel at the rate of 400 pounds per square. Apply slag at the rate of 300 pounds per square. Ensure that a minimum of half of the aggregate layer is fully adhered in the top pour coat.

3.11 MISCELLANEOUS INSTALLATIONS/TREATMENTS

- A. Return mechanical ventilator units to their original positions and secure to the existing curbs with EPDM-gasketed screws. Provide a minimum of one fastener on each side of the curb and a minimum of one fastener every 12-inches o.c.
- B. Reconnect all electrical, plumbing, gas line and ventilation connections required to return mechanical units to their original operating condition. Retain a qualified, licensed electrical subcontractor to reconnect electrical equipment. Retain a qualified, licensed mechanical subcontractor to reconnect gas lines and ventilation connections. Coordinate required disconnections and reconnections with the Owner.
- C. Walkway pads: Install walkway pads at locations indicated on drawings. Install the pads in



accordance with the requirements and recommendations of the roofing manufacturer. Extend the pads a minimum of 4-inches in all directions beyond wood blocking.

- D. Install splashblocks set on walkpads at locations indicated on the drawings.
- E. Rooftop conduit and pipe supports:
 - 1. Install adjustable prefabricated pipe supports at rooftop conduit and pipes.
 - 2. Space pipe supports at intervals recommended by the support manufacturer, as determined by the diameter and weight of the conduit or pipe.
 - 3. Separate the support from the roof surface by installing the support over roof walkway pads, installed as specified.
- F. Pre-fabricated plumbing vent pipe extensions:
 - 1. Refer to manufacturer requirements and recommendations for installation.
 - 2. Prior to flashing installation, seal intersection of pipe extension and existing plumbing vent.
- G. Install self-adhering underlayment beneath coping caps, and at other locations indicated on the drawings.
 - 1. Refer to manufacturer requirements and recommendations for installation.
- H. Replacement roof hatch installation:
 - 1. Remove and discard existing roof hatch.
 - 2. Provide wood nailers beneath roof hatch flanges, if necessary, to match insulation thickness.
 - 3. Install new roof hatch following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- I. Extendable safety post installation:
 - 1. Install new safety post following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- J. Application of elastomeric coating to rooftop penetrations:
 - 1. Prepare substrate in a manner that is acceptable to the coating manufacturer. Substrate preparation includes, but is not limited to: treatment of excessive gaps, repair of damaged or loose sheet metal components, repair of holes, cleaning of roof penetrations, treatment of surface rust, treatment of residual asphalt, and priming (if required by the roof coating manufacturer).
 - 2. Coat the indicated penetrations following the recommendations and requirements of the coating manufacturer.
- K. Installation of equipment support curbs:
 - 1. Install support curbs where indicated on the project drawings. Flash curbs into the roof system as indicated on the project drawings.
 - 2. Refer to manufacturer requirements and recommendations for installation.

USPS CSF Specifications issued: 10/1/2013
Last revised: 3/6/2013

NOTE TO SPECIFIER



Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 51 13 00



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SECTION 07 51 13 00 - MPF BUILT-UP ASPHALT ROOFING**

NOTE TO SPECIFIER

Editing is needed for each individual project; modify as needed for project specific requirements. Included "NOTE TO SPECIFIER" instructions provide guidance concerning required editing, and options have been included requiring action on the part of the specifier/designer. Select the option appropriate for the project and delete option(s) not selected.

NOTE TO SPECIFIER

EDIT Section footer as necessary to reflect the project name and location, USPS Project number, and required date of the technical specification document. Coordinate this project specific information with the USPS Project Manager. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this section where an aggregate-surfaced, hot asphalt-applied four-ply roofing membrane is selected as the roofing system.

Per the United States Postal Service Roofing Design Standards, an aggregate-surfaced, hot asphalt-applied four-ply roofing membrane system is an acceptable roofing system over facilities with a Critical or Non-Critical building designation.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to the installation of an aggregate-surfaced built-up asphalt roofing membrane, including flashings, and related accessories.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 072100 – Thermal Insulation
- D. Section 076200 – Sheet Metal Flashings and Trim
- E. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 ALTERNATES

- A. Provide an alternate price for the 20-Year Total System Warranty described in Article 1.9A.

1.4 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
1. American Society for Testing and Materials (ASTM)
 - a. ASTM D 312 - Standard Specification for Asphalt Used in Roofing
 - b. ASTM D 2178 - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing
 - c. ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements
 - d. ASTM D 1668 - Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
 - e. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
 - f. ASTM D 4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free
 - g. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
 - h. ASTM D 2824 - Standard Specification for Aluminum-Pigmented Asphalt Roof Coatings, Non-fibered, Asbestos Fibered, and Fibered without Asbestos
 - i. ASTM D 1863 - Standard Specification for Mineral Aggregate Used on Built-Up Roofs
 - j. ASTM D 1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
 2. Factory Mutual Global (FM)
 3. Underwriters Laboratories (UL)
 4. National Roofing Contractors Association (NRCA)
 5. American Society of Civil Engineers (ASCE)
 - a. ASCE 7 Minimum Design Loads of Buildings and Other Structures

1.5 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.6 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.



- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp. Store roll materials standing on end.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
 - 1. When the outside temperature is forecast to fall below 32°F (°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives and primers should be maintained at a temperature of 50°F (10°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 - 2. When applying hot asphalt, reduce mop lead distance to 2-feet or less.
 - 3. If a minimum asphalt temperature of 420°F (216°C) cannot be maintained at the point of application, discontinue work.
 - 4. Refer to the asphalt roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

1.9 MANUFACTURER WARRANTY AND CONTRACTOR GUARANTEE

- A. Provide an alternate price for a manufacturer 20-Year Total System, Non-Pro-Rated Warranty (including insulation, roofing membrane, and flashings) covering materials and labor. The warranty shall include the following additional items:
 - 1. The warranty shall include a wind rider for the design wind speed at the specific project location.
 - 2. Roofing inspection by a technical representative of the roofing membrane manufacturer 22-24 months after date of Final Acceptance.



3. Roofing manufacturer will provide unlimited repairs during warranty period with no cost limitation.
 4. Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions.
 5. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Record Built-Up Asphalt Roofing Specification Section to Warranty.
- B. The Contractor shall provide a two-year contractor guarantee. At a minimum, the contractor guarantee shall include the following:
1. Contractor name, address, phone number and project contact name.
 2. The project completion date, and date of guarantee expiration.
 3. The contractor guarantee shall include, in writing, all project work, workmanship, and/or all materials installed by the contractor or subcontractors to be of a quality that will comply with all project specific requirements of the Construction Documents and other documents governing the Work and workmanship through the guarantee period.
 4. The contractor shall investigate roof leaks during the guarantee period within a reasonable time period, but in no instance greater than 24-hours after notification of a leak. The contractor shall repair leaks determined to be the cause of the Work at no cost to the Owner.

PART 2 – PRODUCTS

2.1 BUILT-UP ASPHALT ROOFING SYSTEM SUMMARY

- A. The complete roofing membrane system assembly shall consist of a built-up, four-ply roof system consisting of the specified asphalt saturated felts identified in paragraph 2.3A set in hot, fluid applications of asphalt. Aggregate surfacing shall be applied to the completed roof membrane.

NOTE TO SPECIFIER

***NOTE:** In high wind areas, such as those with a calculated wind uplift pressure of greater than 45 psf in the roof field, enhancements to the roof system may be required and must be considered by the design professional/specifier. Consult with the roofing membrane manufacturer and qualified testing agencies for further information and guidance related to possible roof system enhancements in high wind areas.*

- B. The complete roofing system assembly shall resist uplift pressures calculated according to ASCE 7-05 for the field, perimeters and corners. The specified approval rating must incorporate a safety factor of 2 over the maximum calculated uplift pressure in foot-pound units.
- C. The complete roofing system assembly shall achieve an FM or UL Class A fire rating.

2.2 BITUMEN

- A. Asphalt: ASTM D 312, Type III.

2.3 ROOFING FELTS, SHEETS, AND FABRICS

- A. Roofing membrane plies: Asphalt-saturated Type VI ply felt meeting ASTM D 2178; manufactured by the roofing membrane manufacturer.
- B. Base flashings:



1. Inner ply: Modified bitumen flashing sheet, polyester reinforced, minimum nominal 85 mil thickness; ASTM D 6164, Type I, Grade S.
2. Outer ply: Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, minimum nominal 130 mil thickness; ASTM D 6164, Type I, Grade G.
 - a. Color: White or light gray; as determined by Owner.
- C. For use at roof sump flashings and elsewhere as may be indicated: Asphalt treated woven glass fabric, ASTM D 1668, Type I.
- D. For use at temporary overnight tie-ins: Asphalt-saturated organic felt, No. 15, non-perforated, ASTM D 226, Type 1.

2.4 ADHESIVES, CEMENTS, PRIMERS AND COATINGS

- A. Roofing and flashing cement: ASTM D 4586, Type I, (summer grade or winter grade as applicable to season).
- B. Modified bitumen cement (For use at granule surfaced flashing sheets and other locations required by the roofing membrane manufacturer): Product compatible with modified bitumen roofing surfacing flashing sheet and approved by the roofing membrane manufacturer.
- C. Asphalt primer: ASTM D 41.
- D. Aluminum coating (for flashings): Fibrated aluminum coating; ASTM D 2824, Type III. Product type approved by the roofing membrane manufacturer.

2.5 AGGREGATE

- A. Gravel, ASTM D 1863, Size No. 67; clean and dry.
- B. Slag, ASTM D 1863, Size No. 67; clean and dry.

2.6 FASTENERS

- A. Roofing membrane and flashing fasteners: Unless otherwise indicated, types as required by the roofing membrane manufacturer.

NOTE TO SPECIFIER

EDIT items in Article 2.7 to reflect actual project conditions and requirements. Re-letter/number paragraphs and sub-paragraphs after editing.

2.7 MISCELLANEOUS MATERIALS

- A. Walkway pads: Product approved by the roofing manufacturer.
- B. Splashblocks: Concrete; size as necessary to accommodate existing condition.
- C. Pitch pan fill materials:
 1. Non-shrink grout (for bottom fill): Quick-set, fast-drying grout; product acceptable to roofing manufacturer.



2. Pourable sealer (for top fill): Two-part pourable elastomeric sealer, product acceptable to roofing manufacturer.
- D. Conduit and pipe supports:
1. For pipes with a diameter up to 6-inches:
 - a. Adjustable prefabricated support such as Pipe Pier 150 manufactured by Pipe Pier Support Systems, Hamel, MN, or approved equal.
 - b. Product approved by the roofing manufacturer for this application.
 - c. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
 2. For pipes with a diameter greater than 6-inches:
 - a. Product approved by the roofing manufacturer for this application.
 - b. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
- E. Self-adhering membrane (for use over parapet walls beneath coping caps, and at other locations indicated on the drawings): Product approved for use beneath sheet metal by the membrane manufacturer, and meeting the following criteria:
1. Meeting the requirements of ASTM D 1970.
 2. Approved for use as an underlayment for standing seam sheet metal roofing.
 3. A 40-mil minimum membrane thickness.
- F. Roof hatch:
1. Roof hatch, such as "Type E" or "Type S", manufactured by The Bilco Company, New Haven, CT, or approved equal.
 - a. Size and configuration as necessary.
 - b. Product approved by the roofing manufacturer for this application.
- G. Extendable ladder-mounted safety post, such as "LadderUP Safety Post", manufactured by The Bilco Company, New Haven, CT, or approved equal.
1. Size and configuration as necessary to accommodate and new roof hatch.
 2. Product approved by the roofing manufacturer for this application.
- H. Acrylic elastomeric coating (for use at roof penetrations and other locations indicated on the project drawings). Product approved for use by the membrane manufacturer for this application, and meeting the following criteria:
1. Meeting the requirements of ASTM D 6083.
 2. White color.
- I. Rooftop unit support curbs: Product such as "Pate Equipment Supports" manufactured by The Pate Company, Lombard, IL, or approved equal.
1. Size and configuration as necessary to accommodate rooftop unit.
 2. Fabricated from 18 ga. galvanized steel, minimum, with welded seams; and a nominal 2-inch thick nailer affixed atop the curb support.
 3. Fabricated to allow for a minimum flashing height of 8-inches, minimum.
 4. Product approved by the roofing manufacturer for this application.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.



NOTE TO SPECIFIER

Review available field data. Edit required Section references based on structural deck types present on the project.

- B. Ensure that the insulation and cover board substrate is installed as specified in Section 072100 are suitable to receive roofing membrane materials.

3.2 BITUMEN KETTLE OPERATION

- A. Operator Preparation – Kettle operation requires an individual who is trained in the use of such equipment and use of the kettle requires a designate operator who will remain at the kettle during its use. Under no circumstance shall the kettle be unmanned. Never allow any untrained person to operate the kettle. Kettle temperature shall be recorded a minimum of twice per day.
- B. Kettle operator must be dressed accordingly; including, but not limited to, the following items:
 - 1. Long-sleeved shirt, buttoned at the cuffs.
 - 2. Long pants without cuffs.
 - 3. Gloves, snug fitting at the cuffs.
 - 4. Heavy shoes with high tops.
- C. Site Preparation – The kettle should be located close enough to the building to allow for proper setup of thin-wall tubing. Care must be taken to protect building, by use of tarpaulins. However, be aware of the possible hazards from locating too close, such as splashing of asphalt or the spread of fire.
- D. Avoid locating kettle near openings and air intakes on the building to lessen the effect of fumes on the people inside.
- E. Select a clear, level area with firm ground. Locate kettle away from all flammable materials and away from all electrical lines. Chock wheels front and back when kettle is in operation. Make sure the kettle is level and stable from rocking. Place non-flammable material underneath kettle to protect the ground from spillage. Set up a warning line system around the entire kettle working area. Keep unauthorized people away from the area. If LP fuel is being used, secure the cylinder(s) so that it cannot tip over. Locate cylinder(s) at least ten feet from the burners. Keep all fuel upwind from the kettle and away from open flames. Place asphalt to be used for the day in a location convenient for loading the kettle.
- F. Ground protection (plywood and EPDM membrane) is required at kettle site. Comply with all Local Fire Codes or requirements set forth by Local Fire Marshall.

3.3 BITUMEN FUME CONTROL

- A. The Contractor shall include the cost of providing a fume recovery system such as Fumeguard Asphalt & Pitch Fume Control System as manufactured by the Garlock Equipment Company or approved equal in all projects where asphalt is specified.
- B. Fumes from paint, adhesives, or any other sources are prohibited from entering the building interior. Contractor must provide proper ventilation and take necessary precautions to prevent fume permeation including covering intake vents, providing and installing carbon filters, arranging for HVAC equipment shut down, or any other necessary means to prevent fumes from entering the building.

3.4 ROOFING MEMBRANE INSTALLATION

- A. Except as may be modified by these specifications and drawings, install roofing membrane in accordance with the requirements and recommendations of the roofing membrane manufacturer, using the manufacturer's current printed instructions.
- B. Chalk lining: Beginning at the low points or drains, chalk line the cover board surface to serve as guides for the proper mopping and laying of the roofing membrane plies.
- C. Felt direction: Install roofing membrane felts perpendicular to the roof slope.
- D. Broom or press each ply into place, full width.
- E. Provide non-perforated asphalt organic felt envelopes at perimeter edges, and metal pitch dams at roof openings, and at other locations required by the roofing membrane manufacturer to prevent coal-tar pitch drip.
- F. Install only as much roofing as can be completed in a work day, including flashing and detail work. All installed roofing shall be sealed to a watertight condition prior to leaving the site daily.
- G. Sequence roofing work to eliminate the use of installed roofing as a walkway, or as a storage platform for materials.
- H. Where wheeled or excessive traffic over new or existing roofing work is unavoidable, provide and use 3/4-inch plywood, set over a minimum of two-inch thick rigid board insulation to protect roofing components in place.
- I. Overnight tie-in: Care should be exercised to ensure that water does not flow beneath any completed sections of the roof by temporarily sealing the loose edge of the membrane at the end of each work day and when the weather is threatening. The roofing membrane manufacturer's requirements should be followed closely.
- J. Remove debris from the roof daily prior to leaving the site. Inspect the site at ground level. Remove any roof replacement related debris from the ground.

3.5 BASE FLASHINGS

- A. Curb height: Unless otherwise indicated provide an 8-inch minimum flashing height above the finished roofing surface. Refer to Section 061053 for wood blocking requirements related to raising of rooftop curbs.
- B. Ensure that all flashing substrates are suitable to receive new base flashing materials.
- C. Install base flashings at vertical walls and curbs in accordance with the roofing membrane manufacturer's requirements and recommendations, with the following exceptions/clarifications:
 - 1. Flashing Securement:
 - a. If the flashing substrate is wood or wood nailers are present, secure the flashing top edge with roofing nails and 1-inch metal cap fasteners spaced 6-inches on center, maximum.
 - b. At all other substrates, secure the top edge of flashing with an aluminum anchor bar, secured 12-inches o.c., max., or as recommended by the roofing membrane manufacturer; whichever is less. Refer to Section 076202 for aluminum anchor bar requirements.



2. Flashing stripping: Use woven glass fabric and roofing cement to seal vertical laps and the flashing top edge of the flashing (including anchor bars, if applicable).
3. Flashing and stripping coating: Apply the specified aluminum coating over base flashings and strippings. Apply the coating in accordance with the requirements and recommendations of the roofing membrane manufacturer. Ensure that the surface coating is uniform in color and appearance. Do not apply coating during cold weather, or immediately after the application of strippings. If necessary, allow strippings time to "flash off", as recommended by the coating manufacturer.

NOTE TO SPECIFIER

Hot-air welding of flashing base ply and surfacing ply seams, using a flameless welding machine, is required.

- D. Hot-air welded seams: Using a heat gun, hot-air weld flashing base ply and surfacing ply seams. Do not use torches to hot-air weld seams.

3.6 ROOF SUMP FLASHINGS

- A. Prior to installation of the base ply, install a three-course stripping of woven glass fabric and roofing cement over the cover board/insulation substrate.
- B. Ensure that the roofing membrane plies extend into the roof sump.
- C. Install a three-course stripping of woven glass fabric and roofing cement over the roofing plies.
- D. Install a lead sheet flashing over the roofing plies in the sump; refer to Section 076202. Prime both sides of the lead sheet prior to installation.
- E. Install two plies of woven glass fabric, each ply set in roofing cement, over the lead flashing sheet.
- F. Ensure that the roofing membrane felts, lead flashing sheet, and woven glass fabric flashing plies extend under the clamping ring and into the drain bowl. Tightly secure the clamping ring.
- G. Apply the specified aluminum coating over the roof sump flashings. Apply the coating in accordance with the requirements and recommendations of the coating manufacturer. Ensure that the surface coating is uniform in color and appearance.
- H. Install a roof sump gravel stop as indicated in Section 076202.

3.7 METAL FLASHINGS AND ACCESSORIES

- A. Refer to Section 076202.

3.8 SHEET METAL FLANGE STRIPPINGS

- A. At sheet metal flanges associated with roof sump area gravel stops, tubular penetrations, pitch pans and perimeter edge sheet metal fascia flashings:
 1. Prime the top and bottom of the sheet metal flange. Allow the primer time to dry.
 2. Set flange in a full bed of roofing cement.
 3. Install strippings in accordance with the drawings and the requirements and recommendations of the modified bitumen roofing membrane manufacturer.



3.9 SEALANTS

- A. Refer to Section 079200.

3.10 AGGREGATE SURFACING

- A. Roofing membrane inspection/repair: Repair all fishmouths, wrinkles, ridges, disbonded or dry membrane laps, or any other defects in the new roof membrane in accordance with the recommendations of the roofing membrane manufacturer prior to the aggregate surfacing application.
- B. Aggregate application:
1. Embed aggregate uniformly into a top pour coat of hot and fluid asphalt applied at a rate not less than 70 pounds per square. Apply gravel at the rate of 400 pounds per square. Apply slag at the rate of 300 pounds per square. Ensure that a minimum of half of the aggregate layer is fully adhered in the top pour coat.

NOTE TO SPECIFIER

EDIT items in Article 3.11 to reflect actual project conditions and requirements. Re-letter/number paragraphs and sub-paragraphs after editing.

3.11 MISCELLANEOUS INSTALLATIONS/TREATMENTS

- A. Install mechanical ventilator units in position and secure to the existing curbs with EPDM-gasketed screws. Provide a minimum of one fastener on each side of the curb and a minimum of one fastener every 12-inches o.c.
- B. Connect all electrical, plumbing, gas line and ventilation connections required for mechanical units. Retain a qualified, licensed electrical subcontractor to connect electrical equipment. Retain a qualified, licensed mechanical subcontractor to connect gas lines and ventilation connections.
- C. Walkway pads: Install walkway pads at locations indicated on drawings. Install the pads in accordance with the requirements and recommendations of the roofing manufacturer. Extend the pads a minimum of 4-inches in all directions beyond wood blocking.
- D. Install splashblocks set on walkpads at locations indicated on the drawings.
- E. Rooftop conduit and pipe supports:
1. Install adjustable prefabricated pipe supports at rooftop conduit and pipes.
 2. Space pipe supports at intervals recommended by the support manufacturer, as determined by the diameter and weight of the conduit or pipe.
 3. Separate the support from the roof surface by installing the support over roof walkway pads, installed as specified.
- F. Pre-fabricated plumbing vent pipe extensions:
1. Refer to manufacturer requirements and recommendations for installation.
- G. Install self-adhering underlayment beneath coping caps, and at other locations indicated on the drawings.
1. Refer to manufacturer requirements and recommendations for installation.



- H. Roof hatch installation:
 - 1. Provide wood nailers beneath roof hatch flanges, if necessary, to match insulation thickness.
 - 2. Install new roof hatch following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- I. Extendable safety post installation:
 - 1. Install new safety post following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- J. Application of elastomeric coating to rooftop penetrations:
 - 1. Prepare substrate in a manner that is acceptable to the coating manufacturer. Substrate preparation includes, but is not limited to: treatment of excessive gaps, repair of damaged or loose sheet metal components, repair of holes, cleaning of roof penetrations, treatment of surface rust, treatment of residual asphalt, and priming (if required by the roof coating manufacturer).
 - 2. Coat the indicated penetrations following the recommendations and requirements of the coating manufacturer.
- K. Installation of equipment support curbs:
 - 1. Install support curbs where indicated on the project drawings. Flash curbs into the roof system as indicated on the project drawings.
 - 2. Refer to manufacturer requirements and recommendations for installation.

USPS MPF Specifications, issued: 10/1/2013
 Last revised: 9/16/2013

NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 51 13 00



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SECTION 07 51 16 00 - R&A BUILT-UP COAL TAR PITCH ROOFING

NOTE TO SPECIFIER

This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this section where an aggregate-surfaced, coal tar pitch four-ply roofing membrane is selected as the roofing system in a roof replacement application.

Per the United States Postal Service Roofing Design Standards, an aggregate-surfaced, coal tar pitch four-ply roofing membrane system is an acceptable roofing system over facilities with a Critical or Non-Critical building designation.

NOTE TO SPECIFIER

Section Formatting:

Consistent formatting of Sections gives the complete document a professional look. This Section uses a 10pt. Arial font, and is formatted as follows:

1. *Insert one 10pt. line after the Section Number. Section Number is in CAPS.*
2. *Insert two 10pt. lines after the Section Title. Section Title is in CAPS.*
3. *Insert one 10pt. line after a PART. PARTS are in CAPS. If a Section is not used, include NOT USED following the PART title as shown below.*
4. *Insert one 10pt. line after Article paragraphs. Articles are in CAPS.*
5. *Insert two 10pt. lines at the end of an Article.*
6. *Complete Section with END OF SETION.*
7. *No lines should be placed between paragraphs and sub-paragraphs, or between sub-paragraphs and other sub-paragraphs.*

Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION



NOT USED

Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to the installation of an aggregate-surfaced built-up coal tar pitch roofing membrane, including flashings, and related accessories.

NOTE TO SPECIFIER

Review available field data. For roof areas consisting of an underlying concrete, gypsum concrete, cementitious wood fiber, and/or lightweight insulating concrete structural deck, include Section 072221 – Insulation and Cover Board over Underlayment within 1.2 RELATED SECTIONS below. For roof areas consisting of an underlying steel and/or wood deck, include Section 072223 – Roof Insulation and Cover Board over Steel and Wood Deck within the 1.2 RELATED SECTIONS below. For projects containing structural deck types applicable to both Sections 072221 and 072223, include both Sections. Re-letter paragraphs and sub-paragraphs after editing.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 024100 – Roof Removal and Substrate Preparation
- D. Section 061053 – Miscellaneous Rough Carpentry for Roof Replacement
- E. Section 072221 – Roof Insulation and Cover Board over Underlayment
- F. Section 072223 – Roof Insulation and Cover Board over Steel and Wood Roof Decks
- G. Section 076202 – Sheet Metal for Built-Up Roofing
- H. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

NOTE TO SPECIFIER

Per discussions between the designer and USPS Project Manager, determine the warranty requirements for the project. Choose from the following warranty options and actions:

1. *If an alternate price for a 20-year "Total System Warranty" is specified, Leave Article 1.3 unchanged.*
2. *If a 20-year "Total System Warranty" will be included in the base proposal, or if no warranty is specified, remove Article 1.3.*

Re-letter/number items after editing.



1.3 ALTERNATES

- A. Provide an alternate price for the 20-Year Total System Warranty described in paragraph 1.9A.

1.4 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
1. American Society for Testing and Materials (ASTM)
 - a. ASTM D 450 - Standard Specification for Coal-Tar Pitch Used in Roofing, Damp proofing, and Waterproofing
 - b. ASTM D 312 - Standard Specification for Asphalt Used in Roofing
 - c. ASTM D 227 - Standard Specification for Coal-Tar-Saturated Organic Felt Used in Roofing and Waterproofing
 - d. ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements
 - e. ASTM D 1668 - Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
 - f. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
 - g. ASTM D 4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free
 - h. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Damp proofing, and Waterproofing
 - i. ASTM D 2824 - Standard Specification for Aluminum-Pigmented Asphalt Roof Coatings, Non-fibered, Asbestos Fibered, and Fibered without Asbestos
 - j. ASTM D 1863 - Standard Specification for Mineral Aggregate Used on Built-Up Roofs
 - k. ASTM D 1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
 2. Factory Mutual Global (FM)
 3. Underwriters Laboratories (UL)
 4. National Roofing Contractors Association (NRCA)
 5. American Society of Civil Engineers (ASCE)
 - a. ASCE 7 Minimum Design Loads of Buildings and Other Structures

1.5 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.6 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and



warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.

- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp. Store roll materials standing on end.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
 - 1. When the outside temperature is forecast to fall below 32°F (°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives and primers should be maintained at a temperature of 50°F (10°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 - 2. When applying hot asphalt, reduce mop lead distance to 2-feet or less.
 - 3. If a minimum asphalt temperature of 420°F (216°C) cannot be maintained at the point of application, discontinue work.
 - 4. Refer to the coal tar pitch roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

**NOTE TO SPECIFIER**

Per discussions between the designer and USPS Project Manager, determine the warranty requirements for the project. Choose from the following warranty options and actions:

1. *If an alternate price for a 20-year "Total System, Non-Pro-Rated Warranty" is specified, do not edit paragraph 1.9A.*
2. *If a 20-year "Total System, Non-Pro-Rated Warranty" will be included in the base proposal, DELETE "an alternate price for" from paragraph 1.9A.*
3. *If no warranty is specified, EDIT the title of Article 1.9 (DELETE the words "MANUFACTURER WARRANTY AND"), and DELETE paragraph 1.9A. The two-year contractor guarantee shall remain in place.*

Re-letter/number paragraphs and sub-paragraphs after editing.

1.9 MANUFACTURER WARRANTY AND CONTRACTOR GUARANTEE

- A. Provide an alternate price for a manufacturer 20-Year Total System, Non-Pro-Rated Warranty (including insulation, roofing membrane, and flashings) covering materials and labor. The warranty shall include the following additional items:
 1. The warranty shall include a wind rider for the design wind speed at the specific project location.
 2. Roofing inspection by a technical representative of the roofing membrane manufacturer 22-24 months after date of Final Acceptance.
 3. Roofing manufacturer will provide unlimited repairs during warranty period with no cost limitation.
 4. Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions.
 5. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Record Built-Up Coal Tar Pitch Roofing Specification Section to Warranty.
- B. The Contractor shall provide a two-year contractor guarantee. At a minimum, the contractor guarantee shall include the following:
 1. Contractor name, address, phone number and project contact name.
 2. The project completion date, and date of guarantee expiration.
 3. The contractor guarantee shall include, in writing, all project work, workmanship, and/or all materials installed by the contractor or subcontractors to be of a quality that will comply with all project specific requirements of the Construction Documents and other documents governing the Work and workmanship through the guarantee period.
 4. The contractor shall investigate roof leaks during the guarantee period within a reasonable time period, but in no instance greater than 24-hours after notification of a leak. The contractor shall repair leaks determined to be the cause of the Work at no cost to the Owner.

PART 2 – PRODUCTS

2.1 BUILT-UP COAL TAR PITCH ROOFING SYSTEM SUMMARY

- A. The complete roofing membrane system assembly shall consist of a built-up, four-ply roof system consisting of the specified coal tar pitch saturated felts identified in paragraph 2.3A set in hot, fluid applications of coal tar pitch. Aggregate surfacing shall be applied to the completed roof membrane.

NOTE TO SPECIFIER

***NOTE:** In high wind areas, such as those with a calculated wind uplift pressure of greater than 45 psf in the roof field, enhancements to the roof system may be required and must be considered by the design*



professional/specifier. Consult with the roofing membrane manufacturer and qualified testing agencies such as FM and Miami-Dade County for further information and guidance related to possible roof system enhancements in high wind areas.

- B. The complete roofing system assembly shall resist uplift pressures calculated according to ASCE 7-05 for the field, perimeters and corners. The specified approval rating must incorporate a safety factor of 2 over the maximum calculated uplift pressure in foot-pound units.
- C. The complete roofing system assembly shall achieve an FM or UL Class A fire rating.

2.2 BITUMEN

- A. Coal-tar pitch: ASTM D 450, Type I.
- B. Asphalt: ASTM D 312, Type III.

2.3 ROOFING FELTS, SHEETS, AND FABRICS

- A. Roofing membrane plies: Felt/sheet meeting ASTM D 227; manufactured by the roofing membrane manufacturer.
- B. Base flashings:
 - 1. Inner ply: Modified bitumen flashing sheet, polyester reinforced, minimum nominal 85 mil thickness; ASTM D 6164, Type I, Grade S.
 - 2. Outer ply: Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, minimum nominal 130 mil thickness; ASTM D 6164, Type I, Grade G.
 - a. Color: White or light gray; as determined by Owner.
- C. For use at roof sump flashings and elsewhere as may be indicated: Asphalt treated woven glass fabric, ASTM D 1668, Type I.
- D. Reinforcing sheet (for curb, wall, and re-entry corner reinforcement): Modified bitumen flashing sheet, polyester reinforced, minimum nominal 85 mil thickness; ASTM D 6164, Type I, Grade S. Product type acceptable to the roofing membrane manufacturer.
- E. For use at temporary overnight tie-ins, at as felt/envelope and bleeder material: Asphalt-saturated organic felt, No. 15, non-perforated, ASTM D 226, Type 1.

2.4 ADHESIVES, CEMENTS, PRIMERS AND COATINGS

- A. Roofing and flashing cement: ASTM D 4586, Type I, (summer grade or winter grade as applicable to season).
- B. Modified bitumen cement (For use at granule surfaced flashing sheets and other locations required by the roofing membrane manufacturer): Product compatible with modified bitumen roofing surfacing flashing sheet and approved by the roofing membrane manufacturer.
- C. Asphalt primer: ASTM D 41.
- D. Aluminum coating (for flashings): Fibrated aluminum coating; ASTM D 2824, Type III. Product type approved by the roofing membrane manufacturer.



2.5 AGGREGATE

- A. Gravel, ASTM D1863, Size No. 67; clean and dry.
- B. Slag, ASTM D 1863, Size No. 67; clean and dry.

2.6 FASTENERS

- A. Roofing membrane and flashing fasteners: Unless otherwise indicated, types as required by the roofing membrane manufacturer.

2.7 MISCELLANEOUS MATERIALS

- A. Walkway pads: Product approved by the roofing manufacturer.
- B. Splashblocks: Concrete; size as necessary to accommodate existing condition.
- C. Pitch pan fill materials:
 - 1. Non-shrink grout (for bottom fill): Quick-set, fast-drying grout; product acceptable to roofing manufacturer.
 - 2. Pourable sealer (for top fill): Two-part pourable elastomeric sealer, product acceptable to roofing manufacturer.
- D. Conduit and pipe supports:
 - 1. For pipes with a diameter up to 6-inches:
 - a. Adjustable prefabricated support such as Pipe Pier 150 manufactured by Pipe Pier Support Systems, Hamel, MN, or approved equal.
 - b. Product approved by the roofing manufacturer for this application.
 - c. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
 - 2. For pipes with a diameter greater than 6-inches:
 - a. Product approved by the roofing manufacturer for this application.
 - b. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
- E. Pre-fabricated plumbing vent pipe extensions:
 - 1. For use where necessary to achieve the 8-inch minimum flashing height:
 - a. Pre-fabricated plumbing vent extensions, such as Tubos Pre-Fabricated Pipe Extension, by Tubos, Inc., Clearwater, FL.
 - b. Product approved by the roofing manufacturer for this application.
 - c. Size and configuration of extension as necessary to match existing pipe diameter, providing the 8-inch minimum flashing height, and allowing for flashing as show on the drawings.
- F. Self-adhering membrane (for use over parapet walls beneath coping caps, and at other locations indicated on the drawings): Product approved for use beneath sheet metal by the membrane manufacturer, and meeting the following criteria:
 - 1. Meeting the requirements of ASTM D 1970.
 - 2. Approved for use as an underlayment for standing seam sheet metal roofing.
 - 3. A 40-mil minimum membrane thickness.
- G. Replacement roof hatch:



1. Roof hatch, such as "Type E" or "Type S", manufactured by The Bilco Company, New Haven, CT, or approved equal.
 - a. Size and configuration as necessary to match existing roof hatch.
 - b. Product approved by the roofing manufacturer for this application.
- H. Extendable ladder-mounted safety post, such as "LadderUP Safety Post", manufactured by The Bilco Company, New Haven, CT, or approved equal.
 1. Size and configuration as necessary to accommodate existing ladder and new roof hatch.
 2. Product approved by the roofing manufacturer for this application.
- I. Acrylic elastomeric coating (for use at roof penetrations and other locations indicated on the project drawings). Product approved for use by the membrane manufacturer for this application, and meeting the following criteria:
 1. Meeting the requirements of ASTM D 6083.
 2. White color.
- J. Rooftop unit support curbs: Product such as "Pate Equipment Supports" manufactured by The Pate Company, Lombard, IL, or approved equal.
 1. Size and configuration as necessary to accommodate existing rooftop unit.
 2. Fabricated from 18 ga. galvanized steel, minimum, with welded seams; and a nominal 2-inch thick nailer affixed atop the curb support.
 3. Fabricated to allow for a minimum flashing height of 8-inches, minimum.
 4. Product approved by the roofing manufacturer for this application.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.

NOTE TO SPECIFIER

Review available field data. For roof areas consisting of an underlying concrete, gypsum concrete or cementitious wood fiber structural deck, include Section 072221 within paragraph 3.1B below. For roof areas consisting of an underlying steel or wood deck, include Section 072223 within paragraph 3.1B below. For projects containing structural deck types applicable to both Sections 072221 and 072223, include both Sections.

- B. Ensure that the insulation and cover board substrate is installed as specified in Sections 072221 and 072223 are suitable to receive roofing membrane materials.

3.2 BITUMEN KETTLE OPERATION

- A. Operator Preparation – Kettle operation requires an individual who is trained in the use of such equipment and use of the kettle requires a designate operator who will remain at the kettle during its use. Under no circumstance shall the kettle be unmanned. Never allow any untrained person to operate the kettle. Kettle temperature shall be recorded a minimum of twice per day.
- B. Kettle operator must be dressed accordingly; including, but not limited to, the following items:
 1. Long-sleeved shirt, buttoned at the cuffs.
 2. Long pants without cuffs.
 3. Gloves snug fitting at the cuffs.
 4. Heavy shoes with high tops.



- C. Site Preparation – The kettle should be located close enough to the building to allow for proper setup of thin-wall tubing. Care must be taken to protect building, by use of tarpaulins. However, be aware of the possible hazards from locating too close, such as splashing of asphalt or the spread of fire.
- D. Avoid locating kettle near openings and air intakes on the building to lessen the effect of fumes on the people inside.
- E. Select a clear, level area with firm ground. Locate kettle away from all flammable materials and away from all electrical lines. Chock wheels front and back when kettle is in operation. Make sure the kettle is level and stable from rocking. Place non-flammable material underneath kettle to protect the ground from spillage. Set up a warning line system around the entire kettle working area. Keep unauthorized people away from the area. If LP fuel is being used, secure the cylinder(s) so that it cannot tip over. Locate cylinder(s) at least ten feet from the burners. Keep all fuel upwind from the kettle and away from open flames. Place asphalt to be used for the day in a location convenient for loading the kettle.
- F. Ground protection (plywood and EPDM membrane) is required at kettle site. Comply with all Local Fire Codes or requirements set forth by Local Fire Marshall.

3.3 BITUMEN FUME CONTROL

- A. The Contractor shall include the cost of providing a fume recovery system such as Fumeguard Asphalt & Pitch Fume Control System as manufactured by the Garlock Equipment Company or approved equal in all projects where coal tar pitch and/or asphalt is specified.
- B. Fumes from paint, adhesives, or any other sources are prohibited from entering the building interior. Contractor must provide proper ventilation and take necessary precautions to prevent fume permeation including covering intake vents, providing and installing carbon filters, arranging for HVAC equipment shut down, or any other necessary means to prevent fumes from entering the building.

3.4 ROOFING MEMBRANE INSTALLATION

- A. Except as may be modified by these specifications and drawings, install roofing membrane in accordance with the requirements and recommendations of the roofing membrane manufacturer, using the manufacturer's current printed instructions.
- B. Chalk lining: Beginning at the low points or drains, chalk line the cover board surface to serve as guides for the proper mopping and laying of the roofing membrane plies.
- C. Felt direction: Install roofing membrane felts perpendicular to the roof slope.
- D. Broom or press each ply into place, full width.
- E. Provide non-perforated asphalt organic felt envelopes at perimeter edges, and metal pitch dams at roof openings, and at other locations required by the roofing membrane manufacturer to prevent coal-tar pitch drippage.
- F. Curb, wall, and re-entry corner reinforcement: Apply one ply of polyester reinforcing sheet over the installed 4-ply membrane in an application of hot coal tar pitch before application of aggregate at these locations. Apply the sheet full-width out from the base of the flashing around rooftop openings and overlap the corners. At wall re-entry corners, install the sheet full-width 8-feet down each side overlapping the corner (or full-length down each side if wall is less than 8 feet in



length).

- G. Install only as much roofing as can be completed in a work day, including flashing and detail work. All installed roofing shall be sealed to a watertight condition prior to leaving the site daily.
- H. Sequence roofing work to eliminate the use of installed roofing as a walkway, or as a storage platform for materials.
- I. Where wheeled or excessive traffic over new or existing roofing work is unavoidable, provide and use 3/4-inch plywood, set over a minimum of two-inch thick rigid board insulation to protect roofing components in place.
- J. Overnight tie-in: Care should be exercised to ensure that water does not flow beneath any completed sections of the roof by temporarily sealing the loose edge of the membrane at the end of each work day and when the weather is threatening. The roofing membrane manufacturer's requirements should be followed closely.
- K. Remove debris from the roof daily prior to leaving the site. Inspect the site at ground level. Remove any roof replacement related debris from the ground.

3.5 BASE FLASHINGS

- A. Curb height: Unless otherwise indicated or not possible due to existing conditions encountered, provide an 8-inch minimum flashing height above the finished roofing surface. Refer to Section 061053 for wood blocking requirements related to raising of rooftop curbs.
- B. Ensure that all flashing substrates are suitable to receive new base flashing materials.
- C. Install base flashings at vertical walls and curbs in accordance with the roofing membrane manufacturer's requirements and recommendations, with the following exceptions/clarifications:
 - 1. Flashing Securement:
 - a. If the flashing substrate is wood or wood nailers are present, secure the flashing top edge with roofing nails and 1-inch metal cap fasteners spaced 6-inches on center, maximum.
 - b. At all other substrates, secure the top edge of flashing with an aluminum anchor bar, secured 12-inches o.c., max., or as recommended by the roofing membrane manufacturer; whichever is less. Refer to Section 076202 for aluminum anchor bar requirements.
 - 2. Flashing stripping: Use woven glass fabric and roofing cement to seal vertical laps and the flashing top edge of the flashing (including anchor bars, if applicable).
 - 3. Flashing and stripping coating: Apply the specified aluminum coating over base flashings and stripping. Apply the coating in accordance with the requirements and recommendations of the roofing membrane manufacturer. Ensure that the surface coating is uniform in color and appearance. Do not apply coating during cold weather, or immediately after the application of stripping. If necessary, allow stripping time to "flash off", as recommended by the coating manufacturer.

NOTE TO SPECIFIER

Hot-air welding of flashing base ply and surfacing ply seams, using a flameless welding machine, is required. Use of torches during roof replacement application is not allowed.

- D. Hot-air welded seams: Using a heat gun, hot-air weld flashing base ply and surfacing ply seams. Do not use torches to hot-air weld seams.

3.6 ROOF SUMP FLASHINGS

- A. Prior to installation of the base ply, install a three-course stripping of woven glass fabric and roofing cement over the cover board/insulation substrate.
- B. Ensure that the roofing membrane plies extend into the roof sump.
- C. Install a three-course stripping of woven glass fabric and roofing cement over the roofing plies.
- D. Install a lead sheet flashing over the roofing plies in the sump; refer to Section 076202. Prime both sides of the lead sheet prior to installation.
- E. Install two plies of woven glass fabric, each ply set in roofing cement, over the lead flashing sheet.
- F. Ensure that the roofing membrane felts, lead flashing sheet, and woven glass fabric flashing plies extend under the clamping ring and into the drain bowl. Tightly secure the clamping ring.
- G. Apply the specified aluminum coating over the roof sump flashings. Apply the coating in accordance with the requirements and recommendations of the coating manufacturer. Ensure that the surface coating is uniform in color and appearance.
- H. Install a roof sump gravel stop as indicated in Section 076202.

3.7 METAL FLASHINGS AND ACCESSORIES

- A. Refer to Section 076202.

3.8 SHEET METAL FLANGE STRIPPINGS

- A. At sheet metal flanges associated with roof sump area gravel stops, tubular penetrations, pitch pans and perimeter edge sheet metal fascia flashings:
 - 1. Prime the top and bottom of the sheet metal flange. Allow the primer time to dry.
 - 2. Set flange in a full bed of roofing cement.
 - 3. Install stripping in accordance with the drawings and the requirements and recommendations of the modified bitumen roofing membrane manufacturer.

3.9 SEALANTS

- A. Refer to Section 079201.

3.10 AGGREGATE SURFACING

- A. Roofing membrane inspection/repair: Repair all fishmouths, wrinkles, ridges, disbanded or dry membrane laps, or any other defects in the new roof membrane in accordance with the recommendations of the roofing membrane manufacturer prior to the aggregate surfacing application.
- B. Aggregate application:



1. Embed aggregate uniformly into a top pour coat of hot and fluid coal-tar pitch applied at a rate not less than 70 pounds per square. Apply gravel at the rate of 400 pounds per square. Apply slag at the rate of 300 pounds per square. Ensure that a minimum of half of the aggregate layer is fully adhered in the top pour coat.

3.11 MISCELLANEOUS INSTALLATIONS/TREATMENTS

- A. Return mechanical ventilator units to their original positions and secure to the existing curbs with EPDM-gasketed screws. Provide a minimum of one fastener on each side of the curb and a minimum of one fastener every 12-inches o.c.
- B. Reconnect all electrical, plumbing, gas line and ventilation connections required to return mechanical units to their original operating condition. Retain a qualified, licensed electrical subcontractor to reconnect electrical equipment. Retain a qualified, licensed mechanical subcontractor to reconnect gas lines and ventilation connections. Coordinate required disconnections and reconnections with the Owner.
- C. Walkway pads: Install walkway pads at locations indicated on drawings. Install the pads in accordance with the requirements and recommendations of the roofing manufacturer. Extend the pads a minimum of 4-inches in all directions beyond wood blocking.
- D. Install splashblocks set on walkpads at locations indicated on the drawings.
- E. Rooftop conduit and pipe supports:
 1. Install adjustable prefabricated pipe supports at rooftop conduit and pipes.
 2. Space pipe supports at intervals recommended by the support manufacturer, as determined by the diameter and weight of the conduit or pipe.
 3. Separate the support from the roof surface by installing the support over roof walkway pads, installed as specified.
- F. Pre-fabricated plumbing vent pipe extensions:
 1. Refer to manufacturer requirements and recommendations for installation.
 2. Prior to flashing installation, seal intersection of pipe extension and existing plumbing vent.
- G. Install self-adhering underlayment beneath coping caps, and at other locations indicated on the drawings.
 1. Refer to manufacturer requirements and recommendations for installation.
- H. Replacement roof hatch installation:
 1. Remove and discard existing roof hatch.
 2. Provide wood nailers beneath roof hatch flanges, if necessary, to match insulation thickness.
 3. Install new roof hatch following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- I. Extendable safety post installation:
 1. Install new safety post following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- J. Application of elastomeric coating to rooftop penetrations:
 1. Prepare substrate in a manner that is acceptable to the coating manufacturer. Substrate preparation includes, but is not limited to: treatment of excessive gaps, repair of damaged or loose sheet metal components, repair of holes, cleaning of roof penetrations,



- treatment of surface rust, treatment of residual asphalt, and priming (if required by the roof coating manufacturer.
 - 2. Coat the indicated penetrations following the recommendations and requirements of the coating manufacturer.
- K. Installation of equipment support curbs:
 - 1. Install support curbs where indicated on the project drawings. Flash curbs into the roof system as indicated on the project drawings.
 - 2. Refer to manufacturer requirements and recommendations for installation.

USPS CSF Specifications issued: 10/1/2013

Last revised: 3/6/2013

NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 51 16 00



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SECTION 07 51 16 00 - CSF BUILT-UP COAL TAR PITCH ROOFING**

NOTE TO SPECIFIER

Editing is needed for each individual project; modify as needed for project specific requirements. Included "NOTE TO SPECIFIER" instructions provide guidance concerning required editing, and options have been included requiring action on the part of the specifier/designer. Select the option appropriate for the project and delete option(s) not selected.

NOTE TO SPECIFIER

EDIT Section footer as necessary to reflect the project name and location, USPS Project number, and required date of the technical specification document. Coordinate this project specific information with the USPS Project Manager. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this section where an aggregate-surfaced, coal tar pitch four-ply roofing membrane is selected as the roofing system.

Per the United States Postal Service Roofing Design Standards, an aggregate-surfaced, coal tar pitch four-ply roofing membrane system is an acceptable roofing system over facilities with a Critical or Non-Critical building designation.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to the installation of an aggregate-surfaced built-up coal tar pitch roofing membrane, including flashings, and related accessories.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 072100 – Thermal Insulation
- D. Section 076200 – Flashings and Trim
- E. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 ALTERNATES

- A. Provide an alternate price for the 20-Year Total System Warranty described in paragraph 1.9A.

1.4 REFERENCES



- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
1. American Society for Testing and Materials (ASTM)
 - a. ASTM D 450 - Standard Specification for Coal-Tar Pitch Used in Roofing, Damp proofing, and Waterproofing
 - b. ASTM D 312 - Standard Specification for Asphalt Used in Roofing
 - c. ASTM D 227 - Standard Specification for Coal-Tar-Saturated Organic Felt Used in Roofing and Waterproofing
 - d. ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements
 - e. ASTM D 1668 - Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
 - f. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
 - g. ASTM D 4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free
 - h. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Damp proofing, and Waterproofing
 - i. ASTM D 2824 - Standard Specification for Aluminum-Pigmented Asphalt Roof Coatings, Non-fibered, Asbestos Fibered, and Fibered without Asbestos
 - j. ASTM D 1863 - Standard Specification for Mineral Aggregate Used on Built-Up Roofs
 - k. ASTM D 1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
 2. Factory Mutual Global (FM)
 3. Underwriters Laboratories (UL)
 4. National Roofing Contractors Association (NRCA)
 5. American Society of Civil Engineers (ASCE)
 - a. ASCE 7 Minimum Design Loads of Buildings and Other Structures

1.5 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.6 QUALITY ASSURANCE PROCEDURES

- A. **Applicator Qualifications:** A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. **Single Source Responsibility:** Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. **Examine the technical specifications and drawings.** Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.

- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp. Store roll materials standing on end.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
 - 1. When the outside temperature is forecast to fall below 32°F (°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives and primers should be maintained at a temperature of 50°F (10°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 - 2. When applying hot asphalt, reduce mop lead distance to 2-feet or less.
 - 3. If a minimum asphalt temperature of 420°F (216°C) cannot be maintained at the point of application, discontinue work.
 - 4. Refer to the coal tar pitch roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

1.9 MANUFACTURER WARRANTY AND CONTRACTOR GUARANTEE

- A. Provide an alternate price for a manufacturer 20-Year Total System, Non-Pro-Rated Warranty (including insulation, roofing membrane, and flashings) covering materials and labor. The warranty shall include the following additional items:
 - 1. The warranty shall include a wind rider for the design wind speed at the specific project location.
 - 2. Roofing inspection by a technical representative of the roofing membrane manufacturer 22-24 months after date of Final Acceptance.



3. Roofing manufacturer will provide unlimited repairs during warranty period with no cost limitation.
 4. Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions.
 5. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Record Built-Up Coal Tar Pitch Roofing Specification Section to Warranty.
- B. The Contractor shall provide a two-year contractor guarantee. At a minimum, the contractor guarantee shall include the following:
1. Contractor name, address, phone number and project contact name.
 2. The project completion date, and date of guarantee expiration.
 3. The contractor guarantee shall include, in writing, all project work, workmanship, and/or all materials installed by the contractor or subcontractors to be of a quality that will comply with all project specific requirements of the Construction Documents and other documents governing the Work and workmanship through the guarantee period.
 4. The contractor shall investigate roof leaks during the guarantee period within a reasonable time period, but in no instance greater than 24-hours after notification of a leak. The contractor shall repair leaks determined to be the cause of the Work at no cost to the Owner.

PART 2 – PRODUCTS

2.1 BUILT-UP COAL TAR PITCH ROOFING SYSTEM SUMMARY

- A. The complete roofing membrane system assembly shall consist of a built-up, four-ply roof system consisting of the specified coal tar pitch saturated felts identified in paragraph 2.3A set in hot, fluid applications of coal tar pitch. Aggregate surfacing shall be applied to the completed roof membrane.

NOTE TO SPECIFIER

NOTE: In high wind areas, such as those with a calculated wind uplift pressure of greater than 45 psf in the roof field, enhancements to the roof system may be required and must be considered by the design professional/specifier. Consult with the roofing membrane manufacturer and qualified testing agencies for further information and guidance related to possible roof system enhancements in high wind areas.

- B. The complete roofing system assembly shall resist uplift pressures calculated according to ASCE 7-05 for the field, perimeters and corners. The specified approval rating must incorporate a safety factor of 2 over the maximum calculated uplift pressure in foot-pound units.
- C. The complete roofing system assembly shall achieve an FM or UL Class A fire rating.

2.2 BITUMEN

- A. Coal-tar pitch: ASTM D 450, Type I.
- B. Asphalt: ASTM D 312, Type III.

2.3 ROOFING FELTS, SHEETS, AND FABRICS

- A. Roofing membrane plies: Felt/sheet meeting ASTM D 227; manufactured by the roofing membrane manufacturer.



- B. Base flashings:
 - 1. Inner ply: Modified bitumen flashing sheet, polyester reinforced, minimum nominal 85 mil thickness; ASTM D 6164, Type I, Grade S.
 - 2. Outer ply: Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, minimum nominal 130 mil thickness; ASTM D 6164, Type I, Grade G.
 - a. Color: White or light gray; as determined by Owner.
- C. For use at roof sump flashings and elsewhere as may be indicated: Asphalt treated woven glass fabric, ASTM D 1668, Type I.
- D. Reinforcing sheet (for curb, wall, and re-entry corner reinforcement): Modified bitumen flashing sheet, polyester reinforced, minimum nominal 85 mil thickness; ASTM D 6164, Type I, Grade S. Product type acceptable to the roofing membrane manufacturer.
- E. For use at temporary overnight tie-ins, at as felt/envelope and bleeder material: Asphalt-saturated organic felt, No. 15, non-perforated, ASTM D 226, Type 1.

2.4 ADHESIVES, CEMENTS, PRIMERS AND COATINGS

- A. Roofing and flashing cement: ASTM D 4586, Type I, (summer grade or winter grade as applicable to season).
- B. Modified bitumen cement (For use at granule surfaced flashing sheets and other locations required by the roofing membrane manufacturer): Product compatible with modified bitumen roofing surfacing flashing sheet and approved by the roofing membrane manufacturer.
- C. Asphalt primer: ASTM D 41.
- D. Aluminum coating (for flashings): Fibrated aluminum coating; ASTM D 2824, Type III. Product type approved by the roofing membrane manufacturer.

2.5 AGGREGATE

- A. Gravel, ASTM D1863, Size No. 67; clean and dry.
- B. Slag, ASTM D 1863, Size No. 67; clean and dry.

2.6 FASTENERS

- A. Roofing membrane and flashing fasteners: Unless otherwise indicated, types as required by the roofing membrane manufacturer.

NOTE TO SPECIFIER

EDIT items in Article 2.7 to reflect actual project conditions and requirements. Re-letter/number paragraphs and sub-paragraphs after editing.

2.7 MISCELLANEOUS MATERIALS

- A. Walkway pads: Product approved by the roofing manufacturer.



- B. Splashblocks: Concrete; size as necessary to accommodate existing condition.
- C. Pitch pan fill materials:
 - 1. Non-shrink grout (for bottom fill): Quick-set, fast-drying grout; product acceptable to roofing manufacturer.
 - 2. Pourable sealer (for top fill): Two-part pourable elastomeric sealer, product acceptable to roofing manufacturer.
- D. Conduit and pipe supports:
 - 1. For pipes with a diameter up to 6-inches:
 - a. Adjustable prefabricated support such as Pipe Pier 150 manufactured by Pipe Pier Support Systems, Hamel, MN, or approved equal.
 - b. Product approved by the roofing manufacturer for this application.
 - c. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
 - 2. For pipes with a diameter greater than 6-inches:
 - a. Product approved by the roofing manufacturer for this application.
 - b. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
- E. Self-adhering membrane (for use over parapet walls beneath coping caps, and at other locations indicated on the drawings): Product approved for use beneath sheet metal by the membrane manufacturer, and meeting the following criteria:
 - 1. Meeting the requirements of ASTM D 1970.
 - 2. Approved for use as an underlayment for standing seam sheet metal roofing.
 - 3. A 40-mil minimum membrane thickness.
- F. Roof hatch:
 - 1. Roof hatch, such as "Type E" or "Type S", manufactured by The Bilco Company, New Haven, CT, or approved equal.
 - a. Size and configuration as necessary.
 - b. Product approved by the roofing manufacturer for this application.
- G. Extendable ladder-mounted safety post, such as "LadderUP Safety Post", manufactured by The Bilco Company, New Haven, CT, or approved equal.
 - 1. Size and configuration as necessary to accommodate new roof hatch.
 - 2. Product approved by the roofing manufacturer for this application.
- H. Acrylic elastomeric coating (for use at roof penetrations and other locations indicated on the project drawings). Product approved for use by the membrane manufacturer for this application, and meeting the following criteria:
 - 1. Meeting the requirements of ASTM D 6083.
 - 2. White color.
- I. Rooftop unit support curbs: Product such as "Pate Equipment Supports" manufactured by The Pate Company, Lombard, IL, or approved equal.
 - 1. Size and configuration as necessary to accommodate rooftop unit.
 - 2. Fabricated from 18 ga. galvanized steel, minimum, with welded seams; and a nominal 2-inch thick nailer affixed atop the curb support.
 - 3. Fabricated to allow for a minimum flashing height of 8-inches, minimum.
 - 4. Product approved by the roofing manufacturer for this application.

PART 3 - EXECUTION



3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.

NOTE TO SPECIFIER

Review available field data. Edit required Section references based on existing structural deck types present on the project.

- B. Ensure that the insulation and cover board substrate is installed as specified in Sections 072221, 072222 and 072223 are suitable to receive roofing membrane materials.

3.2 BITUMEN KETTLE OPERATION

- A. Operator Preparation – Kettle operation requires an individual who is trained in the use of such equipment and use of the kettle requires a designate operator who will remain at the kettle during its use. Under no circumstance shall the kettle be unmanned. Never allow any untrained person to operate the kettle. Kettle temperature shall be recorded a minimum of twice per day.
- B. Kettle operator must be dressed accordingly; including, but not limited to, the following items:
1. Long-sleeved shirt, buttoned at the cuffs.
 2. Long pants without cuffs.
 3. Gloves snug fitting at the cuffs.
 4. Heavy shoes with high tops.
- C. Site Preparation – The kettle should be located close enough to the building to allow for proper setup of thin-wall tubing. Care must be taken to protect building, by use of tarpaulins. However, be aware of the possible hazards from locating too close, such as splashing of asphalt or the spread of fire.
- D. Avoid locating kettle near openings and air intakes on the building to lessen the effect of fumes on the people inside.
- E. Select a clear, level area with firm ground. Locate kettle away from all flammable materials and away from all electrical lines. Chock wheels front and back when kettle is in operation. Make sure the kettle is level and stable from rocking. Place non-flammable material underneath kettle to protect the ground from spillage. Set up a warning line system around the entire kettle working area. Keep unauthorized people away from the area. If LP fuel is being used, secure the cylinder(s) so that it cannot tip over. Locate cylinder(s) at least ten feet from the burners. Keep all fuel upwind from the kettle and away from open flames. Place asphalt to be used for the day in a location convenient for loading the kettle.
- F. Ground protection (plywood and EPDM membrane) is required at kettle site. Comply with all Local Fire Codes or requirements set forth by Local Fire Marshall.

3.3 BITUMEN FUME CONTROL

- A. The Contractor shall include the cost of providing a fume recovery system such as Fumeguard Asphalt & Pitch Fume Control System as manufactured by the Garlock Equipment Company or approved equal in all projects where coal tar pitch and/or asphalt is specified.
- B. Fumes from paint, adhesives, or any other sources are prohibited from entering the building interior. Contractor must provide proper ventilation and take necessary precautions to prevent



fume permeation including covering intake vents, providing and installing carbon filters, arranging for HVAC equipment shut down, or any other necessary means to prevent fumes from entering the building.

3.4 ROOFING MEMBRANE INSTALLATION

- A. Except as may be modified by these specifications and drawings, install roofing membrane in accordance with the requirements and recommendations of the roofing membrane manufacturer, using the manufacturer's current printed instructions.
- B. Chalk lining: Beginning at the low points or drains, chalk line the cover board surface to serve as guides for the proper mopping and laying of the roofing membrane plies.
- C. Felt direction: Install roofing membrane felts perpendicular to the roof slope.
- D. Broom or press each ply into place, full width.
- E. Provide non-perforated asphalt organic felt envelopes at perimeter edges, and metal pitch dams at roof openings, and at other locations required by the roofing membrane manufacturer to prevent coal-tar pitch drippage.
- F. Curb, wall, and re-entry corner reinforcement: Apply one ply of polyester reinforcing sheet over the installed 4-ply membrane in an application of hot coal tar pitch before application of aggregate at these locations. Apply the sheet full-width out from the base of the flashing around rooftop openings and overlap the corners. At wall re-entry corners, install the sheet full-width 8-feet down each side overlapping the corner (or full-length down each side if wall is less than 8 feet in length).
- G. Install only as much roofing as can be completed in a work day, including flashing and detail work. All installed roofing shall be sealed to a watertight condition prior to leaving the site daily.
- H. Sequence roofing work to eliminate the use of installed roofing as a walkway, or as a storage platform for materials.
- I. Where wheeled or excessive traffic over new or existing roofing work is unavoidable, provide and use 3/4-inch plywood, set over a minimum of two-inch thick rigid board insulation to protect roofing components in place.
- J. Overnight tie-in: Care should be exercised to ensure that water does not flow beneath any completed sections of the roof by temporarily sealing the loose edge of the membrane at the end of each work day and when the weather is threatening. The roofing membrane manufacturer's requirements should be followed closely.
- K. Remove debris from the roof daily prior to leaving the site. Inspect the site at ground level. Remove any roof replacement related debris from the ground.

3.5 BASE FLASHINGS

- A. Curb height: Unless otherwise indicated provide an 8-inch minimum flashing height above the finished roofing surface. Refer to Section 061053 for wood blocking requirements related to raising of rooftop curbs.
- B. Ensure that all flashing substrates are suitable to receive new base flashing materials.

- C. Install base flashings at vertical walls and curbs in accordance with the roofing membrane manufacturer's requirements and recommendations, with the following exceptions/clarifications:
1. Flashing Securement:
 - a. If the flashing substrate is wood or wood nailers are present, secure the flashing top edge with roofing nails and 1-inch metal cap fasteners spaced 6-inches on center, maximum.
 - b. At all other substrates, secure the top edge of flashing with an aluminum anchor bar, secured 12-inches o.c., max., or as recommended by the roofing membrane manufacturer; whichever is less. Refer to Section 076202 for aluminum anchor bar requirements.
 2. Flashing stripping: Use woven glass fabric and roofing cement to seal vertical laps and the flashing top edge of the flashing (including anchor bars, if applicable).
 3. Flashing and stripping coating: Apply the specified aluminum coating over base flashings and stripping. Apply the coating in accordance with the requirements and recommendations of the roofing membrane manufacturer. Ensure that the surface coating is uniform in color and appearance. Do not apply coating during cold weather, or immediately after the application of stripping. If necessary, allow stripping time to "flash off", as recommended by the coating manufacturer.

NOTE TO SPECIFIER

Hot-air welding of flashing base ply and surfacing ply seams, using a flameless welding machine, is required.

- D. Hot-air welded seams: Using a heat gun, hot-air weld flashing base ply and surfacing ply seams. Do not use torches to hot-air weld seams.

3.6 ROOF SUMP FLASHINGS

- A. Prior to installation of the base ply, install a three-course stripping of woven glass fabric and roofing cement over the cover board/insulation substrate.
- B. Ensure that the roofing membrane plies extend into the roof sump.
- C. Install a three-course stripping of woven glass fabric and roofing cement over the roofing plies.
- D. Install a lead sheet flashing over the roofing plies in the sump; refer to Section 076202. Prime both sides of the lead sheet prior to installation.
- E. Install two plies of woven glass fabric, each ply set in roofing cement, over the lead flashing sheet.
- F. Ensure that the roofing membrane felts, lead flashing sheet, and woven glass fabric flashing plies extend under the clamping ring and into the drain bowl. Tightly secure the clamping ring.
- G. Apply the specified aluminum coating over the roof sump flashings. Apply the coating in accordance with the requirements and recommendations of the coating manufacturer. Ensure that the surface coating is uniform in color and appearance.
- H. Install a roof sump gravel stop as indicated in Section 076202.

3.7 METAL FLASHINGS AND ACCESSORIES

- A. Refer to Section 076202.

3.8 SHEET METAL FLANGE STRIPPINGS

- A. At sheet metal flanges associated with roof sump area gravel stops, tubular penetrations, pitch pans and perimeter edge sheet metal fascia flashings:
1. Prime the top and bottom of the sheet metal flange. Allow the primer time to dry.
 2. Set flange in a full bed of roofing cement.
 3. Install stripping in accordance with the drawings and the requirements and recommendations of the modified bitumen roofing membrane manufacturer.

3.9 SEALANTS

- A. Refer to Section 079201.

3.10 AGGREGATE SURFACING

- A. Roofing membrane inspection/repair: Repair all fishmouths, wrinkles, ridges, disbanded or dry membrane laps, or any other defects in the new roof membrane in accordance with the recommendations of the roofing membrane manufacturer prior to the aggregate surfacing application.
- B. Aggregate application:
1. Embed aggregate uniformly into a top pour coat of hot and fluid coal-tar pitch applied at a rate not less than 70 pounds per square. Apply gravel at the rate of 400 pounds per square. Apply slag at the rate of 300 pounds per square. Ensure that a minimum of half of the aggregate layer is fully adhered in the top pour coat.

NOTE TO SPECIFIER

EDIT items in Article 3.11 to reflect actual project conditions and requirements. Re-letter/number paragraphs and sub-paragraphs after editing.

3.11 MISCELLANEOUS INSTALLATIONS/TREATMENTS

- A. Install mechanical ventilator units in position and secure to the existing curbs with EPDM-gasketed screws. Provide a minimum of one fastener on each side of the curb and a minimum of one fastener every 12-inches o.c.
- B. Connect all electrical, plumbing, gas line and ventilation connections required for mechanical units. Retain a qualified, licensed electrical subcontractor to connect electrical equipment. Retain a qualified, licensed mechanical subcontractor to connect gas lines and ventilation connections.
- C. Walkway pads: Install walkway pads at locations indicated on drawings. Install the pads in accordance with the requirements and recommendations of the roofing manufacturer. Extend the pads a minimum of 4-inches in all directions beyond wood blocking.
- D. Install splashblocks set on walkpads at locations indicated on the drawings.
- E. Rooftop conduit and pipe supports:
1. Install adjustable prefabricated pipe supports at rooftop conduit and pipes.



2. Space pipe supports at intervals recommended by the support manufacturer, as determined by the diameter and weight of the conduit or pipe.
 3. Separate the support from the roof surface by installing the support over roof walkway pads, installed as specified.
- F. Install self-adhering underlayment beneath coping caps, and at other locations indicated on the drawings.
1. Refer to manufacturer requirements and recommendations for installation.
- G. Replacement roof hatch installation:
1. Provide wood nailers beneath roof hatch flanges, if necessary, to match insulation thickness.
 2. Install new roof hatch following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- H. Extendable safety post installation:
1. Install new safety post following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- I. Application of elastomeric coating to rooftop penetrations:
1. Prepare substrate in a manner that is acceptable to the coating manufacturer. Substrate preparation includes, but is not limited to: treatment of excessive gaps, repair of damaged or loose sheet metal components, repair of holes, cleaning of roof penetrations, treatment of surface rust, treatment of residual asphalt, and priming (if required by the roof coating manufacturer).
 2. Coat the indicated penetrations following the recommendations and requirements of the coating manufacturer.
- J. Installation of equipment support curbs:
1. Install support curbs where indicated on the project drawings. Flash curbs into the roof system as indicated on the project drawings.
 2. Refer to manufacturer requirements and recommendations for installation.

USPS CSF Specifications, issued: 10/1/2013
Last revised: 9/16/2013

NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 51 16 00



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SECTION 07 51 16 00 - MPF BUILT-UP COAL TAR PITCH ROOFING**

NOTE TO SPECIFIER

Editing is needed for each individual project; modify as needed for project specific requirements. Included "NOTE TO SPECIFIER" instructions provide guidance concerning required editing, and options have been included requiring action on the part of the specifier/designer. Select the option appropriate for the project and delete option(s) not selected.

NOTE TO SPECIFIER

EDIT Section footer as necessary to reflect the project name and location, USPS Project number, and required date of the technical specification document. Coordinate this project specific information with the USPS Project Manager. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this section where an aggregate-surfaced, coal tar pitch four-ply roofing membrane is selected as the roofing system.

Per the United States Postal Service Roofing Design Standards, an aggregate-surfaced, coal tar pitch four-ply roofing membrane system is an acceptable roofing system over facilities with a Critical or Non-Critical building designation.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to the installation of an aggregate-surfaced built-up coal tar pitch roofing membrane, including flashings, and related accessories.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 072100 – Thermal Insulation
- D. Section 076200 – Flashings and Trim
- E. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 ALTERNATES

- A. Provide an alternate price for the 20-Year Total System Warranty described in paragraph 1.9A.

1.4 REFERENCES



- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
1. American Society for Testing and Materials (ASTM)
 - a. ASTM D 450 - Standard Specification for Coal-Tar Pitch Used in Roofing, Damp proofing, and Waterproofing
 - b. ASTM D 312 - Standard Specification for Asphalt Used in Roofing
 - c. ASTM D 227 - Standard Specification for Coal-Tar-Saturated Organic Felt Used in Roofing and Waterproofing
 - d. ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements
 - e. ASTM D 1668 - Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
 - f. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
 - g. ASTM D 4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free
 - h. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Damp proofing, and Waterproofing
 - i. ASTM D 2824 - Standard Specification for Aluminum-Pigmented Asphalt Roof Coatings, Non-fibered, Asbestos Fibered, and Fibered without Asbestos
 - j. ASTM D 1863 - Standard Specification for Mineral Aggregate Used on Built-Up Roofs
 - k. ASTM D 1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
 2. Factory Mutual Global (FM)
 3. Underwriters Laboratories (UL)
 4. National Roofing Contractors Association (NRCA)
 5. American Society of Civil Engineers (ASCE)
 - a. ASCE 7 Minimum Design Loads of Buildings and Other Structures

1.5 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.6 QUALITY ASSURANCE PROCEDURES

- A. **Applicator Qualifications:** A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. **Single Source Responsibility:** Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. **Examine the technical specifications and drawings.** Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.

- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp. Store roll materials standing on end.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
 - 1. When the outside temperature is forecast to fall below 32°F (°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives and primers should be maintained at a temperature of 50°F (10°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 - 2. When applying hot asphalt, reduce mop lead distance to 2-feet or less.
 - 3. If a minimum asphalt temperature of 420°F (216°C) cannot be maintained at the point of application, discontinue work.
 - 4. Refer to the coal tar pitch roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

1.9 MANUFACTURER WARRANTY AND CONTRACTOR GUARANTEE

- A. Provide an alternate price for a manufacturer 20-Year Total System, Non-Pro-Rated Warranty (including insulation, roofing membrane, and flashings) covering materials and labor. The warranty shall include the following additional items:
 - 1. The warranty shall include a wind rider for the design wind speed at the specific project location.
 - 2. Roofing inspection by a technical representative of the roofing membrane manufacturer 22-24 months after date of Final Acceptance.



3. Roofing manufacturer will provide unlimited repairs during warranty period with no cost limitation.
 4. Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions.
 5. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Record Built-Up Coal Tar Pitch Roofing Specification Section to Warranty.
- B. The Contractor shall provide a two-year contractor guarantee. At a minimum, the contractor guarantee shall include the following:
1. Contractor name, address, phone number and project contact name.
 2. The project completion date, and date of guarantee expiration.
 3. The contractor guarantee shall include, in writing, all project work, workmanship, and/or all materials installed by the contractor or subcontractors to be of a quality that will comply with all project specific requirements of the Construction Documents and other documents governing the Work and workmanship through the guarantee period.
 4. The contractor shall investigate roof leaks during the guarantee period within a reasonable time period, but in no instance greater than 24-hours after notification of a leak. The contractor shall repair leaks determined to be the cause of the Work at no cost to the Owner.

PART 2 – PRODUCTS

2.1 BUILT-UP COAL TAR PITCH ROOFING SYSTEM SUMMARY

- A. The complete roofing membrane system assembly shall consist of a built-up, four-ply roof system consisting of the specified coal tar pitch saturated felts identified in paragraph 2.3A set in hot, fluid applications of coal tar pitch. Aggregate surfacing shall be applied to the completed roof membrane.

NOTE TO SPECIFIER

***NOTE:** In high wind areas, such as those with a calculated wind uplift pressure of greater than 45 psf in the roof field, enhancements to the roof system may be required and must be considered by the design professional/specifier. Consult with the roofing membrane manufacturer and qualified testing agencies for further information and guidance related to possible roof system enhancements in high wind areas.*

- B. The complete roofing system assembly shall resist uplift pressures calculated according to ASCE 7-05 for the field, perimeters and corners. The specified approval rating must incorporate a safety factor of 2 over the maximum calculated uplift pressure in foot-pound units.
- C. The complete roofing system assembly shall achieve an FM or UL Class A fire rating.

2.2 BITUMEN

- A. Coal-tar pitch: ASTM D 450, Type I.
- B. Asphalt: ASTM D 312, Type III.

2.3 ROOFING FELTS, SHEETS, AND FABRICS

- A. Roofing membrane plies: Felt/sheet meeting ASTM D 227; manufactured by the roofing membrane manufacturer.



- B. Base flashings:
 - 1. Inner ply: Modified bitumen flashing sheet, polyester reinforced, minimum nominal 85 mil thickness; ASTM D 6164, Type I, Grade S.
 - 2. Outer ply: Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, minimum nominal 130 mil thickness; ASTM D 6164, Type I, Grade G.
 - a. Color: White or light gray; as determined by Owner.
- C. For use at roof sump flashings and elsewhere as may be indicated: Asphalt treated woven glass fabric, ASTM D 1668, Type I.
- D. Reinforcing sheet (for curb, wall, and re-entry corner reinforcement): Modified bitumen flashing sheet, polyester reinforced, minimum nominal 85 mil thickness; ASTM D 6164, Type I, Grade S. Product type acceptable to the roofing membrane manufacturer.
- E. For use at temporary overnight tie-ins, at as felt/envelope and bleeder material: Asphalt-saturated organic felt, No. 15, non-perforated, ASTM D 226, Type 1.

2.4 ADHESIVES, CEMENTS, PRIMERS AND COATINGS

- A. Roofing and flashing cement: ASTM D 4586, Type I, (summer grade or winter grade as applicable to season).
- B. Modified bitumen cement (For use at granule surfaced flashing sheets and other locations required by the roofing membrane manufacturer): Product compatible with modified bitumen roofing surfacing flashing sheet and approved by the roofing membrane manufacturer.
- C. Asphalt primer: ASTM D 41.
- D. Aluminum coating (for flashings): Fibrated aluminum coating; ASTM D 2824, Type III. Product type approved by the roofing membrane manufacturer.

2.5 AGGREGATE

- A. Gravel, ASTM D1863, Size No. 67; clean and dry.
- B. Slag, ASTM D 1863, Size No. 67; clean and dry.

2.6 FASTENERS

- A. Roofing membrane and flashing fasteners: Unless otherwise indicated, types as required by the roofing membrane manufacturer.

NOTE TO SPECIFIER

EDIT items in Article 2.7 to reflect actual project conditions and requirements. Re-letter/number paragraphs and sub-paragraphs after editing.

2.7 MISCELLANEOUS MATERIALS

- A. Walkway pads: Product approved by the roofing manufacturer.



- B. Splashblocks: Concrete; size as necessary to accommodate existing condition.
- C. Pitch pan fill materials:
 - 1. Non-shrink grout (for bottom fill): Quick-set, fast-drying grout; product acceptable to roofing manufacturer.
 - 2. Pourable sealer (for top fill): Two-part pourable elastomeric sealer, product acceptable to roofing manufacturer.
- D. Conduit and pipe supports:
 - 1. For pipes with a diameter up to 6-inches:
 - a. Adjustable prefabricated support such as Pipe Pier 150 manufactured by Pipe Pier Support Systems, Hamel, MN, or approved equal.
 - b. Product approved by the roofing manufacturer for this application.
 - c. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
 - 2. For pipes with a diameter greater than 6-inches:
 - a. Product approved by the roofing manufacturer for this application.
 - b. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
- E. Self-adhering membrane (for use over parapet walls beneath coping caps, and at other locations indicated on the drawings): Product approved for use beneath sheet metal by the membrane manufacturer, and meeting the following criteria:
 - 1. Meeting the requirements of ASTM D 1970.
 - 2. Approved for use as an underlayment for standing seam sheet metal roofing.
 - 3. A 40-mil minimum membrane thickness.
- F. Roof hatch:
 - 1. Roof hatch, such as "Type E" or "Type S", manufactured by The Bilco Company, New Haven, CT, or approved equal.
 - a. Size and configuration as necessary.
 - b. Product approved by the roofing manufacturer for this application.
- G. Extendable ladder-mounted safety post, such as "LadderUP Safety Post", manufactured by The Bilco Company, New Haven, CT, or approved equal.
 - 1. Size and configuration as necessary to accommodate new roof hatch.
 - 2. Product approved by the roofing manufacturer for this application.
- H. Acrylic elastomeric coating (for use at roof penetrations and other locations indicated on the project drawings). Product approved for use by the membrane manufacturer for this application, and meeting the following criteria:
 - 1. Meeting the requirements of ASTM D 6083.
 - 2. White color.
- I. Rooftop unit support curbs: Product such as "Pate Equipment Supports" manufactured by The Pate Company, Lombard, IL, or approved equal.
 - 1. Size and configuration as necessary to accommodate rooftop unit.
 - 2. Fabricated from 18 ga. galvanized steel, minimum, with welded seams; and a nominal 2-inch thick nailer affixed atop the curb support.
 - 3. Fabricated to allow for a minimum flashing height of 8-inches, minimum.
 - 4. Product approved by the roofing manufacturer for this application.

PART 3 - EXECUTION



3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.

NOTE TO SPECIFIER

Review available field data. Edit required Section references based on existing structural deck types present on the project.

- B. Ensure that the insulation and cover board substrate is installed as specified in Sections 072221, 072222 and 072223 are suitable to receive roofing membrane materials.

3.2 BITUMEN KETTLE OPERATION

- A. Operator Preparation – Kettle operation requires an individual who is trained in the use of such equipment and use of the kettle requires a designate operator who will remain at the kettle during its use. Under no circumstance shall the kettle be unmanned. Never allow any untrained person to operate the kettle. Kettle temperature shall be recorded a minimum of twice per day.
- B. Kettle operator must be dressed accordingly; including, but not limited to, the following items:
1. Long-sleeved shirt, buttoned at the cuffs.
 2. Long pants without cuffs.
 3. Gloves snug fitting at the cuffs.
 4. Heavy shoes with high tops.
- C. Site Preparation – The kettle should be located close enough to the building to allow for proper setup of thin-wall tubing. Care must be taken to protect building, by use of tarpaulins. However, be aware of the possible hazards from locating too close, such as splashing of asphalt or the spread of fire.
- D. Avoid locating kettle near openings and air intakes on the building to lessen the effect of fumes on the people inside.
- E. Select a clear, level area with firm ground. Locate kettle away from all flammable materials and away from all electrical lines. Chock wheels front and back when kettle is in operation. Make sure the kettle is level and stable from rocking. Place non-flammable material underneath kettle to protect the ground from spillage. Set up a warning line system around the entire kettle working area. Keep unauthorized people away from the area. If LP fuel is being used, secure the cylinder(s) so that it cannot tip over. Locate cylinder(s) at least ten feet from the burners. Keep all fuel upwind from the kettle and away from open flames. Place asphalt to be used for the day in a location convenient for loading the kettle.
- F. Ground protection (plywood and EPDM membrane) is required at kettle site. Comply with all Local Fire Codes or requirements set forth by Local Fire Marshall.

3.3 BITUMEN FUME CONTROL

- A. The Contractor shall include the cost of providing a fume recovery system such as Fumeguard Asphalt & Pitch Fume Control System as manufactured by the Garlock Equipment Company or approved equal in all projects where coal tar pitch and/or asphalt is specified.
- B. Fumes from paint, adhesives, or any other sources are prohibited from entering the building interior. Contractor must provide proper ventilation and take necessary precautions to prevent



fume permeation including covering intake vents, providing and installing carbon filters, arranging for HVAC equipment shut down, or any other necessary means to prevent fumes from entering the building.

3.4 ROOFING MEMBRANE INSTALLATION

- A. Except as may be modified by these specifications and drawings, install roofing membrane in accordance with the requirements and recommendations of the roofing membrane manufacturer, using the manufacturer's current printed instructions.
- B. Chalk lining: Beginning at the low points or drains, chalk line the cover board surface to serve as guides for the proper mopping and laying of the roofing membrane plies.
- C. Felt direction: Install roofing membrane felts perpendicular to the roof slope.
- D. Broom or press each ply into place, full width.
- E. Provide non-perforated asphalt organic felt envelopes at perimeter edges, and metal pitch dams at roof openings, and at other locations required by the roofing membrane manufacturer to prevent coal-tar pitch drippage.
- F. Curb, wall, and re-entry corner reinforcement: Apply one ply of polyester reinforcing sheet over the installed 4-ply membrane in an application of hot coal tar pitch before application of aggregate at these locations. Apply the sheet full-width out from the base of the flashing around rooftop openings and overlap the corners. At wall re-entry corners, install the sheet full-width 8-feet down each side overlapping the corner (or full-length down each side if wall is less than 8 feet in length).
- G. Install only as much roofing as can be completed in a work day, including flashing and detail work. All installed roofing shall be sealed to a watertight condition prior to leaving the site daily.
- H. Sequence roofing work to eliminate the use of installed roofing as a walkway, or as a storage platform for materials.
- I. Where wheeled or excessive traffic over new or existing roofing work is unavoidable, provide and use 3/4-inch plywood, set over a minimum of two-inch thick rigid board insulation to protect roofing components in place.
- J. Overnight tie-in: Care should be exercised to ensure that water does not flow beneath any completed sections of the roof by temporarily sealing the loose edge of the membrane at the end of each work day and when the weather is threatening. The roofing membrane manufacturer's requirements should be followed closely.
- K. Remove debris from the roof daily prior to leaving the site. Inspect the site at ground level. Remove any roof replacement related debris from the ground.

3.5 BASE FLASHINGS

- A. Curb height: Unless otherwise indicated provide an 8-inch minimum flashing height above the finished roofing surface. Refer to Section 061053 for wood blocking requirements related to raising of rooftop curbs.
- B. Ensure that all flashing substrates are suitable to receive new base flashing materials.

- C. Install base flashings at vertical walls and curbs in accordance with the roofing membrane manufacturer's requirements and recommendations, with the following exceptions/clarifications:
1. Flashing Securement:
 - a. If the flashing substrate is wood or wood nailers are present, secure the flashing top edge with roofing nails and 1-inch metal cap fasteners spaced 6-inches on center, maximum.
 - b. At all other substrates, secure the top edge of flashing with an aluminum anchor bar, secured 12-inches o.c., max., or as recommended by the roofing membrane manufacturer; whichever is less. Refer to Section 076202 for aluminum anchor bar requirements.
 2. Flashing stripping: Use woven glass fabric and roofing cement to seal vertical laps and the flashing top edge of the flashing (including anchor bars, if applicable).
 3. Flashing and stripping coating: Apply the specified aluminum coating over base flashings and stripping. Apply the coating in accordance with the requirements and recommendations of the roofing membrane manufacturer. Ensure that the surface coating is uniform in color and appearance. Do not apply coating during cold weather, or immediately after the application of stripping. If necessary, allow stripping time to "flash off", as recommended by the coating manufacturer.

NOTE TO SPECIFIER

Hot-air welding of flashing base ply and surfacing ply seams, using a flameless welding machine, is required.

- D. Hot-air welded seams: Using a heat gun, hot-air weld flashing base ply and surfacing ply seams. Do not use torches to hot-air weld seams.

3.6 ROOF SUMP FLASHINGS

- A. Prior to installation of the base ply, install a three-course stripping of woven glass fabric and roofing cement over the cover board/insulation substrate.
- B. Ensure that the roofing membrane plies extend into the roof sump.
- C. Install a three-course stripping of woven glass fabric and roofing cement over the roofing plies.
- D. Install a lead sheet flashing over the roofing plies in the sump; refer to Section 076202. Prime both sides of the lead sheet prior to installation.
- E. Install two plies of woven glass fabric, each ply set in roofing cement, over the lead flashing sheet.
- F. Ensure that the roofing membrane felts, lead flashing sheet, and woven glass fabric flashing plies extend under the clamping ring and into the drain bowl. Tightly secure the clamping ring.
- G. Apply the specified aluminum coating over the roof sump flashings. Apply the coating in accordance with the requirements and recommendations of the coating manufacturer. Ensure that the surface coating is uniform in color and appearance.
- H. Install a roof sump gravel stop as indicated in Section 076202.

3.7 METAL FLASHINGS AND ACCESSORIES

- A. Refer to Section 076202.



3.8 SHEET METAL FLANGE STRIPPINGS

- A. At sheet metal flanges associated with roof sump area gravel stops, tubular penetrations, pitch pans and perimeter edge sheet metal fascia flashings:
 1. Prime the top and bottom of the sheet metal flange. Allow the primer time to dry.
 2. Set flange in a full bed of roofing cement.
 3. Install stripping in accordance with the drawings and the requirements and recommendations of the modified bitumen roofing membrane manufacturer.

3.9 SEALANTS

- A. Refer to Section 079201.

3.10 AGGREGATE SURFACING

- A. Roofing membrane inspection/repair: Repair all fishmouths, wrinkles, ridges, disbanded or dry membrane laps, or any other defects in the new roof membrane in accordance with the recommendations of the roofing membrane manufacturer prior to the aggregate surfacing application.
- B. Aggregate application:
 1. Embed aggregate uniformly into a top pour coat of hot and fluid coal-tar pitch applied at a rate not less than 70 pounds per square. Apply gravel at the rate of 400 pounds per square. Apply slag at the rate of 300 pounds per square. Ensure that a minimum of half of the aggregate layer is fully adhered in the top pour coat.

NOTE TO SPECIFIER

EDIT items in Article 3.11 to reflect actual project conditions and requirements. Re-letter/number paragraphs and sub-paragraphs after editing.

3.11 MISCELLANEOUS INSTALLATIONS/TREATMENTS

- A. Install mechanical ventilator units in position and secure to the existing curbs with EPDM-gasketed screws. Provide a minimum of one fastener on each side of the curb and a minimum of one fastener every 12-inches o.c.
- B. Connect all electrical, plumbing, gas line and ventilation connections required for mechanical units. Retain a qualified, licensed electrical subcontractor to connect electrical equipment. Retain a qualified, licensed mechanical subcontractor to connect gas lines and ventilation connections.
- C. Walkway pads: Install walkway pads at locations indicated on drawings. Install the pads in accordance with the requirements and recommendations of the roofing manufacturer. Extend the pads a minimum of 4-inches in all directions beyond wood blocking.
- D. Install splashblocks set on walkpads at locations indicated on the drawings.
- E. Rooftop conduit and pipe supports:
 1. Install adjustable prefabricated pipe supports at rooftop conduit and pipes.



2. Space pipe supports at intervals recommended by the support manufacturer, as determined by the diameter and weight of the conduit or pipe.
 3. Separate the support from the roof surface by installing the support over roof walkway pads, installed as specified.
- F. Install self-adhering underlayment beneath coping caps, and at other locations indicated on the drawings.
1. Refer to manufacturer requirements and recommendations for installation.
- G. Replacement roof hatch installation:
1. Provide wood nailers beneath roof hatch flanges, if necessary, to match insulation thickness.
 2. Install new roof hatch following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- H. Extendable safety post installation:
1. Install new safety post following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- I. Application of elastomeric coating to rooftop penetrations:
1. Prepare substrate in a manner that is acceptable to the coating manufacturer. Substrate preparation includes, but is not limited to: treatment of excessive gaps, repair of damaged or loose sheet metal components, repair of holes, cleaning of roof penetrations, treatment of surface rust, treatment of residual asphalt, and priming (if required by the roof coating manufacturer).
 2. Coat the indicated penetrations following the recommendations and requirements of the coating manufacturer.
- J. Installation of equipment support curbs:
1. Install support curbs where indicated on the project drawings. Flash curbs into the roof system as indicated on the project drawings.
 2. Refer to manufacturer requirements and recommendations for installation.

USPS MPF Specifications, issued: 10/1/2013
Last revised: 9/16/2013

NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 51 16 00



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SECTION 07 52 00 00 - MPF MODIFIED BITUMINOUS MEMBRANE ROOFING**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made.

NOTE TO SPECIFIER

Use this section where Modified Bituminous Membrane Roofing is selected as the roofing system.

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.07 52 00 00

NOTE TO SPECIFIER

This roofing section includes three (3) options regarding inspections and /or warranty; two (2) options regarding insulation type; and two (2) options regarding insulation system attachment.

The Contracting Officer (CO) must provide direction to the Specifier on which one of the warranty options will be selected for this project. After receiving direction from the CO, the Specifier must edit the warranty sections to ensure that this option is consistently applied throughout.

The warranty options are:

WARRANTY OPTION 1, Part-Time Third-Party Inspections: these are to be provided at construction milestones as listed below. A manufacturer's warranty is optional. The Contracting Officer may choose to mandate Part-Time Third Party Inspections AND mandate manufacturer's warranty.

WARRANTY OPTION 2, Full-time Third-Party inspections: an inspector is to be continuously present during the entire period of roofing installation. A manufacturer's warranty is optional. The Contracting Officer may choose to mandate Full-Time Third Party Inspections AND mandate manufacturer's warranty.

WARRANTY OPTION 3, Manufacturer's Warranty: this option requires a warranty from the manufacturer. Inspections are to be provided by the manufacturer at the milestones listed below or as necessary to meet manufacturer's requirements.

There are two (2) options regarding insulation attachment. The Specifier must provide direction on which one of the options will be selected for this project. The Specifier must edit the section to ensure that this option is consistently applied throughout the section. Note that facilities with a metal roof deck are most conducive to mechanical attachment of the insulation assembly. Facilities with concrete roof decks are most conducive to adhered attachment of the insulation assembly. The Specifier shall determine the insulation type based on existing construction; building code review; and cost analysis. The insulation attachment options are:

INSULATION Attachment OPTION 1, Mechanically attached.

INSULATION Attachment OPTION 2, Adhered.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:



1. Preparation of roof deck to receive roofing system.
2. Vapor/Air retarder.[Specifier to make determination of use and location within the system based on facility conditions and general environment]
3. [Mechanically fastened] [Adhesively Applied] Roof insulation and glass mat gypsum board.
4. Modified bituminous SBS (Styrene-Butadiene-Styrene) roofing felts, and cap sheet.
5. Flashing membranes.
6. Accessories.
7. Edge Metal
8. Warranty

B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

C. Related Sections:

1. Section 061000 - Rough Carpentry: Wood blocking, curbs, and nailers.
2. Section 076200 - Sheet Metal Flashing and Trim: Counter flashings, edge trim, and other sheet metal.
3. Section 077213 - Manufactured Curbs: Curbs for roof penetrations.
4. Section 077233 - Roof Hatches: Hatch with integral curb.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM C208 - Specification for Insulating Board (Cellulosic Fiber), Structural and Decorative.
2. ASTM C726 - Specification for Mineral Fiber Roof Insulation Board.
3. ASTM C728 - Specification for Perlite Thermal Insulation Board.
4. ASTM C1177 - Standard Specification for Glass Mat Gypsum Roof Board.
5. ASTM D41 - Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
6. ASTM D226 - Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
7. ASTM D312 - Specification for Asphalt Used in Roofing.
8. ASTM D2178 - Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.
9. ASTM D4586 - Specification for Asphalt Roof Cement, Asbestos Free.
10. ASTM D5147 - Test Methods for Modified Bituminous Sheet Materials.
11. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
12. ASTM D6162 or D6163 - Specifications for SBS Modified Bitumen Cap Sheets.

B. Factory Mutual Global (FMG):

1. FMG - RoofNav - Internet Based FM Roof Assembly Testing and Approvals Database
2. FMG - Approval Guide, Building Materials.
3. FMG - Loss Prevention Data 1-28, Wind Loads to Roof Systems and Roof Deck Securement.
4. FMG - Loss Prevention Data 1-29, Above Deck Roof Components (June 1996).
5. FMG - Standard 4450, Class 1 Insulated Steel Deck Roofs.
6. FMG - Standard 4470, Class 1 Roof Covers.

C. Federal Specification (FS):

1. FS HH-I-1972/2 - Insulation Board, Thermal, Polyurethane or Polyisocyanurate Faced with Asphalt/Organic Felt or Glass Reinforced Fiber Felt on Both Sides of the Foam.

1.3 SYSTEM DESCRIPTION

A. DOE Energy Star Modified Bituminous Roofing System: Consisting of Glass Mat Gypsum Roof Board on layered insulation on metal deck with two-ply of hot-mopped felts and cap sheet applied



with Manufacturer's clear or light-colored adhesive. Cap sheet to have factory applied white reflective coating.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals

1. Product Data:

- a. FM RoofNav Assembly Number certifying proposed roof system has been tested and approved by FMG for the specified FM[1-90] [1-105] [1-120] rating.
- b. Felt materials, base flashing, materials, vapor retarder, [fastener & plate,] adhesive materials, edge metal and insulation.
- c. [Insulation fastener layouts complying with FMG Loss Prevention Data Sheet 1-29 patterns for specified wind uplift resistance. Indicate number of insulation fasteners required and spacing of fasteners for field, perimeter, and corners for each pattern.] [Adhesively applied or mopped insulation coverage rates and layout must comply with the proposed FM RoofNav assembly number and adhesive application rates relative to that assembly. Indicate insulation adhesive application rates required and the coverage/ribbon spacing of adhesive for field, perimeter, and corners for each pattern. Insulation adhesion rates and coverage/ribbon spacing submissions must also be inclusive of the roof system manufacturer's instructions, including cold weather installation instructions and are required for approval prior to job start.]

2. Shop Drawings: Indicate setting plan for insulation including fastener pattern, layout of roofing seams, direction of laps and base flashing details.

3. Assurance/Control Submittals:

- a. Certificates: Manufacturer certificate that components and products as a system meet or exceed specified standards and complies with referenced quality assurance standards in section 1.5 including the FM RoofNav assembly number.
- b. Qualification Documentation: Manufacturer certification indicating roofing applicator qualifications complying with requirements specified in Paragraph entitled "Applicator Qualifications" of this Section.

NOTE TO SPECIFIER

WARRANTY OPTION 1, Part-Time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 1, Part-Time Third-Party inspections.

- c. Field Quality Control Reports: Submit the following reports directly to Contracting Officer from the Third-Party Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:

- 1) Preparatory inspection.
- 2) Initial inspection.
- 3) Follow-up inspections.
- 4) Final inspection.
- 5) Maintenance Instruction: Document training by furnishing a sign-in sheet with a description of the training provided, instructors name and organization, and those who received training. Refer to 017704 1.3, 1.4, and 1.5 for more specific training requirements.

NOTE TO SPECIFIER

WARRANTY OPTION 2, Full-time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 2, Full-time Third-Party inspections.

- d. Field Quality Control Reports: Submit daily reports directly to Contracting Officer from the Full-time Third-Party Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements.



- e. Maintenance Instruction: Document training by furnishing a sign-in sheet with a description of the training provided, instructors name and organization, and those who received training. Refer to 017704 1.3, 1.4, and 1.5 for more specific training requirements.

NOTE TO SPECIFIER

Include the paragraphs below if Contracting Officer mandates a Manufacturer's warranty. Delete the paragraphs below if the Contracting Officer chooses to have Part-Time or Full Time Third Party inspections and No Warranty.

- f. Sample of specified Warranty
- g. Manufacturer's certification letter acknowledging receipt of specifications, intent to issue warranty, and intent to perform field audits as outlined in 1.4.3.d.
- h. Manufacturer's Field Reports: Submit the following reports directly to Contracting Officer from Manufacturer's Roofing Quality Control Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
- 1) Preparatory inspection.
 - 2) Initial inspection.
 - 3) Follow-up inspections.
 - 4) Final inspection.

NOTE TO SPECIFIER

End of WARRANTY OPTION

- i. Written certification or product data sheet attesting that proposed roofing membrane meets the EPA ENERGY STAR® Roof Products Program specification for energy efficiency and that the manufacturer is listed as a Partner.
4. Maintenance Instruction: Document training by furnishing a sign-in sheet with a description of the training provided, instructors name and organization, and those who received training. Refer to 017704 1.3, 1.4, and 1.5 for more specific training requirements.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. FMG Listing: Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

NOTE TO SPECIFIER

90 pounds per square foot wind uplift minimum. Design roofing and insulation system to comply with regional requirements and special regulations of local authority having jurisdiction. Verify with USPS Contracting Officer. Contact Roofing System Manufacturer for information about 105 or 120 or greater pounds per square foot of uplift resistance.

**NOTE TO SPECIFIER**

Edit "Class" in the following paragraph for project's fire resistance and wind uplift resistance requirements. Verify availability of roofing systems that meet these classifications. "Class 1A" signifies meeting ASTM E 108, Class A fire performance for FMG-approved Class 1 roof covers. For areas having three or more hailstorms annually, FMG recommends roofing systems rated SH (severe hail) instead of MH (moderate hail).

1. Fire/Windstorm Classification: Class 1A- [90] [105] [120] <Insert number>.
2. Hail Resistance: [MH] [SH].

D. Pre-installation Meeting:

1. Convene a Pre-installation Meeting at Project Site one week prior to commencing work of this Section.
2. Require attendance of parties directly affecting work of this Section.
3. Review preparation and installation procedures and coordinating and scheduling required with related work.

NOTE TO SPECIFIER

WARRANTY OPTION 1, Part-Time Third-Party Inspections: Include the paragraph below if Contracting Officer mandates WARRANTY OPTION 1, Part-Time Third-Party inspections.

- a. Require the Third-Party Roofing Inspector to conduct Pre-installation Meeting along with Contractor Quality Control Representative and Contracting Officer.

NOTE TO SPECIFIER

WARRANTY OPTION 2, Full-time Third-Party Inspections: Include the paragraph below if Contracting Officer mandates WARRANTY OPTION 2, Full-time Third-Party inspections.

- b. Require the Full-time Third-Party Roofing Inspector to conduct Pre-installation Meeting along with Contractor Quality Control Representative and Contracting Officer.

NOTE TO SPECIFIER

Include the paragraph below if Contracting Officer mandates a Manufacturer's warranty.

- c. Require Manufacturer's Roofing Quality Control Inspector to conduct Pre-installation Meeting along with Contractor Quality Control Representative and Contracting Officer.

NOTE TO SPECIFIER

End of WARRANTY OPTION

4. Agenda:
 - a. Tour, inspect and discuss condition of substrate, roof drains, roof drain final locations, curbs, penetrations and other preparatory work performed by other trades.
 - b. Review structural loading limitations of deck and inspect deck for loss of flatness and for required mechanical fastening.
 - c. Review roofing system requirements (Drawings, Specifications and other Contract Documents).
 - d. Review required submittals, both completed and yet to be completed.
 - e. Review and finalize construction schedule related to roofing work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
 - f. Review requirements for inspections, testing, certifying, and material usage accounting procedures.
 - g. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions, including possibility of temporary roofing.
 - h. Review safety precautions relating to roofing installation.



- i. Review environmental procedures.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Protect foam insulation from direct sunlight exposure. Store roll materials standing on end.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.7 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements:
 - 1. Do not apply roofing felts during inclement weather. When air temperature is expected to fall below 40 degrees F, follow submitted roof system manufacturer's specified Cold Weather Application Procedures.
 - 2. Do not apply roofing felts to wet, damp or frozen deck surface or when precipitation is occurring.
 - 3. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

NOTE TO SPECIFIER

Manufacturer's warranty: Include the paragraphs below if Contracting Officer mandates a Manufacturer's warranty.

1.8 WARRANTY

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Warranty:
 - 1. Submit written warranty, without monetary limitation, signed by roofing system manufacturer agreeing to promptly repair leaks in roof felts and base flashings resulting from defects in materials and workmanship.
 - 2. Warranty Period: [20] [____] years.
 - 3. Warranty shall not exclude "ponding" water.
 - 4. Include materials and workmanship for all manufacturer's supplied roofing components including but not limited to:
 - a. Membranes.
 - b. Bituminous flashings, including edge metal, metal flashings and accessories supplied by roofing system manufacturer.
 - c. Insulation.
 - d. Asphalt bitumen.
 - e. Fasteners and adhesives.
 - f. Vapor / Air Barrier
 - 5. Include the following additional items within Warranty:
 - a. Roofing inspection by Manufacturer's Roofing Quality Control Inspector between 22 and 24 months after date of Final Acceptance.
 - b. Roofing manufacturer will provide unlimited repairs during warranty period with no cost limitation.



- c. Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions.
- d. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Record Modified Bituminous Membrane Roofing Specification Section to Warranty.
- 6. Wind Coverage
 - a. Warranty shall cover wind gusts up to [____] miles per hour.

End of WARRANTY OPTION

NOTE TO SPECIFIER

Verify manufacturer information and availability at time of Project Manual preparation for Project.

PART 2 - PRODUCTS

2.1 ROOFING SYSTEM MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering roofing systems which may be incorporated into the Work include the following:
 - 1. Barrett Company, Wilmington, DE (800) 647-0100.
 - 2. Certaineed Roofing Products, Valley Forge, PA, (800) 233-8990.
 - 3. Firestone Building Products Company, Carmel, IN (800) 428-4442.
 - 4. GAF Materials Corporation, Wayne, NJ (800) 766-3411.
 - 5. Johns Manville Corporation, Denver, CO (800) 654-3103.
 - 6. MBTechnology, Fresno, CA (800) 621-9281.
 - 7. W.P. Hickman Systems, Incorporated, Solon, OH (440) 248-7760.
 - 8. Tremco Inc., Beachwood OH, (800) 852-6013.
 - 9. Soprema, Inc., Wadsworth, OH, (800) 356- 3521.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 ROOFING FELTS

- A. Ply Felt: ASTM D2178, Manufacturer's recommended asphalt coated fiberglass mat.
- B. Cap Sheet: granule surfaced, fire resistant SBS/SEBS modified bitumen membrane reinforced composite polyester/glass core with a factory applied, white, reflective acrylic coating.
 - 1. Solar reflectance per Cool Roof Rating Council (CRRC):
 - a. Initial reflectance: 0.65, minimum.
 - b. Three years after installation: 0.50, minimum.

2.3 FLASHING MEMBRANE

- A. Base and Wall Flashings: Polyester mat saturated in asphalt and coated on both sides with SBS rubber modified asphalt, with ceramic granule finish surface.

2.4 BITUMINOUS MATERIALS

- A. Modified Asphalt Bitumen: SBS or SEBS Modified Asphalts as recommended by Roofing Manufacturer.



- B. Plastic Cement: ASTM D4586, Type I and II Cutback Asphalt Type, asbestos-free.
 - 1. Non-setting type at horizontal use and between dissimilar materials.
 - 2. Hard setting type at vertical uses.
- C. Asphalt Primer: ASTM D41, asphaltic primer suitable for use with roofing, for application to concrete or masonry surfaces.
- D. Modified Bitumen Flashing Cement: Manufacturer's standard one-part or two-part SBS modified bitumen cement.

2.5 ROOF INSULATION

Polyisocyanurate Foam Insulation

- A. Flat Roof Board Insulation: Polyisocyanurate Foam Insulation which meets or exceeds FS HH-I-1972/2, both faces covered with glass fiber felt; comply with FMG Standard 4450 Approval. (ASTM C1289, Type II – Class 1 – Grade 2)
 - 1. Thermal Resistance: in service R-5.6 per inch of thickness in cooling conditions
 - 2. Thermal Resistance: in service R-5.0 per inch of thickness in heating conditions
 - 3. Compressive Strength: 20 PSI Minimum
 - 4. Maximum Board Thickness is 2"
 - 5. Minimum Board Thickness is 1.5" on the base layer
- B. Tapered Polyisocyanurate Foam Insulation: Provide crickets, saddles, and tapered insulation of same material as second layer of insulation; taper to the following slopes:
 - 1. Cricket and Saddles: 1/4 inch per foot or twice the slope of the roof, whichever is greater.
 - 2. Insulation Installed to Counterslope Roof Structure: 1/2 inch to the foot, or twice slope of roof, whichever is greater.
- C. Roof Curb Insulation: Polyisocyanurate foam; thickness to match wood nailer.
- D. Tapered Insulation: Provide crickets, saddles, and tapered insulation of same material as second layer of insulation; taper to the following slopes:
 - 1. Cricket and Saddles: 1/4 inch per foot or twice the slope of the roof, whichever is greater.
 - 2. Insulation Installed to Counterslope Roof Structure: 1/2 inch to the foot, or twice slope of roof, whichever is greater.
- E. Cover Board: 1/2" Factory Primed Glass Mat Gypsum Roof Board: ASTM C-1177. Zero flame spread and zero smoke developed per ASTM E84. Minimum 500 pounds per square inch compressive strength.

2.6 ACCESSORIES

NOTE TO SPECIFIER

INSULATION ATTACHMENT OPTION 1, Mechanically attached insulation assemblies: Include the paragraphs below if the Specifier chooses mechanically attached insulation.

- A. Roofing Insulation Fasteners: Fasteners shall be as tested and approved by FMG as part of the roofing system assembly.
 - 1. Mechanical Fasteners for Insulation: Coated fasteners with plates appropriate for purpose intended and approved by Factory Mutual and supplied by roofing membrane manufacturer.



Thickness of insulation and roofing membrane manufacturer's deck penetration requirements shall determine the length of the fastener.

- B. Roofing Fasteners: Galvanized or non-ferrous type, size and configuration as required to suit application.
- C. Mechanical Fasteners for Insulation: Coated fasteners, screw type with plates as specified, appropriate for purpose intended and approved by Factory Mutual and system manufacturer; length required for thickness of insulation materials and penetration of deck substrate.

NOTE TO SPECIFIER

INSULATION ATTACHMENT OPTION 2, Adhered insulation assemblies: Include the paragraphs below if the Specifier chooses adhered insulation or mopped system.

- A. Roofing Insulation Adhesive: Insulation Adhesive shall be as tested and approved by FMG as part of the roofing system assembly.
 - 1. Insulation Adhesive: [The specifier shall research the requirements with respect to Volatile Organic Compounds and temperature limitations of project to complete this specification section. The completed section will dictate Standard VOC content insulation adhesive, Low VOC content insulation adhesive, OR No VOC content insulation adhesive.]
 - 2. Specified adhesive shall be for purpose intended and approved by Factory Mutual and supplied by roofing membrane manufacturer.

NOTE TO SPECIFIER

End of INSULATION ATTACHMENT OPTIONS

- D. Fibrous Cant and Tapered Edge Strips: High density, asphalt impregnated wood fiber or perlite, location as indicated on Drawings.
- E. Walkway and Isolation Pads: Manufacturer's standard for selected roofing system.

NOTE TO SPECIFIER

Counterflashing over termination bars is strongly recommended by membrane manufacturers.

- F. Termination Bar: Manufacturer's standard 1 inch (25 mm) wide extruded or rolled aluminum bar, pre-punched at 6 inches (15 cm) on center.
- G. Molded Pipe Flashing: Factory molded neoprene base flashing for pipe roof penetrations. Subject to compliance with requirements, provide the following:

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.



NOTE TO SPECIFIER

Edit paragraph below based on Contracting Officer's selection of roofing inspections and/or manufacturer's warranty.

- B. Verification of Conditions: Verify, with [Third-Party Roofing Inspector] [Full-time Third-Party Roofing Inspector] [Manufacturer's Quality Control Inspector] present, that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Provide covers and other means of protection as necessary to protect building surfaces against damage during roofing work.
- B. Where work shall continue over finished roof felts, protect surfaces.

3.3 ROOF INSULATION INSTALLATION

NOTE TO SPECIFIER

INSULATION ATTACHMENT OPTION 1, Mechanically attached insulation assemblies: Include the paragraphs below if the Specifier chooses mechanically attached insulation.

- A. Lay insulation boards to moderate contact without forcing joints. Cut insulation to fit neatly to perimeter blocking and around protrusions through roof.
 - 1. Gaps between insulation boards, nailers and penetrations of 1/4 inch (0.64 cm) or greater are not acceptable.
- B. Place roof crickets and tapered thickness insulation to the required slope pattern in accordance with manufacturer's published instructions.
- C. Mechanically Attached Installation:
 - 1. Maximum insulation board dimension is 4' x 8'
 - 2. Place long edge of boards parallel to deck flutes, forming joint over solid bearing. Lay first layer insulation units with long edge joints continuous and end joints staggered.
 - 3. Lay second and subsequent layers of insulation with both long side and end joints offset 6 inches (15 cm) from joints below.
 - 4. Factory primed glass mat gypsum board and overlaid insulation may be loose laid and fastened with the same insulation fastener and plate in accordance with manufacturer's approved assembly. Fastener and plate must be approved by the roof system manufacturer and installed at the required density to achieve the specified FMG [1A]-[90][105][120] system, in accordance with requirements of FMG Loss Prevention Data Sheet 1-29 for specified wind uplift requirements.



- D. Apply no more insulation than can be waterproofed with roofing membrane in same day.
- E. Mechanically attach a single layer of insulation to manufactured metal curbs.

NOTE TO SPECIFIER

INSULATION ATTACHMENT OPTION 2, Adhered insulation assemblies: Include the paragraphs below if the Specifier chooses adhered insulation.

Lay insulation boards to moderate contact without forcing joints. Cut insulation to fit neatly to perimeter blocking and around protrusions through roof.

- 1. Gaps between insulation boards, nailers and penetrations of 1/4 inch (0.64 cm) or greater are not acceptable.

- F. Place roof crickets and tapered thickness insulation to the required slope pattern in accordance with manufacturer's published instructions.

G. Adhered Installation:

- 1. 4-foot x 4-foot maximum board size for insulation boards adhered to a substrate including successive layers.
- 2. Lay second and subsequent layers of insulation so that the insulation board's joints are staggered vertically and offset from the underlying layers.
- 3. Factory primed glass mat gypsum board and overlaid insulation shall be adhered in accordance with the manufacture's recommendations and submitted FM assembly number to achieve the specified FMG [1A]-[90][105][120] system, in accordance with requirements of FMG Loss Prevention Data Sheet 1-29 for specified wind uplift requirements.

- H. Apply no more insulation than can be waterproofed with roofing membrane in same day.

- I. Adhere a single layer of insulation to manufactured metal curbs with modified bitumen flashing cement.

3.4 ROOFING FELTS APPLICATION

- A. Equiviscous Temperature at Point of Application: No more than 25 degrees F from bitumen rating (EVT) indicated on bitumen container label.
- B. Roofing felts shall not be installed over glass mat gypsum board which is wet or has entrapped moisture from shipping which may cause calcination

NOTE TO SPECIFIER

Specific lap dimensions are not included in this Section at request of felts manufacturers since roll sizes vary among manufacturers, particularly in their process of converting to metric system.

- C. Apply roofing felts in accordance with manufacturer's published instructions for specified system.
- D. Apply felts firmly and uniformly, smooth, free from voids, air pockets, wrinkles, fishmouths, lap joints, or tears into hot asphalt applied just before felt at manufacturer's published nominal uniform rate over entire surface. Do not permit foot traffic on freshly mopped felts.



3.5 WATER CUTOFFS AND WEATHER PROTECTION

- A. Install water cut-offs, two plies in hot asphalt with asphalt glaze coat, at end of day's operation to seal insulation and edge of roof felts from moisture entry. If rain or foul weather appears imminent during roofing application, cease operations and protect deck, insulation, flashings, penetrations and felts from moisture intrusion and damage with water cutoffs. Insulation and roofing materials not so protected before rain are considered damaged materials and will be rejected.
- B. Apply two plies of felt in 23 lbs/sq of hot asphalt with asphalt glaze coat over cutoffs and as recommended by roofing system manufacturer. Plug steel deck flutes under cutoff felts to prevent moisture from getting under insulation.
- C. Remove water cut-offs and other temporary weather protections prior to continuing roofing work. Remove materials that have been subject to moisture damage and return deck to clean, dry condition before proceeding with roofing operations. Remove damaged materials from job site.
- D. Water cut-offs and weather protection shall not be considered part of final roof specified system.

3.6 FLASHING MEMBRANE AND ACCESSORIES

- A. Extend membrane felts up cant strips. Apply modified bituminous sheet base flashing in hot asphalt and mechanically fasten top edge in accordance with manufacturer's published instructions.
- B. Roof Penetrations:
- C. Mop in and seal flanges of items penetrating through membrane with modified bituminous flashing.

NOTE TO SPECIFIER

Counterflashing over termination bars is strongly recommended by membrane manufacturers.

- D. Fasten termination bars at 6 inches on center maximum.

NOTE TO SPECIFIER

"Minimum 1 inch gap" is specified between pads since recommended spacing between pads differs among manufacturers.

- E. Walkway Pads: Mop in and seal modified bitumen walkway pads at each rooftop mechanical unit and roof hatch as indicated on Drawings. Provide minimum 1 inch (25 mm) gap between perpendicular pads to allow for positive drainage.
- F. Isolation Pads: Set pads in roofing cement. Install isolation pads at pipe supports as indicated on Drawings.

3.7 ROOF SURFACING

- A. Cap Sheet: Install lapped granulated cap sheet starting at low point of roofing system. Offset laps from laps of preceding ply sheets and align cap sheet without stretching. Lap in direction to shed water. Extend cap sheet over and terminate beyond cants. Minimize exposed adhesive.
- B. Avoid walking on plies until mastic has set



3.8 CONSTRUCTION

A. Interface with Other Work:

1. Overlayered insulation board applied as a second layer with joints offset from bottom layer.
2. Crickets and Saddles: 1/4 inch per foot.
3. Insulation Installed to Counterslope Roof Structure: 1/2 inch per foot, or twice slope of roof.
4. Polyisocyanurate Foam Insulation Fasteners: Metal plate fasteners as approved by roofing system manufacturer.
5. Cant Height: 3 inches (8 cm).
6. Pipe Boots, by Portals Plus, Inc., Bensenville, IL, (800) 774-5240.
7. Verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains, valleys, and eaves. Verify flutes of steel deck are evenly spaced at intersections.
8. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, and cant strips, nailing strips, and reglets are in place. Verify deck is supported and tightly secured.
9. Verify deck surfaces are dry and free of water, snow, and ice.
10. Install insulation in strict accordance with Manufacturer's recommended procedures with FM Approved fasteners and plates for specified wind uplift resistance requirements.
11. Gaps between insulation boards, nailers and penetrations of 1/4 inch (0.64 cm) or greater are not acceptable.
12. Phased installation of roofing felts will not be permitted.
13. Molded Pipe Flashing: Install where configuration of penetration will permit, including but not limited to electrical conduit and plumbing vents.
14. Roof Curbs: Install manufactured roof curbs, specified in Section 077213, where molded pipe flashing cannot be installed due to configuration of penetration.
15. Coordinate Work with installation of associated metal counterflashings specified under other Sections as Work of this Section proceeds.
16. Phased installation of roofing felts (glaze coating of ply felts) is not permitted.
17. Complete installation of base flashing at roof curbs prior to setting roof top equipment.
18. Attend and conduct Pre-installation Meeting.
19. Perform preparatory, initial, follow-up and final inspections for roof insulation and roofing system.
20. Prepare and submit inspection reports for each inspection made.
21. Attend and conduct Pre-installation Meeting.
22. Perform full-time inspections for roof insulation and roofing system.
23. Prepare and submit inspection reports for each inspection made.
24. Attend and conduct Pre-installation Meeting.
25. Perform preparatory, initial, follow-up and final inspections for roof insulation and roofing system.
26. Prepare and submit inspection reports for each inspection made.
27. Provide on-site instruction to review the components of the system and detail any common troubleshooting or maintenance that is required to ensure normal performance of the roofing system.
28. Provide one complete set of installation details and manuals that will remain at the installed location.

3.9 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field inspection.

NOTE TO SPECIFIER

WARRANTY OPTION 1, Part-Time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 1, Part-Time Third-Party inspections.

B. Field Services: Third-Party Roofing Inspector.

NOTE TO SPECIFIER



WARRANTY OPTION 2, Full-time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 2, Full-time Third-Party inspections.

C. Field Services: Full-time Third-Party Roofing Inspector.

NOTE TO SPECIFIER

OPTION 3, Manufacturer's warranty: Include the paragraphs below if Contracting Officer mandates OPTION 3, Manufacturer's warranty or if the Contracting Officer mandates Option 1 of Option 2 and also chooses the optional manufacturer's warranty.

D. Manufacturer's Field Services: Manufacturer's Roofing Quality Control Inspector.

NOTE TO SPECIFIER

End Manufacturer's warranty

E. Maintenance Instruction

1. Provide on-site instruction to review the components of the system and detail any common troubleshooting or maintenance that is required to ensure normal performance of the roofing system.
2. Provide one complete set of installation details and component manuals that will remain at the installed location.

3.10 CLEANING

- A. Section 017300 - Execution: Requirements for cleaning.
- B. Remove bituminous markings from finished surfaces. In areas where finished surfaces are soiled by asphalt or other source of soiling caused by work of this Section, consult manufacturer of surfaces for cleaning advice and comply with their instruction.
- C. Replace defaced or disfigured finishes caused by Work of this Section.

3.11 PROTECTION

- A. Where construction traffic must continue over finished roof installation, protect surfaces in manner recommended by roofing system manufacturer to protect Manufacturer's Warranty.

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END OF SECTION



SECTION 07 52 00 00 - CSF MODIFIED BITUMINOUS MEMBRANE ROOFING**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

This roofing section includes three (3) options regarding inspections and /or warranty; two (2) options regarding insulation type; and two (2) options regarding insulation system attachment.

The Contracting Officer (CO) must provide direction to the Specifier on which one of the warranty options will be selected for this project. After receiving direction from the CO, the Specifier must edit the warranty sections to ensure that this option is consistently applied throughout.

The warranty options are:

WARRANTY OPTION 1, Part-Time Third-Party Inspections: these are to be provided at construction milestones as listed below. A manufacturer's warranty is optional. The Contracting Officer may choose to mandate Part-Time Third Party Inspections AND mandate manufacturer's warranty.

WARRANTY OPTION 2, Full-time Third-Party inspections: an inspector is to be continuously present during the entire period of roofing installation. A manufacturer's warranty is optional. The Contracting Officer may choose to mandate Full-Time Third Party Inspections AND mandate manufacturer's warranty.

WARRANTY OPTION 3, Manufacturer's Warranty: this option requires a warranty from the manufacturer. Inspections are to be provided by the manufacturer at the milestones listed below or as necessary to meet manufacturer's requirements.

There are two (2) options regarding insulation attachment. The Specifier must provide direction on which one of the options will be selected for this project. The Specifier must edit the section to ensure that this option is consistently applied throughout the section. Note that facilities with a metal roof deck are most conducive to mechanical attachment of the insulation assembly. Facilities with concrete roof decks are most conducive to adhered attachment of the insulation assembly. The Specifier shall determine the insulation type based on existing construction; building code review; and cost analysis. The insulation attachment options are:

INSULATION Attachment OPTION 1, Mechanically attached.

INSULATION Attachment OPTION 2, Adhered.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparation of roof deck to receive roofing system.
2. Vapor/Air retarder.[Specifier to make determination of use and location within the system based on facility conditions and general environment]
3. [Mechanically fastened] [Adhesively Applied] Roof insulation and glass mat gypsum board.
4. Modified bituminous SBS (Styrene-Butadiene-Styrene) roofing felts, and cap sheet.
5. Flashing membranes.
6. Accessories.
7. Edge Metal



8. Warranty

- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 061000 - Rough Carpentry: Wood blocking, curbs, and nailers.
 - 2. Section 076200 - Sheet Metal Flashing and Trim: Counter flashings, edge trim, and other sheet metal.
 - 3. Section 077213 - Manufactured Curbs: Curbs for roof penetrations.
 - 4. Section 077233 - Roof Hatches: Hatch with integral curb.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM C208 - Specification for Insulating Board (Cellulosic Fiber), Structural and Decorative.
 - 2. ASTM C726 - Specification for Mineral Fiber Roof Insulation Board.
 - 3. ASTM C728 - Specification for Perlite Thermal Insulation Board.
 - 4. ASTM C1177 - Standard Specification for Glass Mat Gypsum Roof Board.
 - 5. ASTM D41 - Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
 - 6. ASTM D226 - Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
 - 7. ASTM D312 - Specification for Asphalt Used in Roofing.
 - 8. ASTM D2178 - Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.
 - 9. ASTM D4586 - Specification for Asphalt Roof Cement, Asbestos Free.
 - 10. ASTM D5147 - Test Methods for Modified Bituminous Sheet Materials.
 - 11. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
 - 12. ASTM D6162 or D6163 - Specifications for SBS Modified Bitumen Cap Sheets.
- B. Factory Mutual Global (FMG):
 - 1. FMG - RoofNav - Internet Based FM Roof Assembly Testing and Approvals Database
 - 2. FMG - Approval Guide, Building Materials.
 - 3. FMG - Loss Prevention Data 1-28, Wind Loads to Roof Systems and Roof Deck Securement.
 - 4. FMG - Loss Prevention Data 1-29, Above Deck Roof Components (June 1996).
 - 5. FMG - Standard 4450, Class 1 Insulated Steel Deck Roofs.
 - 6. FMG - Standard 4470, Class 1 Roof Covers.
- C. Federal Specification (FS):
 - 1. FS HH-I-1972/2 - Insulation Board, Thermal, Polyurethane or Polyisocyanurate Faced with Asphalt/Organic Felt or Glass Reinforced Fiber Felt on Both Sides of the Foam.

1.3 SYSTEM DESCRIPTION

- A. DOE Energy Star Modified Bituminous Roofing System: Consisting of Glass Mat Gypsum Roof Board on layered insulation on metal deck with two-ply of hot-mopped felts and cap sheet applied with Manufacturer's clear or light-colored adhesive. Cap sheet to have factory applied white reflective coating.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals
 - 1. Product Data:



- a. FM RoofNav Assembly Number certifying proposed roof system has been tested and approved by FMG for the specified FM[1-90] [1-105] [1-120] rating.
- b. Felt materials, base flashing, materials, vapor retarder, [fastener & plate,] adhesive materials, edge metal and insulation.
- c. [Insulation fastener layouts complying with FMG Loss Prevention Data Sheet 1-29 patterns for specified wind uplift resistance. Indicate number of insulation fasteners required and spacing of fasteners for field, perimeter, and corners for each pattern.] [Adhesively applied or mopped insulation coverage rates and layout must comply with the proposed FM RoofNav assembly number and adhesive application rates relative to that assembly. Indicate insulation adhesive application rates required and the coverage/ribbon spacing of adhesive for field, perimeter, and corners for each pattern. Insulation adhesion rates and coverage/ribbon spacing submissions must also be inclusive of the roof system manufacturer's instructions, including cold weather installation instructions and are required for approval prior to job start.]
2. Shop Drawings: Indicate setting plan for insulation including fastener pattern, layout of roofing seams, direction of laps and base flashing details.
3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer certificate that components and products as a system meet or exceed specified standards and complies with referenced quality assurance standards in section 1.5 including the FM RoofNav assembly number.
 - b. Qualification Documentation: Manufacturer certification indicating roofing applicator qualifications complying with requirements specified in Paragraph entitled "Applicator Qualifications" of this Section.

NOTE TO SPECIFIER

WARRANTY OPTION 1, Part-Time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 1, Part-Time Third-Party inspections.

- c. Field Quality Control Reports: Submit the following reports directly to Contracting Officer from the Third-Party Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
 - 1) Preparatory inspection.
 - 2) Initial inspection.
 - 3) Follow-up inspections.
 - 4) Final inspection.
 - 5) Maintenance Instruction: Document training by furnishing a sign-in sheet with a description of the training provided, instructors name and organization, and those who received training. Refer to 017704 1.3, 1.4, and 1.5 for more specific training requirements.

NOTE TO SPECIFIER

WARRANTY OPTION 2, Full-time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 2, Full-time Third-Party inspections.

- d. Field Quality Control Reports: Submit daily reports directly to Contracting Officer from the Full-time Third-Party Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements.
- e. Maintenance Instruction: Document training by furnishing a sign-in sheet with a description of the training provided, instructors name and organization, and those who received training. Refer to 017704 1.3, 1.4, and 1.5 for more specific training requirements.

NOTE TO SPECIFIER

Include the paragraphs below if Contracting Officer mandates a Manufacturer's warranty. Delete the paragraphs below if the Contracting Officer chooses to have Part-Time or Full Time Third Party inspections and No Warranty.

- f. Sample of specified Warranty



- g. Manufacturer's certification letter acknowledging receipt of specifications, intent to issue warranty, and intent to perform field audits as outlined in 1.4.3.d.
- h. Manufacturer's Field Reports: Submit the following reports directly to Contracting Officer from Manufacturer's Roofing Quality Control Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
 - 1) Preparatory inspection.
 - 2) Initial inspection.
 - 3) Follow-up inspections.
 - 4) Final inspection.

NOTE TO SPECIFIER

End of WARRANTY OPTION

- i. Written certification or product data sheet attesting that proposed roofing membrane meets the EPA ENERGY STAR® Roof Products Program specification for energy efficiency and that the manufacturer is listed as a Partner.
4. Maintenance Instruction: Document training by furnishing a sign-in sheet with a description of the training provided, instructors name and organization, and those who received training. Refer to 017704 1.3, 1.4, and 1.5 for more specific training requirements.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. FMG Listing: Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

NOTE TO SPECIFIER

90 pounds per square foot wind uplift minimum. Design roofing and insulation system to comply with regional requirements and special regulations of local authority having jurisdiction. Verify with USPS Contracting Officer. Contact Roofing System Manufacturer for information about 105 or 120 or greater pounds per square foot of uplift resistance.

NOTE TO SPECIFIER

Edit "Class" in the following paragraph for project's fire resistance and wind uplift resistance requirements. Verify availability of roofing systems that meet these classifications. "Class 1A" signifies meeting ASTM E 108, Class A fire performance for FMG-approved Class 1 roof covers. For areas having three or more hailstorms annually, FMG recommends roofing systems rated SH (severe hail) instead of MH (moderate hail).

- 1. Fire/Windstorm Classification: Class 1A- [90] [105] [120] <Insert number>.
- 2. Hail Resistance: [MH] [SH].



- D. Pre-installation Meeting:
1. Convene a Pre-installation Meeting at Project Site one week prior to commencing work of this Section.
 2. Require attendance of parties directly affecting work of this Section.
 3. Review preparation and installation procedures and coordinating and scheduling required with related work.

NOTE TO SPECIFIER

WARRANTY OPTION 1, Part-Time Third-Party Inspections: Include the paragraph below if Contracting Officer mandates WARRANTY OPTION 1, Part-Time Third-Party inspections.

- a. Require the Third-Party Roofing Inspector to conduct Pre-installation Meeting along with Contractor Quality Control Representative and Contracting Officer.

NOTE TO SPECIFIER

WARRANTY OPTION 2, Full-time Third-Party Inspections: Include the paragraph below if Contracting Officer mandates WARRANTY OPTION 2, Full-time Third-Party inspections.

- b. Require the Full-time Third-Party Roofing Inspector to conduct Pre-installation Meeting along with Contractor Quality Control Representative and Contracting Officer.

NOTE TO SPECIFIER

Include the paragraph below if Contracting Officer mandates a Manufacturer's warranty.

- c. Require Manufacturer's Roofing Quality Control Inspector to conduct Pre-installation Meeting along with Contractor Quality Control Representative and Contracting Officer.

NOTE TO SPECIFIER

End of WARRANTY OPTION

4. Agenda:
 - a. Tour, inspect and discuss condition of substrate, roof drains, roof drain final locations, curbs, penetrations and other preparatory work performed by other trades.
 - b. Review structural loading limitations of deck and inspect deck for loss of flatness and for required mechanical fastening.
 - c. Review roofing system requirements (Drawings, Specifications and other Contract Documents).
 - d. Review required submittals, both completed and yet to be completed.
 - e. Review and finalize construction schedule related to roofing work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
 - f. Review requirements for inspections, testing, certifying, and material usage accounting procedures.
 - g. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions, including possibility of temporary roofing.
 - h. Review safety precautions relating to roofing installation.
 - i. Review environmental procedures.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.



- C. Store materials in weather protected environment, clear of ground and moisture. Protect foam insulation from direct sunlight exposure. Store roll materials standing on end.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.7 PROJECT CONDITIONS OR SITE CONDITIONS

A. Environmental Requirements:

1. Do not apply roofing felts during inclement weather. When air temperature is expected to fall below 40 degrees F, follow submitted roof system manufacturer's specified Cold Weather Application Procedures.
2. Do not apply roofing felts to wet, damp or frozen deck surface or when precipitation is occurring.
3. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

NOTE TO SPECIFIER

Manufacturer's warranty: Include the paragraphs below if Contracting Officer mandates a Manufacturer's warranty.

1.8 WARRANTY

A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.

B. Warranty:

1. Submit written warranty, without monetary limitation, signed by roofing system manufacturer agreeing to promptly repair leaks in roof felts and base flashings resulting from defects in materials and workmanship.
2. Warranty Period: [20] [____] years.
3. Warranty shall not exclude "ponding" water.
4. Include materials and workmanship for all manufacturer's supplied roofing components including but not limited to:
 - a. Membranes.
 - b. Bituminous flashings, including edge metal, metal flashings and accessories supplied by roofing system manufacturer.
 - c. Insulation.
 - d. Asphalt bitumen.
 - e. Fasteners and adhesives.
 - f. Vapor / Air Barrier
5. Include the following additional items within Warranty:
 - a. Roofing inspection by Manufacturer's Roofing Quality Control Inspector between 22 and 24 months after date of Final Acceptance.
 - b. Roofing manufacturer will provide unlimited repairs during warranty period with no cost limitation.
 - c. Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions.
 - d. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Record Modified Bituminous Membrane Roofing Specification Section to Warranty.
6. Wind Coverage
 - a. Warranty shall cover wind gusts up to [____] miles per hour.

End of WARRANTY OPTION



NOTE TO SPECIFIER

Verify manufacturer information and availability at time of Project Manual preparation for Project.

PART 2 - PRODUCTS

2.1 ROOFING SYSTEM MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering roofing systems which may be incorporated into the Work include the following:
 1. Barrett Company, Wilmington, DE (800) 647-0100.
 2. Certaineed Roofing Products, Valley Forge, PA, (800) 233-8990.
 3. Firestone Building Products Company, Carmel, IN (800) 428-4442.
 4. GAF Materials Corporation, Wayne, NJ (800) 766-3411.
 5. Johns Manville Corporation, Denver, CO (800) 654-3103.
 6. MBTechnology, Fresno, CA (800) 621-9281.
 7. W.P. Hickman Systems, Incorporated, Solon, OH (440) 248-7760.
 8. Tremco Inc., Beachwood OH, (800) 852-6013.
 9. Soprema, Inc., Wadsworth, OH, (800) 356- 3521.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 ROOFING FELTS

- A. Ply Felt: ASTM D2178, Manufacturer's recommended asphalt coated fiberglass mat.
- B. Cap Sheet: granule surfaced, fire resistant SBS/SEBS modified bitumen membrane reinforced composite polyester/glass core with a factory applied, white, reflective acrylic coating.
 1. Solar reflectance per Cool Roof Rating Council (CRRC):
 - a. Initial reflectance: 0.65, minimum.
 - b. Three years after installation: 0.50, minimum.

2.3 FLASHING MEMBRANE

- A. Base and Wall Flashings: Polyester mat saturated in asphalt and coated on both sides with SBS rubber modified asphalt, with ceramic granule finish surface.

2.4 BITUMINOUS MATERIALS

- A. Modified Asphalt Bitumen: SBS or SEBS Modified Asphalts as recommended by Roofing Manufacturer.
- B. Plastic Cement: ASTM D4586, Type I and II Cutback Asphalt Type, asbestos-free.
 1. Non-setting type at horizontal use and between dissimilar materials.
 2. Hard setting type at vertical uses.
- C. Asphalt Primer: ASTM D41, asphaltic primer suitable for use with roofing, for application to concrete or masonry surfaces.
- D. Modified Bitumen Flashing Cement: Manufacturer's standard one-part or two-part SBS modified bitumen cement.



2.5 ROOF INSULATION

Polyisocyanurate Foam Insulation

- A. Flat Roof Board Insulation: Polyisocyanurate Foam Insulation which meets or exceeds FS HH-I-1972/2, both faces covered with glass fiber felt; comply with FMG Standard 4450 Approval. (ASTM C1289, Type II – Class 1 – Grade 2)
 - 1. Thermal Resistance: in service R-5.6 per inch of thickness in cooling conditions
 - 2. Thermal Resistance: in service R-5.0 per inch of thickness in heating conditions
 - 3. Compressive Strength: 20 PSI Minimum
 - 4. Maximum Board Thickness is 2"
 - 5. Minimum Board Thickness is 1.5" on the base layer
- B. Tapered Polyisocyanurate Foam Insulation: Provide crickets, saddles, and tapered insulation of same material as second layer of insulation; taper to the following slopes:
 - 1. Crickets and Saddles: 1/4 inch per foot or twice the slope of the roof, whichever is greater.
 - 2. Insulation Installed to Counterslope Roof Structure: 1/2 inch to the foot, or twice slope of roof, whichever is greater.
- C. Roof Curb Insulation: Polyisocyanurate foam; thickness to match wood nailer.
- D. Tapered Insulation: Provide crickets, saddles, and tapered insulation of same material as second layer of insulation; taper to the following slopes:
 - 1. Crickets and Saddles: 1/4 inch per foot or twice the slope of the roof, whichever is greater.
 - 2. Insulation Installed to Counterslope Roof Structure: 1/2 inch to the foot, or twice slope of roof, whichever is greater.
- E. Cover Board: 1/2" Factory Primed Glass Mat Gypsum Roof Board: ASTM C-1177. Zero flame spread and zero smoke developed per ASTM E84. Minimum 500 pounds per square inch compressive strength.

2.6 ACCESSORIES

NOTE TO SPECIFIER

INSULATION ATTACHMENT OPTION 1, Mechanically attached insulation assemblies: Include the paragraphs below if the Specifier chooses mechanically attached insulation.

- A. Roofing Insulation Fasteners: Fasteners shall be as tested and approved by FMG as part of the roofing system assembly.
 - 1. Mechanical Fasteners for Insulation: Coated fasteners with plates appropriate for purpose intended and approved by Factory Mutual and supplied by roofing membrane manufacturer. Thickness of insulation and roofing membrane manufacturer's deck penetration requirements shall determine the length of the fastener.
- B. Roofing Fasteners: Galvanized or non-ferrous type, size and configuration as required to suit application.
- C. Mechanical Fasteners for Insulation: Coated fasteners, screw type with plates as specified, appropriate for purpose intended and approved by Factory Mutual and system manufacturer; length required for thickness of insulation materials and penetration of deck substrate.

NOTE TO SPECIFIER



INSULATION ATTACHMENT OPTION 2, Adhered insulation assemblies: Include the paragraphs below if the Specifier chooses adhered insulation or mopped system.

- A. Roofing Insulation Adhesive: Insulation Adhesive shall be as tested and approved by FMG as part of the roofing system assembly.
 - 1. Insulation Adhesive: [The specifier shall research the requirements with respect to Volatile Organic Compounds and temperature limitations of project to complete this specification section. The completed section will dictate Standard VOC content insulation adhesive, Low VOC content insulation adhesive, OR No VOC content insulation adhesive.]
 - 2. Specified adhesive shall be for purpose intended and approved by Factory Mutual and supplied by roofing membrane manufacturer.

NOTE TO SPECIFIER

End of INSULATION ATTACHMENT OPTIONS

- D. Fibrous Cant and Tapered Edge Strips: High density, asphalt impregnated wood fiber or perlite, location as indicated on Drawings.
- E. Walkway and Isolation Pads: Manufacturer's standard for selected roofing system.

NOTE TO SPECIFIER

Counterflashing over termination bars is strongly recommended by membrane manufacturers.

- F. Termination Bar: Manufacturer's standard 1 inch (25 mm) wide extruded or rolled aluminum bar, pre-punched at 6 inches (15 cm) on center.
- G. Molded Pipe Flashing: Factory molded neoprene base flashing for pipe roof penetrations. Subject to compliance with requirements, provide the following:

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.

NOTE TO SPECIFIER

Edit paragraph below based on Contracting Officer's selection of roofing inspections and/or manufacturer's warranty.

- B. Verification of Conditions: Verify, with [Third-Party Roofing Inspector] [Full-time Third-Party Roofing Inspector] [Manufacturer's Quality Control Inspector] present, that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.



- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Provide covers and other means of protection as necessary to protect building surfaces against damage during roofing work.
- B. Where work shall continue over finished roof felts, protect surfaces.

3.3 ROOF INSULATION INSTALLATION

NOTE TO SPECIFIER

INSULATION ATTACHMENT OPTION 1, Mechanically attached insulation assemblies: Include the paragraphs below if the Specifier chooses mechanically attached insulation.

- A. Lay insulation boards to moderate contact without forcing joints. Cut insulation to fit neatly to perimeter blocking and around protrusions through roof.
 - 1. Gaps between insulation boards, nailers and penetrations of 1/4 inch (0.64 cm) or greater are not acceptable.
- B. Place roof crickets and tapered thickness insulation to the required slope pattern in accordance with manufacturer's published instructions.
- C. Mechanically Attached Installation:
 - 1. Maximum insulation board dimension is 4' x 8'
 - 2. Place long edge of boards parallel to deck flutes, forming joint over solid bearing. Lay first layer insulation units with long edge joints continuous and end joints staggered.
 - 3. Lay second and subsequent layers of insulation with both long side and end joints offset 6 inches (15 cm) from joints below.
 - 4. Factory primed glass mat gypsum board and overlaid insulation may be loose laid and fastened with the same insulation fastener and plate in accordance with manufacturer's approved assembly. Fastener and plate must be approved by the roof system manufacturer and installed at the required density to achieve the specified FMG [1A]-[90][105][120] system, in accordance with requirements of FMG Loss Prevention Data Sheet 1-29 for specified wind uplift requirements.
- D. Apply no more insulation than can be waterproofed with roofing membrane in same day.
- E. Mechanically attach a single layer of insulation to manufactured metal curbs.

NOTE TO SPECIFIER

INSULATION ATTACHMENT OPTION 2, Adhered insulation assemblies: Include the paragraphs below if the Specifier chooses adhered insulation.



Lay insulation boards to moderate contact without forcing joints. Cut insulation to fit neatly to perimeter blocking and around protrusions through roof.

1. Gaps between insulation boards, nailers and penetrations of 1/4 inch (0.64 cm) or greater are not acceptable.

F. Place roof crickets and tapered thickness insulation to the required slope pattern in accordance with manufacturer's published instructions.

G. Adhered Installation:

1. 4-foot x 4-foot maximum board size for insulation boards adhered to a substrate including successive layers.
2. Lay second and subsequent layers of insulation so that the insulation board's joints are staggered vertically and offset from the underlying layers.
3. Factory primed glass mat gypsum board and overlaid insulation shall be adhered in accordance with the manufacture's recommendations and submitted FM assembly number to achieve the specified FMG [1A]-[90][105][120] system, in accordance with requirements of FMG Loss Prevention Data Sheet 1-29 for specified wind uplift requirements.

H. Apply no more insulation than can be waterproofed with roofing membrane in same day.

I. Adhere a single layer of insulation to manufactured metal curbs with modified bitumen flashing cement.

3.4 ROOFING FELTS APPLICATION

A. Equiviscous Temperature at Point of Application: No more than 25 degrees F from bitumen rating (EVT) indicated on bitumen container label.

B. Roofing felts shall not be installed over glass mat gypsum board which is wet or has entrapped moisture from shipping which may cause calcination

NOTE TO SPECIFIER

Specific lap dimensions are not included in this Section at request of felts manufacturers since roll sizes vary among manufacturers, particularly in their process of converting to metric system.

C. Apply roofing felts in accordance with manufacturer's published instructions for specified system.

D. Apply felts firmly and uniformly, smooth, free from voids, air pockets, wrinkles, fishmouths, lap joints, or tears into hot asphalt applied just before felt at manufacturer's published nominal uniform rate over entire surface. Do not permit foot traffic on freshly mopped felts.

3.5 WATER CUTOFFS AND WEATHER PROTECTION

A. Install water cut-offs, two plies in hot asphalt with asphalt glaze coat, at end of day's operation to seal insulation and edge of roof felts from moisture entry. If rain or foul weather appears imminent during roofing application, cease operations and protect deck, insulation, flashings, penetrations and felts from moisture intrusion and damage with water cutoffs. Insulation and roofing materials not so protected before rain are considered damaged materials and will be rejected.

B. Apply two plies of felt in 23 lbs/sq of hot asphalt with asphalt glaze coat over cutoffs and as recommended by roofing system manufacturer. Plug steel deck flutes under cutoff felts to prevent moisture from getting under insulation.



- C. Remove water cut-offs and other temporary weather protections prior to continuing roofing work. Remove materials that have been subject to moisture damage and return deck to clean, dry condition before proceeding with roofing operations. Remove damaged materials from job site.
- D. Water cut-offs and weather protection shall not be considered part of final roof specified system.

3.6 FLASHING MEMBRANE AND ACCESSORIES

- A. Extend membrane felts up cant strips. Apply modified bituminous sheet base flashing in hot asphalt and mechanically fasten top edge in accordance with manufacturer's published instructions.
- B. Roof Penetrations:
- C. Mop in and seal flanges of items penetrating through membrane with modified bituminous flashing.

NOTE TO SPECIFIER

Counterflashing over termination bars is strongly recommended by membrane manufacturers.

- D. Fasten termination bars at 6 inches on center maximum.

NOTE TO SPECIFIER

"Minimum 1 inch gap" is specified between pads since recommended spacing between pads differs among manufacturers.

- E. Walkway Pads: Mop in and seal modified bitumen walkway pads at each rooftop mechanical unit and roof hatch as indicated on Drawings. Provide minimum 1 inch (25 mm) gap between perpendicular pads to allow for positive drainage.
- F. Isolation Pads: Set pads in roofing cement. Install isolation pads at pipe supports as indicated on Drawings.

3.7 ROOF SURFACING

- A. Cap Sheet: Install lapped granulated cap sheet starting at low point of roofing system. Offset laps from laps of preceding ply sheets and align cap sheet without stretching. Lap in direction to shed water. Extend cap sheet over and terminate beyond cants. Minimize exposed adhesive.
- B. Avoid walking on plies until mastic has set

3.8 CONSTRUCTION

- A. Interface with Other Work:
 1. Overlayered insulation board applied as a second layer with joints offset from bottom layer.
 2. Crickets and Saddles: 1/4 inch per foot.
 3. Insulation Installed to Counterslope Roof Structure: 1/2 inch per foot, or twice slope of roof.
 4. Polyisocyanurate Foam Insulation Fasteners: Metal plate fasteners as approved by roofing system manufacturer.
 5. Cant Height: 3 inches (8 cm).
 6. Pipe Boots, by Portals Plus, Inc., Bensenville, IL, (800) 774-5240.



7. Verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains, valleys, and eaves. Verify flutes of steel deck are evenly spaced at intersections.
8. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, and cant strips, nailing strips, and reglets are in place. Verify deck is supported and tightly secured.
9. Verify deck surfaces are dry and free of water, snow, and ice.
10. Install insulation in strict accordance with Manufacturer's recommended procedures with FM Approved fasteners and plates for specified wind uplift resistance requirements.
11. Gaps between insulation boards, nailers and penetrations of 1/4 inch (0.64 cm) or greater are not acceptable.
12. Phased installation of roofing felts will not be permitted.
13. Molded Pipe Flashing: Install where configuration of penetration will permit, including but not limited to electrical conduit and plumbing vents.
14. Roof Curbs: Install manufactured roof curbs, specified in Section 077213, where molded pipe flashing cannot be installed due to configuration of penetration.
15. Coordinate Work with installation of associated metal counterflashings specified under other Sections as Work of this Section proceeds.
16. Phased installation of roofing felts (glaze coating of ply felts) is not permitted.
17. Complete installation of base flashing at roof curbs prior to setting roof top equipment.
18. Attend and conduct Pre-installation Meeting.
19. Perform preparatory, initial, follow-up and final inspections for roof insulation and roofing system.
20. Prepare and submit inspection reports for each inspection made.
21. Attend and conduct Pre-installation Meeting.
22. Perform full-time inspections for roof insulation and roofing system.
23. Prepare and submit inspection reports for each inspection made.
24. Attend and conduct Pre-installation Meeting.
25. Perform preparatory, initial, follow-up and final inspections for roof insulation and roofing system.
26. Prepare and submit inspection reports for each inspection made.
27. Provide on-site instruction to review the components of the system and detail any common troubleshooting or maintenance that is required to ensure normal performance of the roofing system.
28. Provide one complete set of installation details and manuals that will remain at the installed location.

3.9 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field inspection.

NOTE TO SPECIFIER

WARRANTY OPTION 1, Part-Time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 1, Part-Time Third-Party inspections.

B. Field Services: Third-Party Roofing Inspector.

NOTE TO SPECIFIER

WARRANTY OPTION 2, Full-time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 2, Full-time Third-Party inspections.

C. Field Services: Full-time Third-Party Roofing Inspector.

NOTE TO SPECIFIER

OPTION 3, Manufacturer's warranty: Include the paragraphs below if Contracting Officer mandates OPTION 3, Manufacturer's warranty or if the Contracting Officer mandates Option 1 of Option 2 and also chooses the optional manufacturer's warranty.



D. Manufacturer's Field Services: Manufacturer's Roofing Quality Control Inspector.

NOTE TO SPECIFIER

End Manufacturer's warranty

E. Maintenance Instruction

1. Provide on-site instruction to review the components of the system and detail any common troubleshooting or maintenance that is required to ensure normal performance of the roofing system.
2. Provide one complete set of installation details and component manuals that will remain at the installed location.

3.10 CLEANING

- A. Section 017300 - Execution: Requirements for cleaning.
- B. Remove bituminous markings from finished surfaces. In areas where finished surfaces are soiled by asphalt or other source of soiling caused by work of this Section, consult manufacturer of surfaces for cleaning advice and comply with their instruction.
- C. Replace defaced or disfigured finishes caused by Work of this Section.

3.11 PROTECTION

- A. Where construction traffic must continue over finished roof installation, protect surfaces in manner recommended by roofing system manufacturer to protect Manufacturer's Warranty.

USPS CSF Specification issued: 10/1/2013

Last revised: 4/19/2011

END OF SECTION 07 52 00 00



SECTION 07 52 13 00 - R&A APP MODIFIED BITUMEN ROOFING

NOTE TO SPECIFIER

This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this section where a cold-applied APP (Atactic Polupropylene) modified bitumen roofing membrane is selected as the roofing system in a roof replacement application. Per the United States Postal Service Roofing Design Standards, a cold-applied APP (Atactic Polupropylene) modified bitumen roofing system is a recommended roofing system over facilities with a Critical or Non-Critical building designation.

NOTE TO SPECIFIER

Section Formatting:

Consistent formatting of Sections gives the complete document a professional look. This Section uses a 10pt. Arial font, and is formatted as follows:

1. *Insert one 10pt. line after the Section Number. Section Number is in CAPS.*
2. *Insert two 10pt. lines after the Section Title. Section Title is in CAPS.*
3. *Insert one 10pt. line after a PART. PARTS are in CAPS. If a Section is not used, include NOT USED following the PART title as shown below.*
4. *Insert one 10pt. line after Article paragraphs. Articles are in CAPS.*
5. *Insert two 10pt. lines at the end of an Article.*
6. *Complete Section with END OF SETION.*
7. *No lines should be placed between paragraphs and sub-paragraphs, or between sub-paragraphs and other sub-paragraphs.*

Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION



NOT USED

Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to the installation of APP (Atactic Polupropylene) modified bitumen roofing membrane, including flashings, DOE Energy Star compliant reflective surfacing, and related accessories.

NOTE TO SPECIFIER

Review available field data. For roof areas consisting of an underlying concrete, gypsum concrete, cementitious wood fiber, and/or lightweight insulating concrete structural deck, include Section 072221 – Insulation and Cover Board over Underlayment within 1.2 RELATED SECTIONS below. For roof areas consisting of an underlying steel and/or wood deck, include Section 072223 – Roof Insulation and Cover Board over Steel and Wood Deck within the 1.2 RELATED SECTIONS below. For projects containing structural deck types applicable to both Sections 072221 and 072223, include both Sections. Re-letter paragraphs and sub-paragraphs after editing.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 024100 – Roof Removal and Substrate Preparation
- D. Section 061053 – Miscellaneous Rough Carpentry for Roof Replacement
- E. Section 072221 – Roof Insulation and Cover Board over Underlayment
- F. Section 072223 – Roof Insulation and Cover Board over Steel and Wood Roof Decks
- G. Section 076203 – Sheet Metal for Modified Bitumen Roofing
- H. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

NOTE TO SPECIFIER

Per discussions between the designer and USPS Project Manager, determine the warranty requirements for the project. Choose from the following warranty options and actions:

1. *If an alternate price for a 20-year "Total System Warranty" is specified, Leave Article 1.3 unchanged.*
2. *If a 20-year "Total System Warranty" will be included in the base proposal, or if no warranty is*



specified, remove Article 1.3.

Re-letter/number items after editing.

NOTE TO SPECIFIER

Two options are available for paragraph 1.3B:

1. *If the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per USPS Design Standards. This option will be included in the Base Proposal Cost; DELETE Article 1.3B from the list below.*
2. *If the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. Do not edit paragraph 1.3B.*

Per discussions between the designer and USPS Project Manager, determine the required outcome from the list above. Choose one option only. Edit the item below, based on the options listed above. Re-letter/number items after editing, if necessary.

1.3 ALTERNATES

- A. Provide an alternate price for the 20-Year Total System Warranty described in paragraph 1.9A.
- B. Provide an alternate price for application of a reflective white coating over the installed modified bitumen roof system as specified within Articles 2.4 and 3.4 of this Section.

1.4 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 1. American Society for Testing and Materials (ASTM)
 - a. ASTM D 6222 - Standard Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using Polyester Reinforcements
 - b. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
 - c. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
 - d. ASTM D 1668 - Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
 - e. ASTM D 1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
 2. Factory Mutual Global (FM)
 3. Underwriters Laboratories (UL)
 4. National Roofing Contractors Association (NRCA)
 5. American Society of Civil Engineers (ASCE)
 - a. ASCE 7 Minimum Design Loads of Buildings and Other Structures

1.5 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.



1.6 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp. Store roll materials standing on end.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
 - 1. NOTE: Do not install APP modified bitumen roofing at temperatures below 50°F (10°C).
 - 2. When the outside temperature is forecast to fall below 50°F (10°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives and primers should be maintained at a temperature of 50°F (10°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 - 3. Refer to the APP modified bitumen roofing manufacturer and NRCA requirements and



recommendations for additional cold weather application recommendations and restrictions.

- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

NOTE TO SPECIFIER

Per discussions between the designer and USPS Project Manager, determine the warranty requirements for the project. Choose from the following warranty options and actions:

1. *If an alternate price for a 20-year "Total System, Non-Pro-Rated Warranty" is specified, do not edit paragraph 1.9A.*
2. *If a 20-year "Total System, Non-Pro-Rated Warranty" will be included in the base proposal, DELETE an alternate price for from paragraph 1.9A.*
3. *If no warranty is specified, EDIT the title of Article 1.9 (DELETE the words "MANUFACTURER WARRANTY AND"), and DELETE paragraph 1.9A. The two-year contractor guarantee shall remain in place.*

Re-letter/number paragraphs and sub-paragraphs after editing.

1.9 MANUFACTURER WARRANTY AND CONTRACTOR GUARANTEE

- A. Provide an alternate price for a manufacturer 20-Year Total System, Non-Pro-Rated Warranty (including insulation, roofing membrane, and flashings) covering materials and labor. The warranty shall include the following additional items:
1. The warranty shall include a wind rider for the design wind speed at the specific project location.
 2. Roofing inspection by a technical representative of the roofing membrane manufacturer 22-24 months after date of Final Acceptance.
 3. Roofing manufacturer will provide unlimited repairs during warranty period with no cost limitation.
 4. Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions.
 5. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Record APP Modified Bitumen Roofing Specification Section to Warranty.
- B. The Contractor shall provide a two-year contractor guarantee. At a minimum, the contractor guarantee shall include the following:
1. Contractor name, address, phone number and project contact name.
 2. The project completion date, and date of guarantee expiration.
 3. The contractor guarantee shall include, in writing, all project work, workmanship, and/or all materials installed by the contractor or subcontractors to be of a quality that will comply with all project specific requirements of the Construction Documents and other documents governing the Work and workmanship through the guarantee period.
 4. The contractor shall investigate roof leaks during the guarantee period within a reasonable time period, but in no instance greater than 24-hours after notification of a leak. The contractor shall repair leaks determined to be the cause of the Work at no cost to the Owner.

PART 2 – PRODUCTS

2.1 MODIFIED BITUMEN ROOFING SYSTEM SUMMARY

- A. The complete roofing membrane system assembly shall consist of an APP surfacing ply over an APP base ply, meeting or exceeding the requirements listed in paragraphs 2.2A and 2.2B. The



completed system shall have a combined minimum thickness of 300 mils.

NOTE TO SPECIFIER

***NOTE:** In high wind areas, such as those with a calculated wind uplift pressure of greater than 45 psf in the roof field, enhancements to the roof system may be required and must be considered by the design professional/specifier. Consult with the roofing membrane manufacturer and qualified testing agencies such as FM and Miami-Dade County for further information and guidance related to possible roof system enhancements in high wind areas.*

- B. The complete roofing system assembly shall resist uplift pressures calculated according to ASCE 7-05 for the field, perimeters and corners. The specified approval rating must incorporate a safety factor of 2 over the maximum calculated uplift pressure in foot-pound units.
- C. The complete roofing system assembly shall achieve an FM or UL Class A fire rating.

2.2 MODIFIED BITUMEN ROOFING MEMBRANE

- A. Base ply:
 - 1. Modified bitumen base sheet, glass fiber reinforced, minimum nominal 140 mil thickness; ASTM D 6222, Type I.
- B. Surfacing ply:
 - 1. Modified bitumen granule-surfaced surfacing sheet, fire-resistant, triple reinforced (polyester and glass fiber), minimum nominal 160 mil thickness; ASTM D 6222, Type I.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.

2.3 MODIFIED BITUMEN ROOFING FLASHING

- A. Base flashing ply:
 - 1. Modified bitumen base sheet, glass fiber reinforced, minimum nominal 140 mil thickness; ASTM D 6222, Type I.
- B. Surfacing flashing ply:
 - 1. Modified bitumen granule-surfaced surfacing sheet, fire-resistant, triple reinforced (polyester and glass fiber), minimum nominal 160 mil thickness; ASTM D 6222, Type I.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.

NOTE TO SPECIFIER

Two options are available for Article 2.4:

- 1. *If the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per the USPS Roofing Design Standards. This option will be included in the Base Proposal; DELETE "(ALTERNATE)" from the Article title.*
- 2. *If the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. Do not edit Article 2.4.*

Determine the required outcome from the list above. Choose one option only. EDIT the item below, based on the options listed above. Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

2.4 DOE ENERGY STAR INITIAL SOLAR REFLECTANCE REQUIREMENT (ALTERNATE)

- A. Provide a completed roofing system approved by the roofing membrane manufacturer, and meeting the Initial Solar Reflectance requirement of 0.65, minimum, as required by DOE Energy Star. The following product is acceptable to achieve this requirement:
 - 1. Use of the specified surfacing plies meeting the requirements identified in Article 2.1, 2.2 and 2.3, and a field-applied acrylic elastomeric coating applied to the finished APP modified bitumen roofing membrane and flashing surfacing ply. The coating shall be approved for the use specified by the roofing membrane and coating manufacturers.

NOTE TO SPECIFIER

If liquid-applied flashing is required for this project, do not edit Article 2.5. If liquid-applied flashing is not required for this project, DELETE Article 2.5. If necessary, re-letter/number paragraphs and sub-paragraphs after editing.

2.5 LIQUID-APPLIED FLASHING

- A. Base and top coats:
 - 1. Single or dual component, moisture-cured. Product approved by the roofing membrane manufacturer for use in the specified configuration.
- B. Reinforcing fabric:
 - 1. Polyester-reinforced fabric. Product approved by the roofing membrane manufacturer for use in the specified configuration.

2.6 ADHESIVES, CEMENTS AND PRIMERS

- A. Cold adhesive: Product approved by the roofing membrane manufacturer.
- B. Flashing cement and roofing cement: Product compatible with APP Modified bitumen roofing and approved by the roofing membrane manufacturer.
- C. Asphalt primer: ASTM D 41.

2.7 FASTENERS

- A. Roofing membrane and flashing fasteners: Unless otherwise indicated, types as required by the roofing membrane manufacturer.

2.8 ROOFING FELTS

- A. For use at temporary overnight tie-ins: Modified bitumen base sheet, glass fiber reinforced, minimum nominal 140 mil thickness; ASTM D 6222, Type I.
- B. For use at roof sump flashings and elsewhere as may be indicated: Asphalt treated woven glass fabric, ASTM D 1668, Type I.

2.9 MISCELLANEOUS MATERIALS

- A. Walkway pads: Product approved by the roofing manufacturer.



- B. Splashblocks: Concrete; size as necessary to accommodate existing condition.
- C. Pitch pan fill materials:
 - 1. Non-shrink grout (for bottom fill): Quick-set, fast-drying grout; product acceptable to roofing manufacturer.
 - 2. Pourable sealer (for top fill): Two-part pourable elastomeric sealer, product acceptable to roofing manufacturer.
- D. Conduit and pipe supports:
 - 1. For pipes with a diameter up to 6-inches:
 - a. Adjustable prefabricated support such as Pipe Pier 150 manufactured by Pipe Pier Support Systems, Hamel, MN, or approved equal.
 - b. Product approved by the roofing manufacturer for this application.
 - c. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
 - 2. For pipes with a diameter greater than 6-inches:
 - a. Product approved by the roofing manufacturer for this application.
 - b. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
- E. Pre-fabricated plumbing vent pipe extensions:
 - 1. For use where necessary to achieve the 8-inch minimum flashing height:
 - a. Pre-fabricated plumbing vent extensions, such as Tubos Pre-Fabricated Pipe Extension, by Tubos, Inc., Clearwater, FL.
 - b. Product approved by the roofing manufacturer for this application.
 - c. Size and configuration of extension as necessary to match existing pipe diameter, providing the 8-inch minimum flashing height, and allowing for flashing as show on the drawings.
- F. Self-adhering membrane (for use over parapet walls beneath coping caps, and at other locations indicated on the drawings): Product approved for use beneath sheet metal by the membrane manufacturer, and meeting the following criteria:
 - 1. Meeting the requirements of ASTM D 1970.
 - 2. Approved for use as an underlayment for standing seam sheet metal roofing.
 - 3. A 40-mil minimum membrane thickness.
- G. Replacement roof hatch:
 - 1. Roof hatch, such as "Type E" or "Type S", manufactured by The Bilco Company, New Haven, CT, or approved equal.
 - a. Size and configuration as necessary to match existing roof hatch.
 - b. Product approved by the roofing manufacturer for this application.
- H. Extendable ladder-mounted safety post, such as "LadderUP Safety Post", manufactured by The Bilco Company, New Haven, CT, or approved equal.
 - 1. Size and configuration as necessary to accommodate existing ladder and new roof hatch.
 - 2. Product approved by the roofing manufacturer for this application.
- I. Acrylic elastomeric coating (for use at roof penetrations and other locations indicated on the project drawings). Product approved for use by the membrane manufacturer for this application, and meeting the following criteria:
 - 1. Meeting the requirements of ASTM D 6083.
 - 2. White color.
- J. Rooftop unit support curbs: Product such as "Pate Equipment Supports" manufactured by The



Pate Company, Lombard, IL, or approved equal.

1. Size and configuration as necessary to accommodate existing rooftop unit.
2. Fabricated from 18 ga. galvanized steel, minimum, with welded seams; and a nominal 2-inch thick nailer affixed atop the curb support.
3. Fabricated to allow for a minimum flashing height of 8-inches, minimum.
4. Product approved by the roofing manufacturer for this application.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.

NOTE TO SPECIFIER

Review available field data. For roof areas consisting of an underlying concrete, gypsum concrete or cementitious wood fiber structural deck, include Section 072221 within paragraph 3.1B below. For roof areas consisting of an underlying steel or wood deck, include Section 072223 within paragraph 3.1B below. For projects containing structural deck types applicable to both Sections 072221 and 072223, include both Sections.

- B. Ensure that the insulation and cover board substrate is installed as specified in Sections 072221 and 072223 are suitable to receive roofing membrane materials.

3.2 ROOFING MEMBRANE INSTALLATION

- A. Except as may be modified by these specifications and drawings, install roofing membrane in accordance with the requirements and recommendations of the roofing membrane manufacturer, using the manufacturer's current printed instructions.
- B. Chalk lining: Beginning at the low points or drains, chalk line the cover board surface to serve as guides for the proper mopping and laying of the roofing membrane plies.
- C. Broom or press each ply into place, full width.

NOTE TO SPECIFIER

Hot-air welding of roofing membrane base ply and surfacing ply seams, using a flameless welding machine, is required. Use of torches during roof replacement application is not allowed.

- D. Hot-air welded seams: A flameless welding machine must be used for field membrane seams. Hot-air weld base ply and surfacing ply seams. Do not use torches to weld seams.
- E. Install only as much roofing as can be completed in a work day, including flashing and detail work. All installed roofing shall be sealed to a watertight condition prior to leaving the site daily.
- F. Sequence roofing work to eliminate the use of installed roofing as a walkway, or as a storage platform for materials.
- G. Where wheeled or excessive traffic over new or existing roofing work is unavoidable, provide and use 3/4-inch plywood, set over a minimum of two-inch thick rigid board insulation to protect roofing components in place.
- H. Overnight tie-in: Care should be exercised to ensure that water does not flow beneath any completed sections of the roof by temporarily sealing the loose edge of the membrane at the end



of each work day and when the weather is threatening. The roofing membrane manufacturer's requirements should be followed closely.

- I. Remove debris from the roof daily prior to leaving the site. Inspect the site at ground level. Remove any roof replacement related debris from the ground.
- J. Fire watch: Per local codes, provide a fire watch after completion of daily work.

3.3 BASE FLASHINGS

- A. Curb height: Unless otherwise indicated or not possible due to existing conditions encountered, provide an 8-inch minimum flashing height above the finished roofing surface. Refer to Section 061053 for wood blocking requirements related to raising of rooftop curbs.
- B. Ensure that all flashing substrates are suitable to receive new base flashing materials.
- C. Install base flashings at vertical walls and curbs in accordance with the roofing membrane manufacturer's requirements and recommendations.

NOTE TO SPECIFIER

Hot-air welding of flashing base ply and surfacing ply seams, using a flameless welding machine, is required. Use of torches during roof replacement application is not allowed.

- D. Hot-air welded seams: Using a heat gun, hot-air weld flashing base ply and surfacing ply seams. Do not use torches to weld seams.
- E. Secure the top edge of flashing as shown on the drawings, and In accordance with roofing membrane manufacturer recommendations and requirements. Seal the completed flashing top edge with a 3-course stripping of woven glass fabric and flashing cement.
- F. Fire watch: Per local codes, provide a fire watch after completion of daily work.

NOTE TO SPECIFIER

Two options are available for Article 3.4:

1. *If the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per USPS Design Standards. This option will be included in the Base Proposal; DELETE "(ALTERNATE WORK)" from the Article title.*
2. *If the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. Do not edit Article 3.4.*

Determine the required outcome from the list above. Choose one option only. Edit the item below, based on the options listed above. Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

3.4 REFLECTIVE SURFACING INSTALLATION (ALTERNATE WORK)

- A. Installation of field-applied acrylic elastomeric roof coating:
 1. Prepare substrate in a manner that is acceptable to the roofing membrane and coating manufacturers. Substrate preparation includes, but is not limited to: removal of dirt and debris, repair of defects in the roof membrane and flashing, treatment of surface residue,



treatment of areas of excessive ponding, and priming (if required by the roof coating manufacturer).

- a. After substrate preparation work is complete, inspect all surface preparation work. Correct any identified defects prior to application of coating.
- b. Inspect the areas adjacent to the work area for cars and other property that could be damaged by coating overspray. Prior to work start, remove or protect cars and other property that may be damaged by work activities.
- c. Prior to work start, close any rooftop air intakes within and adjacent to the work area.
- d. Follow manufacturer guidelines for rate of application and application procedures of the base and finish coats, as outlined in the written literature provided by the coating manufacturer.
- e. Apply the coating following the requirements and recommendations of the roofing membrane and coating manufacturer. Install a minimum of two coats of acrylic elastomeric coating over the roof surface.

NOTE TO SPECIFIER

If liquid-applied flashing is required for this project, do not edit Article 3.5. If liquid-applied flashing is not required for this project, DELETE Article 3.5. If necessary, re-letter/number paragraphs and sub-paragraphs after editing.

3.5 LIQUID-APPLIED FLASHING

- A. At locations to receive liquid applied flashings, as indicated on the project drawings:
 1. Follow the written instructions for application of liquid-applied flashing provided by the roofing membrane manufacturer.
 2. Prepare the flashing substrate in a manner that is acceptable to the roofing membrane manufacturer. Substrate preparation includes, but is not limited to, removal of dirt and debris, repair of defects in the roof membrane and flashing, treatment of surface residue, treatment of areas of excessive ponding, and priming (if required by the roof coating manufacturer).
 3. Apply the base coat of liquid applied flashing to the substrate.
 4. Install required reinforcing mesh into the base coat.
 5. Apply the top coat of liquid applied flashing over the reinforcing mesh and base coat. Extend the top coat over and beyond the reinforcing mesh.
 6. At horizontal surfaces, broadcast granules over the completed flashing.

3.6 ROOF SUMP FLASHINGS

- A. Prior to installation of the base ply, install a three-course stripping of woven glass fabric and roofing cement over the cover board/insulation substrate.
- B. Ensure that the roofing membrane plies extend into the roof sump.
- C. Install a three-course stripping of woven glass fabric and roofing cement over the base ply.
- D. Install a lead sheet flashing over the base ply in the sump; refer to Section 076203. Prime both sides of the lead sheet prior to installation.
- E. Install modified bitumen flashing ply over the lead flashing sheet.
- F. Ensure that the roofing membrane base and surfacing plies, lead flashing sheet, and modified bitumen flashing ply extend under the clamping ring and into the drain bowl. Tightly secure the clamping ring.

3.7 SHEET METAL FLANGE STRIPPINGS

- A. At sheet metal flanges associated with tubular penetration, pitch pan and perimeter edge sheet metal fascia flashings:
1. Prime the top and bottom of the sheet metal flange. Allow the primer time to dry.
 2. Set flange in a full bed of modified bitumen flashing cement.
 3. Install strippings in accordance with the drawings and the requirements and recommendations of the modified bitumen roofing membrane manufacturer.

3.8 MISCELLANEOUS INSTALLATIONS/TREATMENTS

- A. Return mechanical ventilator units to their original positions and secure to the existing curbs with EPDM-gasketed screws. Provide a minimum of one fastener on each side of the curb and a minimum of one fastener every 12-inches o.c.
- B. Reconnect all electrical, plumbing, gas line and ventilation connections required to return mechanical units to their original operating condition. Retain a qualified, licensed electrical subcontractor to reconnect electrical equipment. Retain a qualified, licensed mechanical subcontractor to reconnect gas lines and ventilation connections. Coordinate required disconnections and reconnections with the Owner.
- C. Walkway pads: Install walkway pads at locations indicated on drawings. Install the pads in accordance with the requirements and recommendations of the roofing manufacturer. Extend the pads a minimum of 4-inches in all directions beyond wood blocking.
- D. Install splashblocks set on walkpads at locations indicated on the drawings.
- E. Rooftop conduit and pipe supports:
1. Install adjustable prefabricated pipe supports at rooftop conduit and pipes.
 2. Space pipe supports at intervals recommended by the support manufacturer, as determined by the diameter and weight of the conduit or pipe.
 3. Separate the support from the roof surface by installing the support over roof walkway pads, installed as specified.
- F. Pre-fabricated plumbing vent pipe extensions:
1. Refer to manufacturer requirements and recommendations for installation.
 2. Prior to flashing installation, seal intersection of pipe extension and existing plumbing vent.
- G. Install self-adhering underlayment beneath coping caps, and at other locations indicated on the drawings.
1. Refer to manufacturer requirements and recommendations for installation.
- H. Replacement roof hatch installation:
1. Remove and discard existing roof hatch.
 2. Provide wood nailers beneath roof hatch flanges, if necessary, to match insulation thickness.
 3. Install new roof hatch following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- I. Extendable safety post installation:



1. Install new safety post following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- J. Application of elastomeric coating to rooftop penetrations:
 1. Prepare substrate in a manner that is acceptable to the coating manufacturer. Substrate preparation includes, but is not limited to: treatment of excessive gaps, repair of damaged or loose sheet metal components, repair of holes, cleaning of roof penetrations, treatment of surface rust, treatment of residual asphalt, and priming (if required by the roof coating manufacturer).
 2. Coat the indicated penetrations following the recommendations and requirements of the coating manufacturer.
- K. Installation of equipment support curbs:
 1. Install support curbs where indicated on the project drawings. Flash curbs into the roof system as indicated on the project drawings.
 2. Refer to manufacturer requirements and recommendations for installation.

USPS CSF Specifications issued: 10/1/2013

Last revised: 3/6/2013

NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 52 13 00



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SECTION 07 52 15 00 - R&A MB SURFACING PLY OVER BUR ROOFING

NOTE TO SPECIFIER

This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this section where a cold-applied or hot-asphalt applied SBS (Styrene-Butadiene-Styrene) modified bitumen surfacing ply over a hot asphalt-applied three-ply built-up roofing membrane is selected as the roofing system in a roof replacement application. For cold-applied SBS (Styrene-Butadiene-Styrene) modified bitumen roofing membranes, use Section 075216 – SBS MODIFIED BITUMEN ROOFING IN COLD ADHESIVE. For hot asphalt-applied SBS (Styrene-Butadiene-Styrene) modified bitumen roofing membranes, use Section 075217 – SBS MODIFIED BITUMEN ROOFING IN HOT ASPHALT.

Per the United States Postal Service Roofing Design Standards, a cold-applied or hot-asphalt applied SBS (Styrene-Butadiene-Styrene) modified bitumen surfacing ply over a hot asphalt-applied three-ply built-up roofing membrane is an acceptable roofing system over facilities with a Critical or Non-Critical building designation.

NOTE TO SPECIFIER

Section Formatting:

Consistent formatting of Sections gives the complete document a professional look. This Section uses a 10pt. Arial font, and is formatted as follows:

1. *Insert one 10pt. line after the Section Number. Section Number is in CAPS.*
2. *Insert two 10pt. lines after the Section Title. Section Title is in CAPS.*
3. *Insert one 10pt. line after a PART. PARTS are in CAPS. If a Section is not used, include NOT USED following the PART title as shown below.*
4. *Insert one 10pt. line after Article paragraphs. Articles are in CAPS.*
5. *Insert two 10pt. lines at the end of an Article.*
6. *Complete Section with END OF SETION.*
7. *No lines should be placed between paragraphs and sub-paragraphs, or between sub-paragraphs and other sub-paragraphs.*

Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS



NOT USED

PART 3 – EXECUTION

NOT USED

Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to the installation of an SBS (Styrene-Butadiene-Styrene) surfacing ply over a three-ply built-up roofing membrane, including flashings, DOE Energy Star compliant reflective surfacing, and related accessories.

NOTE TO SPECIFIER

Review available field data. For roof areas consisting of an underlying concrete, gypsum concrete, cementitious wood fiber, and/or lightweight insulating concrete structural deck, include Section 072221 – Insulation and Cover Board over Underlayment within 1.2 RELATED SECTIONS below. For roof areas consisting of an underlying steel and/or wood deck, include Section 072223 – Roof Insulation and Cover Board over Steel and Wood Deck within the 1.2 RELATED SECTIONS below. For projects containing structural deck types applicable to both Sections 072221 and 072223, include both Sections. Re-letter paragraphs and sub-paragraphs after editing.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 024100 – Roof Removal and Substrate Preparation
- D. Section 061053 – Miscellaneous Rough Carpentry for Roof Replacement
- E. Section 072221 – Roof Insulation and Cover Board over Underlayment
- F. Section 072223 – Roof Insulation and Cover Board over Steel and Wood Roof Decks
- G. Section 076203 – Sheet Metal for Modified Bitumen Roofing
- H. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

NOTE TO SPECIFIER

Per discussions between the designer and USPS Project Manager, determine the warranty requirements for the project. Choose from the following warranty options and actions:



1. If an alternate price for a 20-year "Total System Warranty" is specified, Leave Article 1.3 unchanged.
2. If a 20-year "Total System Warranty" will be included in the base proposal, or if no warranty is specified, remove Article 1.3.

Re-letter/number items after editing.

NOTE TO SPECIFIER

Two options are available for paragraph 1.3B:

1. If the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per USPS Design Standards. This option will be included in the Base Proposal Cost; **DELETE** Article 1.3B from the list below.
2. If the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. Do not edit paragraph 1.3B.

Per discussions between the designer and USPS Project Manager, determine the required outcome from the list above. Choose one option only. Edit the item below, based on the options listed above. *Re-letter/number items after editing, if necessary.*

1.3 ALTERNATES

- A. Provide an alternate price for the 20-Year Total System Warranty described in paragraph 1.9A.
- B. Provide an alternate price for application of a reflective white coating over the installed modified bitumen roof system as specified within Articles 2.4 and 3.6 of this Section.

NOTE TO SPECIFIER

EDIT Article 1.4 – REFERENCES below, based on the system specified:

1. If an SBS modified bitumen ply conforming to ASTM D 6164 is chosen as the surfacing ply for the system, **DELETE** "ASTM D 6162 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements" from the reference list.
2. If an SBS modified bitumen ply conforming to ASTM D 6162 is chosen as the surfacing ply for the system, **DELETE** "ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements" from the reference list.

Re-letter/number paragraphs and sub-paragraphs after editing.

1.4 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 1. American Society for Testing and Materials (ASTM)
 - a. ASTM D 2178 - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing
 - b. ASTM D 6162 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements
 - c. ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements
 - d. ASTM D 312 - Standard Specification for Asphalt Used in Roofing
 - e. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing



- f. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
- g. ASTM D 1668 - Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
- h. ASTM D 4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free
- i. ASTM D 1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
- 2. Factory Mutual Global (FM)
- 3. Underwriters Laboratories (UL)
- 4. National Roofing Contractors Association (NRCA)
- 5. American Society of Civil Engineers (ASCE)
 - a. ASCE 7 Minimum Design Loads of Buildings and Other Structures

1.5 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.6 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover



insulation, roofing materials, and other moisture-sensitive products with a canvas tarp. Store roll materials standing on end.

- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
 1. NOTE: Do not install SBS modified bitumen roofing at temperatures below 50°F (10°C).
 2. When the outside temperature is forecast to fall below 50°F (10°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives and primers should be maintained at a temperature of 50°F (10°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 3. When applying hot asphalt, reduce mop lead distance to 2-feet or less.
 4. If a minimum asphalt temperature of 420°F (216°C) cannot be maintained at the point of application, discontinue work.
 5. Refer to the SBS modified bitumen roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

NOTE TO SPECIFIER

Per discussions between the designer and USPS Project Manager, determine the warranty requirements for the project. Choose from the following warranty options and actions:

1. *If an alternate price for a 20-year "Total System, Non-Pro-Rated Warranty" is specified, do not edit paragraph 1.9A.*
2. *If a 20-year "Total System, Non-Pro-Rated Warranty" will be included in the base proposal, DELETE "an alternate price for" from paragraph 1.9A.*
3. *If no warranty is specified, EDIT the title of Article 1.9 (DELETE the words "MANUFACTURER WARRANTY AND"), and DELETE paragraph 1.9A. The two-year contractor guarantee shall remain in place.*

Re-letter/number paragraphs and sub-paragraphs after editing.

1.9 MANUFACTURER WARRANTY AND CONTRACTOR GUARANTEE

- A. Provide an alternate price for a manufacturer 20-Year Total System, Non-Pro-Rated Warranty (including insulation, roofing membrane, and flashings) covering materials and labor. The warranty shall include the following additional items:
 1. The warranty shall include a wind rider for the design wind speed at the specific project location.
 2. Roofing inspection by a technical representative of the roofing membrane manufacturer 22-24 months after date of Final Acceptance.
 3. Roofing manufacturer will provide unlimited repairs during warranty period with no cost limitation.



4. Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions.
 5. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Record MB Surfacing Ply over BUR Roofing Specification Section to Warranty.
- B. The Contractor shall provide a two-year contractor guarantee. At a minimum, the contractor guarantee shall include the following:
1. Contractor name, address, phone number and project contact name.
 2. The project completion date, and date of guarantee expiration.
 3. The contractor guarantee shall include, in writing, all project work, workmanship, and/or all materials installed by the contractor or subcontractors to be of a quality that will comply with all project specific requirements of the Construction Documents and other documents governing the Work and workmanship through the guarantee period.
 4. The contractor shall investigate roof leaks during the guarantee period within a reasonable time period, but in no instance greater than 24-hours after notification of a leak. The contractor shall repair leaks determined to be the cause of the Work at no cost to the Owner.

PART 2 – PRODUCTS

2.1 ROOFING SYSTEM SUMMARY

- A. The complete roofing membrane system assembly shall consist of an SBS surfacing ply over a three-ply asphalt built-up roof membrane, meeting or exceeding the requirements listed in paragraphs 2.2A and 2.2B.

NOTE TO SPECIFIER

***NOTE:** In high wind areas, such as those with a calculated wind uplift pressure of greater than 45 psf in the roof field, enhancements to the roof system may be required and must be considered by the design professional/specifier. Consult with the roofing membrane manufacturer and qualified testing agencies such as FM and Miami-Dade County for further information and guidance related to possible roof system enhancements in high wind areas.*

- B. The complete roofing system assembly shall resist uplift pressures calculated according to ASCE 7-05 for the field, perimeters and corners. The specified approval rating must incorporate a safety factor of 2 over the maximum calculated uplift pressure in foot-pound units.
- C. The complete roofing system assembly shall achieve an FM or UL Class A fire rating.

2.2 ASPHALT BUILT-UP ROOFING MEMBRANE AND SBS MB SURFACING PLY

- A. Three-ply built up roof membrane:
1. Roofing membrane plies: Asphalt-saturated Type VI ply felt meeting ASTM D 2178; manufactured by the roofing membrane manufacturer.

NOTE TO SPECIFIER

Two options are listed below:

1. Article 2.2B: A surfacing ply utilizing a polyester-reinforced surfacing ply (ASTM D 6164, Type II).
2. Article 2.2C: A surfacing ply utilizing a dual-reinforced base sheet, with both glass fiber and polyester reinforcement (ASTM D 6162, Type III) and surfacing ply (ASTM D 6162, Type III).



Per discussions between the designer and USPS Project Manager, determine the surfacing ply desired from the list above. Choose one surfacing ply only. EDIT the list below, leaving one surfacing ply, based on the two options listed above. DELETE the sub-paragraph containing references to the surfacing ply that is not chosen. Re-letter/number paragraphs and sub-paragraphs after editing.

- B. Surfacing ply ("A" System):
 - 1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, minimum nominal 130 mil thickness; ASTM D 6164, Type II, Grade G.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.
- C. Surfacing ply ("B" System):
 - 1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, fire-rated, minimum nominal 160 mil thickness; ASTM D 6162, Type III, Grade G.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.

NOTE TO SPECIFIER

Two options are listed below within Article 2.3:

- 1. An "A" System, utilizing a polyester-reinforced base ply (ASTM D 6164, Type II) and surfacing ply (ASTM D 6164, Type II).
- 2. A "B" System, utilizing a dual-reinforced base sheet, with both glass fiber and polyester reinforcement (ASTM D 6162, Type II) and surfacing ply (ASTM D 6162, Type II).

Per discussions between the designer and USPS Project Manager, determine the flashing system desired from the list above. Choose one system only. Edit the list below, leaving one base and surfacing ply for the MB roofing membrane and flashing system, based on the systems listed above. Re-letter/number paragraphs and sub-paragraphs after editing.

2.3 MODIFIED BITUMEN ROOFING FLASHING

- A. Base ply ("A" System):
 - 1. Modified bitumen base sheet, polyester reinforced, minimum nominal 115 mil thickness; ASTM D 6164, Type II, Grade S.
- B. Surfacing ply ("A" System):
 - 1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, fire-rated, minimum nominal 130 mil thickness; ASTM D 6164, Type II, Grade G.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.
- C. Base ply ("B" System):
 - 1. Modified bitumen base sheet, polyester reinforced, minimum nominal 130 mil thickness; ASTM D 6162, Type III, Grade S.
- D. Surfacing ply ("B" System):
 - 1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, fire-rated, minimum nominal 160 mil thickness; ASTM D 6162, Type III, Grade G.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.

NOTE TO SPECIFIER

Four options are available for Article 2.4:

- 1. If an "A System" is specified, and the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a



reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per the USPS Roofing Design Standards. This option will be included in the Base Proposal; DELETE "(ALTERNATE)" from the Article title.

2. *If an "A System" is specified, and the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. Do not edit Article 2.4.*
3. *If a "B System" is specified, and the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per the USPS Roofing Design Standards. This option will be included in the Base Proposal; DELETE "(ALTERNATE)" from the Article title. DELETE sub-paragraphs 2.4.A.1 and 2.4.A.2, and the word "other" from sub-paragraph 2.4.A.3.*
4. *If a "B System" is specified, and the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. DELETE sub-paragraphs 2.4.A.1 and 2.4.A.2, and the word "other" from sub-paragraph 2.4.A.3.*

Determine the required outcome from the list above. Choose one option only. EDIT the item below, based on the options listed above. Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

2.4 DOE ENERGY STAR INITIAL SOLAR REFLECTANCE REQUIREMENT (ALTERNATE)

- A. Provide a completed roofing system approved by the roofing membrane manufacturer, and meeting the Initial Solar Reflectance requirement of 0.65, minimum, as required by DOE Energy Star. The following products are acceptable to achieve this requirement:
 1. Surfacing plies, used in lieu of those identified within paragraphs 2.2.B and 2.3.B:
 - a. Firestone "SBS Premium UltraWhite" surfacing ply, manufactured by Firestone Building Products, as the specified roofing membrane and flashing surfacing ply identified in paragraphs 2.2.B and 2.3.B.
 - b. JM "Dynalastic 250 FR CR" surfacing ply, manufactured by Johns Manville, as the specified roofing membrane and flashing surfacing ply identified in paragraphs 2.2.B and 2.3.B.
 2. Acrylic elastomeric coating, applied over surfacing plies identified within paragraphs 2.2.B and 2.3.B:
 - a. Use of surfacing plies meeting the requirements identified in Articles 2.2 and 2.3 of this Section, and a field-applied acrylic elastomeric coating applied to the finished SBS modified bitumen roofing membrane and flashing surfacing ply. The coating shall be approved for the use specified by the roofing membrane and coating manufacturers.

NOTE TO SPECIFIER

If liquid-applied flashing is required for this project, do not edit Article 2.5. If liquid-applied flashing is not required for this project, DELETE Article 2.5. If necessary, re-letter/number paragraphs and sub-paragraphs after editing.

2.5 LIQUID-APPLIED FLASHING

- A. Base and top coats:
 1. Single or dual component, moisture-cured. Product approved by the roofing membrane manufacturer for use in the specified configuration.
- B. Reinforcing fabric:
 1. Polyester-reinforced fabric. Product approved by the roofing membrane manufacturer for use in the specified configuration.



NOTE TO SPECIFIER

If surfacing ply is applied using cold adhesive, do not edit Article 2.4. If surfacing ply is to be applied using hot asphalt, DELETE paragraph 2.4B. If necessary, re-letter/number paragraphs and sub-paragraphs after editing.

2.6 ADHESIVES, CEMENTS AND PRIMERS

- A. Asphalt: ASTM D 312, Type III.
- B. Cold adhesive: Product approved by the roofing membrane manufacturer.
- C. Flashing cement and roofing cement: Product compatible with SBS Modified bitumen roofing and approved by the roofing membrane manufacturer.
- D. Asphalt primer: ASTM D 41.

2.7 FASTENERS

- A. Roofing membrane and flashing fasteners: Unless otherwise indicated, types as required by the roofing membrane manufacturer.

2.8 ROOFING FELTS

- A. For use at temporary overnight tie-ins: Asphalt-saturated organic felt, No. 15, non-perforated, ASTM D 226, Type 1.
- B. For use at roof sump flashings and elsewhere as may be indicated: Asphalt treated woven glass fabric, ASTM D 1668, Type I.

2.9 MISCELLANEOUS MATERIALS

- A. Walkway pads: Product approved by the roofing manufacturer.
- B. Splashblocks: Concrete; size as necessary to accommodate existing condition.
- C. Pitch pan fill materials:
 - 1. Non-shrink grout (for bottom fill): Quick-set, fast-drying grout; product acceptable to roofing manufacturer.
 - 2. Pourable sealer (for top fill): Two-part pourable elastomeric sealer, product acceptable to roofing manufacturer.
- D. Conduit and pipe supports:
 - 1. For pipes with a diameter up to 6-inches:
 - a. Adjustable prefabricated support such as Pipe Pier 150 manufactured by Pipe Pier Support Systems, Hamel, MN, or approved equal.
 - b. Product approved by the roofing manufacturer for this application.
 - c. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
 - 2. For pipes with a diameter greater than 6-inches:
 - a. Product approved by the roofing manufacturer for this application.
 - b. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.



- E. Pre-fabricated plumbing vent pipe extensions:
 - 1. For use where necessary to achieve the 8-inch minimum flashing height:
 - a. Pre-fabricated plumbing vent extensions, such as Tubos Pre-Fabricated Pipe Extension, by Tubos, Inc., Clearwater, FL.
 - b. Product approved by the roofing manufacturer for this application.
 - c. Size and configuration of extension as necessary to match existing pipe diameter, providing the 8-inch minimum flashing height, and allowing for flashing as show on the drawings.
- F. Self-adhering membrane (for use over parapet walls beneath coping caps, and at other locations indicated on the drawings): Product approved for use beneath sheet metal by the membrane manufacturer, and meeting the following criteria:
 - 1. Meeting the requirements of ASTM D 1970.
 - 2. Approved for use as an underlayment for standing seam sheet metal roofing.
 - 3. A 40-mil minimum membrane thickness.
- G. Replacement roof hatch:
 - 1. Roof hatch, such as "Type E" or "Type S", manufactured by The Bilco Company, New Haven, CT, or approved equal.
 - a. Size and configuration as necessary to match existing roof hatch.
 - b. Product approved by the roofing manufacturer for this application.
- H. Extendable ladder-mounted safety post, such as "LadderUP Safety Post", manufactured by The Bilco Company, New Haven, CT, or approved equal.
 - 1. Size and configuration as necessary to accommodate existing ladder and new roof hatch.
 - 2. Product approved by the roofing manufacturer for this application.
- I. Acrylic elastomeric coating (for use at roof penetrations and other locations indicated on the project drawings). Product approved for use by the membrane manufacturer for this application, and meeting the following criteria:
 - 1. Meeting the requirements of ASTM D 6083.
 - 2. White color.
- J. Rooftop unit support curbs: Product such as "Pate Equipment Supports" manufactured by The Pate Company, Lombard, IL, or approved equal.
 - 1. Size and configuration as necessary to accommodate existing rooftop unit.
 - 2. Fabricated from 18 ga. galvanized steel, minimum, with welded seams; and a nominal 2-inch thick nailer affixed atop the curb support.
 - 3. Fabricated to allow for a minimum flashing height of 8-inches, minimum.
 - 4. Product approved by the roofing manufacturer for this application.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.

NOTE TO SPECIFIER

Review available field data. For roof areas consisting of an underlying concrete, gypsum concrete or cementitious wood fiber structural deck, include Section 072221 within paragraph 3.1B below. For roof areas consisting of an underlying steel or wood deck, include Section 072223 within paragraph 3.1B below. For projects containing structural deck types applicable to both Sections 072221 and 072223, include both Sections.



- B. Ensure that the insulation and cover board substrate is installed as specified in Sections 072221 and 072223 are suitable to receive roofing membrane materials.

3.2 BITUMEN KETTLE OPERATION

- A. Operator Preparation – Kettle operation requires an individual who is trained in the use of such equipment and use of the kettle requires a designate operator who will remain at the kettle during its use. Under no circumstance shall the kettle be unmanned. Never allow any untrained person to operate the kettle. Kettle temperature shall be recorded a minimum of twice per day.
- B. Kettle operator must be dressed accordingly; including, but not limited to, the following items:
 1. Long-sleeved shirt, buttoned at the cuffs.
 2. Long pants without cuffs.
 3. Gloves, snug fitting at the cuffs.
 4. Heavy shoes with high tops.
- C. Site Preparation – The kettle should be located close enough to the building to allow for proper setup of thin-wall tubing. Care must be taken to protect building, by use of tarpaulins. However, be aware of the possible hazards from locating too close, such as splashing of asphalt or the spread of fire.
- D. Avoid locating kettle near openings and air intakes on the building to lessen the effect of fumes on the people inside.
- E. Select a clear, level area with firm ground. Locate kettle away from all flammable materials and away from all electrical lines. Chock wheels front and back when kettle is in operation. Make sure the kettle is level and stable from rocking. Place non-flammable material underneath kettle to protect the ground from spillage. Set up a warning line system around the entire kettle working area. Keep unauthorized people away from the area. If LP fuel is being used, secure the cylinder(s) so that it cannot tip over. Locate cylinder(s) at least ten feet from the burners. Keep all fuel upwind from the kettle and away from open flames. Place asphalt to be used for the day in a location convenient for loading the kettle.
- F. Ground protection (plywood and EPDM membrane) is required at kettle site. Comply with all Local Fire Codes or requirements set forth by Local Fire Marshall.

3.3 BITUMEN FUME CONTROL

- A. The Contractor shall include the cost of providing a fume recovery system such as Fumeguard Asphalt & Pitch Fume Control System as manufactured by the Garlock Equipment Company or approved equal in all projects where coal tar pitch and/or asphalt is specified (if Applicable).
- B. Fumes from paint, adhesives, or any other sources are prohibited from entering the building interior. Contractor must provide proper ventilation and take necessary precautions to prevent fume permeation including covering intake vents, providing and installing carbon filters, arranging for HVAC equipment shut down, or any other necessary means to prevent fumes from entering the building.

3.4 ROOFING MEMBRANE INSTALLATION

- A. Except as may be modified by these specifications and drawings, install roofing membrane in accordance with the requirements and recommendations of the roofing membrane manufacturer,



using the manufacturer's current printed instructions.

- B. Chalk lining: Beginning at the low points or drains, chalk line the cover board surface to serve as guides for the proper mopping and laying of the roofing membrane plies.
- C. Broom or press each ply into place, full width.

NOTE TO SPECIFIER

Hot-air welding of base and surfacing ply seams, using a flameless welding machine, is required. Use of torches during roof replacement application is not allowed.

- D. Hot-air welded seams: A flameless welding machine must be used for field membrane seams. Hot-air weld base ply and surfacing ply seams. Do not use torches to weld seams.
- E. Install only as much roofing as can be completed in a work day, including flashing and detail work. All installed roofing shall be sealed to a watertight condition prior to leaving the site daily.
- F. Sequence roofing work to eliminate the use of installed roofing as a walkway, or as a storage platform for materials.
- G. Where wheeled or excessive traffic over new or existing roofing work is unavoidable, provide and use 3/4-inch plywood, set over a minimum of two-inch thick rigid board insulation to protect roofing components in place.
- H. Overnight tie-in: Care should be exercised to ensure that water does not flow beneath any completed sections of the roof by temporarily sealing the loose edge of the membrane at the end of each work day and when the weather is threatening. The roofing membrane manufacturer's requirements should be followed closely.
- I. Remove debris from the roof daily prior to leaving the site. Inspect the site at ground level. Remove any roof replacement related debris from the ground.
- J. Fire watch: Per local codes, provide a fire watch after completion of daily work

3.5 BASE FLASHINGS

- A. Curb height: Unless otherwise indicated or not possible due to existing conditions encountered, provide an 8-inch minimum flashing height above the finished roofing surface. Refer to Section 061053 for wood blocking requirements related to raising of rooftop curbs.
- B. Ensure that all flashing substrates are suitable to receive new base flashing materials.
- C. Install base flashings at vertical walls and curbs in accordance with the roofing membrane manufacturer's requirements and recommendations.
- D. Hot-air welded seams: Using a heat gun, hot-air weld flashing base ply and surfacing ply seams. Do not use torches to weld seams.
- E. Secure the top edge of flashing as shown on the drawings, and In accordance with roofing membrane manufacturer recommendations and requirements. Seal the completed flashing top edge with a 3-course stripping of woven glass fabric and flashing cement.
- F. Fire watch: Per local codes, provide a fire watch after completion of daily work



NOTE TO SPECIFIER

Four options are available for Article 3.6:

1. If an "A System" is specified, and the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per USPS Design Standards. This option will be included in the Base Proposal; DELETE "(ALTERNATE WORK)" from the Article title.
2. If an "A System" is chosen, and the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. Do not edit Article 3.6.
3. If a "B System" is specified, and the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per USPS Design Standards. This option will be included in the Base Proposal; DELETE "(ALTERNATE WORK)" from the Article title. DELETE paragraph 3.6A.
4. If a "B System" is specified, and the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. DELETE paragraph 3.6A.

Determine the required outcome from the list above. Choose one option only. Edit the item below, based on the options listed above. Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

3.6 REFLECTIVE SURFACING INSTALLATION (ALTERNATE WORK)

- A. Installation of surfacing plies with a factory-applied reflective coatings:
 1. Apply the surfacing sheet, following the requirements and recommendations of the roofing membrane manufacturer.
 2. Exercise reasonable care to keep reflective sheets clean, and clear of debris.
 3. At roofing membrane and flashing surfacing ply seams and laps:
 - a. Clean the seam and lap area of dirt and debris. Power wash the seams and laps, if necessary to remove excessive residue.
 - b. At seams, broadcast reflective granules over seam area; or prime seams and laps, and apply two coats minimum of the specified acrylic elastomeric coating over the seam and lap areas.
 4. At locations determined by the Owner to contain excessive staining:
 - a. Clean the identified area(s) of dirt and debris. Power wash the area, if necessary to remove excessive residue.
 - b. Prime the area, if required by the coating manufacturer. Apply two coats, minimum, of the specified acrylic elastomeric coating over the area.
- B. Installation of field-applied acrylic elastomeric roof coating:
 1. Prepare substrate in a manner that is acceptable to the roofing membrane and coating manufacturers. Substrate preparation includes, but is not limited to: removal of dirt and debris, repair of defects in the roof membrane and flashing, treatment of surface residue, treatment of areas of excessive ponding, and priming (if required by the roof coating manufacturer).
 - a. After substrate preparation work is complete, inspect all surface preparation work. Correct any identified defects prior to application of coating.
 - b. Inspect the areas adjacent to the work area for cars and other property that could be damaged by coating overspray. Prior to work start, remove or protect cars and other property that may be damaged by work activities.
 - c. Prior to work start, close any rooftop air intakes within and adjacent to the work area.



- d. Follow manufacturer guidelines for rate of application and application procedures of the base and finish coats, as outlined in the written literature provided by the coating manufacturer.
- e. Apply the coating following the requirements and recommendations of the roofing membrane and coating manufacturer. Install a minimum of two coats of acrylic elastomeric coating over the roof surface.

NOTE TO SPECIFIER

If liquid-applied flashing is required for this project, do not edit Article 3.7. If liquid-applied flashing is not required for this project, DELETE Article 3.7. If necessary, re-letter/number paragraphs and sub-paragraphs after editing.

3.7 LIQUID-APPLIED FLASHING

- A. At locations to receive liquid applied flashings, as indicated on the project drawings:
 - 1. Follow the written instructions for application of liquid-applied flashing provided by the roofing membrane manufacturer.
 - 2. Prepare the flashing substrate in a manner that is acceptable to the roofing membrane manufacturer. Substrate preparation includes, but is not limited to, removal of dirt and debris, repair of defects in the roof membrane and flashing, treatment of surface residue, treatment of areas of excessive ponding, and priming (if required by the roof coating manufacturer).
 - 3. Apply the base coat of liquid applied flashing to the substrate.
 - 4. Install required reinforcing mesh into the base coat.
 - 5. Apply the top coat of liquid applied flashing over the reinforcing mesh and base coat. Extend the top coat over and beyond the reinforcing mesh.
 - 6. At horizontal surfaces, broadcast granules over the completed flashing.

3.8 ROOF SUMP FLASHINGS

- A. Prior to installation of the base ply, install a three-course stripping of woven glass fabric and roofing cement over the cover board/insulation substrate.
- B. Ensure that the roofing membrane plies extend into the roof sump.
- C. Install a three-course stripping of woven glass fabric and roofing cement over the base ply.
- D. Install a lead sheet flashing over the base ply in the sump; refer to Section 076203. Prime both sides of the lead sheet prior to installation.
- E. Install modified bitumen flashing ply over the lead flashing sheet.
- F. Ensure that the roofing base and surfacing plies, lead flashing sheet, and modified bitumen flashing ply extend under the clamping ring and into the drain bowl. Tightly secure the clamping ring.

3.9 SHEET METAL FLANGE STRIPPINGS

- A. At sheet metal flanges associated with tubular penetration, pitch pan and perimeter edge sheet metal fascia flashings:
 - 1. Prime the top and bottom of the sheet metal flange. Allow the primer time to dry.
 - 2. Set flange in a full bed of modified bitumen flashing cement.



3. Install strippings in accordance with the drawings and the requirements and recommendations of the modified bitumen roofing membrane manufacturer.

3.10 MISCELLANEOUS INSTALLATIONS/TREATMENTS

- A. Return mechanical ventilator units to their original positions and secure to the existing curbs with EPDM-gasketed screws. Provide a minimum of one fastener on each side of the curb and a minimum of one fastener every 12-inches o.c.
- B. Reconnect all electrical, plumbing, gas line and ventilation connections required to return mechanical units to their original operating condition. Retain a qualified, licensed electrical subcontractor to reconnect electrical equipment. Retain a qualified, licensed mechanical subcontractor to reconnect gas lines and ventilation connections. Coordinate required disconnections and reconnections with the Owner.
- C. Walkway pads: Install walkway pads at locations indicated on drawings. Install the pads in accordance with the requirements and recommendations of the roofing manufacturer. Extend the pads a minimum of 4-inches in all directions beyond wood blocking.
- D. Install splashblocks set on walkpads at locations indicated on the drawings.
- E. Rooftop conduit and pipe supports:
 1. Install adjustable prefabricated pipe supports at rooftop conduit and pipes.
 2. Space pipe supports at intervals recommended by the support manufacturer, as determined by the diameter and weight of the conduit or pipe.
 3. Separate the support from the roof surface by installing the support over roof walkway pads, installed as specified.
- F. Pre-fabricated plumbing vent pipe extensions:
 1. Refer to manufacturer requirements and recommendations for installation.
 2. Prior to flashing installation, seal intersection of pipe extension and existing plumbing vent.
- G. Install self-adhering underlayment beneath coping caps, and at other locations indicated on the drawings.
 1. Refer to manufacturer requirements and recommendations for installation.
- H. Replacement roof hatch installation:
 1. Remove and discard existing roof hatch.
 2. Provide wood nailers beneath roof hatch flanges, if necessary, to match insulation thickness.
 3. Install new roof hatch following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- I. Extendable safety post installation:
 1. Install new safety post following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- J. Application of elastomeric coating to rooftop penetrations:
 1. Prepare substrate in a manner that is acceptable to the coating manufacturer. Substrate preparation includes, but is not limited to: treatment of excessive gaps, repair of damaged or loose sheet metal components, repair of holes, cleaning of roof penetrations, treatment of surface rust, treatment of residual asphalt, and priming (if required by the roof coating manufacturer).



2. Coat the indicated penetrations following the recommendations and requirements of the coating manufacturer.
- K. Installation of equipment support curbs:
1. Install support curbs where indicated on the project drawings. Flash curbs into the roof system as indicated on the project drawings.
 2. Refer to manufacturer requirements and recommendations for installation.

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NOTE TO SPECIFIER

*Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to **black text**. Review the footer information with the USPS Project Manager for accuracy.*

END OF SECTION 07 52 15 00



SECTION 07 52 16 00 - CSF SBS MODIFIED BITUMEN ROOFING IN COLD ADHESIVE**

NOTE TO SPECIFIER

Editing is needed for each individual project; modify as needed for project specific requirements. Included "NOTE TO SPECIFIER" instructions provide guidance concerning required editing, and options have been included requiring action on the part of the specifier/designer. Select the option appropriate for the project and delete option(s) not selected.

NOTE TO SPECIFIER

EDIT Section footer as necessary to reflect the project name and location, USPS Project number, and required date of the technical specification document. Coordinate this project specific information with the USPS Project Manager. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this section where a cold-applied SBS (Styrene-Butadiene-Styrene) Modified Bitumen Roofing Membrane is selected as the roofing system. For hot-applied SBS (Styrene-Butadiene-Styrene) Modified Bitumen Roofing Membranes, use Section 075217 – SBS MODIFIED BITUMEN ROOFING IN HOT ASPHALT.

Per the United States Postal Service Roofing Design Standards, an SBS modified bitumen roofing system applied in cold adhesive is a recommended roofing system over facilities with a Critical or Non-Critical building designation.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to the installation of SBS (Styrene-Butadiene-Styrene) modified bitumen roofing membrane and flashings in cold adhesive, DOE Energy Star compliant reflective surfacing, related accessories, and warranty and guarantee requirements.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 072100 – Thermal Insulation
- D. Section 076200 – Sheet Metal Flashings and Trim
- E. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

NOTE TO SPECIFIER

Per discussions between the designer and USPS Project Manager, determine the warranty requirements for the project. Choose from the following warranty options and actions:

1. *If an alternate price for a 20-year "Total System Warranty" is specified, Leave Article 1.3 unchanged.*
2. *If a 20-year "Total System Warranty" will be included in the base proposal, or if no warranty is*

CSF SBS MODIFIED BITUMEN ROOFING IN COLD



specified, remove Article 1.3.

Re-letter/number items after editing.

NOTE TO SPECIFIER

Two options are available for paragraph 1.3.B:

1. *If the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per USPS Design Standards. This option will be included in the Base Proposal Cost; DELETE Article 1.3B from the list below.*
2. *If the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. Do not edit paragraph 1.3.B.*

Per discussions between the designer and USPS Project Manager, determine the required outcome from the list above. Choose one option only. Edit the item below, based on the options listed above. Re-letter/number items after editing, if necessary.

1.3 ALTERNATES

- A. Provide an alternate price for the 20-Year Total System Warranty described in paragraph 1.9A.
- B. Provide an alternate price for a completed roof system with a DOE Energy Star compliant reflective surfacing over the installed modified bitumen roof system as specified within Articles 2.4 and 3.4 of this Section.

NOTE TO SPECIFIER

EDIT Article 1.4 – REFERENCES below, based on the system specified:

1. *If an "A" System is chosen, DELETE "ASTM D 6162 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements" from the reference list.*
2. *If a "B" System is chosen, DELETE "ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements" from the reference list.*

Re-letter/number paragraphs and sub-paragraphs after editing.

1.4 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 1. American Society for Testing and Materials (ASTM)
 - a. ASTM D 6162 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements
 - b. ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements
 - c. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
 - d. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
 - e. ASTM D 1668 - Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing

- f. ASTM D 1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
- 2. Factory Mutual Global (FM)
- 3. Underwriters Laboratories (UL)
- 4. National Roofing Contractors Association (NRCA)
- 5. American Society of Civil Engineers (ASCE)
 - a. ASCE 7 Minimum Design Loads of Buildings and Other Structures

1.5 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.6 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp. Store roll materials standing on end.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.



1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
 - 1. NOTE: Do not install SBS modified bitumen roofing at temperatures below 50°F (10°C).
 - 2. When the outside temperature is forecast to fall below 50°F (10°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives and primers should be maintained at a temperature of 50°F (10°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 - 3. Refer to the SBS modified bitumen roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

1.9 MANUFACTURER WARRANTY AND CONTRACTOR GUARANTEE

- A. Provide an alternate price for a manufacturer 20-Year Total System, Non-Pro-Rated Warranty (including insulation, roofing membrane, and flashings) covering materials and labor. The warranty shall include the following additional items:
 - 1. The warranty shall include a wind rider for the design wind speed at the specific project location.
 - 2. Roofing inspection by a technical representative of the roofing membrane manufacturer 22-24 months after date of Final Acceptance.
 - 3. Roofing manufacturer will provide unlimited repairs during warranty period with no cost limitation.
 - 4. Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions.
 - 5. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Record SBS Modified Bitumen in Cold Adhesive Specification Section to Warranty.
- B. The Contractor shall provide a two-year contractor guarantee. At a minimum, the contractor guarantee shall include the following:
 - 1. Contractor name, address, phone number and project contact name.
 - 2. The project completion date, and date of guarantee expiration.
 - 3. The contractor guarantee shall include, in writing, all project work, workmanship, and/or all materials installed by the contractor or subcontractors to be of a quality that will comply with all project specific requirements of the Construction Documents and other documents governing the Work and workmanship through the guarantee period.
 - 4. The contractor shall investigate roof leaks during the guarantee period within a reasonable time period, but in no instance greater than 24-hours after notification of a leak. The contractor shall repair leaks determined to be the cause of the Work at no cost to the Owner.



PART 2 – PRODUCTS

2.1 MODIFIED BITUMEN ROOFING SYSTEM SUMMARY

- A. The complete roofing membrane system assembly shall consist of an SBS surfacing ply over an SBS base ply, meeting or exceeding the requirements listed in paragraphs 2.2A and 2.2B.

NOTE TO SPECIFIER

***NOTE:** In high wind areas, such as those with a calculated wind uplift pressure of greater than 45 psf in the roof field, enhancements to the roof system may be required and must be considered by the design professional/specifier. Consult with the roofing membrane manufacturer and qualified testing agencies for further information and guidance related to possible roof system enhancements in high wind areas.*

- B. The complete roofing system assembly shall resist uplift pressures calculated according to ASCE 7-05 for the field, perimeters and corners. The specified approval rating must incorporate a safety factor of 2 over the maximum calculated uplift pressure in foot-pound units.
- C. The complete roofing system assembly shall achieve an FM or UL Class A fire rating.
- D. Acceptable roofing membrane manufacturers include those manufacturing both a modified bitumen base ply and surfacing ply meeting the requirements listed in Articles 2.2 and 2.3. Roofing membrane manufacturers offering a surfacing ply meeting the requirements listed in Articles 2.2 and 2.3, but not offering a base ply meeting the requirement are acceptable with the following restrictions:
1. The submitted system shall include a base ply meeting the requirements of ASTM D 6164, Type II, Grade S.
 2. A letter, signed by authorized representatives of the modified bitumen surfacing ply and base ply manufacturers, indicating the completed system meets the requirements listed in Article 2.1., shall be submitted to the Owner for review.
 3. The completed system shall be capable of meeting the warranty and guarantee requirements outlined in Article 1.9. The total system warranty described shall be the responsibility of a single roofing supplier/manufacturer.

NOTE TO SPECIFIER

Two options are listed below within Articles 2.2 and 2.3:

1. An "A" System, utilizing a polyester-reinforced base ply (ASTM D 6164, Type II) and surfacing ply (ASTM D 6164, Type II).
2. A "B" System, utilizing a dual-reinforced base sheet, with both glass fiber and polyester reinforcement (ASTM D 6162, Type III) and surfacing ply (ASTM D 6162, Type III).

Per discussions between the designer and USPS Project Manager, determine the system desired from the list above. Choose one system only. Edit the list below, leaving one base and surfacing ply for the MB roofing membrane and flashing system, based on the systems listed above. *Re-letter/number paragraphs and sub-paragraphs after editing.*

2.2 MODIFIED BITUMEN ROOFING MEMBRANE

- A. Base ply ("A" System):
1. Modified bitumen base sheet, polyester reinforced, minimum nominal 115 mil thickness; ASTM D 6164, Type II, Grade S.
- B. Surfacing ply ("A" System):



1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, fire-rated, minimum nominal 130 mil thickness; ASTM D 6164, Type II, Grade G.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.
- C. Base ply ("B" System):
 1. Modified bitumen base sheet, polyester reinforced, minimum nominal 130 mil thickness; ASTM D 6162, Type III, Grade S.
- D. Surfacing ply ("B" System):
 1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, fire-rated, minimum nominal 160 mil thickness; ASTM D 6162, Type III, Grade G.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.

2.3 MODIFIED BITUMEN ROOFING FLASHING

- A. Base ply ("A" System):
 1. Modified bitumen base sheet, polyester reinforced, minimum nominal 115 mil thickness; ASTM D 6164, Type II, Grade S.
- B. Surfacing ply ("A" System):
 1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, fire-rated, minimum nominal 130 mil thickness; ASTM D 6164, Type II, Grade G.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.
- C. Base ply ("B" System):
 1. Modified bitumen base sheet, polyester reinforced, minimum nominal 130 mil thickness; ASTM D 6162, Type III, Grade S.
- D. Surfacing ply ("B" System):
 1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, fire-rated, minimum nominal 160 mil thickness; ASTM D 6162, Type III, Grade G.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.

NOTE TO SPECIFIER

Four options are available for Article 2.4:

1. If an "A System" is specified, and the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per the USPS Roofing Design Standards. This option will be included in the Base Proposal; DELETE "(ALTERNATE)" from the Article title.
2. If an "A System" is specified, and the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. Do not edit Article 2.4.
3. If a "B System" is specified, and the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per the USPS Roofing Design Standards. This option will be included in the Base Proposal; DELETE "(ALTERNATE)" from the Article title. DELETE sub-paragraphs 2.4.A.1 and 2.4.A.2, and the word "other" from sub-paragraph 2.4.A.3.
4. If a "B System" is specified, and the project is located in an ASHRAE Climate Zones 5, 6 or 7, a



reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. DELETE sub-paragraphs 2.4.A.1 and 2.4.A.2, and the word "other" from sub-paragraph 2.4.A.3.

Determine the required outcome from the list above. Choose one option only. EDIT the item below, based on the options listed above. Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

2.4 DOE ENERGY STAR INITIAL SOLAR REFLECTANCE REQUIREMENT (ALTERNATE)

- A. Provide a completed roofing system approved by the roofing membrane manufacturer, and meeting the Initial Solar Reflectance requirement of 0.65, minimum, as required by DOE Energy Star. The following products are acceptable to achieve this requirement:
 - 1. Surfacing plies, used in lieu of those identified within paragraphs 2.2.B and 2.3.B:
 - a. Firestone "SBS Premium UltraWhite" surfacing ply, manufactured by Firestone Building Products, as the specified roofing membrane and flashing surfacing ply identified in paragraphs 2.2.B and 2.3.B.
 - b. JM "Dynalastic 250 FR CR" surfacing ply, manufactured by Johns Manville, as the specified roofing membrane and flashing surfacing ply identified in paragraphs 2.2.B and 2.3.B.
 - 2. Acrylic elastomeric coating, applied over surfacing plies identified within paragraphs 2.2.B and 2.3.B:
 - a. Use of surfacing plies meeting the requirements identified in Articles 2.2 and 2.3 of this Section, and a field-applied acrylic elastomeric coating applied to the finished SBS modified bitumen roofing membrane and flashing surfacing ply. The coating shall be approved for the use specified by the roofing membrane and coating manufacturers.

NOTE TO SPECIFIER

If liquid-applied flashing is required for this project, do not edit Article 2.5. If liquid-applied flashing is not required for this project, DELETE Article 2.5. If necessary, re-letter/number paragraphs and sub-paragraphs after editing.

2.5 LIQUID-APPLIED FLASHING

- A. Base and top coats:
 - 1. Single or dual component, moisture-cured. Product approved by the roofing membrane manufacturer for use in the specified configuration.
- B. Reinforcing fabric:
 - 1. Polyester-reinforced fabric. Product approved by the roofing membrane manufacturer for use in the specified configuration.

2.6 ADHESIVES, CEMENTS AND PRIMERS

- A. Cold adhesive: Product approved by the roofing membrane manufacturer.
- B. Flashing cement and roofing cement: Product compatible with SBS Modified bitumen roofing and approved by the roofing membrane manufacturer.
- C. Asphalt primer: ASTM D 41.

2.7 FASTENERS



- A. Roofing membrane and flashing fasteners: Unless otherwise indicated, types as required by the roofing membrane manufacturer.

2.8 ROOFING SHEETS FOR TEMPORARY TIE-INS

- A. For use at temporary overnight tie-ins: Specified modified bitumen base sheet, polyester reinforced, minimum nominal 115 mil thickness.
- B. For use at roof sump flashings and elsewhere as may be indicated: Asphalt treated woven glass fabric, ASTM D 1668, Type I.

NOTE TO SPECIFIER

EDIT items in Article 2.9 to reflect actual project conditions and requirements. Re-letter/number paragraphs and sub-paragraphs after editing.

2.9 MISCELLANEOUS MATERIALS

- A. Walkway pads: Product approved by the roofing manufacturer.
- B. Splashblocks: Concrete; size as necessary to accommodate existing condition.
- C. Pitch pan fill materials:
 - 1. Non-shrink grout (for bottom fill): Quick-set, fast-drying grout; product acceptable to roofing manufacturer.
 - 2. Pourable sealer (for top fill): Two-part pourable elastomeric sealer, product acceptable to roofing manufacturer.
- D. Conduit and pipe supports:
 - 1. For pipes with a diameter up to 6-inches:
 - a. Adjustable prefabricated support such as Pipe Pier 150 manufactured by Pipe Pier Support Systems, Hamel, MN, or approved equal.
 - b. Product approved by the roofing manufacturer for this application.
 - c. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
 - 2. For pipes with a diameter greater than 6-inches:
 - a. Product approved by the roofing manufacturer for this application.
 - b. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
- E. Self-adhering membrane (for use over parapet walls beneath coping caps, and at other locations indicated on the drawings): Product approved for use beneath sheet metal by the membrane manufacturer, and meeting the following criteria:
 - 1. Meeting the requirements of ASTM D 1970.
 - 2. Approved for use as an underlayment for standing seam sheet metal roofing.
 - 3. A 40-mil minimum membrane thickness.
- F. Roof hatch:
 - 1. Roof hatch, such as "Type E" or "Type S", manufactured by The Bilco Company, New Haven, CT, or approved equal.
 - a. Size and configuration as necessary.



- b. Product approved by the roofing manufacturer for this application.
- G. Extendable ladder-mounted safety post, such as "LadderUP Safety Post", manufactured by The Bilco Company, New Haven, CT, or approved equal.
 - 1. Size and configuration as necessary to accommodate new roof hatch.
 - 2. Product approved by the roofing manufacturer for this application.
- H. Acrylic elastomeric coating (for use at roof penetrations and other locations indicated on the project drawings). Product approved for use by the membrane manufacturer for this application, and meeting the following criteria:
 - 1. Meeting the requirements of ASTM D 6083.
 - 2. White color.
- I. Rooftop unit support curbs: Product such as "Pate Equipment Supports" manufactured by The Pate Company, Lombard, IL, or approved equal.
 - 1. Size and configuration as necessary to accommodate existing rooftop unit.
 - 2. Fabricated from 18 ga. galvanized steel, minimum, with welded seams; and a nominal 2-inch thick nailer affixed atop the curb support.
 - 3. Fabricated to allow for a minimum flashing height of 8-inches, minimum.
 - 4. Product approved by the roofing manufacturer for this application.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.

NOTE TO SPECIFIER

Review available field data. Edit required Section references based on existing structural deck types present on the project. For roof areas consisting of an underlying concrete, gypsum concrete or cementitious wood fiber structural deck, include Section 072221 within paragraph 3.1.B below. For roof areas consisting of an underlying wood deck, include Section 072222 within paragraph 3.1.B below. For roof areas consisting of an underlying steel deck, include Section 072223 within paragraph 3.1.B below.

- B. Ensure that the insulation and cover board substrate is installed as specified in Sections 072221, 072222 and 072223 are suitable to receive roofing membrane materials.

3.2 ROOFING MEMBRANE INSTALLATION

- A. Except as may be modified by these specifications and drawings, install roofing membrane in accordance with the requirements and recommendations of the roofing membrane manufacturer, using the manufacturer's current printed instructions.
- B. Chalk lining: Beginning at the low points or drains, chalk line the cover board surface to serve as guides for the proper laying of the roofing membrane plies.
- C. Broom or press each ply into place, full width.

NOTE TO SPECIFIER

Hot-air welding of roofing membrane base ply and surfacing ply seams, using a flameless welding machine, is required. Use of torches during roof replacement application is not allowed.



- D. Hot-air welded seams: A flameless welding machine must be used for field membrane seams. Hot-air weld base ply and surfacing ply seams. Do not use torches to weld seams.
- E. Install only as much roofing as can be completed in a work day, including flashing and detail work. All installed roofing shall be sealed to a watertight condition prior to leaving the site daily.
- F. Sequence roofing work to eliminate the use of installed roofing as a walkway, or as a storage platform for materials.
- G. Where wheeled or excessive traffic over new or existing roofing work is unavoidable, provide and use 3/4-inch plywood, set over a minimum of two-inch thick rigid board insulation to protect roofing components in place.
- H. Overnight tie-in: Care should be exercised to ensure that water does not flow beneath any completed sections of the roof by temporarily sealing the loose edge of the membrane at the end of each work day and when the weather is threatening. The roofing membrane manufacturer's requirements should be followed closely.
- I. Remove debris from the roof daily prior to leaving the site. Inspect the site at ground level. Remove any roof replacement related debris from the ground.
- J. Fire watch: Per local codes, provide a fire watch after completion of daily work

3.3 BASE FLASHINGS

- A. Curb height: Unless otherwise indicated provide an 8-inch minimum flashing height above the finished roofing surface. Refer to Section 061053 for wood blocking requirements related to raising of rooftop curbs.
- B. Ensure that all flashing substrates are suitable to receive new base flashing materials.
- C. Install base flashings at vertical walls and curbs in accordance with the roofing membrane manufacturer's requirements and recommendations.

NOTE TO SPECIFIER

Hot-air welding of roofing membrane base and surfacing ply seams, using a flameless welding machine, is required.

- D. Hot-air welded seams: Using a heat gun, hot-air weld flashing base ply and surfacing ply seams. Do not use torches to weld seams.
- E. Secure the top edge of flashing as shown on the drawings, and In accordance with roofing membrane manufacturer recommendations and requirements. Seal the completed flashing top edge with a 3-course stripping of woven glass fabric and flashing cement.
- F. Fire watch: Per local codes, provide a fire watch after completion of daily work

NOTE TO SPECIFIER

Four options are available for Article 3.4:

1. *If an "A System" is specified, and the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a*



- reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per USPS Design Standards. This option will be included in the Base Proposal; DELETE "(ALTERNATE WORK)" from the Article title.*
2. *If an "A System" is chosen, and the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. Do not edit Article 3.4.*
 3. *If a "B System" is specified, and the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per USPS Design Standards. This option will be included in the Base Proposal; DELETE "(ALTERNATE WORK)" from the Article title. DELETE paragraph 3.4A.*
 4. *If a "B System" is specified, and the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. DELETE paragraph 3.4A.*

Determine the required outcome from the list above. Choose one option only. Edit the item below, based on the options listed above. Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

3.4 REFLECTIVE SURFACING INSTALLATION (ALTERNATE WORK)

- A. Installation of surfacing plies with a factory-applied reflective coatings:
 1. Apply the surfacing sheet, following the requirements and recommendations of the roofing membrane manufacturer.
 2. Exercise reasonable care to keep reflective sheets clean, and clear of debris.
 3. At roofing membrane and flashing surfacing ply seams and laps:
 - a. Clean the seam and lap area of dirt and debris. Power wash the seams and laps, if necessary to remove excessive residue.
 - b. At seams, broadcast reflective granules over seam area; or prime seams and laps, and apply two coats minimum of the specified acrylic elastomeric coating over the seam and lap areas.
 4. At locations determined by the Owner to contain excessive staining:
 - a. Clean the identified area(s) of dirt and debris. Power wash the area, if necessary to remove excessive residue.
 - b. Prime the area, if required by the coating manufacturer. Apply two coats, minimum, of the specified acrylic elastomeric coating over the area.
- B. Installation of field-applied acrylic elastomeric roof coating:
 1. Prepare substrate in a manner that is acceptable to the roofing membrane and coating manufacturers. Substrate preparation includes, but is not limited to: removal of dirt and debris, repair of defects in the roof membrane and flashing, treatment of surface residue, treatment of areas of excessive ponding, and priming (if required by the roof coating manufacturer).
 - a. After substrate preparation work is complete, inspect all surface preparation work. Correct any identified defects prior to application of coating.
 - b. Inspect the areas adjacent to the work area for cars and other property that could be damaged by coating overspray. Prior to work start, remove or protect cars and other property that may be damaged by work activities.
 - c. Prior to work start, close any rooftop air intakes within and adjacent to the work area.
 - d. Follow manufacturer guidelines for rate of application and application procedures of the base and finish coats, as outlined in the written literature provided by the coating manufacturer.
 - e. Apply the coating following the requirements and recommendations of the roofing membrane and coating manufacturer. Install a minimum of two coats of acrylic elastomeric coating over the roof surface.



NOTE TO SPECIFIER

If liquid-applied flashing is required for this project, do not edit Article 3.5. If liquid-applied flashing is not required for this project, DELETE Article 3.5. If necessary, re-letter/number paragraphs and sub-paragraphs after editing.

3.5 LIQUID-APPLIED FLASHING

- A. At locations to receive liquid applied flashings, as indicated on the project drawings:
 - 1. Follow the written instructions for application of liquid-applied flashing provided by the roofing membrane manufacturer.
 - 2. Prepare the flashing substrate in a manner that is acceptable to the roofing membrane manufacturer. Substrate preparation includes, but is not limited to, removal of dirt and debris, repair of defects in the roof membrane and flashing, treatment of surface residue, treatment of areas of excessive ponding, and priming (if required by the roof coating manufacturer).
 - 3. Apply the base coat of liquid applied flashing to the substrate.
 - 4. Install required reinforcing mesh into the base coat.
 - 5. Apply the top coat of liquid applied flashing over the reinforcing mesh and base coat. Extend the top coat over and beyond the reinforcing mesh.
 - 6. At horizontal surfaces, broadcast granules over the completed flashing.

3.6 ROOF SUMP FLASHINGS

- A. Prior to installation of the base ply, install a three-course stripping of woven glass fabric and roofing cement over the cover board/insulation substrate.
- B. Ensure that the roofing membrane plies extend into the roof sump.
- C. Install a three-course stripping of woven glass fabric and roofing cement over the base ply.
- D. Install a lead sheet flashing over the base ply in the sump; refer to Section 076203. Prime both sides of the lead sheet prior to installation.
- E. Install modified bitumen flashing ply over the lead flashing sheet.
- F. Ensure that the roofing base and surfacing plies, lead flashing sheet, and modified bitumen flashing ply extend under the clamping ring and into the drain bowl. Tightly secure the clamping ring.

3.7 SHEET METAL FLANGE STRIPPINGS

- A. At sheet metal flanges associated with tubular penetration, pitch pan and perimeter edge sheet metal fascia flashings:
 - 1. Prime the top and bottom of the sheet metal flange. Allow the primer time to dry.
 - 2. Set flange in a full bed of roofing cement.
 - 3. Install strippings in accordance with the drawings and the requirements and recommendations of the modified bitumen roofing membrane manufacturer.

NOTE TO SPECIFIER



EDIT items in Article 3.8 to reflect actual project conditions and requirements. Re-letter/number paragraphs and sub-paragraphs after editing.

3.8 MISCELLANEOUS INSTALLATIONS/TREATMENTS

- A. Install mechanical ventilator units in position and secure to the existing curbs with EPDM-gasketed screws. Provide a minimum of one fastener on each side of the curb and a minimum of one fastener every 12-inches o.c.
- B. Connect all electrical, plumbing, gas line and ventilation connections required for mechanical units. Retain a qualified, licensed electrical subcontractor to connect electrical equipment. Retain a qualified, licensed mechanical subcontractor to connect gas lines and ventilation connections.
- C. Walkway pads: Install walkway pads at locations indicated on drawings. Install the pads in accordance with the requirements and recommendations of the roofing manufacturer. Extend the pads a minimum of 4-inches in all directions beyond wood blocking.
- D. Install splashblocks set on walkpads at locations indicated on the drawings.
- E. Rooftop conduit and pipe supports:
 - 1. Install adjustable prefabricated pipe supports at rooftop conduit and pipes.
 - 2. Space pipe supports at intervals recommended by the support manufacturer, as determined by the diameter and weight of the conduit or pipe.
 - 3. Separate the support from the roof surface by installing the support over roof walkway pads, installed as specified.
- F. Install self-adhering underlayment beneath coping caps, and at other locations indicated on the drawings.
 - 1. Refer to manufacturer requirements and recommendations for installation.
- G. Replacement roof hatch installation:
 - 1. Provide wood nailers beneath roof hatch flanges, if necessary, to match insulation thickness.
 - 2. Install new roof hatch following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- H. Extendable safety post installation:
 - 1. Install new safety post following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- I. Application of elastomeric coating to rooftop penetrations:
 - 1. Prepare substrate in a manner that is acceptable to the coating manufacturer. Substrate preparation includes, but is not limited to: treatment of excessive gaps, repair of damaged or loose sheet metal components, repair of holes, cleaning of roof penetrations, treatment of surface rust, treatment of residual asphalt, and priming (if required by the roof coating manufacturer).
 - 2. Coat the indicated penetrations following the recommendations and requirements of the coating manufacturer.
- J. Installation of equipment support curbs:
 - 1. Install support curbs where indicated on the project drawings. Flash curbs into the roof system as indicated on the project drawings.
 - 2. Refer to manufacturer requirements and recommendations for installation.



USPS CSF Specifications, issued: 10/1/2013
Last revised: 9/16/2013

NOTE TO SPECIFIER

*Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to **black** text. Review the footer information with the USPS Project Manager for accuracy.*

END OF SECTION 07 52 16 00



SECTION 07 52 16 00 - MPF SBS MODIFIED BITUMEN ROOFING IN COLD ADHESIVE**

NOTE TO SPECIFIER

Editing is needed for each individual project; modify as needed for project specific requirements. Included "NOTE TO SPECIFIER" instructions provide guidance concerning required editing, and options have been included requiring action on the part of the specifier/designer. Select the option appropriate for the project and delete option(s) not selected.

NOTE TO SPECIFIER

EDIT Section footer as necessary to reflect the project name and location, USPS Project number, and required date of the technical specification document. Coordinate this project specific information with the USPS Project Manager. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this section where a cold-applied SBS (Styrene-Butadiene-Styrene) Modified Bitumen Roofing Membrane is selected as the roofing system. For hot-applied SBS (Styrene-Butadiene-Styrene) Modified Bitumen Roofing Membranes, use Section 075217 – SBS MODIFIED BITUMEN ROOFING IN HOT ASPHALT.

Per the United States Postal Service Roofing Design Standards, an SBS modified bitumen roofing system applied in cold adhesive is a recommended roofing system over facilities with a Critical or Non-Critical building designation.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to the installation of SBS (Styrene-Butadiene-Styrene) modified bitumen roofing membrane and flashings in cold adhesive, DOE Energy Star compliant reflective surfacing, related accessories, and warranty and guarantee requirements.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 072100 – Thermal Insulation
- D. Section 076200 – Sheet Metal Flashings and Trim
- E. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

NOTE TO SPECIFIER

Per discussions between the designer and USPS Project Manager, determine the warranty requirements for the project. Choose from the following warranty options and actions:

1. *If an alternate price for a 20-year "Total System Warranty" is specified, Leave Article 1.3 unchanged.*
2. *If a 20-year "Total System Warranty" will be included in the base proposal, or if no warranty is*

MPF SBS MODIFIED BITUMEN ROOFING IN COLD



specified, remove Article 1.3.

Re-letter/number items after editing.

NOTE TO SPECIFIER

Two options are available for paragraph 1.3.B:

1. *If the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per USPS Design Standards. This option will be included in the Base Proposal Cost; DELETE Article 1.3B from the list below.*
2. *If the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. Do not edit paragraph 1.3.B.*

Per discussions between the designer and USPS Project Manager, determine the required outcome from the list above. Choose one option only. Edit the item below, based on the options listed above. Re-letter/number items after editing, if necessary.

1.3 ALTERNATES

- A. Provide an alternate price for the 20-Year Total System Warranty described in paragraph 1.9A.
- B. Provide an alternate price for a completed roof system with a DOE Energy Star compliant reflective surfacing over the installed modified bitumen roof system as specified within Articles 2.4 and 3.4 of this Section.

NOTE TO SPECIFIER

EDIT Article 1.4 – REFERENCES below, based on the system specified:

1. *If an "A" System is chosen, DELETE "ASTM D 6162 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements" from the reference list.*
2. *If a "B" System is chosen, DELETE "ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements" from the reference list.*

Re-letter/number paragraphs and sub-paragraphs after editing.

1.4 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 1. American Society for Testing and Materials (ASTM)
 - a. ASTM D 6162 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements
 - b. ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements
 - c. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
 - d. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
 - e. ASTM D 1668 - Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing



- f. ASTM D 1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
- 2. Factory Mutual Global (FM)
- 3. Underwriters Laboratories (UL)
- 4. National Roofing Contractors Association (NRCA)
- 5. American Society of Civil Engineers (ASCE)
 - a. ASCE 7 Minimum Design Loads of Buildings and Other Structures

1.5 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.6 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp. Store roll materials standing on end.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.



1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
 - 1. NOTE: Do not install SBS modified bitumen roofing at temperatures below 50°F (10°C).
 - 2. When the outside temperature is forecast to fall below 50°F (10°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives and primers should be maintained at a temperature of 50°F (10°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 - 3. Refer to the SBS modified bitumen roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

1.9 MANUFACTURER WARRANTY AND CONTRACTOR GUARANTEE

- A. Provide an alternate price for a manufacturer 20-Year Total System, Non-Pro-Rated Warranty (including insulation, roofing membrane, and flashings) covering materials and labor. The warranty shall include the following additional items:
 - 1. The warranty shall include a wind rider for the design wind speed at the specific project location.
 - 2. Roofing inspection by a technical representative of the roofing membrane manufacturer 22-24 months after date of Final Acceptance.
 - 3. Roofing manufacturer will provide unlimited repairs during warranty period with no cost limitation.
 - 4. Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions.
 - 5. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Record SBS Modified Bitumen in Cold Adhesive Specification Section to Warranty.
- B. The Contractor shall provide a two-year contractor guarantee. At a minimum, the contractor guarantee shall include the following:
 - 1. Contractor name, address, phone number and project contact name.
 - 2. The project completion date, and date of guarantee expiration.
 - 3. The contractor guarantee shall include, in writing, all project work, workmanship, and/or all materials installed by the contractor or subcontractors to be of a quality that will comply with all project specific requirements of the Construction Documents and other documents governing the Work and workmanship through the guarantee period.
 - 4. The contractor shall investigate roof leaks during the guarantee period within a reasonable time period, but in no instance greater than 24-hours after notification of a leak. The contractor shall repair leaks determined to be the cause of the Work at no cost to the Owner.



PART 2 – PRODUCTS

2.1 MODIFIED BITUMEN ROOFING SYSTEM SUMMARY

- A. The complete roofing membrane system assembly shall consist of an SBS surfacing ply over an SBS base ply, meeting or exceeding the requirements listed in paragraphs 2.2A and 2.2B.

NOTE TO SPECIFIER

***NOTE:** In high wind areas, such as those with a calculated wind uplift pressure of greater than 45 psf in the roof field, enhancements to the roof system may be required and must be considered by the design professional/specifier. Consult with the roofing membrane manufacturer and qualified testing agencies for further information and guidance related to possible roof system enhancements in high wind areas.*

- B. The complete roofing system assembly shall resist uplift pressures calculated according to ASCE 7-05 for the field, perimeters and corners. The specified approval rating must incorporate a safety factor of 2 over the maximum calculated uplift pressure in foot-pound units.
- C. The complete roofing system assembly shall achieve an FM or UL Class A fire rating.
- D. Acceptable roofing membrane manufacturers include those manufacturing both a modified bitumen base ply and surfacing ply meeting the requirements listed in Articles 2.2 and 2.3. Roofing membrane manufacturers offering a surfacing ply meeting the requirements listed in Articles 2.2 and 2.3, but not offering a base ply meeting the requirement are acceptable with the following restrictions:
1. The submitted system shall include a base ply meeting the requirements of ASTM D 6164, Type II, Grade S.
 2. A letter, signed by authorized representatives of the modified bitumen surfacing ply and base ply manufacturers, indicating the completed system meets the requirements listed in Article 2.1., shall be submitted to the Owner for review.
 3. The completed system shall be capable of meeting the warranty and guarantee requirements outlined in Article 1.9. The total system warranty described shall be the responsibility of a single roofing supplier/manufacturer.

NOTE TO SPECIFIER

Two options are listed below within Articles 2.2 and 2.3:

1. An "A" System, utilizing a polyester-reinforced base ply (ASTM D 6164, Type II) and surfacing ply (ASTM D 6164, Type II).
2. A "B" System, utilizing a dual-reinforced base sheet, with both glass fiber and polyester reinforcement (ASTM D 6162, Type III) and surfacing ply (ASTM D 6162, Type III).

Per discussions between the designer and USPS Project Manager, determine the system desired from the list above. Choose one system only. Edit the list below, leaving one base and surfacing ply for the MB roofing membrane and flashing system, based on the systems listed above. *Re-letter/number paragraphs and sub-paragraphs after editing.*

2.2 MODIFIED BITUMEN ROOFING MEMBRANE

- A. Base ply ("A" System):
1. Modified bitumen base sheet, polyester reinforced, minimum nominal 115 mil thickness; ASTM D 6164, Type II, Grade S.
- B. Surfacing ply ("A" System):



1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, fire-rated, minimum nominal 130 mil thickness; ASTM D 6164, Type II, Grade G.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.
- C. Base ply ("B" System):
 1. Modified bitumen base sheet, polyester reinforced, minimum nominal 130 mil thickness; ASTM D 6162, Type III, Grade S.
- D. Surfacing ply ("B" System):
 1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, fire-rated, minimum nominal 160 mil thickness; ASTM D 6162, Type III, Grade G.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.

2.3 MODIFIED BITUMEN ROOFING FLASHING

- A. Base ply ("A" System):
 1. Modified bitumen base sheet, polyester reinforced, minimum nominal 115 mil thickness; ASTM D 6164, Type II, Grade S.
- B. Surfacing ply ("A" System):
 1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, fire-rated, minimum nominal 130 mil thickness; ASTM D 6164, Type II, Grade G.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.
- C. Base ply ("B" System):
 1. Modified bitumen base sheet, polyester reinforced, minimum nominal 130 mil thickness; ASTM D 6162, Type III, Grade S.
- D. Surfacing ply ("B" System):
 1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, fire-rated, minimum nominal 160 mil thickness; ASTM D 6162, Type III, Grade G.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.

NOTE TO SPECIFIER

Four options are available for Article 2.4:

1. If an "A System" is specified, and the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per the USPS Roofing Design Standards. This option will be included in the Base Proposal; DELETE "(ALTERNATE)" from the Article title.
2. If an "A System" is specified, and the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. Do not edit Article 2.4.
3. If a "B System" is specified, and the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per the USPS Roofing Design Standards. This option will be included in the Base Proposal; DELETE "(ALTERNATE)" from the Article title. DELETE sub-paragraphs 2.4.A.1 and 2.4.A.2, and the word "other" from sub-paragraph 2.4.A.3.
4. If a "B System" is specified, and the project is located in an ASHRAE Climate Zones 5, 6 or 7, a



reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. DELETE sub-paragraphs 2.4.A.1 and 2.4.A.2, and the word "other" from sub-paragraph 2.4.A.3.

Determine the required outcome from the list above. Choose one option only. EDIT the item below, based on the options listed above. Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

2.4 DOE ENERGY STAR INITIAL SOLAR REFLECTANCE REQUIREMENT (ALTERNATE)

- A. Provide a completed roofing system approved by the roofing membrane manufacturer, and meeting the Initial Solar Reflectance requirement of 0.65, minimum, as required by DOE Energy Star. The following products are acceptable to achieve this requirement:
 - 1. Surfacing plies, used in lieu of those identified within paragraphs 2.2.B and 2.3.B:
 - a. Firestone "SBS Premium UltraWhite" surfacing ply, manufactured by Firestone Building Products, as the specified roofing membrane and flashing surfacing ply identified in paragraphs 2.2.B and 2.3.B.
 - b. JM "Dynalastic 250 FR CR" surfacing ply, manufactured by Johns Manville, as the specified roofing membrane and flashing surfacing ply identified in paragraphs 2.2.B and 2.3.B.
 - 2. Acrylic elastomeric coating, applied over surfacing plies identified within paragraphs 2.2.B and 2.3.B:
 - a. Use of surfacing plies meeting the requirements identified in Articles 2.2 and 2.3 of this Section, and a field-applied acrylic elastomeric coating applied to the finished SBS modified bitumen roofing membrane and flashing surfacing ply. The coating shall be approved for the use specified by the roofing membrane and coating manufacturers.

NOTE TO SPECIFIER

If liquid-applied flashing is required for this project, do not edit Article 2.5. If liquid-applied flashing is not required for this project, DELETE Article 2.5. If necessary, re-letter/number paragraphs and sub-paragraphs after editing.

2.5 LIQUID-APPLIED FLASHING

- A. Base and top coats:
 - 1. Single or dual component, moisture-cured. Product approved by the roofing membrane manufacturer for use in the specified configuration.
- B. Reinforcing fabric:
 - 1. Polyester-reinforced fabric. Product approved by the roofing membrane manufacturer for use in the specified configuration.

2.6 ADHESIVES, CEMENTS AND PRIMERS

- A. Cold adhesive: Product approved by the roofing membrane manufacturer.
- B. Flashing cement and roofing cement: Product compatible with SBS Modified bitumen roofing and approved by the roofing membrane manufacturer.
- C. Asphalt primer: ASTM D 41.

2.7 FASTENERS



- A. Roofing membrane and flashing fasteners: Unless otherwise indicated, types as required by the roofing membrane manufacturer.

2.8 ROOFING SHEETS FOR TEMPORARY TIE-INS

- A. For use at temporary overnight tie-ins: Specified modified bitumen base sheet, polyester reinforced, minimum nominal 115 mil thickness.
- B. For use at roof sump flashings and elsewhere as may be indicated: Asphalt treated woven glass fabric, ASTM D 1668, Type I.

NOTE TO SPECIFIER

EDIT items in Article 2.9 to reflect actual project conditions and requirements. Re-letter/number paragraphs and sub-paragraphs after editing.

2.9 MISCELLANEOUS MATERIALS

- A. Walkway pads: Product approved by the roofing manufacturer.
- B. Splashblocks: Concrete; size as necessary to accommodate existing condition.
- C. Pitch pan fill materials:
 - 1. Non-shrink grout (for bottom fill): Quick-set, fast-drying grout; product acceptable to roofing manufacturer.
 - 2. Pourable sealer (for top fill): Two-part pourable elastomeric sealer, product acceptable to roofing manufacturer.
- D. Conduit and pipe supports:
 - 1. For pipes with a diameter up to 6-inches:
 - a. Adjustable prefabricated support such as Pipe Pier 150 manufactured by Pipe Pier Support Systems, Hamel, MN, or approved equal.
 - b. Product approved by the roofing manufacturer for this application.
 - c. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
 - 2. For pipes with a diameter greater than 6-inches:
 - a. Product approved by the roofing manufacturer for this application.
 - b. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
- E. Self-adhering membrane (for use over parapet walls beneath coping caps, and at other locations indicated on the drawings): Product approved for use beneath sheet metal by the membrane manufacturer, and meeting the following criteria:
 - 1. Meeting the requirements of ASTM D 1970.
 - 2. Approved for use as an underlayment for standing seam sheet metal roofing.
 - 3. A 40-mil minimum membrane thickness.
- F. Roof hatch:
 - 1. Roof hatch, such as "Type E" or "Type S", manufactured by The Bilco Company, New Haven, CT, or approved equal.
 - a. Size and configuration as necessary.



- b. Product approved by the roofing manufacturer for this application.
- G. Extendable ladder-mounted safety post, such as "LadderUP Safety Post", manufactured by The Bilco Company, New Haven, CT, or approved equal.
 - 1. Size and configuration as necessary to accommodate new roof hatch.
 - 2. Product approved by the roofing manufacturer for this application.
- H. Acrylic elastomeric coating (for use at roof penetrations and other locations indicated on the project drawings). Product approved for use by the membrane manufacturer for this application, and meeting the following criteria:
 - 1. Meeting the requirements of ASTM D 6083.
 - 2. White color.
- I. Rooftop unit support curbs: Product such as "Pate Equipment Supports" manufactured by The Pate Company, Lombard, IL, or approved equal.
 - 1. Size and configuration as necessary to accommodate existing rooftop unit.
 - 2. Fabricated from 18 ga. galvanized steel, minimum, with welded seams; and a nominal 2-inch thick nailer affixed atop the curb support.
 - 3. Fabricated to allow for a minimum flashing height of 8-inches, minimum.
 - 4. Product approved by the roofing manufacturer for this application.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.

NOTE TO SPECIFIER

Review available field data. Edit required Section references based on existing structural deck types present on the project. For roof areas consisting of an underlying concrete, gypsum concrete or cementitious wood fiber structural deck, include Section 072221 within paragraph 3.1.B below. For roof areas consisting of an underlying wood deck, include Section 072222 within paragraph 3.1.B below. For roof areas consisting of an underlying steel deck, include Section 072223 within paragraph 3.1.B below.

- B. Ensure that the insulation and cover board substrate is installed as specified in Sections 072221, 072222 and 072223 are suitable to receive roofing membrane materials.

3.2 ROOFING MEMBRANE INSTALLATION

- A. Except as may be modified by these specifications and drawings, install roofing membrane in accordance with the requirements and recommendations of the roofing membrane manufacturer, using the manufacturer's current printed instructions.
- B. Chalk lining: Beginning at the low points or drains, chalk line the cover board surface to serve as guides for the proper laying of the roofing membrane plies.
- C. Broom or press each ply into place, full width.

NOTE TO SPECIFIER

Hot-air welding of roofing membrane base ply and surfacing ply seams, using a flameless welding machine, is required. Use of torches during roof replacement application is not allowed.



- D. Hot-air welded seams: A flameless welding machine must be used for field membrane seams. Hot-air weld base ply and surfacing ply seams. Do not use torches to weld seams.
- E. Install only as much roofing as can be completed in a work day, including flashing and detail work. All installed roofing shall be sealed to a watertight condition prior to leaving the site daily.
- F. Sequence roofing work to eliminate the use of installed roofing as a walkway, or as a storage platform for materials.
- G. Where wheeled or excessive traffic over new or existing roofing work is unavoidable, provide and use 3/4-inch plywood, set over a minimum of two-inch thick rigid board insulation to protect roofing components in place.
- H. Overnight tie-in: Care should be exercised to ensure that water does not flow beneath any completed sections of the roof by temporarily sealing the loose edge of the membrane at the end of each work day and when the weather is threatening. The roofing membrane manufacturer's requirements should be followed closely.
- I. Remove debris from the roof daily prior to leaving the site. Inspect the site at ground level. Remove any roof replacement related debris from the ground.
- J. Fire watch: Per local codes, provide a fire watch after completion of daily work

3.3 BASE FLASHINGS

- A. Curb height: Unless otherwise indicated provide an 8-inch minimum flashing height above the finished roofing surface. Refer to Section 061053 for wood blocking requirements related to raising of rooftop curbs.
- B. Ensure that all flashing substrates are suitable to receive new base flashing materials.
- C. Install base flashings at vertical walls and curbs in accordance with the roofing membrane manufacturer's requirements and recommendations.

NOTE TO SPECIFIER

Hot-air welding of roofing membrane base and surfacing ply seams, using a flameless welding machine, is required.

- D. Hot-air welded seams: Using a heat gun, hot-air weld flashing base ply and surfacing ply seams. Do not use torches to weld seams.
- E. Secure the top edge of flashing as shown on the drawings, and In accordance with roofing membrane manufacturer recommendations and requirements. Seal the completed flashing top edge with a 3-course stripping of woven glass fabric and flashing cement.
- F. Fire watch: Per local codes, provide a fire watch after completion of daily work

NOTE TO SPECIFIER

Four options are available for Article 3.4:

1. *If an "A System" is specified, and the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a*



- reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per USPS Design Standards. This option will be included in the Base Proposal; DELETE “(ALTERNATE WORK)” from the Article title.*
2. *If an “A System” is chosen, and the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. Do not edit Article 3.4.*
 3. *If a “B System” is specified, and the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per USPS Design Standards. This option will be included in the Base Proposal; DELETE “(ALTERNATE WORK)” from the Article title. DELETE paragraph 3.4A.*
 4. *If a “B System” is specified, and the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. DELETE paragraph 3.4A.*

Determine the required outcome from the list above. Choose one option only. Edit the item below, based on the options listed above. Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

3.4 REFLECTIVE SURFACING INSTALLATION (ALTERNATE WORK)

- A. Installation of surfacing plies with a factory-applied reflective coatings:
 1. Apply the surfacing sheet, following the requirements and recommendations of the roofing membrane manufacturer.
 2. Exercise reasonable care to keep reflective sheets clean, and clear of debris.
 3. At roofing membrane and flashing surfacing ply seams and laps:
 - a. Clean the seam and lap area of dirt and debris. Power wash the seams and laps, if necessary to remove excessive residue.
 - b. At seams, broadcast reflective granules over seam area; or prime seams and laps, and apply two coats minimum of the specified acrylic elastomeric coating over the seam and lap areas.
 4. At locations determined by the Owner to contain excessive staining:
 - a. Clean the identified area(s) of dirt and debris. Power wash the area, if necessary to remove excessive residue.
 - b. Prime the area, if required by the coating manufacturer. Apply two coats, minimum, of the specified acrylic elastomeric coating over the area.
- B. Installation of field-applied acrylic elastomeric roof coating:
 1. Prepare substrate in a manner that is acceptable to the roofing membrane and coating manufacturers. Substrate preparation includes, but is not limited to: removal of dirt and debris, repair of defects in the roof membrane and flashing, treatment of surface residue, treatment of areas of excessive ponding, and priming (if required by the roof coating manufacturer).
 - a. After substrate preparation work is complete, inspect all surface preparation work. Correct any identified defects prior to application of coating.
 - b. Inspect the areas adjacent to the work area for cars and other property that could be damaged by coating overspray. Prior to work start, remove or protect cars and other property that may be damaged by work activities.
 - c. Prior to work start, close any rooftop air intakes within and adjacent to the work area.
 - d. Follow manufacturer guidelines for rate of application and application procedures of the base and finish coats, as outlined in the written literature provided by the coating manufacturer.
 - e. Apply the coating following the requirements and recommendations of the roofing membrane and coating manufacturer. Install a minimum of two coats of acrylic elastomeric coating over the roof surface.



NOTE TO SPECIFIER

If liquid-applied flashing is required for this project, do not edit Article 3.5. If liquid-applied flashing is not required for this project, DELETE Article 3.5. If necessary, re-letter/number paragraphs and sub-paragraphs after editing.

3.5 LIQUID-APPLIED FLASHING

- A. At locations to receive liquid applied flashings, as indicated on the project drawings:
 - 1. Follow the written instructions for application of liquid-applied flashing provided by the roofing membrane manufacturer.
 - 2. Prepare the flashing substrate in a manner that is acceptable to the roofing membrane manufacturer. Substrate preparation includes, but is not limited to, removal of dirt and debris, repair of defects in the roof membrane and flashing, treatment of surface residue, treatment of areas of excessive ponding, and priming (if required by the roof coating manufacturer).
 - 3. Apply the base coat of liquid applied flashing to the substrate.
 - 4. Install required reinforcing mesh into the base coat.
 - 5. Apply the top coat of liquid applied flashing over the reinforcing mesh and base coat. Extend the top coat over and beyond the reinforcing mesh.
 - 6. At horizontal surfaces, broadcast granules over the completed flashing.

3.6 ROOF SUMP FLASHINGS

- A. Prior to installation of the base ply, install a three-course stripping of woven glass fabric and roofing cement over the cover board/insulation substrate.
- B. Ensure that the roofing membrane plies extend into the roof sump.
- C. Install a three-course stripping of woven glass fabric and roofing cement over the base ply.
- D. Install a lead sheet flashing over the base ply in the sump; refer to Section 076203. Prime both sides of the lead sheet prior to installation.
- E. Install modified bitumen flashing ply over the lead flashing sheet.
- F. Ensure that the roofing base and surfacing plies, lead flashing sheet, and modified bitumen flashing ply extend under the clamping ring and into the drain bowl. Tightly secure the clamping ring.

3.7 SHEET METAL FLANGE STRIPPINGS

- A. At sheet metal flanges associated with tubular penetration, pitch pan and perimeter edge sheet metal fascia flashings:
 - 1. Prime the top and bottom of the sheet metal flange. Allow the primer time to dry.
 - 2. Set flange in a full bed of roofing cement.
 - 3. Install strippings in accordance with the drawings and the requirements and recommendations of the modified bitumen roofing membrane manufacturer.

NOTE TO SPECIFIER



EDIT items in Article 3.8 to reflect actual project conditions and requirements. Re-letter/number paragraphs and sub-paragraphs after editing.

3.8 MISCELLANEOUS INSTALLATIONS/TREATMENTS

- A. Install mechanical ventilator units in position and secure to the existing curbs with EPDM-gasketed screws. Provide a minimum of one fastener on each side of the curb and a minimum of one fastener every 12-inches o.c.
- B. Connect all electrical, plumbing, gas line and ventilation connections required for mechanical units. Retain a qualified, licensed electrical subcontractor to connect electrical equipment. Retain a qualified, licensed mechanical subcontractor to connect gas lines and ventilation connections.
- C. Walkway pads: Install walkway pads at locations indicated on drawings. Install the pads in accordance with the requirements and recommendations of the roofing manufacturer. Extend the pads a minimum of 4-inches in all directions beyond wood blocking.
- D. Install splashblocks set on walkpads at locations indicated on the drawings.
- E. Rooftop conduit and pipe supports:
 - 1. Install adjustable prefabricated pipe supports at rooftop conduit and pipes.
 - 2. Space pipe supports at intervals recommended by the support manufacturer, as determined by the diameter and weight of the conduit or pipe.
 - 3. Separate the support from the roof surface by installing the support over roof walkway pads, installed as specified.
- F. Install self-adhering underlayment beneath coping caps, and at other locations indicated on the drawings.
 - 1. Refer to manufacturer requirements and recommendations for installation.
- G. Replacement roof hatch installation:
 - 1. Provide wood nailers beneath roof hatch flanges, if necessary, to match insulation thickness.
 - 2. Install new roof hatch following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- H. Extendable safety post installation:
 - 1. Install new safety post following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- I. Application of elastomeric coating to rooftop penetrations:
 - 1. Prepare substrate in a manner that is acceptable to the coating manufacturer. Substrate preparation includes, but is not limited to: treatment of excessive gaps, repair of damaged or loose sheet metal components, repair of holes, cleaning of roof penetrations, treatment of surface rust, treatment of residual asphalt, and priming (if required by the roof coating manufacturer).
 - 2. Coat the indicated penetrations following the recommendations and requirements of the coating manufacturer.
- J. Installation of equipment support curbs:
 - 1. Install support curbs where indicated on the project drawings. Flash curbs into the roof system as indicated on the project drawings.
 - 2. Refer to manufacturer requirements and recommendations for installation.



USPS MPF Specifications, issued: 10/1/2013
Last revised: 9/16/2013

NOTE TO SPECIFIER

*Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to **black** text. Review the footer information with the USPS Project Manager for accuracy.*

END OF SECTION 07 52 16 00



SECTION 07 52 16 00 - R&A SBS MODIFIED BITUMEN ROOFING IN COLD ADHESIVE

NOTE TO SPECIFIER

This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this section where a cold-applied SBS (Styrene-Butadiene-Styrene) Modified Bitumen Roofing Membrane is selected as the roofing system in a roof replacement application. For hot-applied SBS (Styrene-Butadiene-Styrene) Modified Bitumen Roofing Membranes, use Section 075217 – SBS MODIFIED BITUMEN ROOFING IN HOT ASPHALT.

Per the United States Postal Service Roofing Design Standards, an SBS modified bitumen roofing system applied in cold adhesive is a recommended roofing system over facilities with a Critical or Non-Critical building designation.

NOTE TO SPECIFIER

Section Formatting:

Consistent formatting of Sections gives the complete document a professional look. This Section uses a 10pt. Arial font, and is formatted as follows:

1. *Insert one 10pt. line after the Section Number. Section Number is in CAPS.*
2. *Insert two 10pt. lines after the Section Title. Section Title is in CAPS.*
3. *Insert one 10pt. line after a PART. PARTS are in CAPS. If a Section is not used, include NOT USED following the PART title as shown below.*
4. *Insert one 10pt. line after Article paragraphs. Articles are in CAPS.*
5. *Insert two 10pt. lines at the end of an Article.*
6. *Complete Section with END OF SETION.*
7. *No lines should be placed between paragraphs and sub-paragraphs, or between sub-paragraphs and other sub-paragraphs.*

Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED



PART 3 – EXECUTION

NOT USED

Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to the installation of SBS (Styrene-Butadiene-Styrene) modified bitumen roofing membrane and flashings in cold adhesive, DOE Energy Star compliant reflective surfacing, related accessories, and warranty and guarantee requirements.

NOTE TO SPECIFIER

Review available field data. For roof areas consisting of an underlying concrete, gypsum concrete, cementitious wood fiber, and/or lightweight insulating concrete structural deck, include Section 072221 – Insulation and Cover Board over Underlayment within 1.2 RELATED SECTIONS below. For roof areas consisting of an underlying steel and/or wood deck, include Section 072223 – Roof Insulation and Cover Board over Steel and Wood Deck within the 1.2 RELATED SECTIONS below. For projects containing structural deck types applicable to both Sections 072221 and 072223, include both Sections. Re-letter paragraphs and sub-paragraphs after editing.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 024100 – Roof Removal and Substrate Preparation
- D. Section 061053 – Miscellaneous Rough Carpentry for Roof Replacement
- E. Section 072221 – Roof Insulation and Cover Board over Underlayment
- F. Section 072223 – Roof Insulation and Cover Board over Steel and Wood Roof Decks
- G. Section 076203 – Sheet Metal for Modified Bitumen Roofing
- H. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

NOTE TO SPECIFIER

Per discussions between the designer and USPS Project Manager, determine the warranty requirements for the project. Choose from the following warranty options and actions:



1. If an alternate price for a 20-year "Total System Warranty" is specified, Leave Article 1.3 unchanged.
2. If a 20-year "Total System Warranty" will be included in the base proposal, or if no warranty is specified, remove Article 1.3.

Re-letter/number items after editing.

NOTE TO SPECIFIER

Two options are available for paragraph 1.3B:

1. If the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per USPS Design Standards. This option will be included in the Base Proposal Cost; DELETE Article 1.3B from the list below.
2. If the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. Do not edit paragraph 1.3B.

Per discussions between the designer and USPS Project Manager, determine the required outcome from the list above. Choose one option only. Edit the item below, based on the options listed above. Re-letter/number items after editing, if necessary.

1.3 ALTERNATES

- A. Provide an alternate price for the 20-Year Total System Warranty described in paragraph 1.9A.
- B. Provide an alternate price for application of a reflective white coating over the installed modified bitumen roof system as specified within Articles 2.4 and 3.4 of this Section.

NOTE TO SPECIFIER

EDIT Article 1.4 – REFERENCES below, based on the system specified:

1. If an "A" System is chosen, DELETE "ASTM D 6162 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements" from the reference list.
2. If a "B" System is chosen, DELETE "ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements" from the reference list.

Re-letter/number paragraphs and sub-paragraphs after editing.

1.4 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 1. American Society for Testing and Materials (ASTM)
 - a. ASTM D 6162 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements
 - b. ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements
 - c. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
 - d. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing



- e. ASTM D 1668 - Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
- f. ASTM D 1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
- 2. Factory Mutual Global (FM)
- 3. Underwriters Laboratories (UL)
- 4. National Roofing Contractors Association (NRCA)
- 5. American Society of Civil Engineers (ASCE)
 - a. ASCE 7 Minimum Design Loads of Buildings and Other Structures

1.5 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.6 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp. Store roll materials standing on end.



- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
1. NOTE: Do not install SBS modified bitumen roofing at temperatures below 50°F (10°C).
 2. When the outside temperature is forecast to fall below 50°F (10°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives and primers should be maintained at a temperature of 50°F (10°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 3. Refer to the SBS modified bitumen roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

NOTE TO SPECIFIER

Per discussions between the designer and USPS Project Manager, determine the warranty requirements for the project. Choose from the following warranty options and actions:

1. *If an alternate price for a 20-year "Total System, Non-Pro-Rated Warranty" is specified, do not edit paragraph 1.9A.*
2. *If a 20-year "Total System, Non-Pro-Rated Warranty" will be included in the base proposal, DELETE "an alternate price for" from paragraph 1.9A.*
3. *If no warranty is specified, EDIT the title of Article 1.9 (DELETE the words "MANUFACTURER WARRANTY AND"), and DELETE paragraph 1.9A. The two-year contractor guarantee shall remain in place.*

Re-letter/number paragraphs and sub-paragraphs after editing.

1.9 MANUFACTURER WARRANTY AND CONTRACTOR GUARANTEE

- A. Provide an alternate price for a manufacturer 20-Year Total System, Non-Pro-Rated Warranty (including insulation, roofing membrane, and flashings) covering materials and labor. The warranty shall include the following additional items:
1. The warranty shall include a wind rider for the design wind speed at the specific project location.
 2. Roofing inspection by a technical representative of the roofing membrane manufacturer 22-24 months after date of Final Acceptance.
 3. Roofing manufacturer will provide unlimited repairs during warranty period with no cost limitation.
 4. Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions.
 5. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Record SBS Modified Bitumen in Cold Adhesive Specification Section to Warranty.

R&A SBS MODIFIED BITUMEN ROOFING IN COLD



- B. The Contractor shall provide a two-year contractor guarantee. At a minimum, the contractor guarantee shall include the following:
1. Contractor name, address, phone number and project contact name.
 2. The project completion date, and date of guarantee expiration.
 3. The contractor guarantee shall include, in writing, all project work, workmanship, and/or all materials installed by the contractor or subcontractors to be of a quality that will comply with all project specific requirements of the Construction Documents and other documents governing the Work and workmanship through the guarantee period.
 4. The contractor shall investigate roof leaks during the guarantee period within a reasonable time period, but in no instance greater than 24-hours after notification of a leak. The contractor shall repair leaks determined to be the cause of the Work at no cost to the Owner.

PART 2 – PRODUCTS

2.1 MODIFIED BITUMEN ROOFING SYSTEM SUMMARY

- A. The complete roofing membrane system assembly shall consist of an SBS surfacing ply over an SBS base ply, meeting or exceeding the requirements listed in paragraphs 2.2A and 2.2B.

NOTE TO SPECIFIER

***NOTE:** In high wind areas, such as those with a calculated wind uplift pressure of greater than 45 psf in the roof field, enhancements to the roof system may be required and must be considered by the design professional/specifier. Consult with the roofing membrane manufacturer and qualified testing agencies such as FM and Miami-Dade County for further information and guidance related to possible roof system enhancements in high wind areas.*

- B. The complete roofing system assembly shall resist uplift pressures calculated according to ASCE 7-05 for the field, perimeters and corners. The specified approval rating must incorporate a safety factor of 2 over the maximum calculated uplift pressure in foot-pound units.
- C. The complete roofing system assembly shall achieve an FM or UL Class A fire rating.
- D. Acceptable roofing membrane manufacturers include those manufacturing both a modified bitumen base ply and surfacing ply meeting the requirements listed in Articles 2.2 and 2.3. Roofing membrane manufacturers offering a surfacing ply meeting the requirements listed in Articles 2.2 and 2.3, but not offering a base ply meeting the requirement are acceptable with the following restrictions:
1. The submitted system shall include a base ply meeting the requirements of ASTM D 6164, Type II, Grade S.
 2. A letter, signed by authorized representatives of the modified bitumen surfacing ply and base ply manufacturers, indicating the completed system meets the requirements listed in Article 2.1., shall be submitted to the Owner for review.
 3. The completed system shall be capable of meeting the warranty and guarantee requirements outlined in Article 1.9. The total system warranty described shall be the responsibility of a single roofing supplier/manufacturer.

NOTE TO SPECIFIER

Two options are listed below within Articles 2.2 and 2.3:

1. An "A" System, utilizing a polyester-reinforced base ply (ASTM D 6164, Type II) and surfacing ply



(ASTM D 6164, Type II).

2. A "B" System, utilizing a dual-reinforced base sheet, with both glass fiber and polyester reinforcement (ASTM D 6162, Type III) and surfacing ply (ASTM D 6162, Type III).

Per discussions between the designer and USPS Project Manager, determine the system desired from the list above. Choose one system only. Edit the list below, leaving one base and surfacing ply for the MB roofing membrane and flashing system, based on the systems listed above. *Re-letter/number paragraphs and sub-paragraphs after editing.*

2.2 MODIFIED BITUMEN ROOFING MEMBRANE

- A. Base ply ("A" System):
1. Modified bitumen base sheet, polyester reinforced, minimum nominal 115 mil thickness; ASTM D 6164, Type II, Grade S.
- B. Surfacing ply ("A" System):
1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, fire-rated, minimum nominal 130 mil thickness; ASTM D 6164, Type II, Grade G.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.
- C. Base ply ("B" System):
1. Modified bitumen base sheet, polyester reinforced, minimum nominal 130 mil thickness; ASTM D 6162, Type III, Grade S.
- D. Surfacing ply ("B" System):
1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, fire-rated, minimum nominal 160 mil thickness; ASTM D 6162, Type III, Grade G.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.

2.3 MODIFIED BITUMEN ROOFING FLASHING

- A. Base ply ("A" System):
1. Modified bitumen base sheet, polyester reinforced, minimum nominal 115 mil thickness; ASTM D 6164, Type II, Grade S.
- B. Surfacing ply ("A" System):
1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, fire-rated, minimum nominal 130 mil thickness; ASTM D 6164, Type II, Grade G.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.
- C. Base ply ("B" System):
1. Modified bitumen base sheet, polyester reinforced, minimum nominal 130 mil thickness; ASTM D 6162, Type III, Grade S.
- D. Surfacing ply ("B" System):
1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, fire-rated, minimum nominal 160 mil thickness; ASTM D 6162, Type III, Grade G.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.

**NOTE TO SPECIFIER**

Four options are available for Article 2.4:

1. If an "A System" is specified, and the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per the USPS Roofing Design Standards. This option will be included in the Base Proposal; **DELETE** "(ALTERNATE)" from the Article title.
2. If an "A System" is specified, and the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. Do not edit Article 2.4.
3. If a "B System" is specified, and the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per the USPS Roofing Design Standards. This option will be included in the Base Proposal; **DELETE** "(ALTERNATE)" from the Article title. **DELETE** sub-paragraphs 2.4.A.1 and 2.4.A.2, and the word "other" from sub-paragraph 2.4.A.3.
4. If a "B System" is specified, and the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. **DELETE** sub-paragraphs 2.4.A.1 and 2.4.A.2, and the word "other" from sub-paragraph 2.4.A.3.

Determine the required outcome from the list above. Choose one option only. EDIT the item below, based on the options listed above. Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

2.4 DOE ENERGY STAR INITIAL SOLAR REFLECTANCE REQUIREMENT (ALTERNATE)

- A. Provide a completed roofing system approved by the roofing membrane manufacturer, and meeting the Initial Solar Reflectance requirement of 0.65, minimum, as required by DOE Energy Star. The following products are acceptable to achieve this requirement:
 1. Surfacing plies, used in lieu of those identified within paragraphs 2.2.B and 2.3.B:
 - a. Firestone "SBS Premium UltraWhite" surfacing ply, manufactured by Firestone Building Products, as the specified roofing membrane and flashing surfacing ply identified in paragraphs 2.2.B and 2.3.B.
 - b. JM "Dynalastic 250 FR CR" surfacing ply, manufactured by Johns Manville, as the specified roofing membrane and flashing surfacing ply identified in paragraphs 2.2.B and 2.3.B.
 2. Acrylic elastomeric coating, applied over surfacing plies identified within paragraphs 2.2.B and 2.3.B:
 - a. Use of surfacing plies meeting the requirements identified in Articles 2.2 and 2.3 of this Section, and a field-applied acrylic elastomeric coating applied to the finished SBS modified bitumen roofing membrane and flashing surfacing ply. The coating shall be approved for the use specified by the roofing membrane and coating manufacturers.

NOTE TO SPECIFIER

If liquid-applied flashing is required for this project, do not edit Article 2.5. If liquid-applied flashing is not required for this project, **DELETE** Article 2.5. If necessary, re-letter/number paragraphs and sub-paragraphs after editing.

2.5 LIQUID-APPLIED FLASHING

- A. Base and top coats:
 1. Single or dual component, moisture-cured. Product approved by the roofing membrane manufacturer for use in the specified configuration.



- B. Reinforcing fabric:
 - 1. Polyester-reinforced fabric. Product approved by the roofing membrane manufacturer for use in the specified configuration.

2.6 ADHESIVES, CEMENTS AND PRIMERS

- A. Cold adhesive: Product approved by the roofing membrane manufacturer.
- B. Flashing cement and roofing cement: Product compatible with SBS Modified bitumen roofing and approved by the roofing membrane manufacturer.
- C. Asphalt primer: ASTM D 41.

2.7 FASTENERS

- A. Roofing membrane and flashing fasteners: Unless otherwise indicated, types as required by the roofing membrane manufacturer.

NOTE TO SPECIFIER

Two options are listed below within Article 2.7:

- 1. *For "A" Systems, utilizing a polyester-reinforced base ply (ASTM D 6164, Type II) and surfacing ply (ASTM D 6164, Type II).*
- 2. *For "B" System, utilizing a dual-reinforced base sheet, with both glass fiber and polyester reinforcement (ASTM D 6162, Type II) and surfacing ply (ASTM D 6162, Type II).*

Per discussions between the designer and USPS Project Manager, determine the system desired from the list above. Choose one ply sheet only. EDIT the list below, leaving one ply sheet for use as a temporary overnight tie-in sheet, based on the specified systems listed above. Do not edit paragraph 2.7C. Re-letter/number paragraphs and sub-paragraphs after editing.

2.8 ROOFING SHEETS FOR TEMPORARY TIE-INS

- A. For use at temporary overnight tie-ins ("A" System): Modified bitumen base sheet, polyester reinforced, minimum nominal 115 mil thickness; ASTM D 6164, Type II, Grade S.
- B. For use at temporary overnight tie-ins ("B" System): Modified bitumen base sheet, polyester reinforced, minimum nominal 130 mil thickness; ASTM D 6162, Type II, Grade S.
- C. For use at roof sump flashings and elsewhere as may be indicated: Asphalt treated woven glass fabric, ASTM D 1668, Type I.

2.9 MISCELLANEOUS MATERIALS

- A. Walkway pads: Product approved by the roofing manufacturer.
- B. Splashblocks: Concrete; size as necessary to accommodate existing condition.
- C. Pitch pan fill materials:
 - 1. Non-shrink grout (for bottom fill): Quick-set, fast-drying grout; product acceptable to roofing manufacturer.



2. Pourable sealer (for top fill): Two-part pourable elastomeric sealer, product acceptable to roofing manufacturer.
- D. Conduit and pipe supports:
1. For pipes with a diameter up to 6-inches:
 - a. Adjustable prefabricated support such as Pipe Pier 150 manufactured by Pipe Pier Support Systems, Hamel, MN, or approved equal.
 - b. Product approved by the roofing manufacturer for this application.
 - c. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
 2. For pipes with a diameter greater than 6-inches:
 - a. Product approved by the roofing manufacturer for this application.
 - b. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
- E. Pre-fabricated plumbing vent pipe extensions:
1. For use where necessary to achieve the 8-inch minimum flashing height:
 - a. Pre-fabricated plumbing vent extensions, such as Tubos Pre-Fabricated Pipe Extension, by Tubos, Inc., Clearwater, FL.
 - b. Product approved by the roofing manufacturer for this application.
 - c. Size and configuration of extension as necessary to match existing pipe diameter, providing the 8-inch minimum flashing height, and allowing for flashing as show on the drawings.
- F. Self-adhering membrane (for use over parapet walls beneath coping caps, and at other locations indicated on the drawings): Product approved for use beneath sheet metal by the membrane manufacturer, and meeting the following criteria:
1. Meeting the requirements of ASTM D 1970.
 2. Approved for use as an underlayment for standing seam sheet metal roofing.
 3. A 40-mil minimum membrane thickness.
- G. Replacement roof hatch:
1. Roof hatch, such as "Type E" or "Type S", manufactured by The Bilco Company, New Haven, CT, or approved equal.
 - a. Size and configuration as necessary to match existing roof hatch.
 - b. Product approved by the roofing manufacturer for this application.
- H. Extendable ladder-mounted safety post, such as "LadderUP Safety Post", manufactured by The Bilco Company, New Haven, CT, or approved equal.
1. Size and configuration as necessary to accommodate existing ladder and new roof hatch.
 2. Product approved by the roofing manufacturer for this application.
- I. Acrylic elastomeric coating (for use at roof penetrations and other locations indicated on the project drawings). Product approved for use by the membrane manufacturer for this application, and meeting the following criteria:
1. Meeting the requirements of ASTM D 6083.
 2. White color.
- J. Rooftop unit support curbs: Product such as "Pate Equipment Supports" manufactured by The Pate Company, Lombard, IL, or approved equal.
1. Size and configuration as necessary to accommodate existing rooftop unit.
 2. Fabricated from 18 ga. galvanized steel, minimum, with welded seams; and a nominal 2-inch thick nailer affixed atop the curb support.
 3. Fabricated to allow for a minimum flashing height of 8-inches, minimum.



4. Product approved by the roofing manufacturer for this application.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.

NOTE TO SPECIFIER

Review available field data. For roof areas consisting of an underlying concrete, gypsum concrete or cementitious wood fiber structural deck, include Section 072221 within paragraph 3.1B below. For roof areas consisting of an underlying steel or wood deck, include Section 072223 within paragraph 3.1B below. For projects containing structural deck types applicable to both Sections 072221 and 072223, include both Sections.

- B. Ensure that the insulation and cover board substrate is installed as specified in Sections 072221 and 072223 are suitable to receive roofing membrane materials.

3.2 ROOFING MEMBRANE INSTALLATION

- A. Except as may be modified by these specifications and drawings, install roofing membrane in accordance with the requirements and recommendations of the roofing membrane manufacturer, using the manufacturer's current printed instructions.
- B. Chalk lining: Beginning at the low points or drains, chalk line the cover board surface to serve as guides for the proper mopping and laying of the roofing membrane plies.
- C. Broom or press each ply into place, full width.

NOTE TO SPECIFIER

Hot-air welding of roofing membrane base ply and surfacing ply seams, using a flameless welding machine, is required. Use of torches during roof replacement application is not allowed.

- D. Hot-air welded seams: A flameless welding machine must be used for field membrane seams. Hot-air weld base ply and surfacing ply seams. Do not use torches to weld seams.
- E. Install only as much roofing as can be completed in a work day, including flashing and detail work. All installed roofing shall be sealed to a watertight condition prior to leaving the site daily.
- F. Sequence roofing work to eliminate the use of installed roofing as a walkway, or as a storage platform for materials.
- G. Where wheeled or excessive traffic over new or existing roofing work is unavoidable, provide and use 3/4-inch plywood, set over a minimum of two-inch thick rigid board insulation to protect roofing components in place.
- H. Overnight tie-in: Care should be exercised to ensure that water does not flow beneath any completed sections of the roof by temporarily sealing the loose edge of the membrane at the end of each work day and when the weather is threatening. The roofing membrane manufacturer's requirements should be followed closely.
- I. Remove debris from the roof daily prior to leaving the site. Inspect the site at ground level.



Remove any roof replacement related debris from the ground.

- J. Fire watch: Per local codes, provide a fire watch after completion of daily work

3.3 BASE FLASHINGS

- A. Curb height: Unless otherwise indicated or not possible due to existing conditions encountered, provide an 8-inch minimum flashing height above the finished roofing surface. Refer to Section 061053 for wood blocking requirements related to raising of rooftop curbs.
- B. Ensure that all flashing substrates are suitable to receive new base flashing materials.
- C. Install base flashings at vertical walls and curbs in accordance with the roofing membrane manufacturer's requirements and recommendations.

NOTE TO SPECIFIER

Hot-air welding of roofing membrane base and surfacing ply seams, using a flameless welding machine, is required. Use of torches during roof replacement application is not allowed.

- D. Hot-air welded seams: Using a heat gun, hot-air weld flashing base ply and surfacing ply seams. Do not use torches to weld seams.
- E. Secure the top edge of flashing as shown on the drawings, and In accordance with roofing membrane manufacturer recommendations and requirements. Seal the completed flashing top edge with a 3-course stripping of woven glass fabric and flashing cement.
- F. Fire watch: Per local codes, provide a fire watch after completion of daily work

NOTE TO SPECIFIER

Four options are available for Article 3.4:

1. *If an "A System" is specified, and the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per USPS Design Standards. This option will be included in the Base Proposal; DELETE "(ALTERNATE WORK)" from the Article title.*
2. *If an "A System" is chosen, and the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. Do not edit Article 3.4.*
3. *If a "B System" is specified, and the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per USPS Design Standards. This option will be included in the Base Proposal; DELETE "(ALTERNATE WORK)" from the Article title. DELETE paragraph 3.4A.*
4. *If a "B System" is specified, and the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. DELETE paragraph 3.4A.*

Determine the required outcome from the list above. Choose one option only. Edit the item below, based on the options listed above. Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

3.4 REFLECTIVE SURFACING INSTALLATION (ALTERNATE WORK)

- A. Installation of surfacing plies with a factory-applied reflective coatings:



1. Apply the surfacing sheet, following the requirements and recommendations of the roofing membrane manufacturer.
 2. Exercise reasonable care to keep reflective sheets clean, and clear of debris.
 3. At roofing membrane and flashing surfacing ply seams and laps:
 - a. Clean the seam and lap area of dirt and debris. Power wash the seams and laps, if necessary to remove excessive residue.
 - b. At seams, broadcast reflective granules over seam area; or prime seams and laps, and apply two coats minimum of the specified acrylic elastomeric coating over the seam and lap areas.
 4. At locations determined by the Owner to contain excessive staining:
 - a. Clean the identified area(s) of dirt and debris. Power wash the area, if necessary to remove excessive residue.
 - b. Prime the area, if required by the coating manufacturer. Apply two coats, minimum, of the specified acrylic elastomeric coating over the area.
- B. Installation of field-applied acrylic elastomeric roof coating:
1. Prepare substrate in a manner that is acceptable to the roofing membrane and coating manufacturers. Substrate preparation includes, but is not limited to: removal of dirt and debris, repair of defects in the roof membrane and flashing, treatment of surface residue, treatment of areas of excessive ponding, and priming (if required by the roof coating manufacturer).
 - a. After substrate preparation work is complete, inspect all surface preparation work. Correct any identified defects prior to application of coating.
 - b. Inspect the areas adjacent to the work area for cars and other property that could be damaged by coating overspray. Prior to work start, remove or protect cars and other property that may be damaged by work activities.
 - c. Prior to work start, close any rooftop air intakes within and adjacent to the work area.
 - d. Follow manufacturer guidelines for rate of application and application procedures of the base and finish coats, as outlined in the written literature provided by the coating manufacturer.
 - e. Apply the coating following the requirements and recommendations of the roofing membrane and coating manufacturer. Install a minimum of two coats of acrylic elastomeric coating over the roof surface.

NOTE TO SPECIFIER

If liquid-applied flashing is required for this project, do not edit Article 3.5. If liquid-applied flashing is not required for this project, DELETE Article 3.5. If necessary, re-letter/number paragraphs and sub-paragraphs after editing.

3.5 LIQUID-APPLIED FLASHING

- A. At locations to receive liquid applied flashings, as indicated on the project drawings:
1. Follow the written instructions for application of liquid-applied flashing provided by the roofing membrane manufacturer.
 2. Prepare the flashing substrate in a manner that is acceptable to the roofing membrane manufacturer. Substrate preparation includes, but is not limited to, removal of dirt and debris, repair of defects in the roof membrane and flashing, treatment of surface residue, treatment of areas of excessive ponding, and priming (if required by the roof coating manufacturer).
 3. Apply the base coat of liquid applied flashing to the substrate.
 4. Install required reinforcing mesh into the base coat.
 5. Apply the top coat of liquid applied flashing over the reinforcing mesh and base coat. Extend the top coat over and beyond the reinforcing mesh.



6. At horizontal surfaces, broadcast granules over the completed flashing.

3.6 ROOF SUMP FLASHINGS

- A. Prior to installation of the base ply, install a three-course stripping of woven glass fabric and roofing cement over the cover board/insulation substrate.
- B. Ensure that the roofing membrane plies extend into the roof sump.
- C. Install a three-course stripping of woven glass fabric and roofing cement over the base ply.
- D. Install a lead sheet flashing over the base ply in the sump; refer to Section 076203. Prime both sides of the lead sheet prior to installation.
- E. Install modified bitumen flashing ply over the lead flashing sheet.
- F. Ensure that the roofing base and surfacing plies, lead flashing sheet, and modified bitumen flashing ply extend under the clamping ring and into the drain bowl. Tightly secure the clamping ring.

3.7 SHEET METAL FLANGE STRIPPINGS

- A. At sheet metal flanges associated with tubular penetration, pitch pan and perimeter edge sheet metal fascia flashings:
 1. Prime the top and bottom of the sheet metal flange. Allow the primer time to dry.
 2. Set flange in a full bed of roofing cement.
 3. Install strippings in accordance with the drawings and the requirements and recommendations of the modified bitumen roofing membrane manufacturer.

3.8 MISCELLANEOUS INSTALLATIONS/TREATMENTS

- A. Return mechanical ventilator units to their original positions and secure to the existing curbs with EPDM-gasketed screws. Provide a minimum of one fastener on each side of the curb and a minimum of one fastener every 12-inches o.c.
- B. Reconnect all electrical, plumbing, gas line and ventilation connections required to return mechanical units to their original operating condition. Retain a qualified, licensed electrical subcontractor to reconnect electrical equipment. Retain a qualified, licensed mechanical subcontractor to reconnect gas lines and ventilation connections. Coordinate required disconnections and reconnections with the Owner.
- C. Walkway pads: Install walkway pads at locations indicated on drawings. Install the pads in accordance with the requirements and recommendations of the roofing manufacturer. Extend the pads a minimum of 4-inches in all directions beyond wood blocking.
- D. Install splashblocks set on walkpads at locations indicated on the drawings.
- E. Rooftop conduit and pipe supports:
 1. Install adjustable prefabricated pipe supports at rooftop conduit and pipes.
 2. Space pipe supports at intervals recommended by the support manufacturer, as determined by the diameter and weight of the conduit or pipe.



3. Separate the support from the roof surface by installing the support over roof walkway pads, installed as specified.
- F. Pre-fabricated plumbing vent pipe extensions:
 1. Refer to manufacturer requirements and recommendations for installation.
 2. Prior to flashing installation, seal intersection of pipe extension and existing plumbing vent.
- G. Install self-adhering underlayment beneath coping caps, and at other locations indicated on the drawings.
 1. Refer to manufacturer requirements and recommendations for installation.
- H. Replacement roof hatch installation:
 1. Remove and discard existing roof hatch.
 2. Provide wood nailers beneath roof hatch flanges, if necessary, to match insulation thickness.
 3. Install new roof hatch following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- I. Extendable safety post installation:
 1. Install new safety post following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- J. Application of elastomeric coating to rooftop penetrations:
 1. Prepare substrate in a manner that is acceptable to the coating manufacturer. Substrate preparation includes, but is not limited to: treatment of excessive gaps, repair of damaged or loose sheet metal components, repair of holes, cleaning of roof penetrations, treatment of surface rust, treatment of residual asphalt, and priming (if required by the roof coating manufacturer).
 2. Coat the indicated penetrations following the recommendations and requirements of the coating manufacturer.
- K. Installation of equipment support curbs:
 1. Install support curbs where indicated on the project drawings. Flash curbs into the roof system as indicated on the project drawings.
 2. Refer to manufacturer requirements and recommendations for installation.

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 Last revised: 3/6/2013

NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 52 16 00



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SECTION 07 52 17 00 - CSF SBS MODIFIED BITUMEN ROOFING IN HOT ASPHALT**

NOTE TO SPECIFIER

Editing is needed for each individual project; modify as needed for project specific requirements. Included "NOTE TO SPECIFIER" instructions provide guidance concerning required editing, and options have been included requiring action on the part of the specifier/designer. Select the option appropriate for the project and delete option(s) not selected.

NOTE TO SPECIFIER

EDIT Section footer as necessary to reflect the project name and location, USPS Project number, and required date of the technical specification document. Coordinate this project specific information with the USPS Project Manager. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this section where a cold-applied SBS (Styrene-Butadiene-Styrene) Modified Bitumen Roofing Membrane is selected as the roofing system. For hot-applied SBS (Styrene-Butadiene-Styrene) Modified Bitumen Roofing Membranes, use Section 075216 – SBS MODIFIED BITUMEN ROOFING IN COLD ADHESIVE. Per the United States Postal Service Roofing Design Standards, an SBS modified bitumen roofing system applied in hot asphalt is a recommended roofing system over facilities with a Critical or Non-Critical building designation.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to the installation of SBS (Styrene-Butadiene-Styrene) modified bitumen roofing membrane and flashings in hot asphalt, DOE Energy Star compliant reflective surfacing, related accessories, and warranty and guarantee requirements.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 072100 – Thermal Insulation
- D. Section 076203 – Sheet Metal Flashings and Trim
- E. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

NOTE TO SPECIFIER

Per discussions between the designer and USPS Project Manager, determine the warranty requirements for the project. Choose from the following warranty options and actions:

- 1. *If an alternate price for a 20-year "Total System Warranty" is specified, Leave Article 1.3 unchanged.*

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2. If a 20-year "Total System Warranty" will be included in the base proposal, or if no warranty is specified, remove Article 1.3.

Re-letter/number items after editing.

NOTE TO SPECIFIER

Two options are available for paragraph 1.3.B:

1. If the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per USPS Design Standards. This option will be included in the Base Proposal Cost; DELETE Article 1.3B from the list below.
2. If the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. Do not edit paragraph 1.3.B.

Per discussions between the designer and USPS Project Manager, determine the required outcome from the list above. Choose one option only. Edit the item below, based on the options listed above. Re-letter/number items after editing, if necessary.

1.3 ALTERNATES

- A. Provide an alternate price for the 20-Year Total System Warranty described in paragraph 1.9A.
- B. Provide an alternate price for a completed roof system with a DOE Energy Star compliant reflective surfacing over the installed modified bitumen roof system as specified within Articles 2.4 and 3.6 of this Section.

NOTE TO SPECIFIER

EDIT Article 1.4 – REFERENCES below, based on the system specified:

1. If an "A" is chosen, DELETE "ASTM D 6162 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements" from the reference list.
2. If a "B" System is chosen, DELETE "ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements" from the reference list.

Re-letter/number paragraphs and sub-paragraphs after editing.

1.4 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 1. American Society for Testing and Materials (ASTM)
 - a. ASTM D 6162 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements
 - b. ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements
 - c. ASTM D 312 - Standard Specification for Asphalt Used in Roofing
 - d. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
 - e. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing



- f. ASTM D 1668 - Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
- g. ASTM D 1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
- 2. Factory Mutual Global (FM)
- 3. Underwriters Laboratories (UL)
- 4. National Roofing Contractors Association (NRCA)
- 5. American Society of Civil Engineers (ASCE)
 - a. ASCE 7 Minimum Design Loads of Buildings and Other Structures

1.5 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.6 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp. Store roll materials standing on end.



- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
 1. NOTE: Do not install SBS modified bitumen roofing at temperatures below 50°F (10°C).
 2. When the outside temperature is forecast to fall below 50°F (10°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives and primers should be maintained at a temperature of 50°F (10°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 3. When applying hot asphalt, reduce mop lead distance to 2-feet or less.
 4. If a minimum asphalt temperature of 420°F (216°C) cannot be maintained at the point of application, discontinue work.
 5. Refer to the SBS modified bitumen roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

1.9 MANUFACTURER WARRANTY AND CONTRACTOR GUARANTEE

- A. Provide an alternate price for a manufacturer 20-Year Total System, Non-Pro-Rated Warranty (including insulation, roofing membrane, and flashings) covering materials and labor. The warranty shall include the following additional items:
 1. The warranty shall include a wind rider for the design wind speed at the specific project location.
 2. Roofing inspection by a technical representative of the roofing membrane manufacturer 22-24 months after date of Final Acceptance.
 3. Roofing manufacturer will provide unlimited repairs during warranty period with no cost limitation.
 4. Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions.
 5. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Record SBS Modified Bitumen Roofing in Hot Asphalt Specification Section to Warranty.
- B. The Contractor shall provide a two-year contractor guarantee. At a minimum, the contractor guarantee shall include the following:
 1. Contractor name, address, phone number and project contact name.
 2. The project completion date, and date of guarantee expiration.
 3. The contractor guarantee shall include, in writing, all project work, workmanship, and/or all materials installed by the contractor or subcontractors to be of a quality that will comply with all project specific requirements of the Construction Documents and other documents governing the Work and workmanship through the guarantee period.
 4. The contractor shall investigate roof leaks during the guarantee period within a



reasonable time period, but in no instance greater than 24-hours after notification of a leak. The contractor shall repair leaks determined to be the cause of the Work at no cost to the Owner.

PART 2 – PRODUCTS

2.1 MODIFIED BITUMEN ROOFING SYSTEM SUMMARY

- A. The complete roofing membrane system assembly shall consist of an SBS surfacing ply over an SBS base ply, meeting or exceeding the requirements listed in paragraphs 2.2A and 2.2B.

NOTE TO SPECIFIER

NOTE: In high wind areas, such as those with a calculated wind uplift pressure of greater than 45 psf in the roof field, enhancements to the roof system may be required and must be considered by the design professional/specifier. Consult with the roofing membrane manufacturer and qualified testing agencies for further information and guidance related to possible roof system enhancements in high wind areas.

- B. The complete roofing system assembly shall resist uplift pressures calculated according to ASCE 7-05 for the field, perimeters and corners. The specified approval rating must incorporate a safety factor of 2 over the maximum calculated uplift pressure in foot-pound units.
- C. The complete roofing system assembly shall achieve an FM or UL Class A fire rating.
- D. Acceptable roofing membrane manufacturers include those manufacturing both a modified bitumen base ply and surfacing ply meeting the requirements listed in Articles 2.2 and 2.3. Roofing membrane manufacturers offering a surfacing ply meeting the requirements listed in Articles 2.2 and 2.3, but not offering a base ply meeting the requirement are acceptable with the following restrictions:
1. The submitted system shall include a base ply meeting the requirements of ASTM D 6164, Type II, Grade S.
 2. A letter, signed by authorized representatives of the modified bitumen surfacing ply and base ply manufacturers, indicating the completed system meets the requirements listed in Article 2.1., shall be submitted to the Owner for review.
 3. The completed system shall be capable of meeting the warranty and guarantee requirements outlined in Article 1.9. The total system warranty described shall be the responsibility of a single roofing supplier/manufacturer.

NOTE TO SPECIFIER

Two options are listed below within Articles 2.2 and 2.3:

1. An "A" System, utilizing a polyester-reinforced base ply (ASTM D 6164, Type II) and surfacing ply (ASTM D 6164, Type II).
2. A "B" System, utilizing a dual-reinforced base sheet, with both glass fiber and polyester reinforcement (ASTM D 6162, Type III) and surfacing ply (ASTM D 6162, Type III).

Per discussions between the designer and USPS Project Manager, determine the system desired from the list above. Choose one system only. Edit the list below, leaving one base and surfacing ply for the MB roofing membrane and flashing system, based on the systems listed above. *Re-letter/number paragraphs and sub-paragraphs after editing.*

2.2 MODIFIED BITUMEN ROOFING MEMBRANE

- A. Base ply ("A" System):

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1. Modified bitumen base sheet, polyester reinforced, minimum nominal 115 mil thickness; ASTM D 6164, Type II, Grade S.
- B. Surfacing ply ("A" System):
 1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, fire-rated, minimum nominal 130 mil thickness; ASTM D 6164, Type II, Grade G.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.
- C. Base ply ("B" System):
 1. Modified bitumen base sheet, polyester reinforced, minimum nominal 130 mil thickness; ASTM D 6162, Type III, Grade S.
- D. Surfacing ply ("B" System):
 1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, fire-rated, minimum nominal 160 mil thickness; ASTM D 6162, Type III, Grade G.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.

2.3 MODIFIED BITUMEN ROOFING FLASHING

- A. Base ply ("A" System):
 1. Modified bitumen base sheet, polyester reinforced, minimum nominal 115 mil thickness; ASTM D 6164, Type II, Grade S.
- B. Surfacing ply ("A" System):
 1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, fire-rated, minimum nominal 130 mil thickness; ASTM D 6164, Type II, Grade G.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.
- C. Base ply ("B" System):
 1. Modified bitumen base sheet, polyester reinforced, minimum nominal 130 mil thickness; ASTM D 6162, Type III, Grade S.
- D. Surfacing ply ("B" System):
 1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, fire-rated, minimum nominal 160 mil thickness; ASTM D 6162, Type III, Grade G.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.

NOTE TO SPECIFIER

Four options are available for Article 2.4:

1. If an "A System" is specified, and the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per the USPS Roofing Design Standards. This option will be included in the Base Proposal; DELETE "(ALTERNATE)" from the Article title.
2. If an "A System" is specified, and the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. Do not edit Article 2.4.
3. If a "B System" is specified, and the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per



the USPS Roofing Design Standards. This option will be included in the Base Proposal; DELETE "(ALTERNATE)" from the Article title. DELETE sub-paragraphs 2.4.A.1 and 2.4.A.2, and the word "other" from sub-paragraph 2.4.A.3.

4. *If a "B System" is specified, and the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. DELETE sub-paragraphs 2.4.A.1 and 2.4.A.2, and the word "other" from sub-paragraph 2.4.A.3.*

Determine the required outcome from the list above. Choose one option only. EDIT the item below, based on the options listed above. Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

2.4 DOE ENERGY STAR INITIAL SOLAR REFLECTANCE REQUIREMENT (ALTERNATE)

- A. Provide a completed roofing system approved by the roofing membrane manufacturer, and meeting the Initial Solar Reflectance requirement of 0.65, minimum, as required by DOE Energy Star. The following products are acceptable to achieve this requirement:
 1. Surfacing plies, used in lieu of those identified within paragraphs 2.2.B and 2.3.B:
 - a. Firestone "SBS Premium UltraWhite" surfacing ply, manufactured by Firestone Building Products, as the specified roofing membrane and flashing surfacing ply identified in paragraphs 2.2.B and 2.3.B.
 - b. JM "Dynalastic 250 FR CR" surfacing ply, manufactured by Johns Manville, as the specified roofing membrane and flashing surfacing ply identified in paragraphs 2.2.B and 2.3.B.
 2. Acrylic elastomeric coating, applied over surfacing plies identified within paragraphs 2.2.B and 2.3.B:
 - a. Use of surfacing plies meeting the requirements identified in Articles 2.2 and 2.3 of this Section, and a field-applied acrylic elastomeric coating applied to the finished SBS modified bitumen roofing membrane and flashing surfacing ply. The coating shall be approved for the use specified by the roofing membrane and coating manufacturers.

NOTE TO SPECIFIER

If liquid-applied flashing is required for this project, do not edit Article 2.5. If liquid-applied flashing is not required for this project, DELETE Article 2.5. If necessary, re-letter/number paragraphs and sub-paragraphs after editing.

2.5 LIQUID-APPLIED FLASHING

- A. Base and top coats:
 1. Single or dual component, moisture-cured. Product approved by the roofing membrane manufacturer for use in the specified configuration.
- B. Reinforcing fabric:
 1. Polyester-reinforced fabric. Product approved by the roofing membrane manufacturer for use in the specified configuration.

2.6 ADHESIVES, CEMENTS AND PRIMERS

- A. Asphalt: ASTM D 312, Type III.
- B. Flashing cement and roofing cement: Product compatible with SBS Modified bitumen roofing and approved by the roofing membrane manufacturer.



- C. Asphalt primer: ASTM D 41.

2.7 FASTENERS

- A. Roofing membrane and flashing fasteners: Unless otherwise indicated, types as required by the roofing membrane manufacturer.

2.8 ROOFING FELTS FOR TEMPORARY TIE-INS

- A. For use at temporary overnight tie-ins: Asphalt-saturated organic felt, No. 15, non-perforated, ASTM D 226, Type 1.
- B. For use at roof sump flashings and elsewhere as may be indicated: Asphalt treated woven glass fabric, ASTM D 1668, Type I.

NOTE TO SPECIFIER

EDIT items in Article 2.9 to reflect actual project conditions and requirements. Re-letter/number paragraphs and sub-paragraphs after editing.

2.9 MISCELLANEOUS MATERIALS

- A. Walkway pads: Product approved by the roofing manufacturer.
- B. Splashblocks: Concrete; size as necessary to accommodate existing condition.
- C. Pitch pan fill materials:
1. Non-shrink grout (for bottom fill): Quick-set, fast-drying grout; product acceptable to roofing manufacturer.
 2. Pourable sealer (for top fill): Two-part pourable elastomeric sealer, product acceptable to roofing manufacturer.
- D. Conduit and pipe supports:
1. For pipes with a diameter up to 6-inches:
 - a. Adjustable prefabricated support such as Pipe Pier 150 manufactured by Pipe Pier Support Systems, Hamel, MN, or approved equal.
 - b. Product approved by the roofing manufacturer for this application.
 - c. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
 2. For pipes with a diameter greater than 6-inches:
 - a. Product approved by the roofing manufacturer for this application.
 - b. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
- E. Self-adhering membrane (for use over parapet walls beneath coping caps, and at other locations indicated on the drawings): Product approved for use beneath sheet metal by the membrane manufacturer, and meeting the following criteria:
1. Meeting the requirements of ASTM D 1970.
 2. Approved for use as an underlayment for standing seam sheet metal roofing.
 3. A 40-mil minimum membrane thickness.



- F. Roof hatch:
 - 1. Roof hatch, such as "Type E" or "Type S", manufactured by The Bilco Company, New Haven, CT, or approved equal.
 - a. Size and configuration as necessary.
 - b. Product approved by the roofing manufacturer for this application.
- G. Extendable ladder-mounted safety post, such as "LadderUP Safety Post", manufactured by The Bilco Company, New Haven, CT, or approved equal.
 - 1. Size and configuration as necessary to accommodate new roof hatch.
 - 2. Product approved by the roofing manufacturer for this application.
- H. Acrylic elastomeric coating (for use at roof penetrations and other locations indicated on the project drawings). Product approved for use by the membrane manufacturer for this application, and meeting the following criteria:
 - 1. Meeting the requirements of ASTM D 6083.
 - 2. White color.
- I. Rooftop unit support curbs: Product such as "Pate Equipment Supports" manufactured by The Pate Company, Lombard, IL, or approved equal.
 - 1. Size and configuration as necessary to accommodate existing rooftop unit.
 - 2. Fabricated from 18 ga. galvanized steel, minimum, with welded seams; and a nominal 2-inch thick nailer affixed atop the curb support.
 - 3. Fabricated to allow for a minimum flashing height of 8-inches, minimum.
 - 4. Product approved by the roofing manufacturer for this application.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.

NOTE TO SPECIFIER

Review available field data. Edit required Section references based on existing structural deck types present on the project. For roof areas consisting of an underlying concrete, gypsum concrete or cementitious wood fiber structural deck, include Section 072221 within paragraph 3.1.B below. For roof areas consisting of an underlying wood deck, include Section 072222 within paragraph 3.1.B below. For roof areas consisting of an underlying steel deck, include Section 072223 within paragraph 3.1.B below.

- B. Ensure that the insulation and cover board substrate is installed as specified in Sections 072221, 072222 and 072223 are suitable to receive roofing membrane materials.

3.2 BITUMEN KETTLE OPERATION

- A. Operator Preparation – Kettle operation requires an individual who is trained in the use of such equipment and use of the kettle requires a designate operator who will remain at the kettle during its use. Under no circumstance shall the kettle be unmanned. Never allow any untrained person to operate the kettle. Kettle temperature shall be recorded a minimum of twice per day.
- B. Kettle operator must be dressed accordingly; including, but not limited to, the following items:
 - 1. Long-sleeved shirt, buttoned at the cuffs.
 - 2. Long pants without cuffs.



3. Gloves, snug fitting at the cuffs.
 4. Heavy shoes with high tops.
- C. Site Preparation – The kettle should be located close enough to the building to allow for proper setup of thin-wall tubing. Care must be taken to protect building, by use of tarpaulins. However, be aware of the possible hazards from locating too close, such as splashing of asphalt or the spread of fire.
- D. Avoid locating kettle near openings and air intakes on the building to lessen the effect of fumes on the people inside.
- E. Select a clear, level area with firm ground. Locate kettle away from all flammable materials and away from all electrical lines. Chock wheels front and back when kettle is in operation. Make sure the kettle is level and stable from rocking. Place non-flammable material underneath kettle to protect the ground from spillage. Set up a warning line system around the entire kettle working area. Keep unauthorized people away from the area. If LP fuel is being used, secure the cylinder(s) so that it cannot tip over. Locate cylinder(s) at least ten feet from the burners. Keep all fuel upwind from the kettle and away from open flames. Place asphalt to be used for the day in a location convenient for loading the kettle.
- F. Ground protection (plywood and EPDM membrane) is required at kettle site. Comply with all Local Fire Codes or requirements set forth by Local Fire Marshall.

3.3 BITUMEN FUME CONTROL

- A. The Contractor shall include the cost of providing a fume recovery system such as Fumeguard Asphalt & Pitch Fume Control System as manufactured by the Garlock Equipment Company or approved equal in all projects where coal tar pitch and/or asphalt is specified (if Applicable).
- B. Fumes from paint, adhesives, or any other sources are prohibited from entering the building interior. Contractor must provide proper ventilation and take necessary precautions to prevent fume permeation including covering intake vents, providing and installing carbon filters, arranging for HVAC equipment shut down, or any other necessary means to prevent fumes from entering the building.

3.4 ROOFING MEMBRANE INSTALLATION

- A. Except as may be modified by these specifications and drawings, install roofing membrane in accordance with the requirements and recommendations of the roofing membrane manufacturer, using the manufacturer's current printed instructions.
- B. Chalk lining: Beginning at the low points or drains, chalk line the cover board surface to serve as guides for the proper mopping and laying of the roofing membrane plies.
- C. Broom or press each ply into place, full width.

NOTE TO SPECIFIER

Hot-air welding of roofing membrane base and surfacing ply seams, using a flameless welding machine, is required.

- D. Hot-air welded seams: A flameless welding machine must be used for field membrane seams.



- Hot-air weld base ply and surfacing ply seams. Do not use torches to weld seams.
- E. Install only as much roofing as can be completed in a work day, including flashing and detail work. All installed roofing shall be sealed to a watertight condition prior to leaving the site daily.
 - F. Sequence roofing work to eliminate the use of installed roofing as a walkway, or as a storage platform for materials.
 - G. Where wheeled or excessive traffic over new or existing roofing work is unavoidable, provide and use 3/4-inch plywood, set over a minimum of two-inch thick rigid board insulation to protect roofing components in place.
 - H. Overnight tie-in: Care should be exercised to ensure that water does not flow beneath any completed sections of the roof by temporarily sealing the loose edge of the membrane at the end of each work day and when the weather is threatening. The roofing membrane manufacturer's requirements should be followed closely.
 - I. Remove debris from the roof daily prior to leaving the site. Inspect the site at ground level. Remove any roof replacement related debris from the ground.
 - J. Fire watch: Per local codes, provide a fire watch after completion of daily work

3.5 BASE FLASHINGS

- A. Curb height: Unless otherwise indicated provide an 8-inch minimum flashing height above the finished roofing surface. Refer to Section 061053 for wood blocking requirements related to raising of rooftop curbs.
- B. Ensure that all flashing substrates are suitable to receive new base flashing materials.
- C. Install base flashings at vertical walls and curbs in accordance with the roofing membrane manufacturer's requirements and recommendations.
- D. Hot-air welded seams: Using a heat gun, hot-air weld flashing base ply and surfacing ply seams. Do not use torches to weld seams.
- E. Secure the top edge of flashing as shown on the drawings, and In accordance with roofing membrane manufacturer recommendations and requirements. Seal the completed flashing top edge with a 3-course stripping of woven glass fabric and flashing cement.
- F. Fire watch: Per local codes, provide a fire watch after completion of daily work

NOTE TO SPECIFIER

Four options are available for Article 3.6:

1. *If an "A System" is specified, and the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per USPS Design Standards. This option will be included in the Base Proposal; DELETE "(ALTERNATE WORK)" from the Article title.*
2. *If an "A System" is chosen, and the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. Do not edit Article 3.6.*
3. *If a "B System" is specified, and the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a*

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reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per USPS Design Standards. This option will be included in the Base Proposal; DELETE "(ALTERNATE WORK)" from the Article title. DELETE paragraph 3.6A.

4. *If a "B System" is specified, and the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. DELETE paragraph 3.6A.*

Determine the required outcome from the list above. Choose one option only. Edit the item below, based on the options listed above. Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

3.6 REFLECTIVE SURFACING INSTALLATION (ALTERNATE WORK)

- A. Installation of surfacing plies with a factory-applied reflective coatings:
1. Apply the surfacing sheet, following the requirements and recommendations of the roofing membrane manufacturer.
 2. Exercise reasonable care to keep reflective sheets clean, and clear of debris.
 3. At roofing membrane and flashing surfacing ply seams and laps:
 - a. Clean the seam and lap area of dirt and debris. Power wash the seams and laps, if necessary to remove excessive residue.
 - b. At seams, broadcast reflective granules over seam area; or prime seams and laps, and apply two coats minimum of the specified acrylic elastomeric coating over the seam and lap areas.
 4. At locations determined by the Owner to contain excessive staining:
 - a. Clean the identified area(s) of dirt and debris. Power wash the area, if necessary to remove excessive residue.
 - b. Prime the area, if required by the coating manufacturer. Apply two coats, minimum, of the specified acrylic elastomeric coating over the area.
- B. Installation of field-applied acrylic elastomeric roof coating:
1. Prepare substrate in a manner that is acceptable to the roofing membrane and coating manufacturers. Substrate preparation includes, but is not limited to: removal of dirt and debris, repair of defects in the roof membrane and flashing, treatment of surface residue, treatment of areas of excessive ponding, and priming (if required by the roof coating manufacturer).
 - a. After substrate preparation work is complete, inspect all surface preparation work. Correct any identified defects prior to application of coating.
 - b. Inspect the areas adjacent to the work area for cars and other property that could be damaged by coating overspray. Prior to work start, remove or protect cars and other property that may be damaged by work activities.
 - c. Prior to work start, close any rooftop air intakes within and adjacent to the work area.
 - d. Follow manufacturer guidelines for rate of application and application procedures of the base and finish coats, as outlined in the written literature provided by the coating manufacturer.
 - e. Apply the coating following the requirements and recommendations of the roofing membrane and coating manufacturer. Install a minimum of two coats of acrylic elastomeric coating over the roof surface.

NOTE TO SPECIFIER

If liquid-applied flashing is required for this project, do not edit Article 3.7. If liquid-applied flashing is not required for this project, DELETE Article 3.7. If necessary, re-letter/number paragraphs and sub-paragraphs after editing.



3.7 LIQUID-APPLIED FLASHING

- A. At locations to receive liquid applied flashings, as indicated on the project drawings:
 1. Follow the written instructions for application of liquid-applied flashing provided by the roofing membrane manufacturer.
 2. Prepare the flashing substrate in a manner that is acceptable to the roofing membrane manufacturer. Substrate preparation includes, but is not limited to, removal of dirt and debris, repair of defects in the roof membrane and flashing, treatment of surface residue, treatment of areas of excessive ponding, and priming (if required by the roof coating manufacturer).
 3. Apply the base coat of liquid applied flashing to the substrate.
 4. Install required reinforcing mesh into the base coat.
 5. Apply the top coat of liquid applied flashing over the reinforcing mesh and base coat. Extend the top coat over and beyond the reinforcing mesh.
 6. At horizontal surfaces, broadcast granules over the completed flashing.

3.8 ROOF SUMP FLASHINGS

- A. Prior to installation of the base ply, install a three-course stripping of woven glass fabric and roofing cement over the cover board/insulation substrate.
- B. Ensure that the roofing membrane plies extend into the roof sump.
- C. Install a three-course stripping of woven glass fabric and roofing cement over the base ply.
- D. Install a lead sheet flashing over the base ply in the sump; refer to Section 076203. Prime both sides of the lead sheet prior to installation.
- E. Install modified bitumen flashing ply over the lead flashing sheet.
- F. Ensure that the roofing base and surfacing plies, lead flashing sheet, and modified bitumen flashing ply extend under the clamping ring and into the drain bowl. Tightly secure the clamping ring.

3.9 SHEET METAL FLANGE STRIPPINGS

- A. At sheet metal flanges associated with tubular penetration, pitch pan and perimeter edge sheet metal fascia flashings:
 1. Prime the top and bottom of the sheet metal flange. Allow the primer time to dry.
 2. Set flange in a full bed of roofing cement.
 3. Install strippings in accordance with the drawings and the requirements and recommendations of the modified bitumen roofing membrane manufacturer.

NOTE TO SPECIFIER

EDIT items in Article 3.10 to reflect actual project conditions and requirements. Re-letter/number paragraphs and sub-paragraphs after editing.

3.10 MISCELLANEOUS INSTALLATIONS/TREATMENTS

- A. Install mechanical ventilator units in position and secure to the existing curbs with EPDM-gasketed screws. Provide a minimum of one fastener on each side of the curb and a minimum of

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one fastener every 12-inches o.c.

- B. Connect all electrical, plumbing, gas line and ventilation connections required for mechanical units. Retain a qualified, licensed electrical subcontractor to connect electrical equipment. Retain a qualified, licensed mechanical subcontractor to connect gas lines and ventilation connections.
- C. Walkway pads: Install walkway pads at locations indicated on drawings. Install the pads in accordance with the requirements and recommendations of the roofing manufacturer. Extend the pads a minimum of 4-inches in all directions beyond wood blocking.
- D. Install splashblocks set on walkpads at locations indicated on the drawings.
- E. Rooftop conduit and pipe supports:
 - 1. Install adjustable prefabricated pipe supports at rooftop conduit and pipes.
 - 2. Space pipe supports at intervals recommended by the support manufacturer, as determined by the diameter and weight of the conduit or pipe.
 - 3. Separate the support from the roof surface by installing the support over roof walkway pads, installed as specified.
- F. Install self-adhering underlayment beneath coping caps, and at other locations indicated on the drawings.
 - 1. Refer to manufacturer requirements and recommendations for installation.
- G. Roof hatch installation:
 - 1. Provide wood nailers beneath roof hatch flanges, if necessary, to match insulation thickness.
 - 2. Install new roof hatch following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- H. Extendable safety post installation:
 - 1. Install new safety post following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- I. Application of elastomeric coating to rooftop penetrations:
 - 1. Prepare substrate in a manner that is acceptable to the coating manufacturer. Substrate preparation includes, but is not limited to: treatment of excessive gaps, repair of damaged or loose sheet metal components, repair of holes, cleaning of roof penetrations, treatment of surface rust, treatment of residual asphalt, and priming (if required by the roof coating manufacturer).
 - 2. Coat the indicated penetrations following the recommendations and requirements of the coating manufacturer.
- J. Installation of equipment support curbs:
 - 1. Install support curbs where indicated on the project drawings. Flash curbs into the roof system as indicated on the project drawings.
 - 2. Refer to manufacturer requirements and recommendations for installation.

USPS CSF Specifications, issued: 10/1/2013
Last revised: 9/16/2013



NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 52 17 00



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NOTE TO SPECIFIER

Editing is needed for each individual project; modify as needed for project specific requirements. Included "NOTE TO SPECIFIER" instructions provide guidance concerning required editing, and options have been included requiring action on the part of the specifier/designer. Select the option appropriate for the project and delete option(s) not selected.

NOTE TO SPECIFIER

EDIT Section footer as necessary to reflect the project name and location, USPS Project number, and required date of the technical specification document. Coordinate this project specific information with the USPS Project Manager. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this section where a cold-applied SBS (Styrene-Butadiene-Styrene) Modified Bitumen Roofing Membrane is selected as the roofing system. For hot-applied SBS (Styrene-Butadiene-Styrene) Modified Bitumen Roofing Membranes, use Section 075216 – SBS MODIFIED BITUMEN ROOFING IN COLD ADHESIVE. Per the United States Postal Service Roofing Design Standards, an SBS modified bitumen roofing system applied in hot asphalt is a recommended roofing system over facilities with a Critical or Non-Critical building designation.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to the installation of SBS (Styrene-Butadiene-Styrene) modified bitumen roofing membrane and flashings in hot asphalt, DOE Energy Star compliant reflective surfacing, related accessories, and warranty and guarantee requirements.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 072100 – Thermal Insulation
- D. Section 076203 – Sheet Metal Flashings and Trim
- E. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

NOTE TO SPECIFIER

Per discussions between the designer and USPS Project Manager, determine the warranty requirements for the project. Choose from the following warranty options and actions:

1. *If an alternate price for a 20-year "Total System Warranty" is specified, Leave Article 1.3 unchanged.*

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2. If a 20-year "Total System Warranty" will be included in the base proposal, or if no warranty is specified, remove Article 1.3.

Re-letter/number items after editing.

NOTE TO SPECIFIER

Two options are available for paragraph 1.3.B:

1. If the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per USPS Design Standards. This option will be included in the Base Proposal Cost; DELETE Article 1.3B from the list below.
2. If the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. Do not edit paragraph 1.3.B.

Per discussions between the designer and USPS Project Manager, determine the required outcome from the list above. Choose one option only. Edit the item below, based on the options listed above. Re-letter/number items after editing, if necessary.

1.3 ALTERNATES

- A. Provide an alternate price for the 20-Year Total System Warranty described in paragraph 1.9A.
- B. Provide an alternate price for a completed roof system with a DOE Energy Star compliant reflective surfacing over the installed modified bitumen roof system as specified within Articles 2.4 and 3.6 of this Section.

NOTE TO SPECIFIER

EDIT Article 1.4 – REFERENCES below, based on the system specified:

1. If an "A" is chosen, DELETE "ASTM D 6162 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements" from the reference list.
2. If a "B" System is chosen, DELETE "ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements" from the reference list.

Re-letter/number paragraphs and sub-paragraphs after editing.

1.4 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 1. American Society for Testing and Materials (ASTM)
 - a. ASTM D 6162 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements
 - b. ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements
 - c. ASTM D 312 - Standard Specification for Asphalt Used in Roofing
 - d. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
 - e. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing



- f. ASTM D 1668 - Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
- g. ASTM D 1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
- 2. Factory Mutual Global (FM)
- 3. Underwriters Laboratories (UL)
- 4. National Roofing Contractors Association (NRCA)
- 5. American Society of Civil Engineers (ASCE)
 - a. ASCE 7 Minimum Design Loads of Buildings and Other Structures

1.5 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.6 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp. Store roll materials standing on end.



- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
 - 1. NOTE: Do not install SBS modified bitumen roofing at temperatures below 50°F (10°C).
 - 2. When the outside temperature is forecast to fall below 50°F (10°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives and primers should be maintained at a temperature of 50°F (10°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 - 3. When applying hot asphalt, reduce mop lead distance to 2-feet or less.
 - 4. If a minimum asphalt temperature of 420°F (216°C) cannot be maintained at the point of application, discontinue work.
 - 5. Refer to the SBS modified bitumen roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

1.9 MANUFACTURER WARRANTY AND CONTRACTOR GUARANTEE

- A. Provide an alternate price for a manufacturer 20-Year Total System, Non-Pro-Rated Warranty (including insulation, roofing membrane, and flashings) covering materials and labor. The warranty shall include the following additional items:
 - 1. The warranty shall include a wind rider for the design wind speed at the specific project location.
 - 2. Roofing inspection by a technical representative of the roofing membrane manufacturer 22-24 months after date of Final Acceptance.
 - 3. Roofing manufacturer will provide unlimited repairs during warranty period with no cost limitation.
 - 4. Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions.
 - 5. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Record SBS Modified Bitumen Roofing in Hot Asphalt Specification Section to Warranty.
- B. The Contractor shall provide a two-year contractor guarantee. At a minimum, the contractor guarantee shall include the following:
 - 1. Contractor name, address, phone number and project contact name.
 - 2. The project completion date, and date of guarantee expiration.
 - 3. The contractor guarantee shall include, in writing, all project work, workmanship, and/or all materials installed by the contractor or subcontractors to be of a quality that will comply with all project specific requirements of the Construction Documents and other documents governing the Work and workmanship through the guarantee period.
 - 4. The contractor shall investigate roof leaks during the guarantee period within a



reasonable time period, but in no instance greater than 24-hours after notification of a leak. The contractor shall repair leaks determined to be the cause of the Work at no cost to the Owner.

PART 2 – PRODUCTS

2.1 MODIFIED BITUMEN ROOFING SYSTEM SUMMARY

- A. The complete roofing membrane system assembly shall consist of an SBS surfacing ply over an SBS base ply, meeting or exceeding the requirements listed in paragraphs 2.2A and 2.2B.

NOTE TO SPECIFIER

NOTE: In high wind areas, such as those with a calculated wind uplift pressure of greater than 45 psf in the roof field, enhancements to the roof system may be required and must be considered by the design professional/specifier. Consult with the roofing membrane manufacturer and qualified testing agencies for further information and guidance related to possible roof system enhancements in high wind areas.

- B. The complete roofing system assembly shall resist uplift pressures calculated according to ASCE 7-05 for the field, perimeters and corners. The specified approval rating must incorporate a safety factor of 2 over the maximum calculated uplift pressure in foot-pound units.
- C. The complete roofing system assembly shall achieve an FM or UL Class A fire rating.
- D. Acceptable roofing membrane manufacturers include those manufacturing both a modified bitumen base ply and surfacing ply meeting the requirements listed in Articles 2.2 and 2.3. Roofing membrane manufacturers offering a surfacing ply meeting the requirements listed in Articles 2.2 and 2.3, but not offering a base ply meeting the requirement are acceptable with the following restrictions:
1. The submitted system shall include a base ply meeting the requirements of ASTM D 6164, Type II, Grade S.
 2. A letter, signed by authorized representatives of the modified bitumen surfacing ply and base ply manufacturers, indicating the completed system meets the requirements listed in Article 2.1., shall be submitted to the Owner for review.
 3. The completed system shall be capable of meeting the warranty and guarantee requirements outlined in Article 1.9. The total system warranty described shall be the responsibility of a single roofing supplier/manufacturer.

NOTE TO SPECIFIER

Two options are listed below within Articles 2.2 and 2.3:

1. An "A" System, utilizing a polyester-reinforced base ply (ASTM D 6164, Type II) and surfacing ply (ASTM D 6164, Type II).
2. A "B" System, utilizing a dual-reinforced base sheet, with both glass fiber and polyester reinforcement (ASTM D 6162, Type III) and surfacing ply (ASTM D 6162, Type III).

Per discussions between the designer and USPS Project Manager, determine the system desired from the list above. Choose one system only. Edit the list below, leaving one base and surfacing ply for the MB roofing membrane and flashing system, based on the systems listed above. *Re-letter/number paragraphs and sub-paragraphs after editing.*

2.2 MODIFIED BITUMEN ROOFING MEMBRANE

- A. Base ply ("A" System):

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1. Modified bitumen base sheet, polyester reinforced, minimum nominal 115 mil thickness; ASTM D 6164, Type II, Grade S.
- B. Surfacing ply ("A" System):
 1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, fire-rated, minimum nominal 130 mil thickness; ASTM D 6164, Type II, Grade G.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.
- C. Base ply ("B" System):
 1. Modified bitumen base sheet, polyester reinforced, minimum nominal 130 mil thickness; ASTM D 6162, Type III, Grade S.
- D. Surfacing ply ("B" System):
 1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, fire-rated, minimum nominal 160 mil thickness; ASTM D 6162, Type III, Grade G.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.

2.3 MODIFIED BITUMEN ROOFING FLASHING

- A. Base ply ("A" System):
 1. Modified bitumen base sheet, polyester reinforced, minimum nominal 115 mil thickness; ASTM D 6164, Type II, Grade S.
- B. Surfacing ply ("A" System):
 1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, fire-rated, minimum nominal 130 mil thickness; ASTM D 6164, Type II, Grade G.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.
- C. Base ply ("B" System):
 1. Modified bitumen base sheet, polyester reinforced, minimum nominal 130 mil thickness; ASTM D 6162, Type III, Grade S.
- D. Surfacing ply ("B" System):
 1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, fire-rated, minimum nominal 160 mil thickness; ASTM D 6162, Type III, Grade G.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.

NOTE TO SPECIFIER

Four options are available for Article 2.4:

1. If an "A System" is specified, and the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per the USPS Roofing Design Standards. This option will be included in the Base Proposal; DELETE "(ALTERNATE)" from the Article title.
2. If an "A System" is specified, and the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. Do not edit Article 2.4.
3. If a "B System" is specified, and the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per



the USPS Roofing Design Standards. This option will be included in the Base Proposal; DELETE "(ALTERNATE)" from the Article title. DELETE sub-paragraphs 2.4.A.1 and 2.4.A.2, and the word "other" from sub-paragraph 2.4.A.3.

4. *If a "B System" is specified, and the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. DELETE sub-paragraphs 2.4.A.1 and 2.4.A.2, and the word "other" from sub-paragraph 2.4.A.3.*

Determine the required outcome from the list above. Choose one option only. EDIT the item below, based on the options listed above. Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

2.4 DOE ENERGY STAR INITIAL SOLAR REFLECTANCE REQUIREMENT (ALTERNATE)

- A. Provide a completed roofing system approved by the roofing membrane manufacturer, and meeting the Initial Solar Reflectance requirement of 0.65, minimum, as required by DOE Energy Star. The following products are acceptable to achieve this requirement:
 1. Surfacing plies, used in lieu of those identified within paragraphs 2.2.B and 2.3.B:
 - a. Firestone "SBS Premium UltraWhite" surfacing ply, manufactured by Firestone Building Products, as the specified roofing membrane and flashing surfacing ply identified in paragraphs 2.2.B and 2.3.B.
 - b. JM "Dynalastic 250 FR CR" surfacing ply, manufactured by Johns Manville, as the specified roofing membrane and flashing surfacing ply identified in paragraphs 2.2.B and 2.3.B.
 2. Acrylic elastomeric coating, applied over surfacing plies identified within paragraphs 2.2.B and 2.3.B:
 - a. Use of surfacing plies meeting the requirements identified in Articles 2.2 and 2.3 of this Section, and a field-applied acrylic elastomeric coating applied to the finished SBS modified bitumen roofing membrane and flashing surfacing ply. The coating shall be approved for the use specified by the roofing membrane and coating manufacturers.

NOTE TO SPECIFIER

If liquid-applied flashing is required for this project, do not edit Article 2.5. If liquid-applied flashing is not required for this project, DELETE Article 2.5. If necessary, re-letter/number paragraphs and sub-paragraphs after editing.

2.5 LIQUID-APPLIED FLASHING

- A. Base and top coats:
 1. Single or dual component, moisture-cured. Product approved by the roofing membrane manufacturer for use in the specified configuration.
- B. Reinforcing fabric:
 1. Polyester-reinforced fabric. Product approved by the roofing membrane manufacturer for use in the specified configuration.

2.6 ADHESIVES, CEMENTS AND PRIMERS

- A. Asphalt: ASTM D 312, Type III.
- B. Flashing cement and roofing cement: Product compatible with SBS Modified bitumen roofing and approved by the roofing membrane manufacturer.



- C. Asphalt primer: ASTM D 41.

2.7 FASTENERS

- A. Roofing membrane and flashing fasteners: Unless otherwise indicated, types as required by the roofing membrane manufacturer.

2.8 ROOFING FELTS FOR TEMPORARY TIE-INS

- A. For use at temporary overnight tie-ins: Asphalt-saturated organic felt, No. 15, non-perforated, ASTM D 226, Type 1.
- B. For use at roof sump flashings and elsewhere as may be indicated: Asphalt treated woven glass fabric, ASTM D 1668, Type I.

NOTE TO SPECIFIER

EDIT items in Article 2.9 to reflect actual project conditions and requirements. Re-letter/number paragraphs and sub-paragraphs after editing.

2.9 MISCELLANEOUS MATERIALS

- A. Walkway pads: Product approved by the roofing manufacturer.
- B. Splashblocks: Concrete; size as necessary to accommodate existing condition.
- C. Pitch pan fill materials:
1. Non-shrink grout (for bottom fill): Quick-set, fast-drying grout; product acceptable to roofing manufacturer.
 2. Pourable sealer (for top fill): Two-part pourable elastomeric sealer, product acceptable to roofing manufacturer.
- D. Conduit and pipe supports:
1. For pipes with a diameter up to 6-inches:
 - a. Adjustable prefabricated support such as Pipe Pier 150 manufactured by Pipe Pier Support Systems, Hamel, MN, or approved equal.
 - b. Product approved by the roofing manufacturer for this application.
 - c. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
 2. For pipes with a diameter greater than 6-inches:
 - a. Product approved by the roofing manufacturer for this application.
 - b. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
- E. Self-adhering membrane (for use over parapet walls beneath coping caps, and at other locations indicated on the drawings): Product approved for use beneath sheet metal by the membrane manufacturer, and meeting the following criteria:
1. Meeting the requirements of ASTM D 1970.
 2. Approved for use as an underlayment for standing seam sheet metal roofing.
 3. A 40-mil minimum membrane thickness.



- F. Roof hatch:
 - 1. Roof hatch, such as "Type E" or "Type S", manufactured by The Bilco Company, New Haven, CT, or approved equal.
 - a. Size and configuration as necessary.
 - b. Product approved by the roofing manufacturer for this application.
- G. Extendable ladder-mounted safety post, such as "LadderUP Safety Post", manufactured by The Bilco Company, New Haven, CT, or approved equal.
 - 1. Size and configuration as necessary to accommodate new roof hatch.
 - 2. Product approved by the roofing manufacturer for this application.
- H. Acrylic elastomeric coating (for use at roof penetrations and other locations indicated on the project drawings). Product approved for use by the membrane manufacturer for this application, and meeting the following criteria:
 - 1. Meeting the requirements of ASTM D 6083.
 - 2. White color.
- I. Rooftop unit support curbs: Product such as "Pate Equipment Supports" manufactured by The Pate Company, Lombard, IL, or approved equal.
 - 1. Size and configuration as necessary to accommodate existing rooftop unit.
 - 2. Fabricated from 18 ga. galvanized steel, minimum, with welded seams; and a nominal 2-inch thick nailer affixed atop the curb support.
 - 3. Fabricated to allow for a minimum flashing height of 8-inches, minimum.
 - 4. Product approved by the roofing manufacturer for this application.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.

NOTE TO SPECIFIER

Review available field data. Edit required Section references based on existing structural deck types present on the project. For roof areas consisting of an underlying concrete, gypsum concrete or cementitious wood fiber structural deck, include Section 072221 within paragraph 3.1.B below. For roof areas consisting of an underlying wood deck, include Section 072222 within paragraph 3.1.B below. For roof areas consisting of an underlying steel deck, include Section 072223 within paragraph 3.1.B below.

- B. Ensure that the insulation and cover board substrate is installed as specified in Sections 072221, 072222 and 072223 are suitable to receive roofing membrane materials.

3.2 BITUMEN KETTLE OPERATION

- A. Operator Preparation – Kettle operation requires an individual who is trained in the use of such equipment and use of the kettle requires a designate operator who will remain at the kettle during its use. Under no circumstance shall the kettle be unmanned. Never allow any untrained person to operate the kettle. Kettle temperature shall be recorded a minimum of twice per day.
- B. Kettle operator must be dressed accordingly; including, but not limited to, the following items:
 - 1. Long-sleeved shirt, buttoned at the cuffs.
 - 2. Long pants without cuffs.



3. Gloves, snug fitting at the cuffs.
 4. Heavy shoes with high tops.
- C. Site Preparation – The kettle should be located close enough to the building to allow for proper setup of thin-wall tubing. Care must be taken to protect building, by use of tarpaulins. However, be aware of the possible hazards from locating too close, such as splashing of asphalt or the spread of fire.
- D. Avoid locating kettle near openings and air intakes on the building to lessen the effect of fumes on the people inside.
- E. Select a clear, level area with firm ground. Locate kettle away from all flammable materials and away from all electrical lines. Chock wheels front and back when kettle is in operation. Make sure the kettle is level and stable from rocking. Place non-flammable material underneath kettle to protect the ground from spillage. Set up a warning line system around the entire kettle working area. Keep unauthorized people away from the area. If LP fuel is being used, secure the cylinder(s) so that it cannot tip over. Locate cylinder(s) at least ten feet from the burners. Keep all fuel upwind from the kettle and away from open flames. Place asphalt to be used for the day in a location convenient for loading the kettle.
- F. Ground protection (plywood and EPDM membrane) is required at kettle site. Comply with all Local Fire Codes or requirements set forth by Local Fire Marshall.

3.3 BITUMEN FUME CONTROL

- A. The Contractor shall include the cost of providing a fume recovery system such as Fumeguard Asphalt & Pitch Fume Control System as manufactured by the Garlock Equipment Company or approved equal in all projects where coal tar pitch and/or asphalt is specified (if Applicable).
- B. Fumes from paint, adhesives, or any other sources are prohibited from entering the building interior. Contractor must provide proper ventilation and take necessary precautions to prevent fume permeation including covering intake vents, providing and installing carbon filters, arranging for HVAC equipment shut down, or any other necessary means to prevent fumes from entering the building.

3.4 ROOFING MEMBRANE INSTALLATION

- A. Except as may be modified by these specifications and drawings, install roofing membrane in accordance with the requirements and recommendations of the roofing membrane manufacturer, using the manufacturer's current printed instructions.
- B. Chalk lining: Beginning at the low points or drains, chalk line the cover board surface to serve as guides for the proper mopping and laying of the roofing membrane plies.
- C. Broom or press each ply into place, full width.

NOTE TO SPECIFIER

Hot-air welding of roofing membrane base and surfacing ply seams, using a flameless welding machine, is required.

- D. Hot-air welded seams: A flameless welding machine must be used for field membrane seams.



- Hot-air weld base ply and surfacing ply seams. Do not use torches to weld seams.
- E. Install only as much roofing as can be completed in a work day, including flashing and detail work. All installed roofing shall be sealed to a watertight condition prior to leaving the site daily.
 - F. Sequence roofing work to eliminate the use of installed roofing as a walkway, or as a storage platform for materials.
 - G. Where wheeled or excessive traffic over new or existing roofing work is unavoidable, provide and use 3/4-inch plywood, set over a minimum of two-inch thick rigid board insulation to protect roofing components in place.
 - H. Overnight tie-in: Care should be exercised to ensure that water does not flow beneath any completed sections of the roof by temporarily sealing the loose edge of the membrane at the end of each work day and when the weather is threatening. The roofing membrane manufacturer's requirements should be followed closely.
 - I. Remove debris from the roof daily prior to leaving the site. Inspect the site at ground level. Remove any roof replacement related debris from the ground.
 - J. Fire watch: Per local codes, provide a fire watch after completion of daily work

3.5 BASE FLASHINGS

- A. Curb height: Unless otherwise indicated provide an 8-inch minimum flashing height above the finished roofing surface. Refer to Section 061053 for wood blocking requirements related to raising of rooftop curbs.
- B. Ensure that all flashing substrates are suitable to receive new base flashing materials.
- C. Install base flashings at vertical walls and curbs in accordance with the roofing membrane manufacturer's requirements and recommendations.
- D. Hot-air welded seams: Using a heat gun, hot-air weld flashing base ply and surfacing ply seams. Do not use torches to weld seams.
- E. Secure the top edge of flashing as shown on the drawings, and In accordance with roofing membrane manufacturer recommendations and requirements. Seal the completed flashing top edge with a 3-course stripping of woven glass fabric and flashing cement.
- F. Fire watch: Per local codes, provide a fire watch after completion of daily work

NOTE TO SPECIFIER

Four options are available for Article 3.6:

1. If an "A System" is specified, and the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per USPS Design Standards. This option will be included in the Base Proposal; DELETE "(ALTERNATE WORK)" from the Article title.
2. If an "A System" is chosen, and the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. Do not edit Article 3.6.
3. If a "B System" is specified, and the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a

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reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per USPS Design Standards. This option will be included in the Base Proposal; DELETE "(ALTERNATE WORK)" from the Article title. DELETE paragraph 3.6A.

4. *If a "B System" is specified, and the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. DELETE paragraph 3.6A.*

Determine the required outcome from the list above. Choose one option only. Edit the item below, based on the options listed above. Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

3.6 REFLECTIVE SURFACING INSTALLATION (ALTERNATE WORK)

- A. Installation of surfacing plies with a factory-applied reflective coatings:
 1. Apply the surfacing sheet, following the requirements and recommendations of the roofing membrane manufacturer.
 2. Exercise reasonable care to keep reflective sheets clean, and clear of debris.
 3. At roofing membrane and flashing surfacing ply seams and laps:
 - a. Clean the seam and lap area of dirt and debris. Power wash the seams and laps, if necessary to remove excessive residue.
 - b. At seams, broadcast reflective granules over seam area; or prime seams and laps, and apply two coats minimum of the specified acrylic elastomeric coating over the seam and lap areas.
 4. At locations determined by the Owner to contain excessive staining:
 - a. Clean the identified area(s) of dirt and debris. Power wash the area, if necessary to remove excessive residue.
 - b. Prime the area, if required by the coating manufacturer. Apply two coats, minimum, of the specified acrylic elastomeric coating over the area.
- B. Installation of field-applied acrylic elastomeric roof coating:
 1. Prepare substrate in a manner that is acceptable to the roofing membrane and coating manufacturers. Substrate preparation includes, but is not limited to: removal of dirt and debris, repair of defects in the roof membrane and flashing, treatment of surface residue, treatment of areas of excessive ponding, and priming (if required by the roof coating manufacturer).
 - a. After substrate preparation work is complete, inspect all surface preparation work. Correct any identified defects prior to application of coating.
 - b. Inspect the areas adjacent to the work area for cars and other property that could be damaged by coating overspray. Prior to work start, remove or protect cars and other property that may be damaged by work activities.
 - c. Prior to work start, close any rooftop air intakes within and adjacent to the work area.
 - d. Follow manufacturer guidelines for rate of application and application procedures of the base and finish coats, as outlined in the written literature provided by the coating manufacturer.
 - e. Apply the coating following the requirements and recommendations of the roofing membrane and coating manufacturer. Install a minimum of two coats of acrylic elastomeric coating over the roof surface.

NOTE TO SPECIFIER

If liquid-applied flashing is required for this project, do not edit Article 3.7. If liquid-applied flashing is not required for this project, DELETE Article 3.7. If necessary, re-letter/number paragraphs and sub-paragraphs after editing.



3.7 LIQUID-APPLIED FLASHING

- A. At locations to receive liquid applied flashings, as indicated on the project drawings:
 - 1. Follow the written instructions for application of liquid-applied flashing provided by the roofing membrane manufacturer.
 - 2. Prepare the flashing substrate in a manner that is acceptable to the roofing membrane manufacturer. Substrate preparation includes, but is not limited to, removal of dirt and debris, repair of defects in the roof membrane and flashing, treatment of surface residue, treatment of areas of excessive ponding, and priming (if required by the roof coating manufacturer).
 - 3. Apply the base coat of liquid applied flashing to the substrate.
 - 4. Install required reinforcing mesh into the base coat.
 - 5. Apply the top coat of liquid applied flashing over the reinforcing mesh and base coat. Extend the top coat over and beyond the reinforcing mesh.
 - 6. At horizontal surfaces, broadcast granules over the completed flashing.

3.8 ROOF SUMP FLASHINGS

- A. Prior to installation of the base ply, install a three-course stripping of woven glass fabric and roofing cement over the cover board/insulation substrate.
- B. Ensure that the roofing membrane plies extend into the roof sump.
- C. Install a three-course stripping of woven glass fabric and roofing cement over the base ply.
- D. Install a lead sheet flashing over the base ply in the sump; refer to Section 076203. Prime both sides of the lead sheet prior to installation.
- E. Install modified bitumen flashing ply over the lead flashing sheet.
- F. Ensure that the roofing base and surfacing plies, lead flashing sheet, and modified bitumen flashing ply extend under the clamping ring and into the drain bowl. Tightly secure the clamping ring.

3.9 SHEET METAL FLANGE STRIPPINGS

- A. At sheet metal flanges associated with tubular penetration, pitch pan and perimeter edge sheet metal fascia flashings:
 - 1. Prime the top and bottom of the sheet metal flange. Allow the primer time to dry.
 - 2. Set flange in a full bed of roofing cement.
 - 3. Install strippings in accordance with the drawings and the requirements and recommendations of the modified bitumen roofing membrane manufacturer.

NOTE TO SPECIFIER

EDIT items in Article 3.10 to reflect actual project conditions and requirements. Re-letter/number paragraphs and sub-paragraphs after editing.

3.10 MISCELLANEOUS INSTALLATIONS/TREATMENTS

- A. Install mechanical ventilator units in position and secure to the existing curbs with EPDM-gasketed screws. Provide a minimum of one fastener on each side of the curb and a minimum of

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one fastener every 12-inches o.c.

- B. Connect all electrical, plumbing, gas line and ventilation connections required for mechanical units. Retain a qualified, licensed electrical subcontractor to connect electrical equipment. Retain a qualified, licensed mechanical subcontractor to connect gas lines and ventilation connections.
- C. Walkway pads: Install walkway pads at locations indicated on drawings. Install the pads in accordance with the requirements and recommendations of the roofing manufacturer. Extend the pads a minimum of 4-inches in all directions beyond wood blocking.
- D. Install splashblocks set on walkpads at locations indicated on the drawings.
- E. Rooftop conduit and pipe supports:
 - 1. Install adjustable prefabricated pipe supports at rooftop conduit and pipes.
 - 2. Space pipe supports at intervals recommended by the support manufacturer, as determined by the diameter and weight of the conduit or pipe.
 - 3. Separate the support from the roof surface by installing the support over roof walkway pads, installed as specified.
- F. Install self-adhering underlayment beneath coping caps, and at other locations indicated on the drawings.
 - 1. Refer to manufacturer requirements and recommendations for installation.
- G. Roof hatch installation:
 - 1. Provide wood nailers beneath roof hatch flanges, if necessary, to match insulation thickness.
 - 2. Install new roof hatch following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- H. Extendable safety post installation:
 - 1. Install new safety post following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- I. Application of elastomeric coating to rooftop penetrations:
 - 1. Prepare substrate in a manner that is acceptable to the coating manufacturer. Substrate preparation includes, but is not limited to: treatment of excessive gaps, repair of damaged or loose sheet metal components, repair of holes, cleaning of roof penetrations, treatment of surface rust, treatment of residual asphalt, and priming (if required by the roof coating manufacturer).
 - 2. Coat the indicated penetrations following the recommendations and requirements of the coating manufacturer.
- J. Installation of equipment support curbs:
 - 1. Install support curbs where indicated on the project drawings. Flash curbs into the roof system as indicated on the project drawings.
 - 2. Refer to manufacturer requirements and recommendations for installation.

USPS MPF Specifications, issued: 10/1/2013
Last revised: 9/16/2013



NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 52 17 00



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SECTION 07 52 17 00 - R&A SBS MODIFIED BITUMEN ROOFING IN HOT ASPHALT

NOTE TO SPECIFIER

This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this section where a cold-applied SBS (Styrene-Butadiene-Styrene) Modified Bitumen Roofing Membrane is selected as the roofing system in a roof replacement application. For hot-applied SBS (Styrene-Butadiene-Styrene) Modified Bitumen Roofing Membranes, use Section 075216 – SBS MODIFIED BITUMEN ROOFING IN COLD ADHESIVE.

Per the United States Postal Service Roofing Design Standards, an SBS modified bitumen roofing system applied in hot asphalt is a recommended roofing system over facilities with a Critical or Non-Critical building designation.

NOTE TO SPECIFIER

Section Formatting:

Consistent formatting of Sections gives the complete document a professional look. This Section uses a 10pt. Arial font, and is formatted as follows:

1. *Insert one 10pt. line after the Section Number. Section Number is in CAPS.*
2. *Insert two 10pt. lines after the Section Title. Section Title is in CAPS.*
3. *Insert one 10pt. line after a PART. PARTS are in CAPS. If a Section is not used, include NOT USED following the PART title as shown below.*
4. *Insert one 10pt. line after Article paragraphs. Articles are in CAPS.*
5. *Insert two 10pt. lines at the end of an Article.*
6. *Complete Section with END OF SETION.*
7. *No lines should be placed between paragraphs and sub-paragraphs, or between sub-paragraphs and other sub-paragraphs.*

Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED



PART 3 – EXECUTION

NOT USED

Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to the installation of SBS (Styrene-Butadiene-Styrene) modified bitumen roofing membrane and flashings in hot asphalt, DOE Energy Star compliant reflective surfacing, related accessories, and warranty and guarantee requirements.

NOTE TO SPECIFIER

Review available field data. For roof areas consisting of an underlying concrete, gypsum concrete, cementitious wood fiber, and/or lightweight insulating concrete structural deck, include Section 072221 – Insulation and Cover Board over Underlayment within 1.2 RELATED SECTIONS below. For roof areas consisting of an underlying steel and/or wood deck, include Section 072223 – Roof Insulation and Cover Board over Steel and Wood Deck within the 1.2 RELATED SECTIONS below. For projects containing structural deck types applicable to both Sections 072221 and 072223, include both Sections. Re-letter paragraphs and sub-paragraphs after editing.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 024100 – Roof Removal and Substrate Preparation
- D. Section 061053 – Miscellaneous Rough Carpentry for Roof Replacement
- E. Section 072221 – Roof Insulation and Cover Board over Underlayment
- F. Section 072223 – Roof Insulation and Cover Board over Steel and Wood Roof Decks
- G. Section 076203 – Sheet Metal for Modified Bitumen Roofing
- H. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

NOTE TO SPECIFIER

Per discussions between the designer and USPS Project Manager, determine the warranty requirements for the project. Choose from the following warranty options and actions:

1. *If an alternate price for a 20-year "Total System Warranty" is specified, Leave Article 1.3 unchanged.*



2. If a 20-year "Total System Warranty" will be included in the base proposal, or if no warranty is specified, remove Article 1.3.

Re-letter/number items after editing.

NOTE TO SPECIFIER

Two options are available for paragraph 1.3B:

1. If the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per USPS Design Standards. This option will be included in the Base Proposal Cost; **DELETE** Article 1.3B from the list below.
2. If the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. Do not edit paragraph 1.3B.

Per discussions between the designer and USPS Project Manager, determine the required outcome from the list above. Choose one option only. Edit the item below, based on the options listed above. *Re-letter/number items after editing, if necessary.*

1.3 ALTERNATES

- A. Provide an alternate price for the 20-Year Total System Warranty described in paragraph 1.9A.
- B. Provide an alternate price for application of a reflective white coating over the installed modified bitumen roof system as specified within Articles 2.4 and 3.6 of this Section.

NOTE TO SPECIFIER

EDIT Article 1.4 – REFERENCES below, based on the system specified:

1. If an "A" is chosen, **DELETE** "ASTM D 6162 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements" from the reference list.
2. If a "B" System is chosen, **DELETE** "ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements" from the reference list.

Re-letter/number paragraphs and sub-paragraphs after editing.

1.4 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 1. American Society for Testing and Materials (ASTM)
 - a. ASTM D 6162 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements
 - b. ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements
 - c. ASTM D 312 - Standard Specification for Asphalt Used in Roofing
 - d. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
 - e. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
 - f. ASTM D 1668 - Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing



- g. ASTM D 1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
- 2. Factory Mutual Global (FM)
- 3. Underwriters Laboratories (UL)
- 4. National Roofing Contractors Association (NRCA)
- 5. American Society of Civil Engineers (ASCE)
 - a. ASCE 7 Minimum Design Loads of Buildings and Other Structures

1.5 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.6 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp. Store roll materials standing on end.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store



materials on previously completed roofing.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
 - 1. NOTE: Do not install SBS modified bitumen roofing at temperatures below 50°F (10°C).
 - 2. When the outside temperature is forecast to fall below 50°F (10°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives and primers should be maintained at a temperature of 50°F (10°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 - 3. When applying hot asphalt, reduce mop lead distance to 2-feet or less.
 - 4. If a minimum asphalt temperature of 420°F (216°C) cannot be maintained at the point of application, discontinue work.
 - 5. Refer to the SBS modified bitumen roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

NOTE TO SPECIFIER

Per discussions between the designer and USPS Project Manager, determine the warranty requirements for the project. Choose from the following warranty options and actions:

- 1. *If an alternate price for a 20-year "Total System, Non-Pro-Rated Warranty" is specified, do not edit paragraph 1.9A.*
- 2. *If a 20-year "Total System, Non-Pro-Rated Warranty" will be included in the base proposal, DELETE "an alternate price for" from paragraph 1.9A.*
- 3. *If no warranty is specified, EDIT the title of Article 1.9 (DELETE the words "MANUFACTURER WARRANTY AND"), and DELETE paragraph 1.9A. The two-year contractor guarantee shall remain in place.*

Re-letter/number paragraphs and sub-paragraphs after editing.

1.9 MANUFACTURER WARRANTY AND CONTRACTOR GUARANTEE

- A. Provide an alternate price for a manufacturer 20-Year Total System, Non-Pro-Rated Warranty (including insulation, roofing membrane, and flashings) covering materials and labor. The warranty shall include the following additional items:
 - 1. The warranty shall include a wind rider for the design wind speed at the specific project location.
 - 2. Roofing inspection by a technical representative of the roofing membrane manufacturer 22-24 months after date of Final Acceptance.
 - 3. Roofing manufacturer will provide unlimited repairs during warranty period with no cost limitation.
 - 4. Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions.
 - 5. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Record SBS Modified Bitumen Roofing in Hot Asphalt Specification Section to Warranty.



- B. The Contractor shall provide a two-year contractor guarantee. At a minimum, the contractor guarantee shall include the following:
1. Contractor name, address, phone number and project contact name.
 2. The project completion date, and date of guarantee expiration.
 3. The contractor guarantee shall include, in writing, all project work, workmanship, and/or all materials installed by the contractor or subcontractors to be of a quality that will comply with all project specific requirements of the Construction Documents and other documents governing the Work and workmanship through the guarantee period.
 4. The contractor shall investigate roof leaks during the guarantee period within a reasonable time period, but in no instance greater than 24-hours after notification of a leak. The contractor shall repair leaks determined to be the cause of the Work at no cost to the Owner.

PART 2 – PRODUCTS

2.1 MODIFIED BITUMEN ROOFING SYSTEM SUMMARY

- A. The complete roofing membrane system assembly shall consist of an SBS surfacing ply over an SBS base ply, meeting or exceeding the requirements listed in paragraphs 2.2A and 2.2B.

NOTE TO SPECIFIER

***NOTE:** In high wind areas, such as those with a calculated wind uplift pressure of greater than 45 psf in the roof field, enhancements to the roof system may be required and must be considered by the design professional/specifier. Consult with the roofing membrane manufacturer and qualified testing agencies such as FM and Miami-Dade County for further information and guidance related to possible roof system enhancements in high wind areas.*

- B. The complete roofing system assembly shall resist uplift pressures calculated according to ASCE 7-05 for the field, perimeters and corners. The specified approval rating must incorporate a safety factor of 2 over the maximum calculated uplift pressure in foot-pound units.
- C. The complete roofing system assembly shall achieve an FM or UL Class A fire rating.
- D. Acceptable roofing membrane manufacturers include those manufacturing both a modified bitumen base ply and surfacing ply meeting the requirements listed in Articles 2.2 and 2.3. Roofing membrane manufacturers offering a surfacing ply meeting the requirements listed in Articles 2.2 and 2.3, but not offering a base ply meeting the requirement are acceptable with the following restrictions:
1. The submitted system shall include a base ply meeting the requirements of ASTM D 6164, Type II, Grade S.
 2. A letter, signed by authorized representatives of the modified bitumen surfacing ply and base ply manufacturers, indicating the completed system meets the requirements listed in Article 2.1., shall be submitted to the Owner for review.
 3. The completed system shall be capable of meeting the warranty and guarantee requirements outlined in Article 1.9. The total system warranty described shall be the responsibility of a single roofing supplier/manufacturer.

NOTE TO SPECIFIER

Two options are listed below within Articles 2.2 and 2.3:

1. An "A" System, utilizing a polyester-reinforced base ply (ASTM D 6164, Type II) and surfacing ply



(ASTM D 6164, Type II).

2. A "B" System, utilizing a dual-reinforced base sheet, with both glass fiber and polyester reinforcement (ASTM D 6162, Type III) and surfacing ply (ASTM D 6162, Type III).

Per discussions between the designer and USPS Project Manager, determine the system desired from the list above. Choose one system only. Edit the list below, leaving one base and surfacing ply for the MB roofing membrane and flashing system, based on the systems listed above. *Re-letter/number paragraphs and sub-paragraphs after editing.*

2.2 MODIFIED BITUMEN ROOFING MEMBRANE

A. Base ply ("A" System):

1. Modified bitumen base sheet, polyester reinforced, minimum nominal 115 mil thickness; ASTM D 6164, Type II, Grade S.

B. Surfacing ply ("A" System):

1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, fire-rated, minimum nominal 130 mil thickness; ASTM D 6164, Type II, Grade G.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.

C. Base ply ("B" System):

1. Modified bitumen base sheet, polyester reinforced, minimum nominal 130 mil thickness; ASTM D 6162, Type III, Grade S.

D. Surfacing ply ("B" System):

1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, fire-rated, minimum nominal 160 mil thickness; ASTM D 6162, Type III, Grade G.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.

2.3 MODIFIED BITUMEN ROOFING FLASHING

A. Base ply ("A" System):

1. Modified bitumen base sheet, polyester reinforced, minimum nominal 115 mil thickness; ASTM D 6164, Type II, Grade S.

B. Surfacing ply ("A" System):

1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, fire-rated, minimum nominal 130 mil thickness; ASTM D 6164, Type II, Grade G.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.

C. Base ply ("B" System):

1. Modified bitumen base sheet, polyester reinforced, minimum nominal 130 mil thickness; ASTM D 6162, Type III, Grade S.

D. Surfacing ply ("B" System):

1. Modified bitumen granule-surfaced surfacing sheet, polyester reinforced, fire-rated, minimum nominal 160 mil thickness; ASTM D 6162, Type III, Grade G.
 - a. Color: White, or as determined by Owner.
 - b. Initial Solar Reflectance: 0.26 or greater.

NOTE TO SPECIFIER



Four options are available for Article 2.4:

1. If an "A System" is specified, and the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per the USPS Roofing Design Standards. This option will be included in the Base Proposal; DELETE "(ALTERNATE)" from the Article title.
2. If an "A System" is specified, and the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. Do not edit Article 2.4.
3. If a "B System" is specified, and the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per the USPS Roofing Design Standards. This option will be included in the Base Proposal; DELETE "(ALTERNATE)" from the Article title. DELETE sub-paragraphs 2.4.A.1 and 2.4.A.2, and the word "other" from sub-paragraph 2.4.A.3.
4. If a "B System" is specified, and the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. DELETE sub-paragraphs 2.4.A.1 and 2.4.A.2, and the word "other" from sub-paragraph 2.4.A.3.

Determine the required outcome from the list above. Choose one option only. EDIT the item below, based on the options listed above. Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

2.4 DOE ENERGY STAR INITIAL SOLAR REFLECTANCE REQUIREMENT (ALTERNATE)

- A. Provide a completed roofing system approved by the roofing membrane manufacturer, and meeting the Initial Solar Reflectance requirement of 0.65, minimum, as required by DOE Energy Star. The following products are acceptable to achieve this requirement:
 1. Surfacing plies, used in lieu of those identified within paragraphs 2.2.B and 2.3.B:
 - a. Firestone "SBS Premium UltraWhite" surfacing ply, manufactured by Firestone Building Products, as the specified roofing membrane and flashing surfacing ply identified in paragraphs 2.2.B and 2.3.B.
 - b. JM "Dynalastic 250 FR CR" surfacing ply, manufactured by Johns Manville, as the specified roofing membrane and flashing surfacing ply identified in paragraphs 2.2.B and 2.3.B.
 2. Acrylic elastomeric coating, applied over surfacing plies identified within paragraphs 2.2.B and 2.3.B:
 - a. Use of surfacing plies meeting the requirements identified in Articles 2.2 and 2.3 of this Section, and a field-applied acrylic elastomeric coating applied to the finished SBS modified bitumen roofing membrane and flashing surfacing ply. The coating shall be approved for the use specified by the roofing membrane and coating manufacturers.

NOTE TO SPECIFIER

If liquid-applied flashing is required for this project, do not edit Article 2.5. If liquid-applied flashing is not required for this project, DELETE Article 2.5. If necessary, re-letter/number paragraphs and sub-paragraphs after editing.

2.5 LIQUID-APPLIED FLASHING

- A. Base and top coats:
 1. Single or dual component, moisture-cured. Product approved by the roofing membrane manufacturer for use in the specified configuration.
- B. Reinforcing fabric:



1. Polyester-reinforced fabric. Product approved by the roofing membrane manufacturer for use in the specified configuration.

2.6 ADHESIVES, CEMENTS AND PRIMERS

- A. Asphalt: ASTM D 312, Type III.
- B. Flashing cement and roofing cement: Product compatible with SBS Modified bitumen roofing and approved by the roofing membrane manufacturer.
- C. Asphalt primer: ASTM D 41.

2.7 FASTENERS

- A. Roofing membrane and flashing fasteners: Unless otherwise indicated, types as required by the roofing membrane manufacturer.

2.8 ROOFING FELTS FOR TEMPORARY TIE-INS

- A. For use at temporary overnight tie-ins: Asphalt-saturated organic felt, No. 15, non-perforated, ASTM D 226, Type 1.
- B. For use at roof sump flashings and elsewhere as may be indicated: Asphalt treated woven glass fabric, ASTM D 1668, Type I.

2.9 MISCELLANEOUS MATERIALS

- A. Walkway pads: Product approved by the roofing manufacturer.
- B. Splashblocks: Concrete; size as necessary to accommodate existing condition.
- C. Pitch pan fill materials:
 1. Non-shrink grout (for bottom fill): Quick-set, fast-drying grout; product acceptable to roofing manufacturer.
 2. Pourable sealer (for top fill): Two-part pourable elastomeric sealer, product acceptable to roofing manufacturer.
- D. Conduit and pipe supports:
 1. For pipes with a diameter up to 6-inches:
 - a. Adjustable prefabricated support such as Pipe Pier 150 manufactured by Pipe Pier Support Systems, Hamel, MN, or approved equal.
 - b. Product approved by the roofing manufacturer for this application.
 - c. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
 2. For pipes with a diameter greater than 6-inches:
 - a. Product approved by the roofing manufacturer for this application.
 - b. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
- E. Pre-fabricated plumbing vent pipe extensions:
 1. For use where necessary to achieve the 8-inch minimum flashing height:



- a. Pre-fabricated plumbing vent extensions, such as Tubos Pre-Fabricated Pipe Extension, by Tubos, Inc., Clearwater, FL.
 - b. Product approved by the roofing manufacturer for this application.
 - c. Size and configuration of extension as necessary to match existing pipe diameter, providing the 8-inch minimum flashing height, and allowing for flashing as show on the drawings.
- F. Self-adhering membrane (for use over parapet walls beneath coping caps, and at other locations indicated on the drawings): Product approved for use beneath sheet metal by the membrane manufacturer, and meeting the following criteria:
 - 1. Meeting the requirements of ASTM D 1970.
 - 2. Approved for use as an underlayment for standing seam sheet metal roofing.
 - 3. A 40-mil minimum membrane thickness.
- G. Replacement roof hatch:
 - 1. Roof hatch, such as "Type E" or "Type S", manufactured by The Bilco Company, New Haven, CT, or approved equal.
 - a. Size and configuration as necessary to match existing roof hatch.
 - b. Product approved by the roofing manufacturer for this application.
- H. Extendable ladder-mounted safety post, such as "LadderUP Safety Post", manufactured by The Bilco Company, New Haven, CT, or approved equal.
 - 1. Size and configuration as necessary to accommodate existing ladder and new roof hatch.
 - 2. Product approved by the roofing manufacturer for this application.
- I. Acrylic elastomeric coating (for use at roof penetrations and other locations indicated on the project drawings). Product approved for use by the membrane manufacturer for this application, and meeting the following criteria:
 - 1. Meeting the requirements of ASTM D 6083.
 - 2. White color.
- J. Rooftop unit support curbs: Product such as "Pate Equipment Supports" manufactured by The Pate Company, Lombard, IL, or approved equal.
 - 1. Size and configuration as necessary to accommodate existing rooftop unit.
 - 2. Fabricated from 18 ga. galvanized steel, minimum, with welded seams; and a nominal 2-inch thick nailer affixed atop the curb support.
 - 3. Fabricated to allow for a minimum flashing height of 8-inches, minimum.
 - 4. Product approved by the roofing manufacturer for this application.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.

NOTE TO SPECIFIER

Review available field data. For roof areas consisting of an underlying concrete, gypsum concrete or cementitious wood fiber structural deck, include Section 072221 within the paragraph 3.1B below. For roof areas consisting of an underlying steel or wood deck, include Section 072223 within paragraph 3.1B below. For projects containing structural deck types applicable to both Sections 072221 and 072223, include both Sections.

- B. Ensure that the insulation and cover board substrate is installed as specified in Sections 072221

and 072223 are suitable to receive roofing membrane materials.

3.2 BITUMEN KETTLE OPERATION

- A. Operator Preparation – Kettle operation requires an individual who is trained in the use of such equipment and use of the kettle requires a designate operator who will remain at the kettle during its use. Under no circumstance shall the kettle be unmanned. Never allow any untrained person to operate the kettle. Kettle temperature shall be recorded a minimum of twice per day.
- B. Kettle operator must be dressed accordingly; including, but not limited to, the following items:
 - 1. Long-sleeved shirt, buttoned at the cuffs.
 - 2. Long pants without cuffs.
 - 3. Gloves, snug fitting at the cuffs.
 - 4. Heavy shoes with high tops.
- C. Site Preparation – The kettle should be located close enough to the building to allow for proper setup of thin-wall tubing. Care must be taken to protect building, by use of tarpaulins. However, be aware of the possible hazards from locating too close, such as splashing of asphalt or the spread of fire.
- D. Avoid locating kettle near openings and air intakes on the building to lessen the effect of fumes on the people inside.
- E. Select a clear, level area with firm ground. Locate kettle away from all flammable materials and away from all electrical lines. Chock wheels front and back when kettle is in operation. Make sure the kettle is level and stable from rocking. Place non-flammable material underneath kettle to protect the ground from spillage. Set up a warning line system around the entire kettle working area. Keep unauthorized people away from the area. If LP fuel is being used, secure the cylinder(s) so that it cannot tip over. Locate cylinder(s) at least ten feet from the burners. Keep all fuel upwind from the kettle and away from open flames. Place asphalt to be used for the day in a location convenient for loading the kettle.
- F. Ground protection (plywood and EPDM membrane) is required at kettle site. Comply with all Local Fire Codes or requirements set forth by Local Fire Marshall.

3.3 BITUMEN FUME CONTROL

- A. The Contractor shall include the cost of providing a fume recovery system such as Fumeguard Asphalt & Pitch Fume Control System as manufactured by the Garlock Equipment Company or approved equal in all projects where coal tar pitch and/or asphalt is specified (if Applicable).
- B. Fumes from paint, adhesives, or any other sources are prohibited from entering the building interior. Contractor must provide proper ventilation and take necessary precautions to prevent fume permeation including covering intake vents, providing and installing carbon filters, arranging for HVAC equipment shut down, or any other necessary means to prevent fumes from entering the building.

3.4 ROOFING MEMBRANE INSTALLATION

- A. Except as may be modified by these specifications and drawings, install roofing membrane in accordance with the requirements and recommendations of the roofing membrane manufacturer, using the manufacturer's current printed instructions.



- B. Chalk lining: Beginning at the low points or drains, chalk line the cover board surface to serve as guides for the proper mopping and laying of the roofing membrane plies.
- C. Broom or press each ply into place, full width.

NOTE TO SPECIFIER

Hot-air welding of roofing membrane base and surfacing ply seams, using a flameless welding machine, is required. Use of torches during roof replacement application is not allowed.

- D. Hot-air welded seams: A flameless welding machine must be used for field membrane seams. Hot-air weld base ply and surfacing ply seams. Do not use torches to weld seams.
- E. Install only as much roofing as can be completed in a work day, including flashing and detail work. All installed roofing shall be sealed to a watertight condition prior to leaving the site daily.
- F. Sequence roofing work to eliminate the use of installed roofing as a walkway, or as a storage platform for materials.
- G. Where wheeled or excessive traffic over new or existing roofing work is unavoidable, provide and use 3/4-inch plywood, set over a minimum of two-inch thick rigid board insulation to protect roofing components in place.
- H. Overnight tie-in: Care should be exercised to ensure that water does not flow beneath any completed sections of the roof by temporarily sealing the loose edge of the membrane at the end of each work day and when the weather is threatening. The roofing membrane manufacturer's requirements should be followed closely.
- I. Remove debris from the roof daily prior to leaving the site. Inspect the site at ground level. Remove any roof replacement related debris from the ground.
- J. Fire watch: Per local codes, provide a fire watch after completion of daily work

3.5 BASE FLASHINGS

- A. Curb height: Unless otherwise indicated or not possible due to existing conditions encountered, provide an 8-inch minimum flashing height above the finished roofing surface. Refer to Section 061053 for wood blocking requirements related to raising of rooftop curbs.
- B. Ensure that all flashing substrates are suitable to receive new base flashing materials.
- C. Install base flashings at vertical walls and curbs in accordance with the roofing membrane manufacturer's requirements and recommendations.
- D. Hot-air welded seams: Using a heat gun, hot-air weld flashing base ply and surfacing ply seams. Do not use torches to weld seams.
- E. Secure the top edge of flashing as shown on the drawings, and In accordance with roofing membrane manufacturer recommendations and requirements. Seal the completed flashing top edge with a 3-course stripping of woven glass fabric and flashing cement.
- F. Fire watch: Per local codes, provide a fire watch after completion of daily work



NOTE TO SPECIFIER

Four options are available for Article 3.6:

1. If an "A System" is specified, and the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per USPS Design Standards. This option will be included in the Base Proposal; DELETE "(ALTERNATE WORK)" from the Article title.
2. If an "A System" is chosen, and the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. Do not edit Article 3.6.
3. If a "B System" is specified, and the project is located in ASHRAE Climate Zones 1, 2, 3 or 4, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star is required per USPS Design Standards. This option will be included in the Base Proposal; DELETE "(ALTERNATE WORK)" from the Article title. DELETE paragraph 3.6A.
4. If a "B System" is specified, and the project is located in an ASHRAE Climate Zones 5, 6 or 7, a reflective roofing surface meeting the reflectivity requirements of DOE Energy Star shall be added as an alternate. DELETE paragraph 3.6A.

Determine the required outcome from the list above. Choose one option only. Edit the item below, based on the options listed above. Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

3.6 REFLECTIVE SURFACING INSTALLATION (ALTERNATE WORK)

- A. Installation of surfacing plies with a factory-applied reflective coatings:
 1. Apply the surfacing sheet, following the requirements and recommendations of the roofing membrane manufacturer.
 2. Exercise reasonable care to keep reflective sheets clean, and clear of debris.
 3. At roofing membrane and flashing surfacing ply seams and laps:
 - a. Clean the seam and lap area of dirt and debris. Power wash the seams and laps, if necessary to remove excessive residue.
 - b. At seams, broadcast reflective granules over seam area; or prime seams and laps, and apply two coats minimum of the specified acrylic elastomeric coating over the seam and lap areas.
 4. At locations determined by the Owner to contain excessive staining:
 - a. Clean the identified area(s) of dirt and debris. Power wash the area, if necessary to remove excessive residue.
 - b. Prime the area, if required by the coating manufacturer. Apply two coats, minimum, of the specified acrylic elastomeric coating over the area.
- B. Installation of field-applied acrylic elastomeric roof coating:
 1. Prepare substrate in a manner that is acceptable to the roofing membrane and coating manufacturers. Substrate preparation includes, but is not limited to: removal of dirt and debris, repair of defects in the roof membrane and flashing, treatment of surface residue, treatment of areas of excessive ponding, and priming (if required by the roof coating manufacturer).
 - a. After substrate preparation work is complete, inspect all surface preparation work. Correct any identified defects prior to application of coating.
 - b. Inspect the areas adjacent to the work area for cars and other property that could be damaged by coating overspray. Prior to work start, remove or protect cars and other property that may be damaged by work activities.
 - c. Prior to work start, close any rooftop air intakes within and adjacent to the work area.
 - d. Follow manufacturer guidelines for rate of application and application procedures of the base and finish coats, as outlined in the written literature provided by the coating manufacturer.



- e. Apply the coating following the requirements and recommendations of the roofing membrane and coating manufacturer. Install a minimum of two coats of acrylic elastomeric coating over the roof surface.

NOTE TO SPECIFIER

If liquid-applied flashing is required for this project, do not edit Article 3.7. If liquid-applied flashing is not required for this project, DELETE Article 3.7. If necessary, re-letter/number paragraphs and sub-paragraphs after editing.

3.7 LIQUID-APPLIED FLASHING

- A. At locations to receive liquid applied flashings, as indicated on the project drawings:
 - 1. Follow the written instructions for application of liquid-applied flashing provided by the roofing membrane manufacturer.
 - 2. Prepare the flashing substrate in a manner that is acceptable to the roofing membrane manufacturer. Substrate preparation includes, but is not limited to, removal of dirt and debris, repair of defects in the roof membrane and flashing, treatment of surface residue, treatment of areas of excessive ponding, and priming (if required by the roof coating manufacturer).
 - 3. Apply the base coat of liquid applied flashing to the substrate.
 - 4. Install required reinforcing mesh into the base coat.
 - 5. Apply the top coat of liquid applied flashing over the reinforcing mesh and base coat. Extend the top coat over and beyond the reinforcing mesh.
 - 6. At horizontal surfaces, broadcast granules over the completed flashing.

3.8 ROOF SUMP FLASHINGS

- A. Prior to installation of the base ply, install a three-course stripping of woven glass fabric and roofing cement over the cover board/insulation substrate.
- B. Ensure that the roofing membrane plies extend into the roof sump.
- C. Install a three-course stripping of woven glass fabric and roofing cement over the base ply.
- D. Install a lead sheet flashing over the base ply in the sump; refer to Section 076203. Prime both sides of the lead sheet prior to installation.
- E. Install modified bitumen flashing ply over the lead flashing sheet.
- F. Ensure that the roofing base and surfacing plies, lead flashing sheet, and modified bitumen flashing ply extend under the clamping ring and into the drain bowl. Tightly secure the clamping ring.

3.9 SHEET METAL FLANGE STRIPPINGS

- A. At sheet metal flanges associated with tubular penetration, pitch pan and perimeter edge sheet metal fascia flashings:
 - 1. Prime the top and bottom of the sheet metal flange. Allow the primer time to dry.
 - 2. Set flange in a full bed of roofing cement.
 - 3. Install strippings in accordance with the drawings and the requirements and recommendations of the modified bitumen roofing membrane manufacturer.

3.10 MISCELLANEOUS INSTALLATIONS/TREATMENTS

- A. Return mechanical ventilator units to their original positions and secure to the existing curbs with EPDM-gasketed screws. Provide a minimum of one fastener on each side of the curb and a minimum of one fastener every 12-inches o.c.
- B. Reconnect all electrical, plumbing, gas line and ventilation connections required to return mechanical units to their original operating condition. Retain a qualified, licensed electrical subcontractor to reconnect electrical equipment. Retain a qualified, licensed mechanical subcontractor to reconnect gas lines and ventilation connections. Coordinate required disconnections and reconnections with the Owner.
- C. Walkway pads: Install walkway pads at locations indicated on drawings. Install the pads in accordance with the requirements and recommendations of the roofing manufacturer. Extend the pads a minimum of 4-inches in all directions beyond wood blocking.
- D. Install splashblocks set on walkpads at locations indicated on the drawings.
- E. Rooftop conduit and pipe supports:
 - 1. Install adjustable prefabricated pipe supports at rooftop conduit and pipes.
 - 2. Space pipe supports at intervals recommended by the support manufacturer, as determined by the diameter and weight of the conduit or pipe.
 - 3. Separate the support from the roof surface by installing the support over roof walkway pads, installed as specified.
- F. Pre-fabricated plumbing vent pipe extensions:
 - 1. Refer to manufacturer requirements and recommendations for installation.
 - 2. Prior to flashing installation, seal intersection of pipe extension and existing plumbing vent.
- G. Install self-adhering underlayment beneath coping caps, and at other locations indicated on the drawings.
 - 1. Refer to manufacturer requirements and recommendations for installation.
- H. Replacement roof hatch installation:
 - 1. Remove and discard existing roof hatch.
 - 2. Provide wood nailers beneath roof hatch flanges, if necessary, to match insulation thickness.
 - 3. Install new roof hatch following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- I. Extendable safety post installation:
 - 1. Install new safety post following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- J. Application of elastomeric coating to rooftop penetrations:
 - 1. Prepare substrate in a manner that is acceptable to the coating manufacturer. Substrate preparation includes, but is not limited to: treatment of excessive gaps, repair of damaged or loose sheet metal components, repair of holes, cleaning of roof penetrations, treatment of surface rust, treatment of residual asphalt, and priming (if required by the roof coating manufacturer).
 - 2. Coat the indicated penetrations following the recommendations and requirements of the coating manufacturer.



- K. Installation of equipment support curbs:
1. Install support curbs where indicated on the project drawings. Flash curbs into the roof system as indicated on the project drawings.
 2. Refer to manufacturer requirements and recommendations for installation.

USPS CSF Specifications issued: 10/1/2013

Last revised: 3/6/2013

NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 52 17 00



SECTION 07 53 16 00 - CSF CHLOROSULFONATE- POLYETHYLENE (CSPE) ROOFING

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

This roofing section includes three (3) options regarding inspections and /or warranty; two (2) options regarding insulation type; and two (2) options regarding insulation system attachment.

The Contracting Officer (CO) must provide direction to the Specifier on which one of the warranty options will be selected for this project. After receiving direction from the CO, the Specifier must edit the warranty sections to ensure that this option is consistently applied throughout.

The warranty options are:

WARRANTY OPTION 1, Part-Time Third-Party Inspections: these are to be provided at construction milestones as listed below. A manufacturer's warranty is optional. The Contracting Officer may choose to mandate Part-Time Third Party Inspections AND mandate manufacturer's warranty.

WARRANTY OPTION 2, Full-time Third-Party inspections: an inspector is to be continuously present during the entire period of roofing installation. A manufacturer's warranty is optional. The Contracting Officer may choose to mandate Full-Time Third Party Inspections AND mandate manufacturer's warranty.

WARRANTY OPTION 3, Manufacturer's Warranty: this option requires a warranty from the manufacturer. Inspections are to be provided by the manufacturer at the milestones listed below or as necessary to meet manufacturer's requirements.

There are two (2) options regarding primary roof insulation type. The Specifier must provide direction on which one of the options will be selected for this project. The Specifier must edit the section to ensure that this option is consistently applied throughout the section. Note that facilities with a metal roof deck are most conducive to Polyisocyanurate insulation due to the fact that a thermal barrier is not required under the insulation in order to maintain the systems fire rating (Use of XPS over a metal deck would require a thermal barrier under the insulation assembly if selected). Concrete roof decks can utilize Extruded Polystyrene Insulation attached directly to the prepared roof deck without the need for a thermal barrier. The Specifier shall determine the insulation type based on existing construction; building code review; and cost analysis. The insulation type options are:

INSULATION Type OPTION 1, Polyisocyanurate.

INSULATION Type OPTION 2, Extruded Polystyrene.

There are two (2) options regarding insulation attachment. The Specifier must provide direction on which one of the options will be selected for this project. The Specifier must edit the section to ensure that this option is consistently applied throughout the section. Note that facilities with a metal roof deck are most conducive to mechanical attachment of the insulation assembly. Facilities with concrete roof decks are most conducive to adhered attachment of the insulation assembly. The Specifier shall determine the insulation type based on existing construction; building code review; and cost analysis. The insulation attachment options are:

INSULATION Attachment OPTION 1, Mechanically attached.

INSULATION Attachment OPTION 2, Adhered.



PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparation of roof deck to receive roofing membrane.
2. Vapor/Air retarder. [Specifier to make determination of use and location within the system based on facility conditions and general environment]
3. [Mechanically fastened] [Adhesively Applied] Roof insulation and Glass mat gypsum board.
4. Fully adhered membrane roofing system.
5. Flashing membrane.
6. Accessories.
7. Edge metal.
8. [Warranty]

B. Related Documents:

1. The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section.
2. Memorandum of Understanding (MOU) between the United States Environmental Protection Agency's ENERGY STAR® Roof Products Program and Roofing Material Manufacturers.
3. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

C. Related Sections:

1. Section 061000 - Rough Carpentry: Wood blocking, curbs, and nailers.
2. Section 076200 - Sheet Metal Flashing and Trim: Counter flashings, edge metal and other sheet metal.
3. Section 077213 - Manufactured Curbs: Curbs for roof penetrations.
4. Section 077233 - Roof Hatches: Hatch with integral curb.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM C208 - Specification for Cellulosic Fiber Insulating Board.
2. ASTM C1177 - Standard Specification for Glass Mat Gypsum Roof Board.
3. ASTM C1289 - Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
4. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers.
5. ASTM D570 - Test Method for Water Absorption of Plastics.
6. ASTM D638 - Test Method for Tensile Properties of Plastics.
7. ASTM D751 - Test Method for Coated Fabrics.
8. ASTM D1004 - Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
9. ASTM D1079 - Terminology Relating to Roofing and Waterproofing.
10. ASTM D1204 - Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature.
11. ASTM D2136 - Test Method for Coated Fabrics – Low Temperature Bend Test.
12. ASTM D3045 - Practice for Heat Aging of Plastics Without Load.
13. ASTM D4397 - Standard Specification for Polyethylene Sheeting.
14. ASTM D4434 - Specification for Poly(Vinyl Chloride) Sheet Roofing. (Most Recent Edition)
15. ASTM D5019 - Standard specification for reinforced CSM (Chlorosulfonated Polyethylene) sheet used in single-ply roof membrane.
16. ASTM D5602 - Test Method for Static Puncture Resistance of Roofing Membrane Samples.
17. ASTM D5635 - Test Method for Dynamic Puncture Resistance of Roofing Membrane Samples.



18. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
19. ASTM E96 - Test Methods for Water Vapor Transmission of Materials.
20. ASTM E108 - Test Methods for Fire Tests of Roof Coverings.
21. ASTM E903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmission of Materials Using Integrating Spheres.
22. ASTM G21 - Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
23. ASTM G26 - Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials.
24. ASTM G53 - Practice for Operating Light- and Water – Exposure Apparatus (Fluorescent UV/Condensation Type) for Exposure of Nonmetallic Materials.

B. Factory Mutual Global (FMG):

1. FMG – RoofNav – Internet Based FM Roof Assembly Testing and Approvals Database
2. FMG - Approval Guide, Building Materials.
3. FMG - Loss Prevention Data 1-28, Wind Loads to Roof Systems and Roof Deck Securement.
4. FMG - Loss Prevention Data 1-29, Above Deck Roof Components (June 1996).
5. FMG - Standard 4450, Class 1 Insulated Steel Deck Roofs.
6. FMG - Standard 4470, Class 1 Roof Covers.

C. Underwriters Laboratory (UL):

1. Class A rated roofing system

1.3 SYSTEM DESCRIPTION

- A. ENERGY STAR® Compliant Fully adhered CSPE Membrane Roofing System: ASTM D5019 on Glass Mat Gypsum Roof Board on overlayed insulation secured to [metal or concrete] deck.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals

1. Product Data:
 - a. FM RoofNav Assembly Number certifying proposed roof system has been tested and approved by FMG for the specified FM[1-90] [1-105] [1-120] rating.
 - b. Membrane materials, base flashing, vapor retarder, [fastener & plate,] adhesive materials, edge metal and insulation.
 - c. [Insulation fastener layouts complying with FMG Loss Prevention Data Sheet 1-29 patterns for specified wind uplift resistance. Indicate number of insulation fasteners required and spacing of fasteners for field, perimeter, and corners for each pattern.] [Adhesively applied insulation coverage rates and layout must comply with the proposed FM RoofNav assembly number and adhesive application rates relative to that assembly. Indicate insulation adhesive application rates required and the coverage/ribbon spacing of adhesive for field, perimeter, and corners for each pattern. Insulation adhesion rates and coverage/ribbon spacing submissions must also be inclusive of the roof system manufacturer's instructions, including cold weather installation instructions and are required for approval prior to job start.]
 - d. Adhered membrane adhesive and application rates for adhering membrane roof to the overlayed insulation system with coverboard. Membrane adhesive shall be installed in compliance with roof membrane system manufacturer's FM RoofNav assembly approval number and all of the manufacturer's instructions including cold weather installation instructions of the proposed shall be required for approval prior to job start.
2. Shop Drawings: Indicate setting plan for insulation including fastener pattern, layout of roofing seams, direction of laps and base flashing details.



3. Assurance/Control Submittals:

- a. Certificates: Manufacturer is to certify that components and products meet or exceed specified standards and complies with referenced quality assurance standards in section 1.5 including the FM RoofNav assembly number.
- b. Qualification Documentation: Manufacturer certification indicating roofing applicator qualifications complying with requirements specified in Paragraph entitled "Applicator Qualifications" of this Section.

NOTE TO SPECIFIER

WARRANTY OPTION 1, Part-Time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 1, Part-Time Third-Party inspections.

- c. Field Quality Control Reports: Submit the following reports directly to Contracting Officer from the Third-Party Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
 - 1) Preparatory inspection.
 - 2) Initial inspection.
 - 3) Follow-up inspections.
 - 4) Final inspection.
 - 5) Maintenance Instruction: Document training by furnishing a sign-in sheet with a description of the training provided, instructors name and organization, and those who received training. Refer to 017704 1.3, 1.4, and 1.5 for more specific training requirements.

NOTE TO SPECIFIER

WARRANTY OPTION 2, Full-time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 2, Full-time Third-Party inspections.

- d. Field Quality Control Reports: Submit daily reports directly to Contracting Officer from the Full-time Third-Party Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements.
- e. Maintenance Instruction: Document training by furnishing a sign-in sheet with a description of the training provided, instructors name and organization, and those who received training. Refer to 017704 1.3, 1.4, and 1.5 for more specific training requirements.

NOTE TO SPECIFIER

Include the paragraphs below if Contracting Officer mandates a Manufacturer's warranty. Delete the paragraphs below if the Contracting Officer chooses to have Part-Time or Full Time Third Party inspections and No Warranty.

- f. Sample of specified Warranty
- g. Manufacturer's certification letter acknowledging receipt of specifications, intent to issue warranty, and intent to perform field audits as outlined in 1.4.3.d.
- h. Manufacturer's Field Reports: Submit the following reports directly to Contracting Officer from Manufacturer's Roofing Quality Control Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
 - 1) Preparatory inspection.
 - 2) Initial inspection.
 - 3) Follow-up inspections.
 - 4) Final inspection.

NOTE TO SPECIFIER

End of WARRANTY OPTION



- i. Written certification that proposed roofing membrane meets the EPA ENERGY STAR® Roof Products Program specification for energy efficiency and that the manufacturer is listed as a Partner.
4. Maintenance Instruction: Document training by furnishing a sign-in sheet with a description of the raining provided, instructors name and organization, and those who received training. Refer to 017704 1.3, 1.4, and 1.5 for more specific training requirements.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or by licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by membrane manufacturer for specified roofing system and shall be in compliance with all applicable regulatory requirements.
- C. FMG Listing: Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system and that are listed in the most recent FMG "RoofNav" on-line directory or FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

NOTE TO SPECIFIER

90 pounds per square foot wind uplift minimum. Design roofing and insulation system to comply with regional requirements and special regulations of local authority having jurisdiction. Verify with USPS Contracting Officer. Contact Roofing System Manufacturer for information about 120 or 150 pounds per square foot of uplift resistance.

NOTE TO SPECIFIER

Edit "Class" in the following paragraph for project's fire resistance and wind uplift resistance requirements. Verify availability of roofing systems that meet these classifications. "Class 1A" signifies meeting ASTM E 108, Class A fire performance for FMG-approved Class 1 roof covers. For areas having three or more hailstorms annually, FMG recommends roofing systems rated SH (severe hail) instead of MH (moderate hail).

1. Fire/Windstorm Classification: Class 1A- [90] [105] [120] [____].
2. Hail Resistance: [MH] [SH].

- D. Pre-installation Meeting:
 1. Convene a Pre-installation Meeting at Project Site one week prior to commencing work of this Section.
 2. Require attendance of parties directly affecting work of this Section.
 3. Review preparation and installation procedures and coordinating and scheduling required with related work.

NOTE TO SPECIFIER

WARRANTY OPTION 1, Part-Time Third-Party Inspections: Include the paragraph below if Contracting Officer mandates WARRANTY OPTION 1, Part-Time Third-Party inspections.

- a. Require the Third-Party Roofing Inspector to conduct Pre-installation Meeting along with Contractor Quality Control Representative and Contracting Officer.

NOTE TO SPECIFIER

WARRANTY OPTION 2, Full-time Third-Party Inspections: Include the paragraph below if Contracting Officer mandates WARRANTY OPTION 2, Full-time Third-Party inspections.

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- *****
- b. Require the Full-time Third-Party Roofing Inspector to conduct Pre-installation Meeting along with Contractor Quality Control Representative and Contracting Officer.
- *****

NOTE TO SPECIFIER

Include the paragraph below if Contracting Officer mandates a Manufacturer's warranty.

- c. Require Manufacturer's Roofing Quality Control Inspector to conduct Pre-installation Meeting along with Contractor Quality Control Representative and Contracting Officer.
- *****

NOTE TO SPECIFIER

End of WARRANTY OPTION

4. Agenda:
- a. Tour, inspect and discuss condition of substrate, roof drains, roof drain final locations, curbs, penetrations and other preparatory work performed by other trades.
 - b. Review structural loading limitations of deck and inspect deck for loss of flatness and for required mechanical fastening.
 - c. Review roofing system requirements (Drawings, Specifications and other Contract Documents).
 - d. Review required submittals, both completed and yet to be completed.
 - e. Review and finalize construction schedule related to roofing work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
 - f. Review requirements for inspections, testing, certifying, and material usage accounting procedures.
 - g. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions, including possibility of temporary roofing.
 - h. Review safety precautions relating to roofing installation.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Deliver materials in manufacturer's original unopened containers or wrappings, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Protect foam insulation from direct sunlight exposure.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.7 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements:
 1. Do not apply roofing membrane during inclement weather. When air temperature is expected to fall below 40 degrees F, follow submitted roof system manufacturer's specified Cold Weather Application Procedures.
 2. Do not apply roofing membrane to wet, damp or frozen deck surface or when precipitation is occurring.



3. Do not expose materials vulnerable to water or the sun in quantities greater than can be weatherproofed during same day.

NOTE TO SPECIFIER

Manufacturer's warranty: Include the paragraphs below if Contracting Officer mandates a Manufacturer's warranty.

1.8 WARRANTY

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Special Warranty:
1. Submit written warranty, without monetary limitation, signed by roofing system manufacturer agreeing to promptly repair leaks in roof membrane and base flashings resulting from defects in materials and workmanship.
 2. Warranty shall not exclude "ponding" water.
 3. Warranty Period: [20] [____] years.
 4. Include materials and workmanship for all manufacturer's supplied roofing components including but not limited to:
 - a. Membranes.
 - b. Flashings, including edge metal, metal flashings and accessories supplied by roofing membrane manufacturer.
 - c. Insulation.
 - d. Fasteners.
 - e. Adhesives.
 - f. Vapor Retarder
 5. Include the following items within Warranty:
 - a. Roofing inspection by Manufacturer's Roofing Quality Control Inspector between 22 and 24 months after date of Final Acceptance.
 - b. Roofing manufacturer will provide unlimited repairs on warranted items during warranty period with no cost limitation.
 - c. Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions. USPS must immediately notify roofing membrane manufacturer of such repairs.
 - d. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Project Membrane Roofing Specification Section to Warranty.
 6. Wind Coverage
 - a. Warranty shall cover wind gusts up to [____] miles per hour.

End of WARRANTY OPTION

NOTE TO SPECIFIER

Verify manufacturer information and availability at time of Project Manual preparation for Project.

PART 2 - PRODUCTS

2.1 CSPE ROOFING MEMBRANE

- A. CSPE Roofing Membrane: ASTM D5019, Type 1, Grade 2, 45-mil- (1.1-mm-) thick, reinforced, flexible uncured sheet from chlorosulfonated polyethylene.

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- B. Solar reflectance must meet ENERGY STAR requirements for low-slope roofs and membrane must be listed on the DOE ENERGY STAR Roof Products Qualified Product List.

NOTE TO SPECIFIER

Verify manufacturer information and availability at time of Project Manual preparation for Project.

2.2 ROOFING SYSTEM MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated into the Work include the following:
1. Burkeline Roofing Systems, San Jose, CA (800) 669-7010.
 2. Conklin Company Inc., Shakopee, MN (800) 394-6076.
 3. Tremco Inc., Beachwood, OH (800) 852-6013.
- B. Manufacturer of roofing membrane must be a Partner in the EPA ENERGY STAR® Roof Products Program for energy efficiency and membrane supplied must be listed on the DOE's ENERGY STAR Roof Products Qualified Product List.

NOTE TO SPECIFIER

Verify manufacturer information and availability at time of Project Manual preparation for Project.

2.3 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
- B. Sheet Flashing: 45-mil-(1.1-mm-) thick, reinforced and 55-mil- (1.4-mm-) thick, reinforced CSPE as recommended by roofing system manufacturer for intended use.
- C. Bonding Adhesive: Manufacturer's clear or light-colored adhesive for bonding roofing membrane and sheet flashings to substrates and projections.
- D. Miscellaneous Accessories: Provide pourable sealers, performed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.4 ROOF INSULATION

NOTE TO SPECIFIER

INSULATION TYPE OPTION 1, Polyisocyanurate foam insulation assemblies: Include the paragraphs below if the Specifier chooses Polyisocyanurate insulation.

Polyisocyanurate Foam Insulation



- A. Flat Roof Board Insulation: Polyisocyanurate Foam Insulation which meets or exceeds FS HH-I-1972/2, both faces covered with glass fiber felt; comply with FMG Standard 4450 Approval. (ASTM C1289, Type II – Class 1 – Grade 2)
 - 1. Thermal Resistance: in service R-5.6 per inch of thickness in cooling conditions
 - 2. Thermal Resistance: in service R-5.0 per inch of thickness in heating conditions
 - 3. Compressive Strength: 20 PSI Minimum
 - 4. Maximum Board Thickness is 2"
 - 5. Minimum Board Thickness is 1.5" on the base layer
- B. Tapered Polyisocyanurate Foam Insulation: Provide crickets, saddles, and tapered insulation of same material as second layer of insulation; taper to the following slopes:
 - 1. Crickets and Saddles: 1/4 inch per foot or twice the slope of the roof, whichever is greater.
 - 2. Insulation Installed to Counterslope Roof Structure: 1/2 inch to the foot, or twice slope of roof, whichever is greater.
- C. Roof Curb Insulation: Polyisocyanurate foam; thickness to match wood nailer.
- D. Tapered Insulation: Provide crickets, saddles, and tapered insulation of same material as second layer of insulation; taper to the following slopes:
 - 1. Crickets and Saddles: 1/4 inch per foot or twice the slope of the roof, whichever is greater.
 - 2. Insulation Installed to Counterslope Roof Structure: 1/2 inch to the foot, or twice slope of roof, whichever is greater.
- E. Cover Board: 1/2" Factory Primed Glass Mat Gypsum Roof Board: ASTM C-1177. Zero flame spread and zero smoke developed per ASTM E84. Minimum 500 pounds per square inch compressive strength.

NOTE TO SPECIFIER

INSULATION TYPE OPTION 2, Extruded Polystyrene insulation assemblies: Include the paragraphs below if the Specifier chooses Extruded Polystyrene insulation.

EXTRUDED Polystyrene (XPS)

- A. Flat Roof Board Insulation: Extruded polystyrene board to ASTM C578, Type IV, rigid, closed cell type, with integral high density skin.
 - 1. Thermal Resistance (ASTM C518): typical 5 year aged value of R-5 per 1 inch of thickness.
 - 2. Compressive Strength (ASTM D1621): Minimum 25 psi.
 - 3. Water Absorption (ASTM D2842): 0.7% by volume maximum.
 - 4. Flame Spread/Smoke Developed Values (ASTM E84): 5/165.
- B. Tapered Roof Board Insulation: Extruded polystyrene board to ASTM C578, Type IV, rigid, closed cell type, with integral high density skin.
 - 1. Thermal Resistance (ASTM C518): typical 5 year aged value of R-5 per 1 inch of thickness.
 - 2. Compressive Strength: Minimum 25 psi.
 - 3. Water Absorption (ASTM D2842): 0.7% by volume maximum.
 - 4. Flame Spread/Smoke Developed Values (ASTM E84): 5/165.
- C. Cover Board: 1/4" Factory Primed Glass Mat Gypsum Roof Board: ASTM C-1177. Zero flame spread and zero smoke developed per ASTM E84. Minimum 500 pounds per square inch compressive strength.

NOTE TO SPECIFIER



90 pounds per square foot wind uplift minimum. Design roofing and insulation system to comply with regional requirements and special regulations of local authority having jurisdiction. Verify with USPS Contracting Officer. Contact Roofing System Manufacturer for information about 120 or 150 pounds per square foot of uplift resistance.

2.5 ROOF INSULATION ASSEMBLIES

NOTE TO SPECIFIER

Use roof insulation systems as required by specific building location and Energy Calculations for specific building type and project requirements. Provide the minimum number of layers of rigid insulation recommended by the Manufacturer, not to be less than two layers. Modify the following options to comply with requirements.

- A. Two layers of polyisocyanurate shall be used with staggered joints. Both layers may be loose laid and fastened with the same insulation fastener and plate.
- B. Total thickness of insulation shall be calculated as indicated on drawings.

2.6 ACCESSORIES

NOTE TO SPECIFIER

INSULATION ATTACHMENT OPTION 1, Mechanically attached insulation assemblies: Include the paragraphs below if the Specifier chooses mechanically attached insulation.

- A. Roofing Insulation Fasteners: Fasteners shall be as tested and approved by FMG as part of the roofing system assembly.
 - 1. Mechanical Fasteners for Insulation: Coated fasteners with plates appropriate for purpose intended and approved by Factory Mutual and supplied by roofing membrane manufacturer. Thickness of insulation and roofing membrane manufacturer's deck penetration requirements shall determine the length of the fastener.
- *****

NOTE TO SPECIFIER

INSULATION ATTACHMENT OPTION 2, Adhered insulation assemblies: Include the paragraphs below if the Specifier chooses adhered insulation.

- A. Roofing Insulation Adhesive: Insulation Adhesive shall be as tested and approved by FMG as part of the roofing system assembly.
 - 1. Insulation Adhesive: [The specifier shall research the requirements with respect to Volatile Organic Compounds and temperature limitations of project to complete this specification section. The completed section will dictate Standard VOC content insulation adhesive, Low VOC content insulation adhesive, OR No VOC content insulation adhesive.]
 - 2. Specified adhesive shall be for purpose intended and approved by Factory Mutual and supplied by roofing membrane manufacturer.
- *****

NOTE TO SPECIFIER

End of INSULATION ATTACHMENT OPTIONS



- B. Walkway Pads: Walkway materials shall be provided by the roofing membrane manufacturer
- C. Isolation Pads: Provide a piece of walkway pad as above
- D. Termination: Use roofing membrane manufacturer's recommended termination details and associated products to comply with Warranty requirements
- E. Pipe Flashings: Prefabricated pipe flashings shall be supplied by the roofing membrane manufacturer
- F. Vapor / Air Retarder [Use and location to be determined by Specifier – Product to be recommended and supplied by roof system manufacturer]

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.

NOTE TO SPECIFIER

Edit paragraph below based on Contracting Officer's selection of roofing inspections and/or manufacturer's warranty.

- B. Verification of Conditions: Verify, with [Third-Party Roofing Inspector] [Full-time Third-Party Roofing Inspector] [Manufacturer's Quality Control Inspector] present, that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains, valleys, and eaves. Verify flutes of steel deck are evenly spaced at intersections.
 - 2. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, and nailing strips, and reglets are in place. Verify deck is supported and tightly secured.
 - 3. Verify deck surfaces are dry and free of water, snow, and ice.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Provide covers and other means of protection as necessary to protect building surfaces against damage during roofing work.
- B. Where work shall continue over finished roof membrane, protect surfaces according to roofing membrane manufacturer's recommendations.

3.3 ROOF INSULATION INSTALLATION

NOTE TO SPECIFIER

CSF CHLOROSULFONATE- POLYETHYLENE (CSPE)



INSULATION ATTACHMENT OPTION 1, Mechanically attached insulation assemblies: Include the paragraphs below if the Specifier chooses mechanically attached insulation.

- A. Lay insulation boards to moderate contact without forcing joints. Cut insulation to fit neatly to perimeter blocking and around protrusions through roof.
 - 1. Gaps between insulation boards, nailers and penetrations of 1/4 inch (0.64 cm) or greater are not acceptable.
- B. Place roof crickets and tapered thickness insulation to the required slope pattern in accordance with manufacturer's published instructions.
- C. Mechanically Attached Installation:
 - 1. Maximum insulation board dimension is 4' x 8'
 - 2. Place long edge of boards parallel to deck flutes, forming joint over solid bearing. Lay first layer insulation units with long edge joints continuous and end joints staggered.
 - 3. Lay second and subsequent layers of insulation with both long side and end joints offset 6 inches (15 cm) from joints below.
 - 4. Factory primed glass mat gypsum board and overlaid insulation may be loose laid and fastened with the same insulation fastener and plate in accordance with manufacturer's approved assembly. Fastener and plate must be approved by the roof system manufacturer and installed at the required density to achieve the specified FMG [1A]-[90][105][120] system, in accordance with requirements of FMG Loss Prevention Data Sheet 1-29 for specified wind uplift requirements.
- D. Apply no more insulation than can be waterproofed with roofing membrane in same day.
- E. Mechanically attach a single layer of insulation to manufactured metal curbs.

NOTE TO SPECIFIER

INSULATION ATTACHMENT OPTION 2, Adhered insulation assemblies: Include the paragraphs below if the Specifier chooses adhered insulation.

- F. Lay insulation boards to moderate contact without forcing joints. Cut insulation to fit neatly to perimeter blocking and around protrusions through roof.
 - 1. Gaps between insulation boards, nailers and penetrations of 1/4 inch (0.64 cm) or greater are not acceptable.
- G. Place roof crickets and tapered thickness insulation to the required slope pattern in accordance with manufacturer's published instructions.
- H. Adhered Installation:
 - 1. 4-foot x 4-foot maximum board size for insulation boards adhered to a substrate including successive layers.
 - 2. Lay second and subsequent layers of insulation so that the insulation board's joints are staggered vertically and offset from the underlying layers.
 - 3. Factory primed glass mat gypsum board and overlaid insulation shall be adhered in accordance with the manufacturer's recommendations and submitted FM assembly number to achieve the specified FMG [1A]-[90][105][120] system, in accordance with requirements of FMG Loss Prevention Data Sheet 1-29 for specified wind uplift requirements.



- I. Apply no more insulation than can be waterproofed with roofing membrane in same day.
- E. Mechanically attach a single layer of insulation to manufactured metal curbs.

3.4 ROOFING MEMBRANE APPLICATION

- A. Apply roofing membrane in accordance with membrane manufacturer's published instructions for specified system.
- B. All quality control recommendations of the roofing system manufacturer shall be strictly followed.

3.5 WATER CUTOFFS AND WEATHER PROTECTION

- A. Install water cut-offs according to roofing membrane manufacturer's recommendations at end of day's operation to seal insulation and edge of roof membrane from moisture entry. If rain or foul weather appears imminent during roofing application, cease operations and protect deck, insulation, flashings, penetrations and membrane from moisture intrusion and damage with water cutoffs. Insulation and roofing materials not so protected before rain are considered damaged materials and will be rejected.
- B. Water cut-offs over steel deck must include steel deck flute plugs to prevent moisture from getting under insulation.
- C. Remove water cut-offs and other temporary weather protections prior to continuing roofing work. Remove materials that have been subject to moisture damage and return deck to clean, dry condition before proceeding with roofing operations. Remove damaged materials from job site.
- D. Water cut-offs and weather protection shall not be considered part of final roof system specified.

3.6 FLASHING MEMBRANE AND ACCESSORIES

- A. Field membrane shall be terminated with fasteners and plates. Flashing membrane, mechanically attached or adhered, shall be extended past the termination of the field membrane and hot air welded on the horizontal plane.
- B. Roof Penetrations:
 - 1. Prefabricated pipe flashings shall be installed where the configuration of penetration will permit, including but not limited to electrical conduit, and plumbing vents.
 - 2. Field fabrication of flashing shall be used only where the configuration of the penetration prohibits the use of prefabricated flashing.
- C. Fasten membrane and flashing terminations per roofing membrane manufacturer's recommendations.
- D. Walkway Pads: Weld walkways to roofing membrane per manufacturer's recommendation.

3.7 ROOF SURFACING

- A. No field-applied surfacing shall be utilized with this roofing system.

3.8 CONSTRUCTION

CSF CHLOROSULFONATE- POLYETHYLENE (CSPE)



A. Interface with Other Work:

1. Coordinate Work with installation of associated metal counterflashings specified under other Sections as Work of this Section proceeds.
2. Complete installation of base flashing at roof curbs prior to setting roof top equipment.
3. Coordinate Work with Plumbing for roof drain(s) installation.

3.9 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field inspection.

NOTE TO SPECIFIER

WARRANTY OPTION 1, Part-Time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 1, Part-Time Third-Party inspections.

B. Field Services: Third-Party Roofing Inspector.

1. Attend and conduct Pre-installation Meeting.
2. Perform preparatory, initial, follow-up and final inspections for roof insulation and roofing system.
3. Prepare and submit inspection reports for each inspection made.

NOTE TO SPECIFIER

WARRANTY OPTION 2, Full-time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 2, Full-time Third-Party inspections.

C. Field Services: Full-time Third-Party Roofing Inspector.

1. Attend and conduct Pre-installation Meeting.
2. Perform full-time inspections for roof insulation and roofing system.
3. Prepare and submit inspection reports for each inspection made.

NOTE TO SPECIFIER

OPTION 3, Manufacturer's warranty: Include the paragraphs below if Contracting Officer mandates OPTION 3, Manufacturer's warranty or if the Contracting Officer mandates Option 1 of Option 2 and also chooses the optional manufacturer's warranty.

D. Manufacturer's Field Services: Manufacturer's Roofing Quality Control Inspector.

1. Attend and conduct Pre-installation Meeting.
2. Perform preparatory, initial, follow-up and final inspections for roof insulation and roofing system.
3. Prepare and submit inspection reports for each inspection made.

NOTE TO SPECIFIER

End Manufacturer's warranty

E. Maintenance Instruction

1. Provide on-site instruction to review the components of the system and detail any common troubleshooting or maintenance that is required to ensure normal performance of the roofing system.
2. Provide one complete set of installation details and manuals that will remain at the installed location.



3.10 CLEANING

- A. Section 017300 - Execution: Requirements for cleaning.
- B. Remove dirt, debris, and markings from finished surfaces. In areas where finished surfaces are soiled, consult roofing membrane manufacturer for cleaning advice and comply with their instruction.
- C. Replace defaced or disfigured finishes caused by Work of this Section.

3.11 PROTECTION

- A. Where construction traffic must continue over finished roof installation, protect surfaces in manner recommended by roofing system manufacturer to protect Manufacturer's Warranty.

USPS CSF Specifications issued: 10/1/2013

Last revised: 4/19/2011

END OF SECTION 07 53 16 00



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SECTION 07 53 23 00 - CSF ETHYLENE-PROPYLENE-DIENE-MONOMER ROOFING

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

This roofing section includes three (3) options regarding inspections and /or warranty; two (2) options regarding insulation type; and two (2) options regarding insulation system attachment.

The Contracting Officer (CO) must provide direction to the Specifier on which one of the warranty options will be selected for this project. After receiving direction from the CO, the Specifier must edit the warranty sections to ensure that this option is consistently applied throughout.

The warranty options are:

WARRANTY OPTION 1, Part-Time Third-Party Inspections: these are to be provided at construction milestones as listed below. A manufacturer's warranty is optional. The Contracting Officer may choose to mandate Part-Time Third Party Inspections AND mandate manufacturer's warranty.

WARRANTY OPTION 2, Full-time Third-Party inspections: an inspector is to be continuously present during the entire period of roofing installation. A manufacturer's warranty is optional. The Contracting Officer may choose to mandate Full-Time Third Party Inspections AND mandate manufacturer's warranty.

WARRANTY OPTION 3, Manufacturer's Warranty: this option requires a warranty from the manufacturer. Inspections are to be provided by the manufacturer at the milestones listed below or as necessary to meet manufacturer's requirements.

There are two (2) options regarding primary roof insulation type. The Specifier must provide direction on which one of the options will be selected for this project. The Specifier must edit the section to ensure that this option is consistently applied throughout the section. Note that facilities with a metal roof deck are most conducive to Polyisocyanurate insulation due to the fact that a thermal barrier is not required under the insulation in order to maintain the systems fire rating (Use of XPS over a metal deck would require a thermal barrier under the insulation assembly if selected). Concrete roof decks can utilize Extruded Polystyrene Insulation attached directly to the prepared roof deck without the need for a thermal barrier. The Specifier shall determine the insulation type based on existing construction; building code review; and cost analysis. The insulation type options are:

INSULATION Type OPTION 1, Polyisocyanurate.

INSULATION Type OPTION 2, Extruded Polystyrene.

There are two (2) options regarding insulation attachment. The Specifier must provide direction on which one of the options will be selected for this project. The Specifier must edit the section to ensure that this option is consistently applied throughout the section. Note that facilities with a metal roof deck are most conducive to mechanical attachment of the insulation assembly. Facilities with concrete roof decks are most conducive to adhered attachment of the insulation assembly. The Specifier shall determine the insulation type based on existing construction; building code review; and cost analysis. The insulation attachment options are:

INSULATION Attachment OPTION 1, Mechanically attached.

INSULATION Attachment OPTION 2, Adhered.



PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparation of roof deck to receive roofing membrane.
2. Vapor/Air retarder. [Specifier to make determination of use and location within the system based on facility conditions and general environment]
3. [Mechanically fastened] [Adhesively Applied] Roof insulation and Glass mat gypsum board.
4. Fully adhered EPDM Elastomeric membrane roofing system.
5. Flashing membrane.
6. Accessories.
7. Edge metal.
8. [Warranty]

B. Related Documents:

1. The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section.
2. Memorandum of Understanding (MOU) between the United States Environmental Protection Agency's ENERGY STAR® Roof Products Program and Roofing Material Manufacturers.
3. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

C. Related Sections:

1. Section 061000 - Rough Carpentry: Wood blocking, curbs, and nailers.
2. Section 076200 - Sheet Metal Flashing and Trim: Counter flashings, edge metal and other sheet metal.
3. Section 077213 - Manufactured Curbs: Curbs for roof penetrations.
4. Section 077233 - Roof Hatches: Hatch with integral curb.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM C208 - Specification for Cellulosic Fiber Insulating Board.
2. ASTM C1177 - Standard Specification for Glass Mat Gypsum Roof Board.
3. ASTM C1289 - Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
4. ASTM D570 - Test Method for Water Absorption of Plastics.
5. ASTM D638 - Test Method for Tensile Properties of Plastics.
6. ASTM D751 - Test Method for Coated Fabrics.
7. ASTM D1004 - Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
8. ASTM D1079 - Terminology Relating to Roofing and Waterproofing.
9. ASTM D1204 - Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature.
10. ASTM D2136 - Test Method for Coated Fabrics – Low Temperature Bend Test.
11. ASTM D3045 - Practice for Heat Aging of Plastics Without Load.
12. ASTM D4637 - Standard Specification for EPDM Seet used in Single-Ply Roof Membrane.
13. ASTM D5602 - Test Method for Static Puncture Resistance of Roofing Membrane Samples.
14. ASTM D5635 - Test Method for Dynamic Puncture Resistance of Roofing Membrane Samples.
15. ASTM D 6878 - Standard Specification for Thermoplastic Polyolefin based Sheet Roofing.
16. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
17. ASTM E96 - Test Methods for Water Vapor Transmission of Materials.
18. ASTM E108 - Test Methods for Fire Tests of Roof Coverings.
19. ASTM E903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmission of Materials Using Integrating Spheres.



20. ASTM G21 - Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
21. ASTM G26 - Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials.
22. ASTM G53 - Practice for Operating Light- and Water – Exposure Apparatus (Fluorescent UV/Condensation Type) for Exposure of Nonmetallic Materials.

B. Factory Mutual Global (FMG):

1. FMG – RoofNav – Internet Based FM Roof Assembly Testing and Approvals Database
2. FMG - Approval Guide, Building Materials.
3. FMG - Loss Prevention Data 1-28, Wind Loads to Roof Systems and Roof Deck Securement.
4. FMG - Loss Prevention Data 1-29, Above Deck Roof Components (June 1996).
5. FMG - Standard 4450, Class 1 Insulated Steel Deck Roofs.
6. FMG - Standard 4470, Class 1 Roof Covers.

C. Underwriters Laboratory (UL):

1. Class A rated roofing system

1.3 SYSTEM DESCRIPTION

- A. ENERGY STAR® Compliant Fully Adhered EPDM Elastomeric Membrane Roofing System on Factory Primed Glass Mat Gypsum Roof Board on overlayered insulation secured to [metal or concrete] deck.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals

1. Product Data:
 - a. FM RoofNav Assembly Number certifying proposed roof system has been tested and approved by FMG for the specified FM[1-90] [1-105] [1-120] rating.
 - b. Membrane materials, base flashing, vapor retarder, [fastener & plate,] adhesive materials, edge metal and insulation.
 - c. [Insulation fastener layouts complying with FMG Loss Prevention Data Sheet 1-29 patterns for specified wind uplift resistance. Indicate number of insulation fasteners required and spacing of fasteners for field, perimeter, and corners for each pattern.] [Adhesively applied insulation coverage rates and layout must comply with the proposed FM RoofNav assembly number and adhesive application rates relative to that assembly. Indicate insulation adhesive application rates required and the coverage/ribbon spacing of adhesive for field, perimeter, and corners for each pattern. Insulation adhesion rates and coverage/ribbon spacing submissions must also be inclusive of the roof system manufacturer's instructions, including cold weather installation instructions and are required for approval prior to job start.]
 - d. Adhered membrane adhesive and application rates for adhering membrane roof to the overlayered insulation system with coverboard. Membrane adhesive shall be installed in compliance with roof membrane system manufacturer's FM RoofNav assembly approval number and all of the manufacturer's instructions including cold weather installation instructions of the proposed shall be required for approval prior to job start.
2. Shop Drawings: Indicate setting plan for insulation including fastener pattern, layout of roofing seams, direction of laps and base flashing details.
3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer is to certify that components and products meet or exceed specified standards and complies with referenced quality assurance standards in section 1.5 including the FM RoofNav assembly number.
 - b. Qualification Documentation: Manufacturer certification indicating roofing applicator qualifications complying with requirements specified in Paragraph entitled "Applicator Qualifications" of this Section.

**NOTE TO SPECIFIER**

WARRANTY OPTION 1, Part-Time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 1, Part-Time Third-Party inspections.

- c. Field Quality Control Reports: Submit the following reports directly to Contracting Officer from the Third-Party Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
 - 1) Preparatory inspection.
 - 2) Initial inspection.
 - 3) Follow-up inspections.
 - 4) Final inspection.
 - 5) Maintenance Instruction: Document training by furnishing a sign-in sheet with a description of the training provided, instructors name and organization, and those who received training. Refer to 017704 1.3, 1.4, and 1.5 for more specific training requirements.

NOTE TO SPECIFIER

WARRANTY OPTION 2, Full-time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 2, Full-time Third-Party inspections.

- d. Field Quality Control Reports: Submit daily reports directly to Contracting Officer from the Full-time Third-Party Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements.
- e. Maintenance Instruction: Document training by furnishing a sign-in sheet with a description of the training provided, instructors name and organization, and those who received training. Refer to 017704 1.3, 1.4, and 1.5 for more specific training requirements.

NOTE TO SPECIFIER

Include the paragraphs below if Contracting Officer mandates a Manufacturer's warranty. Delete the paragraphs below if the Contracting Officer chooses to have Part-Time or Full Time Third Party inspections and No Warranty.

- f. Sample of specified Warranty
- g. Manufacturer's certification letter acknowledging receipt of specifications, intent to issue warranty, and intent to perform field audits as outlined in 1.4.3.d.
- h. Manufacturer's Field Reports: Submit the following reports directly to Contracting Officer from Manufacturer's Roofing Quality Control Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
 - 1) Preparatory inspection.
 - 2) Initial inspection.
 - 3) Follow-up inspections.
 - 4) Final inspection.

NOTE TO SPECIFIER

End of WARRANTY OPTION

- i. Written certification or product data sheet attesting that proposed roofing membrane meets the EPA ENERGY STAR® Roof Products Program specification for energy efficiency and that the manufacturer is listed as a Partner.
4. Maintenance Instruction: Document training by furnishing a sign-in sheet with a description of the training provided, instructors name and organization and those who received training. Refer to 017704 1.3, 1.4 and 1.5 for more specific training requirements.

1.5 QUALITY ASSURANCE



- A. Applicator Qualifications: Company specializing in EPDM membrane roof application with minimum of 5 years documented experience and is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by membrane manufacturer for specified roofing system and shall be in compliance with all applicable regulatory requirements.
- C. FMG Listing: Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system and that are listed in the most recent FMG "RoofNav" on-line directory or FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

NOTE TO SPECIFIER

90 pounds per square foot wind uplift minimum. Design roofing and insulation system to comply with regional requirements and special regulations of local authority having jurisdiction. Verify with USPS Contracting Officer. Contact Roofing System Manufacturer for information about 105 or 120 or greater pounds per square foot of uplift resistance.

NOTE TO SPECIFIER

Edit "Class" in the following paragraph for project's fire resistance and wind uplift resistance requirements. Verify availability of roofing systems that meet these classifications. "Class 1A" signifies meeting ASTM E 108, Class A fire performance for FMG-approved Class 1 roof covers. For areas having three or more hailstorms annually, FMG recommends roofing systems rated SH (severe hail) instead of MH (moderate hail).

1. Fire/Windstorm Classification: Class 1A- [90] [105] [120] <Insert number>.
2. Hail Resistance: [MH] [SH].

D. Pre-installation Meeting:

1. Convene a Pre-installation Meeting at Project Site one week prior to commencing work of this Section.
2. Require attendance of parties directly affecting work of this Section.
3. Review preparation and installation procedures and coordinating and scheduling required with related work.

NOTE TO SPECIFIER

WARRANTY OPTION 1, Part-Time Third-Party Inspections: Include the paragraph below if Contracting Officer mandates WARRANTY OPTION 1, Part-Time Third-Party inspections.

- a. Require the Third-Party Roofing Inspector to conduct Pre-installation Meeting along with Contractor Quality Control Representative and Contracting Officer.

NOTE TO SPECIFIER

WARRANTY OPTION 2, Full-time Third-Party Inspections: Include the paragraph below if Contracting Officer mandates WARRANTY OPTION 2, Full-time Third-Party inspections.

- b. Require the Full-time Third-Party Roofing Inspector to conduct Pre-installation Meeting along with Contractor Quality Control Representative and Contracting Officer.

NOTE TO SPECIFIER

Include the paragraph below if Contracting Officer mandates a Manufacturer's warranty.

- c. Require Manufacturer's Roofing Quality Control Inspector to conduct Pre-installation Meeting along with Contractor Quality Control Representative and Contracting Officer.

**NOTE TO SPECIFIER***End of WARRANTY OPTION*

4. Agenda:
 - a. Tour, inspect and discuss condition of substrate, roof drains, roof drain final locations, curbs, penetrations and other preparatory work performed by other trades.
 - b. Review structural loading limitations of deck and inspect deck for loss of flatness and for required mechanical fastening.
 - c. Review roofing system requirements (Drawings, Specifications and other Contract Documents).
 - d. Review required submittals, both completed and yet to be completed.
 - e. Review and finalize construction schedule related to roofing work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
 - f. Review requirements for inspections, testing, certifying, and material usage accounting procedures.
 - g. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions, including possibility of temporary roofing.
 - h. Review safety precautions relating to roofing installation.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Deliver materials in manufacturer's original unopened containers or wrappings, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Protect foam insulation from direct sunlight exposure.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.7 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements:
 1. Do not apply roofing membrane during inclement weather. When air temperature is expected to fall below 40 degrees F, follow submitted roof system manufacturer's specified Cold Weather Application Procedures.
 2. Do not apply roofing membrane to wet, damp or frozen deck surface or when precipitation is occurring.
 3. Do not expose materials vulnerable to water or the sun in quantities greater than can be weatherproofed during same day.

NOTE TO SPECIFIER*Manufacturer's warranty: Include the paragraphs below if Contracting Officer mandates a Manufacturer's warranty.*

1.8 WARRANTY

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.



B. Special Warranty:

1. Submit written warranty, without monetary limitation, signed by roofing system manufacturer agreeing to promptly repair leaks in roof membrane and base flashings resulting from defects in materials and workmanship.
2. Warranty shall not exclude "ponding" water.
3. Warranty Period: [20] [____] years.
4. Include materials and workmanship for the following items within Warranty:
 - a. Membranes.
 - b. Flashings, including edge metal, metal flashings and accessories supplied by roofing membrane manufacturer.
 - c. Insulation.
 - d. Fasteners.
 - e. Adhesives.
 - f. Vapor / Air Retarder
5. Include the following items within Warranty:
 - a. Roofing inspection by Manufacturer's Roofing Quality Control Inspector between 22 and 24 months after date of Final Acceptance.
 - b. Roofing manufacturer will provide unlimited repairs on warranted items during warranty period with no cost limitation.
 - c. Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions. USPS must immediately notify roofing membrane manufacturer of such repairs.
 - d. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Project Membrane Roofing Specification Section to Warranty.
6. Wind Coverage
 - a. Warranty shall cover wind gusts up to [____] miles per hour.

End of WARRANTY OPTION

NOTE TO SPECIFIER

Verify manufacturer information and availability at time of Project Manual preparation for Project.

PART 2 - PRODUCTS

2.1 EPDM ROOFING MEMBRANE

- A. EPDM Roofing Membrane: ASTM D4637, Type 1, Non-Reinforced minimum thickness of 0.059 inch (59 mil) (1.5 mm).
- B. Product must meet ENERGY STAR requirements for low-slope roofs and must be listed on the DOE ENERGY STAR Roof Products Qualified Product List.
- C. Membrane is to be fungi resistant with no growth and no discoloration after 21 days exposure in accordance with ASTM G21.

2.2 ROOFING SYSTEM MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated into the Work include the following:
 1. Carlisle SynTec Inc., Carlisle, PA (800) 479-6832.
 2. Johns Manville Roofing Systems, Denver, CO (800) 592-6958.
 3. Mule-Hide Products Co., Beloit, WI (800) 786-1492.
 4. Tremco Inc., Beachwood, OH (800) 852-6013.



5. Versico, Carlisle, PA (800)992-7663
- B. Manufacturer of roofing membrane must be a Partner in the EPA ENERGY STAR® Roof Products Program for energy efficiency and membrane supplied must be listed on the DOE's ENERGY STAR Roof Products Qualified Product List.
- C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted with Contracting Officer Approval.

2.3 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
 1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.
- B. Sheet Flashing: 60-mil- (1.5-mm-) thick EPDM, partially cured or cured according to application.
- C. Bonding Adhesive: Manufacturer's standard bonding adhesive.
- D. Seaming Material: [Single-component butyl splicing adhesive and splice cleaner] [Manufacturer's standard synthetic-rubber polymer primer and 3-inch- (75-mm-) wide minimum, butyl splice tape with release film].
- E. Lap Sealant: Manufacturer's standard single-component sealant.
- F. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
- G. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

2.4 ROOF INSULATION

NOTE TO SPECIFIER

INSULATION TYPE OPTION 1, Polyisocyanurate foam insulation assemblies: Include the paragraphs below if the Specifier chooses Polyisocyanurate insulation.

Polyisocyanurate Foam Insulation

- A. Flat Roof Board Insulation: Polyisocyanurate Foam Insulation which meets or exceeds FS HH-I-1972/2, both faces covered with glass fiber felt; comply with FMG Standard 4450 Approval. (ASTM C1289, Type II – Class 1 – Grade 2)
 1. Thermal Resistance: in service R-5.6 per inch of thickness in cooling conditions
 2. Thermal Resistance: in service R-5.0 per inch of thickness in heating conditions
 3. Compressive Strength: 20 PSI Minimum
 4. Maximum Board Thickness is 2"
 5. Minimum Board Thickness is 1.5" on the base layer
- B. Tapered Polyisocyanurate Foam Insulation: Provide crickets, saddles, and tapered insulation of same material as second layer of insulation; taper to the following slopes:
 1. Crickets and Saddles: 1/4 inch per foot or twice the slope of the roof, whichever is greater.



2. Insulation Installed to Counterslope Roof Structure: 1/2 inch to the foot, or twice slope of roof, whichever is greater.
- C. Roof Curb Insulation: Polyisocyanurate foam; thickness to match wood nailer.
- D. Tapered Insulation: Provide crickets, saddles, and tapered insulation of same material as second layer of insulation; taper to the following slopes:
1. Crickets and Saddles: 1/4 inch per foot or twice the slope of the roof, whichever is greater.
 2. Insulation Installed to Counterslope Roof Structure: 1/2 inch to the foot, or twice slope of roof, whichever is greater.
- E. Cover Board: 1/2" Factory Primed Glass Mat Gypsum Roof Board: ASTM C-1177. Zero flame spread and zero smoke developed per ASTM E84. Minimum 500 pounds per square inch compressive strength.

NOTE TO SPECIFIER

INSULATION TYPE OPTION 2, Extruded Polystyrene insulation assemblies: Include the paragraphs below if the Specifier chooses Extruded Polystyrene insulation.

EXTRUDED Polystyrene (XPS)

- A. Flat Roof Board Insulation: Extruded polystyrene board to ASTM C578, Type IV, rigid, closed cell type, with integral high density skin.
1. Thermal Resistance (ASTM C518): typical 5 year aged value of R-5 per 1 inch of thickness.
 2. Compressive Strength (ASTM D1621): Minimum 25 psi.
 3. Water Absorption (ASTM D2842): 0.7% by volume maximum.
 4. Flame Spread/Smoke Developed Values (ASTM E84): 5/165.
- B. Tapered Roof Board Insulation: Extruded polystyrene board to ASTM C578, Type IV, rigid, closed cell type, with integral high density skin.
1. Thermal Resistance (ASTM C518): typical 5 year aged value of R-5 per 1 inch of thickness.
 2. Compressive Strength: Minimum 25 psi.
 3. Water Absorption (ASTM D2842): 0.7% by volume maximum.
 4. Flame Spread/Smoke Developed Values (ASTM E84): 5/165.
- C. Cover Board: 1/4" Factory Primed Glass Mat Gypsum Roof Board: ASTM C-1177. Zero flame spread and zero smoke developed per ASTM E84. Minimum 500 pounds per square inch compressive strength.

2.5 ROOF INSULATION ASSEMBLIES

NOTE TO SPECIFIER

Use roof insulation systems as required by specific building location and Energy Calculations for specific building type and project requirements. Provide the minimum number of layers of rigid insulation recommended by the Manufacturer, not to be less than two layers. Modify the following options to comply with requirements.

- A. Two layers of polyisocyanurate shall be used with staggered joints. Both layers may be loose laid and fastened with the same insulation fastener and plate.
- B. Total thickness of insulation shall be calculated using as indicated on drawings.



2.6 ACCESSORIES

NOTE TO SPECIFIER

INSULATION ATTACHMENT OPTION 1, Mechanically attached insulation assemblies: Include the paragraphs below if the Specifier chooses mechanically attached insulation.

- A. Roofing Insulation Fasteners: Fasteners shall be as tested and approved by FMG as part of the roofing system assembly.
 - 1. Mechanical Fasteners for Insulation: Coated fasteners with plates appropriate for purpose intended and approved by Factory Mutual and supplied by roofing membrane manufacturer. Thickness of insulation and roofing membrane manufacturer's deck penetration requirements shall determine the length of the fastener.

NOTE TO SPECIFIER

INSULATION ATTACHMENT OPTION 2, Adhered insulation assemblies: Include the paragraphs below if the Specifier chooses adhered insulation.

- A. Roofing Insulation Adhesive: Insulation Adhesive shall be as tested and approved by FMG as part of the roofing system assembly.
 - 1. Insulation Adhesive: [The specifier shall research the requirements with respect to Volatile Organic Compounds and temperature limitations of project to complete this specification section. The completed section will dictate Standard VOC content insulation adhesive, Low VOC content insulation adhesive, OR No VOC content insulation adhesive.]
 - 2. Specified adhesive shall be for purpose intended and approved by Factory Mutual and supplied by roofing membrane manufacturer.

NOTE TO SPECIFIER

End of INSULATION ATTACHMENT OPTIONS

- B. Walkway Pads: Walkway materials shall be provided by the roofing membrane manufacturer
- C. Isolation Pads: Provide a piece of walkway pad as above
- D. Termination: Use roofing membrane manufacturer's recommended termination details and associated products to comply with Warranty requirements
- E. Pipe Flashings: Prefabricated pipe flashings shall be supplied by the roofing membrane manufacturer
- F. Vapor / Air Retarder [Use and location to be determined by Specifier – Product to be recommended and supplied by roof system manufacturer]

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.



NOTE TO SPECIFIER

Edit paragraph below based on Contracting Officer's selection of roofing inspections and/or manufacturer's warranty.

- B. Verification of Conditions: Verify, with [Third-Party Roofing Inspector] [Full-time Third-Party Roofing Inspector] [Manufacturer's Quality Control Inspector] present, that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains, valleys, and eaves. Verify flutes of steel deck are evenly spaced at intersections.
 - 2. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, and nailing strips, and reglets are in place. Verify deck is supported and tightly secured.
 - 3. Verify deck surfaces are dry and free of water, snow, and ice.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Provide covers and other means of protection as necessary to protect building surfaces against damage during roofing work.
- B. Where work shall continue over finished roof membrane, protect surfaces according to roofing membrane manufacturer's recommendations.

3.3 ROOF INSULATION INSTALLATION

NOTE TO SPECIFIER

INSULATION ATTACHMENT OPTION 1, Mechanically attached insulation assemblies: Include the paragraphs below if the Specifier chooses mechanically attached insulation.

- A. Lay insulation boards to moderate contact without forcing joints. Cut insulation to fit neatly to perimeter blocking and around protrusions through roof.
 - 1. Gaps between insulation boards, nailers and penetrations of 1/4 inch (0.64 cm) or greater are not acceptable.
- B. Place roof crickets and tapered thickness insulation to the required slope pattern in accordance with manufacturer's published instructions.
- C. Mechanically Attached Installation:
 - 1. Maximum insulation board dimension is 4' x 8'
 - 2. Place long edge of boards parallel to deck flutes, forming joint over solid bearing. Lay first layer insulation units with long edge joints continuous and end joints staggered.
 - 3. Lay second and subsequent layers of insulation with both long side and end joints offset 6 inches (15 cm) from joints below.
 - 4. Factory primed glass mat gypsum board and overlaid insulation may be loose laid and fastened with the same insulation fastener and plate in accordance with manufacturer's approved



assembly. Fastener and plate must be approved by the roof system manufacturer and installed at the required density to achieve the specified FMG [1A]-[90][105][120] system, in accordance with requirements of FMG Loss Prevention Data Sheet 1-29 for specified wind uplift requirements.

- D. Apply no more insulation than can be waterproofed with roofing membrane in same day.
- E. Mechanically attach a single layer of insulation to manufactured metal curbs.

NOTE TO SPECIFIER

INSULATION ATTACHMENT OPTION 2, Adhered insulation assemblies: Include the paragraphs below if the Specifier chooses adhered insulation.

- F. Lay insulation boards to moderate contact without forcing joints. Cut insulation to fit neatly to perimeter blocking and around protrusions through roof.
 - 1. Gaps between insulation boards, nailers and penetrations of 1/4 inch (0.64 cm) or greater are not acceptable.
- G. Place roof crickets and tapered thickness insulation to the required slope pattern in accordance with manufacturer's published instructions.
- H. Adhered Installation:
 - 1. 4-foot x 4-foot maximum board size for insulation boards adhered to a substrate including successive layers.
 - 2. Lay second and subsequent layers of insulation so that the insulation board's joints are staggered vertically and offset from the underlying layers.
 - 3. Factory primed glass mat gypsum board and overlaid insulation shall be adhered in accordance with the manufacturer's recommendations and submitted FM assembly number to achieve the specified FMG [1A]-[90][105][120] system, in accordance with requirements of FMG Loss Prevention Data Sheet 1-29 for specified wind uplift requirements.
- I. Apply no more insulation than can be waterproofed with roofing membrane in same day.
- E. Mechanically attach a single layer of insulation to manufactured metal curbs.

3.4 ROOFING MEMBRANE APPLICATION

- A. Apply roofing membrane in accordance with membrane manufacturer's published instructions for specified system.
- B. All quality control recommendations of the roofing system manufacturer shall be strictly followed.
- C. Cold Weather Application Procedures: When air temperature is expected to fall below 40 degrees F, follow Cold Weather Application Procedures as follows:
 - 1. Store flashing adhesive in heated storage units (minimum temperature 40 degrees F) prior to installation.
 - 2. Follow roofing membrane manufacturer's recommendation for cold weather application of adhered field sheets, corner & perimeter area, and flashings.

3.5 WATER CUTOFFS AND WEATHER PROTECTION



- A. Install water cut-offs according to roofing membrane manufacturer's recommendations at end of day's operation to seal insulation and edge of roof membrane from moisture entry. If rain or foul weather appears imminent during roofing application, cease operations and protect deck, insulation, flashings, penetrations and membrane from moisture intrusion and damage with water cutoffs. Insulation and roofing materials not so protected before rain are considered damaged materials and will be rejected.
- B. Water cut-offs over steel deck must include steel deck flute plugs to prevent moisture from getting under insulation.
- C. Remove water cut-offs and other temporary weather protections prior to continuing roofing work. Remove materials that have been subject to moisture damage and return deck to clean, dry condition before proceeding with roofing operations. Remove damaged materials from job site.
- D. Water cut-offs and weather protection shall not be considered part of final roof system specified.

3.6 FLASHING MEMBRANE AND ACCESSORIES

- A. Field membrane shall be terminated with fasteners and plates. Flashing membrane, mechanically attached or adhered, shall be extended past the termination of the field membrane and hot air welded on the horizontal plane.
- B. Roof Penetrations:
 - 1. Prefabricated pipe flashings shall be installed where the configuration of penetration will permit, including but not limited to electrical conduit, and plumbing vents.
 - 2. Field fabrication of flashing shall be used where the configuration of the penetration prohibits the use of prefabricated flashing.
- C. Fasten membrane and flashing terminations per roofing membrane manufacturer's recommendations.
- D. Walkway Pads: Weld walkways to roofing membrane per manufacturer's recommendation.

3.7 ROOF SURFACING

- A. No field-applied surfacing shall be utilized with this roofing system.

3.8 CONSTRUCTION

- A. Interface with Other Work:
 - 1. Coordinate Work with installation of associated metal counterflashings specified under other Sections as Work of this Section proceeds.
 - 2. Complete installation of base flashing at roof curbs prior to setting roof top equipment.
 - 3. Coordinate Work with Plumbing for roof drain(s) installation.

3.9 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection.

NOTE TO SPECIFIER

WARRANTY OPTION 1, Part-Time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 1, Part-Time Third-Party inspections.



B. Field Services: Third-Party Roofing Inspector.

1. Attend and conduct Pre-installation Meeting.
2. Perform preparatory, initial, follow-up and final inspections for roof insulation and roofing system.
3. Prepare and submit inspection reports for each inspection made.

NOTE TO SPECIFIER

WARRANTY OPTION 2, Full-time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 2, Full-time Third-Party inspections.

C. Field Services: Full-time Third-Party Roofing Inspector.

1. Attend and conduct Pre-installation Meeting.
2. Perform full-time inspections for roof insulation and roofing system.
3. Prepare and submit inspection reports for each inspection made.

NOTE TO SPECIFIER

OPTION 3, Manufacturer's warranty: Include the paragraphs below if Contracting Officer mandates OPTION 3, Manufacturer's warranty or if the Contracting Officer mandates Option 1 of Option 2 and also chooses the optional manufacturer's warranty.

D. Manufacturer's Field Services: Manufacturer's Roofing Quality Control Inspector.

1. Attend and conduct Pre-installation Meeting.
2. Perform preparatory, initial, follow-up and final inspections for roof insulation and roofing system.
3. Prepare and submit inspection reports for each inspection made.

NOTE TO SPECIFIER

End Manufacturer's warranty

4. MAINTENANCE INSTRUCTION

- a. Provide on-site instruction to review the components of the system and detail any common troubleshooting or maintenance that is required to ensure normal performance of the roofing system.
- b. Provide one complete set of installation details and manuals that will remain at the installed location.

3.10 CLEANING

- A. Section 017300 - Execution: Requirements for cleaning.
- B. Remove dirt, debris, and markings from finished surfaces. In areas where finished surfaces are soiled, consult roofing membrane manufacturer for cleaning advice and comply with their instruction.
- C. Replace defaced or disfigured finishes caused by Work of this Section.

3.11 PROTECTION

- A. Where construction traffic must continue over finished roof installation, protect surfaces in manner recommended by roofing system manufacturer to protect Manufacturer's Warranty.



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Last revised: 4/19/2011

END OF SECTION 07 53 23 00



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SECTION 07 53 24 00 - R&A FULLY-ADHERED EPDM ROOFING

NOTE TO SPECIFIER

This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this section where fully-adhered EPDM (Ethylene Propylene Diene Monomer) roofing membrane is selected as the roofing system in a roof replacement application. Per the United States Postal Service Roofing Design Standard, fully-adhered 90-mil EPDM roofing is acceptable for use with restrictions at facilities with a "Critical" or "Non-Critical" building designation. Fully-adhered 60-mil EPDM roofing is acceptable for use at facilities with a "Non-Critical" building designation, but is not acceptable at facilities with a "Critical" building designation. An approved deviation letter is required prior to specifying EPDM as a roof replacement membrane.

NOTE TO SPECIFIER

Section Formatting:

Consistent formatting of Sections gives the complete document a professional look. This Section uses a 10pt. Arial font, and is formatted as follows:

1. Insert one 10pt. line after the Section Number. Section Number is in CAPS.
2. Insert two 10pt. lines after the Section Title. Section Title is in CAPS.
3. Insert one 10pt. line after a PART. PARTS are in CAPS. If a Section is not used, include NOT USED following the PART title as shown below.
4. Insert one 10pt. line after Article paragraphs. Articles are in CAPS.
5. Insert two 10pt. lines at the end of an Article.
6. Complete Section with END OF SETION.
7. No lines should be placed between paragraphs and sub-paragraphs, or between sub-paragraphs and other sub-paragraphs.

Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED



PART 3 – EXECUTION

NOT USED

Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to the installation of fully-adhered Ethylene Propylene Diene Monomer (EPDM) roofing membrane and flashings, related accessories, and warranty and guarantee requirements.

NOTE TO SPECIFIER

Review available field data. For roof areas consisting of an underlying concrete, gypsum concrete, cementitious wood fiber, and/or lightweight insulating concrete structural deck, include Section 072221 – Insulation and Cover Board over Underlayment within 1.2 RELATED SECTIONS below. For roof areas consisting of an underlying steel and/or wood deck, include Section 072223 – Roof Insulation and Cover Board over Steel and Wood Deck within the 1.2 RELATED SECTIONS below. For projects containing structural deck types applicable to both Sections 072221 and 072223, include both Sections. Re-letter paragraphs and sub-paragraphs after editing.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 024100 – Roof Removal and Substrate Preparation
- D. Section 061053 – Miscellaneous Rough Carpentry for Roof Replacement
- E. Section 072221 – Roof Insulation and Cover Board over Underlayment
- F. Section 072223 – Roof Insulation and Cover Board over Steel and Wood Roof Decks
- G. Section 076205 – Sheet Metal for EPDM Roofing
- H. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

NOTE TO SPECIFIER

Per discussions between the designer and USPS Project Manager, determine the warranty requirements for the project. Choose from the following warranty options and actions:

1. *If an alternate price for a 20-year "Total System Warranty" is specified, Leave Article 1.3 unchanged.*
2. *If a 20-year "Total System Warranty" will be included in the base proposal, or if no warranty is*



specified, remove Article 1.3.

Re-letter/number items after editing.

1.3 ALTERNATES

- A. Provide an alternate price for the 20-Year Total System Warranty described in paragraph 1.9A.

1.4 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 - 1. American Society for Testing and Materials (ASTM)
 - a. ASTM D 4637 - Standard Specification for EPDM Sheet Used In Single-Ply Roof Membrane
 - 2. Factory Mutual Global (FM)
 - 3. Underwriters Laboratories (UL)
 - 4. National Roofing Contractors Association (NRCA)
 - 5. American Society of Civil Engineers (ASCE)
 - a. ASCE 7 Minimum Design Loads of Buildings and Other Structures

1.5 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.6 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.



1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
 - 1. NOTE: Do not install EPDM roofing at temperatures below 35°F (2°C).
 - 2. When the outside temperature is forecast to fall below 40°F (5°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives, primers and pressure-sensitive flashings should be maintained at a temperature of 40°F (5°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 - 3. During cold weather applications, limit EPDM roll widths to 10-feet maximum. After unrolling the EPDM membrane, allow the membrane additional time to relax.
 - 4. Be aware of potential condensation formation on the EPDM roof surface during application/flash-off of adhesives and primer. Remove condensation using a heat gun prior to adhesion to the insulation or cover board substrate. Do not use an open flame to remove condensation from the roof membrane or flashing materials.
 - 5. Refer to the EPDM roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

NOTE TO SPECIFIER

Per discussions between the designer and USPS Project Manager, determine the warranty requirements for the project. Choose from the following warranty options and actions:

- 1. *If an alternate price for a 20-year "Total System, Non-Pro-Rated Warranty" is specified, do not edit paragraph 1.9A.*
- 2. *If a 20-year "Total System, Non-Pro-Rated Warranty" will be included in the base proposal, DELETE "an alternate price for" from paragraph 1.9A.*
- 3. *If no warranty is specified, EDIT the title of Article 1.9 (DELETE the words "MANUFACTURER WARRANTY AND"), and DELETE paragraph 1.9A. The two-year contractor guarantee shall remain in place.*

Re-letter/number paragraphs and sub-paragraphs after editing.

1.9 MANUFACTURER WARRANTY AND CONTRACTOR GUARANTEE



- A. Provide an alternate price for a manufacturer 20-Year Total System, Non-Pro-Rated Warranty (including insulation, roofing membrane, and flashings) covering materials and labor. The warranty shall include the following additional items:
1. The warranty shall include a wind rider for the design wind speed at the specific project location.
 2. Roofing inspection by a technical representative of the roofing membrane manufacturer 22-24 months after date of Final Acceptance.
 3. Roofing manufacturer will provide unlimited repairs during warranty period with no cost limitation.
 4. Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions.
 5. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Record Fully-Adhered EPDM Roofing for Roof Replacement Specification Section to Warranty.
- B. The Contractor shall provide a two-year contractor guarantee. At a minimum, the contractor guarantee shall include the following:
1. Contractor name, address, phone number and project contact name.
 2. The project completion date, and date of guarantee expiration.
 3. The contractor guarantee shall include, in writing, all project work, workmanship, and/or all materials installed by the contractor or subcontractors to be of a quality that will comply with all project specific requirements of the Construction Documents and other documents governing the Work and workmanship through the guarantee period.
 4. The contractor shall investigate roof leaks during the guarantee period within a reasonable time period, but in no instance greater than 24-hours after notification of a leak. The contractor shall repair leaks determined to be the cause of the Work at no cost to the Owner.

PART 2 – PRODUCTS

2.1 EPDM ROOFING SYSTEM SUMMARY

- A. The complete roofing membrane system assembly shall consist of products meeting or exceeding the requirements listed in Article 2.2.

NOTE TO SPECIFIER

***NOTE:** In high wind areas, such as those with a calculated wind uplift pressure of greater than 45 psf in the roof field, enhancements to the roof system may be required and must be considered by the design professional/specifier. Consult with the roofing membrane manufacturer and qualified testing agencies such as FM and Miami-Dade County for further information and guidance related to possible roof system enhancements in high wind areas.*

- B. The complete roofing system assembly shall resist uplift pressures calculated according to ASCE 7-05 for the field, perimeters and corners. The specified approval rating must incorporate a safety factor of 2 over the maximum calculated uplift pressure in foot-pound units.
- C. The complete roofing system assembly shall achieve an FM or UL Class A fire rating.

2.2 ROOFING MEMBRANE

NOTE TO SPECIFIER



Per discussions between the designer and USPS Project Manager, determine the EPDM roofing membrane mil thickness required for the project. EDIT paragraph 2.2A below to reflect the specified thickness.

- A. EPDM roofing membrane; fire resistant, cured, non-reinforced, minimum 90-mil thickness, black color; in compliance with ASTM D 4637. Meeting or exceeding the standards established by the following test methods:
- B. EPDM flashing membrane:
 - 1. Cured: fire-resistant, non-reinforced, minimum 60-mil or 90-mil thickness, black color; in compliance with ASTM D 4637. Meeting or exceeding the standards listed in paragraph 2.2A.
 - 2. Uncured: Non-reinforced, minimum 60-mil thickness, black color. Type approved by roofing manufacturer for specific flashing conditions encountered.

2.3 EPDM MEMBRANE SPLICE SYSTEM

- A. Cleaner/primer: Product approved by roofing membrane manufacturer.
- B. In-seam splice tape: Splice tape; minimum 6-inch width, product approved by the roofing membrane manufacturer.
- C. Reinforced perimeter fastening strip: Product approved by the roofing membrane manufacturer.

2.4 PERIMETER EPDM MEMBRANE STRIPPINGS

- A. For use at locations where perimeter edge fascia metal stripping is required:
 - 1. Bottom stripping: EPDM pressure-sensitive flashing product, minimum 5-inch width. Top stripping: EPDM pressure-sensitive flashing product, minimum 9-inch width.

2.5 RELATED EPDM PRODUCTS

- A. Adhesives, cements, sealants, water cut-off mastics, prefabricated accessories, and other related items: Unless otherwise indicated, products manufactured by, or approved by the roofing membrane manufacturer.

2.6 FASTENERS

- A. Roofing membrane and flashing fasteners: Unless otherwise indicated, types as required by the roofing membrane manufacturer.

2.7 MISCELLANEOUS MATERIALS

- A. Walkway pads: Product approved by the roofing manufacturer.
- B. Splashblocks: Concrete; size as necessary to accommodate existing condition.
- C. Pitch pan fill materials:
 - 1. Non-shrink grout (for bottom fill): Quick-set, fast-drying grout; product acceptable to roofing manufacturer.



2. Pourable sealer (for top fill): Two-part pourable elastomeric sealer, product acceptable to roofing manufacturer.
- D. Conduit and pipe supports:
1. For pipes with a diameter up to 6-inches:
 - a. Adjustable prefabricated support such as Pipe Pier 150 manufactured by Pipe Pier Support Systems, Hamel, MN, or approved equal.
 - b. Product approved by the roofing manufacturer for this application.
 - c. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
 2. For pipes with a diameter greater than 6-inches:
 - a. Product approved by the roofing manufacturer for this application.
 - b. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
- E. Pre-fabricated plumbing vent pipe extensions:
1. For use where necessary to achieve the 8-inch minimum flashing height:
 - a. Pre-fabricated plumbing vent extensions, such as Tubos Pre-Fabricated Pipe Extension, by Tubos, Inc., Clearwater, FL.
 - b. Product approved by the roofing manufacturer for this application.
 - c. Size and configuration of extension as necessary to match existing pipe diameter, providing the 8-inch minimum flashing height, and allowing for flashing as show on the drawings.
- F. Replacement roof hatch:
1. Roof hatch, such as "Type E" or "Type S", manufactured by The Bilco Company, New Haven, CT, or approved equal.
 - a. Size and configuration as necessary to match existing roof hatch.
 - b. Product approved by the roofing manufacturer for this application.
- G. Extendable ladder-mounted safety post, such as "LadderUP Safety Post", manufactured by The Bilco Company, New Haven, CT, or approved equal.
1. Size and configuration as necessary to accommodate existing ladder and new roof hatch.
 2. Product approved by the roofing manufacturer for this application.
- H. Acrylic elastomeric coating (for use at roof penetrations and other locations indicated on the project drawings). Product approved for use by the membrane manufacturer for this application, and meeting the following criteria:
1. Meeting the requirements of ASTM D 6083.
 2. White color.
- I. Rooftop unit support curbs: Product such as "Pate Equipment Supports" manufactured by The Pate Company, Lombard, IL, or approved equal.
1. Size and configuration as necessary to accommodate existing rooftop unit.
 2. Fabricated from 18 ga. galvanized steel, minimum, with welded seams; and a nominal 2-inch thick nailer affixed atop the curb support.
 3. Fabricated to allow for a minimum flashing height of 8-inches, minimum.
 4. Product approved by the roofing manufacturer for this application.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.



NOTE TO SPECIFIER

Review available field data. For roof areas consisting of an underlying concrete, gypsum concrete or cementitious wood fiber structural deck, include Section 072221 within paragraph 3.1B below. For roof areas consisting of an underlying steel or wood deck, include Section 072223 within paragraph 3.1B below. For projects containing structural deck types applicable to both Sections 072221 and 072223, include both Sections.

- B. Ensure that the insulation and cover board substrate is installed as specified in Sections 072221 and 072223 are suitable to receive roofing membrane materials.

3.2 ROOFING MEMBRANE INSTALLATION

- A. Except as may be modified by these specifications and drawings, install roofing membrane in accordance with the requirements and recommendations of the roofing membrane manufacturer, using the manufacturer's current printed instructions.
- B. Do not use asphalt, coal tar pitch, or roofing cement in conjunction with EPDM materials. Petroleum-based products, grease, oil and solvents should not be allowed to come in contact with the EPDM roof membrane system.
- C. All membrane splicing and bonding surfaces must be clean and dry.
- D. Install only as much roofing as can be completed in a work day, including flashing and detail work. All installed field seams shall be sealed to a watertight condition prior to leaving the site daily.
- E. Sequence roofing work to eliminate the use of installed roofing as a walkway, or as a storage platform for materials.
- F. Overnight tie-in: Care should be exercised to ensure that water does not flow beneath any completed sections of the roof by temporarily sealing the loose edge of the membrane at the end of each work day and when the weather is threatening. The roofing membrane manufacturer's requirements should be followed closely.
- G. Remove debris from the roof daily prior to leaving the site. Inspect the site at ground level. Remove any roof replacement related debris from the ground.
- H. Do not use any open flame to dry the roof membrane or to heat the flashing materials.

3.3 FLASHINGS AND STRIPPINGS

- A. Complete all flashings on a daily basis as the roof system work progresses.
- B. Lap splice flashing:
 - 1. Install specified in-seam splice tape at field-spliced seams. Install in-seam splice system in accordance with roofing membrane manufacturer requirements.
- C. Wall and curb flashings: Install flashings as indicated on drawings and in accordance with the requirements and recommendations of the roofing membrane manufacturer.
 - 1. Follow manufacturer-generated details for flashing requirements at inside (90-degree) and outside (270-degree) corners of curbs and walls.
- D. Tubular penetration flashings:



1. Finished tubular penetration flashings shall be a minimum of 8-inches above the finished roof membrane elevation.
 2. Install pressure-sensitive flashing at all tubular penetrations.
 - a. Install flashings as indicated on the drawings.
- E. Pitch pan flashings:
1. Install pressure-sensitive strippings at all pitch pan penetrations. Refer to Section 076205 for pitch pan fabrication requirements.
 - a. Install flashings as indicated on the drawings.
- F. Sheet metal flange strippings:
1. Install pressure-sensitive flashing at perimeter edge metal flanges. Refer to Section 076205 for perimeter edge metal fabrication requirements.
 - a. Install strippings as indicated on the drawings.
- G. Follow the additional requirements and recommendations of the roofing membrane manufacturer regarding flashing product installation.

3.4 MISCELLANEOUS INSTALLATIONS/TREATMENTS

- A. Return mechanical ventilator units to their original positions and secure to the existing curbs with EPDM-gasketed screws. Provide a minimum of one fastener on each side of the curb and a minimum of one fastener every 12-inches o.c.
- B. Reconnect all electrical, plumbing, gas line and ventilation connections required to return mechanical units to their original operating condition. Retain a qualified, licensed electrical subcontractor to reconnect electrical equipment. Retain a qualified, licensed mechanical subcontractor to reconnect gas lines and ventilation connections. Coordinate required disconnections and reconnections with the Owner.
- C. Walkway pads: Install walkway pads at locations indicated on drawings. Install the pads in accordance with the requirements and recommendations of the roofing manufacturer. Extend the pads a minimum of 4-inches in all directions beyond wood blocking.
- D. Install splashblocks set on walkpads at locations indicated on the drawings.
- E. Rooftop conduit and pipe supports:
1. Install adjustable prefabricated pipe supports at rooftop conduit and pipes.
 2. Space pipe supports at intervals recommended by the support manufacturer, as determined by the diameter and weight of the conduit or pipe.
 3. Separate the support from the roof surface by installing the support over roof walkway pads, installed as specified.
- F. Pre-fabricated plumbing vent pipe extensions:
1. Refer to manufacturer requirements and recommendations for installation.
 2. Prior to flashing installation, seal intersection of pipe extension and existing plumbing vent.
- G. Replacement roof hatch installation:
1. Remove and discard existing roof hatch.
 2. Provide wood nailers beneath roof hatch flanges, if necessary, to match insulation thickness.
 3. Install new roof hatch following the written instructions, recommendations, and requirements of the roof hatch manufacturer.



- H. Extendable safety post installation:
 - 1. Install new safety post following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- I. Application of elastomeric coating to rooftop penetrations:
 - 1. Prepare substrate in a manner that is acceptable to the coating manufacturer. Substrate preparation includes, but is not limited to: treatment of excessive gaps, repair of damaged or loose sheet metal components, repair of holes, cleaning of roof penetrations, treatment of surface rust, treatment of residual asphalt, and priming (if required by the roof coating manufacturer).
 - 2. Coat the indicated penetrations following the recommendations and requirements of the coating manufacturer.
- J. Installation of equipment support curbs:
 - 1. Install support curbs where indicated on the project drawings. Flash curbs into the roof system as indicated on the project drawings.
 - 2. Refer to manufacturer requirements and recommendations for installation.

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NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 53 24 00



SECTION 07 54 19 00 - MPF POLYVINYL-CHLORIDE MEMBRANE ROOFING

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification.

NOTE TO SPECIFIER

Use this section for where Fully Adhered PVC membrane Roofing is selected as the roofing system. EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.07 54 19 00

NOTE TO SPECIFIER

This roofing section includes three (3) options regarding inspections and /or warranty; two (2) options regarding insulation type; and two (2) options regarding insulation system attachment.

The Contracting Officer (CO) must provide direction to the Specifier on which one of the warranty options will be selected for this project. After receiving direction from the CO, the Specifier must edit the warranty sections to ensure that this option is consistently applied throughout.

The warranty options are:

WARRANTY OPTION 1, Part-Time Third-Party Inspections: these are to be provided at construction milestones as listed below. A manufacturer's warranty is optional. The Contracting Officer may choose to mandate Part-Time Third Party Inspections AND mandate manufacturer's warranty.

WARRANTY OPTION 2, Full-time Third-Party inspections: an inspector is to be continuously present during the entire period of roofing installation. A manufacturer's warranty is optional. The Contracting Officer may choose to mandate Full-Time Third Party Inspections AND mandate manufacturer's warranty.

WARRANTY OPTION 3, Manufacturer's Warranty: this option requires a warranty from the manufacturer. Inspections are to be provided by the manufacturer at the milestones listed below or as necessary to meet manufacturer's requirements.

There are two (2) options regarding primary roof insulation type. The Specifier must provide direction on which one of the options will be selected for this project. The Specifier must edit the section to ensure that this option is consistently applied throughout the section. Note that facilities with a metal roof deck are most conducive to Polyisocyanurate insulation due to the fact that a thermal barrier is not required under the insulation in order to maintain the systems fire rating (Use of XPS over a metal deck would require a thermal barrier under the insulation assembly if selected). Concrete roof decks can utilize Extruded Polystyrene Insulation attached directly to the prepared roof deck without the need for a thermal barrier. The Specifier shall determine the insulation type based on existing construction; building code review; and cost analysis. The insulation type options are:

INSULATION Type OPTION 1, Polyisocyanurate.

INSULATION Type OPTION 2, Extruded Polystyrene.

There are two (2) options regarding insulation attachment. The Specifier must provide direction on which one of the options will be selected for this project. The Specifier must edit the section to ensure that this option is consistently applied throughout the section. Note that facilities with a metal roof deck are most conducive to mechanical attachment of the insulation assembly. Facilities with concrete roof decks are most conducive to adhered attachment of the insulation assembly. The Specifier shall determine the insulation type based on existing construction; building code review; and cost analysis. The insulation attachment options are:

INSULATION Attachment OPTION 1, Mechanically attached.

INSULATION Attachment OPTION 2, Adhered.



PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Preparation of roof deck to receive roofing membrane.
 2. Vapor/Air retarder.[Specifier to make determination of use and location within the system based on facility conditions and general environment]
 3. [Mechanically fastened] [Adhesively Applied] Roof insulation and Glass mat gypsum board.
 4. Fully Adhered PVC membrane roofing system.
 5. Flashing membrane.
 6. Accessories.
 7. Edge metal.
 8. [Warranty]
- B. Related Documents:
 1. The Contract Documents, as defined in Section 011000- Summary of Work, apply to the Work of this Section.
 2. Memorandum of Understanding (MOU) between the United States Environmental Protection Agency's ENERGY STAR® Roof Products Program and Roofing Material Manufacturers.
 3. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 1. Section 061000 - Rough Carpentry: Wood blocking, curbs, and nailers.
 2. Section 077213 - Manufactured Curbs: Curbs for roof penetrations.
 3. Section 077233 -Roof Hatches: Hatch with integral curb.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 1. ASTM C208 - Specification for Cellulosic Fiber Insulating Board.
 2. ASTM C1177 - Standard Specification for Glass Mat Gypsum Roof Board.
 3. ASTM C1289 - Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 4. ASTM D570 - Test Method for Water Absorption of Plastics.
 5. ASTM D638 - Test Method for Tensile Properties of Plastics.
 6. ASTM D751 - Test Method for Coated Fabrics.
 7. ASTM D1004 - Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
 8. ASTM D1079 - Terminology Relating to Roofing and Waterproofing.
 9. ASTM D1204 - Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature.
 10. ASTM D2136 - Test Method for Coated Fabrics – Low Temperature Bend Test.
 11. ASTM D3045 - Practice for Heat Aging of Plastics Without Load.
 12. ASTM D4434 - Specification for Poly(Vinyl Chloride) Sheet Roofing. (Most Recent Edition) (PVC only)
 13. ASTM D6754 – Specification for KEE Based Sheet Roofing (Most Recent Edition)(KEE only)
 14. ASTM D5602 - Test Method for Static Puncture Resistance of Roofing Membrane Samples.
 15. ASTM D5635 - Test Method for Dynamic Puncture Resistance of Roofing Membrane Samples.
 16. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.



17. ASTM E96 - Test Methods for Water Vapor Transmission of Materials.
18. ASTM E108 - Test Methods for Fire Tests of Roof Coverings.
19. ASTM E903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmission of Materials Using Integrating Spheres.
20. ASTM G21 - Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi (KEE only).
21. ASTM G26 - Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials.
22. ASTM G53 - Practice for Operating Light- and Water – Exposure Apparatus (Fluorescent UV/Condensation Type) for Exposure of Nonmetallic Materials.

B. Factory Mutual Global (FMG):

1. FMG – RoofNav – Internet Based FM Roof Assembly Testing and Approvals Database
2. FMG - Approval Guide, Building Materials
3. FMG - Loss Prevention Data 1-28, Wind Loads to Roof Systems and Roof Deck Securement.
4. FMG - Loss Prevention Data 1-29, Above Deck Roof Components (June 1996).
5. FMG - Standard 4450, Class 1 Insulated Steel Deck Roofs.
6. FMG - Standard 4470, Class 1 Roof Covers.

C. Underwriters Laboratory (UL):

1. Class A rated roofing system
2. Recycled Content Certification
 - a. Manufacturer's membrane product recycled content to be validated by UL Environmental (ULE)

1.3 SYSTEM DESCRIPTION

- A. ENERGY STAR® Compliant Fully Adhered PVC Membrane Roofing System on Factory Primed Glass Mat Gypsum Roof Board on overlayed insulation secured to [metal or concrete] deck.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals

1. Product Data:
 - a. FM RoofNav Assembly Number certifying proposed roof system has been tested and approved by FMG for the specified FM[1-90] [1-105] [1-120] rating.
 - b. Membrane materials, base flashing, vapor retarder, [fastener & plate,] adhesive materials, edge metal and insulation.
 - c. [Insulation fastener layouts complying with FMG Loss Prevention Data Sheet 1-29 patterns for specified wind uplift resistance. Indicate number of insulation fasteners required and spacing of fasteners for field, perimeter, and corners for each pattern.] [Adhesively applied insulation coverage rates and layout must comply with the proposed FM RoofNav assembly number and adhesive application rates relative to that assembly. Indicate insulation adhesive application rates required and the coverage/ribbon spacing of adhesive for field, perimeter, and corners for each pattern. Insulation adhesion rates and coverage/ribbon spacing submissions must also be inclusive of the roof system manufacturer's instructions, including cold weather installation instructions and are required for approval prior to job start.]
 - d. Adhered membrane adhesive and application rates for adhering membrane roof to the overlayed insulation system with coverboard. Membrane adhesive shall be installed in compliance with roof membrane system manufacturer's FM RoofNav assembly approval number and all of the manufacturer's instructions including cold weather installation instructions of the proposed shall be required for approval prior to job start.
2. Shop Drawings: Indicate setting plan for insulation including fastener pattern, layout of roofing seams, direction of laps and base flashing details.



3. Assurance/Control Submittals:

- a. Certificates: Manufacturer is to certify that components and products meet or exceed specified standards and complies with referenced quality assurance standards in section 1.5 including the FM RoofNav assembly number.
- b. Qualification Documentation: Manufacturer certification indicating roofing applicator qualifications complying with requirements specified in Paragraph entitled "Applicator Qualifications" of this Section.

NOTE TO SPECIFIER

WARRANTY OPTION 1, Part-Time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 1, Part-Time Third-Party inspections.

- c. Field Quality Control Reports: Submit the following reports directly to Contracting Officer from the Third-Party Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 -Quality Requirements:
 - 1) Preparatory inspection.
 - 2) Initial inspection.
 - 3) Follow-up inspections.
 - 4) Final inspection.
 - 5) Maintenance Instruction: Document training by furnishing a sign-in sheet with a description of the training provided, instructors name and organization, and those who received training. Refer to 017704 1.3, 1.4, and 1.5 for more specific training requirements.

NOTE TO SPECIFIER

WARRANTY OPTION 2, Full-time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 2, Full-time Third-Party inspections.

- d. Field Quality Control Reports: Submit daily reports directly to Contracting Officer from the Full-time Third-Party Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 -Quality Requirements.
- e. Maintenance Instruction: Document training by furnishing a sign-in sheet with a description of the training provided, instructors name and organization, and those who received training. Refer to 017704 1.3, 1.4, and 1.5 for more specific training requirements.

NOTE TO SPECIFIER

Include the paragraphs below if Contracting Officer mandates a Manufacturer's warranty. Delete the paragraphs below if the Contracting Officer chooses to have Part-Time or Full Time Third Party inspections and No Warranty.

- f. Sample of specified Warranty
- g. Manufacturer's certification letter acknowledging receipt of specifications, intent to issue warranty, and intent to perform field audits as outlined in 1.4.3.d.
- h. Manufacturer's Field Reports: Submit the following reports directly to Contracting Officer from Manufacturer's Roofing Quality Control Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 -Quality Requirements:
 - 1) Preparatory inspection.
 - 2) Initial inspection.
 - 3) Follow-up inspections.
 - 4) Final inspection.

NOTE TO SPECIFIER

End of WARRANTY OPTION



- i. Written certification or product data sheet attesting that proposed roofing membrane meets the EPA ENERGY STAR® Roof Products Program specification for energy efficiency and that the manufacturer is listed as a Partner.
4. Maintenance Instruction: Document training by furnishing a sign-in sheet with a description of the training provided, instructors name and organization and those who received training. Refer to 017704 1.3, 1.4, and 1.5 for more specific training requirements.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in PVC membrane roof application with minimum of 5 years documented experience and that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product, and that is eligible to receive a manufacturer's warranty.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by membrane manufacturer for specified roofing system and shall be in compliance with all applicable regulatory requirements.
- C. FMG Listing: Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system and that are listed in the most recent FMG "RoofNav" on-line directory or FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

NOTE TO SPECIFIER

90 pounds per square foot wind uplift minimum. Design roofing and insulation system to comply with regional requirements and special regulations of local authority having jurisdiction. Verify with USPS Contracting Officer. Contact Roofing System Manufacturer for information about 105 or 120 or greater pounds per square foot of uplift resistance.

NOTE TO SPECIFIER

Edit "Class" in the following paragraph for project's fire resistance and wind uplift resistance requirements. Verify availability of roofing systems that meet these classifications. "Class 1A" signifies meeting ASTM E 108, Class A fire performance for FMG-approved Class 1 roof covers. For areas having three or more hailstorms annually, FMG recommends roofing systems rated SH (severe hail) instead of MH (moderate hail).

1. Fire/Windstorm Classification: Class 1A- [90] [105] [120] <Insert number>.
2. Hail Resistance: [MH] [SH].

- D. Pre-installation Meeting:
 1. Convene a Pre-installation Meeting at Project Site one week prior to commencing work of this Section.
 2. Require attendance of parties directly affecting work of this Section.
 3. Review preparation and installation procedures and coordinating and scheduling required with related work.

NOTE TO SPECIFIER

WARRANTY OPTION 1, Part-Time Third-Party Inspections: Include the paragraph below if Contracting Officer mandates WARRANTY OPTION 1, Part-Time Third-Party inspections.

- a. Require the Third-Party Roofing Inspector to conduct Pre-installation Meeting along with Contractor Quality Control Representative and Contracting Officer.

NOTE TO SPECIFIER



WARRANTY OPTION 2, Full-time Third-Party Inspections: Include the paragraph below if Contracting Officer mandates WARRANTY OPTION 2, Full-time Third-Party inspections.

- b. Require the Full-time Third-Party Roofing Inspector to conduct Pre-installation Meeting along with Contractor Quality Control Representative and Contracting Officer.

NOTE TO SPECIFIER

Include the paragraph below if Contracting Officer mandates a Manufacturer's warranty.

- c. Require Manufacturer's Roofing Quality Control Inspector to conduct Pre-installation Meeting along with Contractor Quality Control Representative and Contracting Officer.

NOTE TO SPECIFIER

End of WARRANTY OPTION

- 4. Agenda:
 - a. Tour, inspect and discuss condition of substrate, roof drains, roof drain final locations, curbs, penetrations and other preparatory work performed by other trades.
 - b. Review structural loading limitations of deck and inspect deck for loss of flatness and for required mechanical fastening.
 - c. Review roofing system requirements (Drawings, Specifications and other Contract Documents).
 - d. Review required submittals, both completed and yet to be completed.
 - e. Review and finalize construction schedule related to roofing work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
 - f. Review requirements for inspections, testing, certifying, and material usage accounting procedures.
 - g. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions, including possibility of temporary roofing.
 - h. Review safety precautions relating to roofing installation.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Deliver materials in manufacturer's original unopened containers or wrappings, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Protect foam insulation from direct sunlight exposure.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.7 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements:
 - 1. Do not apply roofing membrane during inclement weather. When air temperature is expected to fall below 40 degrees F, follow submitted roof system manufacturer's specified Cold Weather Application Procedures.
 - 2. Do not apply roofing membrane to wet, damp or frozen deck surface or when precipitation is occurring.



3. Do not expose materials vulnerable to water or the sun in quantities greater than can be weatherproofed during same day.

NOTE TO SPECIFIER

Manufacturer's warranty: Include the paragraphs below if Contracting Officer mandates a Manufacturer's warranty.

1.8 WARRANTY

- A. Section 017704 - Closeout Submittals: Procedures for closeout submittals.
- B. Special Warranty:
1. Submit written warranty, without monetary limitation, signed by roofing system manufacturer agreeing to promptly repair leaks in roof membrane and base flashings resulting from defects in materials and workmanship.
 2. Warranty shall not exclude "ponding" water.
 3. Warranty Period: [20] [____] years.
 4. Include materials and workmanship for all manufacturer's supplied roofing components including but not limited to:
 - a. Membranes.
 - b. Flashings, including edge metal, metal flashings and accessories supplied by roofing membrane manufacturer.
 - c. Insulation.
 - d. Fasteners.
 - e. Adhesives.
 - f. Vapor / Air Retarder
 5. Include the following items within Warranty:
 - a. Roofing inspection by Manufacturer's Roofing Quality Control Inspector between 22 and 24 months after date of Final Acceptance.
 - b. Roofing manufacturer will provide unlimited repairs on warranted items during warranty period with no cost limitation.
 - c. Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions. USPS must immediately notify roofing membrane manufacturer of such repairs.
 - d. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Project Membrane Roofing Specification Section to Warranty.
 6. Wind Coverage
 - a. Warranty shall cover wind gusts up to [____] miles per hour.

End of WARRANTY OPTION

NOTE TO SPECIFIER

Verify manufacturer information and availability at time of Project Manual preparation for Project.

PART 2 - PRODUCTS

2.1 ROOFING MEMBRANE

- A. Must have recycled content.



- B. Fabric or fiber reinforced Polyvinyl Chloride Roofing Membrane shall comply with ASTM D4434, Type II or Type III. KEE Membrane Shall comply with ASTM D6754.
- C. Minimum thickness of 0.059 inch (59 mil) (1.5 mm)
- D. Product must meet ENERGY STAR requirements for low-slope roofs and must be listed on the ENERGY STAR Roof Products Program Qualified Product List.
- E. Solar reflectance per Energy Star or Cool Roof Council (CRRRC)
 - 1. Initial Reflectance: 0.65 minimum
 - 2. Three years after installation: 0.50 minimum

2.2 ROOFING SYSTEM MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated into the Work include the following:
 - 1. Carlisle., Carlisle, PA (800) 479-6832
 - 2. Duro-Last Roofing Inc, Saginaw MI (800) 248-0280.
 - 3. Johns Manville Roofing Systems, Denver, CO (800) 592-6958.
 - 4. Seaman Corporation (Fibertite), Wooster, OH (800) 927-8578.
 - 5. Sika Sarnafil Division, Sika Corp, Canton, MA (800) 451-2504.
 - 6. Tremco Inc., Beachwood, OH (800) 852-6013.
 - 7. Versico, Carlisle, PA (800)992-7663
- B. Manufacturer of roofing membrane must be a Partner in the EPA ENERGY STAR® Roof Products Program for energy efficiency and membrane supplied must be listed on the ENERGY STAR Roof Products Qualified Product List.
- C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted with Contracting Officer Approval.

NOTE TO SPECIFIER

Verify manufacturer information and availability at time of Project Manual preparation for Project.

2.3 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
 - 1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.
- B. Sheet Flashing
 - 1. Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as PVC sheet membrane.
 - 2. Manufacturer's standard PVC clad metal - A PVC-coated, heat-weldable sheet metal capable of being formed into a variety of shapes and profiles. PVC Clad Metal shall be a 25 gauge, G90 galvanized metal sheet with a 20 mil (0.5 mm) unsupported PVC membrane laminated on one side.
- C. Perimeter Edge and Metal Flashings
 - 1. To be supplied by the roof system manufacturer in accordance with the rated assembly
 - a. Minimum 25 gauge galvanized steel with Kynar finish – color selected by Contracting Officer OR
 - b. Roof System manufacturer's rated and approved clad metal



- D. Bonding Adhesive: Manufacturer's standard clear or light-colored [solvent] [water]-based bonding adhesive for membrane, and solvent-based bonding adhesive for base flashings.

2.4 ROOF INSULATION

NOTE TO SPECIFIER

INSULATION TYPE OPTION 1, Polyisocyanurate foam insulation assemblies: Include the paragraphs below if the Specifier chooses Polyisocyanurate insulation.

Polyisocyanurate Foam Insulation

- A. Flat Roof Board Insulation: Polyisocyanurate Foam Insulation which meets or exceeds FS HH-I-1972/2, both faces covered with glass fiber felt; comply with FMG Standard 4450 Approval. (ASTM C1289, Type II – Class 1 – Grade 2)
1. Thermal Resistance: in service R-5.6 per inch of thickness in cooling conditions
 2. Thermal Resistance: in service R-5.0 per inch of thickness in heating conditions
 3. Compressive Strength: 20 PSI Minimum
 4. Maximum Board Thickness is 2"
 5. Minimum Board Thickness is 1.5" on the base layer
- B. Tapered Polyisocyanurate Foam Insulation: Provide crickets, saddles, and tapered insulation of same material as second layer of insulation; taper to the following slopes:
1. Crickets and Saddles: 1/4 inch per foot or twice the slope of the roof, whichever is greater.
 2. Insulation Installed to Counterslope Roof Structure: 1/2 inch to the foot, or twice slope of roof, whichever is greater.
- C. Roof Curb Insulation: Polyisocyanurate foam; thickness to match wood nailer.
- D. Tapered Insulation: Provide crickets, saddles, and tapered insulation of same material as second layer of insulation; taper to the following slopes:
1. Crickets and Saddles: 1/4 inch per foot or twice the slope of the roof, whichever is greater.
 2. Insulation Installed to Counterslope Roof Structure: 1/2 inch to the foot, or twice slope of roof, whichever is greater.
- E. Cover Board: 1/2" Factory Primed Glass Mat Gypsum Roof Board: ASTM C-1177. Zero flame spread and zero smoke developed per ASTM E84. Minimum 500 pounds per square inch compressive strength.

NOTE TO SPECIFIER

INSULATION TYPE OPTION 2, Extruded Polystyrene insulation assemblies: Include the paragraphs below if the Specifier chooses Extruded Polystyrene insulation.

EXTRUDED Polystyrene (XPS)

- A. Flat Roof Board Insulation: Extruded polystyrene board to ASTM C578, Type IV, rigid, closed cell type, with integral high density skin.
1. Thermal Resistance (ASTM C518): typical 5 year aged value of R-5 per 1 inch of thickness.
 2. Compressive Strength (ASTM D1621): Minimum 25 psi.
 3. Water Absorption (ASTM D2842): 0.7% by volume maximum.
 4. Flame Spread/Smoke Developed Values (ASTM E84): 5/165.



- B. Tapered Roof Board Insulation: Extruded polystyrene board to ASTM C578, Type IV, rigid, closed cell type, with integral high density skin.
 - 1. Thermal Resistance (ASTM C518): typical 5 year aged value of R-5 per 1 inch of thickness.
 - 2. Compressive Strength: Minimum 25 psi.
 - 3. Water Absorption (ASTM D2842): 0.7% by volume maximum.
 - 4. Flame Spread/Smoke Developed Values (ASTM E84): 5/165.
- C. Cover Board: ¼" Factory Primed Glass Mat Gypsum Roof Board: ASTM C-1177. Zero flame spread and zero smoke developed per ASTM E84. Minimum 500 pounds per square inch compressive strength.

2.5 ACCESSORIES

NOTE TO SPECIFIER

INSULATION ATTACHMENT OPTION 1, Mechanically attached insulation assemblies: Include the paragraphs below if the Specifier chooses mechanically attached insulation.

- A. Roofing Insulation Fasteners: Fasteners shall be as tested and approved by FMG as part of the roofing system assembly.
 - 1. Mechanical Fasteners for Insulation: Coated fasteners with plates appropriate for purpose intended and approved by Factory Mutual and supplied by roofing membrane manufacturer. Thickness of insulation and roofing membrane manufacturer's deck penetration requirements shall determine the length of the fastener.

NOTE TO SPECIFIER

INSULATION ATTACHMENT OPTION 2, Adhered insulation assemblies: Include the paragraphs below if the Specifier chooses adhered insulation.

- A. Roofing Insulation Adhesive: Insulation Adhesive shall be as tested and approved by FMG as part of the roofing system assembly.
 - 1. Insulation Adhesive: [The specifier shall research the requirements with respect to Volatile Organic Compounds and temperature limitations of project to complete this specification section. The completed section will dictate Standard VOC content insulation adhesive, Low VOC content insulation adhesive, OR No VOC content insulation adhesive.]
 - 2. Specified adhesive shall be for purpose intended and approved by Factory Mutual and supplied by roofing membrane manufacturer.

NOTE TO SPECIFIER

End of INSULATION ATTACHMENT OPTIONS

- B. Walkway Pads: Walkway materials shall be provided by the roofing membrane manufacturer
- C. Isolation Pads: Provide a piece of walkway pad as above



- D. Termination: Use roofing membrane manufacturer's recommended termination details and associated products to comply with Warranty requirements
- E. Pipe Flashings: Prefabricated pipe flashings shall be supplied by the roofing membrane manufacturer
- F. Vapor / Air Retarder [Use and location to be determined by Specifier – Product to be recommended and supplied by roof system manufacturer]

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.

NOTE TO SPECIFIER

Edit paragraph below based on Contracting Officer's selection of roofing inspections and/or manufacturer's warranty.

- B. Verification of Conditions: Verify, with [Third-Party Roofing Inspector] [Full-time Third-Party Roofing Inspector] [Manufacturer's Quality Control Inspector] present, that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains, valleys, and eaves. Verify flutes of steel deck are evenly spaced at intersections.
 - 2. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, and nailing strips, and reglets are in place. Verify deck is supported and tightly secured.
 - 3. Verify deck surfaces are dry and free of water, snow, and ice.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Provide covers and other means of protection as necessary to protect building surfaces against damage during roofing work.
- B. Where work shall continue over finished roof membrane, protect surfaces according to roofing membrane manufacturer's recommendations.

3.3 ROOF INSULATION INSTALLATION

NOTE TO SPECIFIER

INSULATION ATTACHMENT OPTION 1, Mechanically attached insulation assemblies: Include the paragraphs below if the Specifier chooses mechanically attached insulation.

- A. Lay insulation boards to moderate contact without forcing joints. Cut insulation to fit neatly to perimeter blocking and around protrusions through roof.



1. Gaps between insulation boards, nailers and penetrations of 1/4 inch (0.64 cm) or greater are not acceptable.
- B. Place roof crickets and tapered thickness insulation to the required slope pattern in accordance with manufacturer's published instructions.
- C. Mechanically Attached Installation:
 1. Maximum insulation board dimension is 4' x 8'
 2. Place long edge of boards parallel to deck flutes, forming joint over solid bearing. Lay first layer insulation units with long edge joints continuous and end joints staggered.
 3. Lay second and subsequent layers of insulation with both long side and end joints offset 6 inches (15 cm) from joints below.
 4. Factory primed glass mat gypsum board and overlaid insulation may be loose laid and fastened with the same insulation fastener and plate in accordance with manufacturer's approved assembly. Fastener and plate must be approved by the roof system manufacturer and installed at the required density to achieve the specified FMG [1A]-[90][105][120] system, in accordance with requirements of FMG Loss Prevention Data Sheet 1-29 for specified wind uplift requirements.
- D. Apply no more insulation than can be waterproofed with roofing membrane in same day.
- E. Mechanically attach a single layer of insulation to manufactured metal curbs.

NOTE TO SPECIFIER

INSULATION ATTACHMENT OPTION 2, Adhered insulation assemblies: Include the paragraphs below if the Specifier chooses adhered insulation.

- A. Lay insulation boards to moderate contact without forcing joints. Cut insulation to fit neatly to perimeter blocking and around protrusions through roof.
 1. Gaps between insulation boards, nailers and penetrations of 1/4 inch (0.64 cm) or greater are not acceptable.
- B. Place roof crickets and tapered thickness insulation to the required slope pattern in accordance with manufacturer's published instructions.
- C. Adhered Installation:
 1. 4-foot x 4-foot maximum board size for insulation boards adhered to a substrate including successive layers.
 2. Lay second and subsequent layers of insulation so that the insulation board's joints are staggered vertically and offset from the underlying layers.
 3. Factory primed glass mat gypsum board and overlaid insulation shall be adhered in accordance with the manufacture's recommendations and submitted FM assembly number to achieve the specified FMG [1A]-[90][105][120] system, in accordance with requirements of FMG Loss Prevention Data Sheet 1-29 for specified wind uplift requirements.
- D. Apply no more insulation than can be waterproofed with roofing membrane in same day.
- E. Mechanically attach a single layer of insulation to manufactured metal curbs.

3.4 ROOFING MEMBRANE APPLICATION

- A. Apply roofing membrane in accordance with membrane manufacturer's published instructions for specified system.



- B. All quality control recommendations of the roofing system manufacturer shall be strictly followed.
- C. Cold Weather Application Procedures: When air temperature is expected to fall below 40 degrees F, follow Cold Weather Application Procedures as follows:
 - 1. Store flashing adhesive in heated storage units (minimum temperature 40 degrees F) prior to installation.
 - 2. Follow roofing membrane manufacturer's recommendation for cold weather application of adhered field sheets, corner & perimeter area, and flashings.

3.5 WATER CUTOFFS AND WEATHER PROTECTION

- A. Install water cut-offs according to roofing membrane manufacturer's recommendations at end of day's operation to seal insulation and edge of roof membrane from moisture entry. If rain or foul weather appears imminent during roofing application, cease operations and protect deck, insulation, flashings, penetrations and membrane from moisture intrusion and damage with water cutoffs. Insulation and roofing materials not so protected before rain are considered damaged materials and will be rejected.
- B. Water cut-offs over steel deck must include steel deck flute plugs to prevent moisture from getting under insulation.
- C. Remove water cut-offs and other temporary weather protections prior to continuing roofing work. Remove materials that have been subject to moisture damage and return deck to clean, dry condition before proceeding with roofing operations. Remove damaged materials from job site.
- D. Water cut-offs and weather protection shall not be considered part of final roof system specified.

3.6 FLASHING MEMBRANE AND ACCESSORIES

- A. Field membrane shall be terminated with fasteners and plates. Flashing membrane, mechanically attached or adhered, shall be extended past the termination of the field membrane and hot air welded on the horizontal plane.
- B. Roof Penetrations:
 - 1. Prefabricated pipe flashings shall be installed where the configuration of penetration will permit, including but not limited to electrical conduit, and plumbing vents.
 - 2. Field fabrication of flashing shall be used where the configuration of the penetration prohibits the use of prefabricated flashing.
- C. Fasten membrane and flashing terminations per roofing membrane manufacturer's recommendations.
- D. Walkway Pads: Weld walkways to roofing membrane per manufacturer's recommendation.

3.7 ROOF SURFACING

- A. No field-applied surfacing shall be utilized with this roofing system.

3.8 CONSTRUCTION

- A. Interface with Other Work:
 - 1. Coordinate Work with installation of associated metal counterflashings as Work of this Section proceeds.



2. Complete installation of base flashing at roof curbs prior to setting roof top equipment.
3. Coordinate Work with Plumbing for roof drain(s) installation.

3.9 FIELD QUALITY CONTROL

- A. Section 014000 -Quality Requirements: Field inspection.

NOTE TO SPECIFIER

WARRANTY OPTION 1, Part-Time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 1, Part-Time Third-Party inspections.

- B. Field Services: Third-Party Roofing Inspector.

1. Attend and conduct Pre-installation Meeting.
2. Perform preparatory, initial, follow-up and final inspections for roof insulation and roofing system.
3. Prepare and submit inspection reports for each inspection made.

NOTE TO SPECIFIER

WARRANTY OPTION 2, Full-time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 2, Full-time Third-Party inspections.

- C. Field Services: Full-time Third-Party Roofing Inspector.

1. Attend and conduct Pre-installation Meeting.
2. Perform full-time inspections for roof insulation and roofing system.
3. Prepare and submit inspection reports for each inspection made.

NOTE TO SPECIFIER

OPTION 3, Manufacturer's warranty: Include the paragraphs below if Contracting Officer mandates OPTION 3, Manufacturer's warranty or if the Contracting Officer mandates Option 1 of Option 2 and also chooses the optional manufacturer's warranty.

- D. Manufacturer's Field Services: Manufacturer's Roofing Quality Control Inspector.

1. Attend and conduct Pre-installation Meeting.
2. Perform preparatory, initial, follow-up and final inspections for roof insulation and roofing system.
3. Prepare and submit inspection reports for each inspection made.

NOTE TO SPECIFIER

End Manufacturer's warranty

- E. Maintenance Instruction

1. Provide on-site instruction to review the components of the system and detail any common troubleshooting or maintenance that is required to ensure normal performance of the roofing system.
2. Provide one complete set of installation details and component manuals that will remain at the installed location.

3.10 CLEANING

- A. Section 017300 - Execution: Requirements for cleaning.



- B. Remove dirt, debris, and markings from finished surfaces. In areas where finished surfaces are soiled, consult roofing membrane manufacturer for cleaning advice and comply with their instruction.
- C. Replace defaced or disfigured finishes caused by Work of this Section.

3.11 PROTECTION

- A. Where construction traffic must continue over finished roof installation, protect surfaces in manner recommended by roofing system manufacturer to protect Manufacturer's Warranty.

USPS Mail Processing Facility Specifications issued: 10/1/2013
Last revised: 3/31/2011

END OF SECTION



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SECTION 07 54 19 00 - CSF POLYVINYL-CHLORIDE MEMBRANE ROOFING

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

This roofing section includes three (3) options regarding inspections and /or warranty; two (2) options regarding insulation type; and two (2) options regarding insulation system attachment.

The Contracting Officer (CO) must provide direction to the Specifier on which one of the warranty options will be selected for this project. After receiving direction from the CO, the Specifier must edit the warranty sections to ensure that this option is consistently applied throughout.

The warranty options are:

WARRANTY OPTION 1, Part-Time Third-Party Inspections: these are to be provided at construction milestones as listed below. A manufacturer's warranty is optional. The Contracting Officer may choose to mandate Part-Time Third Party Inspections AND mandate manufacturer's warranty.

WARRANTY OPTION 2, Full-time Third-Party inspections: an inspector is to be continuously present during the entire period of roofing installation. A manufacturer's warranty is optional. The Contracting Officer may choose to mandate Full-Time Third Party Inspections AND mandate manufacturer's warranty.

WARRANTY OPTION 3, Manufacturer's Warranty: this option requires a warranty from the manufacturer. Inspections are to be provided by the manufacturer at the milestones listed below or as necessary to meet manufacturer's requirements.

There are two (2) options regarding primary roof insulation type. The Specifier must provide direction on which one of the options will be selected for this project. The Specifier must edit the section to ensure that this option is consistently applied throughout the section. Note that facilities with a metal roof deck are most conducive to Polyisocyanurate insulation due to the fact that a thermal barrier is not required under the insulation in order to maintain the systems fire rating (Use of XPS over a metal deck would require a thermal barrier under the insulation assembly if selected). Concrete roof decks can utilize Extruded Polystyrene Insulation attached directly to the prepared roof deck without the need for a thermal barrier. The Specifier shall determine the insulation type based on existing construction; building code review; and cost analysis. The insulation type options are:

INSULATION Type OPTION 1, Polyisocyanurate.

INSULATION Type OPTION 2, Extruded Polystyrene.

There are two (2) options regarding insulation attachment. The Specifier must provide direction on which one of the options will be selected for this project. The Specifier must edit the section to ensure that this option is consistently applied throughout the section. Note that facilities with a metal roof deck are most conducive to mechanical attachment of the insulation assembly. Facilities with concrete roof decks are most conducive to adhered attachment of the insulation assembly. The Specifier shall determine the insulation type based on existing construction; building code review; and cost analysis. The insulation attachment options are:

INSULATION Attachment OPTION 1, Mechanically attached.

INSULATION Attachment OPTION 2, Adhered.



PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparation of roof deck to receive roofing membrane.
2. Vapor/Air retarder.[Specifier to make determination of use and location within the system based on facility conditions and general environment]
3. [Mechanically fastened] [Adhesively Applied] Roof insulation and Glass mat gypsum board.
4. Fully Adhered PVC membrane roofing system.
5. Flashing membrane.
6. Accessories.
7. Edge metal.
8. [Warranty]

B. Related Documents:

1. The Contract Documents, as defined in Section 011000- Summary of Work, apply to the Work of this Section.
2. Memorandum of Understanding (MOU) between the United States Environmental Protection Agency's ENERGY STAR® Roof Products Program and Roofing Material Manufacturers.
3. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

C. Related Sections:

1. Section 061000 - Rough Carpentry: Wood blocking, curbs, and nailers.
2. Section 077213 - Manufactured Curbs: Curbs for roof penetrations.
3. Section 077233 -Roof Hatches: Hatch with integral curb.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM C208 - Specification for Cellulosic Fiber Insulating Board.
2. ASTM C1177 - Standard Specification for Glass Mat Gypsum Roof Board.
3. ASTM C1289 - Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
4. ASTM D570 - Test Method for Water Absorption of Plastics.
5. ASTM D638 - Test Method for Tensile Properties of Plastics.
6. ASTM D751 - Test Method for Coated Fabrics.
7. ASTM D1004 - Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
8. ASTM D1079 - Terminology Relating to Roofing and Waterproofing.
9. ASTM D1204 - Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature.
10. ASTM D2136 - Test Method for Coated Fabrics – Low Temperature Bend Test.
11. ASTM D3045 - Practice for Heat Aging of Plastics Without Load.
12. ASTM D4434 - Specification for Poly(Vinyl Chloride) Sheet Roofing. (Most Recent Edition) (PVC only)
13. ASTM D6754 – Specification for KEE Based Sheet Roofing (Most Recent Edition)(KEE only)
14. ASTM D5602 - Test Method for Static Puncture Resistance of Roofing Membrane Samples.
15. ASTM D5635 - Test Method for Dynamic Puncture Resistance of Roofing Membrane Samples.
16. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
17. ASTM E96 - Test Methods for Water Vapor Transmission of Materials.
18. ASTM E108 - Test Methods for Fire Tests of Roof Coverings.
19. ASTM E903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmission of Materials Using Integrating Spheres.



20. ASTM G21 - Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi (KEE only).
 21. ASTM G26 - Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials.
 22. ASTM G53 - Practice for Operating Light- and Water – Exposure Apparatus (Fluorescent UV/Condensation Type) for Exposure of Nonmetallic Materials.
- B. Factory Mutual Global (FMG):
1. FMG – RoofNav – Internet Based FM Roof Assembly Testing and Approvals Database
 2. FMG - Approval Guide, Building Materials
 3. FMG - Loss Prevention Data 1-28, Wind Loads to Roof Systems and Roof Deck Securement.
 4. FMG - Loss Prevention Data 1-29, Above Deck Roof Components (June 1996).
 5. FMG - Standard 4450, Class 1 Insulated Steel Deck Roofs.
 6. FMG - Standard 4470, Class 1 Roof Covers.
- C. Underwriters Laboratory (UL):
1. Class A rated roofing system
 2. Recycled Content Certification
 - a. Manufacturer's membrane product recycled content to be validated by UL Environmental (ULE)

1.3 SYSTEM DESCRIPTION

- A. ENERGY STAR® Compliant Fully Adhered PVC Membrane Roofing System on Factory Primed Glass Mat Gypsum Roof Board on overlayed insulation secured to [metal or concrete] deck.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals
1. Product Data:
 - a. FM RoofNav Assembly Number certifying proposed roof system has been tested and approved by FMG for the specified FM[1-90] [1-105] [1-120] rating.
 - b. Membrane materials, base flashing, vapor retarder, [fastener & plate,] adhesive materials, edge metal and insulation.
 - c. [Insulation fastener layouts complying with FMG Loss Prevention Data Sheet 1-29 patterns for specified wind uplift resistance. Indicate number of insulation fasteners required and spacing of fasteners for field, perimeter, and corners for each pattern.] [Adhesively applied insulation coverage rates and layout must comply with the proposed FM RoofNav assembly number and adhesive application rates relative to that assembly. Indicate insulation adhesive application rates required and the coverage/ribbon spacing of adhesive for field, perimeter, and corners for each pattern. Insulation adhesion rates and coverage/ribbon spacing submissions must also be inclusive of the roof system manufacturer's instructions, including cold weather installation instructions and are required for approval prior to job start.]
 - d. Adhered membrane adhesive and application rates for adhering membrane roof to the overlayed insulation system with coverboard. Membrane adhesive shall be installed in compliance with roof membrane system manufacturer's FM RoofNav assembly approval number and all of the manufacturer's instructions including cold weather installation instructions of the proposed shall be required for approval prior to job start.
 2. Shop Drawings: Indicate setting plan for insulation including fastener pattern, layout of roofing seams, direction of laps and base flashing details.
 3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer is to certify that components and products meet or exceed specified standards and complies with referenced quality assurance standards in section 1.5 including the FM RoofNav assembly number.



- b. Qualification Documentation: Manufacturer certification indicating roofing applicator qualifications complying with requirements specified in Paragraph entitled "Applicator Qualifications" of this Section.

NOTE TO SPECIFIER

WARRANTY OPTION 1, Part-Time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 1, Part-Time Third-Party inspections.

- c. Field Quality Control Reports: Submit the following reports directly to Contracting Officer from the Third-Party Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 -Quality Requirements:
- 1) Preparatory inspection.
 - 2) Initial inspection.
 - 3) Follow-up inspections.
 - 4) Final inspection.
 - 5) Maintenance Instruction: Document training by furnishing a sign-in sheet with a description of the training provided, instructors name and organization, and those who received training. Refer to 017704 1.3, 1.4, and 1.5 for more specific training requirements.

NOTE TO SPECIFIER

WARRANTY OPTION 2, Full-time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 2, Full-time Third-Party inspections.

- d. Field Quality Control Reports: Submit daily reports directly to Contracting Officer from the Full-time Third-Party Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 -Quality Requirements.
- e. Maintenance Instruction: Document training by furnishing a sign-in sheet with a description of the training provided, instructors name and organization, and those who received training. Refer to 017704 1.3, 1.4, and 1.5 for more specific training requirements.

NOTE TO SPECIFIER

Include the paragraphs below if Contracting Officer mandates a Manufacturer's warranty. Delete the paragraphs below if the Contracting Officer chooses to have Part-Time or Full Time Third Party inspections and No Warranty.

- f. Sample of specified Warranty
- g. Manufacturer's certification letter acknowledging receipt of specifications, intent to issue warranty, and intent to perform field audits as outlined in 1.4.3.d.
- h. Manufacturer's Field Reports: Submit the following reports directly to Contracting Officer from Manufacturer's Roofing Quality Control Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 -Quality Requirements:
- 1) Preparatory inspection.
 - 2) Initial inspection.
 - 3) Follow-up inspections.
 - 4) Final inspection.

NOTE TO SPECIFIER

End of WARRANTY OPTION

- i. Written certification or product data sheet attesting that proposed roofing membrane meets the EPA ENERGY STAR® Roof Products Program specification for energy efficiency and that the manufacturer is listed as a Partner.
4. Maintenance Instruction: Document training by furnishing a sign-in sheet with a description of the training provided, instructors name and organization and those who received training. Refer to 017704 1.3, 1.4, and 1.5 for more specific training requirements.



1.5 QUALITY ASSURANCE

- A. **Applicator Qualifications:** Company specializing in PVC membrane roof application with minimum of 5 years documented experience and that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product, and that is eligible to receive a manufacturer's warranty.
- B. **Single Source Responsibility:** Roofing system materials and components shall be supplied and warranted by membrane manufacturer for specified roofing system and shall be in compliance with all applicable regulatory requirements.
- C. **FMG Listing:** Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system and that are listed in the most recent FMG "RoofNav" on-line directory or FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

NOTE TO SPECIFIER

90 pounds per square foot wind uplift minimum. Design roofing and insulation system to comply with regional requirements and special regulations of local authority having jurisdiction. Verify with USPS Contracting Officer. Contact Roofing System Manufacturer for information about 105 or 120 or greater pounds per square foot of uplift resistance.

NOTE TO SPECIFIER

Edit "Class" in the following paragraph for project's fire resistance and wind uplift resistance requirements. Verify availability of roofing systems that meet these classifications. "Class 1A" signifies meeting ASTM E 108, Class A fire performance for FMG-approved Class 1 roof covers. For areas having three or more hailstorms annually, FMG recommends roofing systems rated SH (severe hail) instead of MH (moderate hail).

1. Fire/Windstorm Classification: Class 1A- [90] [105] [120] <Insert number>.
2. Hail Resistance: [MH] [SH].

D. Pre-installation Meeting:

1. Convene a Pre-installation Meeting at Project Site one week prior to commencing work of this Section.
2. Require attendance of parties directly affecting work of this Section.
3. Review preparation and installation procedures and coordinating and scheduling required with related work.

NOTE TO SPECIFIER

WARRANTY OPTION 1, Part-Time Third-Party Inspections: Include the paragraph below if Contracting Officer mandates WARRANTY OPTION 1, Part-Time Third-Party inspections.

- a. Require the Third-Party Roofing Inspector to conduct Pre-installation Meeting along with Contractor Quality Control Representative and Contracting Officer.

NOTE TO SPECIFIER

WARRANTY OPTION 2, Full-time Third-Party Inspections: Include the paragraph below if Contracting Officer mandates WARRANTY OPTION 2, Full-time Third-Party inspections.

- b. Require the Full-time Third-Party Roofing Inspector to conduct Pre-installation Meeting along with Contractor Quality Control Representative and Contracting Officer.

NOTE TO SPECIFIER

Include the paragraph below if Contracting Officer mandates a Manufacturer's warranty.



- c. Require Manufacturer's Roofing Quality Control Inspector to conduct Pre-installation Meeting along with Contractor Quality Control Representative and Contracting Officer.

NOTE TO SPECIFIER

End of WARRANTY OPTION

4. Agenda:
- Tour, inspect and discuss condition of substrate, roof drains, roof drain final locations, curbs, penetrations and other preparatory work performed by other trades.
 - Review structural loading limitations of deck and inspect deck for loss of flatness and for required mechanical fastening.
 - Review roofing system requirements (Drawings, Specifications and other Contract Documents).
 - Review required submittals, both completed and yet to be completed.
 - Review and finalize construction schedule related to roofing work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
 - Review requirements for inspections, testing, certifying, and material usage accounting procedures.
 - Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions, including possibility of temporary roofing.
 - Review safety precautions relating to roofing installation.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Deliver materials in manufacturer's original unopened containers or wrappings, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Protect foam insulation from direct sunlight exposure.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.7 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements:
- Do not apply roofing membrane during inclement weather. When air temperature is expected to fall below 40 degrees F, follow submitted roof system manufacturer's specified Cold Weather Application Procedures.
 - Do not apply roofing membrane to wet, damp or frozen deck surface or when precipitation is occurring.
 - Do not expose materials vulnerable to water or the sun in quantities greater than can be weatherproofed during same day.

NOTE TO SPECIFIER

Manufacturer's warranty: Include the paragraphs below if Contracting Officer mandates a Manufacturer's warranty.



1.8 WARRANTY

- A. Section 017704 - Closeout Submittals: Procedures for closeout submittals.
- B. Special Warranty:
 - 1. Submit written warranty, without monetary limitation, signed by roofing system manufacturer agreeing to promptly repair leaks in roof membrane and base flashings resulting from defects in materials and workmanship.
 - 2. Warranty shall not exclude "ponding" water.
 - 3. Warranty Period: [20] [____] years.
 - 4. Include materials and workmanship for all manufacturer's supplied roofing components including but not limited to:
 - a. Membranes.
 - b. Flashings, including edge metal, metal flashings and accessories supplied by roofing membrane manufacturer.
 - c. Insulation.
 - d. Fasteners.
 - e. Adhesives.
 - f. Vapor / Air Retarder
 - 5. Include the following items within Warranty:
 - a. Roofing inspection by Manufacturer's Roofing Quality Control Inspector between 22 and 24 months after date of Final Acceptance.
 - b. Roofing manufacturer will provide unlimited repairs on warranted items during warranty period with no cost limitation.
 - c. Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions. USPS must immediately notify roofing membrane manufacturer of such repairs.
 - d. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Project Membrane Roofing Specification Section to Warranty.
 - 6. Wind Coverage
 - a. Warranty shall cover wind gusts up to [____] miles per hour.

End of WARRANTY OPTION

NOTE TO SPECIFIER

Verify manufacturer information and availability at time of Project Manual preparation for Project.

PART 2 - PRODUCTS

2.1 ROOFING MEMBRANE

- A. Must have recycled content.
- B. Fabric or fiber reinforced Polyvinyl Chloride Roofing Membrane shall comply with ASTM D4434, Type II or Type III. KEE Membrane Shall comply with ASTM D6754.
- C. Minimum thickness of 0.059 inch (59 mil) (1.5 mm)
- D. Product must meet ENERGY STAR requirements for low-slope roofs and must be listed on the ENERGY STAR Roof Products Program Qualified Product List.
- E. Solar reflectance per Energy Star or Cool Roof Council (CRRC)



1. Initial Reflectance: 0.65 minimum
2. Three years after installation: 0.50 minimum

2.2 ROOFING SYSTEM MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated into the Work include the following:
 1. Carlisle, Carlisle, PA (800) 479-6832
 2. Duro-Last Roofing Inc, Saginaw MI (800) 248-0280.
 3. Johns Manville Roofing Systems, Denver, CO (800) 592-6958.
 4. Seaman Corporation (Fibertite), Wooster, OH (800) 927-8578.
 5. Sika Sarnafil Division, Sika Corp, Canton, MA (800) 451-2504.
 6. Tremco Inc., Beachwood, OH (800) 852-6013.
 7. Versico, Carlisle, PA (800)992-7663
- B. Manufacturer of roofing membrane must be a Partner in the EPA ENERGY STAR® Roof Products Program for energy efficiency and membrane supplied must be listed on the ENERGY STAR Roof Products Qualified Product List.
- C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted with Contracting Officer Approval.

NOTE TO SPECIFIER

Verify manufacturer information and availability at time of Project Manual preparation for Project.

2.3 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
 1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.
- B. Sheet Flashing
 1. Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as PVC sheet membrane.
 2. Manufacturer's standard PVC clad metal - A PVC-coated, heat-weldable sheet metal capable of being formed into a variety of shapes and profiles. PVC Clad Metal shall be a 25 gauge, G90 galvanized metal sheet with a 20 mil (0.5 mm) unsupported PVC membrane laminated on one side.
- C. Perimeter Edge and Metal Flashings
 1. To be supplied by the roof system manufacturer in accordance with the rated assembly
 - a. Minimum 25 gauge galvanized steel with Kynar finish – color selected by Contracting Officer OR
 - b. Roof System manufacturer's rated and approved clad metal
- D. Bonding Adhesive: Manufacturer's standard clear or light-colored [solvent] [water]-based bonding adhesive for membrane, and solvent-based bonding adhesive for base flashings.

2.4 ROOF INSULATION

NOTE TO SPECIFIER



INSULATION TYPE OPTION 1, Polyisocyanurate foam insulation assemblies: Include the paragraphs below if the Specifier chooses Polyisocyanurate insulation.

Polyisocyanurate Foam Insulation

- A. Flat Roof Board Insulation: Polyisocyanurate Foam Insulation which meets or exceeds FS HH-I-1972/2, both faces covered with glass fiber felt; comply with FMG Standard 4450 Approval. (ASTM C1289, Type II – Class 1 – Grade 2)
 - 1. Thermal Resistance: in service R-5.6 per inch of thickness in cooling conditions
 - 2. Thermal Resistance: in service R-5.0 per inch of thickness in heating conditions
 - 3. Compressive Strength: 20 PSI Minimum
 - 4. Maximum Board Thickness is 2"
 - 5. Minimum Board Thickness is 1.5" on the base layer
- B. Tapered Polyisocyanurate Foam Insulation: Provide crickets, saddles, and tapered insulation of same material as second layer of insulation; taper to the following slopes:
 - 1. Crickets and Saddles: 1/4 inch per foot or twice the slope of the roof, whichever is greater.
 - 2. Insulation Installed to Counterslope Roof Structure: 1/2 inch to the foot, or twice slope of roof, whichever is greater.
- C. Roof Curb Insulation: Polyisocyanurate foam; thickness to match wood nailer.
- D. Tapered Insulation: Provide crickets, saddles, and tapered insulation of same material as second layer of insulation; taper to the following slopes:
 - 1. Crickets and Saddles: 1/4 inch per foot or twice the slope of the roof, whichever is greater.
 - 2. Insulation Installed to Counterslope Roof Structure: 1/2 inch to the foot, or twice slope of roof, whichever is greater.
- E. Cover Board: 1/2" Factory Primed Glass Mat Gypsum Roof Board: ASTM C-1177. Zero flame spread and zero smoke developed per ASTM E84. Minimum 500 pounds per square inch compressive strength.

NOTE TO SPECIFIER

INSULATION TYPE OPTION 2, Extruded Polystyrene insulation assemblies: Include the paragraphs below if the Specifier chooses Extruded Polystyrene insulation.

EXTRUDED Polystyrene (XPS)

- A. Flat Roof Board Insulation: Extruded polystyrene board to ASTM C578, Type IV, rigid, closed cell type, with integral high density skin.
 - 1. Thermal Resistance (ASTM C518): typical 5 year aged value of R-5 per 1 inch of thickness.
 - 2. Compressive Strength (ASTM D1621): Minimum 25 psi.
 - 3. Water Absorption (ASTM D2842): 0.7% by volume maximum.
 - 4. Flame Spread/Smoke Developed Values (ASTM E84): 5/165.
- B. Tapered Roof Board Insulation: Extruded polystyrene board to ASTM C578, Type IV, rigid, closed cell type, with integral high density skin.
 - 1. Thermal Resistance (ASTM C518): typical 5 year aged value of R-5 per 1 inch of thickness.
 - 2. Compressive Strength: Minimum 25 psi.
 - 3. Water Absorption (ASTM D2842): 0.7% by volume maximum.
 - 4. Flame Spread/Smoke Developed Values (ASTM E84): 5/165.



- C. Cover Board: ¼" Factory Primed Glass Mat Gypsum Roof Board: ASTM C-1177. Zero flame spread and zero smoke developed per ASTM E84. Minimum 500 pounds per square inch compressive strength.

2.5 ACCESSORIES

NOTE TO SPECIFIER

INSULATION ATTACHMENT OPTION 1, Mechanically attached insulation assemblies: Include the paragraphs below if the Specifier chooses mechanically attached insulation.

- A. Roofing Insulation Fasteners: Fasteners shall be as tested and approved by FMG as part of the roofing system assembly.
1. Mechanical Fasteners for Insulation: Coated fasteners with plates appropriate for purpose intended and approved by Factory Mutual and supplied by roofing membrane manufacturer. Thickness of insulation and roofing membrane manufacturer's deck penetration requirements shall determine the length of the fastener.

NOTE TO SPECIFIER

INSULATION ATTACHMENT OPTION 2, Adhered insulation assemblies: Include the paragraphs below if the Specifier chooses adhered insulation.

- A. Roofing Insulation Adhesive: Insulation Adhesive shall be as tested and approved by FMG as part of the roofing system assembly.
1. Insulation Adhesive: [The specifier shall research the requirements with respect to Volatile Organic Compounds and temperature limitations of project to complete this specification section. The completed section will dictate Standard VOC content insulation adhesive, Low VOC content insulation adhesive, OR No VOC content insulation adhesive.]
 2. Specified adhesive shall be for purpose intended and approved by Factory Mutual and supplied by roofing membrane manufacturer.

NOTE TO SPECIFIER

End of INSULATION ATTACHMENT OPTIONS

- B. Walkway Pads: Walkway materials shall be provided by the roofing membrane manufacturer
- C. Isolation Pads: Provide a piece of walkway pad as above
- D. Termination: Use roofing membrane manufacturer's recommended termination details and associated products to comply with Warranty requirements
- E. Pipe Flashings: Prefabricated pipe flashings shall be supplied by the roofing membrane manufacturer
- F. Vapor / Air Retarder [Use and location to be determined by Specifier – Product to be recommended and supplied by roof system manufacturer]



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.

NOTE TO SPECIFIER

Edit paragraph below based on Contracting Officer's selection of roofing inspections and/or manufacturer's warranty.

- B. Verification of Conditions: Verify, with [Third-Party Roofing Inspector] [Full-time Third-Party Roofing Inspector] [Manufacturer's Quality Control Inspector] present, that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
1. Verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains, valleys, and eaves. Verify flutes of steel deck are evenly spaced at intersections.
 2. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, and nailing strips, and reglets are in place. Verify deck is supported and tightly secured.
 3. Verify deck surfaces are dry and free of water, snow, and ice.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Provide covers and other means of protection as necessary to protect building surfaces against damage during roofing work.
- B. Where work shall continue over finished roof membrane, protect surfaces according to roofing membrane manufacturer's recommendations.

3.3 ROOF INSULATION INSTALLATION

NOTE TO SPECIFIER

INSULATION ATTACHMENT OPTION 1, Mechanically attached insulation assemblies: Include the paragraphs below if the Specifier chooses mechanically attached insulation.

- A. Lay insulation boards to moderate contact without forcing joints. Cut insulation to fit neatly to perimeter blocking and around protrusions through roof.
1. Gaps between insulation boards, nailers and penetrations of 1/4 inch (0.64 cm) or greater are not acceptable.
- B. Place roof crickets and tapered thickness insulation to the required slope pattern in accordance with manufacturer's published instructions.
- C. Mechanically Attached Installation:



1. Maximum insulation board dimension is 4' x 8'
2. Place long edge of boards parallel to deck flutes, forming joint over solid bearing. Lay first layer insulation units with long edge joints continuous and end joints staggered.
3. Lay second and subsequent layers of insulation with both long side and end joints offset 6 inches (15 cm) from joints below.
4. Factory primed glass mat gypsum board and overlayered insulation may be loose laid and fastened with the same insulation fastener and plate in accordance with manufacturer's approved assembly. Fastener and plate must be approved by the roof system manufacturer and installed at the required density to achieve the specified FMG [1A]-[90][105][120] system, in accordance with requirements of FMG Loss Prevention Data Sheet 1-29 for specified wind uplift requirements.

D. Apply no more insulation than can be waterproofed with roofing membrane in same day.

E. Mechanically attach a single layer of insulation to manufactured metal curbs.

NOTE TO SPECIFIER

INSULATION ATTACHMENT OPTION 2, Adhered insulation assemblies: Include the paragraphs below if the Specifier chooses adhered insulation.

- A. Lay insulation boards to moderate contact without forcing joints. Cut insulation to fit neatly to perimeter blocking and around protrusions through roof.
 1. Gaps between insulation boards, nailers and penetrations of 1/4 inch (0.64 cm) or greater are not acceptable.
- B. Place roof crickets and tapered thickness insulation to the required slope pattern in accordance with manufacturer's published instructions.
- C. Adhered Installation:
 1. 4-foot x 4-foot maximum board size for insulation boards adhered to a substrate including successive layers.
 2. Lay second and subsequent layers of insulation so that the insulation board's joints are staggered vertically and offset from the underlying layers.
 3. Factory primed glass mat gypsum board and overlayered insulation shall be adhered in accordance with the manufacture's recommendations and submitted FM assembly number to achieve the specified FMG [1A]-[90][105][120] system, in accordance with requirements of FMG Loss Prevention Data Sheet 1-29 for specified wind uplift requirements.
- D. Apply no more insulation than can be waterproofed with roofing membrane in same day.
- E. Mechanically attach a single layer of insulation to manufactured metal curbs.

3.4 ROOFING MEMBRANE APPLICATION

- A. Apply roofing membrane in accordance with membrane manufacturer's published instructions for specified system.
- B. All quality control recommendations of the roofing system manufacturer shall be strictly followed.
- C. Cold Weather Application Procedures: When air temperature is expected to fall below 40 degrees F, follow Cold Weather Application Procedures as follows:
 1. Store flashing adhesive in heated storage units (minimum temperature 40 degrees F) prior to installation.



2. Follow roofing membrane manufacturer's recommendation for cold weather application of adhered field sheets, corner & perimeter area, and flashings.

3.5 WATER CUTOFFS AND WEATHER PROTECTION

- A. Install water cut-offs according to roofing membrane manufacturer's recommendations at end of day's operation to seal insulation and edge of roof membrane from moisture entry. If rain or foul weather appears imminent during roofing application, cease operations and protect deck, insulation, flashings, penetrations and membrane from moisture intrusion and damage with water cutoffs. Insulation and roofing materials not so protected before rain are considered damaged materials and will be rejected.
- B. Water cut-offs over steel deck must include steel deck flute plugs to prevent moisture from getting under insulation.
- C. Remove water cut-offs and other temporary weather protections prior to continuing roofing work. Remove materials that have been subject to moisture damage and return deck to clean, dry condition before proceeding with roofing operations. Remove damaged materials from job site.
- D. Water cut-offs and weather protection shall not be considered part of final roof system specified.

3.6 FLASHING MEMBRANE AND ACCESSORIES

- A. Field membrane shall be terminated with fasteners and plates. Flashing membrane, mechanically attached or adhered, shall be extended past the termination of the field membrane and hot air welded on the horizontal plane.
- B. Roof Penetrations:
 1. Prefabricated pipe flashings shall be installed where the configuration of penetration will permit, including but not limited to electrical conduit, and plumbing vents.
 2. Field fabrication of flashing shall be used where the configuration of the penetration prohibits the use of prefabricated flashing.
- C. Fasten membrane and flashing terminations per roofing membrane manufacturer's recommendations.
- D. Walkway Pads: Weld walkways to roofing membrane per manufacturer's recommendation.

3.7 ROOF SURFACING

- A. No field-applied surfacing shall be utilized with this roofing system.

3.8 CONSTRUCTION

- A. Interface with Other Work:
 1. Coordinate Work with installation of associated metal counterflashings as Work of this Section proceeds.
 2. Complete installation of base flashing at roof curbs prior to setting roof top equipment.
 3. Coordinate Work with Plumbing for roof drain(s) installation.

3.9 FIELD QUALITY CONTROL

- A. Section 014000 -Quality Requirements: Field inspection.



NOTE TO SPECIFIER

WARRANTY OPTION 1, Part-Time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 1, Part-Time Third-Party inspections.

B. Field Services: Third-Party Roofing Inspector.

1. Attend and conduct Pre-installation Meeting.
2. Perform preparatory, initial, follow-up and final inspections for roof insulation and roofing system.
3. Prepare and submit inspection reports for each inspection made.

NOTE TO SPECIFIER

WARRANTY OPTION 2, Full-time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 2, Full-time Third-Party inspections.

C. Field Services: Full-time Third-Party Roofing Inspector.

1. Attend and conduct Pre-installation Meeting.
2. Perform full-time inspections for roof insulation and roofing system.
3. Prepare and submit inspection reports for each inspection made.

NOTE TO SPECIFIER

OPTION 3, Manufacturer's warranty: Include the paragraphs below if Contracting Officer mandates OPTION 3, Manufacturer's warranty or if the Contracting Officer mandates Option 1 of Option 2 and also chooses the optional manufacturer's warranty.

D. Manufacturer's Field Services: Manufacturer's Roofing Quality Control Inspector.

1. Attend and conduct Pre-installation Meeting.
2. Perform preparatory, initial, follow-up and final inspections for roof insulation and roofing system.
3. Prepare and submit inspection reports for each inspection made.

NOTE TO SPECIFIER

End Manufacturer's warranty

E. Maintenance Instruction

1. Provide on-site instruction to review the components of the system and detail any common troubleshooting or maintenance that is required to ensure normal performance of the roofing system.
2. Provide one complete set of installation details and component manuals that will remain at the installed location.

3.10 CLEANING

- A. Section 017300 - Execution: Requirements for cleaning.
- B. Remove dirt, debris, and markings from finished surfaces. In areas where finished surfaces are soiled, consult roofing membrane manufacturer for cleaning advice and comply with their instruction.
- C. Replace defaced or disfigured finishes caused by Work of this Section.

3.11 PROTECTION



- A. Where construction traffic must continue over finished roof installation, protect surfaces in manner recommended by roofing system manufacturer to protect Manufacturer's Warranty.

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Last revised: 4/19/2011

END OF SECTION 07 54 19 00



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SECTION 07 54 20 00 - R&A FULLY-ADHERED PVC ROOFING

NOTE TO SPECIFIER

This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this section where fully-adhered PVC (Polyvinyl Chloride) roofing membrane is selected as the roofing system in a roof replacement application. Per the United States Postal Service Roofing Design Standard, fully-adhered 80-mil PVC roofing is recommended for facilities with a "Critical" building designation, and is acceptable for use at facilities with a "Non-Critical" building designation. Fully-adhered 60-mil PVC roofing is recommended for use at facilities with a "Non-Critical" building designation, but is not acceptable at facilities with a "Critical" building designation.

NOTE TO SPECIFIER

Section Formatting:

Consistent formatting of Sections gives the complete document a professional look. This Section uses a 10pt. Arial font, and is formatted as follows:

1. *Insert one 10pt. line after the Section Number. Section Number is in CAPS.*
2. *Insert two 10pt. lines after the Section Title. Section Title is in CAPS.*
3. *Insert one 10pt. line after a PART. PARTS are in CAPS. If a Section is not used, include NOT USED following the PART title as shown below.*
4. *Insert one 10pt. line after Article paragraphs. Articles are in CAPS.*
5. *Insert two 10pt. lines at the end of an Article.*
6. *Complete Section with END OF SETION.*
7. *No lines should be placed between paragraphs and sub-paragraphs, or between sub-paragraphs and other sub-paragraphs.*

Example:

Section Number

Section Title

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION



NOT USED

Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to the installation of fully-adhered polyvinyl chloride (PVC) roofing membrane and flashings, related accessories, and warranty and guarantee requirements.

NOTE TO SPECIFIER

Review available field data. For roof areas consisting of an underlying concrete, gypsum concrete, cementitious wood fiber, and/or lightweight insulating concrete structural deck, include Section 072221 – Insulation and Cover Board over Underlayment within 1.2 RELATED SECTIONS below. For roof areas consisting of an underlying steel and/or wood deck, include Section 072223 – Roof Insulation and Cover Board over Steel and Wood Deck within the 1.2 RELATED SECTIONS below. For projects containing structural deck types applicable to both Sections 072221 and 072223, include both Sections. Re-letter paragraphs and sub-paragraphs after editing.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 024100 – Roof Removal and Substrate Preparation
- D. Section 061053 – Miscellaneous Rough Carpentry for Roof Replacement
- E. Section 072221 – Roof Insulation and Cover Board over Underlayment
- F. Section 072223 – Roof Insulation and Cover Board over Steel and Wood Roof Decks
- G. Section 076207 – Sheet Metal for PVC Roofing
- H. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

NOTE TO SPECIFIER

Per discussions between the designer and USPS Project Manager, determine the warranty requirements for the project. Choose from the following warranty options and actions:

1. *If an alternate price for a 20-year "Total System Warranty" is specified, Leave Article 1.3 unchanged.*
2. *If a 20-year "Total System Warranty" will be included in the base proposal, or if no warranty is specified, remove Article 1.3.*

Re-letter/number items after editing.

1.3 ALTERNATES

- A. Provide an alternate price for the 20-Year Total System Warranty described in Item 1.9A.

1.4 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 - 1. American Society for Testing and Materials (ASTM)
 - a. ASTM D 4434 - Standard Specification for Polyvinyl Chloride (PVC) Sheet Roofing
 - 2. Factory Mutual Global (FM)
 - 3. Underwriters Laboratories (UL)
 - 4. National Roofing Contractors Association (NRCA)
 - 5. American Society of Civil Engineers (ASCE)
 - a. ASCE 7 Minimum Design Loads of Buildings and Other Structures

1.5 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.6 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.



- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
 - 1. NOTE: Do not install PVC roofing at temperatures below 40°F (5°C).
 - 2. When the outside temperature is forecast to fall below 40°F (5°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives, primers and pressure-sensitive flashings should be maintained at a temperature of 40°F (5°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 - 3. After unrolling the PVC membrane, allow the membrane additional time to relax.
 - 4. Be aware of potential condensation formation on the PVC roof surface during application/flash-off of adhesives and primer. Remove condensation using a heat gun prior to adhesion to the insulation or cover board substrate. Do not use an open flame to remove condensation from the roof membrane or flashing materials.
 - 5. Refer to the PVC roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

NOTE TO SPECIFIER

Per discussions between the designer and USPS Project Manager, determine the warranty requirements for the project. Choose from the following warranty options and actions:

- 1. *If an alternate price for a 20-year "Total System, Non-Pro-Rated Warranty" is specified, do not edit paragraph 1.9A.*
- 2. *If a 20-year "Total System, Non-Pro-Rated Warranty" will be included in the base proposal, DELETE "an alternate price for" from paragraph 1.9A.*
- 3. *If no warranty is specified, EDIT the title of Article 1.9 (DELETE the words "MANUFACTURER WARRANTY AND"), and DELETE paragraph 1.9A. The two-year contractor guarantee shall remain in place.*

Re-letter/number paragraphs and sub-paragraphs after editing.

1.9 MANUFACTURER WARRANTY AND CONTRACTOR GUARANTEE

- A. Provide an alternate price for a manufacturer 20-Year Total System, Non-Pro-Rated Warranty (including insulation, roofing membrane, and flashings) covering materials and labor. The warranty shall include the following additional items:



1. The warranty shall include a wind rider for the design wind speed at the specific project location.
 2. Roofing inspection by a technical representative of the roofing membrane manufacturer 22-24 months after date of Final Acceptance.
 3. Roofing manufacturer will provide unlimited repairs during warranty period with no cost limitation.
 4. Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions.
 5. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Record Fully-Adhered PVC Roofing for Roof Replacement Specification Section to Warranty.
- B. The Contractor shall provide a two-year contractor guarantee. At a minimum, the contractor guarantee shall include the following:
1. Contractor name, address, phone number and project contact name.
 2. The project completion date, and date of guarantee expiration.
 3. The contractor guarantee shall include, in writing, all project work, workmanship, and/or all materials installed by the contractor or subcontractors to be of a quality that will comply with all project specific requirements of the Construction Documents and other documents governing the Work and workmanship through the guarantee period.
 4. The contractor shall investigate roof leaks during the guarantee period within a reasonable time period, but in no instance greater than 24-hours after notification of a leak. The contractor shall repair leaks determined to be the cause of the Work at no cost to the Owner.

PART 2 – PRODUCTS

2.1 PVC ROOFING SYSTEM SUMMARY

- A. The complete roofing membrane system assembly shall consist of products meeting or exceeding the requirements listed in Items 2.2.

NOTE TO SPECIFIER

NOTE: In high wind areas, such as those with a calculated wind uplift pressure of greater than 45 psf in the roof field, enhancements to the roof system may be required and must be considered by the design professional/specifier. Consult with the roofing membrane manufacturer and qualified testing agencies such as FM and Miami-Dade County for further information and guidance related to possible roof system enhancements in high wind areas.

- B. The complete roofing system assembly shall resist uplift pressures calculated according to ASCE 7-05 for the field, perimeters and corners. The specified approval rating must incorporate a safety factor of 2 over the maximum calculated uplift pressure in foot-pound units.
- C. The complete roofing system assembly shall achieve an FM or UL Class A fire rating.

NOTE TO SPECIFIER

Per discussions between the designer and USPS Project Manager, determine the PVC roofing membrane mil thickness required for the project. EDIT paragraph 2.2A below to reflect the specified thickness.

2.2 ROOFING AND FLASHING MEMBRANE

- A. PVC roofing and flashing membrane; fire resistant, fiberglass-reinforced, minimum 80-mil thickness, white color; in full compliance with all requirements of ASTM D 4434, Type II or Type



III, white color. The selected membrane shall meet the following additional criteria:

1. The selected membrane shall meet the DOE requirements for Initial Solar Reflectance.
- B. PVC flashing detail membrane and sheets (For use at roof penetrations):
1. PVC membrane, minimum 60-mil or 80-mil thickness, white color.

2.3 PVC MEMBRANE PERIMETER REINFORCEMENT AND FLASHING

- A. For use where required at roof perimeters and vertical (wall and curb) transitions:
1. Perimeter and vertical wall securement systems, including anchor bars, fastening plates, and related fasteners, as required by roofing membrane manufacturer.
- B. For use as perimeter edge metal strip-in flashing:
1. Flashing strip material; as required by roofing membrane manufacturer.

2.4 PVC MEMBRANE SEAM INTERSECTION AND CORNER REINFORCEMENT

- A. For use at seam intersections and other locations required by the roofing manufacturer:
1. At field seam and "T-Joint" intersections: PVC membrane patch, approved by the roofing membrane manufacturer for use at locations encountered, fiberglass reinforced; 48-mil thickness, white color.
- B. For use at inside and outside corner reinforcement:
1. Preformed or sheet flashing reinforcement products manufactured by roofing membrane manufacturer.

2.5 RELATED PVC PRODUCTS

- A. Adhesives, primers, cements, sealants, water cut-off mastics, prefabricated accessories, and other related items: Unless otherwise indicated, products manufactured by, or approved by the roofing membrane manufacturer.
- B. Prefabricated flashing boots: Product type manufactured by, and approved by the roofing membrane manufacturer for the roof penetration encountered.

2.6 FASTENERS

- A. Roofing membrane and flashing fasteners: Unless otherwise indicated, types as required by the roofing membrane manufacturer.

2.7 MISCELLANEOUS MATERIALS

- A. Walkway pads: Product approved by the roofing manufacturer.
- B. Splashblocks: Concrete; size as necessary to accommodate existing condition.
- C. Pitch pan fill materials:
1. Non-shrink grout (for bottom fill): Quick-set, fast-drying grout; product acceptable to roofing manufacturer.



2. Pourable sealer (for top fill): Two-part pourable elastomeric sealer, product acceptable to roofing manufacturer.
- D. Conduit and pipe supports:
1. For pipes with a diameter up to 6-inches:
 - a. Adjustable prefabricated support such as Pipe Pier 150 manufactured by Pipe Pier Support Systems, Hamel, MN, or approved equal.
 - b. Product approved by the roofing manufacturer for this application.
 - c. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
 2. For pipes with a diameter greater than 6-inches:
 - a. Product approved by the roofing manufacturer for this application.
 - b. Product capable of accommodating the weight of the supported pipe at intervals recommended by the pipe support manufacturer.
- E. Pre-fabricated plumbing vent pipe extensions:
1. For use where necessary to achieve the 8-inch minimum flashing height:
 - a. Pre-fabricated plumbing vent extensions, such as Tubos Pre-Fabricated Pipe Extension, by Tubos, Inc., Clearwater, FL.
 - b. Product approved by the roofing manufacturer for this application.
 - c. Size and configuration of extension as necessary to match existing pipe diameter, providing the 8-inch minimum flashing height, and allowing for flashing as show on the drawings.
- F. Replacement roof hatch:
1. Roof hatch, such as "Type E" or "Type S", manufactured by The Bilco Company, New Haven, CT, or approved equal.
 - a. Size and configuration as necessary to match existing roof hatch.
 - b. Product approved by the roofing manufacturer for this application.
- G. Extendable ladder-mounted safety post, such as "LadderUP Safety Post", manufactured by The Bilco Company, New Haven, CT, or approved equal.
1. Size and configuration as necessary to accommodate existing ladder and new roof hatch.
 2. Product approved by the roofing manufacturer for this application.
- H. Acrylic elastomeric coating (for use at roof penetrations and other locations indicated on the project drawings). Product approved for use by the membrane manufacturer for this application, and meeting the following criteria:
1. Meeting the requirements of ASTM D 6083.
 2. White color.
- I. Rooftop unit support curbs: Product such as "Pate Equipment Supports" manufactured by The Pate Company, Lombard, IL, or approved equal.
1. Size and configuration as necessary to accommodate existing rooftop unit.
 2. Fabricated from 18 ga. galvanized steel, minimum, with welded seams; and a nominal 2-inch thick nailer affixed atop the curb support.
 3. Fabricated to allow for a minimum flashing height of 8-inches, minimum.
 4. Product approved by the roofing manufacturer for this application.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.



NOTE TO SPECIFIER

Review available field data. For roof areas consisting of an underlying concrete, gypsum concrete or cementitious wood fiber structural deck, include Section 072221 within paragraph 3.1B below. For roof areas consisting of an underlying steel or wood deck, include Section 072223 within paragraph 3.1B below. For projects containing structural deck types applicable to both Sections 072221 and 072223, include both Sections.

- B. Ensure that the insulation and cover board substrate is installed as specified in Sections 072221 and 072223 are suitable to receive roofing membrane materials.

3.2 ROOFING MEMBRANE INSTALLATION

- A. Except as may be modified by these specifications and drawings, install roofing membrane in accordance with the requirements and recommendations of the roofing membrane manufacturer, using the manufacturer's current printed instructions.
- B. Do not use asphalt, coal tar pitch, plastic roof cement in conjunction with PVC materials.
- C. All membrane splicing and bonding surfaces must be clean and dry.
- D. Install only as much roofing as can be completed in a work day, including flashing and detail work. All installed field seams shall be sealed to a watertight condition prior to leaving the site daily.
- E. Sequence roofing work to eliminate the use of installed roofing as a walkway, or as a storage platform for materials.
- F. Overnight tie-in: Care should be exercised to ensure that water does not flow beneath any completed sections of the roof by temporarily sealing the loose edge of the membrane at the end of each work day and when the weather is threatening. The roofing membrane manufacturer's requirements should be followed closely.
- G. Remove debris from the roof daily prior to leaving the site. Inspect the site at ground level. Remove any roof replacement related debris from the ground.
- H. Do not use any open flame to dry the roof membrane or to heat the flashing materials.

3.3 FLASHINGS AND STRIPPINGS

- A. Complete all flashings on a daily basis as the roof system work progresses.
- B. Lap splice flashing:
 - 1. Hot air-weld field seams in accordance with roofing membrane manufacturer requirements.
- C. Wall and curb flashings: Install flashings as indicated on drawings and in accordance with the requirements and recommendations of the roofing membrane manufacturer.
 - 1. Follow manufacturer-generated details for flashing requirements at inside (90-degree) and outside (270-degree) corners of curbs and walls.
- D. Tubular penetration flashings:
 - 1. Finished tubular penetration flashings shall be a minimum of 8-inches above the finished roof membrane elevation.



2. Install field-fabricated flashing at all tubular penetrations.
 - a. Install flashings as indicated on the drawings.
- E. Pitch pan flashings:
 1. Install flashing at all pitch pan penetrations. Refer to Section 075207 for pitch pan fabrication requirements.
 - a. Install flashings as indicated on the drawings.
- F. Sheet metal flange strippings:
 1. Install flashing at perimeter edge metal flanges. Refer to Section 075207 for perimeter edge metal fabrication requirements.
 - a. Install strippings as indicated on the drawings.
- G. Follow the additional requirements and recommendations of the roofing membrane manufacturer regarding flashing product installation.

3.4 MISCELLANEOUS INSTALLATIONS/TREATMENTS

- A. Return mechanical ventilator units to their original positions and secure to the existing curbs with EPDM-gasketed screws. Provide a minimum of one fastener on each side of the curb and a minimum of one fastener every 12-inches o.c.
- B. Reconnect all electrical, plumbing, gas line and ventilation connections required to return mechanical units to their original operating condition. Retain a qualified, licensed electrical subcontractor to reconnect electrical equipment. Retain a qualified, licensed mechanical subcontractor to reconnect gas lines and ventilation connections. Coordinate required disconnections and reconnections with the Owner.
- C. Walkway pads: Install walkway pads at locations indicated on drawings. Install the pads in accordance with the requirements and recommendations of the roofing manufacturer. Extend the pads a minimum of 4-inches in all directions beyond wood blocking.
- D. Install splashblocks set on walkpads at locations indicated on the drawings.
- E. Rooftop conduit and pipe supports:
 1. Install adjustable prefabricated pipe supports at rooftop conduit and pipes.
 2. Space pipe supports at intervals recommended by the support manufacturer, as determined by the diameter and weight of the conduit or pipe.
 3. Separate the support from the roof surface by installing the support over roof walkway pads, installed as specified.
- F. Pre-fabricated plumbing vent pipe extensions:
 1. Refer to manufacturer requirements and recommendations for installation.
 2. Prior to flashing installation, seal intersection of pipe extension and existing plumbing vent.
- G. Replacement roof hatch installation:
 1. Remove and discard existing roof hatch.
 2. Provide wood nailers beneath roof hatch flanges, if necessary, to match insulation thickness.
 3. Install new roof hatch following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- H. Extendable safety post installation:



1. Install new safety post following the written instructions, recommendations, and requirements of the roof hatch manufacturer.
- I. Application of elastomeric coating to rooftop penetrations:
 1. Prepare substrate in a manner that is acceptable to the coating manufacturer. Substrate preparation includes, but is not limited to: treatment of excessive gaps, repair of damaged or loose sheet metal components, repair of holes, cleaning of roof penetrations, treatment of surface rust, treatment of residual asphalt, and priming (if required by the roof coating manufacturer).
 2. Coat the indicated penetrations following the recommendations and requirements of the coating manufacturer.
- J. Installation of equipment support curbs:
 1. Install support curbs where indicated on the project drawings. Flash curbs into the roof system as indicated on the project drawings.
 2. Refer to manufacturer requirements and recommendations for installation.

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Last revised: 3/6/2013

NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 54 20 00



SECTION 07 54 23 00 - MPF THERMOPLASTIC-POLYOLEFIN ROOFING

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification.

NOTE TO SPECIFIER

Use this section for where Fully Adhered TPO membrane Roofing is selected as the roofing system. EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.07 54 23 00

NOTE TO SPECIFIER

This roofing section includes three (3) options regarding inspections and /or warranty; two (2) options regarding insulation type; and two (2) options regarding insulation system attachment.

The Contracting Officer (CO) must provide direction to the Specifier on which one of the warranty options will be selected for this project. After receiving direction from the CO, the Specifier must edit the warranty sections to ensure that this option is consistently applied throughout.

The warranty options are:

WARRANTY OPTION 1, Part-Time Third-Party Inspections: these are to be provided at construction milestones as listed below. A manufacturer's warranty is optional. The Contracting Officer may choose to mandate Part-Time Third Party Inspections AND mandate manufacturer's warranty.

WARRANTY OPTION 2, Full-time Third-Party inspections: an inspector is to be continuously present during the entire period of roofing installation. A manufacturer's warranty is optional. The Contracting Officer may choose to mandate Full-Time Third Party Inspections AND mandate manufacturer's warranty.

WARRANTY OPTION 3, Manufacturer's Warranty: this option requires a warranty from the manufacturer. Inspections are to be provided by the manufacturer at the milestones listed below or as necessary to meet manufacturer's requirements.

There are two (2) options regarding primary roof insulation type. The Specifier must provide direction on which one of the options will be selected for this project. The Specifier must edit the section to ensure that this option is consistently applied throughout the section. Note that facilities with a metal roof deck are most conducive to Polyisocyanurate insulation due to the fact that a thermal barrier is not required under the insulation in order to maintain the systems fire rating (Use of XPS over a metal deck would require a thermal barrier under the insulation assembly if selected). Concrete roof decks can utilize Extruded Polystyrene Insulation attached directly to the prepared roof deck without the need for a thermal barrier. The Specifier shall determine the insulation type based on existing construction; building code review; and cost analysis. The insulation type options are:

INSULATION Type OPTION 1, Polyisocyanurate.

INSULATION Type OPTION 2, Extruded Polystyrene.

There are two (2) options regarding insulation attachment. The Specifier must provide direction on which one of the options will be selected for this project. The Specifier must edit the section to ensure that this option is consistently applied throughout the section. Note that facilities with a metal roof deck are most conducive to mechanical attachment of the insulation assembly. Facilities with concrete roof decks are most conducive to adhered attachment of the insulation assembly. The specifier shall determine the insulation type based on existing construction; building code review; and cost analysis. The insulation attachment options are:

INSULATION Attachment OPTION 1, Mechanically attached.

INSULATION Attachment OPTION 2, Adhered.



PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparation of roof deck to receive roofing membrane.
2. Vapor/Air retarder. [Specifier to make determination of use and location within the system based on facility conditions and general environment]
3. [Mechanically fastened] [Adhesively Applied] Roof insulation and Glass mat gypsum board.
4. Fully Adhered TPO membrane roofing system.
5. Flashing membrane.
6. Accessories.
7. Edge metal.
8. [Warranty]

B. Related Documents:

1. The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section.
2. Memorandum of Understanding (MOU) between the United States Environmental Protection Agency's ENERGY STAR® Roof Products Program and Roofing Material Manufacturers.
3. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

C. Related Sections:

1. Section 061000 - Rough Carpentry: Wood blocking, curbs, and nailers.
2. Section 077213 - Manufactured Curbs: Curbs for roof penetrations.
3. Section 077233 - Roof Hatches: Hatch with integral curb.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM C208 - Specification for Cellulosic Fiber Insulating Board.
2. ASTM C1177 - Standard Specification for Glass Mat Gypsum Roof Board.
3. ASTM C1289 - Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
4. ASTM D570 - Test Method for Water Absorption of Plastics.
5. ASTM D638 - Test Method for Tensile Properties of Plastics.
6. ASTM D751 - Test Method for Coated Fabrics.
7. ASTM D1004 - Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
8. ASTM D1079 - Terminology Relating to Roofing and Waterproofing.
9. ASTM D1204 - Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature.
10. ASTM D2136 - Test Method for Coated Fabrics – Low Temperature Bend Test.
11. ASTM D3045 - Practice for Heat Aging of Plastics Without Load.
12. ASTM D6878 - Specification for Thermoplastic Polyolefin Based Sheet Roofing. (Most Recent Edition)
13. ASTM D5602 - Test Method for Static Puncture Resistance of Roofing Membrane Samples.
14. ASTM D5635 - Test Method for Dynamic Puncture Resistance of Roofing Membrane Samples.
15. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.



16. ASTM E96 - Test Methods for Water Vapor Transmission of Materials.
17. ASTM E108 - Test Methods for Fire Tests of Roof Coverings.
18. ASTM E903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmission of Materials Using Integrating Spheres.
19. ASTM G21 - Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
20. ASTM G26 - Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials.
21. ASTM G53 - Practice for Operating Light- and Water – Exposure Apparatus (Fluorescent UV/Condensation Type) for Exposure of Nonmetallic Materials.

B. Factory Mutual Global (FMG):

1. FMG – RoofNav – Internet Based FM Roof Assembly Testing and Approvals Database
2. FMG - Approval Guide, Building Materials.
3. FMG - Loss Prevention Data 1-28, Wind Loads to Roof Systems and Roof Deck Securement.
4. FMG - Loss Prevention Data 1-29, Above Deck Roof Components (June 1996).
5. FMG - Standard 4450, Class 1 Insulated Steel Deck Roofs.
6. FMG - Standard 4470, Class 1 Roof Covers.

C. Underwriters Laboratory (UL):

1. Class A rated roofing system
2. Recycled Content Certification
 - a. Manufacturer's membrane product recycled content to be validated by UL Environmental (ULE)

1.3 SYSTEM DESCRIPTION

- A. ENERGY STAR® Compliant Fully Adhered TPO Membrane Roofing System on Factory Primed Glass Mat Gypsum Roof Board on overlayed insulation secured to (metal or concrete) deck.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals

1. Product Data:
 - a. FM RoofNav Assembly Number certifying proposed roof system has been tested and approved by FMG for the specified FM[1-90] [1-105] [1-120] rating.
 - b. Membrane materials, base flashing, vapor retarder, [fastener & plate,] adhesive materials, edge metal and insulation.
 - c. [Insulation fastener layouts complying with FMG Loss Prevention Data Sheet 1-29 patterns for specified wind uplift resistance. Indicate number of insulation fasteners required and spacing of fasteners for field, perimeter, and corners for each pattern.] [Adhesively applied insulation coverage rates and layout must comply with the proposed FM RoofNav assembly number and adhesive application rates relative to that assembly. Indicate insulation adhesive application rates required and the coverage/ribbon spacing of adhesive for field, perimeter, and corners for each pattern. Insulation adhesion rates and coverage/ribbon spacing submissions must also be inclusive of the roof system manufacturer's instructions, including cold weather installation instructions and are required for approval prior to job start.]
 - d. Adhered membrane adhesive and application rates for adhering membrane roof to the overlayed insulation system with coverboard. Membrane adhesive shall be installed in compliance with roof membrane system manufacturer's FM RoofNav assembly approval number and all of the manufacturer's instructions including cold weather installation instructions of the proposed shall be required for approval prior to job start.
2. Shop Drawings: Indicate setting plan for insulation including fastener pattern, layout of roofing seams, direction of laps and base flashing details.
3. Assurance/Control Submittals:



- a. Certificates: Manufacturer is to certify that components and products meet or exceed specified standards and complies with referenced quality assurance standards in section 1.5 including the FM RoofNav assembly number.
- b. Qualification Documentation: Manufacturer certification indicating roofing applicator qualifications complying with requirements specified in Paragraph entitled "Applicator Qualifications" of this Section.

NOTE TO SPECIFIER

WARRANTY OPTION 1, Part-Time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 1, Part-Time Third-Party inspections.

- c. Field Quality Control Reports: Submit the following reports directly to Contracting Officer from the Third-Party Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
 - 1) Preparatory inspection.
 - 2) Initial inspection.
 - 3) Follow-up inspections.
 - 4) Final inspection.
 - 5) Maintenance Instruction: Document training by furnishing a sign-in sheet with a description of the training provided, instructors name and organization, and those who received training. Refer to 017704 1.3, 1.4, and 1.5 for more specific training requirements.

NOTE TO SPECIFIER

WARRANTY OPTION 2, Full-time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 2, Full-time Third-Party inspections.

- d. Field Quality Control Reports: Submit daily reports directly to Contracting Officer from the Full-time Third-Party Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements.
- e. Maintenance Instruction: Document training by furnishing a sign-in sheet with a description of the training provided, instructors name and organization, and those who received training. Refer to 017704 1.3, 1.4, and 1.5 for more specific training requirements.

NOTE TO SPECIFIER

Include the paragraphs below if Contracting Officer mandates a Manufacturer's warranty. Delete the paragraphs below if the Contracting Officer chooses to have Part-Time or Full Time Third Party inspections and No Warranty.

- f. Sample of specified Warranty
- g. Manufacturer's certification letter acknowledging receipt of specifications, intent to issue warranty, and intent to perform field audits as outlined in 1.4.3.d.
- h. Manufacturer's Field Reports: Submit the following reports directly to Contracting Officer from Manufacturer's Roofing Quality Control Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
 - 1) Preparatory inspection.
 - 2) Initial inspection.
 - 3) Follow-up inspections.
 - 4) Final inspection.

NOTE TO SPECIFIER

End of WARRANTY OPTION



- i. Written certification or product data sheet attesting that proposed roofing membrane meets the EPA ENERGY STAR® Roof Products Program specification for energy efficiency and that the manufacturer is listed as a Partner.
4. Maintenance Instruction: Document training by furnishing a sign-in sheet with a description of the training provided, instructors name and organization and those who received training. Refer to 017704 1.3, 1.4, and 1.5 for more specific training requirements.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in TPO membrane roof application with minimum of 5 years documented experience and that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product, and that is eligible to receive a manufacturer's warranty.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by membrane manufacturer for specified roofing system and shall be in compliance with all applicable regulatory requirements.
- C. FMG Listing: Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system and that are listed in the most recent FMG "RoofNav" on-line directory or FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

NOTE TO SPECIFIER

90 pounds per square foot wind uplift minimum. Design roofing and insulation system to comply with regional requirements and special regulations of local authority having jurisdiction. Verify with USPS Contracting Officer. Contact Roofing System Manufacturer for information about 120 or 150 or greater pounds per square foot of uplift resistance.

NOTE TO SPECIFIER

Edit "Class" in the following paragraph for project's fire resistance and wind uplift resistance requirements. Verify availability of roofing systems that meet these classifications. "Class 1A" signifies meeting ASTM E 108, Class A fire performance for FMG-approved Class 1 roof covers. For areas having three or more hailstorms annually, FMG recommends roofing systems rated SH (severe hail) instead of MH (moderate hail).

1. Fire/Windstorm Classification: Class 1A- [90] [105] [120] <Insert number>.
2. Hail Resistance: [MH] [SH].

- D. Pre-installation Meeting:
 1. Convene a Pre-installation Meeting at Project Site one week prior to commencing work of this Section.
 2. Require attendance of parties directly affecting work of this Section.
 3. Review preparation and installation procedures and coordinating and scheduling required with related work.

NOTE TO SPECIFIER

WARRANTY OPTION 1, Part-Time Third-Party Inspections: Include the paragraph below if Contracting Officer mandates WARRANTY OPTION 1, Part-Time Third-Party inspections.

- a. Require the Third-Party Roofing Inspector to conduct Pre-installation Meeting along with Contractor Quality Control Representative and Contracting Officer.

NOTE TO SPECIFIER



WARRANTY OPTION 2, Full-time Third-Party Inspections: Include the paragraph below if Contracting Officer mandates WARRANTY OPTION 2, Full-time Third-Party inspections.

- b. Require the Full-time Third-Party Roofing Inspector to conduct Pre-installation Meeting along with Contractor Quality Control Representative and Contracting Officer.

NOTE TO SPECIFIER

Include the paragraph below if Contracting Officer mandates a Manufacturer's warranty.

- c. Require Manufacturer's Roofing Quality Control Inspector to conduct Pre-installation Meeting along with Contractor Quality Control Representative and Contracting Officer.

NOTE TO SPECIFIER

End of WARRANTY OPTION

- 4. Agenda:
 - a. Tour, inspect and discuss condition of substrate, roof drains, roof drain final locations, curbs, penetrations and other preparatory work performed by other trades.
 - b. Review structural loading limitations of deck and inspect deck for loss of flatness and for required mechanical fastening.
 - c. Review roofing system requirements (Drawings, Specifications and other Contract Documents).
 - d. Review required submittals, both completed and yet to be completed.
 - e. Review and finalize construction schedule related to roofing work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
 - f. Review requirements for inspections, testing, certifying, and material usage accounting procedures.
 - g. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions, including possibility of temporary roofing.
 - h. Review safety precautions relating to roofing installation.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Deliver materials in manufacturer's original unopened containers or wrappings, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Protect foam insulation from direct sunlight exposure.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.7 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements:
 - 1. Do not apply roofing membrane during inclement weather. When air temperature is expected to fall below 40 degrees F, follow submitted roof system manufacturer's specified Cold Weather Application Procedures.
 - 2. Do not apply roofing membrane to wet, damp or frozen deck surface or when precipitation is occurring.



3. Do not expose materials vulnerable to water or the sun in quantities greater than can be weatherproofed during same day.

NOTE TO SPECIFIER

Manufacturer's warranty: Include the paragraphs below if Contracting Officer mandates a Manufacturer's warranty.

1.8 WARRANTY

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Special Warranty:
1. Submit written warranty, without monetary limitation, signed by roofing system manufacturer agreeing to promptly repair leaks in roof membrane and base flashings resulting from defects in materials and workmanship.
 2. Warranty shall not exclude "ponding" water.
 3. Warranty Period: [20] [____] years.
 4. Include materials and workmanship for all manufacturer's supplied roofing components including but not limited to:
 - a. Membranes.
 - b. Flashings, including edge metal, metal flashings and accessories supplied by roofing membrane manufacturer.
 - c. Insulation.
 - d. Fasteners.
 - e. Adhesives.
 - f. Vapor / Air Retarder
 5. Include the following items within Warranty:
 - a. Roofing inspection by Manufacturer's Roofing Quality Control Inspector between 22 and 24 months after date of Final Acceptance.
 - b. Roofing manufacturer will provide unlimited repairs on warranted items during warranty period with no cost limitation.
 - c. Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions. USPS must immediately notify roofing membrane manufacturer of such repairs.
 - d. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Project Membrane Roofing Specification Section to Warranty.
 6. Wind Coverage
 - a. Warranty shall cover wind gusts up to [____] miles per hour.

End of WARRANTY OPTION

Verify manufacturer information and availability at time of Project Manual preparation for Project.

PART 2 - PRODUCTS

2.1 ROOFING MEMBRANE

- A. Must have recycled content
- B. Fabric-Reinforced Thermoplastic Polyolefin Sheet: Uniform, flexible sheet formed from a thermoplastic polyolefin, internally fabric or scrim reinforced: ASTM D6878.



- C. Minimum Thickness: [59 mils (1.5 mm)] <Insert thickness if thicker is required >, minimum.
- D. Product must meet ENERGY STAR requirements for low-slope roofs and must be listed on the ENERGY STAR Roof Products Program Qualified Product List.
- E. Solar reflectance, per Cool Roof Rating Council (CRRC):
 - 1. Initial reflectance: 0.65 minimum.
 - 2. Three years after installation: 0.50 minimum.
- F. Physical Properties:
 - 1. Breaking Strength: 225 lbf (1kN); ASTM D 751, grab method.
 - 2. Elongation at Break: 15 percent; ASTM D 751.
 - 3. Tearing Strength: 55 lbf (245 N) minimum; ATSM D 751, Procedure B.
 - 4. Brittleness Point: Minus 22 deg F (30 deg C).
 - 5. Ozone Resistance: No cracks after sample, wrapped around a 3-inch- (75-mm-) diameter mandrel, is exposed for 166 hours to a temperature of 104 deg F (40 deg C) and an ozone level of 100 pphm (100 mPa); ASTM D 1149.
 - 6. Resistance to Heat Aging: 90 percent minimum retention of breaking strength, elongation at break, and tearing strength after 166 hours at 240 deg F (116 deg C); ASTM D 5573.
 - 7. Water Absorption: Less than 4 percent mass change after 166 hours' immersion at 158 deg F (70 deg C); ASTM D 471.
 - 8. Linear Dimension Change: Plus or minus 2 percent; ASTM D 1204

2.2 ROOFING SYSTEM MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated into the Work include the following:
 - 1. Carlisle Syntec Inc., Carlisle, PA (800) 479-6832.
 - 2. Firestone Building Products, Indianapolis, IN (800) 428-4442
 - 3. GAF Materials Corp., Wayne, NJ (800) 766-3411
 - 4. Johns Manville Roofing Systems, Denver, CO (800) 592-6958.
 - 5. Sika Sarnafil Division, Sika Corp, Canton, MA (800) 451-2504.
 - 6. Tremco Inc., Beachwood, OH (800) 852-6013.
 - 7. Versico, Carlisle, PA (800)992-7663
- B. Manufacturer of roofing membrane must be a Partner in the EPA ENERGY STAR® Roof Products Program for energy efficiency and membrane supplied must be listed on the ENERGY STAR Roof Products Qualified Product List.
- C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted with Contracting Officer Approval.

NOTE TO SPECIFIER

Verify manufacturer information and availability at time of Project Manual preparation for Project.

2.3 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
 - 1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.
- B. Sheet Flashing
 - 1. Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as TPO sheet membrane.



2. Manufacturer's standard TPO clad metal - A TPO-coated, heat-weldable sheet metal capable of being formed into a variety of shapes and profiles. TPO Clad Metal shall be a 25 gauge, G90 galvanized metal sheet with a 20 mil (0.5 mm) unsupported TPO membrane laminated on one side.
- C. Perimeter Edge and Metal Flashings
1. To be supplied by the roof system manufacturer in accordance with the rated assembly
 - a. Minimum 25 gauge galvanized steel with Kynar finish – color selected by Contracting Officer OR
 - b. Roof System manufacturer's rated and approved clad metal
- D. Bonding Adhesive: Manufacturer's standard clear or light-colored [solvent] [water]-based bonding adhesive for membrane, and solvent-based bonding adhesive for base flashings.

2.4 ROOF INSULATION

NOTE TO SPECIFIER

INSULATION TYPE OPTION 1, Polyisocyanurate foam insulation assemblies: Include the paragraphs below if the Specifier chooses Polyisocyanurate insulation.

Polyisocyanurate Foam Insulation

- A. Flat Roof Board Insulation: Polyisocyanurate Foam Insulation which meets or exceeds FS HH-I-1972/2, both faces covered with glass fiber felt; comply with FMG Standard 4450 Approval. (ASTM C1289, Type II – Class 1 – Grade 2)
 1. Thermal Resistance: in service R-5.6 per inch of thickness in cooling conditions
 2. Thermal Resistance: in service R-5.0 per inch of thickness in heating conditions
 3. Compressive Strength: 20 PSI Minimum
 4. Maximum Board Thickness is 2"
 5. Minimum Board Thickness is 1.5" on the base layer
- B. Tapered Polyisocyanurate Foam Insulation: Provide crickets, saddles, and tapered insulation of same material as second layer of insulation; taper to the following slopes:
 1. Crickets and Saddles: 1/4 inch per foot or twice the slope of the roof, whichever is greater.
 2. Insulation Installed to Counterslope Roof Structure: 1/2 inch to the foot, or twice slope of roof, whichever is greater.
- C. Roof Curb Insulation: Polyisocyanurate foam; thickness to match wood nailer.
- D. Tapered Insulation: Provide crickets, saddles, and tapered insulation of same material as second layer of insulation; taper to the following slopes:
 1. Crickets and Saddles: 1/4 inch per foot or twice the slope of the roof, whichever is greater.
 2. Insulation Installed to Counterslope Roof Structure: 1/2 inch to the foot, or twice slope of roof, whichever is greater.
- E. Cover Board: 1/2" Factory Primed Glass Mat Gypsum Roof Board: ASTM C-1177. Zero flame spread and zero smoke developed per ASTM E84. Minimum 500 pounds per square inch compressive strength.

NOTE TO SPECIFIER

INSULATION TYPE OPTION 2, Extruded Polystyrene insulation assemblies: Include the paragraphs below if the Specifier chooses Extruded Polystyrene insulation.

**EXTRUDED Polystyrene (XPS)**

- A. Flat Roof Board Insulation: Extruded polystyrene board to ASTM C578, Type IV, rigid, closed cell type, with integral high density skin.
 - 1. Thermal Resistance (ASTM C518): typical 5 year aged value of R-5 per 1 inch of thickness.
 - 2. Compressive Strength (ASTM D1621): Minimum 25 psi.
 - 3. Water Absorption (ASTM D2842): 0.7% by volume maximum.
 - 4. Flame Spread/Smoke Developed Values (ASTM E84): 5/165.
- B. Tapered Roof Board Insulation: Extruded polystyrene board to ASTM C578, Type IV, rigid, closed cell type, with integral high density skin.
 - 1. Thermal Resistance (ASTM C518): typical 5 year aged value of R-5 per 1 inch of thickness.
 - 2. Compressive Strength: Minimum 25 psi.
 - 3. Water Absorption (ASTM D2842): 0.7% by volume maximum.
 - 4. Flame Spread/Smoke Developed Values (ASTM E84): 5/165.
- C. Cover Board: 1/4" Factory Primed Glass Mat Gypsum Roof Board: ASTM C-1177. Zero flame spread and zero smoke developed per ASTM E84. Minimum 500 pounds per square inch compressive strength.

2.5 ACCESSORIES

NOTE TO SPECIFIER

INSULATION ATTACHMENT OPTION 1, Mechanically attached insulation assemblies: Include the paragraphs below if the Specifier chooses mechanically attached insulation.

- A. Roofing Insulation Fasteners: Fasteners shall be as tested and approved by FMG as part of the roofing system assembly.
 - 1. Mechanical Fasteners for Insulation: Coated fasteners with plates appropriate for purpose intended and approved by Factory Mutual and supplied by roofing membrane manufacturer. Thickness of insulation and roofing membrane manufacturer's deck penetration requirements shall determine the length of the fastener.

NOTE TO SPECIFIER

INSULATION ATTACHMENT OPTION 2, Adhered insulation assemblies: Include the paragraphs below if the Specifier chooses adhered insulation.

- A. Roofing Insulation Adhesive: Insulation Adhesive shall be as tested and approved by FMG as part of the roofing system assembly.
 - 1. Insulation Adhesive: [The specifier shall research the requirements with respect to Volatile Organic Compounds and temperature limitations of project to complete this specification section. The completed section will dictate Standard VOC content insulation adhesive, Low VOC content insulation adhesive, OR No VOC content insulation adhesive.]
 - 2. Specified adhesive shall be for purpose intended and approved by Factory Mutual and supplied by roofing membrane manufacturer.

**NOTE TO SPECIFIER***End of INSULATION ATTACHMENT OPTIONS*

- B. Walkway Pads: Walkway materials shall be provided by the roofing membrane manufacturer
- C. Isolation Pads: Provide a piece of walkway pad as above
- D. Termination: Use roofing membrane manufacturer's recommended termination details and associated products to comply with Warranty requirements
- E. Pipe Flashings: Prefabricated pipe flashings shall be supplied by the roofing membrane manufacturer
- F. Vapor / Air Retarder [Use and location to be determined by Specifier – Product to be recommended and supplied by roof system manufacturer]

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Section 017300 - Execution: Verification of existing conditions before starting work.

NOTE TO SPECIFIER

Edit paragraph below based on Contracting Officer's selection of roofing inspections and/or manufacturer's warranty.

- B. Verification of Conditions: Verify, with [Third-Party Roofing Inspector] [Full-time Third-Party Roofing Inspector] [Manufacturer's Quality Control Inspector] present that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains, valleys, and eaves. Verify flutes of steel deck are evenly spaced at intersections.
 - 2. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, and nailing strips, and reglets are in place. Verify deck is supported and tightly secured.
 - 3. Verify deck surfaces are dry and free of water, snow, and ice.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Provide covers and other means of protection as necessary to protect building surfaces against damage during roofing work.
- B. Where work shall continue over finished roof membrane, protect surfaces according to roofing membrane manufacturer's recommendations.

3.3 ROOF INSULATION INSTALLATION

**NOTE TO SPECIFIER**

INSULATION ATTACHMENT OPTION 1, Mechanically attached insulation assemblies: Include the paragraphs below if the Specifier chooses mechanically attached insulation.

- A. Lay insulation boards to moderate contact without forcing joints. Cut insulation to fit neatly to perimeter blocking and around protrusions through roof.
 - 1. Gaps between insulation boards, nailers and penetrations of 1/4 inch (0.64 cm) or greater are not acceptable.
- B. Place roof crickets and tapered thickness insulation to the required slope pattern in accordance with manufacturer's published instructions.
- C. Mechanically Attached Installation:
 - 1. Maximum insulation board dimension is 4' x 8'
 - 2. Place long edge of boards parallel to deck flutes, forming joint over solid bearing. Lay first layer insulation units with long edge joints continuous and end joints staggered.
 - 3. Lay second and subsequent layers of insulation with both long side and end joints offset 6 inches (15 cm) from joints below.
 - 4. Factory primed glass mat gypsum board and overlaid insulation may be loose laid and fastened with the same insulation fastener and plate in accordance with manufacturer's approved assembly. Fastener and plate must be approved by the roof system manufacturer and installed at the required density to achieve the specified FMG [1A]-[90][105][120] system, in accordance with requirements of FMG Loss Prevention Data Sheet 1-29 for specified wind uplift requirements.
- D. Apply no more insulation than can be waterproofed with roofing membrane in same day.
- E. Mechanically attach a single layer of insulation to manufactured metal curbs.

NOTE TO SPECIFIER

INSULATION ATTACHMENT OPTION 2, Adhered insulation assemblies: Include the paragraphs below if the Specifier chooses adhered insulation.

- F. Lay insulation boards to moderate contact without forcing joints. Cut insulation to fit neatly to perimeter blocking and around protrusions through roof.
 - 1. Gaps between insulation boards, nailers and penetrations of 1/4 inch (0.64 cm) or greater are not acceptable.
- G. Place roof crickets and tapered thickness insulation to the required slope pattern in accordance with manufacturer's published instructions.
- H. Adhered Installation:
 - 1. 4-foot x 4-foot maximum board size for insulation boards adhered to a substrate including successive layers.
 - 2. Lay second and subsequent layers of insulation so that the insulation board's joints are staggered vertically and offset from the underlying layers.
 - 3. Factory primed glass mat gypsum board and overlaid insulation shall be adhered in accordance with the manufacturer's recommendations and submitted FM assembly number to achieve the specified FMG [1A]-[90][105][120] system, in accordance with requirements of FMG Loss Prevention Data Sheet 1-29 for specified wind uplift requirements.
- I. Apply no more insulation than can be waterproofed with roofing membrane in same day.



- E. Mechanically attach a single layer of insulation to manufactured metal curbs.

3.4 ROOFING MEMBRANE APPLICATION

- A. Apply roofing membrane in accordance with membrane manufacturer's published instructions for specified system.
- B. All quality control recommendations of the roofing system manufacturer shall be strictly followed.
- C. Cold Weather Application Procedures: When air temperature is expected to fall below 40 degrees F, follow Cold Weather Application Procedures as follows:
 - 1. Store flashing adhesive in heated storage units (minimum temperature 40 degrees F) prior to installation.
 - 2. Follow roofing membrane manufacturer's recommendation for cold weather application of adhered field sheets, corner & perimeter area, and flashings.

3.5 WATER CUTOFFS AND WEATHER PROTECTION

- A. Install water cut-offs according to roofing membrane manufacturer's recommendations at end of day's operation to seal insulation and edge of roof membrane from moisture entry. If rain or foul weather appears imminent during roofing application, cease operations and protect deck, insulation, flashings, penetrations and membrane from moisture intrusion and damage with water cutoffs. Insulation and roofing materials not so protected before rain are considered damaged materials and will be rejected.
- B. Water cut-offs over steel deck must include steel deck flute plugs to prevent moisture from getting under insulation.
- C. Remove water cut-offs and other temporary weather protections prior to continuing roofing work. Remove materials that have been subject to moisture damage and return deck to clean, dry condition before proceeding with roofing operations. Remove damaged materials from job site.
- D. Water cut-offs and weather protection shall not be considered part of final roof system specified.

3.6 FLASHING MEMBRANE AND ACCESSORIES

- A. Field membrane shall be terminated with fasteners and plates. Flashing membrane, mechanically attached or adhered, shall be extended past the termination of the field membrane and hot air welded on the horizontal plane.
- B. Roof Penetrations:
 - 1. Prefabricated pipe flashings shall be installed where the configuration of penetration will permit, including but not limited to electrical conduit, and plumbing vents.
 - 2. Field fabrication of flashing shall be used where the configuration of the penetration prohibits the use of prefabricated flashing.
- C. Fasten membrane and flashing terminations per roofing membrane manufacturer's recommendations.
- D. Walkway Pads: Weld walkways to roofing membrane per manufacturer's recommendation.

3.7 ROOF SURFACING



- A. No field-applied surfacing shall be utilized with this roofing system.

3.8 CONSTRUCTION

- A. Interface with Other Work:
1. Coordinate Work with installation of associated metal counterflashings specified under other Sections as Work of this Section proceeds.
 2. Complete installation of base flashing at roof curbs prior to setting roof top equipment.
 3. Coordinate Work with Plumbing for roof drain(s) installation.

3.9 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection.

NOTE TO SPECIFIER

WARRANTY OPTION 1, Part-Time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 1, Part-Time Third-Party inspections.

- B. Field Services: Third-Party Roofing Inspector.
1. Attend and conduct Pre-installation Meeting.
 2. Perform preparatory, initial, follow-up and final inspections for roof insulation and roofing system.
 3. Prepare and submit inspection reports for each inspection made.

NOTE TO SPECIFIER

WARRANTY OPTION 2, Full-time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 2, Full-time Third-Party inspections.

- C. Field Services: Full-time Third-Party Roofing Inspector.
1. Attend and conduct Pre-installation Meeting.
 2. Perform full-time inspections for roof insulation and roofing system.
 3. Prepare and submit inspection reports for each inspection made.

NOTE TO SPECIFIER

OPTION 3, Manufacturer's warranty: Include the paragraphs below if Contracting Officer mandates OPTION 3, Manufacturer's warranty or if the Contracting Officer mandates Option 1 of Option 2 and also chooses the optional manufacturer's warranty.

- D. Manufacturer's Field Services: Manufacturer's Roofing Quality Control Inspector.
1. Attend and conduct Pre-installation Meeting.
 2. Perform preparatory, initial, follow-up and final inspections for installation of roof insulation and roofing system.
 3. Prepare and submit inspection reports for each inspection made.

NOTE TO SPECIFIER

End Manufacturer's warranty

- E. Maintenance Instruction
1. Provide on-site instruction to review the components of the system and detail any common troubleshooting or maintenance that is required to ensure normal performance of the roofing system.



2. Provide one complete set of installation details and component manuals that will remain at the installed location.

3.10 CLEANING

- A. Section 017300 - Execution: Requirements for cleaning.
- B. Remove dirt, debris, and markings from finished surfaces. In areas where finished surfaces are soiled, consult roofing membrane manufacturer for cleaning advice and comply with their instruction.
- C. Replace defaced or disfigured finishes caused by Work of this Section.

3.11 PROTECTION

- A. Where construction traffic must continue over finished roof installation, protect surfaces in manner recommended by roofing system manufacturer to protect Manufacturer's Warranty.

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Last revised: 3/31/2011

END OF SECTION



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SECTION 07 54 23 00 - CSF THERMOPLASTIC-POLYOLEFIN ROOFING

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

This roofing section includes three (3) options regarding inspections and /or warranty; two (2) options regarding insulation type; and two (2) options regarding insulation system attachment.

The Contracting Officer (CO) must provide direction to the Specifier on which one of the warranty options will be selected for this project. After receiving direction from the CO, the Specifier must edit the warranty sections to ensure that this option is consistently applied throughout.

The warranty options are:

WARRANTY OPTION 1, Part-Time Third-Party Inspections: these are to be provided at construction milestones as listed below. A manufacturer's warranty is optional. The Contracting Officer may choose to mandate Part-Time Third Party Inspections AND mandate manufacturer's warranty.

WARRANTY OPTION 2, Full-time Third-Party inspections: an inspector is to be continuously present during the entire period of roofing installation. A manufacturer's warranty is optional. The Contracting Officer may choose to mandate Full-Time Third Party Inspections AND mandate manufacturer's warranty.

WARRANTY OPTION 3, Manufacturer's Warranty: this option requires a warranty from the manufacturer. Inspections are to be provided by the manufacturer at the milestones listed below or as necessary to meet manufacturer's requirements.

There are two (2) options regarding primary roof insulation type. The Specifier must provide direction on which one of the options will be selected for this project. The Specifier must edit the section to ensure that this option is consistently applied throughout the section. Note that facilities with a metal roof deck are most conducive to Polyisocyanurate insulation due to the fact that a thermal barrier is not required under the insulation in order to maintain the systems fire rating (Use of XPS over a metal deck would require a thermal barrier under the insulation assembly if selected). Concrete roof decks can utilize Extruded Polystyrene Insulation attached directly to the prepared roof deck without the need for a thermal barrier. The Specifier shall determine the insulation type based on existing construction; building code review; and cost analysis. The insulation type options are:

INSULATION Type OPTION 1, Polyisocyanurate.

INSULATION Type OPTION 2, Extruded Polystyrene.

There are two (2) options regarding insulation attachment. The Specifier must provide direction on which one of the options will be selected for this project. The Specifier must edit the section to ensure that this option is consistently applied throughout the section. Note that facilities with a metal roof deck are most conducive to mechanical attachment of the insulation assembly. Facilities with concrete roof decks are most conducive to adhered attachment of the insulation assembly. The specifier shall determine the insulation type based on existing construction; building code review; and cost analysis. The insulation attachment options are:

INSULATION Attachment OPTION 1, Mechanically attached.

INSULATION Attachment OPTION 2, Adhered.



PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparation of roof deck to receive roofing membrane.
2. Vapor/Air retarder. [Specifier to make determination of use and location within the system based on facility conditions and general environment]
3. [Mechanically fastened] [Adhesively Applied] Roof insulation and Glass mat gypsum board.
4. Fully Adhered TPO membrane roofing system.
5. Flashing membrane.
6. Accessories.
7. Edge metal.
8. [Warranty]

B. Related Documents:

1. The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section.
2. Memorandum of Understanding (MOU) between the United States Environmental Protection Agency's ENERGY STAR® Roof Products Program and Roofing Material Manufacturers.
3. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

C. Related Sections:

1. Section 061000 - Rough Carpentry: Wood blocking, curbs, and nailers.
2. Section 077213 - Manufactured Curbs: Curbs for roof penetrations.
3. Section 077233 - Roof Hatches: Hatch with integral curb.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM C208 - Specification for Cellulosic Fiber Insulating Board.
2. ASTM C1177 - Standard Specification for Glass Mat Gypsum Roof Board.
3. ASTM C1289 - Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
4. ASTM D570 - Test Method for Water Absorption of Plastics.
5. ASTM D638 - Test Method for Tensile Properties of Plastics.
6. ASTM D751 - Test Method for Coated Fabrics.
7. ASTM D1004 - Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
8. ASTM D1079 - Terminology Relating to Roofing and Waterproofing.
9. ASTM D1204 - Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature.
10. ASTM D2136 - Test Method for Coated Fabrics – Low Temperature Bend Test.
11. ASTM D3045 - Practice for Heat Aging of Plastics Without Load.
12. ASTM D6878 - Specification for Thermoplastic Polyolefin Based Sheet Roofing. (Most Recent Edition)
13. ASTM D5602 - Test Method for Static Puncture Resistance of Roofing Membrane Samples.
14. ASTM D5635 - Test Method for Dynamic Puncture Resistance of Roofing Membrane Samples.
15. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
16. ASTM E96 - Test Methods for Water Vapor Transmission of Materials.
17. ASTM E108 - Test Methods for Fire Tests of Roof Coverings.
18. ASTM E903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmission of Materials Using Integrating Spheres.
19. ASTM G21 - Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.



20. ASTM G26 - Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials.
21. ASTM G53 - Practice for Operating Light- and Water – Exposure Apparatus (Fluorescent UV/Condensation Type) for Exposure of Nonmetallic Materials.

B. Factory Mutual Global (FMG):

1. FMG – RoofNav – Internet Based FM Roof Assembly Testing and Approvals Database
2. FMG - Approval Guide, Building Materials.
3. FMG - Loss Prevention Data 1-28, Wind Loads to Roof Systems and Roof Deck Securement.
4. FMG - Loss Prevention Data 1-29, Above Deck Roof Components (June 1996).
5. FMG - Standard 4450, Class 1 Insulated Steel Deck Roofs.
6. FMG - Standard 4470, Class 1 Roof Covers.

C. Underwriters Laboratory (UL):

1. Class A rated roofing system
2. Recycled Content Certification
 - a. Manufacturer's membrane product recycled content to be validated by UL Environmental (ULE)

1.3 SYSTEM DESCRIPTION

- A. ENERGY STAR® Compliant Fully Adhered TPO Membrane Roofing System on Factory Primed Glass Mat Gypsum Roof Board on overlayed insulation secured to (metal or concrete) deck.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals

1. Product Data:
 - a. FM RoofNav Assembly Number certifying proposed roof system has been tested and approved by FMG for the specified FM[1-90] [1-105] [1-120] rating.
 - b. Membrane materials, base flashing, vapor retarder, [fastener & plate,] adhesive materials, edge metal and insulation.
 - c. [Insulation fastener layouts complying with FMG Loss Prevention Data Sheet 1-29 patterns for specified wind uplift resistance. Indicate number of insulation fasteners required and spacing of fasteners for field, perimeter, and corners for each pattern.] [Adhesively applied insulation coverage rates and layout must comply with the proposed FM RoofNav assembly number and adhesive application rates relative to that assembly. Indicate insulation adhesive application rates required and the coverage/ribbon spacing of adhesive for field, perimeter, and corners for each pattern. Insulation adhesion rates and coverage/ribbon spacing submissions must also be inclusive of the roof system manufacturer's instructions, including cold weather installation instructions and are required for approval prior to job start.]
 - d. Adhered membrane adhesive and application rates for adhering membrane roof to the overlayed insulation system with coverboard. Membrane adhesive shall be installed in compliance with roof membrane system manufacturer's FM RoofNav assembly approval number and all of the manufacturer's instructions including cold weather installation instructions of the proposed shall be required for approval prior to job start.
2. Shop Drawings: Indicate setting plan for insulation including fastener pattern, layout of roofing seams, direction of laps and base flashing details.
3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer is to certify that components and products meet or exceed specified standards and complies with referenced quality assurance standards in section 1.5 including the FM RoofNav assembly number.



- b. Qualification Documentation: Manufacturer certification indicating roofing applicator qualifications complying with requirements specified in Paragraph entitled "Applicator Qualifications" of this Section.

NOTE TO SPECIFIER

WARRANTY OPTION 1, Part-Time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 1, Part-Time Third-Party inspections.

- c. Field Quality Control Reports: Submit the following reports directly to Contracting Officer from the Third-Party Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
- 1) Preparatory inspection.
 - 2) Initial inspection.
 - 3) Follow-up inspections.
 - 4) Final inspection.
 - 5) Maintenance Instruction: Document training by furnishing a sign-in sheet with a description of the training provided, instructors name and organization, and those who received training. Refer to 017704 1.3, 1.4, and 1.5 for more specific training requirements.

NOTE TO SPECIFIER

WARRANTY OPTION 2, Full-time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 2, Full-time Third-Party inspections.

- d. Field Quality Control Reports: Submit daily reports directly to Contracting Officer from the Full-time Third-Party Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements.
- e. Maintenance Instruction: Document training by furnishing a sign-in sheet with a description of the training provided, instructors name and organization, and those who received training. Refer to 017704 1.3, 1.4, and 1.5 for more specific training requirements.

NOTE TO SPECIFIER

Include the paragraphs below if Contracting Officer mandates a Manufacturer's warranty. Delete the paragraphs below if the Contracting Officer chooses to have Part-Time or Full Time Third Party inspections and No Warranty.

- f. Sample of specified Warranty
- g. Manufacturer's certification letter acknowledging receipt of specifications, intent to issue warranty, and intent to perform field audits as outlined in 1.4.3.d.
- h. Manufacturer's Field Reports: Submit the following reports directly to Contracting Officer from Manufacturer's Roofing Quality Control Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
- 1) Preparatory inspection.
 - 2) Initial inspection.
 - 3) Follow-up inspections.
 - 4) Final inspection.

NOTE TO SPECIFIER

End of WARRANTY OPTION

- i. Written certification or product data sheet attesting that proposed roofing membrane meets the EPA ENERGY STAR® Roof Products Program specification for energy efficiency and that the manufacturer is listed as a Partner.



4. Maintenance Instruction: Document training by furnishing a sign-in sheet with a description of the training provided, instructors name and organization and those who received training. Refer to 017704 1.3, 1.4, and 1.5 for more specific training requirements.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in TPO membrane roof application with minimum of 5 years documented experience and that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product, and that is eligible to receive a manufacturer's warranty.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by membrane manufacturer for specified roofing system and shall be in compliance with all applicable regulatory requirements.
- C. FMG Listing: Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system and that are listed in the most recent FMG "RoofNav" on-line directory or FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

NOTE TO SPECIFIER

90 pounds per square foot wind uplift minimum. Design roofing and insulation system to comply with regional requirements and special regulations of local authority having jurisdiction. Verify with USPS Contracting Officer. Contact Roofing System Manufacturer for information about 120 or 150 or greater pounds per square foot of uplift resistance.

NOTE TO SPECIFIER

Edit "Class" in the following paragraph for project's fire resistance and wind uplift resistance requirements. Verify availability of roofing systems that meet these classifications. "Class 1A" signifies meeting ASTM E 108, Class A fire performance for FMG-approved Class 1 roof covers. For areas having three or more hailstorms annually, FMG recommends roofing systems rated SH (severe hail) instead of MH (moderate hail).

1. Fire/Windstorm Classification: Class 1A- [90] [105] [120] <Insert number>.
2. Hail Resistance: [MH] [SH].

- D. Pre-installation Meeting:
 1. Convene a Pre-installation Meeting at Project Site one week prior to commencing work of this Section.
 2. Require attendance of parties directly affecting work of this Section.
 3. Review preparation and installation procedures and coordinating and scheduling required with related work.

NOTE TO SPECIFIER

WARRANTY OPTION 1, Part-Time Third-Party Inspections: Include the paragraph below if Contracting Officer mandates WARRANTY OPTION 1, Part-Time Third-Party inspections.

- a. Require the Third-Party Roofing Inspector to conduct Pre-installation Meeting along with Contractor Quality Control Representative and Contracting Officer.

NOTE TO SPECIFIER

WARRANTY OPTION 2, Full-time Third-Party Inspections: Include the paragraph below if Contracting Officer mandates WARRANTY OPTION 2, Full-time Third-Party inspections.



- b. Require the Full-time Third-Party Roofing Inspector to conduct Pre-installation Meeting along with Contractor Quality Control Representative and Contracting Officer.

NOTE TO SPECIFIER

Include the paragraph below if Contracting Officer mandates a Manufacturer's warranty.

- c. Require Manufacturer's Roofing Quality Control Inspector to conduct Pre-installation Meeting along with Contractor Quality Control Representative and Contracting Officer.

NOTE TO SPECIFIER

End of WARRANTY OPTION

4. Agenda:

- a. Tour, inspect and discuss condition of substrate, roof drains, roof drain final locations, curbs, penetrations and other preparatory work performed by other trades.
- b. Review structural loading limitations of deck and inspect deck for loss of flatness and for required mechanical fastening.
- c. Review roofing system requirements (Drawings, Specifications and other Contract Documents).
- d. Review required submittals, both completed and yet to be completed.
- e. Review and finalize construction schedule related to roofing work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
- f. Review requirements for inspections, testing, certifying, and material usage accounting procedures.
- g. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions, including possibility of temporary roofing.
- h. Review safety precautions relating to roofing installation.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Deliver materials in manufacturer's original unopened containers or wrappings, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Protect foam insulation from direct sunlight exposure.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.7 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements:
 1. Do not apply roofing membrane during inclement weather. When air temperature is expected to fall below 40 degrees F, follow submitted roof system manufacturer's specified Cold Weather Application Procedures.
 2. Do not apply roofing membrane to wet, damp or frozen deck surface or when precipitation is occurring.
 3. Do not expose materials vulnerable to water or the sun in quantities greater than can be weatherproofed during same day.

**NOTE TO SPECIFIER**

Manufacturer's warranty: Include the paragraphs below if Contracting Officer mandates a Manufacturer's warranty.

1.8 WARRANTY

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Special Warranty:
 - 1. Submit written warranty, without monetary limitation, signed by roofing system manufacturer agreeing to promptly repair leaks in roof membrane and base flashings resulting from defects in materials and workmanship.
 - 2. Warranty shall not exclude "ponding" water.
 - 3. Warranty Period: [20] [____] years.
 - 4. Include materials and workmanship for all manufacturer's supplied roofing components including but not limited to:
 - a. Membranes.
 - b. Flashings, including edge metal, metal flashings and accessories supplied by roofing membrane manufacturer.
 - c. Insulation.
 - d. Fasteners.
 - e. Adhesives.
 - f. Vapor / Air Retarder
 - 5. Include the following items within Warranty:
 - a. Roofing inspection by Manufacturer's Roofing Quality Control Inspector between 22 and 24 months after date of Final Acceptance.
 - b. Roofing manufacturer will provide unlimited repairs on warranted items during warranty period with no cost limitation.
 - c. Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions. USPS must immediately notify roofing membrane manufacturer of such repairs.
 - d. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Project Membrane Roofing Specification Section to Warranty.
 - 6. Wind Coverage
 - a. Warranty shall cover wind gusts up to [____] miles per hour.

End of WARRANTY OPTION

Verify manufacturer information and availability at time of Project Manual preparation for Project.

PART 2 - PRODUCTS**2.1 ROOFING MEMBRANE**

- A. Must have recycled content
- B. Fabric-Reinforced Thermoplastic Polyolefin Sheet: Uniform, flexible sheet formed from a thermoplastic polyolefin, internally fabric or scrim reinforced: ASTM D6878.
- C. Minimum Thickness: [59 mils (1.5 mm)] <Insert thickness if thicker is required >, minimum.



- D. Product must meet ENERGY STAR requirements for low-slope roofs and must be listed on the ENERGY STAR Roof Products Program Qualified Product List.
- E. Solar reflectance, per Cool Roof Rating Council (CRRC):
 - 1. Initial reflectance: 0.65 minimum.
 - 2. Three years after installation: 0.50 minimum.
- F. Physical Properties:
 - 1. Breaking Strength: 225 lbf (1kN); ASTM D 751, grab method.
 - 2. Elongation at Break: 15 percent; ASTM D 751.
 - 3. Tearing Strength: 55 lbf (245 N) minimum; ATSM D 751, Procedure B.
 - 4. Brittleness Point: Minus 22 deg F (30 deg C).
 - 5. Ozone Resistance: No cracks after sample, wrapped around a 3-inch- (75-mm-) diameter mandrel, is exposed for 166 hours to a temperature of 104 deg F (40 deg C) and an ozone level of 100 pphm (100 mPa); ASTM D 1149.
 - 6. Resistance to Heat Aging: 90 percent minimum retention of breaking strength, elongation at break, and tearing strength after 166 hours at 240 deg F (116 deg C); ASTM D 5573.
 - 7. Water Absorption: Less than 4 percent mass change after 166 hours' immersion at 158 deg F (70 deg C); ASTM D 471.
 - 8. Linear Dimension Change: Plus or minus 2 percent; ASTM D 1204

2.2 ROOFING SYSTEM MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated into the Work include the following:
 - 1. Carlisle Syntec Inc., Carlisle, PA (800) 479-6832.
 - 2. Firestone Building Products, Indianapolis, IN (800) 428-4442
 - 3. GAF Materials Corp., Wayne, NJ (800) 766-3411
 - 4. Johns Manville Roofing Systems, Denver, CO (800) 592-6958.
 - 5. Sika Sarnafil Division, Sika Corp, Canton, MA (800) 451-2504.
 - 6. Tremco Inc., Beachwood, OH (800) 852-6013.
 - 7. Versico, Carlisle, PA (800)992-7663
- B. Manufacturer of roofing membrane must be a Partner in the EPA ENERGY STAR® Roof Products Program for energy efficiency and membrane supplied must be listed on the ENERGY STAR Roof Products Qualified Product List.
- C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted with Contracting Officer Approval.

NOTE TO SPECIFIER

Verify manufacturer information and availability at time of Project Manual preparation for Project.

2.3 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
 - 1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.
- B. Sheet Flashing
 - 1. Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as TPO sheet membrane.



2. Manufacturer's standard TPO clad metal - A TPO-coated, heat-weldable sheet metal capable of being formed into a variety of shapes and profiles. TPO Clad Metal shall be a 25 gauge, G90 galvanized metal sheet with a 20 mil (0.5 mm) unsupported TPO membrane laminated on one side.
- C. Perimeter Edge and Metal Flashings
1. To be supplied by the roof system manufacturer in accordance with the rated assembly
 - a. Minimum 25 gauge galvanized steel with Kynar finish – color selected by Contracting Officer OR
 - b. Roof System manufacturer's rated and approved clad metal
- D. Bonding Adhesive: Manufacturer's standard clear or light-colored [solvent] [water]-based bonding adhesive for membrane, and solvent-based bonding adhesive for base flashings.

2.4 ROOF INSULATION

NOTE TO SPECIFIER

INSULATION TYPE OPTION 1, Polyisocyanurate foam insulation assemblies: Include the paragraphs below if the Specifier chooses Polyisocyanurate insulation.

Polyisocyanurate Foam Insulation

- A. Flat Roof Board Insulation: Polyisocyanurate Foam Insulation which meets or exceeds FS HH-I-1972/2, both faces covered with glass fiber felt; comply with FMG Standard 4450 Approval. (ASTM C1289, Type II – Class 1 – Grade 2)
 1. Thermal Resistance: in service R-5.6 per inch of thickness in cooling conditions
 2. Thermal Resistance: in service R-5.0 per inch of thickness in heating conditions
 3. Compressive Strength: 20 PSI Minimum
 4. Maximum Board Thickness is 2"
 5. Minimum Board Thickness is 1.5" on the base layer
- B. Tapered Polyisocyanurate Foam Insulation: Provide crickets, saddles, and tapered insulation of same material as second layer of insulation; taper to the following slopes:
 1. Crickets and Saddles: 1/4 inch per foot or twice the slope of the roof, whichever is greater.
 2. Insulation Installed to Counterslope Roof Structure: 1/2 inch to the foot, or twice slope of roof, whichever is greater.
- C. Roof Curb Insulation: Polyisocyanurate foam; thickness to match wood nailer.
- D. Tapered Insulation: Provide crickets, saddles, and tapered insulation of same material as second layer of insulation; taper to the following slopes:
 1. Crickets and Saddles: 1/4 inch per foot or twice the slope of the roof, whichever is greater.
 2. Insulation Installed to Counterslope Roof Structure: 1/2 inch to the foot, or twice slope of roof, whichever is greater.
- E. Cover Board: 1/2" Factory Primed Glass Mat Gypsum Roof Board: ASTM C-1177. Zero flame spread and zero smoke developed per ASTM E84. Minimum 500 pounds per square inch compressive strength.

NOTE TO SPECIFIER

INSULATION TYPE OPTION 2, Extruded Polystyrene insulation assemblies: Include the paragraphs below if the Specifier chooses Extruded Polystyrene insulation.

**EXTRUDED Polystyrene (XPS)**

- A. Flat Roof Board Insulation: Extruded polystyrene board to ASTM C578, Type IV, rigid, closed cell type, with integral high density skin.
 - 1. Thermal Resistance (ASTM C518): typical 5 year aged value of R-5 per 1 inch of thickness.
 - 2. Compressive Strength (ASTM D1621): Minimum 25 psi.
 - 3. Water Absorption (ASTM D2842): 0.7% by volume maximum.
 - 4. Flame Spread/Smoke Developed Values (ASTM E84): 5/165.
- B. Tapered Roof Board Insulation: Extruded polystyrene board to ASTM C578, Type IV, rigid, closed cell type, with integral high density skin.
 - 1. Thermal Resistance (ASTM C518): typical 5 year aged value of R-5 per 1 inch of thickness.
 - 2. Compressive Strength: Minimum 25 psi.
 - 3. Water Absorption (ASTM D2842): 0.7% by volume maximum.
 - 4. Flame Spread/Smoke Developed Values (ASTM E84): 5/165.
- C. Cover Board: 1/4" Factory Primed Glass Mat Gypsum Roof Board: ASTM C-1177. Zero flame spread and zero smoke developed per ASTM E84. Minimum 500 pounds per square inch compressive strength.

2.5 ACCESSORIES

NOTE TO SPECIFIER

INSULATION ATTACHMENT OPTION 1, Mechanically attached insulation assemblies: Include the paragraphs below if the Specifier chooses mechanically attached insulation.

- A. Roofing Insulation Fasteners: Fasteners shall be as tested and approved by FMG as part of the roofing system assembly.
 - 1. Mechanical Fasteners for Insulation: Coated fasteners with plates appropriate for purpose intended and approved by Factory Mutual and supplied by roofing membrane manufacturer. Thickness of insulation and roofing membrane manufacturer's deck penetration requirements shall determine the length of the fastener.

NOTE TO SPECIFIER

INSULATION ATTACHMENT OPTION 2, Adhered insulation assemblies: Include the paragraphs below if the Specifier chooses adhered insulation.

- A. Roofing Insulation Adhesive: Insulation Adhesive shall be as tested and approved by FMG as part of the roofing system assembly.
 - 1. Insulation Adhesive: [The specifier shall research the requirements with respect to Volatile Organic Compounds and temperature limitations of project to complete this specification section. The completed section will dictate Standard VOC content insulation adhesive, Low VOC content insulation adhesive, OR No VOC content insulation adhesive.]
 - 2. Specified adhesive shall be for purpose intended and approved by Factory Mutual and supplied by roofing membrane manufacturer.

**NOTE TO SPECIFIER***End of INSULATION ATTACHMENT OPTIONS*

- B. Walkway Pads: Walkway materials shall be provided by the roofing membrane manufacturer
- C. Isolation Pads: Provide a piece of walkway pad as above
- D. Termination: Use roofing membrane manufacturer's recommended termination details and associated products to comply with Warranty requirements
- E. Pipe Flashings: Prefabricated pipe flashings shall be supplied by the roofing membrane manufacturer
- F. Vapor / Air Retarder [Use and location to be determined by Specifier – Product to be recommended and supplied by roof system manufacturer]

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Section 017300 - Execution: Verification of existing conditions before starting work.

NOTE TO SPECIFIER

Edit paragraph below based on Contracting Officer's selection of roofing inspections and/or manufacturer's warranty.

- B. Verification of Conditions: Verify, with [Third-Party Roofing Inspector] [Full-time Third-Party Roofing Inspector] [Manufacturer's Quality Control Inspector] present that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains, valleys, and eaves. Verify flutes of steel deck are evenly spaced at intersections.
 - 2. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, and nailing strips, and reglets are in place. Verify deck is supported and tightly secured.
 - 3. Verify deck surfaces are dry and free of water, snow, and ice.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Provide covers and other means of protection as necessary to protect building surfaces against damage during roofing work.
- B. Where work shall continue over finished roof membrane, protect surfaces according to roofing membrane manufacturer's recommendations.

3.3 ROOF INSULATION INSTALLATION

**NOTE TO SPECIFIER**

INSULATION ATTACHMENT OPTION 1, Mechanically attached insulation assemblies: Include the paragraphs below if the Specifier chooses mechanically attached insulation.

- A. Lay insulation boards to moderate contact without forcing joints. Cut insulation to fit neatly to perimeter blocking and around protrusions through roof.
 - 1. Gaps between insulation boards, nailers and penetrations of 1/4 inch (0.64 cm) or greater are not acceptable.
- B. Place roof crickets and tapered thickness insulation to the required slope pattern in accordance with manufacturer's published instructions.
- C. Mechanically Attached Installation:
 - 1. Maximum insulation board dimension is 4' x 8'
 - 2. Place long edge of boards parallel to deck flutes, forming joint over solid bearing. Lay first layer insulation units with long edge joints continuous and end joints staggered.
 - 3. Lay second and subsequent layers of insulation with both long side and end joints offset 6 inches (15 cm) from joints below.
 - 4. Factory primed glass mat gypsum board and overlayered insulation may be loose laid and fastened with the same insulation fastener and plate in accordance with manufacturer's approved assembly. Fastener and plate must be approved by the roof system manufacturer and installed at the required density to achieve the specified FMG [1A]-[90][105][120] system, in accordance with requirements of FMG Loss Prevention Data Sheet 1-29 for specified wind uplift requirements.
- D. Apply no more insulation than can be waterproofed with roofing membrane in same day.
- E. Mechanically attach a single layer of insulation to manufactured metal curbs.

NOTE TO SPECIFIER

INSULATION ATTACHMENT OPTION 2, Adhered insulation assemblies: Include the paragraphs below if the Specifier chooses adhered insulation.

- F. Lay insulation boards to moderate contact without forcing joints. Cut insulation to fit neatly to perimeter blocking and around protrusions through roof.
 - 1. Gaps between insulation boards, nailers and penetrations of 1/4 inch (0.64 cm) or greater are not acceptable.
- G. Place roof crickets and tapered thickness insulation to the required slope pattern in accordance with manufacturer's published instructions.
- H. Adhered Installation:
 - 1. 4-foot x 4-foot maximum board size for insulation boards adhered to a substrate including successive layers.
 - 2. Lay second and subsequent layers of insulation so that the insulation board's joints are staggered vertically and offset from the underlying layers.
 - 3. Factory primed glass mat gypsum board and overlayered insulation shall be adhered in accordance with the manufacture's recommendations and submitted FM assembly number to achieve the specified FMG [1A]-[90][105][120] system, in accordance with requirements of FMG Loss Prevention Data Sheet 1-29 for specified wind uplift requirements.
- I. Apply no more insulation than can be waterproofed with roofing membrane in same day.



- E. Mechanically attach a single layer of insulation to manufactured metal curbs.

3.4 ROOFING MEMBRANE APPLICATION

- A. Apply roofing membrane in accordance with membrane manufacturer's published instructions for specified system.
- B. All quality control recommendations of the roofing system manufacturer shall be strictly followed.
- C. Cold Weather Application Procedures: When air temperature is expected to fall below 40 degrees F, follow Cold Weather Application Procedures as follows:
 - 1. Store flashing adhesive in heated storage units (minimum temperature 40 degrees F) prior to installation.
 - 2. Follow roofing membrane manufacturer's recommendation for cold weather application of adhered field sheets, corner & perimeter area, and flashings.

3.5 WATER CUTOFFS AND WEATHER PROTECTION

- A. Install water cut-offs according to roofing membrane manufacturer's recommendations at end of day's operation to seal insulation and edge of roof membrane from moisture entry. If rain or foul weather appears imminent during roofing application, cease operations and protect deck, insulation, flashings, penetrations and membrane from moisture intrusion and damage with water cutoffs. Insulation and roofing materials not so protected before rain are considered damaged materials and will be rejected.
- B. Water cut-offs over steel deck must include steel deck flute plugs to prevent moisture from getting under insulation.
- C. Remove water cut-offs and other temporary weather protections prior to continuing roofing work. Remove materials that have been subject to moisture damage and return deck to clean, dry condition before proceeding with roofing operations. Remove damaged materials from job site.
- D. Water cut-offs and weather protection shall not be considered part of final roof system specified.

3.6 FLASHING MEMBRANE AND ACCESSORIES

- A. Field membrane shall be terminated with fasteners and plates. Flashing membrane, mechanically attached or adhered, shall be extended past the termination of the field membrane and hot air welded on the horizontal plane.
- B. Roof Penetrations:
 - 1. Prefabricated pipe flashings shall be installed where the configuration of penetration will permit, including but not limited to electrical conduit, and plumbing vents.
 - 2. Field fabrication of flashing shall be used where the configuration of the penetration prohibits the use of prefabricated flashing.
- C. Fasten membrane and flashing terminations per roofing membrane manufacturer's recommendations.
- D. Walkway Pads: Weld walkways to roofing membrane per manufacturer's recommendation.

3.7 ROOF SURFACING



- A. No field-applied surfacing shall be utilized with this roofing system.

3.8 CONSTRUCTION

- A. Interface with Other Work:
1. Coordinate Work with installation of associated metal counterflashings specified under other Sections as Work of this Section proceeds.
 2. Complete installation of base flashing at roof curbs prior to setting roof top equipment.
 3. Coordinate Work with Plumbing for roof drain(s) installation.

3.9 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection.

NOTE TO SPECIFIER

WARRANTY OPTION 1, Part-Time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 1, Part-Time Third-Party inspections.

- B. Field Services: Third-Party Roofing Inspector.
1. Attend and conduct Pre-installation Meeting.
 2. Perform preparatory, initial, follow-up and final inspections for roof insulation and roofing system.
 3. Prepare and submit inspection reports for each inspection made.

NOTE TO SPECIFIER

WARRANTY OPTION 2, Full-time Third-Party Inspections: Include the paragraphs below if Contracting Officer mandates WARRANTY OPTION 2, Full-time Third-Party inspections.

- C. Field Services: Full-time Third-Party Roofing Inspector.
1. Attend and conduct Pre-installation Meeting.
 2. Perform full-time inspections for roof insulation and roofing system.
 3. Prepare and submit inspection reports for each inspection made.

NOTE TO SPECIFIER

OPTION 3, Manufacturer's warranty: Include the paragraphs below if Contracting Officer mandates OPTION 3, Manufacturer's warranty or if the Contracting Officer mandates Option 1 of Option 2 and also chooses the optional manufacturer's warranty.

- D. Manufacturer's Field Services: Manufacturer's Roofing Quality Control Inspector.
1. Attend and conduct Pre-installation Meeting.
 2. Perform preparatory, initial, follow-up and final inspections for installation of roof insulation and roofing system.
 3. Prepare and submit inspection reports for each inspection made.

NOTE TO SPECIFIER

End Manufacturer's warranty

- E. Maintenance Instruction
1. Provide on-site instruction to review the components of the system and detail any common troubleshooting or maintenance that is required to ensure normal performance of the roofing system.



2. Provide one complete set of installation details and component manuals that will remain at the installed location.

3.10 CLEANING

- A. Section 017300 - Execution: Requirements for cleaning.
- B. Remove dirt, debris, and markings from finished surfaces. In areas where finished surfaces are soiled, consult roofing membrane manufacturer for cleaning advice and comply with their instruction.
- C. Replace defaced or disfigured finishes caused by Work of this Section.

3.11 PROTECTION

- A. Where construction traffic must continue over finished roof installation, protect surfaces in manner recommended by roofing system manufacturer to protect Manufacturer's Warranty.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/19/2011

END OF SECTION 07 54 23 00



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SECTION 07 56 00 00 - R&A ACRYLIC ELASTOMERIC ROOF COATING FOR SHEET METAL ROOFING

NOTE TO SPECIFIER

This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this section where an acrylic elastomeric roof coating is specified over an existing sheet metal roof system.

NOTE TO SPECIFIER

Section Formatting:

Consistent formatting of Sections gives the complete document a professional look. This Section uses a 10pt. Arial font, and is formatted as follows:

1. Insert one 10pt. line after the Section Number. Section Number is in CAPS.
2. Insert two 10pt. lines after the Section Title. Section Title is in CAPS.
3. Insert one 10pt. line after a PART. PARTS are in CAPS. If a Section is not used, include NOT USED following the PART title as shown below.
4. Insert one 10pt. line after Article paragraphs. Articles are in CAPS.
5. Insert two 10pt. lines at the end of an Article.
6. Complete Section with END OF SETION.
7. No lines should be placed between paragraphs and sub-paragraphs, or between sub-paragraphs and other sub-paragraphs.

Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED



Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to the installation of acrylic elastomeric roof coatings over existing sheet metal roofing, including pre-installation substrate preparation procedures and sheet metal roofing repair requirements.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 079201 – Sealants for Roof Replacement
- D. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

NOTE TO SPECIFIER

Per discussions between the designer and USPS Project Manager, determine the warranty requirements for the project. Choose from the following warranty options and actions:

1. *If an alternate price for a 10-year "Total System Warranty" is specified, Leave Article 1.3 unchanged.*
2. *If a 10-year "Total System Warranty" will be included in the base proposal, or if no warranty is specified, remove Article 1.3.*

Re-letter/number items after editing.

1.3 ALTERNATES

- A. Provide an alternate price for the 10-Year Total System Warranty described in paragraph 1.9A.

1.4 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 1. American Society for Testing and Materials (ASTM)
 - a. ASTM D 6083 – Standard Specification for Liquid Applied Acrylic Coating Used in Roofing
 2. National Roofing Contractors Association (NRCA)

1.5 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.6 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
 - 1. NOTE: Follow the coating manufacturer recommendations for acceptable application temperature of coating materials.



2. When the outside temperature is forecast to fall below 50°F (10°C), store unused materials in a heated location. Remove these materials only when ready for installation.
3. Do not apply coating materials when precipitation is forecast within 24-hours after anticipated completion of coating work.
4. Coatings, sealants, and primers should be maintained at a temperature between 50°F (10°C) and 80°F (27°C) at all times. Do not use coatings, sealants, or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
5. Refer to the coating manufacturer and NRCA requirements and recommendations for additional cold weather application requirements and restrictions.

- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

NOTE TO SPECIFIER

Per discussions between the designer and USPS Project Manager, determine the warranty requirements for the project. Choose from the following warranty options and actions:

1. *If an alternate price for a 20-year "Total System, Non-Pro-Rated Warranty" is specified, do not edit paragraph 1.9A.*
2. *If a 20-year "Total System, Non-Pro-Rated Warranty" will be included in the base proposal, DELETE "an alternate price for" from paragraph 1.9A.*
3. *If no warranty is specified, EDIT the title of Article 1.9 (DELETE the words "MANUFACTURER WARRANTY AND"), and DELETE paragraph 1.9A. The two-year contractor guarantee shall remain in place.*

Re-letter/number paragraphs and sub-paragraphs after editing.

1.9 MANUFACTURER WARRANTY AND CONTRACTOR GUARANTEE

- A. Provide an alternate price for a manufacturer 20-Year Total System, Non-Pro-Rated Warranty (including insulation, roofing membrane, and flashings) covering materials and labor. The warranty shall include the following additional items:
 - a. Roofing inspection by a technical representative of the roofing membrane manufacturer 22-24 months after date of Final Acceptance.
 - b. Roofing manufacturer will provide unlimited repairs during warranty period with no cost limitation.
 - c. Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions.
 - d. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Record Acrylic Elastomeric Roof Coating for Sheet Metal Roofing Specification Section to Warranty.
- B. The Contractor shall provide a two-year contractor guarantee. At a minimum, the contractor guarantee shall include the following:
 1. Contractor name, address, phone number and project contact name.
 2. The project completion date, and date of guarantee expiration.
 3. The contractor guarantee shall include, in writing, all project work, workmanship, and/or all materials installed by the contractor or subcontractors to be of a quality that will comply with all project specific requirements of the Construction Documents and other documents governing the Work and workmanship through the guarantee period.
 4. The contractor shall investigate roof leaks during the guarantee period within a reasonable time period, but in no instance greater than 24-hours after notification of a leak. The contractor shall repair leaks determined to be the cause of the Work at no cost to the Owner.



PART 2 – PRODUCTS

2.1 ACRYLIC ELASTOMERIC ROOF COATING SYSTEM SUMMARY

- A. Acceptable coating manufacturers: Manufacturers offering coatings and products meeting the requirements listed in Article 2.2.

NOTE TO SPECIFIER

Per discussions between the designer and USPS Project Manager, determine the warranty requirements for the project. Choose from the following warranty options and actions:

1. *If a 10-year "Total System, Non-Pro-Rated Warranty" will be included in the base proposal, or if an alternate price for a 10-year "Total System, Non-Pro-Rated Warranty" is specified, do not edit paragraph 2.1B.*
2. *If no warranty is specified, DELETE paragraph 2.1B.*

- B. Selected products, when used within the specified roof assembly, must be capable of meeting the warranty requirements listed in Article 1.9.

2.2 ACRYLIC ELASTOMERIC ROOF COATING

- A. Spray-applied base coat:
1. Acrylic elastomeric base coat; ASTM D 6083, color recommended by manufacturer for this application.
- B. Spray-applied finish coat:
1. Acrylic elastomeric finish coat; ASTM D 6083, color determined by Owner.

2.3 FASTENER, SEAM, FLASHING AND MISCELLANEOUS TREATMENT MATERIALS

- A. For encapsulation of fastener heads and gutter straps located on the sheet metal panels:
1. Acrylic elastomeric sealant approved for use in this application by the coating manufacturer.
 - a. Color: Light gray.
- B. For treatment of horizontal and vertical seams, ridge caps, rake edges, parapet walls, curb flashings, and other roof penetrations:
1. Acrylic elastomeric sealant approved for use in this application by the coating manufacturer.
 - a. Color: Light gray.
 2. Reinforcing fabric approved for use in this application by the coating manufacturer.
 - a. 6-inch and 12-inch widths.
- C. For treatment of exterior and interior gutters:
1. Acrylic elastomeric sealant approved for use in this application by the coating manufacturer.
 - a. Color: Light gray.
 2. Reinforcing fabric approved for use in this application by the coating manufacturer.
 - a. 6-inch and 12-inch widths.
- D. For treatment of residual asphalt:

R&A ACRYLIC ELASTOMERIC ROOF COATING FOR SHEET



1. Acrylic elastomeric coating approved for use in this application by the coating manufacturer.
 - a. Color: White or light gray.
- E. For treatment of remaining areas of rust (after power washing):
 1. Acrylic primer/rust inhibitor approved for use in this application by the coating manufacturer.
- F. For priming of existing prefinished sheet metal roof panels, if required by the coating manufacturer:
 1. Acrylic primer approved for use in this application by the coating manufacturer.

2.4 MISCELLANEOUS SHEET METAL REPAIR MATERIALS

- A. For use at damaged roof panels, or panels containing holes greater than 6-inches in diameter:
 1. Sheet metal roof panels to match existing size and configuration of existing panels.
- B. For use at roof panel holes less than 6-inches in diameter:
 1. Sheet metal: 24-gauge galvanized steel; size as necessary to extend 3-inches minimum on all sides of hole.
 2. For securing steel plate to steel deck: Fasteners approved by the coating manufacturer.
- C. Sheet metal cricket/saddle material:
 1. Sheet metal: 20-gauge galvanized steel; size and configuration as necessary to result in adequate slope and size to move water around obstruction.
 2. For securing crickets to curbs, walls and sheet metal roof panels: Fasteners approved by the coating manufacturer.
 3. For sealing sheet metal flanges (if required by roof coating manufacturer): Sealant acceptable to coating manufacturer.
- D. Replacement fasteners:
 1. For use where existing fasteners are missing, loose or damaged, or where fasteners must be used to re-secure loose sheet metal panels: Fastener type equal to existing roof system fasteners, compatible with existing sheet metal panel system, and acceptable to the coating manufacturer. Use oversized fasteners where existing fasteners are damaged or missing.
- E. Replacement pipe boots:
 1. For use where existing pipe boots are damaged or missing: Pre-fabricated, neoprene-type pipe boot, size as necessary to accommodate existing tubular penetration diameter.

2.5 RELATED COATING PRODUCTS

- A. Primers, manufacturer-required surface treatments, sealants, prefabricated accessories, and other related items: Unless otherwise indicated, products manufactured by, or approved by the coating manufacturer.

2.6 SEALANT

- A. Refer to Section 079201.

PART 3 - EXECUTION

3.1 PREPARATION OF SUBSTRATE

- A. Prepare substrate in a manner that is acceptable to the coating manufacturer. Substrate preparation includes, but is not limited to: treatment of excessive gaps, installation of sheet metal crickets behind rooftop units and other obstructions, repair of damaged or loose sheet metal panels, repair of holes in sheet metal panels, cleaning of panels, treatment of surface rust, treatment of areas of excessive ponding, treatment of residual asphalt, and priming of panels (if required by the roof coating manufacturer).
1. Treatment of gaps: At gap locations identified by the roof coating manufacturer as excessive, secure panels with approved fasteners. Fill gaps with closed-cell foam strips, if necessary.
 2. Installation of sheet metal crickets: Install sheet metal crickets behind all units and other rooftop obstructions where none presently exist, and a potential exists for ponding water to accumulate.
 - a. Install approved sealant behind the flanges of the sheet metal cricket prior to securement to the substrate and rooftop unit/obstruction. Secure with approved fasteners.
 3. Repair of damaged/loose sheet metal panels, and panels with holes:
 - a. Replace damaged panels, and panels containing holes greater than 6-inches in diameter with new panels to match existing size, gauge and configuration. Secure panels in a manner equal to existing securement panel with approved fasteners.
 - b. Re-secure loose panel sections with approved fasteners.
 - c. Install sheet metal plates over holes less than 6-inches in diameter. Ensure that the panel extends 3-inches, minimum, on all sides of the existing hole. Secure the plate to the panel with approved fasteners.
 4. Power washing: Power wash areas identified to receive roof coatings. Refer to manufacturer for equipment requirements and other recommendations regarding power washing.
 5. Removal of rust, asphaltic residue, and loose/deteriorated paint:
 - a. Using mechanical methods such as wire brushing, remove excessive rust, asphaltic residue and loose/deteriorated paint from the sheet metal panels.
 - b. Treat areas where these materials cannot be removed with materials and in a manner prescribed by the coating manufacturer.
 6. Priming: Prime panels if required by the coating manufacturer.

3.2 TREATMENT OF SEAMS, FASTENERS AND FLASHINGS

- A. Treatment of seams:
1. Horizontal seams:
 - a. Install specified seam flashing material at horizontal seam. Follow manufacturer-specific requirements for application and required material thickness for the seam type encountered.
 2. Vertical seams:
 - a. Install flashing material at vertical seams. Install reinforcing fabric into flashing material. Coat reinforcing fabric with an additional application of flashing material.
 3. Ridge, rake, wall, curb, and other rooftop penetration flashings:
 - a. Fill excessive gaps in ridge and rake edges.



- b. Install flashing material at flashings. Install reinforcing fabric into flashing material. Coat reinforcing fabric with an additional application of flashing material.
 - B. Treatment of fasteners and gutter straps:
 - 1. Inspect all existing system fasteners. Re-secure loose fasteners. Where existing fasteners are damaged, stripped, missing, or cannot be re-secured, install a new, approved fastener.
 - 2. Encapsulate all fastener heads with flashing material.
 - 3. Gutter straps: Encapsulate with flashing material.
 - C. Treatment of rooftop units, skylights, pitch pans, tubular penetrations, wall terminations, and other roof penetrations:
 - 1. Inspect rooftop penetrations for damage. Repair penetrations using specified materials.
 - 2. Install flashing material horizontal-to-vertical transitions. Install reinforcing fabric into flashing material. Coat reinforcing fabric with an additional application of flashing material.
 - D. Treatment of ridge caps and rake edges:

3.3 ACRYLIC ELASTOMERIC ROOF COATING APPLICATION

- A. General:
 - 1. Inspect all surface preparation and flashing work. Correct any identified defects prior to application of coating.
 - 2. Inspect the areas adjacent to the work area for cars and other property that could be damaged by coating overspray. Prior to work start, remove or protect cars and other property that may be damaged by work activities.
 - 3. Prior to work start, close any rooftop air intakes within and adjacent to the work area.
 - 4. Follow manufacturer guidelines for rate of application and application procedures of the base and finish coats, as outlined in the written literature provided by the coating manufacturer.

USPS CSF Specifications issued: 10/1/2013

Last revised: 3/6/2013

NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 56 00 00



SECTION 07 61 00 00 - CSF SHEET METAL ROOFING

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.07 61 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. This section covers the metal roof system required for the "Platform" and "Carrier Loading" and includes the panels, panel clips, flashing, panel splices, ridge material, fascias, gutter and downspouts, and all necessary fasteners for the above. Not included are the structural roof supports.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data:
 - a. Product data including manufacturer's product specifications, standard details, certified product test results, installation instructions, and general recommendations, as applicable to materials and finishes for each component and for total panel system.
 - 2. Shop Drawings:
 - a. Submit erection/shop drawings for each product specified showing all erection procedures and accessories required. Field measure and verify dimensions prior to fabrication of metal roofing.
 - 3. Samples:
 - a. Samples for initial selection purposes in form of manufacturer's color charts or chips showing full range of colors, textures, and patterns available for roof and wall panels with factory-applied finishes.
 - b. Samples for verification purposes of roof panels. Provide sample panels 12 inches long by actual panel width, in the profile, style, color, and texture indicated. Include clips, battens, fasteners, closures, and other panel accessories.
 - 4. Assurance/Control Submittals:



- a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
- b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Special Warranty: Submit written special warranty with forms completed in United States Postal Service name and registered with manufacturer as specified in this Section.

1.3 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 - 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver panels and other components so they will not be damaged or deformed. Package roof panels for protection against transportation damage.
- C. Handling: Exercise care in unloading, storing, and erecting roof covering panels to prevent bending, warping, twisting, and surface damage.
- D. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight ventilated covering. Store metal roof panels so that they will not accumulate water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Roof panels shall meet ENERGY STAR requirements for low-slope roofs and be listed on the DOE's ENERGY STAR Roof Products Qualified Product List.

1.6 WARRANTY

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Special Warranty:
 - 1. Manufacturer shall warrant to correct defects in paint finish for 20 years following Substantial Completion.
 - 2. Installer shall warrant to correct defects in material and workmanship for two years following Substantial Completion.

PART 2 - PRODUCTS

NOTE TO SPECIFIER



Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Nucor Building Systems, Waterloo, IN (219) 837-7891.
 - 2. Overly Manufacturing Company, Greensburg, PA (724) 834-7300.
 - 3. Centria, Moon Township, PA (800) 759-7474.
 - 4. Metal Sales Manufacturing Corporation, Sellersburg, IN (800) 999-7777.
 - 5. Star Building Systems, Oklahoma City, OK (800) 654-3921.
 - 6. Tremco Inc., Beachwood, OH (800) 852-6013.
- B. Manufacturer of sheet metal roofing must be a Partner in the EPA ENERGY STAR® Roof Products Program for energy efficiency and sheet metal roofing and coatings supplied must be listed on the DOE's ENERGY STAR Roof Products Qualified Product List.
- C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

- A. Panel:
 - 1. The panels shall be manufactured from 24 gauge, 0.5 oz./sq ft Galvalume steel strip having a minimum yield of 50,000 psi.
 - 2. The panel ends shall be factory punched and notched at splice and ridge locations.
 - 3. The panel side laps shall have factory-applied mastic.
 - 4. Panels shall have a UL Class 90 Uplift Rating.
- B. Panel Splice:
 - 1. The panel splice shall have a 16 gauge steel back-up plate and an 11 gauge aluminum cinch strap so that when assembled the mastic used in the splice will be under constant compression.
 - 2. The back-up plate and cinch strap shall be factory punched to ensure proper fit.
- C. Floating Panel Clip:
 - 1. The floating panel clips shall be self-centering and allow for up to 2-7/16 inch expansion and/or contraction from the installed position. The clip design shall ensure that movement does not occur between the panel and the clip.
 - 2. The floating panel clip shall have factory-applied mastic to ensure a weathertight installation.
 - 3. Each clip shall be attached to the supporting joist and purlin with 2 fasteners, the size and type as recommended by the panel manufacturer.
- D. Trim and Flashing:
 - 1. Gable, eave and parapet wall flashing details will be detailed, designed, and supplied by the panel manufacturer.
 - 2. High eave flashing and flashing parallel to the roof panels must accommodate the thermal expansion and contraction of the roof without damage to the roof panels or flashing.
 - 3. All exposed soffit, fascia, trim and flashing material shall be manufactured from galvanized steel strip and shall have a full strength fluopolymer (containing a minimum of 70 percent Kynar 500 resin) system of 1.0 + .1 mil total dry film thickness. On the reverse side, a white wash coat of 0.3 to 0.4 mil dry film thickness is applied.
 - 4. Flexible membranes, where required, shall be supplied by the panel manufacturer.
- E. Bird Nesting:



1. Projections of structural framing creating bird nesting areas shall be framed out with sheet metal closures, with all fluted deck flutes sealed off with rubber closure inserts.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 1. Examine alignment of the steel structure and related supports prior to installation and do not proceed until any defects are corrected.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Examine the alignment of the steel structure before installing any roof panels, and do not proceed with installation if the steel structure is not aligned to the tolerances necessary.
- B. Erection of the metal roofing panels must be started correctly and the sheets held true to line. Horizontal lines are to be straight and level and vertical lines plumb.

3.3 DISSIMILAR MATERIALS

- A. Where aluminum materials come in contact with dissimilar metals, an insulating paint or tape shall be applied between the aluminum and the dissimilar metal.

3.4 CLEANING AND PROTECTION

- A. Damaged Units: Replace panels and other components of the work that have been damaged or have deteriorated beyond successful repair by means of finish touch-up or similar minor repair procedures.
- B. Cleaning: Remove temporary protective coverings and strippable films (if any) as soon as each panel is installed. Upon completion of panel installation, clean finished surfaces as recommended by panel manufacturer, and maintain in a clean condition during construction.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



SECTION 07 61 13 00 - CSF STANDING SEAM SHEET METAL ROOFING

NOTE TO SPECIFIER

Editing is needed for each individual project; modify as needed for project specific requirements. Included "NOTE TO SPECIFIER" instructions provide guidance concerning required editing, and options have been included requiring action on the part of the specifier/designer. Select the option appropriate for the project and delete option(s) not selected.

NOTE TO SPECIFIER

EDIT Section footer as necessary to reflect the project name and location, USPS Project number, and required date of the technical specification document. Coordinate this project specific information with the USPS Project Manager. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this section where standing seam sheet metal roofing is selected as the roofing system. Per the United States Postal Service Roofing Design Standard, standing seam sheet metal roofing systems are acceptable with restrictions for steep slope applications at facilities with a "Critical" or "Non-Critical" building designation. Discuss the use of standing seam sheet metal roofing with the USPS Project Manager prior to specifying. An approved deviation letter may be required prior to specifying a standing seam sheet metal roofing system.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to the installation of standing seam sheet metal roofing, flashings, and related accessories.

NOTE TO SPECIFIER

Review available field data:

1. *For projects that do not include roof areas with underlying steel decks, DELETE paragraph 1.2D from the list below.*
2. *For projects that do not include roof areas with underlying wood decks, DELETE paragraph 1.2E from the list below.*
3. *For projects that include roof areas with both underlying steel and wood decks, do not edit the list below.*

Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 079201 – Sealants for Roofing
- D. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 ALTERNATES



- A. Provide an alternate price for the 20-Year Total System Warranty described in paragraph 1.9A.

1.4 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 - 1. American Architectural Manufacturers Association
 - a. AAMA 621 – Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) & Zinc-Aluminum Coated Steel Substrates
 - 2. American Society for Testing and Materials (ASTM)
 - a. ASTM A 792/A 792M – Standard Specification for Sheet Steel, 55% Aluminum-Zinc Alloy Coated by the Hot-Dip Process
 - b. ASTM D 1970 – Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
 - c. ASTM B 209 – Aluminum and Aluminum Alloy Sheet and Plate
 - d. ASTM F 1667 – Standard Specification for Driven Fasteners: Nails, Spikes, and Staples
 - 3. National Roofing Contractors Association (NRCA)
 - a. NRCA Roofing and Waterproofing Manual, 5th Edition
 - 4. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).
 - a. SMACNA Architectural Sheet Metal Manual, 7th Edition
 - 5. Underwriters Laboratories, Inc. (UL)
 - a. UL 2218 - Impact Resistance of Prepared Roof Covering Materials
 - b. UL 580 - Tests for Uplift Resistance of Roof Assemblies

1.5 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.6 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.



- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.
- F. Refer to manufacturer minimum slope requirements for the standing seam sheet metal system selected for use. Do not install standing seam sheet metal roof systems on slopes less than 2-inches per foot.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
 - 1. NOTE: Do not install standing seam sheet metal roofing at temperatures below 32°F (0°C).
 - 2. When the outside temperature is forecast to fall below 40°F (5°C), store unused materials in a heated location. Remove these materials only when ready for installation.
 - 3. Do not install self-adhering membrane when the temperature of the outside air, self-adhering membrane, or roof deck are below 40°F (5°C).
 - 4. Refer to the sheet metal roofing panel manufacturer and NRCA requirements and recommendations for additional cold weather application requirements and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

1.9 MANUFACTURER WARRANTY AND CONTRACTOR GUARANTEE

- A. Provide an alternate price for a manufacturer 20-Year Total System, Non-Pro-Rated Warranty (including insulation, roofing membrane, and flashings) covering materials and labor. The warranty shall include the following additional items:
 - a. Roofing inspection by a technical representative of the roofing membrane manufacturer 22-24 months after date of Final Acceptance.
 - b. Roofing manufacturer will provide unlimited repairs during warranty period with no cost limitation.



- c. Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions.
 - d. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Record Standing Seam Sheet Metal Roofing Specification Section to Warranty.
- B. The Contractor shall provide a two-year contractor guarantee. At a minimum, the contractor guarantee shall include the following:
- 1. Contractor name, address, phone number and project contact name.
 - 2. The project completion date, and date of guarantee expiration.
 - 3. The contractor guarantee shall include, in writing, all project work, workmanship, and/or all materials installed by the contractor or subcontractors to be of a quality that will comply with all project specific requirements of the Construction Documents and other documents governing the Work and workmanship through the guarantee period.
 - 4. The contractor shall investigate roof leaks during the guarantee period within a reasonable time period, but in no instance greater than 24-hours after notification of a leak. The contractor shall repair leaks determined to be the cause of the Work at no cost to the Owner.

PART 2 – PRODUCTS

2.1 STANDING SEAM SHEET METAL ROOFING SYSTEM SUMMARY

- A. Acceptable sheet metal roofing panel manufacturers: Manufacturers offering panels meeting the requirements listed in Item 2.2.
- B. Selected products, when used within the specified roof assembly, must be capable of meeting the warranty requirements listed in Article 1.9.

NOTE TO SPECIFIER

Review available field data:

- 1. *If an architectural standing seam sheet metal system is specified (a continuous underlying substrate, such as a plywood deck, is present), do not edit Article 2.2 below.*
- 2. *If a structural standing seam sheet metal system is specified (the system will be installed directly over structural steel purlins), DELETE Article 2.2 below.*

Re-number Articles, if necessary, after editing.

2.2 UNDERLAYMENT

- A. Self-adhering membrane: Product approved for use in high-temperature conditions by the underlayment manufacturer and sheet metal panel manufacturer, and meeting the following criteria:
 - 1. Meeting the requirements of ASTM D 1970.
 - 2. Approved for use as an underlayment for standing seam sheet metal roofing.
 - 3. A 40-mil minimum membrane thickness.
- B. For use over self-adhering membrane:
 - 1. Red rosin paper; 36-inch width, minimum; 3 pounds per 100 square feet, minimum.

2.3 SHEET METAL ROOF PANELS

**NOTE TO SPECIFIER**

Review available field data:

1. If an architectural standing seam sheet metal system is specified (a continuous underlying substrate, such as a plywood deck, is present), *DELETE* "and/or structural" from paragraph 2.3A, and *DELETE* sub-paragraph 2.3.A.2 below.
2. If a structural standing seam sheet metal system is specified (the system will be installed directly over structural steel purlins), *DELETE* "architectural and/or" from paragraph 2.3A, but do not edit sub-paragraph 2.3.A.2 below.

- A. Product type: Factory-formed, prefinished galvanized steel, minimum 22-gauge architectural and/or structural sheet metal roof panels; conforming to ASTM A 792/A 792M. Fabricated to allow for a minimum 1-3/4 inch high standing seams 18-inches o.c. maximum, or as recommended by the sheet metal roofing panel manufacturer for this application. Factory-fabricated "ready to use" for field assembly.
 1. Panels shall be capable of spanning the structural purlins spacing.
- B. Panel finish: Kynar 500 coated, with a factory-applied top side film thickness of .70 to .90 mil over a .25 to .30 mil prime coat to provide a total dry film thickness of .95 to 1.25 mil, to meet AAMA 621. Underside of panel shall be coated with a primer with a dry film thickness of .25 mil. Finish shall conform to all tests for adhesions, flexibility and longevity as specified by Kynar 500 supplier. Standard color as determined by the Owner.
- C. Impact Resistance: Conforming to the requirements of UL 2218.
- D. Wind uplift: Conforming to the requirements of UL 580, and capable of obtaining a UL Class 90 rating for wind uplift.

2.4 CLIPS

- A. System clips: Concealed; size, type, and configuration as necessary to match roof system type. Product manufactured by or approved by the sheet metal panel manufacturer.

NOTE TO SPECIFIER

Review available field data:

1. If an architectural standing seam sheet metal system is specified (a continuous underlying substrate, such as a plywood deck, is present), do not edit paragraph 2.5.A below.
2. If a structural standing seam sheet metal system is specified (the system will be installed directly over structural steel purlins), *DELETE* paragraph 2.5.A below.

Re-number/letter paragraphs and sub-paragraphs, if necessary, after editing.

2.5 FASTENERS

- A. For fastening red rosin paper:
 1. Staples; size as necessary to hold red rosin paper in place prior to installation of standing seam sheet metal roof system.
- B. For fastening of sheet metal clips:
 1. Fastener type compatible with the substrate encountered, and approved for use in this application by the sheet metal panel manufacturer.
- C. For fastening of other sheet metal accessories:



1. Fastener type compatible with the substrate encountered, and approved for use in this application by the sheet metal panel manufacturer. Provide neoprene washers where shown on drawings.

2.6 SHEET METAL AND FLASHING ACCESSORIES

- A. Rake edges, perimeter fascia, fascia extensions, hip and ridge flashings, expansion joints and counterflashing: Prefinished galvanized steel: Kynar 500 coating, 24-gauge; color as selected by Owner.
 1. Fabricate to the dimensions and configurations indicated on the drawings.
- B. Continuous cleats: Galvanized steel; G 90, hot-dipped zinc-coated sheet steel, 22-gauge, minimum.
- C. Gutters: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating. Fabricate gutters to match dimensions indicated on the drawings; fabricate in 10-foot sections, with a 4-inch flange with a 1/2-inch hug at the inner edge of the gutter flange.
 1. Gutter spacers: Painted galvanized steel, 1-inch wide by 1/8-inch thick; seal and secure to gutter as shown on drawings. Paint color to match gutter.
- D. Scuppers:
 1. Scupper liners: Stainless steel, 22-gauge. Fabricate scupper flashings in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-26, 1-28, 1-29 and 1-30. Provide a 4-inch flange with a 1/2-inch hug at the inner edge of the scupper flange. Solder all seams watertight.
 2. Conductor boxes and scupper closure plates: Stainless steel, 22-gauge. Solder all seams watertight. Fabricate these components in accordance with the drawings, and the requirements outlined in the "SMACNA Architectural Sheet Metal Manual, 7th Edition".
- E. Conductor box fascia covers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by the Owner.
- F. Downspouts, associated with gutters and scuppers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by Owner. Fabricate downspouts with a "Pittsburgh Lock" seam, and in accordance with the drawings and "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-32B and 1-32F; size the hangers to match downspouts.
- G. Apron, wall and cricket flashing (related to rooftop curbs, chimneys and other square penetrations: Prefinished galvanized steel: Kynar 500 coating, 24-gauge; color as selected by Owner.
 1. Fabricate to the dimensions and configurations indicated on the drawings.
- H. Plumbing vent and tubular penetration flashings: Metal flashing with flanged sleeve with hood, prefabricated flashing with elastomeric collar, or other product type manufactured by, or approved by the sheet metal panel manufacturer.
 1. For sheet metal plumbing vent and tubular penetration flashings with flange and sleeve and hood:
 - a. Clamp: Stainless steel plumbers clamp, size as necessary to tightly secure hood.

2.7 MISCELLANEOUS MATERIALS



- A. Ventilation accessories, including ridge vents, soffit vents and other rooftop vents:
 - 1. Provide accessories manufactured by, or approved by, the sheet metal roofing manufacturer, if required.
- B. For use at sheet metal flashing strip-ins, and where indicated on drawings:
 - 1. Pressure-sensitive EPDM flashing material; non-reinforced, nominal 60-mil thickness, black color. Type acceptable to asphalt shingle roofing manufacturer for specific flashing conditions encountered. Minimum 5-inch width.
 - 2. Primer: Type compatible with pressure-sensitive EPDM flashing and acceptable to the sheet metal panel manufacturer.
- C. Butyl tape: for use behind counterflashing flanges and other locations indicated where indicated on the drawings. Width and thickness as necessary to create a seal between the existing substrate and secured counterflashing.

NOTE TO SPECIFIER

Review available field data:

- 1. *At project locations where excessive, accumulating snow is possible, the designer/specifier must consider the use of a snow retention system. If such a system is determined to be necessary for the project location, do not edit Article 2.8.*
- 2. *If a snow retention system is not determined to be necessary for the project location, or cannot be installed due to the potential of increased structural load on the building structure, DELETE Article 2.8.*

NOTE: *A structural analysis should be performed prior to specifying a snow retention system to ensure a structure's capability to support potential additional load from accumulated snow.*

Re-number/letter Articles, paragraphs and sub-paragraphs, if necessary, after editing.

2.8 SNOW RETENTION SYSTEM

- A. Provide a snow retention system:
 - 1. The snow retention system shall be approved for use by the sheet metal panel manufacturer.
 - 2. Snow retention system standing seam clamps: Product such as "S-5! Clamps", manufactured by S-5! Attachment Solutions – Metal Roof Innovations, Ltd., Colorado Springs, CO. Clamp size and configuration as necessary to accommodate standing seam size and profile. Product shall be approved by Owner prior to use.
 - 3. Snow retention system: Snow retention system appropriate for the anticipated snow accumulation at the project location. Products such as "Sno-Rail/Sno-Fence" and "Sno-Clip", manufactured by Alpine SnowGuards, Morisville, VT.

2.9 SEALANT

- A. Refer to Section 079201.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.

NOTE TO SPECIFIER



Review available field data:

1. If an architectural standing seam sheet metal system is specified (a continuous underlying substrate, such as a plywood deck, is present), do not edit Article 3.2 below.
2. If a structural standing seam sheet metal system is specified (the system will be installed directly over structural steel purlins), DELETE Article 3.2 below.

Re-number Articles, if necessary, after editing.

3.2 UNDELAYMENT INSTALLATION

- A. Install self-adhering membrane: Follow installation requirements of the underlayment manufacturer.
- B. Install one ply of red rosin sheathing paper. Secure to the deck as necessary to hold in place.

NOTE TO SPECIFIER

Review available field data:

1. If an architectural standing seam sheet metal system is specified (a continuous underlying substrate, such as a plywood deck, is present), do not edit sub-paragraph 3.3.A.1 below.
2. If a structural standing seam sheet metal system is specified (the system will be installed directly over structural steel purlins), delete "including underlayments," from sub-paragraph 3.3.A.1.

3.3 STANDING SEAM SHEET METAL ROOFING INSTALLATION

- A. Roof system general installation instructions:
 1. Except as may be modified by these specifications and drawings, install the specified sheet metal roof panel system, including underlayments, in accordance with the requirements and recommendations of the manufacturer, using the manufacturer's current printed instructions, the recommendations outlined in the NRCA "Roofing and Waterproofing Manual, 5th Edition", and the recommendations outlined in the "SMACNA Architectural Sheet Metal Manual, 7th Edition".
 2. Panels shall be installed plumb and true in a proper alignment and in relation to the existing structural framing. If necessary, use chalk lines as visible guides to ensure the proper alignment of the panels.
 3. Install sheet metal panel clips as required to secure the standing seam sheet metal panel system to the underlying substrate, and to allow movement of the roof system. Follow the requirements and recommendations of the sheet metal panel manufacturer. Install a minimum of two fasteners per clip.

3.4 SHEET METAL FLASHING INSTALLATION

- A. Rake edges perimeter fascias and fascia extensions:
 1. Continuous cleats: Provide continuous cleats where indicated on drawings. Secure the horizontal flange and vertical face of the continuous cleat with ring shank coated nails 12-inches o.c., max. Decrease fastener spacing to 6-inches o.c., max. within 10-feet of a building corner.
 2. Drip edges, fascia and fascia extensions: Place the drip edge, fascia or fascia extension. Hook the fascia to the underlying continuous cleat. Secure the flange with nails 3-inches o.c. in two staggered rows as indicated on the drawings.
- B. Hip and ridge flashings:



1. Fabricate and install hip and ridge caps as indicated on the drawings. Follow the recommendations and requirements of the sheet metal panel manufacturer.
- C. Expansion joints:
1. Fabricate and install expansion joint flashings as indicated on the drawings.
- D. Counterflashings: Install counterflashings at locations indicated on the drawings as follows:
1. Install continuous butyl tape behind vertical face of counterflashing.
 2. Secure counterflashings with fasteners spaced as indicated on drawings.
 3. Provide a continuous bead of sealant along the top edge of surface-mounted counterflashings to shed water and provide a watertight seal.
- E. Slip counterflashings: Install slip counterflashings at locations where existing sheet metal counterflashings cannot be lifted or removed, and at other locations indicated on the drawings as follows:
1. Install continuous butyl tape behind vertical face of counterflashing.
 2. Secure counterflashings with fasteners spaced as indicated on drawings.
- F. Gutters and downspouts:
1. Install the specified gutter spacers 24-inches o.c. Seal and secure the spacers to the gutter assembly as indicated on the drawings.
 2. Overlap individual gutter sections 1-1/2 inches. Seal overlap, and pop-rivet sections together with two rows of pop rivets. Space pop rivets 1/2-inch min., and 3/4-inches max. in each row. Completed gutter sections shall not exceed 50-feet in length.
 3. Secure the flange with nails 3-inches o.c. in two staggered rows.
 4. Gutter expansion joints: Provide gutter expansion joints at locations recommended by SMACNA; fabricated following the recommendations of SMACNA.
 5. Downspouts: Install downspouts at locations indicated on drawings. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
- G. Scupper liners, closure plates, conductor boxes and downspouts:
1. Scupper liners: Install scupper liners at through-fascia, through-wall, and overflow scupper locations indicated on the drawings. Install scupper liners following the requirements and recommendations of SMACNA.
 2. Cover plates: At the exterior face of the scupper, install cover plates. Install scupper cover plates as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 3. Conductor boxes: Where indicated on the drawings, install conductor boxes as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 4. Downspouts: Install downspouts at conductor boxes. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
 5. Install conductor box fascia covers as indicated on the drawings. Fully clip fascia covers to stainless steel conductor boxes, or secure to substrate with fasteners appropriate for the substrate encountered.
- H. Apron, side, and cricket flashings:
1. Install apron and backer/cricket flashings at roof curbs, chimneys, wall terminations, locations indicated on drawings, and at locations recommended by the sheet metal panel manufacturer.



- a. At penetrations greater than 24-inches, roof slopes greater than 6:12 (27 degrees), when a large volume of snow or ice could accumulate behind a roof penetration or when the average January temperature is 30°F (-1°C) or lower, install cricket flashings in lieu of backer flashings behind roof penetrations.
 - b. Where cricket widths exceed 18-inches, provide wood framing and plywood support beneath sheet metal cricket flashing.
 - c. Secure apron and backer/cricket flashings to the underlying substrate with fasteners appropriate to the substrate.
- I. Tubular penetration flashing: Flash round pipe penetrations with a manufacturer recommended pipe flashing boot and specified watertight hood.
- 1. Flash tubular penetration where indicated on drawings. Follow asphalt shingle manufacturer recommendations and requirements.
 - 2. Hood and drawband: Where a flanged sleeve sheet metal flashing is used, install a stainless steel hood over the flanged sleeve; solder all seams watertight. Secure a stainless steel drawband around the top of each hood to secure the hood to the penetration. Seal the top of the drawband and hood.

3.5 MISCELLANEOUS INSTALLATIONS/TREATMENTS

- A. Install ventilation accessories, including ridge vents, soffit vents and other rooftop vents at locations indicated on the drawings, or recommended by the sheet metal panel manufacturer following the printed instructions of the manufacturer.
- B. Sheet metal flashing strip-ins:
 - 1. Install specified strip-in where indicated on drawings.
- C. Butyl tape:
 - 1. Install specified butyl tape behind counterflashings where indicated on drawings.

NOTE TO SPECIFIER

Review available field data:

- 1. *If a snow retention system is to be included on the project, do not edit Article 3.6.*
- 2. *If a snow retention system is not included on the project, DELETE Article 3.6.*

NOTE: *A structural analysis should be performed prior to specifying a snow retention system to ensure a structure's capability to support potential additional load from accumulated snow.*

Re-number/letter Articles, paragraphs and sub-paragraphs, if necessary, after editing.

3.6 SNOW RETENTION SYSTEM INSTALLATION

- A. Install the snow retention system following the recommendations and requirements of the standing seam sheet metal panel and snow retention system manufacturers.

USPS CSF Specifications, issued: 10/1/2013
Last revised: 9/16/2013



NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 61 13 00



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SECTION 07 61 13 00 - MPF STANDING SEAM SHEET METAL ROOFING

NOTE TO SPECIFIER

Editing is needed for each individual project; modify as needed for project specific requirements. Included "NOTE TO SPECIFIER" instructions provide guidance concerning required editing, and options have been included requiring action on the part of the specifier/designer. Select the option appropriate for the project and delete option(s) not selected.

NOTE TO SPECIFIER

EDIT Section footer as necessary to reflect the project name and location, USPS Project number, and required date of the technical specification document. Coordinate this project specific information with the USPS Project Manager. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this section where standing seam sheet metal roofing is selected as the roofing system. Per the United States Postal Service Roofing Design Standard, standing seam sheet metal roofing systems are acceptable with restrictions for steep slope applications at facilities with a "Critical" or "Non-Critical" building designation. Discuss the use of standing seam sheet metal roofing with the USPS Project Manager prior to specifying. An approved deviation letter may be required prior to specifying a standing seam sheet metal roofing system.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to the installation of standing seam sheet metal roofing, flashings, and related accessories.

NOTE TO SPECIFIER

Review available field data:

1. *For projects that do not include roof areas with underlying steel decks, DELETE paragraph 1.2D from the list below.*
2. *For projects that do not include roof areas with underlying wood decks, DELETE paragraph 1.2E from the list below.*
3. *For projects that include roof areas with both underlying steel and wood decks, do not edit the list below.*

Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 079201 – Sealants for Roofing
- D. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 ALTERNATES



- A. Provide an alternate price for the 20-Year Total System Warranty described in paragraph 1.9A.

1.4 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 - 1. American Architectural Manufacturers Association
 - a. AAMA 621 – Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) & Zinc-Aluminum Coated Steel Substrates
 - 2. American Society for Testing and Materials (ASTM)
 - a. ASTM A 792/A 792M – Standard Specification for Sheet Steel, 55% Aluminum-Zinc Alloy Coated by the Hot-Dip Process
 - b. ASTM D 1970 – Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
 - c. ASTM B 209 – Aluminum and Aluminum Alloy Sheet and Plate
 - d. ASTM F 1667 – Standard Specification for Driven Fasteners: Nails, Spikes, and Staples
 - 3. National Roofing Contractors Association (NRCA)
 - a. NRCA Roofing and Waterproofing Manual, 5th Edition
 - 4. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).
 - a. SMACNA Architectural Sheet Metal Manual, 7th Edition
 - 5. Underwriters Laboratories, Inc. (UL)
 - a. UL 2218 - Impact Resistance of Prepared Roof Covering Materials
 - b. UL 580 - Tests for Uplift Resistance of Roof Assemblies

1.5 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.6 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.



- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.
- F. Refer to manufacturer minimum slope requirements for the standing seam sheet metal system selected for use. Do not install standing seam sheet metal roof systems on slopes less than 2-inches per foot.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
 - 1. NOTE: Do not install standing seam sheet metal roofing at temperatures below 32°F (0°C).
 - 2. When the outside temperature is forecast to fall below 40°F (5°C), store unused materials in a heated location. Remove these materials only when ready for installation.
 - 3. Do not install self-adhering membrane when the temperature of the outside air, self-adhering membrane, or roof deck are below 40°F (5°C).
 - 4. Refer to the sheet metal roofing panel manufacturer and NRCA requirements and recommendations for additional cold weather application requirements and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

1.9 MANUFACTURER WARRANTY AND CONTRACTOR GUARANTEE

- A. Provide an alternate price for a manufacturer 20-Year Total System, Non-Pro-Rated Warranty (including insulation, roofing membrane, and flashings) covering materials and labor. The warranty shall include the following additional items:
 - a. Roofing inspection by a technical representative of the roofing membrane manufacturer 22-24 months after date of Final Acceptance.
 - b. Roofing manufacturer will provide unlimited repairs during warranty period with no cost limitation.



- c. Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions.
 - d. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Record Standing Seam Sheet Metal Roofing Specification Section to Warranty.
- B. The Contractor shall provide a two-year contractor guarantee. At a minimum, the contractor guarantee shall include the following:
- 1. Contractor name, address, phone number and project contact name.
 - 2. The project completion date, and date of guarantee expiration.
 - 3. The contractor guarantee shall include, in writing, all project work, workmanship, and/or all materials installed by the contractor or subcontractors to be of a quality that will comply with all project specific requirements of the Construction Documents and other documents governing the Work and workmanship through the guarantee period.
 - 4. The contractor shall investigate roof leaks during the guarantee period within a reasonable time period, but in no instance greater than 24-hours after notification of a leak. The contractor shall repair leaks determined to be the cause of the Work at no cost to the Owner.

PART 2 – PRODUCTS

2.1 STANDING SEAM SHEET METAL ROOFING SYSTEM SUMMARY

- A. Acceptable sheet metal roofing panel manufacturers: Manufacturers offering panels meeting the requirements listed in Item 2.2.
- B. Selected products, when used within the specified roof assembly, must be capable of meeting the warranty requirements listed in Article 1.9.

NOTE TO SPECIFIER

Review available field data:

- 1. *If an architectural standing seam sheet metal system is specified (a continuous underlying substrate, such as a plywood deck, is present), do not edit Article 2.2 below.*
- 2. *If a structural standing seam sheet metal system is specified (the system will be installed directly over structural steel purlins), DELETE Article 2.2 below.*

Re-number Articles, if necessary, after editing.

2.2 UNDERLAYMENT

- A. Self-adhering membrane: Product approved for use in high-temperature conditions by the underlayment manufacturer and sheet metal panel manufacturer, and meeting the following criteria:
 - 1. Meeting the requirements of ASTM D 1970.
 - 2. Approved for use as an underlayment for standing seam sheet metal roofing.
 - 3. A 40-mil minimum membrane thickness.
- B. For use over self-adhering membrane:
 - 1. Red rosin paper; 36-inch width, minimum; 3 pounds per 100 square feet, minimum.

2.3 SHEET METAL ROOF PANELS

**NOTE TO SPECIFIER**

Review available field data:

1. If an architectural standing seam sheet metal system is specified (a continuous underlying substrate, such as a plywood deck, is present), *DELETE* "and/or structural" from paragraph 2.3A, and *DELETE* sub-paragraph 2.3.A.2 below.
2. If a structural standing seam sheet metal system is specified (the system will be installed directly over structural steel purlins), *DELETE* "architectural and/or" from paragraph 2.3A, but do not edit sub-paragraph 2.3.A.2 below.

- A. Product type: Factory-formed, prefinished galvanized steel, minimum 22-gauge architectural and/or structural sheet metal roof panels; conforming to ASTM A 792/A 792M. Fabricated to allow for a minimum 1-3/4 inch high standing seams 18-inches o.c. maximum, or as recommended by the sheet metal roofing panel manufacturer for this application. Factory-fabricated "ready to use" for field assembly.
 1. Panels shall be capable of spanning the structural purlins spacing.
- B. Panel finish: Kynar 500 coated, with a factory-applied top side film thickness of .70 to .90 mil over a .25 to .30 mil prime coat to provide a total dry film thickness of .95 to 1.25 mil, to meet AAMA 621. Underside of panel shall be coated with a primer with a dry film thickness of .25 mil. Finish shall conform to all tests for adhesions, flexibility and longevity as specified by Kynar 500 supplier. Standard color as determined by the Owner.
- C. Impact Resistance: Conforming to the requirements of UL 2218.
- D. Wind uplift: Conforming to the requirements of UL 580, and capable of obtaining a UL Class 90 rating for wind uplift.

2.4 CLIPS

- A. System clips: Concealed; size, type, and configuration as necessary to match roof system type. Product manufactured by or approved by the sheet metal panel manufacturer.

NOTE TO SPECIFIER

Review available field data:

1. If an architectural standing seam sheet metal system is specified (a continuous underlying substrate, such as a plywood deck, is present), do not edit paragraph 2.5.A below.
2. If a structural standing seam sheet metal system is specified (the system will be installed directly over structural steel purlins), *DELETE* paragraph 2.5.A below.

Re-number/letter paragraphs and sub-paragraphs, if necessary, after editing.

2.5 FASTENERS

- A. For fastening red rosin paper:
 1. Staples; size as necessary to hold red rosin paper in place prior to installation of standing seam sheet metal roof system.
- B. For fastening of sheet metal clips:
 1. Fastener type compatible with the substrate encountered, and approved for use in this application by the sheet metal panel manufacturer.
- C. For fastening of other sheet metal accessories:



1. Fastener type compatible with the substrate encountered, and approved for use in this application by the sheet metal panel manufacturer. Provide neoprene washers where shown on drawings.

2.6 SHEET METAL AND FLASHING ACCESSORIES

- A. Rake edges, perimeter fascia, fascia extensions, hip and ridge flashings, expansion joints and counterflashes: Prefinished galvanized steel: Kynar 500 coating, 24-gauge; color as selected by Owner.
 1. Fabricate to the dimensions and configurations indicated on the drawings.
- B. Continuous cleats: Galvanized steel; G 90, hot-dipped zinc-coated sheet steel, 22-gauge, minimum.
- C. Gutters: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating. Fabricate gutters to match dimensions indicated on the drawings; fabricate in 10-foot sections, with a 4-inch flange with a 1/2-inch hug at the inner edge of the gutter flange.
 1. Gutter spacers: Painted galvanized steel, 1-inch wide by 1/8-inch thick; seal and secure to gutter as shown on drawings. Paint color to match gutter.
- D. Scuppers:
 1. Scupper liners: Stainless steel, 22-gauge. Fabricate scupper flashings in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-26, 1-28, 1-29 and 1-30. Provide a 4-inch flange with a 1/2-inch hug at the inner edge of the scupper flange. Solder all seams watertight.
 2. Conductor boxes and scupper closure plates: Stainless steel, 22-gauge. Solder all seams watertight. Fabricate these components in accordance with the drawings, and the requirements outlined in the "SMACNA Architectural Sheet Metal Manual, 7th Edition".
- E. Conductor box fascia covers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by the Owner.
- F. Downspouts, associated with gutters and scuppers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by Owner. Fabricate downspouts with a "Pittsburgh Lock" seam, and in accordance with the drawings and "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-32B and 1-32F; size the hangers to match downspouts.
- G. Apron, wall and cricket flashing (related to rooftop curbs, chimneys and other square penetrations: Prefinished galvanized steel: Kynar 500 coating, 24-gauge; color as selected by Owner.
 1. Fabricate to the dimensions and configurations indicated on the drawings.
- H. Plumbing vent and tubular penetration flashings: Metal flashing with flanged sleeve with hood, prefabricated flashing with elastomeric collar, or other product type manufactured by, or approved by the sheet metal panel manufacturer.
 1. For sheet metal plumbing vent and tubular penetration flashings with flange and sleeve and hood:
 - a. Clamp: Stainless steel plumbers clamp, size as necessary to tightly secure hood.

2.7 MISCELLANEOUS MATERIALS



- A. Ventilation accessories, including ridge vents, soffit vents and other rooftop vents:
 - 1. Provide accessories manufactured by, or approved by, the sheet metal roofing manufacturer, if required.
- B. For use at sheet metal flashing strip-ins, and where indicated on drawings:
 - 1. Pressure-sensitive EPDM flashing material; non-reinforced, nominal 60-mil thickness, black color. Type acceptable to asphalt shingle roofing manufacturer for specific flashing conditions encountered. Minimum 5-inch width.
 - 2. Primer: Type compatible with pressure-sensitive EPDM flashing and acceptable to the sheet metal panel manufacturer.
- C. Butyl tape: for use behind counterflashing flanges and other locations indicated where indicated on the drawings. Width and thickness as necessary to create a seal between the existing substrate and secured counterflashing.

NOTE TO SPECIFIER

Review available field data:

- 1. *At project locations where excessive, accumulating snow is possible, the designer/specifier must consider the use of a snow retention system. If such a system is determined to be necessary for the project location, do not edit Article 2.8.*
- 2. *If a snow retention system is not determined to be necessary for the project location, or cannot be installed due to the potential of increased structural load on the building structure, DELETE Article 2.8.*

NOTE: *A structural analysis should be performed prior to specifying a snow retention system to ensure a structure's capability to support potential additional load from accumulated snow.*

Re-number/letter Articles, paragraphs and sub-paragraphs, if necessary, after editing.

2.8 SNOW RETENTION SYSTEM

- A. Provide a snow retention system:
 - 1. The snow retention system shall be approved for use by the sheet metal panel manufacturer.
 - 2. Snow retention system standing seam clamps: Product such as "S-5! Clamps", manufactured by S-5! Attachment Solutions – Metal Roof Innovations, Ltd., Colorado Springs, CO. Clamp size and configuration as necessary to accommodate standing seam size and profile. Product shall be approved by Owner prior to use.
 - 3. Snow retention system: Snow retention system appropriate for the anticipated snow accumulation at the project location. Products such as "Sno-Rail/Sno-Fence" and "Sno-Clip", manufactured by Alpine SnowGuards, Morisville, VT.

2.9 SEALANT

- A. Refer to Section 079201.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.

NOTE TO SPECIFIER



Review available field data:

1. If an architectural standing seam sheet metal system is specified (a continuous underlying substrate, such as a plywood deck, is present), do not edit Article 3.2 below.
2. If a structural standing seam sheet metal system is specified (the system will be installed directly over structural steel purlins), DELETE Article 3.2 below.

Re-number Articles, if necessary, after editing.

3.2 UNDELAYMENT INSTALLATION

- A. Install self-adhering membrane: Follow installation requirements of the underlayment manufacturer.
- B. Install one ply of red rosin sheathing paper. Secure to the deck as necessary to hold in place.

NOTE TO SPECIFIER

Review available field data:

1. If an architectural standing seam sheet metal system is specified (a continuous underlying substrate, such as a plywood deck, is present), do not edit sub-paragraph 3.3.A.1 below.
2. If a structural standing seam sheet metal system is specified (the system will be installed directly over structural steel purlins), delete "including underlayments," from sub-paragraph 3.3.A.1.

3.3 STANDING SEAM SHEET METAL ROOFING INSTALLATION

- A. Roof system general installation instructions:
 1. Except as may be modified by these specifications and drawings, install the specified sheet metal roof panel system, including underlayments, in accordance with the requirements and recommendations of the manufacturer, using the manufacturer's current printed instructions, the recommendations outlined in the NRCA "Roofing and Waterproofing Manual, 5th Edition", and the recommendations outlined in the "SMACNA Architectural Sheet Metal Manual, 7th Edition".
 2. Panels shall be installed plumb and true in a proper alignment and in relation to the existing structural framing. If necessary, use chalk lines as visible guides to ensure the proper alignment of the panels.
 3. Install sheet metal panel clips as required to secure the standing seam sheet metal panel system to the underlying substrate, and to allow movement of the roof system. Follow the requirements and recommendations of the sheet metal panel manufacturer. Install a minimum of two fasteners per clip.

3.4 SHEET METAL FLASHING INSTALLATION

- A. Rake edges perimeter fascias and fascia extensions:
 1. Continuous cleats: Provide continuous cleats where indicated on drawings. Secure the horizontal flange and vertical face of the continuous cleat with ring shank coated nails 12-inches o.c., max. Decrease fastener spacing to 6-inches o.c., max. within 10-feet of a building corner.
 2. Drip edges, fascia and fascia extensions: Place the drip edge, fascia or fascia extension. Hook the fascia to the underlying continuous cleat. Secure the flange with nails 3-inches o.c. in two staggered rows as indicated on the drawings.
- B. Hip and ridge flashings:



1. Fabricate and install hip and ridge caps as indicated on the drawings. Follow the recommendations and requirements of the sheet metal panel manufacturer.
- C. Expansion joints:
1. Fabricate and install expansion joint flashings as indicated on the drawings.
- D. Counterflashings: Install counterflashings at locations indicated on the drawings as follows:
1. Install continuous butyl tape behind vertical face of counterflashing.
 2. Secure counterflashings with fasteners spaced as indicated on drawings.
 3. Provide a continuous bead of sealant along the top edge of surface-mounted counterflashings to shed water and provide a watertight seal.
- E. Slip counterflashings: Install slip counterflashings at locations where existing sheet metal counterflashings cannot be lifted or removed, and at other locations indicated on the drawings as follows:
1. Install continuous butyl tape behind vertical face of counterflashing.
 2. Secure counterflashings with fasteners spaced as indicated on drawings.
- F. Gutters and downspouts:
1. Install the specified gutter spacers 24-inches o.c. Seal and secure the spacers to the gutter assembly as indicated on the drawings.
 2. Overlap individual gutter sections 1-1/2 inches. Seal overlap, and pop-rivet sections together with two rows of pop rivets. Space pop rivets 1/2-inch min., and 3/4-inches max. in each row. Completed gutter sections shall not exceed 50-feet in length.
 3. Secure the flange with nails 3-inches o.c. in two staggered rows.
 4. Gutter expansion joints: Provide gutter expansion joints at locations recommended by SMACNA; fabricated following the recommendations of SMACNA.
 5. Downspouts: Install downspouts at locations indicated on drawings. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
- G. Scupper liners, closure plates, conductor boxes and downspouts:
1. Scupper liners: Install scupper liners at through-fascia, through-wall, and overflow scupper locations indicated on the drawings. Install scupper liners following the requirements and recommendations of SMACNA.
 2. Cover plates: At the exterior face of the scupper, install cover plates. Install scupper cover plates as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 3. Conductor boxes: Where indicated on the drawings, install conductor boxes as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 4. Downspouts: Install downspouts at conductor boxes. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
 5. Install conductor box fascia covers as indicated on the drawings. Fully clip fascia covers to stainless steel conductor boxes, or secure to substrate with fasteners appropriate for the substrate encountered.
- H. Apron, side, and cricket flashings:
1. Install apron and backer/cricket flashings at roof curbs, chimneys, wall terminations, locations indicated on drawings, and at locations recommended by the sheet metal panel manufacturer.



- a. At penetrations greater than 24-inches, roof slopes greater than 6:12 (27 degrees), when a large volume of snow or ice could accumulate behind a roof penetration or when the average January temperature is 30°F (-1°C) or lower, install cricket flashings in lieu of backer flashings behind roof penetrations.
 - b. Where cricket widths exceed 18-inches, provide wood framing and plywood support beneath sheet metal cricket flashing.
 - c. Secure apron and backer/cricket flashings to the underlying substrate with fasteners appropriate to the substrate.
- I. Tubular penetration flashing: Flash round pipe penetrations with a manufacturer recommended pipe flashing boot and specified watertight hood.
- 1. Flash tubular penetration where indicated on drawings. Follow asphalt shingle manufacturer recommendations and requirements.
 - 2. Hood and drawband: Where a flanged sleeve sheet metal flashing is used, install a stainless steel hood over the flanged sleeve; solder all seams watertight. Secure a stainless steel drawband around the top of each hood to secure the hood to the penetration. Seal the top of the drawband and hood.

3.5 MISCELLANEOUS INSTALLATIONS/TREATMENTS

- A. Install ventilation accessories, including ridge vents, soffit vents and other rooftop vents at locations indicated on the drawings, or recommended by the sheet metal panel manufacturer following the printed instructions of the manufacturer.
- B. Sheet metal flashing strip-ins:
 - 1. Install specified strip-in where indicated on drawings.
- C. Butyl tape:
 - 1. Install specified butyl tape behind counterflashings where indicated on drawings.

NOTE TO SPECIFIER

Review available field data:

- 1. *If a snow retention system is to be included on the project, do not edit Article 3.6.*
- 2. *If a snow retention system is not included on the project, DELETE Article 3.6.*

NOTE: *A structural analysis should be performed prior to specifying a snow retention system to ensure a structure's capability to support potential additional load from accumulated snow.*

Re-number/letter Articles, paragraphs and sub-paragraphs, if necessary, after editing.

3.6 SNOW RETENTION SYSTEM INSTALLATION

- A. Install the snow retention system following the recommendations and requirements of the standing seam sheet metal panel and snow retention system manufacturers.

USPS MPF Specifications, issued: 10/1/2013
Last revised: 9/16/2013



NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 61 13 00



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SECTION 07 61 13 00 - R&A STANDING SEAM SHEET METAL ROOFING

NOTE TO SPECIFIER

This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this section where standing seam sheet metal roofing is selected as the roofing system in a roof replacement application. Per the United States Postal Service Roofing Design Standard, standing seam sheet metal roofing systems are acceptable with restrictions for steep slope applications at facilities with a "Critical" or "Non-Critical" building designation. Discuss the use of standing seam sheet metal roofing with the USPS Project Manager prior to specifying. An approved deviation letter may be required prior to specifying a standing seam sheet metal roofing system.

NOTE TO SPECIFIER

Section Formatting:

Consistent formatting of Sections gives the complete document a professional look. This Section uses a 10pt. Arial font, and is formatted as follows:

1. *Insert one 10pt. line after the Section Number. Section Number is in CAPS.*
2. *Insert two 10pt. lines after the Section Title. Section Title is in CAPS.*
3. *Insert one 10pt. line after a PART. PARTS are in CAPS. If a Section is not used, include NOT USED following the PART title as shown below.*
4. *Insert one 10pt. line after Article paragraphs. Articles are in CAPS.*
5. *Insert two 10pt. lines at the end of an Article.*
6. *Complete Section with END OF SETION.*
7. *No lines should be placed between paragraphs and sub-paragraphs, or between sub-paragraphs and other sub-paragraphs.*

Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED



PART 3 – EXECUTION

NOT USED

Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to the installation of standing seam sheet metal roofing, flashings, and related accessories.

NOTE TO SPECIFIER

Review available field data:

1. *For projects that do not include roof areas with underlying steel decks, DELETE paragraph 1.2D from the list below.*
2. *For projects that do not include roof areas with underlying wood decks, DELETE paragraph 1.2E from the list below.*
3. *For projects that include roof areas with both underlying steel and wood decks, do not edit the list below.*

Re-letter/number paragraphs and sub-paragraphs after editing, if necessary.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 024100 – Roof Removal and Substrate Preparation
- D. Section 053123 – Steel Roof Deck Repair and Replacement
- E. Section 061516 – Wood Roof Deck Repair and Replacement
- F. Section 079201 – Sealants for Roof Replacement
- G. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

NOTE TO SPECIFIER

Per discussions between the designer and USPS Project Manager, determine the warranty requirements for the project. Choose from the following warranty options and actions:

1. *If an alternate price for a 20-year "Total System Warranty" is specified, Leave Article 1.3 unchanged.*
2. *If a 20-year "Total System Warranty" will be included in the base proposal, or if no warranty is specified, remove Article 1.3.*

Re-letter/number items after editing.

1.3 ALTERNATES

- A. Provide an alternate price for the 20-Year Total System Warranty described in paragraph 1.9A.

1.4 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
1. American Architectural Manufacturers Association
 - a. AAMA 621 – Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) & Zinc-Aluminum Coated Steel Substrates
 2. American Society for Testing and Materials (ASTM)
 - a. ASTM A 792/A 792M – Standard Specification for Sheet Steel, 55% Aluminum-Zinc Alloy Coated by the Hot-Dip Process
 - b. ASTM D 1970 – Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
 - c. ASTM B 209 – Aluminum and Aluminum Alloy Sheet and Plate
 - d. ASTM F 1667 – Standard Specification for Driven Fasteners: Nails, Spikes, and Staples
 3. National Roofing Contractors Association (NRCA)
 - a. NRCA Roofing and Waterproofing Manual, 5th Edition
 4. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).
 - a. SMACNA Architectural Sheet Metal Manual, 7th Edition
 5. Underwriters Laboratories, Inc. (UL)
 - a. UL 2218 - Impact Resistance of Prepared Roof Covering Materials
 - b. UL 580 - Tests for Uplift Resistance of Roof Assemblies

1.5 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.6 QUALITY ASSURANCE PROCEDURES

- A. **Applicator Qualifications:** A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. **Single Source Responsibility:** Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. **Examine the technical specifications and drawings.** Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional



compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.

- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.
- F. Refer to manufacturer minimum slope requirements for the standing seam sheet metal system selected for use. Do not install standing seam sheet metal roof systems on slopes less than 2-inches per foot.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
 - 1. NOTE: Do not install standing seam sheet metal roofing at temperatures below 32°F (0°C).
 - 2. When the outside temperature is forecast to fall below 40°F (5°C), store unused materials in a heated location. Remove these materials only when ready for installation.
 - 3. Do not install self-adhering membrane when the temperature of the outside air, self-adhering membrane, or roof deck are below 40°F (5°C).
 - 4. Refer to the sheet metal roofing panel manufacturer and NRCA requirements and recommendations for additional cold weather application requirements and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

NOTE TO SPECIFIER

Per discussions between the designer and USPS Project Manager, determine the warranty requirements for the project. Choose from the following warranty options and actions:

- 1. *If an alternate price for a 20-year "Total System, Non-Pro-Rated Warranty" is specified, do not edit paragraph 1.9A.*
- 2. *If a 20-year "Total System, Non-Pro-Rated Warranty" will be included in the base proposal,*



3. *DELETE "an alternate price for" from paragraph 1.9A. If no warranty is specified, EDIT the title of Article 1.9 (DELETE the words "MANUFACTURER WARRANTY AND"), and DELETE paragraph 1.9A. The two-year contractor guarantee shall remain in place.*

Re-letter/number paragraphs and sub-paragraphs after editing.

1.9 MANUFACTURER WARRANTY AND CONTRACTOR GUARANTEE

- A. Provide an alternate price for a manufacturer 20-Year Total System, Non-Pro-Rated Warranty (including insulation, roofing membrane, and flashings) covering materials and labor. The warranty shall include the following additional items:
- Roofing inspection by a technical representative of the roofing membrane manufacturer 22-24 months after date of Final Acceptance.
 - Roofing manufacturer will provide unlimited repairs during warranty period with no cost limitation.
 - Temporary emergency repairs may be made by United States Postal Service without voiding any warranty provisions.
 - Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Record Standing Seam Sheet Metal Roofing Specification Section to Warranty.
- B. The Contractor shall provide a two-year contractor guarantee. At a minimum, the contractor guarantee shall include the following:
- Contractor name, address, phone number and project contact name.
 - The project completion date, and date of guarantee expiration.
 - The contractor guarantee shall include, in writing, all project work, workmanship, and/or all materials installed by the contractor or subcontractors to be of a quality that will comply with all project specific requirements of the Construction Documents and other documents governing the Work and workmanship through the guarantee period.
 - The contractor shall investigate roof leaks during the guarantee period within a reasonable time period, but in no instance greater than 24-hours after notification of a leak. The contractor shall repair leaks determined to be the cause of the Work at no cost to the Owner.

PART 2 – PRODUCTS

2.1 STANDING SEAM SHEET METAL ROOFING SYSTEM SUMMARY

- A. Acceptable sheet metal roofing panel manufacturers: Manufacturers offering panels meeting the requirements listed in Item 2.2.

NOTE TO SPECIFIER

Per discussions between the designer and USPS Project Manager, determine the warranty requirements for the project. Choose from the following warranty options and actions:

- If a 20-year "Total System, Non-Pro-Rated Warranty" will be included in the base proposal, or if an alternate price for a 20-year "Total System, Non-Pro-Rated Warranty" is specified, do not edit paragraph 2.1B.*
- If no warranty is specified, DELETE paragraph 2.1B.*

- B. Selected products, when used within the specified roof assembly, must be capable of meeting the warranty requirements listed in Article 1.9.

NOTE TO SPECIFIER



Review available field data:

1. *If an architectural standing seam sheet metal system is specified (a continuous underlying substrate, such as a plywood deck, is present), do not edit Article 2.2 below.*
2. *If a structural standing seam sheet metal system is specified (the system will be installed directly over structural steel purlins), DELETE Article 2.2 below.*

Re-number Articles, if necessary, after editing.

2.2 UNDERLAYMENT

- A. Self-adhering membrane: Product approved for use in high-temperature conditions by the underlayment manufacturer and sheet metal panel manufacturer, and meeting the following criteria:
 1. Meeting the requirements of ASTM D 1970.
 2. Approved for use as an underlayment for standing seam sheet metal roofing.
 3. A 40-mil minimum membrane thickness.
- B. For use over self-adhering membrane:
 1. Red rosin paper; 36-inch width, minimum; 3 pounds per 100 square feet, minimum.

2.3 SHEET METAL ROOF PANELS

NOTE TO SPECIFIER

Review available field data:

1. *If an architectural standing seam sheet metal system is specified (a continuous underlying substrate, such as a plywood deck, is present), DELETE "and/or structural" from paragraph 2.3A, and DELETE sub-paragraph 2.3.A.2 below.*
2. *If a structural standing seam sheet metal system is specified (the system will be installed directly over structural steel purlins), DELETE "architectural and/or" from paragraph 2.3A, but do not edit sub-paragraph 2.3.A.2 below.*

- A. Product type: Factory-formed, prefinished galvanized steel, minimum 22-gauge architectural and/or structural sheet metal roof panels; conforming to ASTM A 792/A 792M. Fabricated to allow for a minimum 1-3/4 inch high standing seams 18-inches o.c. maximum, or as recommended by the sheet metal roofing panel manufacturer for this application. Factory-fabricated "ready to use" for field assembly.
 1. Panels shall match configuration and profile of existing panel system.
 2. Panels shall be capable of spanning the existing structural purlins encountered.
- B. Panel finish: Kynar 500 coated, with a factory-applied top side film thickness of .70 to .90 mil over a .25 to .30 mil prime coat to provide a total dry film thickness of .95 to 1.25 mil, to meet AAMA 621. Underside of panel shall be coated with a primer with a dry film thickness of .25 mil. Finish shall conform to all tests for adhesions, flexibility and longevity as specified by Kynar 500 supplier. Standard color as determined by the Owner.
- C. Impact Resistance: Conforming to the requirements of UL 2218.
- D. Wind uplift: Conforming to the requirements of UL 580, and capable of obtaining a UL Class 90 rating for wind uplift.

2.4 CLIPS



- A. System clips: Concealed; size, type, and configuration as necessary to match roof system type. Product manufactured by or approved by the sheet metal panel manufacturer.

NOTE TO SPECIFIER

Review available field data:

1. *If an architectural standing seam sheet metal system is specified (a continuous underlying substrate, such as a plywood deck, is present), do not edit paragraph 2.5A below.*
2. *If a structural standing seam sheet metal system is specified (the system will be installed directly over structural steel purlins), DELETE paragraph 2.5A below.*

Re-number/letter paragraphs and sub-paragraphs, if necessary, after editing.

2.5 FASTENERS

- A. For fastening red rosin paper:
1. Staples; size as necessary to hold red rosin paper in place prior to installation of standing seam sheet metal roof system.
- B. For fastening of sheet metal clips:
1. Fastener type compatible with the substrate encountered, and approved for use in this application by the sheet metal panel manufacturer.
- C. For fastening of other sheet metal accessories:
1. Fastener type compatible with the substrate encountered, and approved for use in this application by the sheet metal panel manufacturer. Provide neoprene washers where shown on drawings.

2.6 SHEET METAL AND FLASHING ACCESSORIES

- A. Rake edges, perimeter fascia, fascia extensions, hip and ridge flashings, expansion joints and counterflashing: Prefinished galvanized steel: Kynar 500 coating, 24-gauge; color as selected by Owner.
1. Fabricate to the dimensions and configurations indicated on the drawings.
- B. Continuous cleats: Galvanized steel; G 90, hot-dipped zinc-coated sheet steel, 22-gauge, minimum.
- C. Gutters: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating. Fabricate gutters to match dimensions indicated on the drawings; fabricate in 10-foot sections, with a 4-inch flange with a 1/2-inch hug at the inner edge of the gutter flange.
1. Gutter spacers: Painted galvanized steel, 1-inch wide by 1/8-inch thick; seal and secure to gutter as shown on drawings. Paint color to match gutter.
- D. Scuppers:
1. Scupper liners: Stainless steel, 22-gauge. Fabricate scupper flashings in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-26, 1-28, 1-29 and 1-30. Provide a 4-inch flange with a 1/2-inch hug at the inner edge of the scupper flange. Solder all seams watertight.
 2. Conductor boxes and scupper closure plates: Stainless steel, 22-gauge. Solder all seams watertight. Fabricate these components in accordance with the drawings, and the requirements outlined in the "SMACNA Architectural Sheet Metal Manual, 7th Edition".
- E. Conductor box fascia covers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating;



standard prefinished color as selected by the Owner.

- F. Downspouts, associated with gutters and scuppers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by Owner. Fabricate downspouts with a "Pittsburgh Lock" seam, and in accordance with the drawings and "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-32B and 1-32F; size the hangers to match downspouts.
- G. Apron, wall and cricket flashing (related to rooftop curbs, chimneys and other square penetrations: Prefinished galvanized steel: Kynar 500 coating, 24-gauge; color as selected by Owner.
 - 1. Fabricate to the dimensions and configurations indicated on the drawings.
- H. Plumbing vent and tubular penetration flashings: Metal flashing with flanged sleeve with hood, prefabricated flashing with elastomeric collar, or other product type manufactured by, or approved by the sheet metal panel manufacturer.
 - 1. For sheet metal plumbing vent and tubular penetration flashings with flange and sleeve and hood:
 - a. Clamp: Stainless steel plumbers clamp, size as necessary to tightly secure hood.

2.7 MISCELLANEOUS MATERIALS

- A. Ventilation accessories, including ridge vents, soffit vents and other rooftop vents:
 - 1. Provide accessories manufactured by, or approved by, the sheet metal roofing manufacturer, if required.
- B. For use at sheet metal flashing strip-ins, and where indicated on drawings:
 - 1. Pressure-sensitive EPDM flashing material; non-reinforced, nominal 60-mil thickness, black color. Type acceptable to asphalt shingle roofing manufacturer for specific flashing conditions encountered. Minimum 5-inch width.
 - 2. Primer: Type compatible with pressure-sensitive EPDM flashing and acceptable to the sheet metal panel manufacturer.
- C. Butyl tape: for use behind counterflashing flanges and other locations indicated where indicated on the drawings. Width and thickness as necessary to create a seal between the existing substrate and secured counterflashing.

NOTE TO SPECIFIER

Review available field data:

- 1. *At project locations where excessive, accumulating snow is possible, the designer/specifier must consider the use of a snow retention system. If such a system is determined to be necessary for the project location, do not edit Article 2.8.*
- 2. *If a snow retention system is not determined to be necessary for the project location, or cannot be installed due to the potential of increased structural load on the building structure, DELETE Article 2.8.*

NOTE: *A structural analysis should be performed prior to specifying a snow retention system to ensure a structure's capability to support potential additional load from accumulated snow.*

Re-number/letter Articles, paragraphs and sub-paragraphs, if necessary, after editing.

2.8 SNOW RETENTION SYSTEM

- A. Provide a snow retention system:
 - 1. The snow retention system shall be approved for use by the sheet metal panel manufacturer.
 - 2. Snow retention system standing seam clamps: Product such as “S-5! Clamps”, manufactured by S-5! Attachment Solutions – Metal Roof Innovations, Ltd., Colorado Springs, CO. Clamp size and configuration as necessary to accommodate standing seam size and profile. Product shall be approved by Owner prior to use.
 - 3. Snow retention system: Snow retention system appropriate for the anticipated snow accumulation at the project location. Products such as “Sno-Rail/Sno-Fence” and “Sno-Clip”, manufactured by Alpine SnowGuards, Morristown, VT.

2.9 SEALANT

- A. Refer to Section 079201.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Section 024100 for general work and substrate preparation requirements.

NOTE TO SPECIFIER

Review available field data:

- 1. *If an architectural standing seam sheet metal system is specified (a continuous underlying substrate, such as a plywood deck, is present), do not edit Article 3.2 below.*
- 2. *If a structural standing seam sheet metal system is specified (the system will be installed directly over structural steel purlins), DELETE Article 3.2 below.*

Re-number Articles, if necessary, after editing.

3.2 UNDELAYMENT INSTALLATION

- A. Install self-adhering membrane: Follow installation requirements of the underlayment manufacturer.
- B. Install one ply of red rosin sheathing paper. Secure to the deck as necessary to hold in place.

NOTE TO SPECIFIER

Review available field data:

- 1. *If an architectural standing seam sheet metal system is specified (a continuous underlying substrate, such as a plywood deck, is present), do not edit sub-paragraph 3.3.A.1 below.*
- 2. *If a structural standing seam sheet metal system is specified (the system will be installed directly over structural steel purlins), delete “including underlayments,” from sub-paragraph 3.3.A.1.*

3.3 STANDING SEAM SHEET METAL ROOFING INSTALLATION

- A. Roof system general installation instructions:
 - 1. Except as may be modified by these specifications and drawings, install the specified sheet metal roof panel system, including underlayments, in accordance with the requirements and recommendations of the manufacturer, using the manufacturer's



- current printed instructions, the recommendations outlined in the NRCA "Roofing and Waterproofing Manual, 5th Edition", and the recommendations outlined in the "SMACNA Architectural Sheet Metal Manual, 7th Edition".
2. Panels shall be installed plumb and true in a proper alignment and in relation to the existing structural framing. If necessary, use chalk lines as visible guides to ensure the proper alignment of the panels.
 3. Install sheet metal panel clips as required to secure the standing seam sheet metal panel system to the underlying substrate, and to allow movement of the roof system. Follow the requirements and recommendations of the sheet metal panel manufacturer. Install a minimum of two fasteners per clip.

3.4 SHEET METAL FLASHING INSTALLATION

- A. Rake edges perimeter fascias and fascia extensions:
 1. Continuous cleats: Provide continuous cleats where indicated on drawings. Secure the horizontal flange and vertical face of the continuous cleat with ring shank coated nails 12-inches o.c., max. Decrease fastener spacing to 6-inches o.c., max. within 10-feet of a building corner.
 2. Drip edges, fascia and fascia extensions: Place the drip edge, fascia or fascia extension. Hook the fascia to the underlying continuous cleat. Secure the flange with nails 3-inches o.c. in two staggered rows as indicated on the drawings.
- B. Hip and ridge flashings:
 1. Fabricate and install hip and ridge caps as indicated on the drawings. Follow the recommendations and requirements of the sheet metal panel manufacturer.
- C. Expansion joints:
 1. Fabricate and install expansion joint flashings as indicated on the drawings.
- D. Counterflashings: Install counterflashings at locations indicated on the drawings as follows:
 1. Install continuous butyl tape behind vertical face of counterflashing.
 2. Secure counterflashings with fasteners spaced as indicated on drawings.
 3. Provide a continuous bead of sealant along the top edge of surface-mounted counterflashings to shed water and provide a watertight seal.
- E. Slip counterflashings: Install slip counterflashings at locations where existing sheet metal counterflashings cannot be lifted or removed, and at other locations indicated on the drawings as follows:
 1. Install continuous butyl tape behind vertical face of counterflashing.
 2. Secure counterflashings with fasteners spaced as indicated on drawings.
- F. Gutters and downspouts:
 1. Install the specified gutter spacers 24-inches o.c. Seal and secure the spacers to the gutter assembly as indicated on the drawings.
 2. Overlap individual gutter sections 1-1/2 inches. Seal overlap, and pop-rivet sections together with two rows of pop rivets. Space pop rivets 1/2-inch min., and 3/4-inches max. in each row. Completed gutter sections shall not exceed 50-feet in length.
 3. Secure the flange with nails 3-inches o.c. in two staggered rows.
 4. Gutter expansion joints: Provide gutter expansion joints at locations recommended by SMACNA; fabricated following the recommendations of SMACNA.
 5. Downspouts: Install downspouts at locations indicated on drawings. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.

- a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
- G. Scupper liners, closure plates, conductor boxes and downspouts:
 - 1. Scupper liners: Install scupper liners at through-fascia, through-wall, and overflow scupper locations indicated on the drawings. Install scupper liners following the requirements and recommendations of SMACNA.
 - 2. Cover plates: At the exterior face of the scupper, install cover plates. Install scupper cover plates as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 - 3. Conductor boxes: Where indicated on the drawings, install conductor boxes as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 - 4. Downspouts: Install downspouts at conductor boxes. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
 - 5. Install conductor box fascia covers as indicated on the drawings. Fully clip fascia covers to stainless steel conductor boxes, or secure to substrate with fasteners appropriate for the substrate encountered.
- H. Apron, side, and cricket flashings:
 - 1. Install apron and backer/cricket flashings at roof curbs, chimneys, wall terminations, locations indicated on drawings, and at locations recommended by the sheet metal panel manufacturer.
 - a. At penetrations greater than 24-inches, roof slopes greater than 6:12 (27 degrees), when a large volume of snow or ice could accumulate behind a roof penetration or when the average January temperature is 30°F (-1°C) or lower, install cricket flashings in lieu of backer flashings behind roof penetrations.
 - b. Where cricket widths exceed 18-inches, provide wood framing and plywood support beneath sheet metal cricket flashing.
 - c. Secure apron and backer/cricket flashings to the underlying substrate with fasteners appropriate to the substrate.
- I. Tubular penetration flashing: Flash round pipe penetrations with a manufacturer recommended pipe flashing boot and specified watertight hood.
 - 1. Flash tubular penetration where indicated on drawings. Follow asphalt shingle manufacturer recommendations and requirements.
 - 2. Hood and drawband: Where a flanged sleeve sheet metal flashing is used, install a stainless steel hood over the flanged sleeve; solder all seams watertight. Secure a stainless steel drawband around the top of each hood to secure the hood to the penetration. Seal the top of the drawband and hood.

3.5 MISCELLANEOUS INSTALLATIONS/TREATMENTS

- A. Install ventilation accessories, including ridge vents, soffit vents and other rooftop vents at locations indicated on the drawings, or recommended by the sheet metal panel manufacturer following the printed instructions of the manufacturer.
- B. Sheet metal flashing strip-ins:
 - 1. Install specified strip-in where indicated on drawings.
- C. Butyl tape:
 - 1. Install specified butyl tape behind counterflashings where indicated on drawings.



NOTE TO SPECIFIER

Review available field data:

1. If a snow retention system is to be included on the project, do not edit Article 3.6.
2. If a snow retention system is not included on the project, DELETE Article 3.6.

NOTE: A structural analysis should be performed prior to specifying a snow retention system to ensure a structure's capability to support potential additional load from accumulated snow.

Re-number/letter Articles, paragraphs and sub-paragraphs, if necessary, after editing.

3.6 SNOW RETENTION SYSTEM INSTALLATION

- A. Install the snow retention system following the recommendations and requirements of the standing seam sheet metal panel and snow retention system manufacturers.

USPS CSF Specifications issued: 10/1/2013

Last revised: 3/6/2013

NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 61 13 00



SECTION 07 62 00 00 - CSF SHEET METAL FLASHING AND TRIM

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.07 62 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Flashings and counterflashings, gutters and downspouts, and fabricated sheet metal items.
 2. Sheet metal accessories.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 1. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- B. Federal Specifications (FS):
 1. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - a. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 1. Fabricator: Company specializing in manufacturing Products specified with minimum 5 years documented experience.



2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- C. Prevent contact with materials which may cause discoloration or staining.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Sheet: ASTM B209, 3003 alloy, H14 temper; 0.025 inch minimum thickness; Class I clear anodized finish. Actual thickness as indicated on contract drawings or as needed to comply with code requirements and to prevent oil canning.
- B. Pre-Finished Aluminum Sheet: ASTM B209, 3003 alloy, H14 temper; 0.025 inch minimum thickness; finish shop pre-coated with PVDF (polyvinylidene fluoride)] coating; color as indicated on Drawings.

2.2 ACCESSORIES

- A. Fasteners: Aluminum.
- B. Protective Backing Paint: FS TT-C-494, Bituminous.
- C. Sealant: Specified in Section 079200.

2.3 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Fabricate cleats of same material as sheet, interlocking with sheet.
- C. Form pieces in longest possible lengths.
- D. Hem exposed edges on underside 1/2; miter and seam corners.
- E. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- F. Tin edges of copper sheet to be soldered. Solder shop formed metal joints. After soldering, remove flux. Wipe and wash solder joints clean. Weather seal joints.
- G. Fabricate gutters to profile and size indicated on Drawings.
- H. Fabricate downspouts to profile and size indicated on Drawings.



- I. Fabricate accessories in profile and size to suit gutters and downspouts.
 - 1. Anchorage Devices: Type recommended by fabricator.
 - 2. Gutter Supports: Brackets.
 - 3. Downspout Supports: Straps.

- J. Seal metal joints.

2.4 FACTORY FINISHING

- A. PVDF (polyvinylidene fluoride) coating: Multiple coat, thermally cured, fluoropolymer system conforming to AAMA 605.2.
- B. Primer Coat: Finish concealed side of metal sheets with primer compatible with finish system, as recommended by finish system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
 - 2. Verify roofing termination and base flashings are in place, sealed, and secure.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.
- C. Paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil .

3.3 INSTALLATION

- A. Secure flashings in place using concealed fasteners.
- B. Apply plastic cement compound between metal flashings and felt flashings.



- C. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- D. Seal metal joints watertight.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/19/2011

END OF SECTION



SECTION 07 62 02 00 - CSF SHEET METAL FOR BUILT-UP ROOFING

NOTE TO SPECIFIER

Editing is needed for each individual project; modify as needed for project specific requirements. Included "NOTE TO SPECIFIER" instructions provide guidance concerning required editing, and options have been included requiring action on the part of the specifier/designer. Select the option appropriate for the project and delete option(s) not selected.

NOTE TO SPECIFIER

EDIT Section footer as necessary to reflect the project name and location, USPS Project number, and required date of the technical specification document. Coordinate this project specific information with the USPS Project Manager. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this Section In technical specifications where an asphalt built-up roofing membrane (Section 075113) and/or a coal tar pitch roofing membrane (Section 075116) are specified.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to sheet metal fabrication and installation related to built-up roofing.

NOTE TO SPECIFIER

EDIT Article 1.2 RELATED SECTIONS below. DELETE Section references for roofing system Sections not applicable to this project. Re-letter paragraphs after editing.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 075113 – Built-Up Asphalt Roofing
- D. Section 075116 – Built-Up Coal Tar Pitch Roofing
- E. Section 079200 – Sealants for Roofing
- F. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 1. American Society for Testing and Materials (ASTM)



- a. ASTM A 653/653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- b. ASTM D 41/D 41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
- 2. American National Standard Institute (ANSI)
- 3. Factory Mutual Global (FM)
- 4. National Roofing Contractors Association (NRCA)
- 5. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
 - a. SMACNA Architectural Sheet Metal Manual, 6th Edition
- 6. Single Ply Roofing Industry (SPRI)
 - a. ANSI/SPRI/FM 4435/ES-1 – Wind Design for Edge Systems Used with Low Slope Roofing Systems

1.4 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.5 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp.



- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
 - 1. NOTE: Do not install sealants, adhesives or primers associated with sheet metal flashing at temperatures below 50°F (10°C).
 - 2. When the outside temperature is forecast to fall below 50°F (10°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives and primers should be maintained at a temperature of 50°F (10°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 - 3. Refer to the built-up roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

PART 2 – PRODUCTS

NOTE TO SPECIFIER

Article 2.1 may be edited to reflect sheet metal flashing requirements for a specific project. EDIT Article 2.1 as necessary. Re-letter/number paragraphs and sub-paragraphs after editing.

2.1 SHEET METAL ACCESSORIES

- A. Perimeter edge metal flashing system: Perimeter edge sheet metal flashing system consisting of a continuous inner clip and outer fascia piece, designed in accordance with the requirements of ANSI/SPRI/FM 4435/ES-1.
 - 1. Inner clip/retention system and continuous cleats associated with perimeter edge metal flashing systems: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
 - 2. Fascia piece/gravel stop associated with perimeter edge metal flashing systems: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- B. Perimeter parapet cap metal flashing system: Parapet cap sheet metal flashing system consisting of a continuous inner clip and outer fascia piece, designed in accordance with the requirements of ANSI/SPRI/FM 4435/ES-1.
 - 1. Inner clip/retention system and continuous cleats associated with perimeter edge metal flashing systems: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
 - 2. Parapet cap associated with perimeter parapet cap metal flashing systems: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.



- C. Interior parapet caps, area divider caps, expansion joint covers, and fascia extensions: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating, maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
 - 1. Continuous cleats and expansion joint backer pieces associated with prefinished galvanized steel caps and fascia extension installation: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
- D. Curb caps: Galvanized steel, 18-gauge, ASTM A 653/653M; G-90. Fabricate to match dimensions of curbed cap, and as indicated on the drawings. Fabricate top with a cross-break, providing four-way slope to the outer edges of the cap adequate to remove the potential for standing water at the top of cap.
- E. Reglet-mounted, surface-mounted and slip counterflashings: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating, maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- F. Gutters: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating. Fabricate gutters to match dimensions indicated on the drawings; fabricate in 10-foot sections, with a 4-inch flange with a 1/2-inch hug at the inner edge of the gutter flange.
 - 1. Gutter spacers: Painted galvanized steel, 1-inch wide by 1/8-inch thick; seal and secure to gutter as shown on drawings. Paint color to match gutter.
- G. Through-fascia, through-wall and overflow scuppers:
 - 1. Scupper liners: Stainless steel, 22-gauge. Fabricate scupper flashings in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-26, 1-28, 1-29 and 1-30. Provide a 4-inch flange with a 1/2-inch hug at the inner edge of the scupper flange. Solder all seams watertight.
 - 2. Conductor boxes and scupper closure plates: Stainless steel, 22-gauge. Solder all seams watertight. Fabricate these components in accordance with the drawings, and the requirements outlined in the "SMACNA Architectural Sheet Metal Manual, 7th Edition".
- H. Conductor box fascia covers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by the Owner.
- I. Downspouts, associated with gutters and scuppers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by Owner. Fabricate downspouts with a "Pittsburgh Lock" seam, and in accordance with the drawings and "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-32B and 1-32F; size the hangers to match downspouts.
- J. Plumbing vent and roof sump flashing:
 - 1. Plumbing vent flashing: One-piece flange and sleeve formed of minimum 4-pound lead, with a "ribbed" configuration at the base of the sleeve to allow for movement and/or expansion of the vent stack; lead sleeve diameter to closely match the diameter of the existing stack.
 - 2. Roof sump flashing: 30-inches by 30-inches, minimum 4-pound lead roof drain flashing sheet.
- K. Tubular penetrations, pitch pans and hoods/covers:
 - 1. Tubular penetration flashings: Stainless steel, 24-gauge. Fabricate a one-piece flanged sleeve with a flange extending 6-inches minimum out from the sleeve; sleeve to extend minimum 6-inches above the finished roof surface.
 - 2. Pitch pans: Stainless steel, 24-gauge. Fabricate to dimensions shown on drawings, with a minimum 4-inch depth, and flange extending 6-inches minimum out from the pitch pan,

- and other dimensions to be kept to the minimum size necessary to provide a 2-inch clearance all sides from the penetration.
3. Tubular penetration hoods and pitch pan covers: Stainless steel, 24-gauge. Fabricate to dimensions shown on drawings.
- L. High-temperature tubular penetrations:
1. High-temperature tubular penetration flashings and insulation stops: Stainless steel, 24-gauge. Fabricate a one-piece flanged sleeve with a flange extending 6-inches minimum out from the sleeve onto the roof surface.
- M. Miscellaneous sheet metal accessories:
1. For terminating flashing: Anchor bar: 1-inch x 1/8-inch extruded aluminum with slotted holes spaced 6 inches o.c. Do not fabricate with a caulk slot.
 2. For securement of sheet metal hoods at tubular penetrations: Stainless steel adjustable clamp.
 3. For use behind counterflashing flanges where indicated on the drawings: Butyl tape, width and thickness as necessary to create a seal between the existing substrate and secured counterflashing.

2.2 ADHESIVES, CEMENTS AND PRIMERS

- A. Flashing cement and roofing cement: Product compatible with flashing sheet used and approved by the roofing membrane manufacturer for the situation encountered.
- B. Asphalt primer: ASTM D 41/ D 41M.

2.3 FASTENERS

- A. For securing sheet metal flashings: Fasteners indicated on the drawings, or appropriate and approved by the Owner for the substrate encountered, and compatible with the sheet metal type to be secured. Where fastener heads are exposed, provide neoprene gaskets/washers.
- B. For copper: Copper or bronze fasteners.
- C. For stainless steel: Stainless steel fasteners.
- D. For securing aluminum anchor bar: Fasteners appropriate for, and approved by the Owner and roofing manufacturer for the substrate encountered.

2.4 SEALANT

- A. Refer to Section 079201.

PART 3 - EXECUTION

NOTE TO SPECIFIER

Article 3.1 may be edited to reflect sheet metal flashing requirements for a specific project. EDIT Article 3.1 as necessary. Re-letter/number paragraphs and sub-paragraphs after editing.

3.1 SHEET METAL FLASHING INSTALLATION



- A. Perimeter edge metal flashing system:
1. Install perimeter edge metal in a manner that meets the requirements of ANSI/SPRI/FM 4435/ES-1. Provide a system matching the configurations and dimensions indicated on the drawings.
 2. For pre-fabricated parapet cap metal systems: Install in accordance with the metal system manufacturer.
 3. For shop-fabricated perimeter edge metal systems:
 - a. Secure the horizontal flange and vertical face of the inner clip/continuous cleat with ring shank coated nails 12-inches o.c., max. Decrease fastener spacing to 6-inches o.c., max. within 10-feet of a building corner.
 - b. Place the outer fascia/gravel stop piece. Hook the fascia to the underlying continuous cleat. Secure the flange with nails 3-inches o.c. in two staggered rows as indicated on the drawings. Prior to securement, prime both sides of horizontal flange and set in a full bed of roofing cement.
- B. Parapet edge cap metal flashing system:
1. For pre-fabricated parapet cap metal systems: Install in accordance with the metal system manufacturer to meet the requirements of ANSI/SPRI/FM 4435/ES-1. Provide a system matching the dimensions indicated on the drawings.
 2. For shop-fabricated parapet cap metal systems:
 - a. Fabricate inner clips/continuous cleats with a kick-up, creating a minimum 1/2-inch per foot slope toward the roof.
 - b. Secure the horizontal flange and vertical face of the inner clip/continuous cleat with ring shank coated nails 12-inches o.c., max. Decrease fastener spacing to 6-inches o.c., max. within 10-feet of a building corner.
 - c. Place the cap sections. At the outer face, hook the fascia to the underlying continuous cleat. At the inner face, secure the flange with #12 fasteners, fitted with neoprene gaskets/washers 18-inches o.c., max., and within 2-inches of each end.
 - d. Join adjacent parapet cap sections using a standing seam, with a 1" height. Where upturned standing seam ends meet, apply continuous sealant to the joint. Cut outer edges of upturned seams at a 45-degree angle. Fold ear over end, and crimp in place.
 - e. Where parapet caps terminate at walls, turn self-adhering membrane 1-inch, minimum, up wall. Turn coping cap piece 2-inches, minimum, up wall. Seal and secure as indicated on the drawings. Install regletted counterflashing over exposed end piece.
- C. Curb caps, area divider and expansion joint covers:
1. Install caps, covers, and related continuous cleats and backer pieces, as detailed, at locations indicated on the drawings.
 2. Fabricate with seam type indicated on drawings to dimensions indicated on drawings. Provide a 3/4-inch hemmed drip edge.
 3. Fastening: Secure faces of curb caps, area divider covers, and expansion joint covers with specified fasteners appropriate for the substrate encountered, fitted with neoprene gaskets/washers, spaced 18-inches o.c. max., and within 2-inches of each end.
 4. Join adjacent area divider and expansion joint cover sections using a standing seam, with a 1" height. Where upturned standing seam ends meet, apply continuous sealant to the joint. Cut outer edges of upturned seams at a 45-degree angle. Fold ear over end, and crimp in place.
 5. Where area divider and expansion joint covers terminate at walls, turn self-adhering membrane 1-inch, minimum, up wall. Turn coping cap piece 2-inches, minimum, up wall. Seal and secure as indicated on the drawings. Install regletted counterflashing over exposed end piece.



- D. Fascia extensions:
 - 1. Secure fascia extensions with ring shank coated nails 12-inches o.c., max., or fasteners appropriate for, and approved by the Owner for, the substrate condition encountered, 12-inches o.c. max.

- E. Reglet-mounted and slip counterflashings: Provide counterflashings, as detailed, at locations indicated on the drawings:
 - 1. At locations indicated on the drawings, install butyl tape to the backside of counterflashing flanges at the flange interface with the substrate.
 - 2. Cut reglets into masonry walls to accommodate reglet-mounted counterflashing.
 - 3. Fabricate counterflashing to dimensions indicated on drawings. Fabricate the counterflashing with a 3/4-inch hemmed drip edge, and on surface mounted counterflashing, a 1/2-inch 45-degree angle sealant slot. Fabricate slip counterflashings to dimensions necessary to accommodate existing conditions, and as shown on drawings. Provide a minimum 4-inch face if conditions allow.
 - 4. Secure counterflashings with specified fasteners appropriate for substrate condition encountered, fitted with neoprene gaskets/washers. Space fasteners 12-inches o.c. max., and within 2-inches of each end.

- F. Gutters and downspouts:
 - 1. Install the specified gutter spacers 24-inches o.c. Seal and secure the spacers to the gutter assembly as indicated on the drawings.
 - 2. Overlap individual gutter sections 1-1/2 inches. Seal overlap, and pop-rivet sections together with two rows of pop rivets. Space pop rivets 1/2-inch min., and 3/4-inches max. in each row. Completed gutter sections shall not exceed 50-feet in length.
 - 3. Prime both sides of gutter flange and set in a full bed of roofing cement. Secure the flange with nails 3-inches o.c. in two staggered rows.
 - 4. Gutter expansion joints: Provide gutter expansion joints at locations recommended by SMACNA; fabricated following the recommendations of SMACNA.
 - 5. Downspouts: Install downspouts at locations indicated on drawings. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.

- G. Scupper liners, closure plates, conductor boxes and downspouts:
 - 1. Scupper liners: Install scupper liners at through-fascia, through-wall, and overflow scupper locations indicated on the drawings. Install scupper liners following the requirements and recommendations of SMACNA.
 - 2. Cover plates: At the exterior face of the scupper, install cover plates. Install scupper cover plates as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 - 3. Conductor boxes: Where indicated on the drawings, install conductor boxes as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 - 4. Downspouts: Install downspouts at conductor boxes. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
 - 5. Install conductor box fascia covers as indicated on the drawings. Fully clip fascia covers to stainless steel conductor boxes, or secure to substrate with fasteners appropriate for the substrate encountered.

- H. Plumbing vents, tubular penetrations and pitch pan flashings:



1. Flash tubular penetrations, high-temperature penetrations and pitch pans as indicated on drawings. Do not use pitch pans at tubular penetrations without the approval of the Owner.
 2. Install tubular penetration hoods and pitch pan covers as indicated on the drawings.
 3. Prior to flashing application, ensure both sides of tubular penetration sleeve and pitch pan flanges have been primed, and the flange has been set in a full bed of roofing cement.
 4. Where soldering is required at stainless steel flanged sleeves, hoods, and pitch pans: Solder all seams and laps watertight. Prior to soldering of stainless steel, clean work area using solvents and wire brush; removing dirt, oil, grease, and other contaminants from the work area. Tin the work area by applying acid (flux). Perform soldering work. After completion of work, remove excess acid (flux) from the work area.
- I. Anchor bar: Fasten the upper edges of modified bitumen flashings with an anchor bar installed in accordance with the requirements of the roofing membrane manufacturer.

USPS CSF Specifications, issued: 10/1/2013

Last revised: 9/16/2013

NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 62 02 00



SECTION 07 62 02 00 - R&A SHEET METAL FOR BUILT-UP ROOFING

NOTE TO SPECIFIER

This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this Section In technical specifications where an asphalt built-up roofing membrane (Section 075113) and/or a coal tar pitch roofing membrane (Section 075216) are specified.

NOTE TO SPECIFIER

Section Formatting:

Consistent formatting of Sections gives the complete document a professional look. This Section uses a 10pt. Arial font, and is formatted as follows:

1. Insert one 10pt. line after the Section Number. Section Number is in CAPS.
2. Insert two 10pt. lines after the Section Title. Section Title is in CAPS.
3. Insert one 10pt. line after a PART. PARTS are in CAPS. If a Section is not used, include NOT USED following the PART title as shown below.
4. Insert one 10pt. line after Article paragraphs. Articles are in CAPS.
5. Insert two 10pt. lines at the end of an Article.
6. Complete Section with END OF SETION.
7. No lines should be placed between paragraphs and sub-paragraphs, or between sub-paragraphs and other sub-paragraphs.

Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED



Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to sheet metal fabrication and installation related to built-up roofing.

NOTE TO SPECIFIER

EDIT Article 1.2 RELATED SECTIONS below. DELETE Section references for roofing system Sections not applicable to this project. Re-letter paragraphs after editing.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 024100 – Roof Removal and Substrate Preparation
- D. Section 075113 – Built-Up Asphalt Roofing
- E. Section 075116 – Built-Up Coal Tar Pitch Roofing
- F. Section 079200 – Sealants for Roof Replacement
- G. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 - 1. American Society for Testing and Materials (ASTM)
 - a. ASTM A 653/653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - b. ASTM D 41/D 41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
 - 2. American National Standard Institute (ANSI)
 - 3. Factory Mutual Global (FM)
 - 4. National Roofing Contractors Association (NRCA)
 - 5. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
 - a. SMACNA Architectural Sheet Metal Manual, 6th Edition
 - 6. Single Ply Roofing Industry (SPRI)
 - a. ANSI/SPRI/FM 4435/ES-1 – Wind Design for Edge Systems Used with Low Slope Roofing Systems

1.4 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.5 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:



1. NOTE: Do not install sealants, adhesives or primers associated with sheet metal flashing at temperatures below 50°F (10°C).
 2. When the outside temperature is forecast to fall below 50°F (10°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives and primers should be maintained at a temperature of 50°F (10°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 3. Refer to the built-up roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

PART 2 – PRODUCTS

NOTE TO SPECIFIER

Article 2.1 may be edited to reflect sheet metal flashing requirements for a specific project. EDIT Article 2.1 as necessary. Re-letter/number paragraphs and sub-paragraphs after editing.

2.1 SHEET METAL ACCESSORIES

- A. Perimeter edge metal flashing system: Perimeter edge sheet metal flashing system consisting of a continuous inner clip and outer fascia piece, designed in accordance with the requirements of ANSI/SPRI/FM 4435/ES-1.
 1. Inner clip/retention system and continuous cleats associated with perimeter edge metal flashing systems: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
 2. Fascia piece/gravel stop associated with perimeter edge metal flashing systems: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- B. Perimeter parapet cap metal flashing system: Parapet cap sheet metal flashing system consisting of a continuous inner clip and outer fascia piece, designed in accordance with the requirements of ANSI/SPRI/FM 4435/ES-1.
 1. Inner clip/retention system and continuous cleats associated with perimeter edge metal flashing systems: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
 2. Parapet cap associated with perimeter parapet cap metal flashing systems: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- C. Interior parapet caps, area divider caps, expansion joint covers, and fascia extensions: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating, maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
 1. Continuous cleats and expansion joint backer pieces associated with prefinished galvanized steel caps and fascia extension installation: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
- D. Curb caps: Galvanized steel, 18-gauge, ASTM A 653/653M; G-90. Fabricate to match dimensions of curbed cap, and as indicated on the drawings. Fabricate top with a cross-break, providing four-way slope to the outer edges of the cap adequate to remove the potential for standing water at the top of cap.



- E. Reglet-mounted, surface-mounted and slip counterflashings: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating, maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- F. Gutters: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating. Fabricate gutters to match dimensions indicated on the drawings; fabricate in 10-foot sections, with a 4-inch flange with a 1/2-inch hug at the inner edge of the gutter flange.
 - 1. Gutter spacers: Painted galvanized steel, 1-inch wide by 1/8-inch thick; seal and secure to gutter as shown on drawings. Paint color to match gutter.
- G. Through-fascia, through-wall and overflow scuppers:
 - 1. Scupper liners: Stainless steel, 22-gauge. Fabricate scupper flashings in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-26, 1-28, 1-29 and 1-30. Provide a 4-inch flange with a 1/2-inch hug at the inner edge of the scupper flange. Solder all seams watertight.
 - 2. Conductor boxes and scupper closure plates: Stainless steel, 22-gauge. Solder all seams watertight. Fabricate these components in accordance with the drawings, and the requirements outlined in the "SMACNA Architectural Sheet Metal Manual, 7th Edition".
- H. Conductor box fascia covers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by the Owner.
- I. Downspouts, associated with gutters and scuppers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by Owner. Fabricate downspouts with a "Pittsburgh Lock" seam, and in accordance with the drawings and "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-32B and 1-32F; size the hangers to match downspouts.
- J. Plumbing vent and roof sump flashing:
 - 1. Plumbing vent flashing: One-piece flange and sleeve formed of minimum 4-pound lead, with a "ribbed" configuration at the base of the sleeve to allow for movement and/or expansion of the vent stack; lead sleeve diameter to closely match the diameter of the existing stack.
 - 2. Roof sump flashing: 30-inches by 30-inches, minimum 4-pound lead roof drain flashing sheet.
- K. Tubular penetrations, pitch pans and hoods/covers:
 - 1. Tubular penetration flashings: Stainless steel, 24-gauge. Fabricate a one-piece flanged sleeve with a flange extending 6-inches minimum out from the sleeve; sleeve to extend minimum 6-inches above the finished roof surface.
 - 2. Pitch pans: Stainless steel, 24-gauge. Fabricate to dimensions shown on drawings, with a minimum 4-inch depth, and flange extending 6-inches minimum out from the pitch pan, and other dimensions to be kept to the minimum size necessary to provide a 2-inch clearance all sides from the penetration.
 - 3. Tubular penetration hoods and pitch pan covers: Stainless steel, 24-gauge. Fabricate to dimensions shown on drawings.
- L. High-temperature tubular penetrations:
 - 1. High-temperature tubular penetration flashings and insulation stops: Stainless steel, 24-gauge. Fabricate a one-piece flanged sleeve with a flange extending 6-inches minimum out from the sleeve onto the roof surface.
- M. Miscellaneous sheet metal accessories:
 - 1. For terminating flashing: Anchor bar: 1-inch x 1/8-inch extruded aluminum with slotted holes spaced 6 inches o.c. Do not fabricate with a caulk slot.



2. For securement of sheet metal hoods at tubular penetrations: Stainless steel adjustable clamp.
3. For use behind counterflashing flanges where indicated on the drawings: Butyl tape, width and thickness as necessary to create a seal between the existing substrate and secured counterflashing.

2.2 ADHESIVES, CEMENTS AND PRIMERS

- A. Flashing cement and roofing cement: Product compatible with flashing sheet used and approved by the roofing membrane manufacturer for the situation encountered.
- B. Asphalt primer: ASTM D 41/ D 41M.

2.3 FASTENERS

- A. For securing sheet metal flashings: Fasteners indicated on the drawings, or appropriate and approved by the Owner for the substrate encountered, and compatible with the sheet metal type to be secured. Where fastener heads are exposed, provide neoprene gaskets/washers.
- B. For copper: Copper or bronze fasteners.
- C. For stainless steel: Stainless steel fasteners.
- D. For securing aluminum anchor bar: Fasteners appropriate for, and approved by the Owner and roofing manufacturer for the substrate encountered.

2.4 SEALANT

- A. Refer to Section 079201.

PART 3 - EXECUTION

NOTE TO SPECIFIER

Article 3.1 may be edited to reflect sheet metal flashing requirements for a specific project. EDIT Article 3.1 as necessary. Re-letter/number paragraphs and sub-paragraphs after editing.

3.1 SHEET METAL FLASHING INSTALLATION

- A. Perimeter edge metal flashing system:
 1. Install perimeter edge metal in a manner that meets the requirements of ANSI/SPRI/FM 4435/ES-1. Provide a system matching the configurations and dimensions indicated on the drawings.
 2. For pre-fabricated parapet cap metal systems: Install in accordance with the metal system manufacturer.
 3. For shop-fabricated perimeter edge metal systems:
 - a. Secure the horizontal flange and vertical face of the inner clip/continuous cleat with ring shank coated nails 12-inches o.c., max. Decrease fastener spacing to 6-inches o.c., max. within 10-feet of a building corner.
 - b. Place the outer fascia/gravel stop piece. Hook the fascia to the underlying continuous cleat. Secure the flange with nails 3-inches o.c. in two staggered

rows as indicated on the drawings. Prior to securement, prime both sides of horizontal flange and set in a full bed of roofing cement.

- B. Parapet edge cap metal flashing system:
1. For pre-fabricated parapet cap metal systems: Install in accordance with the metal system manufacturer to meet the requirements of ANSI/SPRI/FM 4435/ES-1. Provide a system matching the dimensions indicated on the drawings.
 2. For shop-fabricated parapet cap metal systems:
 - a. Fabricate inner clips/continuous cleats with a kick-up, creating a minimum 1/2-inch per foot slope toward the roof.
 - b. Secure the horizontal flange and vertical face of the inner clip/continuous cleat with ring shank coated nails 12-inches o.c., max. Decrease fastener spacing to 6-inches o.c., max. within 10-feet of a building corner.
 - c. Place the cap sections. At the outer face, hook the fascia to the underlying continuous cleat. At the inner face, secure the flange with #12 fasteners, fitted with neoprene gaskets/washers 18-inches o.c., max., and within 2-inches of each end.
 - d. Join adjacent parapet cap sections using a standing seam, with a 1" height. Where upturned standing seam ends meet, apply continuous sealant to the joint. Cut outer edges of upturned seams at a 45-degree angle. Fold ear over end, and crimp in place.
 - e. Where parapet caps terminate at walls, turn self-adhering membrane 1-inch, minimum, up wall. Turn coping cap piece 2-inches, minimum, up wall. Seal and secure as indicated on the drawings. Install regletted counterflashing over exposed end piece.
- C. Curb caps, area divider and expansion joint covers, and fascia extensions:
1. Install caps, covers, and related continuous cleats and backer pieces, as detailed, at locations indicated on the drawings.
 2. Fabricate with seam type indicated on drawings to dimensions indicated on drawings. Provide a 3/4-inch hemmed drip edge.
 3. Fastening: Secure faces of curb caps, area divider covers, and expansion joint covers with specified fasteners appropriate for the substrate encountered, fitted with neoprene gaskets/washers, spaced 18-inches o.c. max., and within 2-inches of each end.
 4. Join adjacent area divider and expansion joint cover sections using a standing seam, with a 1" height. Where upturned standing seam ends meet, apply continuous sealant to the joint. Cut outer edges of upturned seams at a 45-degree angle. Fold ear over end, and crimp in place.
 5. Where area divider and expansion joint covers terminate at walls, turn self-adhering membrane 1-inch, minimum, up wall. Turn coping cap piece 2-inches, minimum, up wall. Seal and secure as indicated on the drawings. Install regletted counterflashing over exposed end piece.
- D. Fascia extensions:
1. Secure fascia extensions with ring shank coated nails 12-inches o.c., max., or fasteners appropriate for, and approved by the Owner for, the substrate condition encountered, 12-inches o.c. max.
- E. Reglet-mounted and slip counterflashings: Provide counterflashings, as detailed, at locations indicated on the drawings:
1. At locations indicated on the drawings, install butyl tape to the backside of counterflashing flanges at the flange interface with the substrate.
 2. Cut reglets into masonry walls to accommodate reglet-mounted counterflashing.
 3. Fabricate counterflashing to dimensions indicated on drawings. Fabricate the counterflashing with a 3/4-inch hemmed drip edge, and on surface mounted counterflashing, a 1/2-inch 45-degree angle sealant slot. Fabricate slip counterflashings



- to dimensions necessary to accommodate existing conditions, and as shown on drawings. Provide a minimum 4-inch face if conditions allow.
4. Secure counterflashings with specified fasteners appropriate for substrate condition encountered, fitted with neoprene gaskets/washers. Space fasteners 12-inches o.c. max., and within 2-inches of each end.
- F. Gutters and downspouts:
1. Install the specified gutter spacers 24-inches o.c. Seal and secure the spacers to the gutter assembly as indicated on the drawings.
 2. Overlap individual gutter sections 1-1/2 inches. Seal overlap, and pop-rivet sections together with two rows of pop rivets. Space pop rivets 1/2-inch min., and 3/4-inches max. in each row. Completed gutter sections shall not exceed 50-feet in length.
 3. Prime both sides of gutter flange and set in a full bed of roofing cement. Secure the flange with nails 3-inches o.c. in two staggered rows.
 4. Gutter expansion joints: Provide gutter expansion joints at locations recommended by SMACNA; fabricated following the recommendations of SMACNA.
 5. Downspouts: Install downspouts at locations indicated on drawings. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
- G. Scupper liners, closure plates, conductor boxes and downspouts:
1. Scupper liners: Install scupper liners at through-fascia, through-wall, and overflow scupper locations indicated on the drawings. Install scupper liners following the requirements and recommendations of SMACNA.
 2. Cover plates: At the exterior face of the scupper, install cover plates. Install scupper cover plates as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 3. Conductor boxes: Where indicated on the drawings, install conductor boxes as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 4. Downspouts: Install downspouts at conductor boxes. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
 5. Install conductor box fascia covers as indicated on the drawings. Fully clip fascia covers to stainless steel conductor boxes, or secure to substrate with fasteners appropriate for the substrate encountered.
- H. Plumbing vents, tubular penetrations and pitch pan flashings:
1. Flash tubular penetrations, high-temperature penetrations and pitch pans as indicated on drawings. Do not use pitch pans at tubular penetrations without the approval of the Owner.
 2. Install tubular penetration hoods and pitch pan covers as indicated on the drawings.
 3. Prior to flashing application, ensure both sides of tubular penetration sleeve and pitch pan flanges have been primed, and the flange has been set in a full bed of roofing cement.
 4. Where soldering is required at stainless steel flanged sleeves, hoods, and pitch pans: Solder all seams and laps watertight. Prior to soldering of stainless steel, clean work area using solvents and wire brush; removing dirt, oil, grease, and other contaminants from the work area. Tin the work area by applying acid (flux). Perform soldering work. After completion of work, remove excess acid (flux) from the work area.
- I. Anchor bar: Fasten the upper edges of modified bitumen flashings with an anchor bar installed in



accordance with the requirements of the roofing membrane manufacturer.

USPS CSF Specifications issued: 10/1/2013
Last revised: 3/6/2013

NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 62 02 00



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SECTION 07 62 02 00 - MPF SHEET METAL FOR BUILT-UP ROOFING

NOTE TO SPECIFIER

Editing is needed for each individual project; modify as needed for project specific requirements. Included "NOTE TO SPECIFIER" instructions provide guidance concerning required editing, and options have been included requiring action on the part of the specifier/designer. Select the option appropriate for the project and delete option(s) not selected.

NOTE TO SPECIFIER

EDIT Section footer as necessary to reflect the project name and location, USPS Project number, and required date of the technical specification document. Coordinate this project specific information with the USPS Project Manager. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this Section In technical specifications where an asphalt built-up roofing membrane (Section 075113) and/or a coal tar pitch roofing membrane (Section 075116) are specified.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to sheet metal fabrication and installation related to built-up roofing.

NOTE TO SPECIFIER

EDIT Article 1.2 RELATED SECTIONS below. DELETE Section references for roofing system Sections not applicable to this project. Re-letter paragraphs after editing.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 075113 – Built-Up Asphalt Roofing
- D. Section 075116 – Built-Up Coal Tar Pitch Roofing
- E. Section 079200 – Sealants for Roofing
- F. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 1. American Society for Testing and Materials (ASTM)



- a. ASTM A 653/653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- b. ASTM D 41/D 41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
- 2. American National Standard Institute (ANSI)
- 3. Factory Mutual Global (FM)
- 4. National Roofing Contractors Association (NRCA)
- 5. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
 - a. SMACNA Architectural Sheet Metal Manual, 6th Edition
- 6. Single Ply Roofing Industry (SPRI)
 - a. ANSI/SPRI/FM 4435/ES-1 – Wind Design for Edge Systems Used with Low Slope Roofing Systems

1.4 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.5 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp.



- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
1. NOTE: Do not install sealants, adhesives or primers associated with sheet metal flashing at temperatures below 50°F (10°C).
 2. When the outside temperature is forecast to fall below 50°F (10°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives and primers should be maintained at a temperature of 50°F (10°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 3. Refer to the built-up roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

PART 2 – PRODUCTS

NOTE TO SPECIFIER

Article 2.1 may be edited to reflect sheet metal flashing requirements for a specific project. EDIT Article 2.1 as necessary. Re-letter/number paragraphs and sub-paragraphs after editing.

2.1 SHEET METAL ACCESSORIES

- A. Perimeter edge metal flashing system: Perimeter edge sheet metal flashing system consisting of a continuous inner clip and outer fascia piece, designed in accordance with the requirements of ANSI/SPRI/FM 4435/ES-1.
1. Inner clip/retention system and continuous cleats associated with perimeter edge metal flashing systems: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
 2. Fascia piece/gravel stop associated with perimeter edge metal flashing systems: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- B. Perimeter parapet cap metal flashing system: Parapet cap sheet metal flashing system consisting of a continuous inner clip and outer fascia piece, designed in accordance with the requirements of ANSI/SPRI/FM 4435/ES-1.
1. Inner clip/retention system and continuous cleats associated with perimeter edge metal flashing systems: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
 2. Parapet cap associated with perimeter parapet cap metal flashing systems: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.



- C. Interior parapet caps, area divider caps, expansion joint covers, and fascia extensions: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating, maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
 - 1. Continuous cleats and expansion joint backer pieces associated with prefinished galvanized steel caps and fascia extension installation: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
- D. Curb caps: Galvanized steel, 18-gauge, ASTM A 653/653M; G-90. Fabricate to match dimensions of curbed cap, and as indicated on the drawings. Fabricate top with a cross-break, providing four-way slope to the outer edges of the cap adequate to remove the potential for standing water at the top of cap.
- E. Reglet-mounted, surface-mounted and slip counterflashings: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating, maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- F. Gutters: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating. Fabricate gutters to match dimensions indicated on the drawings; fabricate in 10-foot sections, with a 4-inch flange with a 1/2-inch hug at the inner edge of the gutter flange.
 - 1. Gutter spacers: Painted galvanized steel, 1-inch wide by 1/8-inch thick; seal and secure to gutter as shown on drawings. Paint color to match gutter.
- G. Through-fascia, through-wall and overflow scuppers:
 - 1. Scupper liners: Stainless steel, 22-gauge. Fabricate scupper flashings in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-26, 1-28, 1-29 and 1-30. Provide a 4-inch flange with a 1/2-inch hug at the inner edge of the scupper flange. Solder all seams watertight.
 - 2. Conductor boxes and scupper closure plates: Stainless steel, 22-gauge. Solder all seams watertight. Fabricate these components in accordance with the drawings, and the requirements outlined in the "SMACNA Architectural Sheet Metal Manual, 7th Edition".
- H. Conductor box fascia covers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by the Owner.
- I. Downspouts, associated with gutters and scuppers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by Owner. Fabricate downspouts with a "Pittsburgh Lock" seam, and in accordance with the drawings and "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-32B and 1-32F; size the hangers to match downspouts.
- J. Plumbing vent and roof sump flashing:
 - 1. Plumbing vent flashing: One-piece flange and sleeve formed of minimum 4-pound lead, with a "ribbed" configuration at the base of the sleeve to allow for movement and/or expansion of the vent stack; lead sleeve diameter to closely match the diameter of the existing stack.
 - 2. Roof sump flashing: 30-inches by 30-inches, minimum 4-pound lead roof drain flashing sheet.
- K. Tubular penetrations, pitch pans and hoods/covers:
 - 1. Tubular penetration flashings: Stainless steel, 24-gauge. Fabricate a one-piece flanged sleeve with a flange extending 6-inches minimum out from the sleeve; sleeve to extend minimum 6-inches above the finished roof surface.
 - 2. Pitch pans: Stainless steel, 24-gauge. Fabricate to dimensions shown on drawings, with a minimum 4-inch depth, and flange extending 6-inches minimum out from the pitch pan,

- and other dimensions to be kept to the minimum size necessary to provide a 2-inch clearance all sides from the penetration.
3. Tubular penetration hoods and pitch pan covers: Stainless steel, 24-gauge. Fabricate to dimensions shown on drawings.
- L. High-temperature tubular penetrations:
1. High-temperature tubular penetration flashings and insulation stops: Stainless steel, 24-gauge. Fabricate a one-piece flanged sleeve with a flange extending 6-inches minimum out from the sleeve onto the roof surface.
- M. Miscellaneous sheet metal accessories:
1. For terminating flashing: Anchor bar: 1-inch x 1/8-inch extruded aluminum with slotted holes spaced 6 inches o.c. Do not fabricate with a caulk slot.
 2. For securement of sheet metal hoods at tubular penetrations: Stainless steel adjustable clamp.
 3. For use behind counterflashing flanges where indicated on the drawings: Butyl tape, width and thickness as necessary to create a seal between the existing substrate and secured counterflashing.

2.2 ADHESIVES, CEMENTS AND PRIMERS

- A. Flashing cement and roofing cement: Product compatible with flashing sheet used and approved by the roofing membrane manufacturer for the situation encountered.
- B. Asphalt primer: ASTM D 41/ D 41M.

2.3 FASTENERS

- A. For securing sheet metal flashings: Fasteners indicated on the drawings, or appropriate and approved by the Owner for the substrate encountered, and compatible with the sheet metal type to be secured. Where fastener heads are exposed, provide neoprene gaskets/washers.
- B. For copper: Copper or bronze fasteners.
- C. For stainless steel: Stainless steel fasteners.
- D. For securing aluminum anchor bar: Fasteners appropriate for, and approved by the Owner and roofing manufacturer for the substrate encountered.

2.4 SEALANT

- A. Refer to Section 079201.

PART 3 - EXECUTION

NOTE TO SPECIFIER

Article 3.1 may be edited to reflect sheet metal flashing requirements for a specific project. EDIT Article 3.1 as necessary. Re-letter/number paragraphs and sub-paragraphs after editing.

3.1 SHEET METAL FLASHING INSTALLATION



- A. Perimeter edge metal flashing system:
1. Install perimeter edge metal in a manner that meets the requirements of ANSI/SPRI/FM 4435/ES-1. Provide a system matching the configurations and dimensions indicated on the drawings.
 2. For pre-fabricated parapet cap metal systems: Install in accordance with the metal system manufacturer.
 3. For shop-fabricated perimeter edge metal systems:
 - a. Secure the horizontal flange and vertical face of the inner clip/continuous cleat with ring shank coated nails 12-inches o.c., max. Decrease fastener spacing to 6-inches o.c., max. within 10-feet of a building corner.
 - b. Place the outer fascia/gravel stop piece. Hook the fascia to the underlying continuous cleat. Secure the flange with nails 3-inches o.c. in two staggered rows as indicated on the drawings. Prior to securement, prime both sides of horizontal flange and set in a full bed of roofing cement.
- B. Parapet edge cap metal flashing system:
1. For pre-fabricated parapet cap metal systems: Install in accordance with the metal system manufacturer to meet the requirements of ANSI/SPRI/FM 4435/ES-1. Provide a system matching the dimensions indicated on the drawings.
 2. For shop-fabricated parapet cap metal systems:
 - a. Fabricate inner clips/continuous cleats with a kick-up, creating a minimum 1/2-inch per foot slope toward the roof.
 - b. Secure the horizontal flange and vertical face of the inner clip/continuous cleat with ring shank coated nails 12-inches o.c., max. Decrease fastener spacing to 6-inches o.c., max. within 10-feet of a building corner.
 - c. Place the cap sections. At the outer face, hook the fascia to the underlying continuous cleat. At the inner face, secure the flange with #12 fasteners, fitted with neoprene gaskets/washers 18-inches o.c., max., and within 2-inches of each end.
 - d. Join adjacent parapet cap sections using a standing seam, with a 1" height. Where upturned standing seam ends meet, apply continuous sealant to the joint. Cut outer edges of upturned seams at a 45-degree angle. Fold ear over end, and crimp in place.
 - e. Where parapet caps terminate at walls, turn self-adhering membrane 1-inch, minimum, up wall. Turn coping cap piece 2-inches, minimum, up wall. Seal and secure as indicated on the drawings. Install regletted counterflashing over exposed end piece.
- C. Curb caps, area divider and expansion joint covers:
1. Install caps, covers, and related continuous cleats and backer pieces, as detailed, at locations indicated on the drawings.
 2. Fabricate with seam type indicated on drawings to dimensions indicated on drawings. Provide a 3/4-inch hemmed drip edge.
 3. Fastening: Secure faces of curb caps, area divider covers, and expansion joint covers with specified fasteners appropriate for the substrate encountered, fitted with neoprene gaskets/washers, spaced 18-inches o.c. max., and within 2-inches of each end.
 4. Join adjacent area divider and expansion joint cover sections using a standing seam, with a 1" height. Where upturned standing seam ends meet, apply continuous sealant to the joint. Cut outer edges of upturned seams at a 45-degree angle. Fold ear over end, and crimp in place.
 5. Where area divider and expansion joint covers terminate at walls, turn self-adhering membrane 1-inch, minimum, up wall. Turn coping cap piece 2-inches, minimum, up wall. Seal and secure as indicated on the drawings. Install regletted counterflashing over exposed end piece.



- D. Fascia extensions:
 - 1. Secure fascia extensions with ring shank coated nails 12-inches o.c., max., or fasteners appropriate for, and approved by the Owner for, the substrate condition encountered, 12-inches o.c. max.
- E. Reglet-mounted and slip counterflashings: Provide counterflashings, as detailed, at locations indicated on the drawings:
 - 1. At locations indicated on the drawings, install butyl tape to the backside of counterflashing flanges at the flange interface with the substrate.
 - 2. Cut reglets into masonry walls to accommodate reglet-mounted counterflashing.
 - 3. Fabricate counterflashing to dimensions indicated on drawings. Fabricate the counterflashing with a 3/4-inch hemmed drip edge, and on surface mounted counterflashing, a 1/2-inch 45-degree angle sealant slot. Fabricate slip counterflashings to dimensions necessary to accommodate existing conditions, and as shown on drawings. Provide a minimum 4-inch face if conditions allow.
 - 4. Secure counterflashings with specified fasteners appropriate for substrate condition encountered, fitted with neoprene gaskets/washers. Space fasteners 12-inches o.c. max., and within 2-inches of each end.
- F. Gutters and downspouts:
 - 1. Install the specified gutter spacers 24-inches o.c. Seal and secure the spacers to the gutter assembly as indicated on the drawings.
 - 2. Overlap individual gutter sections 1-1/2 inches. Seal overlap, and pop-rivet sections together with two rows of pop rivets. Space pop rivets 1/2-inch min., and 3/4-inches max. in each row. Completed gutter sections shall not exceed 50-feet in length.
 - 3. Prime both sides of gutter flange and set in a full bed of roofing cement. Secure the flange with nails 3-inches o.c. in two staggered rows.
 - 4. Gutter expansion joints: Provide gutter expansion joints at locations recommended by SMACNA; fabricated following the recommendations of SMACNA.
 - 5. Downspouts: Install downspouts at locations indicated on drawings. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
- G. Scupper liners, closure plates, conductor boxes and downspouts:
 - 1. Scupper liners: Install scupper liners at through-fascia, through-wall, and overflow scupper locations indicated on the drawings. Install scupper liners following the requirements and recommendations of SMACNA.
 - 2. Cover plates: At the exterior face of the scupper, install cover plates. Install scupper cover plates as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 - 3. Conductor boxes: Where indicated on the drawings, install conductor boxes as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 - 4. Downspouts: Install downspouts at conductor boxes. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
 - 5. Install conductor box fascia covers as indicated on the drawings. Fully clip fascia covers to stainless steel conductor boxes, or secure to substrate with fasteners appropriate for the substrate encountered.
- H. Plumbing vents, tubular penetrations and pitch pan flashings:



1. Flash tubular penetrations, high-temperature penetrations and pitch pans as indicated on drawings. Do not use pitch pans at tubular penetrations without the approval of the Owner.
 2. Install tubular penetration hoods and pitch pan covers as indicated on the drawings.
 3. Prior to flashing application, ensure both sides of tubular penetration sleeve and pitch pan flanges have been primed, and the flange has been set in a full bed of roofing cement.
 4. Where soldering is required at stainless steel flanged sleeves, hoods, and pitch pans: Solder all seams and laps watertight. Prior to soldering of stainless steel, clean work area using solvents and wire brush; removing dirt, oil, grease, and other contaminants from the work area. Tin the work area by applying acid (flux). Perform soldering work. After completion of work, remove excess acid (flux) from the work area.
- I. Anchor bar: Fasten the upper edges of modified bitumen flashings with an anchor bar installed in accordance with the requirements of the roofing membrane manufacturer.

USPS MPF Specifications, issued: 10/1/2013

Last revised: 9/16/2013

NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 62 02 00



SECTION 07 62 03 00 - MPF SHEET METAL FOR MODIFIED BITUMEN ROOFING

NOTE TO SPECIFIER

Editing is needed for each individual project; modify as needed for project specific requirements. Included "NOTE TO SPECIFIER" instructions provide guidance concerning required editing, and options have been included requiring action on the part of the specifier/designer. Select the option appropriate for the project and delete option(s) not selected.

NOTE TO SPECIFIER

EDIT Section footer as necessary to reflect the project name and location, USPS Project number, and required date of the technical specification document. Coordinate this project specific information with the USPS Project Manager. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this Section In technical specifications where a modified bitumen surfacing ply over a built-up roofing membrane (Section 075215) and/or a modified bitumen, cold adhesive-applied (Section 075216) or hot asphalt-applied (Section 075217) roofing membrane are specified.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to sheet metal fabrication and installation related to modified bitumen roofing.

NOTE TO SPECIFIER

EDIT Article 1.2 RELATED SECTIONS below. DELETE Section references for roofing system Sections not applicable to this project. Re-letter paragraphs after editing.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 075216 – SBS Modified Bitumen Roofing in Cold Adhesive
- D. Section 075217 – SBS Modified Bitumen Roofing in Hot Asphalt
- E. Section 079200 – Sealants for Roofing
- F. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:



1. American Society for Testing and Materials (ASTM)
 - a. ASTM A 653/653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - b. ASTM D 41/D 41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
2. American National Standard Institute (ANSI)
3. Factory Mutual Global (FM)
4. National Roofing Contractors Association (NRCA)
5. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
 - a. SMACNA Architectural Sheet Metal Manual, 7th Edition
6. Single Ply Roofing Industry (SPRI)
 - a. ANSI/SPRI/FM 4435/ES-1 – Wind Design for Edge Systems Used with Low Slope Roofing Systems

1.4 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.5 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover



insulation, roofing materials, and other moisture-sensitive products with a canvas tarp.

- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
 - 1. NOTE: Do not install sealants, adhesives or primers associated with sheet metal flashing at temperatures below 50°F (10°C).
 - 2. When the outside temperature is forecast to fall below 50°F (10°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives and primers should be maintained at a temperature of 50°F (10°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 - 3. Refer to the SBS modified bitumen roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

PART 2 – PRODUCTS

NOTE TO SPECIFIER

Article 2.1 may be edited to reflect sheet metal flashing requirements for a specific project. EDIT Article 2.1 as necessary. Re-letter/number paragraphs and sub-paragraphs after editing.

2.1 SHEET METAL ACCESSORIES

- A. Perimeter edge metal flashing system: Perimeter edge sheet metal flashing system consisting of a continuous inner clip and outer fascia piece, designed in accordance with the requirements of ANSI/SPRI/FM 4435/ES-1.
 - 1. Inner clip/retention system and continuous cleats associated with perimeter edge metal flashing systems: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
 - 2. Fascia piece/gravel stop associated with perimeter edge metal flashing systems: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- B. Perimeter parapet cap metal flashing system: Parapet cap sheet metal flashing system consisting of a continuous inner clip and outer fascia piece, designed in accordance with the requirements of ANSI/SPRI/FM 4435/ES-1.
 - 1. Inner clip/retention system and continuous cleats associated with perimeter edge metal flashing systems: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.



2. Parapet cap associated with perimeter parapet cap metal flashing systems: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- C. Interior parapet caps, area divider caps, expansion joint covers, and fascia extensions: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating, maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
 1. Continuous cleats and expansion joint backer pieces associated with prefinished galvanized steel caps and fascia extension installation: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
- D. Curb caps: Galvanized steel, 18-gauge, ASTM A 653/653M; G-90. Fabricate to match dimensions of curbed cap, and as indicated on the drawings. Fabricate top with a cross-break, providing four-way slope to the outer edges of the cap adequate to remove the potential for standing water at the top of cap.
- E. Reglet-mounted, surface-mounted and slip counterflashings: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating, maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- F. Gutters: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating. Fabricate gutters to match dimensions indicated on the drawings; fabricate in 10-foot sections, with a 4-inch flange with a 1/2-inch hug at the inner edge of the gutter flange.
 1. Gutter spacers: Painted galvanized steel, 1-inch wide by 1/8-inch thick; seal and secure to gutter as shown on drawings. Paint color to match gutter.
- G. Through-fascia, through-wall and overflow scuppers:
 1. Scupper liners: Stainless steel, 22-gauge. Fabricate scupper flashings in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-26, 1-28, 1-29 and 1-30. Provide a 4-inch flange with a 1/2-inch hug at the inner edge of the scupper flange. Solder all seams watertight.
 2. Conductor boxes and scupper closure plates: Stainless steel, 22-gauge. Solder all seams watertight. Fabricate these components in accordance with the drawings, and the requirements outlined in the "SMACNA Architectural Sheet Metal Manual, 7th Edition".
- H. Conductor box fascia covers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by the Owner.
- I. Downspouts, associated with gutters and scuppers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by Owner. Fabricate downspouts with a "Pittsburgh Lock" seam, and in accordance with the drawings and "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-32B and 1-32F; size the hangers to match downspouts.
- J. Plumbing vent and roof sump flashing:
 1. Plumbing vent flashing: One-piece flange and sleeve formed of minimum 4-pound lead, with a "ribbed" configuration at the base of the sleeve to allow for movement and/or expansion of the vent stack; lead sleeve diameter to closely match the diameter of the existing stack.
 2. Roof sump flashing: 30-inches by 30-inches, minimum 4-pound lead roof drain flashing sheet.
- K. Tubular penetrations, pitch pans and hoods/covers:



1. Tubular penetration flashings: Stainless steel, 24-gauge. Fabricate a one-piece flanged sleeve with a flange extending 6-inches minimum out from the sleeve; sleeve to extend minimum 6-inches above the finished roof surface.
 2. Pitch pans: Stainless steel, 24-gauge. Fabricate to dimensions shown on drawings, with a minimum 4-inch depth, and flange extending 6-inches minimum out from the pitch pan, and other dimensions to be kept to the minimum size necessary to provide a 2-inch clearance all sides from the penetration.
 3. Tubular penetration hoods and pitch pan covers: Stainless steel, 24-gauge. Fabricate to dimensions shown on drawings.
- L. High-temperature tubular penetrations:
1. High-temperature tubular penetration flashings and insulation stops: Stainless steel, 24-gauge. Fabricate a one-piece flanged sleeve with a flange extending 6-inches minimum out from the sleeve onto the roof surface.
- M. Miscellaneous sheet metal accessories:
1. For terminating flashing: Anchor bar: 1-inch x 1/8-inch extruded aluminum with slotted holes spaced 6 inches o.c. Do not fabricate with a caulk slot.
 2. For securement of sheet metal hoods at tubular penetrations: Stainless steel adjustable clamp.
 3. For use behind counterflashing flanges where indicated on the drawings: Butyl tape, width and thickness as necessary to create a seal between the existing substrate and secured counterflashing.

2.2 ADHESIVES, CEMENTS AND PRIMERS

- A. Flashing cement and roofing cement: Product compatible with flashing sheet used and approved by the roofing membrane manufacturer for the situation encountered.
- B. Asphalt primer: ASTM D 41/ D 41M.

2.3 FASTENERS

- A. For securing sheet metal flashings: Fasteners indicated on the drawings, or appropriate and approved by the Owner for the substrate encountered, and compatible with the sheet metal type to be secured. Where fastener heads are exposed, provide neoprene gaskets/washers.
- B. For copper: Copper or bronze fasteners.
- C. For stainless steel: Stainless steel fasteners.
- D. For securing aluminum anchor bar: Fasteners appropriate for, and approved by the Owner and roofing manufacturer for the substrate encountered.

2.4 SEALANT

- A. Refer to Section 079201.

PART 3 - EXECUTION

NOTE TO SPECIFIER



Article 3.1 may be edited to reflect sheet metal flashing requirements for a specific project. EDIT Article 3.1 as necessary. Re-letter/number paragraphs and sub-paragraphs after editing.

3.1 SHEET METAL FLASHING INSTALLATION

- A. Perimeter edge metal flashing system:
 - 1. Install perimeter edge metal in a manner that meets the requirements of ANSI/SPRI/FM 4435/ES-1. Provide a system matching the configurations and dimensions indicated on the drawings.
 - 2. For pre-fabricated parapet cap metal systems: Install in accordance with the metal system manufacturer.
 - 3. For shop-fabricated perimeter edge metal systems:
 - a. Secure the horizontal flange and vertical face of the inner clip/continuous cleat with ring shank coated nails 12-inches o.c., max. Decrease fastener spacing to 6-inches o.c., max. within 10-feet of a building corner.
 - b. Place the outer fascia/gravel stop piece. Hook the fascia to the underlying continuous cleat. Secure the flange with nails 3-inches o.c. in two staggered rows as indicated on the drawings. Prior to securement, prime both sides of horizontal flange and set in a full bed of roofing cement.
- B. Parapet edge cap metal flashing system:
 - 1. For pre-fabricated parapet cap metal systems: Install in accordance with the metal system manufacturer to meet the requirements of ANSI/SPRI/FM 4435/ES-1. Provide a system matching the dimensions indicated on the drawings.
 - 2. For shop-fabricated parapet cap metal systems:
 - a. Fabricate inner clips/continuous cleats with a kick-up, creating a minimum 1/2-inch per foot slope toward the roof.
 - b. Secure the horizontal flange and vertical face of the inner clip/continuous cleat with ring shank coated nails 12-inches o.c., max. Decrease fastener spacing to 6-inches o.c., max. within 10-feet of a building corner.
 - c. Place the cap sections. At the outer face, hook the fascia to the underlying continuous cleat. At the inner face, secure the flange with #12 fasteners, fitted with neoprene gaskets/washers 18-inches o.c., max., and within 2-inches of each end.
 - d. Join adjacent parapet cap sections using a standing seam, with a 1" height. Where upturned standing seam ends meet, apply continuous sealant to the joint. Cut outer edges of upturned seams at a 45-degree angle. Fold ear over end, and crimp in place.
 - e. Where parapet caps terminate at walls, turn self-adhering membrane 1-inch, minimum, up wall. Turn coping cap piece 2-inches, minimum, up wall. Seal and secure as indicated on the drawings. Install regletted counterflashing over exposed end piece.
- C. Curb caps, area divider and expansion joint covers:
 - 1. Install caps, covers, and related continuous cleats and backer pieces, as detailed, at locations indicated on the drawings.
 - 2. Fabricate with seam type indicated on drawings to dimensions indicated on drawings. Provide a 3/4-inch hemmed drip edge.
 - 3. Fastening: Secure faces of curb caps, area divider covers, and expansion joint covers with specified fasteners appropriate for the substrate encountered, fitted with neoprene gaskets/washers, spaced 18-inches o.c. max., and within 2-inches of each end.
 - 4. Join adjacent area divider and expansion joint cover sections using a standing seam, with a 1" height. Where upturned standing seam ends meet, apply continuous sealant to the joint. Cut outer edges of upturned seams at a 45-degree angle. Fold ear over end, and crimp in place.



5. Where area divider and expansion joint covers terminate at walls, turn self-adhering membrane 1-inch, minimum, up wall. Turn coping cap piece 2-inches, minimum, up wall. Seal and secure as indicated on the drawings. Install regletted counterflashing over exposed end piece.
- D. Fascia extensions:
1. Secure fascia extensions with ring shank coated nails 12-inches o.c., max., or fasteners appropriate for, and approved by the Owner for, the substrate condition encountered, 12-inches o.c. max.
- E. Reglet-mounted and slip counterflashings: Provide counterflashings, as detailed, at locations indicated on the drawings:
1. At locations indicated on the drawings, install butyl tape to the backside of counterflashing flanges at the flange interface with the substrate.
 2. Cut reglets into masonry walls to accommodate reglet-mounted counterflashing.
 3. Fabricate counterflashing to dimensions indicated on drawings. Fabricate the counterflashing with a 3/4-inch hemmed drip edge, and on surface mounted counterflashing, a 1/2-inch 45-degree angle sealant slot. Fabricate slip counterflashings to dimensions necessary to accommodate existing conditions, and as shown on drawings. Provide a minimum 4-inch face if conditions allow.
 4. Secure counterflashings with specified fasteners appropriate for substrate condition encountered, fitted with neoprene gaskets/washers. Space fasteners 12-inches o.c. max., and within 2-inches of each end.
- F. Gutters and downspouts:
1. Install the specified gutter spacers 24-inches o.c. Seal and secure the spacers to the gutter assembly as indicated on the drawings.
 2. Overlap individual gutter sections 1-1/2 inches. Seal overlap, and pop-rivet sections together with two rows of pop rivets. Space pop rivets 1/2-inch min., and 3/4-inches max. in each row. Completed gutter sections shall not exceed 50-feet in length.
 3. Prime both sides of gutter flange and set in a full bed of roofing cement. Secure the flange with nails 3-inches o.c. in two staggered rows.
 4. Gutter expansion joints: Provide gutter expansion joints at locations recommended by SMACNA; fabricated following the recommendations of SMACNA.
 5. Downspouts: Install downspouts at locations indicated on drawings. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
- G. Scupper liners, closure plates, conductor boxes and downspouts:
1. Scupper liners: Install scupper liners at through-fascia, through-wall, and overflow scupper locations indicated on the drawings. Install scupper liners following the requirements and recommendations of SMACNA.
 2. Cover plates: At the exterior face of the scupper, install cover plates. Install scupper cover plates as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 3. Conductor boxes: Where indicated on the drawings, install conductor boxes as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 4. Downspouts: Install downspouts at conductor boxes. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.



5. Install conductor box fascia covers as indicated on the drawings. Fully clip fascia covers to stainless steel conductor boxes, or secure to substrate with fasteners appropriate for the substrate encountered.
- H. Plumbing vents, tubular penetrations and pitch pan flashings:
1. Flash tubular penetrations, high-temperature penetrations and pitch pans as indicated on drawings. Do not use pitch pans at tubular penetrations without the approval of the Owner.
 2. Install tubular penetration hoods and pitch pan covers as indicated on the drawings.
 3. Prior to flashing application, ensure both sides of tubular penetration sleeve and pitch pan flanges have been primed, and the flange has been set in a full bed of roofing cement.
 4. Where soldering is required at stainless steel flanged sleeves, hoods, and pitch pans: Solder all seams and laps watertight. Prior to soldering of stainless steel, clean work area using solvents and wire brush; removing dirt, oil, grease, and other contaminants from the work area. Tin the work area by applying acid (flux). Perform soldering work. After completion of work, remove excess acid (flux) from the work area.
- I. Anchor bar: Fasten the upper edges of modified bitumen flashings with an anchor bar installed in accordance with the requirements of the roofing membrane manufacturer.

MPF Specifications, issued: 10/1/2013

Last revised: 9/16/2013

NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 62 03 00



SECTION 07 62 03 00 - CSF SHEET METAL FOR MODIFIED BITUMEN ROOFING

NOTE TO SPECIFIER

Editing is needed for each individual project; modify as needed for project specific requirements. Included "NOTE TO SPECIFIER" instructions provide guidance concerning required editing, and options have been included requiring action on the part of the specifier/designer. Select the option appropriate for the project and delete option(s) not selected.

NOTE TO SPECIFIER

EDIT Section footer as necessary to reflect the project name and location, USPS Project number, and required date of the technical specification document. Coordinate this project specific information with the USPS Project Manager. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this Section In technical specifications where a modified bitumen surfacing ply over a built-up roofing membrane (Section 075215) and/or a modified bitumen, cold adhesive-applied (Section 075216) or hot asphalt-applied (Section 075217) roofing membrane are specified.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to sheet metal fabrication and installation related to modified bitumen roofing.

NOTE TO SPECIFIER

EDIT Article 1.2 RELATED SECTIONS below. DELETE Section references for roofing system Sections not applicable to this project. Re-letter paragraphs after editing.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 075216 – SBS Modified Bitumen Roofing in Cold Adhesive
- D. Section 075217 – SBS Modified Bitumen Roofing in Hot Asphalt
- E. Section 079200 – Sealants for Roofing
- F. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:



1. American Society for Testing and Materials (ASTM)
 - a. ASTM A 653/653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - b. ASTM D 41/D 41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
2. American National Standard Institute (ANSI)
3. Factory Mutual Global (FM)
4. National Roofing Contractors Association (NRCA)
5. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
 - a. SMACNA Architectural Sheet Metal Manual, 7th Edition
6. Single Ply Roofing Industry (SPRI)
 - a. ANSI/SPRI/FM 4435/ES-1 – Wind Design for Edge Systems Used with Low Slope Roofing Systems

1.4 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.5 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover



insulation, roofing materials, and other moisture-sensitive products with a canvas tarp.

- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
 - 1. NOTE: Do not install sealants, adhesives or primers associated with sheet metal flashing at temperatures below 50°F (10°C).
 - 2. When the outside temperature is forecast to fall below 50°F (10°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives and primers should be maintained at a temperature of 50°F (10°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 - 3. Refer to the SBS modified bitumen roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

PART 2 – PRODUCTS

NOTE TO SPECIFIER

Article 2.1 may be edited to reflect sheet metal flashing requirements for a specific project. EDIT Article 2.1 as necessary. Re-letter/number paragraphs and sub-paragraphs after editing.

2.1 SHEET METAL ACCESSORIES

- A. Perimeter edge metal flashing system: Perimeter edge sheet metal flashing system consisting of a continuous inner clip and outer fascia piece, designed in accordance with the requirements of ANSI/SPRI/FM 4435/ES-1.
 - 1. Inner clip/retention system and continuous cleats associated with perimeter edge metal flashing systems: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
 - 2. Fascia piece/gravel stop associated with perimeter edge metal flashing systems: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- B. Perimeter parapet cap metal flashing system: Parapet cap sheet metal flashing system consisting of a continuous inner clip and outer fascia piece, designed in accordance with the requirements of ANSI/SPRI/FM 4435/ES-1.
 - 1. Inner clip/retention system and continuous cleats associated with perimeter edge metal flashing systems: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.



2. Parapet cap associated with perimeter parapet cap metal flashing systems: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- C. Interior parapet caps, area divider caps, expansion joint covers, and fascia extensions: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating, maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
 1. Continuous cleats and expansion joint backer pieces associated with prefinished galvanized steel caps and fascia extension installation: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
- D. Curb caps: Galvanized steel, 18-gauge, ASTM A 653/653M; G-90. Fabricate to match dimensions of curbed cap, and as indicated on the drawings. Fabricate top with a cross-break, providing four-way slope to the outer edges of the cap adequate to remove the potential for standing water at the top of cap.
- E. Reglet-mounted, surface-mounted and slip counterflashings: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating, maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- F. Gutters: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating. Fabricate gutters to match dimensions indicated on the drawings; fabricate in 10-foot sections, with a 4-inch flange with a 1/2-inch hug at the inner edge of the gutter flange.
 1. Gutter spacers: Painted galvanized steel, 1-inch wide by 1/8-inch thick; seal and secure to gutter as shown on drawings. Paint color to match gutter.
- G. Through-fascia, through-wall and overflow scuppers:
 1. Scupper liners: Stainless steel, 22-gauge. Fabricate scupper flashings in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-26, 1-28, 1-29 and 1-30. Provide a 4-inch flange with a 1/2-inch hug at the inner edge of the scupper flange. Solder all seams watertight.
 2. Conductor boxes and scupper closure plates: Stainless steel, 22-gauge. Solder all seams watertight. Fabricate these components in accordance with the drawings, and the requirements outlined in the "SMACNA Architectural Sheet Metal Manual, 7th Edition".
- H. Conductor box fascia covers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by the Owner.
- I. Downspouts, associated with gutters and scuppers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by Owner. Fabricate downspouts with a "Pittsburgh Lock" seam, and in accordance with the drawings and "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-32B and 1-32F; size the hangers to match downspouts.
- J. Plumbing vent and roof sump flashing:
 1. Plumbing vent flashing: One-piece flange and sleeve formed of minimum 4-pound lead, with a "ribbed" configuration at the base of the sleeve to allow for movement and/or expansion of the vent stack; lead sleeve diameter to closely match the diameter of the existing stack.
 2. Roof sump flashing: 30-inches by 30-inches, minimum 4-pound lead roof drain flashing sheet.
- K. Tubular penetrations, pitch pans and hoods/covers:



1. Tubular penetration flashings: Stainless steel, 24-gauge. Fabricate a one-piece flanged sleeve with a flange extending 6-inches minimum out from the sleeve; sleeve to extend minimum 6-inches above the finished roof surface.
 2. Pitch pans: Stainless steel, 24-gauge. Fabricate to dimensions shown on drawings, with a minimum 4-inch depth, and flange extending 6-inches minimum out from the pitch pan, and other dimensions to be kept to the minimum size necessary to provide a 2-inch clearance all sides from the penetration.
 3. Tubular penetration hoods and pitch pan covers: Stainless steel, 24-gauge. Fabricate to dimensions shown on drawings.
- L. High-temperature tubular penetrations:
1. High-temperature tubular penetration flashings and insulation stops: Stainless steel, 24-gauge. Fabricate a one-piece flanged sleeve with a flange extending 6-inches minimum out from the sleeve onto the roof surface.
- M. Miscellaneous sheet metal accessories:
1. For terminating flashing: Anchor bar: 1-inch x 1/8-inch extruded aluminum with slotted holes spaced 6 inches o.c. Do not fabricate with a caulk slot.
 2. For securement of sheet metal hoods at tubular penetrations: Stainless steel adjustable clamp.
 3. For use behind counterflashing flanges where indicated on the drawings: Butyl tape, width and thickness as necessary to create a seal between the existing substrate and secured counterflashing.

2.2 ADHESIVES, CEMENTS AND PRIMERS

- A. Flashing cement and roofing cement: Product compatible with flashing sheet used and approved by the roofing membrane manufacturer for the situation encountered.
- B. Asphalt primer: ASTM D 41/ D 41M.

2.3 FASTENERS

- A. For securing sheet metal flashings: Fasteners indicated on the drawings, or appropriate and approved by the Owner for the substrate encountered, and compatible with the sheet metal type to be secured. Where fastener heads are exposed, provide neoprene gaskets/washers.
- B. For copper: Copper or bronze fasteners.
- C. For stainless steel: Stainless steel fasteners.
- D. For securing aluminum anchor bar: Fasteners appropriate for, and approved by the Owner and roofing manufacturer for the substrate encountered.

2.4 SEALANT

- A. Refer to Section 079201.

PART 3 - EXECUTION

NOTE TO SPECIFIER



Article 3.1 may be edited to reflect sheet metal flashing requirements for a specific project. EDIT Article 3.1 as necessary. Re-letter/number paragraphs and sub-paragraphs after editing.

3.1 SHEET METAL FLASHING INSTALLATION

- A. Perimeter edge metal flashing system:
 - 1. Install perimeter edge metal in a manner that meets the requirements of ANSI/SPRI/FM 4435/ES-1. Provide a system matching the configurations and dimensions indicated on the drawings.
 - 2. For pre-fabricated parapet cap metal systems: Install in accordance with the metal system manufacturer.
 - 3. For shop-fabricated perimeter edge metal systems:
 - a. Secure the horizontal flange and vertical face of the inner clip/continuous cleat with ring shank coated nails 12-inches o.c., max. Decrease fastener spacing to 6-inches o.c., max. within 10-feet of a building corner.
 - b. Place the outer fascia/gravel stop piece. Hook the fascia to the underlying continuous cleat. Secure the flange with nails 3-inches o.c. in two staggered rows as indicated on the drawings. Prior to securement, prime both sides of horizontal flange and set in a full bed of roofing cement.
- B. Parapet edge cap metal flashing system:
 - 1. For pre-fabricated parapet cap metal systems: Install in accordance with the metal system manufacturer to meet the requirements of ANSI/SPRI/FM 4435/ES-1. Provide a system matching the dimensions indicated on the drawings.
 - 2. For shop-fabricated parapet cap metal systems:
 - a. Fabricate inner clips/continuous cleats with a kick-up, creating a minimum 1/2-inch per foot slope toward the roof.
 - b. Secure the horizontal flange and vertical face of the inner clip/continuous cleat with ring shank coated nails 12-inches o.c., max. Decrease fastener spacing to 6-inches o.c., max. within 10-feet of a building corner.
 - c. Place the cap sections. At the outer face, hook the fascia to the underlying continuous cleat. At the inner face, secure the flange with #12 fasteners, fitted with neoprene gaskets/washers 18-inches o.c., max., and within 2-inches of each end.
 - d. Join adjacent parapet cap sections using a standing seam, with a 1" height. Where upturned standing seam ends meet, apply continuous sealant to the joint. Cut outer edges of upturned seams at a 45-degree angle. Fold ear over end, and crimp in place.
 - e. Where parapet caps terminate at walls, turn self-adhering membrane 1-inch, minimum, up wall. Turn coping cap piece 2-inches, minimum, up wall. Seal and secure as indicated on the drawings. Install regletted counterflashing over exposed end piece.
- C. Curb caps, area divider and expansion joint covers:
 - 1. Install caps, covers, and related continuous cleats and backer pieces, as detailed, at locations indicated on the drawings.
 - 2. Fabricate with seam type indicated on drawings to dimensions indicated on drawings. Provide a 3/4-inch hemmed drip edge.
 - 3. Fastening: Secure faces of curb caps, area divider covers, and expansion joint covers with specified fasteners appropriate for the substrate encountered, fitted with neoprene gaskets/washers, spaced 18-inches o.c. max., and within 2-inches of each end.
 - 4. Join adjacent area divider and expansion joint cover sections using a standing seam, with a 1" height. Where upturned standing seam ends meet, apply continuous sealant to the joint. Cut outer edges of upturned seams at a 45-degree angle. Fold ear over end, and crimp in place.



5. Where area divider and expansion joint covers terminate at walls, turn self-adhering membrane 1-inch, minimum, up wall. Turn coping cap piece 2-inches, minimum, up wall. Seal and secure as indicated on the drawings. Install regletted counterflashing over exposed end piece.
- D. Fascia extensions:
1. Secure fascia extensions with ring shank coated nails 12-inches o.c., max., or fasteners appropriate for, and approved by the Owner for, the substrate condition encountered, 12-inches o.c. max.
- E. Reglet-mounted and slip counterflashings: Provide counterflashings, as detailed, at locations indicated on the drawings:
1. At locations indicated on the drawings, install butyl tape to the backside of counterflashing flanges at the flange interface with the substrate.
 2. Cut reglets into masonry walls to accommodate reglet-mounted counterflashing.
 3. Fabricate counterflashing to dimensions indicated on drawings. Fabricate the counterflashing with a 3/4-inch hemmed drip edge, and on surface mounted counterflashing, a 1/2-inch 45-degree angle sealant slot. Fabricate slip counterflashings to dimensions necessary to accommodate existing conditions, and as shown on drawings. Provide a minimum 4-inch face if conditions allow.
 4. Secure counterflashings with specified fasteners appropriate for substrate condition encountered, fitted with neoprene gaskets/washers. Space fasteners 12-inches o.c. max., and within 2-inches of each end.
- F. Gutters and downspouts:
1. Install the specified gutter spacers 24-inches o.c. Seal and secure the spacers to the gutter assembly as indicated on the drawings.
 2. Overlap individual gutter sections 1-1/2 inches. Seal overlap, and pop-rivet sections together with two rows of pop rivets. Space pop rivets 1/2-inch min., and 3/4-inches max. in each row. Completed gutter sections shall not exceed 50-feet in length.
 3. Prime both sides of gutter flange and set in a full bed of roofing cement. Secure the flange with nails 3-inches o.c. in two staggered rows.
 4. Gutter expansion joints: Provide gutter expansion joints at locations recommended by SMACNA; fabricated following the recommendations of SMACNA.
 5. Downspouts: Install downspouts at locations indicated on drawings. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
- G. Scupper liners, closure plates, conductor boxes and downspouts:
1. Scupper liners: Install scupper liners at through-fascia, through-wall, and overflow scupper locations indicated on the drawings. Install scupper liners following the requirements and recommendations of SMACNA.
 2. Cover plates: At the exterior face of the scupper, install cover plates. Install scupper cover plates as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 3. Conductor boxes: Where indicated on the drawings, install conductor boxes as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 4. Downspouts: Install downspouts at conductor boxes. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.



5. Install conductor box fascia covers as indicated on the drawings. Fully clip fascia covers to stainless steel conductor boxes, or secure to substrate with fasteners appropriate for the substrate encountered.
- H. Plumbing vents, tubular penetrations and pitch pan flashings:
1. Flash tubular penetrations, high-temperature penetrations and pitch pans as indicated on drawings. Do not use pitch pans at tubular penetrations without the approval of the Owner.
 2. Install tubular penetration hoods and pitch pan covers as indicated on the drawings.
 3. Prior to flashing application, ensure both sides of tubular penetration sleeve and pitch pan flanges have been primed, and the flange has been set in a full bed of roofing cement.
 4. Where soldering is required at stainless steel flanged sleeves, hoods, and pitch pans: Solder all seams and laps watertight. Prior to soldering of stainless steel, clean work area using solvents and wire brush; removing dirt, oil, grease, and other contaminants from the work area. Tin the work area by applying acid (flux). Perform soldering work. After completion of work, remove excess acid (flux) from the work area.
- I. Anchor bar: Fasten the upper edges of modified bitumen flashings with an anchor bar installed in accordance with the requirements of the roofing membrane manufacturer.

CSF Specifications, issued: 10/1/2013

Last revised: 9/16/2013

NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 62 03 00



SECTION 07 62 03 00 - R&A SHEET METAL FOR MODIFIED BITUMEN ROOFING

NOTE TO SPECIFIER

This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this Section In technical specifications where a modified bitumen surfacing ply over a built-up roofing membrane (Section 075215) and/or a modified bitumen, cold adhesive-applied (Section 075216) or hot asphalt-applied (Section 075217) roofing membrane are specified.

NOTE TO SPECIFIER

Section Formatting:

Consistent formatting of Sections gives the complete document a professional look. This Section uses a 10pt. Arial font, and is formatted as follows:

1. Insert one 10pt. line after the Section Number. Section Number is in CAPS.
2. Insert two 10pt. lines after the Section Title. Section Title is in CAPS.
3. Insert one 10pt. line after a PART. PARTS are in CAPS. If a Section is not used, include NOT USED following the PART title as shown below.
4. Insert one 10pt. line after Article paragraphs. Articles are in CAPS.
5. Insert two 10pt. lines at the end of an Article.
6. Complete Section with END OF SETION.
7. No lines should be placed between paragraphs and sub-paragraphs, or between sub-paragraphs and other sub-paragraphs.

Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED



Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to sheet metal fabrication and installation related to modified bitumen roofing.

NOTE TO SPECIFIER

EDIT Article 1.2 RELATED SECTIONS below. DELETE Section references for roofing system Sections not applicable to this project. Re-letter paragraphs after editing.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 075215 – MB Surfacing Ply over Built-Up Roofing in Hot Asphalt
- D. Section 075216 – SBS Modified Bitumen Roofing in Cold Adhesive
- E. Section 075217 – SBS Modified Bitumen Roofing in Hot Asphalt
- F. Section 079201 – Sealants for Roof Replacement
- G. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 - 1. American Society for Testing and Materials (ASTM)
 - a. ASTM A 653/653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - b. ASTM D 41/D 41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
 - 2. American National Standard Institute (ANSI)
 - 3. Factory Mutual Global (FM)
 - 4. National Roofing Contractors Association (NRCA)
 - 5. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
 - a. SMACNA Architectural Sheet Metal Manual, 7th Edition
 - 6. Single Ply Roofing Industry (SPRI)



- a. ANSI/SPRI/FM 4435/ES-1 – Wind Design for Edge Systems Used with Low Slope Roofing Systems

1.4 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.5 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.



- B. Cold weather precautions:
1. NOTE: Do not install sealants, adhesives or primers associated with sheet metal flashing at temperatures below 50°F (10°C).
 2. When the outside temperature is forecast to fall below 50°F (10°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives and primers should be maintained at a temperature of 50°F (10°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 3. Refer to the SBS modified bitumen roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

PART 2 – PRODUCTS

NOTE TO SPECIFIER

Article 2.1 may be edited to reflect sheet metal flashing requirements for a specific project. EDIT Article 2.1 as necessary. Re-letter/number paragraphs and sub-paragraphs after editing.

2.1 SHEET METAL ACCESSORIES

- A. Perimeter edge metal flashing system: Perimeter edge sheet metal flashing system consisting of a continuous inner clip and outer fascia piece, designed in accordance with the requirements of ANSI/SPRI/FM 4435/ES-1.
1. Inner clip/retention system and continuous cleats associated with perimeter edge metal flashing systems: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
 2. Fascia piece/gravel stop associated with perimeter edge metal flashing systems: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- B. Perimeter parapet cap metal flashing system: Parapet cap sheet metal flashing system consisting of a continuous inner clip and outer fascia piece, designed in accordance with the requirements of ANSI/SPRI/FM 4435/ES-1.
1. Inner clip/retention system and continuous cleats associated with perimeter edge metal flashing systems: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
 2. Parapet cap associated with perimeter parapet cap metal flashing systems: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- C. Interior parapet caps, area divider caps, expansion joint covers, and fascia extensions: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating, maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
1. Continuous cleats and expansion joint backer pieces associated with prefinished galvanized steel caps and fascia extension installation: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
- D. Curb caps: Galvanized steel, 18-gauge, ASTM A 653/653M; G-90. Fabricate to match dimensions of curbed cap, and as indicated on the drawings. Fabricate top with a cross-break,



- providing four-way slope to the outer edges of the cap adequate to remove the potential for standing water at the top of cap.
- E. Reglet-mounted, surface-mounted and slip counterflashings: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating, maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
 - F. Gutters: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating. Fabricate gutters to match dimensions indicated on the drawings; fabricate in 10-foot sections, with a 4-inch flange with a 1/2-inch hug at the inner edge of the gutter flange.
 - 1. Gutter spacers: Painted galvanized steel, 1-inch wide by 1/8-inch thick; seal and secure to gutter as shown on drawings. Paint color to match gutter.
 - G. Through-fascia, through-wall and overflow scuppers:
 - 1. Scupper liners: Stainless steel, 22-gauge. Fabricate scupper flashings in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-26, 1-28, 1-29 and 1-30. Provide a 4-inch flange with a 1/2-inch hug at the inner edge of the scupper flange. Solder all seams watertight.
 - 2. Conductor boxes and scupper closure plates: Stainless steel, 22-gauge. Solder all seams watertight. Fabricate these components in accordance with the drawings, and the requirements outlined in the "SMACNA Architectural Sheet Metal Manual, 7th Edition".
 - H. Conductor box fascia covers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by the Owner.
 - I. Downspouts, associated with gutters and scuppers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by Owner. Fabricate downspouts with a "Pittsburgh Lock" seam, and in accordance with the drawings and "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-32B and 1-32F; size the hangers to match downspouts.
 - J. Plumbing vent and roof sump flashing:
 - 1. Plumbing vent flashing: One-piece flange and sleeve formed of minimum 4-pound lead, with a "ribbed" configuration at the base of the sleeve to allow for movement and/or expansion of the vent stack; lead sleeve diameter to closely match the diameter of the existing stack.
 - 2. Roof sump flashing: 30-inches by 30-inches, minimum 4-pound lead roof drain flashing sheet.
 - K. Tubular penetrations, pitch pans and hoods/covers:
 - 1. Tubular penetration flashings: Stainless steel, 24-gauge. Fabricate a one-piece flanged sleeve with a flange extending 6-inches minimum out from the sleeve; sleeve to extend minimum 6-inches above the finished roof surface.
 - 2. Pitch pans: Stainless steel, 24-gauge. Fabricate to dimensions shown on drawings, with a minimum 4-inch depth, and flange extending 6-inches minimum out from the pitch pan, and other dimensions to be kept to the minimum size necessary to provide a 2-inch clearance all sides from the penetration.
 - 3. Tubular penetration hoods and pitch pan covers: Stainless steel, 24-gauge. Fabricate to dimensions shown on drawings.
 - L. High-temperature tubular penetrations:
 - 1. High-temperature tubular penetration flashings and insulation stops: Stainless steel, 24-gauge. Fabricate a one-piece flanged sleeve with a flange extending 6-inches minimum out from the sleeve onto the roof surface.
 - M. Miscellaneous sheet metal accessories:



1. For terminating flashing: Anchor bar: 1-inch x 1/8-inch extruded aluminum with slotted holes spaced 6 inches o.c. Do not fabricate with a caulk slot.
2. For securement of sheet metal hoods at tubular penetrations: Stainless steel adjustable clamp.
3. For use behind counterflashing flanges where indicated on the drawings: Butyl tape, width and thickness as necessary to create a seal between the existing substrate and secured counterflashing.

2.2 ADHESIVES, CEMENTS AND PRIMERS

- A. Flashing cement and roofing cement: Product compatible with flashing sheet used and approved by the roofing membrane manufacturer for the situation encountered.
- B. Asphalt primer: ASTM D 41/ D 41M.

2.3 FASTENERS

- A. For securing sheet metal flashings: Fasteners indicated on the drawings, or appropriate and approved by the Owner for the substrate encountered, and compatible with the sheet metal type to be secured. Where fastener heads are exposed, provide neoprene gaskets/washers.
- B. For copper: Copper or bronze fasteners.
- C. For stainless steel: Stainless steel fasteners.
- D. For securing aluminum anchor bar: Fasteners appropriate for, and approved by the Owner and roofing manufacturer for the substrate encountered.

2.4 SEALANT

- A. Refer to Section 079201.

PART 3 - EXECUTION

NOTE TO SPECIFIER

Article 3.1 may be edited to reflect sheet metal flashing requirements for a specific project. EDIT Article 3.1 as necessary. Re-letter/number paragraphs and sub-paragraphs after editing.

3.1 SHEET METAL FLASHING INSTALLATION

- A. Perimeter edge metal flashing system:
 1. Install perimeter edge metal in a manner that meets the requirements of ANSI/SPRI/FM 4435/ES-1. Provide a system matching the configurations and dimensions indicated on the drawings.
 2. For pre-fabricated parapet cap metal systems: Install in accordance with the metal system manufacturer.
 3. For shop-fabricated perimeter edge metal systems:
 - a. Secure the horizontal flange and vertical face of the inner clip/continuous cleat with ring shank coated nails 12-inches o.c., max. Decrease fastener spacing to 6-inches o.c., max. within 10-feet of a building corner.



- b. Place the outer fascia/gravel stop piece. Hook the fascia to the underlying continuous cleat. Secure the flange with nails 3-inches o.c. in two staggered rows as indicated on the drawings. Prior to securement, prime both sides of horizontal flange and set in a full bed of roofing cement.
- B. Parapet edge cap metal flashing system:
 1. For pre-fabricated parapet cap metal systems: Install in accordance with the metal system manufacturer to meet the requirements of ANSI/SPRI/FM 4435/ES-1. Provide a system matching the dimensions indicated on the drawings.
 2. For shop-fabricated parapet cap metal systems:
 - a. Fabricate inner clips/continuous cleats with a kick-up, creating a minimum 1/2-inch per foot slope toward the roof.
 - b. Secure the horizontal flange and vertical face of the inner clip/continuous cleat with ring shank coated nails 12-inches o.c., max. Decrease fastener spacing to 6-inches o.c., max. within 10-feet of a building corner.
 - c. Place the cap sections. At the outer face, hook the fascia to the underlying continuous cleat. At the inner face, secure the flange with #12 fasteners, fitted with neoprene gaskets/washers 18-inches o.c., max., and within 2-inches of each end.
 - d. Join adjacent parapet cap sections using a standing seam, with a 1" height. Where upturned standing seam ends meet, apply continuous sealant to the joint. Cut outer edges of upturned seams at a 45-degree angle. Fold ear over end, and crimp in place.
 - e. Where parapet caps terminate at walls, turn self-adhering membrane 1-inch, minimum, up wall. Turn coping cap piece 2-inches, minimum, up wall. Seal and secure as indicated on the drawings. Install regletted counterflashing over exposed end piece.
- C. Curb caps, area divider and expansion joint covers, and fascia extensions:
 1. Install caps, covers, and related continuous cleats and backer pieces, as detailed, at locations indicated on the drawings.
 2. Fabricate with seam type indicated on drawings to dimensions indicated on drawings. Provide a 3/4-inch hemmed drip edge.
 3. Fastening: Secure faces of curb caps, area divider covers, and expansion joint covers with specified fasteners appropriate for the substrate encountered, fitted with neoprene gaskets/washers, spaced 18-inches o.c. max., and within 2-inches of each end.
 4. Join adjacent area divider and expansion joint cover sections using a standing seam, with a 1" height. Where upturned standing seam ends meet, apply continuous sealant to the joint. Cut outer edges of upturned seams at a 45-degree angle. Fold ear over end, and crimp in place.
 5. Where area divider and expansion joint covers terminate at walls, turn self-adhering membrane 1-inch, minimum, up wall. Turn coping cap piece 2-inches, minimum, up wall. Seal and secure as indicated on the drawings. Install regletted counterflashing over exposed end piece.
- D. Fascia extensions:
 1. Secure fascia extensions with ring shank coated nails 12-inches o.c., max., or fasteners appropriate for, and approved by the Owner for, the substrate condition encountered, 12-inches o.c. max.
- E. Reglet-mounted and slip counterflashings: Provide counterflashings, as detailed, at locations indicated on the drawings:
 1. At locations indicated on the drawings, install butyl tape to the backside of counterflashing flanges at the flange interface with the substrate.
 2. Cut reglets into masonry walls to accommodate reglet-mounted counterflashing.



3. Fabricate counterflashing to dimensions indicated on drawings. Fabricate the counterflashing with a 3/4-inch hemmed drip edge, and on surface mounted counterflashing, a 1/2-inch 45-degree angle sealant slot. Fabricate slip counterflashings to dimensions necessary to accommodate existing conditions, and as shown on drawings. Provide a minimum 4-inch face if conditions allow.
 4. Secure counterflashings with specified fasteners appropriate for substrate condition encountered, fitted with neoprene gaskets/washers. Space fasteners 12-inches o.c. max., and within 2-inches of each end.
- F. Gutters and downspouts:
1. Install the specified gutter spacers 24-inches o.c. Seal and secure the spacers to the gutter assembly as indicated on the drawings.
 2. Overlap individual gutter sections 1-1/2 inches. Seal overlap, and pop-rivet sections together with two rows of pop rivets. Space pop rivets 1/2-inch min., and 3/4-inches max. in each row. Completed gutter sections shall not exceed 50-feet in length.
 3. Prime both sides of gutter flange and set in a full bed of roofing cement. Secure the flange with nails 3-inches o.c. in two staggered rows.
 4. Gutter expansion joints: Provide gutter expansion joints at locations recommended by SMACNA; fabricated following the recommendations of SMACNA.
 5. Downspouts: Install downspouts at locations indicated on drawings. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
- G. Scupper liners, closure plates, conductor boxes and downspouts:
1. Scupper liners: Install scupper liners at through-fascia, through-wall, and overflow scupper locations indicated on the drawings. Install scupper liners following the requirements and recommendations of SMACNA.
 2. Cover plates: At the exterior face of the scupper, install cover plates. Install scupper cover plates as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 3. Conductor boxes: Where indicated on the drawings, install conductor boxes as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 4. Downspouts: Install downspouts at conductor boxes. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
 5. Install conductor box fascia covers as indicated on the drawings. Fully clip fascia covers to stainless steel conductor boxes, or secure to substrate with fasteners appropriate for the substrate encountered.
- H. Plumbing vents, tubular penetrations and pitch pan flashings:
1. Flash tubular penetrations, high-temperature penetrations and pitch pans as indicated on drawings. Do not use pitch pans at tubular penetrations without the approval of the Owner.
 2. Install tubular penetration hoods and pitch pan covers as indicated on the drawings.
 3. Prior to flashing application, ensure both sides of tubular penetration sleeve and pitch pan flanges have been primed, and the flange has been set in a full bed of roofing cement.
 4. Where soldering is required at stainless steel flanged sleeves, hoods, and pitch pans: Solder all seams and laps watertight. Prior to soldering of stainless steel, clean work area using solvents and wire brush; removing dirt, oil, grease, and other contaminants



from the work area. Tin the work area by applying acid (flux). Perform soldering work. After completion of work, remove excess acid (flux) from the work area.

- I. Anchor bar: Fasten the upper edges of modified bitumen flashings with an anchor bar installed in accordance with the requirements of the roofing membrane manufacturer.

USPS CSF Specifications issued: 10/1/2013
Last revised: 3/6/2013

NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 62 03 00



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SECTION 07 62 05 00 - R&A SHEET METAL FOR EPDM ROOFING

NOTE TO SPECIFIER

This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section.

NOTE TO SPECIFIER

Use this Section In technical specifications where a fully-adhered EPDM roofing membrane (Section 075324) is specified.

NOTE TO SPECIFIER

Section Formatting:

Consistent formatting of Sections gives the complete document a professional look. This Section uses a 10pt. Arial font, and is formatted as follows:

1. Insert one 10pt. line after the Section Number. Section Number is in CAPS.
2. Insert two 10pt. lines after the Section Title. Section Title is in CAPS.
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5. Insert two 10pt. lines at the end of an Article.
6. Complete Section with END OF SETION.
7. No lines should be placed between paragraphs and sub-paragraphs, or between sub-paragraphs and other sub-paragraphs.

Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED



Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to sheet metal fabrication and installation related to fully-adhered Ethylene Propylene Diene Monomer (EPDM) roofing.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 024100 – Roof Removal and Substrate Preparation
- D. Section 075323 – Fully-Adhered EPDM Roofing
- E. Section 079201 – Sealants for Roof Replacement
- F. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 - 1. American Society for Testing and Materials (ASTM)
 - a. ASTM A 653/653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 2. American National Standard Institute (ANSI)
 - 3. Factory Mutual Global (FM)
 - 4. National Roofing Contractors Association (NRCA)
 - 5. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).
 - a. SMACNA Architectural Sheet Metal Manual, 7th Edition
 - 6. Single Ply Roofing Industry (SPRI)
 - a. ANSI/SPRI/FM 4435/ES-1 – Wind Design for Edge Systems Used with Low Slope Roofing Systems

1.4 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.5 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
 - 1. NOTE: Do not install sealants, adhesives, primers and pressure-sensitive flashings associated with sheet metal flashing at temperatures below 35°F (2°C).
 - 2. When the outside temperature is forecast to fall below 40°F (5°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives, primers and pressure-sensitive flashings should be maintained at a temperature of 40°F (5°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.



3. Be aware of potential condensation formation on the EPDM roof surface during application/flash-off of adhesives and primer. Remove condensation using a heat gun prior to adhesion to the insulation or cover board substrate. Do not use an open flame to remove condensation from the roof membrane or flashing materials.
 4. Refer to the EPDM roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

PART 2 – PRODUCTS

NOTE TO SPECIFIER

Article 2.1 may be edited to reflect sheet metal flashing requirements for a specific project. EDIT Article 2.1 as necessary. Re-letter/number paragraphs and sub-paragraphs after editing.

2.1 SHEET METAL ACCESSORIES

- A. Perimeter edge metal flashing system: Perimeter edge sheet metal flashing system consisting of a continuous inner clip and outer fascia piece, designed in accordance with the requirements of ANSI/SPRI/FM 4435/ES-1.
 1. Inner clip/retention system and continuous cleats associated with perimeter edge metal flashing systems: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
 2. Fascia piece/gravel stop associated with perimeter edge metal flashing systems: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- B. Perimeter parapet cap metal flashing system: Parapet cap sheet metal flashing system consisting of a continuous inner clip and outer fascia piece, designed in accordance with the requirements of ANSI/SPRI/FM 4435/ES-1.
 1. Inner clip/retention system and continuous cleats associated with perimeter edge metal flashing systems: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
 2. Parapet cap associated with perimeter parapet cap metal flashing systems: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- C. Interior parapet caps, area divider caps, expansion joint covers, and fascia extensions: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating, maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
 1. Continuous cleats and expansion joint backer pieces associated with prefinished galvanized steel caps and fascia extension installation: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
- D. Curb caps: Galvanized steel, 18-gauge, ASTM A 653/653M; G-90. Fabricate to match dimensions of curbed cap, and as indicated on the drawings. Fabricate top with a cross-break, providing four-way slope to the outer edges of the cap adequate to remove the potential for standing water at the top of cap.
- E. Reglet-mounted, surface-mounted and slip counterflashings: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating, maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.

- F. Gutters: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating. Fabricate gutters to match dimensions indicated on the drawings; fabricate in 10-foot sections, with a 4-inch flange with a 1/2-inch hug at the inner edge of the gutter flange.
 - 1. Gutter spacers: Painted galvanized steel, 1-inch wide by 1/8-inch thick; seal and secure to gutter as shown on drawings. Paint color to match gutter.
- G. Through-fascia, through-wall and overflow scuppers:
 - 1. Scupper liners: Stainless steel, 22-gauge. Fabricate scupper flashings in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-26, 1-28, 1-29 and 1-30. Provide a 4-inch flange with a 1/2-inch hug at the inner edge of the scupper flange. Solder all seams watertight.
 - 2. Conductor boxes and scupper closure plates: Stainless steel, 22-gauge. Solder all seams watertight. Fabricate these components in accordance with the drawings, and the requirements outlined in the "SMACNA Architectural Sheet Metal Manual, 7th Edition".
- H. Conductor box fascia covers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by the Owner.
- I. Downspouts, associated with gutters and scuppers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by Owner. Fabricate downspouts with a "Pittsburgh Lock" seam, and in accordance with the drawings and "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-32B and 1-32F; size the hangers to match downspouts.
- J. High-temperature tubular penetrations:
 - 1. High-temperature tubular penetration flashings and insulation stops: Stainless steel, 24-gauge. Fabricate a one-piece flanged sleeve with a flange extending 6-inches minimum out from the sleeve onto the roof surface.
- K. Pitch pans, tubular penetration hoods, and pitch pan covers:
 - 1. Pitch pans: Stainless steel, 24-gauge. Fabricate to dimensions shown on drawings, with a minimum 4-inch depth, and flange extending 6-inches minimum out from the pitch pan, and other dimensions to be kept to the minimum size necessary to provide a 2-inch clearance all sides from the penetration.
 - 2. Tubular penetration hoods and pitch pan covers: Stainless steel, 24-gauge. Fabricate to dimensions shown on drawings.
- L. Miscellaneous sheet metal accessories:
 - 1. For terminating flashing: Anchor bar: 1-inch x 1/8-inch extruded aluminum with slotted holes spaced 6 inches o.c.
 - 2. For securement of tubular penetration flashings and sheet metal hoods at tubular penetrations: Stainless steel adjustable clamp.
 - 3. For use behind counterflashing flanges where indicated on the drawings: Butyl tape, width and thickness as necessary to create a seal between the existing substrate and secured counterflashing.

2.2 FASTENERS

- A. For securing sheet metal flashings: Fasteners indicated on the drawings, or appropriate and approved by the Owner for the substrate encountered, and compatible with the sheet metal type to be secured. Where fastener heads are exposed, provide neoprene gaskets/washers.
- B. For copper: Copper or bronze fasteners.



- C. For stainless steel: Stainless steel fasteners.
- D. For securing aluminum anchor bar: Fasteners appropriate for, and approved by the Owner and roofing manufacturer for the substrate encountered.

2.3 SEALANT

- A. Refer to Section 079201.

PART 3 - EXECUTION

NOTE TO SPECIFIER

Article 3.1 may be edited to reflect sheet metal flashing requirements for a specific project. EDIT Article 3.1 as necessary. Re-letter/number paragraphs and sub-paragraphs after editing.

3.1 SHEET METAL INSTALLATION

- A. Perimeter edge metal flashing system:
 - 1. Install perimeter edge metal in a manner that meets the requirements of ANSI/SPRI/FM 4435/ES-1. Provide a system matching the configurations and dimensions indicated on the drawings.
 - 2. For pre-fabricated parapet cap metal systems: Install in accordance with the metal system manufacturer.
 - 3. For shop-fabricated perimeter edge metal systems:
 - a. Secure the horizontal flange and vertical face of the inner clip/continuous cleat with ring shank coated nails 12-inches o.c., max. Decrease fastener spacing to 6-inches o.c., max. within 10-feet of a building corner.
 - b. Place the outer fascia/gravel stop piece. Hook the fascia to the underlying continuous cleat. Secure the flange with nails 3-inches o.c. in two staggered rows as indicated on the drawings.
- B. Parapet edge cap metal flashing system:
 - 1. For pre-fabricated parapet cap metal systems: Install in accordance with the metal system manufacturer to meet the requirements of ANSI/SPRI/FM 4435/ES-1. Provide a system matching the dimensions indicated on the drawings.
 - 2. For shop-fabricated parapet cap metal systems:
 - a. Fabricate inner clips/continuous cleats with a kick-up, creating a minimum 1/2-inch per foot slope toward the roof.
 - b. Secure the horizontal flange and vertical face of the inner clip/continuous cleat with ring shank coated nails 12-inches o.c., max. Decrease fastener spacing to 6-inches o.c., max. within 10-feet of a building corner.
 - c. Place the cap sections. At the outer face, hook the fascia to the underlying continuous cleat. At the inner face, secure the flange with #12 fasteners, fitted with neoprene gaskets/washers 18-inches o.c., max., and within 2-inches of each end.
 - d. Join adjacent parapet cap sections using a standing seam, with a 1" height. Where upturned standing seam ends meet, apply continuous sealant to the joint. Cut outer edges of upturned seams at a 45-degree angle. Fold ear over end, and crimp in place.
 - e. Where parapet caps terminate at walls, turn self-adhering membrane 1-inch, minimum, up wall. Turn coping cap piece 2-inches, minimum, up wall. Seal and

secure as indicated on the drawings. Install regletted counterflashing over exposed end piece.

- C. Curb caps, area divider and expansion joint covers, and fascia extensions:
1. Install caps, covers, and related continuous cleats and backer pieces, as detailed, at locations indicated on the drawings.
 2. Fabricate with seam type indicated on drawings to dimensions indicated on drawings. Provide a 3/4-inch hemmed drip edge.
 3. Fastening: Secure faces of curb caps, area divider covers, and expansion joint covers with specified fasteners appropriate for the substrate encountered, fitted with neoprene gaskets/washers, spaced 18-inches o.c. max., and within 2-inches of each end.
 4. Join adjacent area divider and expansion joint cover sections using a standing seam, with a 1" height. Where upturned standing seam ends meet, apply continuous sealant to the joint. Cut outer edges of upturned seams at a 45-degree angle. Fold ear over end, and crimp in place.
 5. Where area divider and expansion joint covers terminate at walls, turn self-adhering membrane 1-inch, minimum, up wall. Turn coping cap piece 2-inches, minimum, up wall. Seal and secure as indicated on the drawings. Install regletted counterflashing over exposed end piece.
- D. Fascia extensions:
1. Secure fascia extensions with ring shank coated nails 12-inches o.c., max., or fasteners appropriate for, and approved by the Owner for, the substrate condition encountered, 12-inches o.c. max.
- E. Reglet-mounted and slip counterflashings: Provide counterflashings, as detailed, at locations indicated on the drawings:
1. At locations indicated on the drawings, install butyl tape to the backside of counterflashing flanges at the flange interface with the substrate.
 2. Cut reglets into masonry walls to accommodate reglet-mounted counterflashing.
 3. Fabricate counterflashing to dimensions indicated on drawings. Fabricate the counterflashing with a 3/4-inch hemmed drip edge, and on surface mounted counterflashing, a 1/2-inch 45-degree angle sealant slot. Fabricate slip counterflashings to dimensions necessary to accommodate existing conditions, and as shown on drawings. Provide a minimum 4-inch face if conditions allow.
 4. Secure counterflashings with specified fasteners appropriate for substrate condition encountered, fitted with neoprene gaskets/washers. Space fasteners 12-inches o.c. max., and within 2-inches of each end.
- F. Gutters and downspouts:
1. Install the specified gutter spacers 24-inches o.c. Seal and secure the spacers to the gutter assembly as indicated on the drawings.
 2. Overlap individual gutter sections 1-1/2 inches. Seal overlap, and pop-rivet sections together with two rows of pop rivets. Space pop rivets 1/2-inch min., and 3/4-inches max. in each row. Completed gutter sections shall not exceed 50-feet in length.
 3. Secure the flange with nails 3-inches o.c. in two staggered rows.
 4. Gutter expansion joints: Provide gutter expansion joints at locations recommended by SMACNA; fabricated following the recommendations of SMACNA.
 5. Downspouts: Install downspouts at locations indicated on drawings. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
- G. Scupper liners, closure plates, conductor boxes and downspouts:



1. Scupper liners: Install scupper liners at through-fascia, through-wall, and overflow scupper locations indicated on the drawings. Install scupper liners following the requirements and recommendations of SMACNA.
 2. Cover plates: At the exterior face of the scupper, install cover plates. Install scupper cover plates as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 3. Conductor boxes: Where indicated on the drawings, install conductor boxes as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 4. Downspouts: Install downspouts at conductor boxes. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
 5. Install conductor box fascia covers as indicated on the drawings. Fully clip fascia covers to stainless steel conductor boxes, or secure to substrate with fasteners appropriate for the substrate encountered.
- H. Plumbing vents, tubular penetrations and pitch pan flashings:
1. Flash tubular penetrations and pitch pans as indicated on drawings. Do not use pitch pans at tubular penetrations without the approval of the Owner.
 2. Install tubular penetration hoods and pitch pan covers as indicated on the drawings.
 3. Where soldering is required at stainless steel flanged sleeves, hoods, and pitch pans: Solder all seams and laps watertight. Prior to soldering of stainless steel, clean work area using solvents and wire brush; removing dirt, oil, grease, and other contaminants from the work area. Tin the work area by applying acid (flux). Perform soldering work. After completion of work, remove excess acid (flux) from the work area.
- I. Anchor bar: Fasten the upper edges of EPDM flashings with an anchor bar installed in accordance with the requirements of the roofing membrane manufacturer.

USPS CSF Specifications issued: 10/1/2013

Last revised: 3/6/2013

NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 62 05 00



SECTION 07 62 05 00 - MPF SHEET METAL FOR EPDM ROOFING

NOTE TO SPECIFIER

Editing is needed for each individual project; modify as needed for project specific requirements. Included "NOTE TO SPECIFIER" instructions provide guidance concerning required editing, and options have been included requiring action on the part of the specifier/designer. Select the option appropriate for the project and delete option(s) not selected.

NOTE TO SPECIFIER

EDIT Section footer as necessary to reflect the project name and location, USPS Project number, and required date of the technical specification document. Coordinate this project specific information with the USPS Project Manager. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this Section In technical specifications where a fully-adhered EPDM roofing membrane (Section 075324) is specified.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to sheet metal fabrication and installation related to fully-adhered Ethylene Propylene Diene Monomer (EPDM) roofing.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 075323 – Fully-Adhered EPDM Roofing
- D. Section 079200 – Sealants for Roofing
- E. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 - 1. American Society for Testing and Materials (ASTM)
 - a. ASTM A 653/653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 2. American National Standard Institute (ANSI)
 - 3. Factory Mutual Global (FM)
 - 4. National Roofing Contractors Association (NRCA)
 - 5. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).
 - a. SMACNA Architectural Sheet Metal Manual, 7th Edition



- 6. Single Ply Roofing Industry (SPRI)
 - a. ANSI/SPRI/FM 4435/ES-1 – Wind Design for Edge Systems Used with Low Slope Roofing Systems

1.4 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.5 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the



outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.

- B. Cold weather precautions:
1. NOTE: Do not install sealants, adhesives, primers and pressure-sensitive flashings associated with sheet metal flashing at temperatures below 35°F (2°C).
 2. When the outside temperature is forecast to fall below 40°F (5°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives, primers and pressure-sensitive flashings should be maintained at a temperature of 40°F (5°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 3. Be aware of potential condensation formation on the EPDM roof surface during application/flash-off of adhesives and primer. Remove condensation using a heat gun prior to adhesion to the insulation or cover board substrate. Do not use an open flame to remove condensation from the roof membrane or flashing materials.
 4. Refer to the EPDM roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

PART 2 – PRODUCTS

NOTE TO SPECIFIER

Article 2.1 may be edited to reflect sheet metal flashing requirements for a specific project. EDIT Article 2.1 as necessary. Re-letter/number paragraphs and sub-paragraphs after editing.

2.1 SHEET METAL ACCESSORIES

- A. Perimeter edge metal flashing system: Perimeter edge sheet metal flashing system consisting of a continuous inner clip and outer fascia piece, designed in accordance with the requirements of ANSI/SPRI/FM 4435/ES-1.
1. Inner clip/retention system and continuous cleats associated with perimeter edge metal flashing systems: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
 2. Fascia piece/gravel stop associated with perimeter edge metal flashing systems: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- B. Perimeter parapet cap metal flashing system: Parapet cap sheet metal flashing system consisting of a continuous inner clip and outer fascia piece, designed in accordance with the requirements of ANSI/SPRI/FM 4435/ES-1.
1. Inner clip/retention system and continuous cleats associated with perimeter edge metal flashing systems: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
 2. Parapet cap associated with perimeter parapet cap metal flashing systems: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- C. Interior parapet caps, area divider caps, expansion joint covers, and fascia extensions: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating, maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.



1. Continuous cleats and expansion joint backer pieces associated with prefinished galvanized steel caps and fascia extension installation: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
- D. Curb caps: Galvanized steel, 18-gauge, ASTM A 653/653M; G-90. Fabricate to match dimensions of curbed cap, and as indicated on the drawings. Fabricate top with a cross-break, providing four-way slope to the outer edges of the cap adequate to remove the potential for standing water at the top of cap.
- E. Reglet-mounted, surface-mounted and slip counterflashings: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating, maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- F. Gutters: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating. Fabricate gutters to match dimensions indicated on the drawings; fabricate in 10-foot sections, with a 4-inch flange with a 1/2-inch hug at the inner edge of the gutter flange.
 1. Gutter spacers: Painted galvanized steel, 1-inch wide by 1/8-inch thick; seal and secure to gutter as shown on drawings. Paint color to match gutter.
- G. Through-fascia, through-wall and overflow scuppers:
 1. Scupper liners: Stainless steel, 22-gauge. Fabricate scupper flashings in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-26, 1-28, 1-29 and 1-30. Provide a 4-inch flange with a 1/2-inch hug at the inner edge of the scupper flange. Solder all seams watertight.
 2. Conductor boxes and scupper closure plates: Stainless steel, 22-gauge. Solder all seams watertight. Fabricate these components in accordance with the drawings, and the requirements outlined in the "SMACNA Architectural Sheet Metal Manual, 7th Edition".
- H. Conductor box fascia covers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by the Owner.
- I. Downspouts, associated with gutters and scuppers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by Owner. Fabricate downspouts with a "Pittsburgh Lock" seam, and in accordance with the drawings and "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-32B and 1-32F; size the hangers to match downspouts.
- J. High-temperature tubular penetrations:
 1. High-temperature tubular penetration flashings and insulation stops: Stainless steel, 24-gauge. Fabricate a one-piece flanged sleeve with a flange extending 6-inches minimum out from the sleeve onto the roof surface.
- K. Pitch pans, tubular penetration hoods, and pitch pan covers:
 1. Pitch pans: Stainless steel, 24-gauge. Fabricate to dimensions shown on drawings, with a minimum 4-inch depth, and flange extending 6-inches minimum out from the pitch pan, and other dimensions to be kept to the minimum size necessary to provide a 2-inch clearance all sides from the penetration.
 2. Tubular penetration hoods and pitch pan covers: Stainless steel, 24-gauge. Fabricate to dimensions shown on drawings.
- L. Miscellaneous sheet metal accessories:
 1. For terminating flashing: Anchor bar: 1-inch x 1/8-inch extruded aluminum with slotted holes spaced 6 inches o.c.
 2. For securement of tubular penetration flashings and sheet metal hoods at tubular penetrations: Stainless steel adjustable clamp.



3. For use behind counterflashing flanges where indicated on the drawings: Butyl tape, width and thickness as necessary to create a seal between the existing substrate and secured counterflashing.

2.2 FASTENERS

- A. For securing sheet metal flashings: Fasteners indicated on the drawings, or appropriate and approved by the Owner for the substrate encountered, and compatible with the sheet metal type to be secured. Where fastener heads are exposed, provide neoprene gaskets/washers.
- B. For copper: Copper or bronze fasteners.
- C. For stainless steel: Stainless steel fasteners.
- D. For securing aluminum anchor bar: Fasteners appropriate for, and approved by the Owner and roofing manufacturer for the substrate encountered.

2.3 SEALANT

- A. Refer to Section 079201.

PART 3 - EXECUTION

NOTE TO SPECIFIER

Article 3.1 may be edited to reflect sheet metal flashing requirements for a specific project. EDIT Article 3.1 as necessary. Re-letter/number paragraphs and sub-paragraphs after editing.

3.1 SHEET METAL INSTALLATION

- A. Perimeter edge metal flashing system:
 1. Install perimeter edge metal in a manner that meets the requirements of ANSI/SPRI/FM 4435/ES-1. Provide a system matching the configurations and dimensions indicated on the drawings.
 2. For pre-fabricated parapet cap metal systems: Install in accordance with the metal system manufacturer.
 3. For shop-fabricated perimeter edge metal systems:
 - a. Secure the horizontal flange and vertical face of the inner clip/continuous cleat with ring shank coated nails 12-inches o.c., max. Decrease fastener spacing to 6-inches o.c., max. within 10-feet of a building corner.
 - b. Place the outer fascia/gravel stop piece. Hook the fascia to the underlying continuous cleat. Secure the flange with nails 3-inches o.c. in two staggered rows as indicated on the drawings.
- B. Parapet edge cap metal flashing system:
 1. For pre-fabricated parapet cap metal systems: Install in accordance with the metal system manufacturer to meet the requirements of ANSI/SPRI/FM 4435/ES-1. Provide a system matching the dimensions indicated on the drawings.
 2. For shop-fabricated parapet cap metal systems:
 - a. Fabricate inner clips/continuous cleats with a kick-up, creating a minimum 1/2-inch per foot slope toward the roof.



- b. Secure the horizontal flange and vertical face of the inner clip/continuous cleat with ring shank coated nails 12-inches o.c., max. Decrease fastener spacing to 6-inches o.c., max. within 10-feet of a building corner.
 - c. Place the cap sections. At the outer face, hook the fascia to the underlying continuous cleat. At the inner face, secure the flange with #12 fasteners, fitted with neoprene gaskets/washers 18-inches o.c., max., and within 2-inches of each end.
 - d. Join adjacent parapet cap sections using a standing seam, with a 1" height. Where upturned standing seam ends meet, apply continuous sealant to the joint. Cut outer edges of upturned seams at a 45-degree angle. Fold ear over end, and crimp in place.
 - e. Where parapet caps terminate at walls, turn self-adhering membrane 1-inch, minimum, up wall. Turn coping cap piece 2-inches, minimum, up wall. Seal and secure as indicated on the drawings. Install regletted counterflashing over exposed end piece.
- C. Curb caps, area divider and expansion joint covers:
 - 1. Install caps, covers, and related continuous cleats and backer pieces, as detailed, at locations indicated on the drawings.
 - 2. Fabricate with seam type indicated on drawings to dimensions indicated on drawings. Provide a 3/4-inch hemmed drip edge.
 - 3. Fastening: Secure faces of curb caps, area divider covers, and expansion joint covers with specified fasteners appropriate for the substrate encountered, fitted with neoprene gaskets/washers, spaced 18-inches o.c. max., and within 2-inches of each end.
 - 4. Join adjacent area divider and expansion joint cover sections using a standing seam, with a 1" height. Where upturned standing seam ends meet, apply continuous sealant to the joint. Cut outer edges of upturned seams at a 45-degree angle. Fold ear over end, and crimp in place.
 - 5. Where area divider and expansion joint covers terminate at walls, turn self-adhering membrane 1-inch, minimum, up wall. Turn coping cap piece 2-inches, minimum, up wall. Seal and secure as indicated on the drawings. Install regletted counterflashing over exposed end piece.
- D. Fascia extensions:
 - 1. Secure fascia extensions with ring shank coated nails 12-inches o.c., max., or fasteners appropriate for, and approved by the Owner for, the substrate condition encountered, 12-inches o.c. max.
- E. Reglet-mounted and slip counterflashings: Provide counterflashings, as detailed, at locations indicated on the drawings:
 - 1. At locations indicated on the drawings, install butyl tape to the backside of counterflashing flanges at the flange interface with the substrate.
 - 2. Cut reglets into masonry walls to accommodate reglet-mounted counterflashing.
 - 3. Fabricate counterflashing to dimensions indicated on drawings. Fabricate the counterflashing with a 3/4-inch hemmed drip edge, and on surface mounted counterflashing, a 1/2-inch 45-degree angle sealant slot. Fabricate slip counterflashings to dimensions necessary to accommodate existing conditions, and as shown on drawings. Provide a minimum 4-inch face if conditions allow.
 - 4. Secure counterflashings with specified fasteners appropriate for substrate condition encountered, fitted with neoprene gaskets/washers. Space fasteners 12-inches o.c. max., and within 2-inches of each end.
- F. Gutters and downspouts:
 - 1. Install the specified gutter spacers 24-inches o.c. Seal and secure the spacers to the gutter assembly as indicated on the drawings.



2. Overlap individual gutter sections 1-1/2 inches. Seal overlap, and pop-rivet sections together with two rows of pop rivets. Space pop rivets 1/2-inch min., and 3/4-inches max. in each row. Completed gutter sections shall not exceed 50-feet in length.
 3. Secure the flange with nails 3-inches o.c. in two staggered rows.
 4. Gutter expansion joints: Provide gutter expansion joints at locations recommended by SMACNA; fabricated following the recommendations of SMACNA.
 5. Downspouts: Install downspouts at locations indicated on drawings. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
- G. Scupper liners, closure plates, conductor boxes and downspouts:
1. Scupper liners: Install scupper liners at through-fascia, through-wall, and overflow scupper locations indicated on the drawings. Install scupper liners following the requirements and recommendations of SMACNA.
 2. Cover plates: At the exterior face of the scupper, install cover plates. Install scupper cover plates as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 3. Conductor boxes: Where indicated on the drawings, install conductor boxes as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 4. Downspouts: Install downspouts at conductor boxes. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
 5. Install conductor box fascia covers as indicated on the drawings. Fully clip fascia covers to stainless steel conductor boxes, or secure to substrate with fasteners appropriate for the substrate encountered.
- H. Plumbing vents, tubular penetrations and pitch pan flashings:
1. Flash tubular penetrations and pitch pans as indicated on drawings. Do not use pitch pans at tubular penetrations without the approval of the Owner.
 2. Install tubular penetration hoods and pitch pan covers as indicated on the drawings.
 3. Where soldering is required at stainless steel flanged sleeves, hoods, and pitch pans: Solder all seams and laps watertight. Prior to soldering of stainless steel, clean work area using solvents and wire brush; removing dirt, oil, grease, and other contaminants from the work area. Tin the work area by applying acid (flux). Perform soldering work. After completion of work, remove excess acid (flux) from the work area.
- I. Anchor bar: Fasten the upper edges of EPDM flashings with an anchor bar installed in accordance with the requirements of the roofing membrane manufacturer.

USPS MPF Specifications, issued: 10/1/2013

Last revised: 9/16/2013

NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.



END OF SECTION 07 62 05 00



SECTION 07 62 05 00 - CSF SHEET METAL FOR EPDM ROOFING

NOTE TO SPECIFIER

Editing is needed for each individual project; modify as needed for project specific requirements. Included "NOTE TO SPECIFIER" instructions provide guidance concerning required editing, and options have been included requiring action on the part of the specifier/designer. Select the option appropriate for the project and delete option(s) not selected.

NOTE TO SPECIFIER

EDIT Section footer as necessary to reflect the project name and location, USPS Project number, and required date of the technical specification document. Coordinate this project specific information with the USPS Project Manager. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this Section In technical specifications where a fully-adhered EPDM roofing membrane (Section 075324) is specified.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to sheet metal fabrication and installation related to fully-adhered Ethylene Propylene Diene Monomer (EPDM) roofing.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 075323 – Fully-Adhered EPDM Roofing
- D. Section 079200 – Sealants for Roofing
- E. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 - 1. American Society for Testing and Materials (ASTM)
 - a. ASTM A 653/653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 2. American National Standard Institute (ANSI)
 - 3. Factory Mutual Global (FM)
 - 4. National Roofing Contractors Association (NRCA)
 - 5. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).
 - a. SMACNA Architectural Sheet Metal Manual, 7th Edition



- 6. Single Ply Roofing Industry (SPRI)
 - a. ANSI/SPRI/FM 4435/ES-1 – Wind Design for Edge Systems Used with Low Slope Roofing Systems

1.4 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.5 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the



outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.

- B. Cold weather precautions:
1. NOTE: Do not install sealants, adhesives, primers and pressure-sensitive flashings associated with sheet metal flashing at temperatures below 35°F (2°C).
 2. When the outside temperature is forecast to fall below 40°F (5°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives, primers and pressure-sensitive flashings should be maintained at a temperature of 40°F (5°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 3. Be aware of potential condensation formation on the EPDM roof surface during application/flash-off of adhesives and primer. Remove condensation using a heat gun prior to adhesion to the insulation or cover board substrate. Do not use an open flame to remove condensation from the roof membrane or flashing materials.
 4. Refer to the EPDM roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

PART 2 – PRODUCTS

NOTE TO SPECIFIER

Article 2.1 may be edited to reflect sheet metal flashing requirements for a specific project. EDIT Article 2.1 as necessary. Re-letter/number paragraphs and sub-paragraphs after editing.

2.1 SHEET METAL ACCESSORIES

- A. Perimeter edge metal flashing system: Perimeter edge sheet metal flashing system consisting of a continuous inner clip and outer fascia piece, designed in accordance with the requirements of ANSI/SPRI/FM 4435/ES-1.
1. Inner clip/retention system and continuous cleats associated with perimeter edge metal flashing systems: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
 2. Fascia piece/gravel stop associated with perimeter edge metal flashing systems: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- B. Perimeter parapet cap metal flashing system: Parapet cap sheet metal flashing system consisting of a continuous inner clip and outer fascia piece, designed in accordance with the requirements of ANSI/SPRI/FM 4435/ES-1.
1. Inner clip/retention system and continuous cleats associated with perimeter edge metal flashing systems: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
 2. Parapet cap associated with perimeter parapet cap metal flashing systems: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- C. Interior parapet caps, area divider caps, expansion joint covers, and fascia extensions: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating, maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.



1. Continuous cleats and expansion joint backer pieces associated with prefinished galvanized steel caps and fascia extension installation: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
- D. Curb caps: Galvanized steel, 18-gauge, ASTM A 653/653M; G-90. Fabricate to match dimensions of curbed cap, and as indicated on the drawings. Fabricate top with a cross-break, providing four-way slope to the outer edges of the cap adequate to remove the potential for standing water at the top of cap.
- E. Reglet-mounted, surface-mounted and slip counterflashings: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating, maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- F. Gutters: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating. Fabricate gutters to match dimensions indicated on the drawings; fabricate in 10-foot sections, with a 4-inch flange with a 1/2-inch hug at the inner edge of the gutter flange.
 1. Gutter spacers: Painted galvanized steel, 1-inch wide by 1/8-inch thick; seal and secure to gutter as shown on drawings. Paint color to match gutter.
- G. Through-fascia, through-wall and overflow scuppers:
 1. Scupper liners: Stainless steel, 22-gauge. Fabricate scupper flashings in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-26, 1-28, 1-29 and 1-30. Provide a 4-inch flange with a 1/2-inch hug at the inner edge of the scupper flange. Solder all seams watertight.
 2. Conductor boxes and scupper closure plates: Stainless steel, 22-gauge. Solder all seams watertight. Fabricate these components in accordance with the drawings, and the requirements outlined in the "SMACNA Architectural Sheet Metal Manual, 7th Edition".
- H. Conductor box fascia covers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by the Owner.
- I. Downspouts, associated with gutters and scuppers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by Owner. Fabricate downspouts with a "Pittsburgh Lock" seam, and in accordance with the drawings and "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-32B and 1-32F; size the hangers to match downspouts.
- J. High-temperature tubular penetrations:
 1. High-temperature tubular penetration flashings and insulation stops: Stainless steel, 24-gauge. Fabricate a one-piece flanged sleeve with a flange extending 6-inches minimum out from the sleeve onto the roof surface.
- K. Pitch pans, tubular penetration hoods, and pitch pan covers:
 1. Pitch pans: Stainless steel, 24-gauge. Fabricate to dimensions shown on drawings, with a minimum 4-inch depth, and flange extending 6-inches minimum out from the pitch pan, and other dimensions to be kept to the minimum size necessary to provide a 2-inch clearance all sides from the penetration.
 2. Tubular penetration hoods and pitch pan covers: Stainless steel, 24-gauge. Fabricate to dimensions shown on drawings.
- L. Miscellaneous sheet metal accessories:
 1. For terminating flashing: Anchor bar: 1-inch x 1/8-inch extruded aluminum with slotted holes spaced 6 inches o.c.
 2. For securement of tubular penetration flashings and sheet metal hoods at tubular penetrations: Stainless steel adjustable clamp.



3. For use behind counterflashing flanges where indicated on the drawings: Butyl tape, width and thickness as necessary to create a seal between the existing substrate and secured counterflashing.

2.2 FASTENERS

- A. For securing sheet metal flashings: Fasteners indicated on the drawings, or appropriate and approved by the Owner for the substrate encountered, and compatible with the sheet metal type to be secured. Where fastener heads are exposed, provide neoprene gaskets/washers.
- B. For copper: Copper or bronze fasteners.
- C. For stainless steel: Stainless steel fasteners.
- D. For securing aluminum anchor bar: Fasteners appropriate for, and approved by the Owner and roofing manufacturer for the substrate encountered.

2.3 SEALANT

- A. Refer to Section 079201.

PART 3 - EXECUTION

NOTE TO SPECIFIER

Article 3.1 may be edited to reflect sheet metal flashing requirements for a specific project. EDIT Article 3.1 as necessary. Re-letter/number paragraphs and sub-paragraphs after editing.

3.1 SHEET METAL INSTALLATION

- A. Perimeter edge metal flashing system:
 1. Install perimeter edge metal in a manner that meets the requirements of ANSI/SPRI/FM 4435/ES-1. Provide a system matching the configurations and dimensions indicated on the drawings.
 2. For pre-fabricated parapet cap metal systems: Install in accordance with the metal system manufacturer.
 3. For shop-fabricated perimeter edge metal systems:
 - a. Secure the horizontal flange and vertical face of the inner clip/continuous cleat with ring shank coated nails 12-inches o.c., max. Decrease fastener spacing to 6-inches o.c., max. within 10-feet of a building corner.
 - b. Place the outer fascia/gravel stop piece. Hook the fascia to the underlying continuous cleat. Secure the flange with nails 3-inches o.c. in two staggered rows as indicated on the drawings.
- B. Parapet edge cap metal flashing system:
 1. For pre-fabricated parapet cap metal systems: Install in accordance with the metal system manufacturer to meet the requirements of ANSI/SPRI/FM 4435/ES-1. Provide a system matching the dimensions indicated on the drawings.
 2. For shop-fabricated parapet cap metal systems:
 - a. Fabricate inner clips/continuous cleats with a kick-up, creating a minimum 1/2-inch per foot slope toward the roof.

- b. Secure the horizontal flange and vertical face of the inner clip/continuous cleat with ring shank coated nails 12-inches o.c., max. Decrease fastener spacing to 6-inches o.c., max. within 10-feet of a building corner.
 - c. Place the cap sections. At the outer face, hook the fascia to the underlying continuous cleat. At the inner face, secure the flange with #12 fasteners, fitted with neoprene gaskets/washers 18-inches o.c., max., and within 2-inches of each end.
 - d. Join adjacent parapet cap sections using a standing seam, with a 1" height. Where upturned standing seam ends meet, apply continuous sealant to the joint. Cut outer edges of upturned seams at a 45-degree angle. Fold ear over end, and crimp in place.
 - e. Where parapet caps terminate at walls, turn self-adhering membrane 1-inch, minimum, up wall. Turn coping cap piece 2-inches, minimum, up wall. Seal and secure as indicated on the drawings. Install regletted counterflashing over exposed end piece.
- C. Curb caps, area divider and expansion joint covers:
 - 1. Install caps, covers, and related continuous cleats and backer pieces, as detailed, at locations indicated on the drawings.
 - 2. Fabricate with seam type indicated on drawings to dimensions indicated on drawings. Provide a 3/4-inch hemmed drip edge.
 - 3. Fastening: Secure faces of curb caps, area divider covers, and expansion joint covers with specified fasteners appropriate for the substrate encountered, fitted with neoprene gaskets/washers, spaced 18-inches o.c. max., and within 2-inches of each end.
 - 4. Join adjacent area divider and expansion joint cover sections using a standing seam, with a 1" height. Where upturned standing seam ends meet, apply continuous sealant to the joint. Cut outer edges of upturned seams at a 45-degree angle. Fold ear over end, and crimp in place.
 - 5. Where area divider and expansion joint covers terminate at walls, turn self-adhering membrane 1-inch, minimum, up wall. Turn coping cap piece 2-inches, minimum, up wall. Seal and secure as indicated on the drawings. Install regletted counterflashing over exposed end piece.
- D. Fascia extensions:
 - 1. Secure fascia extensions with ring shank coated nails 12-inches o.c., max., or fasteners appropriate for, and approved by the Owner for, the substrate condition encountered, 12-inches o.c. max.
- E. Reglet-mounted and slip counterflashings: Provide counterflashings, as detailed, at locations indicated on the drawings:
 - 1. At locations indicated on the drawings, install butyl tape to the backside of counterflashing flanges at the flange interface with the substrate.
 - 2. Cut reglets into masonry walls to accommodate reglet-mounted counterflashing.
 - 3. Fabricate counterflashing to dimensions indicated on drawings. Fabricate the counterflashing with a 3/4-inch hemmed drip edge, and on surface mounted counterflashing, a 1/2-inch 45-degree angle sealant slot. Fabricate slip counterflashings to dimensions necessary to accommodate existing conditions, and as shown on drawings. Provide a minimum 4-inch face if conditions allow.
 - 4. Secure counterflashings with specified fasteners appropriate for substrate condition encountered, fitted with neoprene gaskets/washers. Space fasteners 12-inches o.c. max., and within 2-inches of each end.
- F. Gutters and downspouts:
 - 1. Install the specified gutter spacers 24-inches o.c. Seal and secure the spacers to the gutter assembly as indicated on the drawings.



2. Overlap individual gutter sections 1-1/2 inches. Seal overlap, and pop-rivet sections together with two rows of pop rivets. Space pop rivets 1/2-inch min., and 3/4-inches max. in each row. Completed gutter sections shall not exceed 50-feet in length.
 3. Secure the flange with nails 3-inches o.c. in two staggered rows.
 4. Gutter expansion joints: Provide gutter expansion joints at locations recommended by SMACNA; fabricated following the recommendations of SMACNA.
 5. Downspouts: Install downspouts at locations indicated on drawings. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
- G. Scupper liners, closure plates, conductor boxes and downspouts:
1. Scupper liners: Install scupper liners at through-fascia, through-wall, and overflow scupper locations indicated on the drawings. Install scupper liners following the requirements and recommendations of SMACNA.
 2. Cover plates: At the exterior face of the scupper, install cover plates. Install scupper cover plates as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 3. Conductor boxes: Where indicated on the drawings, install conductor boxes as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 4. Downspouts: Install downspouts at conductor boxes. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
 5. Install conductor box fascia covers as indicated on the drawings. Fully clip fascia covers to stainless steel conductor boxes, or secure to substrate with fasteners appropriate for the substrate encountered.
- H. Plumbing vents, tubular penetrations and pitch pan flashings:
1. Flash tubular penetrations and pitch pans as indicated on drawings. Do not use pitch pans at tubular penetrations without the approval of the Owner.
 2. Install tubular penetration hoods and pitch pan covers as indicated on the drawings.
 3. Where soldering is required at stainless steel flanged sleeves, hoods, and pitch pans: Solder all seams and laps watertight. Prior to soldering of stainless steel, clean work area using solvents and wire brush; removing dirt, oil, grease, and other contaminants from the work area. Tin the work area by applying acid (flux). Perform soldering work. After completion of work, remove excess acid (flux) from the work area.
- I. Anchor bar: Fasten the upper edges of EPDM flashings with an anchor bar installed in accordance with the requirements of the roofing membrane manufacturer.

USPS CSF Specifications, issued: 10/1/2013

Last revised: 9/16/2013

NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.



END OF SECTION 07 62 05 00



SECTION 07 62 07 00 - R&A SHEET METAL FOR PVC ROOFING

NOTE TO SPECIFIER

This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section.

NOTE TO SPECIFIER

Use this Section In technical specifications where a fully-adhered PVC roofing membrane (Section 075420) is specified.

NOTE TO SPECIFIER

Section Formatting:

Consistent formatting of Sections gives the complete document a professional look. This Section uses a 10pt. Arial font, and is formatted as follows:

1. *Insert one 10pt. line after the Section Number. Section Number is in CAPS.*
2. *Insert two 10pt. lines after the Section Title. Section Title is in CAPS.*
3. *Insert one 10pt. line after a PART. PARTS are in CAPS. If a Section is not used, include NOT USED following the PART title as shown below.*
4. *Insert one 10pt. line after Article paragraphs. Articles are in CAPS.*
5. *Insert two 10pt. lines at the end of an Article.*
6. *Complete Section with END OF SETION.*
7. *No lines should be placed between paragraphs and sub-paragraphs, or between sub-paragraphs and other sub-paragraphs.*

Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED



Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to sheet metal fabrication and installation related to fully-adhered Polyvinyl Chloride (PVC) roofing.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 024100 – Roof Removal and Substrate Preparation
- D. Section 075420 – Fully-Adhered PVC Roofing
- E. Section 079201 – Sealants for Roof Replacement
- F. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 - 1. American Society for Testing and Materials (ASTM)
 - a. ASTM A 653/653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 2. American National Standard Institute (ANSI)
 - 3. Factory Mutual Global (FM)
 - 4. National Roofing Contractors Association (NRCA)
 - 5. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).
 - a. SMACNA Architectural Sheet Metal Manual, 6th Edition
 - 6. Single Ply Roofing Industry (SPRI)
 - a. ANSI/SPRI/FM 4435/ES-1 – Wind Design for Edge Systems Used with Low Slope Roofing Systems

1.4 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.5 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
 - 1. NOTE: Do not install sealants, adhesives, primers and pressure-sensitive flashings associated with sheet metal flashing at temperatures below 40°F (5°C).
 - 2. When the outside temperature is forecast to fall below 40°F (5°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives, primers and pressure-sensitive flashings should be maintained at a temperature of 40°F (5°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 - 3. Be aware of potential condensation formation on the PVC roof surface during application/flash-off of adhesives and primer. Remove condensation using a heat gun



- prior to adhesion to the insulation or cover board substrate. Do not use an open flame to remove condensation from the roof membrane or flashing materials.
4. Refer to the PVC roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

PART 2 – PRODUCTS

NOTE TO SPECIFIER

Article 2.1 may be edited to reflect sheet metal flashing requirements for a specific project. EDIT Article 2.1 as necessary. Re-letter/number paragraphs and sub-paragraphs after editing.

2.1 SHEET METAL ACCESSORIES

- A. Perimeter edge metal flashing system: Perimeter edge sheet metal flashing system consisting of a continuous inner clip and outer fascia piece, designed in accordance with the requirements of ANSI/SPRI/FM 4435/ES-1.
 1. Inner clip/retention system and continuous cleats associated with perimeter edge metal flashing systems: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
 2. Fascia piece/gravel stop associated with perimeter edge metal flashing systems: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- B. Perimeter parapet cap metal flashing system: Parapet cap sheet metal flashing system consisting of a continuous inner clip and outer fascia piece, designed in accordance with the requirements of ANSI/SPRI/FM 4435/ES-1.
 1. Inner clip/retention system and continuous cleats associated with perimeter edge metal flashing systems: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
 2. Parapet cap associated with perimeter parapet cap metal flashing systems: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- C. Interior parapet caps, area divider caps, expansion joint covers, and fascia extensions: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating, maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
 1. Continuous cleats and expansion joint backer pieces associated with prefinished galvanized steel caps and fascia extension installation: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
- D. Curb caps: Galvanized steel, 18-gauge, ASTM A 653/653M; G-90. Fabricate to match dimensions of curbed cap, and as indicated on the drawings. Fabricate top with a cross-break, providing four-way slope to the outer edges of the cap adequate to remove the potential for standing water at the top of cap.
- E. Reglet-mounted, surface-mounted and slip counterflashings: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating, maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.



- F. Gutters: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating. Fabricate gutters to match dimensions indicated on the drawings; fabricate in 10-foot sections, with a 4-inch flange with a 1/2-inch hug at the inner edge of the gutter flange.
 - 1. Gutter spacers: Painted galvanized steel, 1-inch wide by 1/8-inch thick; seal and secure to gutter as shown on drawings. Paint color to match gutter.
- G. Through-fascia, through-wall and overflow scuppers:
 - 1. Scupper liners: Stainless steel, 22-gauge. Fabricate scupper flashings in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-26, 1-28, 1-29 and 1-30. Provide a 4-inch flange with a 1/2-inch hug at the inner edge of the scupper flange. Solder all seams watertight.
 - 2. Conductor boxes and scupper closure plates: Stainless steel, 22-gauge. Solder all seams watertight. Fabricate these components in accordance with the drawings, and the requirements outlined in the "SMACNA Architectural Sheet Metal Manual, 7th Edition".
- H. Conductor box fascia covers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by the Owner.
- I. Downspouts, associated with gutters and scuppers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by Owner. Fabricate downspouts with a "Pittsburgh Lock" seam, and in accordance with the drawings and "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-32B and 1-32F; size the hangers to match downspouts.
- J. High-temperature tubular penetrations:
 - 1. High-temperature tubular penetration flashing and insulation stops: Stainless steel, 24-gauge. Fabricate a one-piece flanged sleeve with a flange extending 6-inches minimum out from the sleeve onto the roof surface.
- K. Pitch pans, tubular penetration hoods, and pitch pan covers:
 - 1. Pitch pans: PVC-coated sheet metal, 24-gauge, minimum. Fabricate to dimensions shown on drawings, with a minimum 4-inch depth, and flange extending 6-inches minimum out from the pitch pan, and other dimensions to be kept to the minimum size necessary to provide a 2-inch clearance all sides from the penetration.
 - 2. Tubular penetration hoods and pitch pan covers: Stainless steel, 24-gauge. Fabricate to dimensions shown on drawings.
- L. Miscellaneous sheet metal accessories:
 - 1. For terminating flashing: Anchor bar: 1-inch x 1/8-inch extruded aluminum with slotted holes spaced 6 inches o.c.
 - 2. For securement of tubular penetration flashings and sheet metal hoods at tubular penetrations: Stainless steel adjustable clamp.
 - 3. For use behind counterflashing flanges where indicated on the drawings: Butyl tape, width and thickness as necessary to create a seal between the existing substrate and secured counterflashing.

2.2 FASTENERS

- A. For securing sheet metal flashings: Fasteners indicated on the drawings, or appropriate and approved by the Owner for the substrate encountered, and compatible with the sheet metal type to be secured. Where fastener heads are exposed, provide neoprene gaskets/washers.
- B. For copper: Copper or bronze fasteners.
- C. For stainless steel: Stainless steel fasteners.



- D. For securing aluminum anchor bar: Fasteners appropriate for, and approved by the Owner and roofing manufacturer for the substrate encountered.

2.3 SEALANT

- A. Refer to Section 079201.

PART 3 - EXECUTION

NOTE TO SPECIFIER

Article 3.1 may be edited to reflect sheet metal flashing requirements for a specific project. EDIT Article 3.1 as necessary. Re-letter/number paragraphs and sub-paragraphs after editing.

3.1 SHEET METAL INSTALLATION

- A. Perimeter edge metal flashing system:
1. Install perimeter edge metal in a manner that meets the requirements of ANSI/SPRI/FM 4435/ES-1. Provide a system matching the configurations and dimensions indicated on the drawings.
 2. For pre-fabricated parapet cap metal systems: Install in accordance with the metal system manufacturer.
 3. For shop-fabricated perimeter edge metal systems:
 - a. Secure the horizontal flange and vertical face of the inner clip/continuous cleat with ring shank coated nails 12-inches o.c., max. Decrease fastener spacing to 6-inches o.c., max. within 10-feet of a building corner.
 - b. Place the outer fascia/gravel stop piece. Hook the fascia to the underlying continuous cleat. Secure the flange with nails 3-inches o.c. in two staggered rows as indicated on the drawings.
- B. Parapet edge cap metal flashing system:
1. For pre-fabricated parapet cap metal systems: Install in accordance with the metal system manufacturer to meet the requirements of ANSI/SPRI/FM 4435/ES-1. Provide a system matching the dimensions indicated on the drawings.
 2. For shop-fabricated parapet cap metal systems:
 - a. Fabricate inner clips/continuous cleats with a kick-up, creating a minimum 1/2-inch per foot slope toward the roof.
 - b. Secure the horizontal flange and vertical face of the inner clip/continuous cleat with ring shank coated nails 12-inches o.c., max. Decrease fastener spacing to 6-inches o.c., max. within 10-feet of a building corner.
 - c. Place the cap sections. At the outer face, hook the fascia to the underlying continuous cleat. At the inner face, secure the flange with #12 fasteners, fitted with neoprene gaskets/washers 18-inches o.c., max., and within 2-inches of each end.
 - d. Join adjacent parapet cap sections using a standing seam, with a 1" height. Where upturned standing seam ends meet, apply continuous sealant to the joint. Cut outer edges of upturned seams at a 45-degree angle. Fold ear over end, and crimp in place.
 - e. Where parapet caps terminate at walls, turn self-adhering membrane 1-inch, minimum, up wall. Turn coping cap piece 2-inches, minimum, up wall. Seal and

secure as indicated on the drawings. Install regletted counterflashing over exposed end piece.

- C. Curb caps, area divider and expansion joint covers, and fascia extensions:
1. Install caps, covers, and related continuous cleats and backer pieces, as detailed, at locations indicated on the drawings.
 2. Fabricate with seam type indicated on drawings to dimensions indicated on drawings. Provide a 3/4-inch hemmed drip edge.
 3. Fastening: Secure faces of curb caps, area divider covers, and expansion joint covers with specified fasteners appropriate for the substrate encountered, fitted with neoprene gaskets/washers, spaced 18-inches o.c. max., and within 2-inches of each end.
 4. Join adjacent area divider and expansion joint cover sections using a standing seam, with a 1" height. Where upturned standing seam ends meet, apply continuous sealant to the joint. Cut outer edges of upturned seams at a 45-degree angle. Fold ear over end, and crimp in place.
 5. Where area divider and expansion joint covers terminate at walls, turn self-adhering membrane 1-inch, minimum, up wall. Turn coping cap piece 2-inches, minimum, up wall. Seal and secure as indicated on the drawings. Install regletted counterflashing over exposed end piece.
- D. Fascia extensions:
1. Secure fascia extensions with ring shank coated nails 12-inches o.c., max., or fasteners appropriate for, and approved by the Owner for, the substrate condition encountered, 12-inches o.c. max.
- E. Reglet-mounted and slip counterflashings: Provide counterflashings, as detailed, at locations indicated on the drawings:
1. At locations indicated on the drawings, install butyl tape to the backside of counterflashing flanges at the flange interface with the substrate.
 2. Cut reglets into masonry walls to accommodate reglet-mounted counterflashing.
 3. Fabricate counterflashing to dimensions indicated on drawings. Fabricate the counterflashing with a 3/4-inch hemmed drip edge, and on surface mounted counterflashing, a 1/2-inch 45-degree angle sealant slot. Fabricate slip counterflashings to dimensions necessary to accommodate existing conditions, and as shown on drawings. Provide a minimum 4-inch face if conditions allow.
 4. Secure counterflashings with specified fasteners appropriate for substrate condition encountered, fitted with neoprene gaskets/washers. Space fasteners 12-inches o.c. max., and within 2-inches of each end.
- F. Gutters and downspouts:
1. Install the specified gutter spacers 24-inches o.c. Seal and secure the spacers to the gutter assembly as indicated on the drawings.
 2. Overlap individual gutter sections 1-1/2 inches. Seal overlap, and pop-rivet sections together with two rows of pop rivets. Space pop rivets 1/2-inch min., and 3/4-inch max. in each row. Completed gutter sections shall not exceed 50-feet in length.
 3. Secure the flange with nails 3-inches o.c. in two staggered rows.
 4. Gutter expansion joints: Provide gutter expansion joints at locations recommended by SMACNA; fabricated following the recommendations of SMACNA.
 5. Downspouts: Install downspouts at locations indicated on drawings. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
- G. Scupper liners, closure plates, conductor boxes and downspouts:



1. Scupper liners: Install scupper liners at through-fascia, through-wall, and overflow scupper locations indicated on the drawings. Install scupper liners following the requirements and recommendations of SMACNA.
 2. Cover plates: At the exterior face of the scupper, install cover plates. Install scupper cover plates as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 3. Conductor boxes: Where indicated on the drawings, install conductor boxes as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 4. Downspouts: Install downspouts at conductor boxes. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
 5. Install conductor box fascia covers as indicated on the drawings. Fully clip fascia covers to stainless steel conductor boxes, or secure to substrate with fasteners appropriate for the substrate encountered.
- H. Plumbing vents, tubular penetrations and pitch pan flashings:
1. Flash tubular penetrations and pitch pans as indicated on drawings. Do not use pitch pans at tubular penetrations without the approval of the Owner.
 2. Install tubular penetration hoods and pitch pan covers as indicated on the drawings.
 3. Where soldering is required at stainless steel flanged sleeves, hoods, and pitch pans: Solder all seams and laps watertight. Prior to soldering of stainless steel, clean work area using solvents and wire brush; removing dirt, oil, grease, and other contaminants from the work area. Tin the work area by applying acid (flux). Perform soldering work. After completion of work, remove excess acid (flux) from the work area.
- I. Anchor bar: Fasten the upper edges of PVC flashings with an anchor bar installed in accordance with the requirements of the roofing membrane manufacturer.

USPS CSF Specifications issued: 10/1/2013

Last revised: 3/6/2013

NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 62 07 00

**SECTION 07 62 07 00 - CSF SHEET METAL FOR PVC ROOFING****NOTE TO SPECIFIER**

Editing is needed for each individual project; modify as needed for project specific requirements. Included "NOTE TO SPECIFIER" instructions provide guidance concerning required editing, and options have been included requiring action on the part of the specifier/designer. Select the option appropriate for the project and delete option(s) not selected.

NOTE TO SPECIFIER

EDIT Section footer as necessary to reflect the project name and location, USPS Project number, and required date of the technical specification document. Coordinate this project specific information with the USPS Project Manager. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this Section In technical specifications where a fully-adhered PVC roofing membrane (Section 075420) is specified.

PART 1 - GENERAL**1.1 SUMMARY**

- A. This Section includes requirements related to sheet metal fabrication and installation related to fully-adhered Polyvinyl Chloride (PVC) roofing.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 075419 – Fully-Adhered PVC Roofing
- D. Section 079200 – Sealants for Roofing
- E. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 - 1. American Society for Testing and Materials (ASTM)
 - a. ASTM A 653/653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 2. American National Standard Institute (ANSI)
 - 3. Factory Mutual Global (FM)
 - 4. National Roofing Contractors Association (NRCA)
 - 5. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).
 - a. SMACNA Architectural Sheet Metal Manual, 6th Edition



- 6. Single Ply Roofing Industry (SPRI)
 - a. ANSI/SPRI/FM 4435/ES-1 – Wind Design for Edge Systems Used with Low Slope Roofing Systems

1.4 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.5 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the



manufacturer.

- B. Cold weather precautions:
1. NOTE: Do not install sealants, adhesives, primers and pressure-sensitive flashings associated with sheet metal flashing at temperatures below 40°F (5°C).
 2. When the outside temperature is forecast to fall below 40°F (5°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives, primers and pressure-sensitive flashings should be maintained at a temperature of 40°F (5°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 3. Be aware of potential condensation formation on the PVC roof surface during application/flash-off of adhesives and primer. Remove condensation using a heat gun prior to adhesion to the insulation or cover board substrate. Do not use an open flame to remove condensation from the roof membrane or flashing materials.
 4. Refer to the PVC roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

PART 2 – PRODUCTS

NOTE TO SPECIFIER

Article 2.1 may be edited to reflect sheet metal flashing requirements for a specific project. EDIT Article 2.1 as necessary. Re-letter/number paragraphs and sub-paragraphs after editing.

2.1 SHEET METAL ACCESSORIES

- A. Perimeter edge metal flashing system: Perimeter edge sheet metal flashing system consisting of a continuous inner clip and outer fascia piece, designed in accordance with the requirements of ANSI/SPRI/FM 4435/ES-1.
1. Inner clip/retention system and continuous cleats associated with perimeter edge metal flashing systems: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
 2. Fascia piece/gravel stop associated with perimeter edge metal flashing systems: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- B. Perimeter parapet cap metal flashing system: Parapet cap sheet metal flashing system consisting of a continuous inner clip and outer fascia piece, designed in accordance with the requirements of ANSI/SPRI/FM 4435/ES-1.
1. Inner clip/retention system and continuous cleats associated with perimeter edge metal flashing systems: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
 2. Parapet cap associated with perimeter parapet cap metal flashing systems: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- C. Interior parapet caps, area divider caps, expansion joint covers, and fascia extensions: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating, maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.



1. Continuous cleats and expansion joint backer pieces associated with prefinished galvanized steel caps and fascia extension installation: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
- D. Curb caps: Galvanized steel, 18-gauge, ASTM A 653/653M; G-90. Fabricate to match dimensions of curbed cap, and as indicated on the drawings. Fabricate top with a cross-break, providing four-way slope to the outer edges of the cap adequate to remove the potential for standing water at the top of cap.
- E. Reglet-mounted, surface-mounted and slip counterflashings: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating, maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- F. Gutters: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating. Fabricate gutters to match dimensions indicated on the drawings; fabricate in 10-foot sections, with a 4-inch flange with a 1/2-inch hug at the inner edge of the gutter flange.
 1. Gutter spacers: Painted galvanized steel, 1-inch wide by 1/8-inch thick; seal and secure to gutter as shown on drawings. Paint color to match gutter.
- G. Through-fascia, through-wall and overflow scuppers:
 1. Scupper liners: Stainless steel, 22-gauge. Fabricate scupper flashings in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-26, 1-28, 1-29 and 1-30. Provide a 4-inch flange with a 1/2-inch hug at the inner edge of the scupper flange. Solder all seams watertight.
 2. Conductor boxes and scupper closure plates: Stainless steel, 22-gauge. Solder all seams watertight. Fabricate these components in accordance with the drawings, and the requirements outlined in the "SMACNA Architectural Sheet Metal Manual, 7th Edition".
- H. Conductor box fascia covers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by the Owner.
- I. Downspouts, associated with gutters and scuppers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by Owner. Fabricate downspouts with a "Pittsburgh Lock" seam, and in accordance with the drawings and "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-32B and 1-32F; size the hangers to match downspouts.
- J. High-temperature tubular penetrations:
 1. High-temperature tubular penetration flashing and insulation stops: Stainless steel, 24-gauge. Fabricate a one-piece flanged sleeve with a flange extending 6-inches minimum out from the sleeve onto the roof surface.
- K. Pitch pans, tubular penetration hoods, and pitch pan covers:
 1. Pitch pans: PVC-coated sheet metal, 24-gauge, minimum. Fabricate to dimensions shown on drawings, with a minimum 4-inch depth, and flange extending 6-inches minimum out from the pitch pan, and other dimensions to be kept to the minimum size necessary to provide a 2-inch clearance all sides from the penetration.
 2. Tubular penetration hoods and pitch pan covers: Stainless steel, 24-gauge. Fabricate to dimensions shown on drawings.
- L. Miscellaneous sheet metal accessories:
 1. For terminating flashing: Anchor bar: 1-inch x 1/8-inch extruded aluminum with slotted holes spaced 6 inches o.c.
 2. For securement of tubular penetration flashings and sheet metal hoods at tubular penetrations: Stainless steel adjustable clamp.



3. For use behind counterflashing flanges where indicated on the drawings: Butyl tape, width and thickness as necessary to create a seal between the existing substrate and secured counterflashing.

2.2 FASTENERS

- A. For securing sheet metal flashings: Fasteners indicated on the drawings, or appropriate and approved by the Owner for the substrate encountered, and compatible with the sheet metal type to be secured. Where fastener heads are exposed, provide neoprene gaskets/washers.
- B. For copper: Copper or bronze fasteners.
- C. For stainless steel: Stainless steel fasteners.
- D. For securing aluminum anchor bar: Fasteners appropriate for, and approved by the Owner and roofing manufacturer for the substrate encountered.

2.3 SEALANT

- A. Refer to Section 079201.

PART 3 - EXECUTION

NOTE TO SPECIFIER

Article 3.1 may be edited to reflect sheet metal flashing requirements for a specific project. EDIT Article 3.1 as necessary. Re-letter/number paragraphs and sub-paragraphs after editing.

3.1 SHEET METAL INSTALLATION

- A. Perimeter edge metal flashing system:
 1. Install perimeter edge metal in a manner that meets the requirements of ANSI/SPRI/FM 4435/ES-1. Provide a system matching the configurations and dimensions indicated on the drawings.
 2. For pre-fabricated parapet cap metal systems: Install in accordance with the metal system manufacturer.
 3. For shop-fabricated perimeter edge metal systems:
 - a. Secure the horizontal flange and vertical face of the inner clip/continuous cleat with ring shank coated nails 12-inches o.c., max. Decrease fastener spacing to 6-inches o.c., max. within 10-feet of a building corner.
 - b. Place the outer fascia/gravel stop piece. Hook the fascia to the underlying continuous cleat. Secure the flange with nails 3-inches o.c. in two staggered rows as indicated on the drawings.
- B. Parapet edge cap metal flashing system:
 1. For pre-fabricated parapet cap metal systems: Install in accordance with the metal system manufacturer to meet the requirements of ANSI/SPRI/FM 4435/ES-1. Provide a system matching the dimensions indicated on the drawings.
 2. For shop-fabricated parapet cap metal systems:
 - a. Fabricate inner clips/continuous cleats with a kick-up, creating a minimum 1/2-inch per foot slope toward the roof.



- b. Secure the horizontal flange and vertical face of the inner clip/continuous cleat with ring shank coated nails 12-inches o.c., max. Decrease fastener spacing to 6-inches o.c., max. within 10-feet of a building corner.
 - c. Place the cap sections. At the outer face, hook the fascia to the underlying continuous cleat. At the inner face, secure the flange with #12 fasteners, fitted with neoprene gaskets/washers 18-inches o.c., max., and within 2-inches of each end.
 - d. Join adjacent parapet cap sections using a standing seam, with a 1" height. Where upturned standing seam ends meet, apply continuous sealant to the joint. Cut outer edges of upturned seams at a 45-degree angle. Fold ear over end, and crimp in place.
 - e. Where parapet caps terminate at walls, turn self-adhering membrane 1-inch, minimum, up wall. Turn coping cap piece 2-inches, minimum, up wall. Seal and secure as indicated on the drawings. Install regletted counterflashing over exposed end piece.
- C. Curb caps, area divider and expansion joint covers:
 - 1. Install caps, covers, and related continuous cleats and backer pieces, as detailed, at locations indicated on the drawings.
 - 2. Fabricate with seam type indicated on drawings to dimensions indicated on drawings. Provide a 3/4-inch hemmed drip edge.
 - 3. Fastening: Secure faces of curb caps, area divider covers, and expansion joint covers with specified fasteners appropriate for the substrate encountered, fitted with neoprene gaskets/washers, spaced 18-inches o.c. max., and within 2-inches of each end.
 - 4. Join adjacent area divider and expansion joint cover sections using a standing seam, with a 1" height. Where upturned standing seam ends meet, apply continuous sealant to the joint. Cut outer edges of upturned seams at a 45-degree angle. Fold ear over end, and crimp in place.
 - 5. Where area divider and expansion joint covers terminate at walls, turn self-adhering membrane 1-inch, minimum, up wall. Turn coping cap piece 2-inches, minimum, up wall. Seal and secure as indicated on the drawings. Install regletted counterflashing over exposed end piece.
- D. Fascia extensions:
 - 1. Secure fascia extensions with ring shank coated nails 12-inches o.c., max., or fasteners appropriate for, and approved by the Owner for, the substrate condition encountered, 12-inches o.c. max.
- E. Reglet-mounted and slip counterflashings: Provide counterflashings, as detailed, at locations indicated on the drawings:
 - 1. At locations indicated on the drawings, install butyl tape to the backside of counterflashing flanges at the flange interface with the substrate.
 - 2. Cut reglets into masonry walls to accommodate reglet-mounted counterflashing.
 - 3. Fabricate counterflashing to dimensions indicated on drawings. Fabricate the counterflashing with a 3/4-inch hemmed drip edge, and on surface mounted counterflashing, a 1/2-inch 45-degree angle sealant slot. Fabricate slip counterflashings to dimensions necessary to accommodate existing conditions, and as shown on drawings. Provide a minimum 4-inch face if conditions allow.
 - 4. Secure counterflashings with specified fasteners appropriate for substrate condition encountered, fitted with neoprene gaskets/washers. Space fasteners 12-inches o.c. max., and within 2-inches of each end.
- F. Gutters and downspouts:
 - 1. Install the specified gutter spacers 24-inches o.c. Seal and secure the spacers to the gutter assembly as indicated on the drawings.



2. Overlap individual gutter sections 1-1/2 inches. Seal overlap, and pop-rivet sections together with two rows of pop rivets. Space pop rivets 1/2-inch min., and 3/4-inch max. in each row. Completed gutter sections shall not exceed 50-feet in length.
 3. Secure the flange with nails 3-inches o.c. in two staggered rows.
 4. Gutter expansion joints: Provide gutter expansion joints at locations recommended by SMACNA; fabricated following the recommendations of SMACNA.
 5. Downspouts: Install downspouts at locations indicated on drawings. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
- G. Scupper liners, closure plates, conductor boxes and downspouts:
1. Scupper liners: Install scupper liners at through-fascia, through-wall, and overflow scupper locations indicated on the drawings. Install scupper liners following the requirements and recommendations of SMACNA.
 2. Cover plates: At the exterior face of the scupper, install cover plates. Install scupper cover plates as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 3. Conductor boxes: Where indicated on the drawings, install conductor boxes as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 4. Downspouts: Install downspouts at conductor boxes. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
 5. Install conductor box fascia covers as indicated on the drawings. Fully clip fascia covers to stainless steel conductor boxes, or secure to substrate with fasteners appropriate for the substrate encountered.
- H. Plumbing vents, tubular penetrations and pitch pan flashings:
1. Flash tubular penetrations and pitch pans as indicated on drawings. Do not use pitch pans at tubular penetrations without the approval of the Owner.
 2. Install tubular penetration hoods and pitch pan covers as indicated on the drawings.
 3. Where soldering is required at stainless steel flanged sleeves, hoods, and pitch pans: Solder all seams and laps watertight. Prior to soldering of stainless steel, clean work area using solvents and wire brush; removing dirt, oil, grease, and other contaminants from the work area. Tin the work area by applying acid (flux). Perform soldering work. After completion of work, remove excess acid (flux) from the work area.
- I. Anchor bar: Fasten the upper edges of PVC flashings with an anchor bar installed in accordance with the requirements of the roofing membrane manufacturer.

USPS CSF Specifications, issued: 10/1/2013

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NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.



END OF SECTION 07 62 07 00



SECTION 07 62 07 00 - MPF SHEET METAL FOR PVC ROOFING

NOTE TO SPECIFIER

Editing is needed for each individual project; modify as needed for project specific requirements. Included "NOTE TO SPECIFIER" instructions provide guidance concerning required editing, and options have been included requiring action on the part of the specifier/designer. Select the option appropriate for the project and delete option(s) not selected.

NOTE TO SPECIFIER

EDIT Section footer as necessary to reflect the project name and location, USPS Project number, and required date of the technical specification document. Coordinate this project specific information with the USPS Project Manager. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Use this Section In technical specifications where a fully-adhered PVC roofing membrane (Section 075420) is specified.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to sheet metal fabrication and installation related to fully-adhered Polyvinyl Chloride (PVC) roofing.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 075419 – Fully-Adhered PVC Roofing
- D. Section 079200 – Sealants for Roofing
- E. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 - 1. American Society for Testing and Materials (ASTM)
 - a. ASTM A 653/653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 2. American National Standard Institute (ANSI)
 - 3. Factory Mutual Global (FM)
 - 4. National Roofing Contractors Association (NRCA)
 - 5. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).
 - a. SMACNA Architectural Sheet Metal Manual, 6th Edition



- 6. Single Ply Roofing Industry (SPRI)
 - a. ANSI/SPRI/FM 4435/ES-1 – Wind Design for Edge Systems Used with Low Slope Roofing Systems

1.4 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.5 QUALITY ASSURANCE PROCEDURES

- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the



manufacturer.

- B. Cold weather precautions:
1. NOTE: Do not install sealants, adhesives, primers and pressure-sensitive flashings associated with sheet metal flashing at temperatures below 40°F (5°C).
 2. When the outside temperature is forecast to fall below 40°F (5°C), store unused materials in a heated location. Remove these materials only when ready for installation. Sealants, adhesives, primers and pressure-sensitive flashings should be maintained at a temperature of 40°F (5°C), minimum, at all times. Do not use sealants, adhesives or primers that develop a gelled or lumpy texture to them. Return these materials to a heated location.
 3. Be aware of potential condensation formation on the PVC roof surface during application/flash-off of adhesives and primer. Remove condensation using a heat gun prior to adhesion to the insulation or cover board substrate. Do not use an open flame to remove condensation from the roof membrane or flashing materials.
 4. Refer to the PVC roofing manufacturer and NRCA requirements and recommendations for additional cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

PART 2 – PRODUCTS

NOTE TO SPECIFIER

Article 2.1 may be edited to reflect sheet metal flashing requirements for a specific project. EDIT Article 2.1 as necessary. Re-letter/number paragraphs and sub-paragraphs after editing.

2.1 SHEET METAL ACCESSORIES

- A. Perimeter edge metal flashing system: Perimeter edge sheet metal flashing system consisting of a continuous inner clip and outer fascia piece, designed in accordance with the requirements of ANSI/SPRI/FM 4435/ES-1.
1. Inner clip/retention system and continuous cleats associated with perimeter edge metal flashing systems: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
 2. Fascia piece/gravel stop associated with perimeter edge metal flashing systems: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- B. Perimeter parapet cap metal flashing system: Parapet cap sheet metal flashing system consisting of a continuous inner clip and outer fascia piece, designed in accordance with the requirements of ANSI/SPRI/FM 4435/ES-1.
1. Inner clip/retention system and continuous cleats associated with perimeter edge metal flashing systems: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
 2. Parapet cap associated with perimeter parapet cap metal flashing systems: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- C. Interior parapet caps, area divider caps, expansion joint covers, and fascia extensions: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating, maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.



1. Continuous cleats and expansion joint backer pieces associated with prefinished galvanized steel caps and fascia extension installation: Galvanized steel, minimum 22-gauge, ASTM A 653/653M; G-90, maximum section length of 10-feet.
- D. Curb caps: Galvanized steel, 18-gauge, ASTM A 653/653M; G-90. Fabricate to match dimensions of curbed cap, and as indicated on the drawings. Fabricate top with a cross-break, providing four-way slope to the outer edges of the cap adequate to remove the potential for standing water at the top of cap.
- E. Reglet-mounted, surface-mounted and slip counterflashings: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating, maximum section lengths of 10-feet; standard prefinished color as selected by the Owner.
- F. Gutters: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating. Fabricate gutters to match dimensions indicated on the drawings; fabricate in 10-foot sections, with a 4-inch flange with a 1/2-inch hug at the inner edge of the gutter flange.
 1. Gutter spacers: Painted galvanized steel, 1-inch wide by 1/8-inch thick; seal and secure to gutter as shown on drawings. Paint color to match gutter.
- G. Through-fascia, through-wall and overflow scuppers:
 1. Scupper liners: Stainless steel, 22-gauge. Fabricate scupper flashings in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-26, 1-28, 1-29 and 1-30. Provide a 4-inch flange with a 1/2-inch hug at the inner edge of the scupper flange. Solder all seams watertight.
 2. Conductor boxes and scupper closure plates: Stainless steel, 22-gauge. Solder all seams watertight. Fabricate these components in accordance with the drawings, and the requirements outlined in the "SMACNA Architectural Sheet Metal Manual, 7th Edition".
- H. Conductor box fascia covers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by the Owner.
- I. Downspouts, associated with gutters and scuppers: Prefinished galvanized steel, 24-gauge, with Kynar 500 coating; standard prefinished color as selected by Owner. Fabricate downspouts with a "Pittsburgh Lock" seam, and in accordance with the drawings and "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figures 1-32B and 1-32F; size the hangers to match downspouts.
- J. High-temperature tubular penetrations:
 1. High-temperature tubular penetration flashing and insulation stops: Stainless steel, 24-gauge. Fabricate a one-piece flanged sleeve with a flange extending 6-inches minimum out from the sleeve onto the roof surface.
- K. Pitch pans, tubular penetration hoods, and pitch pan covers:
 1. Pitch pans: PVC-coated sheet metal, 24-gauge, minimum. Fabricate to dimensions shown on drawings, with a minimum 4-inch depth, and flange extending 6-inches minimum out from the pitch pan, and other dimensions to be kept to the minimum size necessary to provide a 2-inch clearance all sides from the penetration.
 2. Tubular penetration hoods and pitch pan covers: Stainless steel, 24-gauge. Fabricate to dimensions shown on drawings.
- L. Miscellaneous sheet metal accessories:
 1. For terminating flashing: Anchor bar: 1-inch x 1/8-inch extruded aluminum with slotted holes spaced 6 inches o.c.
 2. For securement of tubular penetration flashings and sheet metal hoods at tubular penetrations: Stainless steel adjustable clamp.



3. For use behind counterflashing flanges where indicated on the drawings: Butyl tape, width and thickness as necessary to create a seal between the existing substrate and secured counterflashing.

2.2 FASTENERS

- A. For securing sheet metal flashings: Fasteners indicated on the drawings, or appropriate and approved by the Owner for the substrate encountered, and compatible with the sheet metal type to be secured. Where fastener heads are exposed, provide neoprene gaskets/washers.
- B. For copper: Copper or bronze fasteners.
- C. For stainless steel: Stainless steel fasteners.
- D. For securing aluminum anchor bar: Fasteners appropriate for, and approved by the Owner and roofing manufacturer for the substrate encountered.

2.3 SEALANT

- A. Refer to Section 079201.

PART 3 - EXECUTION

NOTE TO SPECIFIER

Article 3.1 may be edited to reflect sheet metal flashing requirements for a specific project. EDIT Article 3.1 as necessary. Re-letter/number paragraphs and sub-paragraphs after editing.

3.1 SHEET METAL INSTALLATION

- A. Perimeter edge metal flashing system:
 1. Install perimeter edge metal in a manner that meets the requirements of ANSI/SPRI/FM 4435/ES-1. Provide a system matching the configurations and dimensions indicated on the drawings.
 2. For pre-fabricated parapet cap metal systems: Install in accordance with the metal system manufacturer.
 3. For shop-fabricated perimeter edge metal systems:
 - a. Secure the horizontal flange and vertical face of the inner clip/continuous cleat with ring shank coated nails 12-inches o.c., max. Decrease fastener spacing to 6-inches o.c., max. within 10-feet of a building corner.
 - b. Place the outer fascia/gravel stop piece. Hook the fascia to the underlying continuous cleat. Secure the flange with nails 3-inches o.c. in two staggered rows as indicated on the drawings.
- B. Parapet edge cap metal flashing system:
 1. For pre-fabricated parapet cap metal systems: Install in accordance with the metal system manufacturer to meet the requirements of ANSI/SPRI/FM 4435/ES-1. Provide a system matching the dimensions indicated on the drawings.
 2. For shop-fabricated parapet cap metal systems:
 - a. Fabricate inner clips/continuous cleats with a kick-up, creating a minimum 1/2-inch per foot slope toward the roof.



- b. Secure the horizontal flange and vertical face of the inner clip/continuous cleat with ring shank coated nails 12-inches o.c., max. Decrease fastener spacing to 6-inches o.c., max. within 10-feet of a building corner.
 - c. Place the cap sections. At the outer face, hook the fascia to the underlying continuous cleat. At the inner face, secure the flange with #12 fasteners, fitted with neoprene gaskets/washers 18-inches o.c., max., and within 2-inches of each end.
 - d. Join adjacent parapet cap sections using a standing seam, with a 1" height. Where upturned standing seam ends meet, apply continuous sealant to the joint. Cut outer edges of upturned seams at a 45-degree angle. Fold ear over end, and crimp in place.
 - e. Where parapet caps terminate at walls, turn self-adhering membrane 1-inch, minimum, up wall. Turn coping cap piece 2-inches, minimum, up wall. Seal and secure as indicated on the drawings. Install regletted counterflashing over exposed end piece.
- C. Curb caps, area divider and expansion joint covers:
 - 1. Install caps, covers, and related continuous cleats and backer pieces, as detailed, at locations indicated on the drawings.
 - 2. Fabricate with seam type indicated on drawings to dimensions indicated on drawings. Provide a 3/4-inch hemmed drip edge.
 - 3. Fastening: Secure faces of curb caps, area divider covers, and expansion joint covers with specified fasteners appropriate for the substrate encountered, fitted with neoprene gaskets/washers, spaced 18-inches o.c. max., and within 2-inches of each end.
 - 4. Join adjacent area divider and expansion joint cover sections using a standing seam, with a 1" height. Where upturned standing seam ends meet, apply continuous sealant to the joint. Cut outer edges of upturned seams at a 45-degree angle. Fold ear over end, and crimp in place.
 - 5. Where area divider and expansion joint covers terminate at walls, turn self-adhering membrane 1-inch, minimum, up wall. Turn coping cap piece 2-inches, minimum, up wall. Seal and secure as indicated on the drawings. Install regletted counterflashing over exposed end piece.
- D. Fascia extensions:
 - 1. Secure fascia extensions with ring shank coated nails 12-inches o.c., max., or fasteners appropriate for, and approved by the Owner for, the substrate condition encountered, 12-inches o.c. max.
- E. Reglet-mounted and slip counterflashings: Provide counterflashings, as detailed, at locations indicated on the drawings:
 - 1. At locations indicated on the drawings, install butyl tape to the backside of counterflashing flanges at the flange interface with the substrate.
 - 2. Cut reglets into masonry walls to accommodate reglet-mounted counterflashing.
 - 3. Fabricate counterflashing to dimensions indicated on drawings. Fabricate the counterflashing with a 3/4-inch hemmed drip edge, and on surface mounted counterflashing, a 1/2-inch 45-degree angle sealant slot. Fabricate slip counterflashings to dimensions necessary to accommodate existing conditions, and as shown on drawings. Provide a minimum 4-inch face if conditions allow.
 - 4. Secure counterflashings with specified fasteners appropriate for substrate condition encountered, fitted with neoprene gaskets/washers. Space fasteners 12-inches o.c. max., and within 2-inches of each end.
- F. Gutters and downspouts:
 - 1. Install the specified gutter spacers 24-inches o.c. Seal and secure the spacers to the gutter assembly as indicated on the drawings.



2. Overlap individual gutter sections 1-1/2 inches. Seal overlap, and pop-rivet sections together with two rows of pop rivets. Space pop rivets 1/2-inch min., and 3/4-inch max. in each row. Completed gutter sections shall not exceed 50-feet in length.
 3. Secure the flange with nails 3-inches o.c. in two staggered rows.
 4. Gutter expansion joints: Provide gutter expansion joints at locations recommended by SMACNA; fabricated following the recommendations of SMACNA.
 5. Downspouts: Install downspouts at locations indicated on drawings. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
- G. Scupper liners, closure plates, conductor boxes and downspouts:
1. Scupper liners: Install scupper liners at through-fascia, through-wall, and overflow scupper locations indicated on the drawings. Install scupper liners following the requirements and recommendations of SMACNA.
 2. Cover plates: At the exterior face of the scupper, install cover plates. Install scupper cover plates as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 3. Conductor boxes: Where indicated on the drawings, install conductor boxes as indicated on the drawings, and following the requirements and recommendations of SMACNA.
 4. Downspouts: Install downspouts at conductor boxes. Secure downspouts in accordance with the "SMACNA Architectural Sheet Metal Manual, 7th Edition", Figure 1-35A, using fasteners appropriate for the substrate encountered.
 - a. Terminate the base of downspouts to match existing condition, unless indicated otherwise on the drawings.
 5. Install conductor box fascia covers as indicated on the drawings. Fully clip fascia covers to stainless steel conductor boxes, or secure to substrate with fasteners appropriate for the substrate encountered.
- H. Plumbing vents, tubular penetrations and pitch pan flashings:
1. Flash tubular penetrations and pitch pans as indicated on drawings. Do not use pitch pans at tubular penetrations without the approval of the Owner.
 2. Install tubular penetration hoods and pitch pan covers as indicated on the drawings.
 3. Where soldering is required at stainless steel flanged sleeves, hoods, and pitch pans: Solder all seams and laps watertight. Prior to soldering of stainless steel, clean work area using solvents and wire brush; removing dirt, oil, grease, and other contaminants from the work area. Tin the work area by applying acid (flux). Perform soldering work. After completion of work, remove excess acid (flux) from the work area.
- I. Anchor bar: Fasten the upper edges of PVC flashings with an anchor bar installed in accordance with the requirements of the roofing membrane manufacturer.

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Last revised: 9/16/2013

NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.



END OF SECTION 07 62 07 00



Task	Specification	Specification Description
07 63 00 00	21 05 00 00	Common Work Results for Fire Suppression
07 71 19 00	01 22 16 00	No Specification Required
07 71 23 00	01 22 16 00	No Specification Required



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SECTION 07 72 13 00 - CSF MANUFACTURED CURBS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.07 72 13 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Prefabricated structural metal roof curbs.
 - 2. Prefabricated non-structural metal roof curbs.
- B. Related Sections:
 - 1. Section 051200 - Structural Steel Framing: Roof opening frames and headers.
 - 2. Section 052100 - Steel Joist Framing: Joists supporting roof curbs.

NOTE TO SPECIFIER

Edit below for Roofing Type used for Project.

- 3. [Section 075113 - Built-Up Asphalt Roofing: Board insulation for roof curbs.]
- 4. [Section 075323 - Ethylene Propylene Diene Monomer (EPDM) Roofing: Board insulation for roof curbs.]
- 5. [Section 075200 - Modified Bituminous Membrane Roofing: Board insulation for roof curbs.]
- 6. Section 238100 - Decentralized Unitary HVAC Equipment.

1.2 REFERENCES

- A. American Welding Society (AWS):
 - 1. AWS D1.1 - Structural Welding Code.
- B. American Society of Testing and Materials (ASTM):
 - 1. ASTM A653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvanealed) by the Hot-Dip Process.
 - 2. ASTM A463 - Specification for Steel Sheet, Cold Rolled, Aluminum Coated Type 1 and Type 2.
 - 3. ASTM A792 - Specification for Steel Sheet, Fifty-Five Percent Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- C. Steel Structures Painting Council (SSPC):



1. SSPC-Paint 20 Type II - Zinc Rich Primers - Organic.

1.3 DEFINITIONS

- A. Structural Roof Curbs: Manufactured roof curbs bearing on structural steel; designed for equipment dead load and roof dead and live loads.
- B. Non-Structural Roof Curbs: Manufactured roof curbs bearing on top of metal deck; not used for support of equipment or roof.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 1. Product Data: Curb profile characteristics, dimensions, structural properties, and finishes.
 2. Shop Drawings: Indicate configurations, dimensions, locations, construction, and installation details.
 3. Assurance/Control Submittals:
 - a. Design Data: Calculations indicating curb structural design complying with design criteria specified in this Section and indicated on Drawings.
 - b. Certificates: Submit manufacturer's certificate that Products meet or exceed specified requirements.
 - c. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

1.5 QUALITY ASSURANCE

- A. Qualifications:
 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.
 3. Welder: Qualify field welding operators in accordance with AWS Standard Qualification Procedures. Provide certification that field welders have satisfactorily passed AWS qualification tests within previous 12 months.
- B. Furnish and install prefabricated metal roof curbs designed by a professional engineer licensed in State where project is located. Meet or exceed Live Loads and Dead Loads as specified in this Section and as indicated on Drawings. Coordinate curb dimensions with shop drawings of equipment to be supported.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Ship curbs to Project Site palletized and banded.
- C. Clearly identify each curb. Stack curbs at site to prevent twisting, bending or permanent deformation.



PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Custom Curb, Incorporated, Chattanooga, TN (800) 251-3001.
 2. Kentuckiana Curb Company, Louisville, KY (800) 382-2872.
 3. Roof Products, Incorporated, Chattanooga, TN (800) 262-6669.
 4. The Pate Company, Broadview, IL (800) 243-3018.
 5. Thycurb Corporation, Addison, IL (800) 666-2872.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

- A. Sheet Steel: One of the following at Contractor's option:
1. Galvanized Steel Sheet: ASTM A446 and ASTM A525, Grade A, G90 hot-dip zinc coating.
 2. Aluminum-Coated Steel Sheet: ASTM A463, Type 2, T2 100 aluminum coating.
 3. Aluminum Zinc Alloy-Coated Steel Sheet (GAVALUME): ASTM A792, AZ55 aluminum zinc alloy coating.

NOTE TO SPECIFIER

Edit below for Roofing Type used for Project.

- B. Board Insulation: Specified in Section [075113] [075323] [075200].
- C. Wood Nailers: CCA Pressure Treated Lumber Type C, "Standard" grade lumber of any species.
- D. Zinc-Rich Primer: SSPC-Paint 20 Type II.

2.3 STRUCTURAL ROOF CURBS

- A. Coated steel sheet curb sections, corners fully mitered and welded; 2 inch by 2 inch (nominal dimension) pressure treated continuous wood nailers mechanically fastened at 12 inches on center to exterior face of curb. Shop prime welded connections with zinc-rich paint complying with SSPC-Paint 20.
- B. Profile:
1. Bottom Flange Width: 2 inches.

NOTE TO SPECIFIER

Edit Roof Curb height below based on roof insulation thickness used for specific Project.

2. Web Height: Comply with local code requirements for minimum curb height, but in no case shall top of curb be less than 8 inches above the surface of the roof.
 3. Top Flange Width: 1 1/2 inches.
 4. Insulation: 1 1/2 inches thick, 3 lb high density fiberglass.
- C. Sheet Metal Gage:
1. Heating, Ventilating and Air Conditioning Units: 14 gage.
 2. Other Structural Roof Curbs: 18 gage.
- D. Reinforce curb sections as required for design loads indicated on Drawings.



- E. Construct curbs to match slope of roof structure (verify roof slope with Drawings); provide level top surface for mounting of equipment.
- F. Welding: AWS D1.1.

2.4 NON-STRUCTURAL ROOF CURBS

- A. Coated steel sheet curb sections, corners fully mitered and welded; 2 inch by 2 inch (nominal dimension) pressure treated continuous wood nailers mechanically fastened at 12 inches on center to exterior face of curb. Shop prime welded connections with zinc-rich paint complying with SSPC-Paint 20.
- B. Profile:
 - 1. Bottom Flange Width: 2 inches.

NOTE TO SPECIFIER

Edit Roof Curb height below based on roof insulation thickness used for specific Project.

- 2. Web Height: Comply with local code requirements for minimum curb height, but in no case shall curb height be less than [12] [____] inches as measured from top of roof insulation to top of curb.
- 3. Top Flange Width: 1-1/2 inches.
- 4. Insulation: 1 1/2 inches thick, 3 lb high density fiberglass.

- C. Sheet Metal Gage: 18 gage.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install curbs in accordance with manufacturer's instructions and as indicated on Drawings.
- B. Structural Roof Curbs:
 - 1. Set units in place and secure base to roof structure by welding to top chord of structural member.
 - 2. Secure metal deck to perimeter of curb as indicated on Drawings.



- C. Non-Structural Roof Curbs: Set units in place and secure base to steel roof deck by self-tapping screw fasteners spaced at a maximum of 12 inches on center, staggered.

3.3 CONSTRUCTION

- A. Interface with Other Work:
 - 1. Coordinate project requirements for custom adapting and connecting to roof curbs with manufacturers and suppliers of curb mounted items and equipment.
 - 2. Coordinate installation with roof membrane installation requirements specified under other Sections.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection.
- B. Inspect structural curb placement and attachment to building steel structural members.
- C. Inspect non-structural curb placement and attachment to steel roof deck.
- D. Verify curb heights, and that top of curb is level.

USPS CSF Specifications issued: 10/1/2013
Last revised: 3/6/2012

END OF SECTION



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Task	Specification	Specification Description
07 72 13 00	23 74 13 00	Packaged, Outdoor, Central-Station Air-Handling Units



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SECTION 07 72 33 00 - CSF ROOF HATCHES

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items at end of Section.07 72 33 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Prefabricated steel roof hatch, with integral support curbs, operable hardware, and counterflashings.
 - 2. Ladder Safety Post.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 055000 - Metal Fabrications: Requirements for shop fabricated roof hatch ladders and other ferrous metal items.
 - 2. Section 099100 - Painting: Exterior finish painting of roof hatch.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Data on unit construction, sizes, configuration, jointing methods, and attachment method.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Deliver to Project site in manufacturer's unopened container.



PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturer's offering specified items which may be incorporated in the Work include the following:
1. Babcock-Davis Hatchways, Incorporated, Arlington, MA. (781) 643-5344.
 2. The Bilco Company, West Haven, CT. (203) 934-6363.
 3. Milcor, Holland, OH. (800) 861-6452.
 4. Precision Stair Corporation, Morristown, TN. (800) 225-7814.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MANUFACTURED UNITS

- A. Model Numbers:
1. Babcock-Davis: 6-102.
 2. Bilco: NB.
 3. Milcor: M-1.
 4. Precision Stair: PLH-G.
- B. Description:
1. Size: 2 feet 6 inches x 4 feet 6 inches.
 2. Curb: 14 gage galvanized G90 steel, fully welded corners; 1 inch rigid insulation; integral cap flashing to receive roof flashing system; extended flange for mounting.
 3. Cover: 14 gage galvanized G90 steel with one inch glass fiber insulation retained by 22 gage steel inner liner. Continuous gasket to provide weatherproof seal.
 4. Hardware:
 - a. Compression spring operator and shock absorber.
 - b. Steel manual pull handle for interior and exterior operation.
 - c. Steel hold-open arm with vinyl covered grip handle for easy release. Cadmium plated finish.
 - d. Heavy duty pintle type hinges.
 - e. The hatch should have a key type deadbolt locking device, slide bolt locking device or have the capability to install a padlock to secure the hatch cover to the hatchway.
 5. Fasteners: Corrosive-resistant fasteners recommended by roof hatch manufacturer, which are to be interior mounted.

NOTE TO SPECIFIER

The hatch assembly should be mounted with anchors that can not be removed from the exterior.

2.3 FABRICATION

- A. Fabricate free of visual distortions and defects. Weld corners and joints.
- B. Fabricate units weathertight with integral capflashing, providing for removal of condensation.
- C. Prime paint; one coat.
- D. Weld hasp, latch and hinges to prevent removal from exterior.



2.4 ROOF HATCH LADDER

- A. Metal Ladder: Specified in Section 055000.
- B. Ladder Safety Post: LadderUP, Model LU-1, by The Bilco Company.
 - 1. Telescoping high strength steel tubular section; locks automatically when fully extended.
 - 2. Stainless steel spring balancing mechanism; controls upward and downward movement.
 - 3. Black enamel finish.
 - 4. Provide fasteners for securing posts to ladder rungs.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Roof Hatch:
 - 1. Install in accordance with manufacturer's published instructions.
 - 2. Provide weathertight installation.
 - 3. Apply bituminous paint on metal surfaces of units in contact with cementitious materials and dissimilar metals.
 - 4. Field paint exterior exposed areas of hatch with 2 coats as specified in Section 099100.
- B. Ladder Safety Post: Secure safety post to top two ladder rungs, on climbing side, in accordance with manufacturer's published instructions.

3.2 CONSTRUCTION

- A. Interface with Other Work:
 - 1. Coordinate location and required clear dimensions of roof deck opening.
 - 2. Coordinate with installation roof insulation, roof membrane, and related flashings.

3.3 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field Inspection.
- B. Independent Roofing Inspector and Roofing manufacturer Roofing Quality Control Inspector will inspect interface of roofing installation and roof hatch installation as a part of the roofing quality control inspections.

3.4 ADJUSTING

- A. Adjust hatch hinge and hold-open arm for smooth operation.
- B. Adjust ladder safety post for smooth non-binding operation.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/19/2011

END OF SECTION



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SECTION 07 72 56 00 - HEAT TRACING FOR FIRE-SUPPRESSION PIPING**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for heat tracing for fire suppression piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes heat tracing with the following electric heating cables:
 - a. Plastic insulated, series resistance.
 - b. Self-regulating, parallel resistance.

C. Submittals

1. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each type of product indicated.
 - a. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.
2. Shop Drawings: For electric heating cable. Include plans, sections, details, and attachments to other work.
 - a. Wiring Diagrams: Power, signal, and control wiring.
3. Field quality-control test reports.
4. Operation and Maintenance Data.
5. Warranty: Special warranty specified in this Section.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within 10 **OR** 15, **as directed**, years from date of Final Completion.

1.2 PRODUCTS**A. Plastic-Insulated, Series-Resistance Heating Cables**

1. Comply with IEEE 515.1.
2. Heating Element: Single- or dual-stranded resistor wire. Terminate with waterproof, factory-assembled nonheating leads with connectors at both ends.
3. Electrical Insulating Jacket: Minimum 4.0-mil (0.10-mm) Kapton with silicone jacket or Tefzel.
4. Cable Cover: Aluminum braid and silicone or Hylar outer jacket, **as directed**.
5. Maximum Operating Temperature: 300 deg F (150 deg C).

B. Self-Regulating, Parallel-Resistance Heating Cables

1. Heating Element: Pair of parallel No. 16 **OR** 18, **as directed**, AWG, tinned **OR** nickel-coated, **as directed**, stranded copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled nonheating leads with connectors at one end, and seal the opposite end watertight. Cable shall be capable of crossing over itself once without overheating.



2. Electrical Insulating Jacket: Flame-retardant polyolefin.
3. Cable Cover: Tinned-copper **OR** Stainless-steel, **as directed**, braid, and polyolefin outer jacket with UV inhibitor, **as directed**.
4. Maximum Operating Temperature (Power On): 150 deg F (65 deg C).
5. Maximum Exposure Temperature (Power Off): 185 deg F (85 deg C).
6. Maximum Operating Temperature: 300 deg F (150 deg C).

C. Controls

1. Remote bulb unit with adjustable temperature range from 30 to 50 deg F (minus 1 to plus 10 deg C).
2. Snap action; open-on-rise, single-pole switch with minimum current rating adequate for connected cable.
3. Remote bulb on capillary, resistance temperature device, or thermistor for directly sensing pipe-wall temperature.
4. Corrosion-resistant, waterproof control enclosure.

D. Accessories

1. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.
2. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 3 mils (0.08 mm) thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.
 - a. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): 3/4 inch (19 mm) minimum.
 - b. Width for Markers on Pipes with OD, Including Insulation, 6 Inches (150 mm) or Larger: 1-1/2 inches (38 mm) minimum.

1.3 EXECUTION

A. Installation

1. Install electric heating cable across expansion joints according to manufacturer's written recommendations using slack cable to allow movement without damage to cable.
2. Install electric heating cables after piping has been tested and before insulation is installed.
3. Install electric heating cables according to IEEE 515.1.
4. Install insulation over piping with electric cables according to Division 21 Section "Fire-suppression Systems Insulation".
5. Install warning tape on piping insulation where piping is equipped with electric heating cables.
6. Set field-adjustable switches and circuit-breaker trip ranges.
7. Protect installed heating cables, including nonheating leads, from damage.

B. Connections

1. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
2. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

C. Field Quality Control

1. Testing: Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
 - a. Test cables for electrical continuity and insulation integrity before energizing.
 - b. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.
2. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounting cables.



3. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 07 72 56 00



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SECTION 07 72 56 00a - HEAT TRACING FOR PLUMBING PIPING**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for heat tracing for plumbing piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes plumbing piping heat tracing for freeze prevention, domestic hot-water-temperature maintenance, and snow and ice melting on roofs and in gutters and downspouts with the following electric heating cables:
 - a. Plastic insulated, series resistance.
 - b. Self-regulating, parallel resistance.
 - c. Constant wattage.

C. Submittals

1. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each type of product indicated.
 - a. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.
2. Shop Drawings: For electric heating cable. Include plans, sections, details, and attachments to other work.
 - a. Wiring Diagrams: Power, signal, and control wiring.
3. Field quality-control test reports.
4. Operation and Maintenance Data: For electric heating cables to include in operation and maintenance manuals.
5. Warranty: Special warranty specified in this Section.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within 10 **OR** 15, **as directed**, years from date of Final Completion.

1.2 PRODUCTS**A. Plastic-Insulated, Series-Resistance Heating Cables**

1. Comply with IEEE 515.1.
2. Heating Element: Single- or dual-stranded resistor wire. Terminate with waterproof, factory-assembled nonheating leads with connectors at both ends.
3. Electrical Insulating Jacket: Minimum 4.0-mil (0.10-mm) Kapton with silicone jacket or Tefzel.
4. Cable Cover: Aluminum braid and silicone or Hylar outer jacket, **as directed**.
5. Maximum Operating Temperature: 300 deg F (150 deg C).

B. Self-Regulating, Parallel-Resistance Heating Cables



1. Heating Element: Pair of parallel No. 16 **OR** 18, **as directed**, AWG, tinned **OR** nickel-coated, **as directed**, stranded copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled nonheating leads with connectors at one end, and seal the opposite end watertight. Cable shall be capable of crossing over itself once without overheating.
 2. Electrical Insulating Jacket: Flame-retardant polyolefin.
 3. Cable Cover: Tinned-copper **OR** Stainless-steel, **as directed**, braid, and polyolefin outer jacket with UV inhibitor, **as directed**.
 4. Maximum Operating Temperature (Power On): 150 deg F (65 deg C).
 5. Maximum Exposure Temperature (Power Off): 185 deg F (85 deg C).
 6. Maximum Operating Temperature: 300 deg F (150 deg C).
- C. Constant-Wattage Heating Cables
1. Heating Element: Pair of parallel No. 12 AWG, tinned **OR** nickel-coated, **as directed**, stranded copper bus wires with single-stranded resistor wire connected between bus wires. Terminate with waterproof, factory-assembled nonheating leads with connectors at one end, and seal the opposite end watertight.
 2. Electrical Insulating Jacket: Flame-retardant fluoropolymer.
 3. Cable Cover: Tinned-copper **OR** Stainless-steel, **as directed**, braid, and polyolefin outer jacket with UV inhibitor, **as directed**.
 4. Maximum Operating Temperature (Power On): 392 deg F (200 deg C).
- D. Controls
1. Pipe-Mounting Thermostats for Freeze Protection:
 - a. Remote bulb unit with adjustable temperature range from 30 to 50 deg F (minus 1 to plus 10 deg C).
 - b. Snap action; open-on-rise, single-pole switch with minimum current rating adequate for connected cable.
 - c. Remote bulb on capillary, resistance temperature device, or thermistor for directly sensing pipe-wall temperature.
 - d. Corrosion-resistant, waterproof control enclosure.
 2. Precipitation and Temperature Sensor for Snow Melting on Roofs and in Gutters:
 - a. Microprocessor-based **OR** Automatic, **as directed**, control with manual on, automatic, and standby/reset switch.
 - b. Precipitation and temperature sensors shall sense the surface conditions of roof and gutters and shall be programmed to energize the cable as follows:
 - 1) Temperature Span: 34 to 44 deg F (1 to 7 deg C).
 - 2) Adjustable Delay Off Span: 30 to 90 minutes.
 - 3) Energize Cables: Following two-minute delay if ambient temperature is below set point and precipitation is detected.
 - 4) De-Energize Cables: On detection of a dry surface plus time delay.
 - c. Corrosion-proof and waterproof enclosure suitable for outdoor mounting, for controls and precipitation and temperature sensors.
 - d. Minimum 30-A contactor to energize cable or close other contactors.
 - e. Precipitation sensor shall be freestanding.
 - f. Provide relay with contacts to indicate operational status, on or off, for interface with central HVAC control system workstation.
 3. Programmable Timer for Domestic Hot-Water-Temperature Maintenance:
 - a. Microprocessor based.
 - b. Minimum of four separate schedules.
 - c. Minimum 24-hour battery carryover.
 - d. On-off-auto switch.
 - e. 365-day calendar with 20 programmable holidays.
 - f. Relays with contacts to indicate operational status, on or off, and for interface with central HVAC control system workstation.



E. Accessories

1. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.
2. Warning Labels: Refer to Division 22 Section "Identification For Plumbing Piping And Equipment".
3. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 3 mils (0.08 mm) thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.
 - a. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): 3/4 inch (19 mm) minimum.
 - b. Width for Markers on Pipes with OD, Including Insulation, 6 Inches (150 mm) or Larger: 1-1/2 inches (38 mm) minimum.

1.3 EXECUTION

A. Applications

1. Install the following types of electric heating cable for the applications described:
 - a. Snow and Ice Melting on Roofs and in Gutters and Downspouts: Plastic-insulated, series-resistance **OR** Self-regulating, parallel-resistance **OR** Constant-wattage, **as directed**, heating cable.
 - b. Temperature Maintenance for Domestic Hot Water: Self-regulating, parallel-resistance heating cable.

B. Installation

1. Install electric heating cable across expansion, construction, and control joints according to manufacturer's written recommendations using cable protection conduit and slack cable to allow movement without damage to cable.
2. Electric Heating Cable Installation for Snow and Ice Melting on Roofs and in Gutters and Downspouts: Install on roof and in gutters and downspouts with clips furnished by manufacturer that are compatible with roof, gutters, and downspouts.
3. Electric Heating Cable Installation for Freeze Protection for Piping:
 - a. Install electric heating cables after piping has been tested and before insulation is installed.
 - b. Install electric heating cables according to IEEE 515.1.
 - c. Install insulation over piping with electric cables according to Division 22 Section "Plumbing Insulation".
 - d. Install warning tape on piping insulation where piping is equipped with electric heating cables.
4. Electric Heating Cable Installation for Temperature Maintenance for Domestic Hot Water:
 - a. Install electric heating cables after piping has been tested and before insulation is installed.
 - b. Install insulation over piping with electric heating cables according to Division 22 Section "Plumbing Insulation".
 - c. Install warning tape on piping insulation where piping is equipped with electric heating cables.
5. Set field-adjustable switches and circuit-breaker trip ranges.
6. Protect installed heating cables, including nonheating leads, from damage.

C. Connections

1. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
2. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

D. Field Quality Control

1. Testing: Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.



- a. Test cables for electrical continuity and insulation integrity before energizing.
 - b. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.
2. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounting cables.
3. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 07 72 56 00a

SECTION 07 72 56 00b - HEAT TRACING FOR HVAC PIPING**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for heat tracing for HVAC piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes heat tracing with the following electric heating cables:
 - a. Plastic insulated, series resistance.
 - b. Self-regulating, parallel resistance.

C. Submittals

1. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each type of product indicated.
 - a. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.
2. Shop Drawings: For electric heating cable. Include plans, sections, details, and attachments to other work.
 - a. Wiring Diagrams: Power, signal, and control wiring.
3. Field quality-control test reports.
4. Operation and Maintenance Data: For electric heating cables to include in operation and maintenance manuals.
5. Warranty: Special warranty specified in this Section.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within 10 **OR** 15, **as directed**, years from date of Final Completion.

1.2 PRODUCTS**A. Plastic-Insulated, Series-Resistance Heating Cables**

1. Comply with IEEE 515.1.
2. Heating Element: Single- or dual-stranded resistor wire. Terminate with waterproof, factory-assembled nonheating leads with connectors at both ends.
3. Electrical Insulating Jacket: Minimum 4.0-mil (0.10-mm) Kapton with silicone jacket or Tefzel.
4. Cable Cover: Aluminum braid and silicone or Hylar outer jacket, **as directed**.
5. Maximum Operating Temperature: 300 deg F (150 deg C).

B. Self-Regulating, Parallel-Resistance Heating Cables

1. Heating Element: Pair of parallel No. 16 **OR** 18 **as directed**, AWG, tinned **OR** nickel-coated **as directed**, stranded copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof,



factory-assembled nonheating leads with connectors at one end, and seal the opposite end watertight. Cable shall be capable of crossing over itself once without overheating.

2. Electrical Insulating Jacket: Flame-retardant polyolefin.
3. Cable Cover: Tinned-copper **OR** Stainless-steel **as directed**, braid, and polyolefin outer jacket with UV inhibitor **as directed**.
4. Maximum Operating Temperature (Power On): 150 deg F (65 deg C).
5. Maximum Exposure Temperature (Power Off): 185 deg F (85 deg C).
6. Maximum Operating Temperature: 300 deg F (150 deg C).

C. Controls

1. Remote bulb unit with adjustable temperature range from 30 to 50 deg F (minus 1 to plus 10 deg C).
2. Snap action; open-on-rise, single-pole switch with minimum current rating adequate for connected cable.
3. Remote bulb on capillary, resistance temperature device, or thermistor for directly sensing pipe-wall temperature.
4. Corrosion-resistant, waterproof control enclosure.

D. Accessories

1. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.
2. Warning Labels: Refer to Division 23 Section "Identification For Hvac Piping And Equipment".
3. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 3 mils (0.08 mm) thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.
 - a. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): 3/4 inch (19 mm) minimum.
 - b. Width for Markers on Pipes with OD, Including Insulation, 6 Inches (150 mm) or Larger: 1-1/2 inches (38 mm) minimum.

1.3 EXECUTION

A. Installation

1. Install electric heating cable across expansion joints according to manufacturer's written recommendations using slack cable to allow movement without damage to cable.
2. Install electric heating cables after piping has been tested and before insulation is installed.
3. Install electric heating cables according to IEEE 515.1.
4. Install insulation over piping with electric cables according to Division 23 Section "Hvac Insulation".
5. Install warning tape on piping insulation where piping is equipped with electric heating cables.
6. Set field-adjustable switches and circuit-breaker trip ranges.
7. Protect installed heating cables, including nonheating leads, from damage.

B. Connections

1. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
2. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

C. Field Quality Control

1. Testing: Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
 - a. Test cables for electrical continuity and insulation integrity before energizing.



- b. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.
2. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounting cables.
3. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 07 72 56 00b



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Task	Specification	Specification Description
07 72 56 00	23 83 13 00	Radiant-Heating Electric Cables
07 72 63 00	01 22 16 00	No Specification Required
07 76 16 00	01 22 16 00	No Specification Required



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SECTION 07 84 00 00 - CSF FIRESTOPPING

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where penetrations of Fire-Rated Walls are part of Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.07 84 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Firestopping in fire-rated wall assemblies.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM E 119 - Test Methods for Fire Tests of Building Construction and Materials.
 - 2. ASTM E 814 - Test Methods for Fire Tests of Through Penetration Fire Stops.
- B. Underwriters' Laboratories, Inc. (UL):
 - 1. UL 1479 - Fire Tests of Through-Penetration Firestops.

1.3 DEFINITIONS

- A. Firestopping: Sealing material or assembly placed in spaces between building materials to stop movement of smoke, heat, gasses, or fire through wall openings.

1.4 SYSTEM DESCRIPTION

- A. Firestopping Materials: ASTM E 119, ASTM E 814, UL 1479 to achieve a fire rating as indicated on Drawings.



1.5 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures of submittals.
 - 1. Product Data: Product characteristics, performance, and limitation criteria.
 - 2. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Qualification Documentation: Firestopping installer documentation of experience indicating compliance with specified qualification requirements.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of this Section with minimum 5 years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver Products in manufacturer's original unopened containers or packages with labels intact, identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions, where applicable.
- B. Store and handle materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.8 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements:
 - 1. Do not install materials when temperature of substrate material and ambient air is below 60 degrees F.
 - 2. Maintain minimum temperature before, during, and for 3 days after installation of materials.
 - 3. Keep away from heat, open flame, sparks, or other sources of ignition until curing is complete. Use only with adequate ventilation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturer's offering firestopping materials which may be incorporated in the work include the following:
 - 1. Nelson Firestop Products, Tulsa, OK (800) 331-7325.
 - 2. Hilti Firestop Systems, Tulsa, OK (800) 879-8000.
 - 3. The Rectorseal Corporation, Houston, TX (800) 231-3345.
 - 4. Specified Technologies, Incorporated (STI), Somerville, NJ (800) 992-1180.
 - 5. 3M Fire Protection Products, St. Paul, MN (800) 328-1687.
 - 6. Tremco Firestop System, Beechwood, OH (800) 321-7906.
- B. Other products such as USG Firestop System by U.S. Gypsum Co. are acceptable if complying with requirements.
- C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.



2.2 MATERIALS

- A. Intumescent Latex Sealant: Single-component, intumescent, latex formulation.
 - 1. LBS, by Nelson Firestop Products.
 - 2. Metacaulk 950 or 1000, by RectorSeal.
 - 3. SpecSeal SSS100, by STI.
 - 4. CP 25WB+, by 3M.
 - 5. TREMstop WBM, by Tremco.
- B. Intumescent Solvent-Release-Curing Sealant: Single component, intumescent, synthetic-polymer based, non-sag grade.
 - 1. CP 25N/S, by 3M.
 - 2. TREMstop WBM, by Tremco.
- C. Intumescent Wrap/Strip: Single-component, elastomeric sheet with aluminum foil on one face.
 - 1. WRS, by Nelson Firestop Products.
 - 2. Metacaulk Wrap Strip, by RectorSeal.
 - 3. SpecSeal SSWRED Wrapstrip, by STI.
 - 4. FS-195+ Wrap/Strip, by 3M.
 - 5. TREMstop WS, by Tremco.
- D. Intumescent Putty: Single-component, non-hardening, dielectric, intumescent putty.
 - 1. FSP, by Nelson Firestop Products.
 - 2. Metacaulk Fire Rated Putty, by RectorSeal.
 - 3. SpecSeal Putty, by STI.
 - 4. Moldable Putty+, by 3M.
- E. Silicone Sealant: Single-component, moisture-curing, silicone-based elastomeric, non-sag grade.
 - 1. CLK N/S, by Nelson Firestop Products.
 - 2. FS 601, by Hilti.
 - 3. Metacaulk 835+, by RectorSeal.
 - 4. SpecSeal PEN 300, by STI.
 - 5. 2000+ Silicone, by 3M.
 - 6. FYRE SIL, by Tremco.
- F. Silicone Foam: Two-component, silicone-based liquid elastomer that, when mixed, expands and cures in place to produce a flexible, nonshrinking foam.
 - 1. FS Fireblocks, by Hilti.
 - 2. SpecSeal PEN 200, by STI.
 - 3. 2001 Silicone RTV Foam, by 3M.
- G. Intumescent Collar: Factory-fabricated, intumescent collar.
 - 1. PCS, by Nelson Firestop Products.
 - 2. CP 642, by Hilti.
 - 3. Metacaulk Pipe Collar, by RectorSeal.
 - 4. SpecSeal SSC Collars, by STI.
 - 5. Plastic Pipe Device, by 3M.
 - 6. TREMstop D, by Tremco.
- H. Intumescent Composite Sheet or Pillows and Mortar: Intumescent sheet used to firestop large openings.
 - 1. CPS, by Nelson Firestop Products.
 - 2. SpecSeal SSB Pillows and SpecSeal SSM Firestop Compound, by STI.
 - 3. CS-195+ Composite Sheet, by 3M.
 - 4. TREMstop PS, by Tremco.



- I. Packing Material: Manufacturer's standard mastic, putty, ceramic fiber blanket, or mineral wool to be used as fill or backing material for firestopping.
 - 1. FSB or Mineral Wool, by Nelson Firestop Products.
 - 2. Mineral Wool, by Hilti.
 - 3. Fire Safing or Backer Rod, by RectorSeal.
 - 4. Mineral Wool Safing, by STI.
 - 5. FireMaster Mastic, FireMaster Putty, or FireMaster Bulk, by 3M.
 - 6. Cerablanket, by Tremco.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to United States Postal Service.

3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter which may affect bond of firestopping material.
- B. Remove incompatible materials which may affect bond.
- C. Place hangers or damming materials in penetration to hold firestopping materials where required.

3.3 INSTALLATION

- A. Follow manufacturer charts for appropriate material to achieve required fire rating in various locations.
- B. Install firestopping at penetrations of fire rated wall materials by sleeves, piping, ductwork, conduit, and other items in accordance with manufacturer's published instructions.

3.4 CLEANING AND PROTECTION

- A. Clean excessive fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturer's of firestopping Products and of products in which opening and joints occur.
- B. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations.



- C. If damage occurs, cut out and remove damaged or deteriorated firestopping and install new materials.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Inspection procedures.
- B. Contracting Officer will inspect each firestopping installation. Do not cover firestopping installations that will be concealed by other construction until Contracting Officer inspection.



3.6 SCHEDULES

A. Provide firestopping complying with UL assemblies specified below.

Penetration	Assembly	Nelson	Hilti	RectorSeal	STI	3M	Tremco
Metal Pipe	CMU Wall 8" Thick or Less	CAJ1224 or CAJ1203	CAJ1150 or CAJ1158	CAJ1114 or CAJ1115	CAJ1079 or CAJ1217	CAJ1001 or CAJ1009	CAJ1179 or CAJ1187
	Gypsum Board Partition	WL1083 or WL1030	WL1052 or WL1054	WL1026 or WL1034	WL1049 or WL1079	WL1003 or WL1009	WL1020 or WL1051
Non-Metallic Pipe	CMU Wall 8" Thick or Less	CAJ2086	CAJ2095 or CAJ2109	CAJ2021 or WJ2025	CAJ2064 or CAJ2045	CAJ2005	CAJ2082 or FA2024
	Gypsum Board Partition	WL2071	WL2078	WL2015 or WL2104	WL2093 or WL2029	WL2002 or WL2005	WL2083 or WL2082
Cable Tray	CMU Wall 8" Thick or Less	CAJ8049 or CAJ4033	CAJ4017	CAJ8043	CAJ4020 or CAJ4029	CAJ4003 or CBJ4020	CAJ4007 or WJA4005
	Gypsum Board Partition	WL4003	WL4006	N/A	WL4005 or WL4008	WL4004	WL3043 or WL3044
Insulated Metal Pipe	CMU Wall 8" thick or Less	CAJ5008 or CAJ5059	CAJ5045	WJ5016 or CAJ5070	CAJ5021 or CAJ5029	CAJ5001 or CAJ5002	CAJ5052 or CBT5005
	Gypsum Board Partition	WL5036	WL5022 or WL5029	WL5057	WL5014 or WL5051	WL5001	WL5034
Construction Gaps	CMU Wall to Metal Deck	N/A	HW-D-0008	TRC/PV120 -14	U900Z020	U900Z028	U900Z013 or U900Z014
	Gypsum Board Partition to Metal Deck	N/A	HW-D-0003 or HW-D-0004	HWD0014 or TRC/PV120 -14	HWD1001	U400V	WHPV60.0 1 or U900Z014

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END OF SECTION



SECTION 07 84 00 00 - MPF FIRESTOPPING

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Firestopping in fire-rated wall assemblies.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM E 119 - Test Methods for Fire Tests of Building Construction and Materials.
 - 2. ASTM E 814 - Test Methods for Fire Tests of Through Penetration Fire Stops.
- B. Underwriters' Laboratories, Inc. (UL):
 - 1. UL 1479 - Fire Tests of Through-Penetration Firestops.

1.3 DEFINITIONS

- A. Firestopping: Sealing material or assembly placed in spaces between building materials to stop movement of smoke, heat, gasses, or fire through wall openings.

1.4 SYSTEM DESCRIPTION

- A. Firestopping Materials: ASTM E 119, ASTM E 814, UL 1479 to achieve a fire rating as indicated on Drawings.

1.5 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures of submittals.
 - 1. Product Data: Product characteristics, performance, and limitation criteria.
 - 2. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.



- b. Qualification Documentation: Firestopping installer documentation of experience indicating compliance with specified qualification requirements.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of this Section with minimum 5 years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver Products in manufacturer's original unopened containers or packages with labels intact, identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions, where applicable.
- B. Store and handle materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.8 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements:
 - 1. Do not install materials when temperature of substrate material and ambient air is below 60 degrees F.
 - 2. Maintain minimum temperature before, during, and for 3 days after installation of materials.
 - 3. Keep away from heat, open flame, sparks, or other sources of ignition until curing is complete. Use only with adequate ventilation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturer's offering firestopping materials which may be incorporated in the work include the following:
 - 1. Nelson Firestop Products, Tulsa, OK (800) 331-7325.
 - 2. Hilti Firestop Systems, Tulsa, OK (800) 879-8000.
 - 3. The Rectorseal Corporation, Houston, TX (800) 231-3345.
 - 4. Specified Technologies, Incorporated (STI), Somerville, NJ (800) 992-1180.
 - 5. 3M Fire Protection Products, St. Paul, MN (800) 328-1687.
 - 6. Tremco Firestop System, Beechwood, OH (800) 321-7906.
- B. Other products such as USG Firestop System by U.S. Gypsum Co. are acceptable if complying with requirements.
- C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

- A. Intumescent Latex Sealant: Single-component, intumescent, latex formulation.
 - 1. LBS, by Nelson Firestop Products.
 - 2. Metacaulk 950 or 1000, by RectorSeal.



3. SpecSeal SSS100, by STI.
 4. CP 25WB+, by 3M.
 5. TREMstop WBM, by Tremco.
- B. Intumescent Solvent-Release-Curing Sealant: Single component, intumescent, synthetic-polymer based, non-sag grade.
1. CP 25N/S, by 3M.
 2. TREMstop WBM, by Tremco.
- C. Intumescent Wrap/Strip: Single-component, elastomeric sheet with aluminum foil on one face.
1. WRS, by Nelson Firestop Products.
 2. Metacaulk Wrap Strip, by RectorSeal.
 3. SpecSeal SSWRED Wrapstrip, by STI.
 4. FS-195+ Wrap/Strip, by 3M.
 5. TREMstop WS, by Tremco.
- D. Intumescent Putty: Single-component, non-hardening, dielectric, intumescent putty.
1. FSP, by Nelson Firestop Products.
 2. Metacaulk Fire Rated Putty, by RectorSeal.
 3. SpecSeal Putty, by STI.
 4. Moldable Putty+, by 3M.
- E. Silicone Sealant: Single-component, moisture-curing, silicone-based elastomeric, non-sag grade.
1. CLK N/S, by Nelson Firestop Products.
 2. FS 601, by Hilti.
 3. Metacaulk 835+, by RectorSeal.
 4. SpecSeal PEN 300, by STI.
 5. 2000+ Silicone, by 3M.
 6. FYRE SIL, by Tremco.
- F. Silicone Foam: Two-component, silicone-based liquid elastomer that, when mixed, expands and cures in place to produce a flexible, nonshrinking foam.
1. FS Fireblocks, by Hilti.
 2. SpecSeal PEN 200, by STI.
 3. 2001 Silicone RTV Foam, by 3M.
- G. Intumescent Collar: Factory-fabricated, intumescent collar.
1. PCS, by Nelson Firestop Products.
 2. CP 642, by Hilti.
 3. Metacaulk Pipe Collar, by RectorSeal.
 4. SpecSeal SSC Collars, by STI.
 5. Plastic Pipe Device, by 3M.
 6. TREMstop D, by Tremco.
- H. Intumescent Composite Sheet or Pillows and Mortar: Intumescent sheet used to firestop large openings.
1. CPS, by Nelson Firestop Products.
 2. SpecSeal SSB Pillows and SpecSeal SSM Firestop Compound, by STI.
 3. CS-195+ Composite Sheet, by 3M.
 4. TREMstop PS, by Tremco.
- I. Packing Material: Manufacturer's standard mastic, putty, ceramic fiber blanket, or mineral wool to be used as fill or backing material for firestopping.
1. FSB or Mineral Wool, by Nelson Firestop Products.
 2. Mineral Wool, by Hilti.
 3. Fire Safing or Backer Rod, by RectorSeal.
 4. Mineral Wool Safing, by STI.



5. FireMaster Mastic, FireMaster Putty, or FireMaster Bulk, by 3M.
6. Cerablanket, by Tremco.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to United States Postal Service.

3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter which may affect bond of firestopping material.
- B. Remove incompatible materials which may affect bond.
- C. Place hangers or damming materials in penetration to hold firestopping materials where required.

3.3 INSTALLATION

- A. Follow manufacturer charts for appropriate material to achieve required fire rating in various locations.
- B. Install firestopping at penetrations of fire rated wall materials by sleeves, piping, ductwork, conduit, and other items in accordance with manufacturer's published instructions.

3.4 CLEANING AND PROTECTION

- A. Clean excessive fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturer's of firestopping Products and of products in which opening and joints occur.
- B. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations.
- C. If damage occurs, cut out and remove damaged or deteriorated firestopping and install new materials.

3.5 FIELD QUALITY CONTROL



-
- A. Section 014000 - Quality Requirements: Inspection procedures.
 - B. Contracting Officer will inspect each firestopping installation. Do not cover firestopping installations that will be concealed by other construction until Contracting Officer inspection.



3.6 SCHEDULES

A. Provide firestopping complying with UL assemblies specified below.

Penetration	Assembly	Nelson	Hilti	RectorSeal	STI	3M	Tremco
Metal Pipe	CMU Wall 8" Thick or Less	CAJ1224 or CAJ1203	CAJ1150 or CAJ1158	CAJ1114 or CAJ1115	CAJ1079 or CAJ1217	CAJ1001 or CAJ1009	CAJ1179 or CAJ1187
	Gypsum Board Partition	WL1083 or WL1030	WL1052 or WL1054	WL1026 or WL1034	WL1049 or WL1079	WL1003 or WL1009	WL1020 or WL1051
Non-Metallic Pipe	CMU Wall 8" Thick or Less	CAJ2086	CAJ2095 or CAJ2109	CAJ2021 or WJ2025	CAJ2064 or CAJ2045	CAJ2005	CAJ2082 or FA2024
	Gypsum Board Partition	WL2071	WL2078	WL2015 or WL2104	WL2093 or WL2029	WL2002 or WL2005	WL2083 or WL2082
Cable Tray	CMU Wall 8" Thick or Less	CAJ8049 or CAJ4033	CAJ4017	CAJ8043	CAJ4020 or CAJ4029	CAJ4003 or CBJ4020	CAJ4007 or WJA4005
	Gypsum Board Partition	WL4003	WL4006	N/A	WL4005 or WL4008	WL4004	WL3043 or WL3044
Insulated Metal Pipe	CMU Wall 8" thick or Less	CAJ5008 or CAJ5059	CAJ5045	WJ5016 or CAJ5070	CAJ5021 or CAJ5029	CAJ5001 or CAJ5002	CAJ5052 or CBT5005
	Gypsum Board Partition	WL5036	WL5022 or WL5029	WL5057	WL5014 or WL5051	WL5001	WL5034
Construction Gaps	CMU Wall to Metal Deck	N/A	HW-D-0008	TRC/PV120 -14	U900Z020	U900Z028	U900Z013 or U900Z014
	Gypsum Board Partition to Metal Deck	N/A	HW-D-0003 or HW-D-0004	HWD0014 or TRC/PV120 -14	HWD1001	U400V	WHPV60.0 1 or U900Z014

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END OF SECTION 07 84 00 00



SECTION 07 92 00 00 - CSF JOINT SEALANTS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.07 92 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Preparing sealant substrate surfaces.
 - 2. Sealant and backing.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 321313 - Concrete Paving: Sealants used in conjunction with paving.
 - 2. Section 033000 - Cast-In-Place Concrete: Sealants used in conjunction with concrete.
 - 3. Section 042100 - Clay Unit Masonry: Sealants used in conjunction with clay masonry.
 - 4. Section 042200 - Concrete Unit Masonry: Sealants used in conjunction with concrete masonry.
 - 5. Section 078400 - Firestopping: Firestopping sealant at fire-rated assemblies.
 - 6. Section 076200 - Sheet Metal Flashing and Trim: Sealants used in conjunction with metal flashings.
 - 7. Section 088000 - Glazing: Sealants used in conjunction with glazing methods.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM C717 - Standard Terminology of Building Seals and Sealants.
 - 2. ASTM C834 - Specification for Latex Sealants.
 - 3. ASTM C920 - Specification for Elastomeric Joint Sealants.
 - 4. ASTM D1056 - Flexible Cellular Material- Sponge or Expanded Rubber.
- B. Federal Specifications (FS):
 - 1. FS SS-S-200 - Sealing Compounds, Two Component, Elastomeric, Polymer Type, Jet-Fuel Resistant, Cold Applied.



2. FS TT-S-1657 - Sealing Compound, Single Component Butyl Rubber Based Solvent Release Type (for Buildings and other Types of Construction).

1.3 SUBMITTALS

- A. Section 013300 – Submittal Procedures: Procedures for submittals.
 1. Product Data: Product chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 1. Warranty: Submit manufacturer warranty with forms completed in United States Postal Service name and registered with manufacturer.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing Work of this Section with minimum 5 years documented experience.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Deliver Products in manufacturer's original unopened containers or packages with labels intact, identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions, where applicable.
- C. Store and handle materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements: Install sealant during manufacturer's recommended temperature ranges and weather conditions for application and cure. Consult manufacturer when sealant cannot be applied during recommended conditions.

1.7 WARRANTY

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Warranty:
 1. Submit written warranty signed by sealant manufacturer agreeing to replace sealants and accessories which fail because of loss of cohesion or adhesion or which do not cure.
 2. Warranty Period: 5 years or longer per the manufacturers' standard warranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS



- A. Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated into the work include the following:
1. Bostik, Inc, Huntingdon Valley, PA, (800) 523-2678, (125) 674-5600.
 2. Dow Corning, Midland, MI (517) 496-4000.
 3. GE Silicones, Waterford, NY (518) 233-3330.
 4. Mameco International, Cleveland, OH, (800) 321-6412, (216) 752-4400.
 5. W.R. Meadows, Inc, Elgin, IL (800) 342-5976, (847) 683-4500.
 6. Nomaco, Inc., Zebulon, NC, (919) 269-6500.
 7. Pecora Corporation, Harleysville, PA, (800) 523-6688, (215) 723-6051.
 8. Sika Corporation, Lyndhurst, NJ, (800) 933-7452, (201) 933-8800.
 9. Sonneborn Building Products Div. ChemRex, Inc., Shakopee, MN (800) 243-6739, (612) 496-6000.
 10. Tremco, Beachwood, OH, (800) 852-3821, (216) 292-5000.
 11. USG Corp., Chicago, IL (800) 874-4968, (312) 606-4000.

2.2 BUILDING SEALANTS (See Sealant Schedule at the end of this Section for specific use of sealants.)

A. Urethanes:

1. Type 1: Two-Part Urethane: Self-Leveling, ASTM C920, Type M, Grade P, Class 25.
 - a. Chem-Calk CC-550, by Bostik.
 - b. Vulkem 245, by Mameco.
 - c. Vulkem 255, Wide-Joint, by Mameco.
 - d. NR-200 Urexpan, by Pecora Corporation.
2. Type 2: Two-Part Urethane: Non-Sag, ASTM C920, Type M, Grade NS, Class 25.
 - a. Chem-Calk 500, by Bostik.
 - b. Vulkem 227, by Mameco.
 - c. Sonolastic NP 2, by Sonneborn Building Products, ChemRex Inc.
3. Type 3: One-Part Urethane: Self-Leveling, ASTM C920, Type S, Grade P, Class 25.
 - a. Vulkem 45, by Mameco.
 - b. Urexpan NR-201, by Pecora Corporation.
 - c. Sonolastic SL1, by Sonneborn Building Products, ChemRex Inc.
 - d. Sikaflex 1C-SL by Sika.
4. Type 4: One-Part Urethane: Non-Sag, ASTM C920, Type S, Grade NS, Class 25.
 - a. Chem-Calk 900, by Bostik.
 - b. Vulkem 116, by Mameco.
 - c. Sonolastic NP I, by Sonneborn Building Products, ChemRex Inc.

B. Silicones:

1. Type 1: One-Part Silicones: ASTM C920, Type S, Grade NS, Class 50.
 - a. 795 Silicone Building Sealant, by Dow Corning.
 - b. 864 Architectural Silicone Sealant, by Pecora Corporation.
2. Type 2: One-Part Silicones: ASTM C920, Type S, Grade NS, Class 25.
 - a. 999-A Silicone Building & Glazing Sealant, Dow Corning.
 - b. Construction 1200 Sealant, General Electric Company.
3. Type 3: One-Part Silicones: ASTM C920, Type S, Grade NS, Class 25. Vertical Surfaces Only.
 - a. Construction 1200 Sealant, General Electric Company.
 - b. 999-A, Dow Corning.
 - c. 860 Glaziers and Contractors Silicone Sealant, by Pecora Corporation. (colors only)
4. Type 4: One-Part Silicones: ASTM C920, Type S, Grade NS, Class 25 or 50.
 - a. 786 Mildew Resistant Silicone Sealant, Dow Corning.
 - b. SCS 1700 Sanitary Sealant, General Electric.
 - c. 898 Silicone Sanitary Sealant, Pecora Corporation.

C. Acrylics, Latex:

1. Type 1: One-Part Acrylic Latex, Non-Sag, ASTM-C-834-76.
 - a. Chem-Calk 600, by Bostik.



- b. LC-130, by MACCO Adhesives, The Glidden Company.
 - c. Easa-ply ALS, by W. R. Meadows, Inc.
 - d. AC-20+Silicone Acrylic Latex, by Pecora Corporation.
 - e. Sonolac, Sonneborn Building Products, ChemRex Inc.
- D. Acoustical Sealants:
 - 1. Type 1: AC-20 FTR Acoustical and Insulation Sealant, by Pecora Corporation.
 - 2. Type 2: 60+ Unicrylic, by Pecora Corporation.
 - 3. Type 3: Sheetrock Acoustical Sealant, by United States Gypsum.
- E. Butyls:
 - 1. Type 1: One-Part Butyl, Non-Sag, FS TT-S-1657.
 - a. Chem-Calk 300, by Bostik.
 - b. BC-158 Butyl Rubber, by Pecora Corporation. (ASTM C1085)
- F. Preformed Compressible & Non-Compressible Fillers:
 - 1. Type 1: Backer Rod - Closed cell polyethylene foam:
 - a. HBR Backer Rod, by Nomaco.
 - b. #92 Greenrod, by Nomaco.
 - c. Sonofoam Closed-Cell Backer Rod, Sonneborn Building Products, ChemRex Inc.
 - 2. Type 2: Backer Rod - Open cell polyurethane foam:
 - a. Denver Foam, by Backer Rod Mfg Inc.
 - b. Foam Pack II, by Nomaco.
 - 3. Type 3: Neoprene compression seals:
 - a. WE, WF, and WG Series, by Watson Bowman & Acme Corp.
 - b. Will-Seal 150 Precompressed Expanding Foam Sealants, by Will-Seal, a Division of Illbruck.
 - 4. Type 4: Butyl Rod: Kirkhill Rubber Co. (714)529-4901.
- G. Bond Breaker Tape: Polyethylene tape of plastic as recommended by sealant manufacturer, to be applied to sealant-contact surfaces where bond to substrate of joint filler must be avoided for proper performance of sealant

2.3 PAVING SEALANTS

- A. Type 1: Two-Part Urethane: Self-Leveling, ASTM C920, Type M, Grade P, Class 25.
 - 1. Vulkem 202, by Mameco. (Jet Fuel Resistant) (FS SS-S-200D, Type H only)
 - 2. NR-300 Urexpan, by Pecora Corporation. (FS SS-S-200E)
- B. Type 2: One-Part Urethane: Self-Leveling, ASTM C920, Type S, Grade P, Class 25.
 - 1. Sonomeric 1 Sealant, by Sonneborn Building Products, ChemRex Inc. (FS SS-S-200E)
 - 2. Vulkem 45, by Mameco.

2.4 COLORS

- A. Generally use sealant colors matching color of material joint is located in.
- B. Where a joint occurs between two materials of differing colors and Contractor cannot determine which material to match, contact Contracting Officer for selection.



2.5 ACCESSORIES

- A. Joint Cleaner: Provide type of joint cleaning compound recommended by sealant manufacturer for joint surfaces to be cleaned.
- B. Primer: As recommended by sealant manufacturer.
- C. Masking tape and similar accessories to protect surfaces from damage.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify that joint widths are in conformance with sealant manufacturer allowable limits.
 - 2. Verify that contaminants capable of interfering with adhesion have been cleaned from joint and joint properly prepared.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Prepare and size joints in accordance with manufacturer's instructions. Clean substrates of dirt, laitance, dust, or mortar using solvent, abrasion, or sandblasting as recommended by manufacturer. Remove loose materials and foreign matter which might impair adhesion of sealant.
- B. Verify that joint backing and release tapes are compatible with sealant. Verify sealant is suitable for substrate. Verify that sealant is paintable if painted finish is indicated.
- C. Protect materials surrounding work of this Section from damage or disfiguration.

3.3 INSTALLATION

- A. Install sealant in accordance with manufacturer's published instructions.
- B. Prime or seal joint surfaces where recommended by sealant manufacturer. Do not allow primer or sealer to spill or migrate onto adjoining surfaces.
- C. Install backer rod and bond breaker tape where required by manufacturer.
- D. Install preformed compressible and non-compressible fillers in accordance with manufacturer's published instructions.



- E. Install sealants to depths recommended by sealant manufacturer in uniform, continuous ribbons free of air pockets, foreign embedded matter, ridges, and sags, "wetting" joint bond surfaces equally on both sides.
- F. Tool joints concave unless shown otherwise. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form slight cove so that joint will not trap moisture and foreign matter. Dry tool joints. Do not use soap, water, or solvent to tool joints.
- G. Epoxy Floor Joint Sealant: Install sealant at floor construction and control joints in accordance with manufacturer's published instructions and initially under manufacturer's supervision.

3.4 CURING

- A. Cure sealants in compliance with manufacturer's published instructions.

3.5 CLEANING

- A. Remove excess and spillage of sealants promptly as the work progresses, using materials and methods as recommended by sealant and substrate manufacturers. Clean adjoining surfaces to eliminate evidence of spillage without damage to adjoining surfaces or finishes.

3.6 SEALANT SCHEDULE

- A. Exterior Joints:
 - 1. Perimeters of exterior openings where frames and other penetrations meet exterior facade of building: precast concrete, brick, CMU, polymer reinforced concrete.
 - a. Sealant Urethane Type 2
 - b. Sealant Silicone Type 1 (for prefinished materials only)
 - 2. Expansion and control joints in exterior surfaces of cast-in-place concrete walls, precast architectural wall panels.
 - a. Sealant Urethane Type 2
 - b. Sealant Urethane Type 4
 - c. Preformed Compressible & Non-Compressible Filler Type 1
 - 3. Expansion and control joints in exterior surfaces of unit masonry walls and polymer reinforced concrete, including at metal panels.
 - a. Sealant Urethane Type 2
 - 4. Coping joints, coping-to-facade joints, cornice and wash, or horizontal surface joints not subject to foot or vehicular traffic.
 - a. Sealant Urethane Type 2
 - b. Sealant Urethane Type 4
 - c. Sealant Silicone Type 1 (for prefinished materials only)
 - 5. Exterior joints in horizontal wearing and non-wearing surfaces.
 - a. Sealant No. Urethane Type 1
 - b. Sealant No. Urethane Type 3
 - c. Preformed Compressible & Non-Compressible Filler Type 1
 - 6. Paving joints and curbs.
 - a. Sealant Urethane Type 4
 - b. Paving Sealant Type 2
 - 7. Setting bed for threshold and saddles.
 - a. Sealant Acoustical Type 1
 - 8. Painted metal lap or flashing joints.
 - a. Sealant Silicone Type 1



B. Interior Joints:

1. Seal interior perimeters of exterior openings.
2. Expansion and control joints on interior of exterior cast-in-place concrete walls.
3. Expansion and control joints on interior of exterior precast, architectural wall panels.
4. Expansion and control joints on interior of exterior masonry walls.
5. Perimeters of interior hollow metal and aluminum frames.
6. Interior masonry vertical control joints and intersecting masonry walls; CMU-to-CMU, CMU-to-concrete.
7. Joints at intersection of exterior masonry walls and interior gypsum board partitions.
8. For all of the above interior joints:
 - a. Sealant Urethane Type 2
 - b. Sealant Urethane Type 4
 - c. Sealant Silicone Type 1 (for prefinished materials only)
9. Exposed interior control joints in drywall and concealed joints.
 - a. Sealant Acrylic, Latex, Type 1
 - b. Sealant Acoustical Type 1
 - c. Sealant Acoustical Type 3
 - d. Sealant Butyl Type 1
10. Joints of underside of precast beams or planks.
 - a. Sealant Urethane Type 2
 - b. Sealant Urethane Type 4
11. Joints at tops of non-load bearing masonry walls at underside of cast-in-place concrete.
 - a. Sealant Urethane Type 2
 - b. Sealant Urethane Type 4
12. Perimeter of bath fixtures: sinks, tubs, urinals, waterclosets, basins, vanities, etc.
 - a. Sealant Silicone Type 4
13. Interior expansion and control joints in floor surfaces exposed to foot traffic.
 - a. Sealant Urethane Type 2
 - b. Sealant Urethane Type 4
 - c. Preformed Compressible & Non-Compressible Filler Type 1
14. Interior saw-cut contraction joints in exposed concrete floors exposed to forklift traffic.
 - a. Paving Sealant Type 1
15. Interior non-moving joints, including control, contraction, or construction joints, in interior floor slabs exposed to heavy duty traffic.
 - a. Paving Sealant Type 1
16. Painted metal lap joints.
 - a. Sealant Silicone Type 1

C. Glazing:

1. Structural Glazing.
 - a. Sealant Silicone Type 2
 - b. Sealant Silicone Type 3
2. General Purpose Glazing.
 - a. Sealant Silicone Type 3
3. End Damming.
 - a. Sealant Butyl Type 1

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END OF SECTION



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**SECTION 07 92 00 00 - MPF JOINT SEALANTS**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 - GENERAL**1.1 SUMMARY**

- A. Sealing of exterior building joints.
- B. Sealing of interior partition joints.
- C. Sealing of ceramic tile joints.
- D. Sealing of joints in exterior paving.

1.2 SUBMITTALS

- A. Product Data: Required
- B. Samples: Required

1.3 QUALITY ASSURANCE

- A. Quality Standards:
 - 1. SWRI (Sealant, Waterproofing and Restoration Institute) requirements for materials and installation.

PART 2 – PRODUCTS**2.1 MANUFACTURERS**

- A. Exterior building joints: Polyurethane Sealant - single component, chemical curing, non-sagging type, 25 percent elongation capability, manufactured by Pecora, Sika, Tremco or Sonneborn.
- B. Interior partition joints: Silicone Sealant - single component, 50 percent elongation capability, manufactured by GE or Dow.
- C. Ceramic tile joints: Silicone Sealant - single component, solvent curing, fungus resistant, 25 percent elongation capability, manufactured by GE or Dow.
- D. Exterior horizontal traffic joints: Polyurethane Sealant - self-leveling, manufactured by Pecora, Sika, Tremco or Sonneborn.

2.2 ACCESSORIES/MIXES

- A. Joint Backing: Round open cell polyethylene urethane foam or butyl rod.



PART 3 – EXECUTION

- 3.1 Install all products in accordance with manufacturer's guidelines and printed instructions.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 3/31/2010

END OF SECTION 07 92 00 00



SECTION 07 92 01 00 - R&A SEALANTS FOR ROOF REPLACEMENT

NOTE TO SPECIFIER

This Section is intended for use with R & A projects undertaken using Fixed Price Construction Contracts or IQC Construction Work Orders. Editing is required based on field design data collected for each individual project. "NOTE TO SPECIFIER" instructions provide guidance concerning editing and options requiring a decision on the part of the Designer. Based on discussions with the USPS Project Manager, select the most appropriate decision or option for the project, and delete the options not selected. Add additional Sections referenced within this Section. Items in blue require action by the specifier/designer.

NOTE TO SPECIFIER

Section Formatting:

Consistent formatting of Sections gives the complete document a professional look. This Section uses a 10pt. Arial font, and is formatted as follows:

1. Insert one 10pt. line after the Section Number. Section Number is in CAPS.
2. Insert two 10pt. lines after the Section Title. Section Title is in CAPS.
3. Insert one 10pt. line after a PART. PARTS are in CAPS. If a Section is not used, include NOT USED following the PART title as shown below.
4. Insert one 10pt. line after Article paragraphs. Articles are in CAPS.
5. Insert two 10pt. lines at the end of an Article.
6. Complete Section with END OF SETION.
7. No lines should be placed between paragraphs and sub-paragraphs, or between sub-paragraphs and other sub-paragraphs.

Example:

SECTION NUMBER

SECTION TITLE

PART 1 - GENERAL

1.1 ARTICLE

- A. Paragraph
 1. Sub-Paragraph
 - a. Sub-Paragraph
 - 1) Sub Paragraph

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED

Edit Section footer as necessary to reflect the project name and location, USPS Project number, and issue date of the technical specification document. Coordinate date with the USPS Project Manager.



PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements related to the installation of sealants associated with sheet metal flashing work.

NOTE TO SPECIFIER

EDIT Article 1.2 RELATED SECTIONS below. DELETE Section references for roofing system Sections not applicable to this project. Re-letter paragraphs after editing.

1.2 RELATED SECTIONS

- A. Section 013300 – Submittal Procedures
- B. Section 016000 – Product Requirements
- C. Section 024100 – Roof Removal and Substrate Preparation
- D. Section 076202 – Sheet Metal for Built-Up Roofing
- E. Section 076203 – Sheet Metal for Modified Bitumen Roofing
- F. Section 076205 – Sheet Metal for EPDM Roofing
- G. Section 076207 – Sheet Metal for PVC Roofing
- H. Section 076209 – Sheet Metal for KEE Roofing
- I. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.3 REFERENCES

- A. Reference standards of the following sources are applicable to products and procedures specified in Part 2 - Products and Part 3 – Execution of this Section:
 - 1. American Society for Testing and Materials (ASTM)
 - a. ASTM C 920 – Standard Specification for Elastomeric Joint Sealants

1.4 SUBMITTALS

- A. Prior to the start of work, submit the following to the Owner for approval:
 - 1. Product submittals required within Section 013300.
- B. Refer to Section 013300 for procedural requirements related to the submittal process.

1.5 QUALITY ASSURANCE PROCEDURES



- A. Applicator Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive a manufacturer's warranty. Company shall have a minimum of 5 years documented experience certified by roofing system manufacturer.
- B. Single Source Responsibility: Roofing system materials and components shall be supplied and warranted by roofing system manufacturer for specified roofing system and shall be in compliance with specified regulatory requirements.
- C. Examine the technical specifications and drawings. Verify all dimensions, detail conditions, roof plan notes and existing site conditions that may affect the work. Verification of existing dimensions and site conditions is the responsibility of the Contractor. No additional compensation will be considered for failure to verify existing dimensions, detail conditions, roof plan note callouts, and existing site conditions.
- D. Upon examination, if conflicts between the technical specifications and drawings, and those of federal, state or local regulatory agencies, the product manufacturer, industry roofing standards, or Owner-mandated requirements are discovered, notify the Owner immediately for resolution.
- E. During work, if conditions are discovered which do not allow for continuation of the work per the technical specifications and drawings, notify the Owner immediately for resolution.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 016000 for transport, handling, storage and product requirements.
- B. Deliver materials in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store materials in weather protected environment, clear of ground and moisture. Cover insulation, roofing materials, and other moisture-sensitive products with a canvas tarp.
- D. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not perform work during inclement weather. Refer to product manufacturer for outdoor temperature requirements for installation of materials. Do not install materials at times when the outdoor temperature does not fall within the minimum/maximum temperature requirements of the manufacturer.
- B. Cold weather precautions:
 - 1. Refer to the sealant manufacturer for cold weather application recommendations and restrictions.
- C. Material Safety Data Sheets (MSDS) of all specified products shall remain on site for the duration of this project.

PART 2 – PRODUCTS

2.1 SEALANT

- A. Sealant: Moisture-cured, non-sag, one-part polyurethane sealant, in compliance with ASTM



C 920, Type S, Grade NS. Color to match sheet metal or as directed by Owner.

1. Closed-cell backing materials, bond breakers, and primers as recommended by the sealant manufacturer for the joint conditions encountered.
- B. High temperature sealant: For use at high-temperature penetrations and other locations where high temperatures are anticipated: Product type approved by Owner for temperature and substrate condition encountered.
- C. Sealant primer: Type recommended and approved by sealant manufacturer for substrate encountered.
- D. Joint filler, backer rod and bond breaker tape:
1. Product(s) recommended and approved by sealant manufacturer for substrate encountered.
 2. Size and configuration as necessary for condition encountered.

PART 3 - EXECUTION

3.1 SEALANT INSTALLATION

- A. Cleaning: Clean surfaces immediately before installation of sealants to provide surfaces suitable for the installation of sealant.
- B. Joint filler, backer rod, and bond breaker tape: Install joint filler and backer rods to result in minimum sealant depth of 1/4-inch and maximum of 1/2 the joint width. If joint is of insufficient depth to receive joint filler or backer rod, install bond breaker tape to the bottom of the joint to prevent three-sided adhesion.
- C. Primer: Apply primer if required by the sealant manufacturer for the type of sealant and conditions encountered. Apply primer in accordance with the sealant manufacturer's requirements and recommendations.
- D. Sealant installation: Install sealant where required in accordance with the requirements and recommendations of the sealant manufacturer. Tool the joint immediately after installation.

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NOTE TO SPECIFIER

Upon completion of Section editing, review Section formatting. Ensure Article, paragraph and sub-paragraph lettering and numbering is consistent. Ensure all "Note to Specifier" comments are removed. Change all blue text to black text. Review the footer information with the USPS Project Manager for accuracy.

END OF SECTION 07 92 01 00



SECTION 08 11 00 00 - CSF METAL DOORS AND FRAMES**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.08 11 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel doors and frames.
 - 2. Steel door louvers.
 - 3. Steel frames for wood doors.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 081400 - Wood Doors: Doors installed in steel frames.
 - 2. Section 087100 - Door Hardware: Hardware coordination.
 - 3. Section 099100 - Painting: Field painting and finishing of doors and frames.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A 152 - Methods for Fire Tests of Door Assemblies.
 - 2. ASTM A 653/A 653M - Standard Specification for Steel Sheets, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 1996.

NOTE TO SPECIFIER

Use METHODS OF FIRE TESTS paragraph below when FIRE RATED door assemblies are a part of the Work.

- 3. ASTM E 152 - Methods of Fire Tests of Door Assemblies.

- B. Door Hardware Institute (DHI):
 - 1. DHI - The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.



2. DHI A115 Series - Specifications for Steel Doors and Frame Preparation for Hardware.

C. Steel Door Institute (SDI):

1. SDI-100 - Recommended Specifications Standard Steel Doors and Frames.
2. SDI-105 - Recommended Erection Instructions for Steel Frames.

D. National Fire Protection Association (NFPA):

1. NFPA 80 - Fire Doors and Windows.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

1. Product Data: Indicate door materials, gauges, configurations, and location of cut-outs hardware reinforcement, and finish.
 - a. Shop Drawings: Indicate door elevations, internal reinforcement, closure method, and cut-outs for louvers.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum 5 years documented experience.
2. Installer: Company specializing in performing work of this Section with minimum 5 years documented experience.

NOTE TO SPECIFIER

Use paragraph below when FIRE RATED door assemblies are a part of the Work.

B. Regulatory Requirements:

1. Fire Rated Door Construction:
 - a. Conform to ASTM E 152, labeled and listed by Underwriters Laboratories (UL).
 - b. Rate of rise of 450 degrees F across door thickness maximum in 30 minutes of fire exposure.

NOTE TO SPECIFIER

Use paragraph below when FIRE RATED door assemblies are a part of the Work.

- C. Installed Door Assembly: Conform to NFPA 80 for fire rated minute label as indicated on Drawings.

1.5 DELIVERY, STORAGE AND PROTECTION

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Protect doors and frames with resilient packaging.
- C. Break seal on-site to permit ventilation.



PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering items which may be incorporated in the Work include the following:
 1. Amweld Building Products, Incorporated, Garrettsville, OH (330) 527-4385, (800) 248-6116.
 2. Ceco Door Products, Brentwood, TN (615) 661-5030.
 3. Curries Company, Mason City, IA (515) 423-1334.
 4. Republic Builders Products, McKenzie, TN (800) 733-3667.
 5. Steelcraft, Cincinnati, OH (513) 745-6400.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

- A. Exterior Doors: SDI-100, Level II - Heavy-Duty - 1-3/4 inch, Model 1 - Full Flush Design, 18 gage cold-rolled steel; galvanized in accordance with ASTM A 653.
- B. Interior Doors: SDI-100, Level II - Heavy-Duty - 1-3/4 inch, Model 1 - Full Flush Design, 18 gage cold-rolled steel.
- C. Exterior Frames: 16 gage, cold-rolled steel, mitered and welded; galvanized in accordance with ASTM A 653.
- D. Interior Frames: 16 gage, cold-rolled steel, mitered and welded, 2 inch profile, for installation in a metal or wood stud security partition.
- E. Interior Frames: 16 gage, cold-rolled steel, mitered and welded, 2 inch profile, for installation in a metal or wood stud and gypsum board partition.

2.3 CORE CONSTRUCTION

- A. Provide one of the following core construction:
 1. Interior Doors: Kraft Honeycomb, Phenolic treated.
 2. Exterior Doors:
 - a. Polyurethane: Core foamed-in-place or laminated. 20 psi strength, 1.8 pcf density; 1/2 inch maximum voids in any direction. Strength of bond between core and steel face sheet shall exceed strength of core so delamination will not occur during operating conditions.
 - b. Polystyrene: Rigid core of polystyrene foam board, 1500 psf compressive strength, 18 psi shear strength. Strength of bond between core and steel face sheet shall exceed strength of core so that delamination will not occur under operating conditions.
 - c. Vertical Steel Stiffeners: 22 gage vertical steel stiffeners, spaced 6 inches apart and spot welded to face sheets at 6 inches on center. Insulate spaces between stiffeners with loose fill insulation full height of door.

2.4 ACCESSORIES

- A. Rubber Silencers: Resilient rubber.

NOTE TO SPECIFIER



Louvers are not permitted in exterior doors, or in doors which provide direct access to the work room floor from a public area, without burglar bars or wire mesh installed on the protected side.

- B. Louvers:
 - 1. Material and Finish: Roll formed 20 gauge steel with wipe coat of zinc.
 - 2. Blade: Inverted Y blade, sight proof.
- C. Top Filler Cap on exterior doors: Install cap, weld, grind, fill and finish smooth.

2.5 PROTECTIVE COATINGS

- A. Bituminous Coating: Fibered asphalt emulsion.
- B. Primer: Exposed surfaces shall be cleaned, treated with Bonderite chemical and given one baked-on shop coat of grey rust inhibiting primer.

2.6 FABRICATION

- A. Fabricate units rigid, neat, and free from warp or buckle. Fabricate KD or welded as specified. Weld exposed joints continuously; grind, dress, and make smooth, flush and invisible.
- B. Reinforce units to receive surface applied finish hardware.
- C. Prepare frame for silencers. Provide three single rubber silencers for single doors and two single silencers on frame head at double doors without mullions.
- D. Primer: Air dried.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install frames in accordance with SDI-105.
- B. Install doors in accordance with DHI.



- C. Install doors in accordance with manufacturer's published instructions, of size, and at locations indicated.
- D. Coordinate with adjacent wall construction for anchor placement.
- E. Field paint doors and frames as specified in Section 099100.
- F. The frame is to be mounted to the studding in such a manner to prevent a spreading of the frame from the studs of less than 1/2 inch.

3.3 CONSTRUCTION

- A. Interface with Other Work:
 - 1. Coordinate frame installation with size, location, and installation.
 - 2. Coordinate with door opening construction, door frame, and door hardware installation.
- B. Site Tolerances:
 - 1. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection.
- B. Inspect metal door and frame installation, alignment, attachment to structure, and operation.

3.5 ADJUSTING AND CLEANING

- A. Adjust hardware for smooth and balanced door movement.
- B. Section 017300 - Execution: Cleaning installed Work.

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Last revised: 4/12/2011

END OF SECTION



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SECTION 08 11 00 00 - MPF METAL DOORS AND FRAMES**

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PART 1 – GENERAL

1.1 SUMMARY

- A. Hollow metal doors and frames.
- B. Vision panels.

1.2 SUBMITTALS

- A. Product Data: Required
- B. Shop Drawings: Required

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. UL 10B, NFPA 80 and ASTM E-152: Fire rated door and frame construction:
 - 2. Handbook RE-4: Standards for Facility Accessibility by the Physically Handicapped.
- B. Quality Standards:
 - 1. Hollow metal work: ANSI/SDI-100 Grade II Model 3 Standard Steel Doors and Frames.

PART 2 -PRODUCTS

2.1 Steel Doors and Frames: 1 ¾" inch thick full flush design, seamless construction.

- A. Exterior Doors:
 - 1. 18 gauge ASTM A526 with ASTM A525, G60 galvanized steel, insulated.
- B. Interior Doors:
 - 1. 18 gauge ASTM A366 or ASTM A568 cold-rolled steel, primed.
- C. Exterior Frames: 16 gauge thick material, core thickness, G60 galvanized.
- D. Interior Frames: 16 gauge thick material, core thickness, primed.
- E. Fire rated doors and frames: Fire rating and construction as required.

2.2 FABRICATION

- A. Steel Doors and Frames
 - 1. Shop Assembly:



- a. Fabricate frames as welded unit.
- 2. Shop/Factory Finishing:
 - a. Steel sheet: Galvanized to G60 coating class at exterior doors. Baked primer at interior doors.

PART 3 – EXECUTION

- 3.1 Install all products in accordance with manufacturer's guidelines and printed instructions.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 3/31/2010

END OF SECTION 08 11 00 00



SECTION 08 14 00 00 - MPF WOOD DOORS**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 – GENERAL

1.1 SUMMARY

- A. Flush solid core wood doors in hollow metal door frames.

1.2 SUBMITTALS

- A. Product Data: Required
- B. Shop Drawings: Required
- C. Samples: Required

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Fire rated door and frame construction: UL10B, NFPA 80 and ASTM E-152.
 - 2. Handicapped: Handbook RE-4.
- B. Quality Standards:
 - 1. Flush wood doors: Comply with AWI 1300 "Quality Standards," Custom Grade.

PART 2 - PRODUCTS

2.1 MANUFACTURER:

- A. Algoma
- B. Eggers
- C. Mohawk
- D. Weyerhaeuser

2.2 SOLID CORE WOOD DOORS - FLUSH, 1-3/4 INCHES THICK.

- A. Core Construction:
 - 1. Non-fire rated: SLC Solid stave lumber.
 - 2. Fire-rated: Type FD 1-1/2 solid stave lumber.
- B. Face Veneer:
 - 1. AWI Premium grade birch for transparent finish.

2.3 FABRICATION



- A. Shop fabricated and finished.
- B. Factory cut doors for finish hardware.

PART 3 – EXECUTION

- 3.1 Install all products in accordance with manufacturer's guidelines and printed instructions.

USPS Mail Processing Facility Specification issued: 10/1/2013
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END OF SECTION 08 14 00 00



SECTION 08 14 00 00 - CSF WOOD DOORS**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.08 14 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Flush wood doors.
 - 2. Wood wicket doors.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 081100 - Metal Doors and Frames: Metal frames for wood doors.
 - 2. Section 087100 - Door Hardware: Hardware coordination.
 - 3. Section 099100 - Painting: Field painting of doors and frames.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM E 152 - Methods of Fire Tests of Door Assemblies.
- B. Architectural Woodwork Institute (AWI):
 - 1. AWI 1300 - Flush Hollow and Solid Core Doors.
- C. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA LD-3 - High Pressure Decorative Laminates.
- D. National Fire Protection Association (NFPA):
 - 1. NFPA 80 - Specification for Fire Doors and Windows.
- E. Window and Door Manufacturers Association (WDMA):
 - 1. WDMA I.S. 1A-97 - Architectural Wood Flush Doors.



1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, special blocking for hardware, and factory machining criteria. Indicate cutouts for door louvers.
 - 2. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Special Warranty: Submit written special warranty forms completed in United States Postal Service name and registered with manufacturer as specified in this Section.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with AWI 1300 for Custom Grade.
- B. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 - 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.
- C. Regulatory Requirements:
 - 1. Fire Door Construction: Conform to ASTM E 152.
 - 2. Installed Fire Rated Door Assembly: Conform to NFPA 80.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Package, deliver, and store doors in accordance with AWI Section 013300.

1.6 WARRANTY

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Special Warranty:
 - 1. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.
 - 2. Warranty Period: Full life of installation.

NOTE TO SPECIFIER

****REQUIRED PART (PRODUCTS) FOLLOWS. DO NOT REVISE THIS PART, EXCEPT AS NOTED BELOW, WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**



PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Algoma Hardwoods, Inc., Algoma, WI, (800) 678-8910.
 - 2. Eggers Industries, Neena, WI, (920) 722-6444.
 - 3. Mohawk Flush Doors, Inc., Northumberland, PA (717) 473-3557.
 - 4. Marshfield DoorSystems, Incorporated, Marshfield, WI (800) 869-3667.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

- A. Solid Core Wood Doors (Interior Use): AWI 1300.
 - 1. Thickness: Indicated on Drawings.
 - 2. Veneer: AWI 1300-S-9 SLC-5 ME.
 - 3. Face Veneer: AWI Custom quality rotary cut birch for paint finish.
 - 4. Core Construction:
 - a. Non Fire-Rated: SLC solid stave lumber.
 - b. Fire-Rated: Type FD 1-1/2 solid stave lumber.
 - 5. Grade: AWI Custom.
- B. Solid Core Wicket Doors (Interior Use): AWI 1300.
 - 1. Thickness: Indicated on Drawings.
 - 2. Face Veneer: AWI Custom quality rotary cut birch for paint finish.
 - 3. Core Construction: SCL Structural Composite Lumber
 - 4. Grade: AWI Custom.
- C. Louvers: Roll formed steel, inverted V blade, sight proof, primed for paint finish, size as indicated on Drawings.
- D. Provide fire-rated labeled doors where indicated on Drawings.

2.3 FABRICATION

- A. Fabricate non fire-rated doors in accordance with AWI 1300.
- B. Fabricate fire-rated doors to AWI 1300 and to Underwriters Laboratories Incorporated requirements. Attach fire rating label to doors.
- C. Furnish and install lock blocks at lock edge, and top of door closer for hardware reinforcement.
- D. Vertical Exposed Edge of Stiles:
 - 1. Wicket Door: Paint same as door facing.
 - 2. Other Wood Doors: Of same species as veneer facing.
- E. Bond edge banding to cores.
- F. Factory machine door for door hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware.



- G. Factory fit doors for frame opening dimensions identified on approved shop drawings.
- H. Doors may be provided pre-hung set in frames and ready for installation in rough openings. Metal door frames specified in Section 081100.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install non fire-rated doors in accordance with AWI Quality Standards requirements.
- B. Install fire-rated doors in accordance with AWI Quality Standard and NFPA 80 requirements.
- C. Machine cut for hardware. Install door hardware specified in Section 087100.
- D. Install door louvers plumb and level.
- E. Field paint doors and door louvers as specified in Section 099100, color as indicated on Drawings.

3.3 CONSTRUCTION

- A. Interface with Other Work:
 - 1. Coordinate frame installation with size, location, and installation.
 - 2. Coordinate with door opening construction, door frame, and door hardware installation.
- B. Site Tolerances:
 - 1. Conform to AWI requirements for fit and clearance tolerances.
 - 2. Conform to AWI 1300 requirements for maximum diagonal warp.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection.
- B. Inspect door and frame installation, alignment, attachment to structure, hardware installation, and operation.



3.5 ADJUSTING AND CLEANING

- A. Adjust hardware for smooth and balanced door movement.

3.6 PROTECTION

- A. Section 017300 - Execution: Protecting installed work.
- B. Protect finished Work from damage.

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END OF SECTION



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SECTION 08 14 16 00 - FLUSH WOOD DOORS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for flush wood doors. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Solid-core doors and transom panels with wood-veneer, medium-density-overlay, hardboard or MDF, and plastic-laminate faces.
 - b. Hollow-core doors with wood-veneer, hardboard or MDF, and plastic-laminate faces.
 - c. Shop priming and Factory finishing flush wood doors.
 - d. Factory fitting flush wood doors to frames and factory machining for hardware.

C. Submittals

1. Product Data: For each type of door indicated. Include factory-finishing specifications.
2. LEED Submittals:
 - a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that flush wood doors comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
 - 1) Include statement indicating costs for each certified wood product.
 - b. Product Data for Credit EQ 4.4: For adhesives and composite wood products, documentation indicating that product contains no urea formaldehyde.
3. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
 - a. Indicate dimensions and locations of mortises and holes for hardware.
 - b. Indicate dimensions and locations of cutouts.
 - c. Indicate requirements for veneer matching.
 - d. Indicate doors to be factory finished and finish requirements.
 - e. Indicate fire-protection ratings for fire-rated doors.
4. Samples: For plastic-laminate door faces and factory-finished doors.

D. Quality Assurance

1. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
2. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated" **OR** WDMA I.S.1-A, "Architectural Wood Flush Doors" **OR** WI's "Manual of Millwork", **as directed**.
3. Forest Certification: Provide doors made with cores **OR** veneers **OR** not less than 70 percent of wood products **OR** all wood products, **as directed**, obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
4. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure **OR** as close to neutral pressure as possible, **as directed**, according to NFPA 252 **OR** UBC Standard 7-2 **OR** UL 10B **OR** UL 10C, **as directed**.
 - a. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.



- b. Temperature-Rise Limit: Where indicated **OR** At vertical exit enclosures and exit passageways, **as directed**, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
- 5. Preinstallation Conference: Conduct conference at Project site.
- E. Delivery, Storage, And Handling
 - 1. Comply with requirements of referenced standard and manufacturer's written instructions.
 - 2. Package doors individually in plastic bags or cardboard cartons **OR** cardboard cartons and wrap bundles of doors in plastic sheeting, **as directed**.
 - 3. Mark each door on bottom **OR** top and bottom, **as directed**, rail with opening number used on Shop Drawings.
- F. Warranty
 - 1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period for Solid-Core Exterior Doors: Two **OR** Five, **as directed**, years from date of Final Completion.
 - b. Warranty Period for Solid-Core Interior Doors: Life of installation.
 - c. Warranty Period for Hollow-Core Interior Doors: One **OR** Two, **as directed**, year(s) from date of Final Completion.

1.2 PRODUCTS

- A. Door Construction, General
 - 1. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.
 - 2. WDMA I.S.1-A Performance Grade:
 - a. Heavy Duty unless otherwise indicated.
 - b. Extra Heavy Duty: Classrooms, public toilets, janitor's closets, assembly spaces, exits, patient rooms, and where indicated.
 - c. Standard Duty: Closets (not including janitor's closets), private toilets, and where indicated.
 - 3. Particleboard-Core Doors:
 - a. Particleboard:
 - 1) ANSI A208.1, Grade LD-1 **OR** Grade LD-2, **as directed**, made with binder containing no urea-formaldehyde resin, **as directed**.
 - OR**
 - Straw-based particleboard complying with ANSI A208.1, Grade LD-2 or M-2, except for density.
 - b. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
 - c. Provide doors with glued-wood-stave **OR** structural-composite-lumber, **as directed**, cores instead of particleboard cores for doors indicated to receive exit devices.
 - 4. Structural-Composite-Lumber-Core Doors:
 - a. Structural Composite Lumber: WDMA I.S.10.
 - 1) Screw Withdrawal, Face: 700 lbf (3100 N).
 - 2) Screw Withdrawal, Edge: 400 lbf (1780 N).
 - 5. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
 - a. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.

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- f. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions, **as directed**.
 - g. Room Match:
 - 1) Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 10 feet (3 m) **OR** 20 feet (6 m), **as directed**, or more.
OR
Provide door faces of compatible color and grain within each separate room or area of building.
 - h. Transom Match: Continuous match **OR** End match **OR** As indicated, **as directed**.
 - i. Blueprint Match: Where indicated, provide doors with faces produced from same flitches as adjacent wood paneling and arranged to provide blueprint match with wood paneling. Comply with requirements in Division 06 Section(s) "Interior Architectural Woodwork" **OR** "Wood Paneling", **as directed**.
 - j. Exposed Vertical **OR** Vertical and Top, **as directed**, Edges: Same species as faces or a compatible species **OR** Same species as faces **OR** Applied wood-veneer edges of same species as faces and covering edges of faces **OR** Applied wood edges of same species as faces and covering edges of crossbands, **as directed**.
 - k. Core: Particleboard **OR** Glued wood stave **OR** Nonglued wood stave **OR** Structural composite lumber, **as directed**.
 - l. Construction:
 - 1) Five **OR** Five or seven, **as directed**, plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press, **as directed**.
OR
Seven plies, either bonded or nonbonded construction.
3. Interior Hollow-Core Doors:
- a. Grade: Premium, with Grade AA faces **OR** Premium, with Grade A faces **OR** Custom (Grade A faces) **OR** Economy (Grade B faces), **as directed**.
 - b. Species: Anigre **OR** Select white ash **OR** Figured select white ash **OR** Select white birch **OR** Cherry **OR** Select red gum **OR** Figured select red gum **OR** Select white maple **OR** Red oak **OR** Persimmon **OR** Sapele **OR** Sycamore **OR** Walnut **OR** White oak **OR** Ucuuba (Virola Duckei) **OR** Cupiuba (Goupia glabra), **as directed**.
 - c. Cut: Rotary cut **OR** Plain sliced (flat sliced) **OR** Quarter sliced **OR** Rift cut, **as directed**.
 - d. Match between Veneer Leaves: Book **OR** Slip **OR** Pleasing, **as directed**, match.
 - e. Assembly of Veneer Leaves on Door Faces: Center-balance **OR** Balance **OR** Running, **as directed**, match.
 - f. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions, **as directed**.
 - g. Exposed Vertical **OR** Vertical and Top, **as directed**, Edges: Same species as faces or a compatible species **OR** Same species as faces **OR** Applied wood-veneer edges of same species as faces and covering edges of faces **OR** Applied wood edges of same species as faces and covering edges of crossbands, **as directed**.
 - h. Construction: Seven plies.
- C. Doors For Opaque Finish
- 1. Exterior Solid-Core Doors:
 - a. Grade: Premium **OR** Custom **OR** Economy, **as directed**.
 - b. Faces: Medium-density overlay **OR** Any closed-grain hardwood of mill option, **as directed**.
 - 1) Apply medium-density overlay to standard-thickness, closed-grain, hardwood face veneers **OR** directly to high-density hardboard crossbands, **as directed**.
 - c. Exposed Vertical **OR** Vertical and Top, **as directed**, Edges: Any closed-grain hardwood.
 - d. Core: Particleboard **OR** Glued wood stave **OR** Structural composite lumber, **as directed**.



- e. Construction: Five **OR** Five or seven, **as directed**, plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press, **as directed**.
- f. Adhesives: Type I per WDMA TM-6.
- 2. Interior Solid-Core Doors:
 - a. Grade: Premium **OR** Custom **OR** Economy, **as directed**.
 - b. Faces: Medium-density overlay **OR** Any closed-grain hardwood of mill option **OR** Hardboard or MDF, **as directed**.
 - 1) Apply medium-density overlay to standard-thickness, closed-grain, hardwood face veneers **OR** directly to high-density hardboard crossbands, **as directed**.
 - 2) Hardboard Faces: AHA A135.4, Class 1 (tempered) or Class 2 (standard).
 - 3) MDF Faces: ANSI A208.2, Grade 150 or 160.
 - c. Exposed Vertical **OR** Vertical and Top, **as directed**, Edges: Any closed-grain hardwood.
 - d. Core: Particleboard **OR** Glued wood stave **OR** Nonglued wood stave **OR** Structural composite lumber, **as directed**.
 - e. Construction:
 - 1) Three **OR** Five **OR** Five or seven, **as directed**, plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press, **as directed**.
OR
Three **OR** Seven, **as directed**, plies, either bonded or nonbonded construction.
- 3. Interior Hollow-Core Doors:
 - a. Grade: Premium **OR** Custom **OR** Economy, **as directed**.
 - b. Faces: Medium-density overlay **OR** Any closed-grain hardwood of mill option **OR** Hardboard or MDF, **as directed**.
 - 1) Hardboard Faces: AHA A135.4, Class 1 (tempered) or Class 2 (standard).
 - 2) MDF Faces: ANSI A208.2, Grade 150 or 160.
 - c. Exposed Vertical **OR** Vertical and Top, **as directed**, Edges: Any closed-grain hardwood.
 - d. Construction: Three **OR** Seven, **as directed**, plies.
- D. Plastic-Laminate-Faced Doors
 - 1. Interior Solid-Core Doors:
 - a. Grade: Premium **OR** Custom **OR** Economy, **as directed**.
 - b. Plastic-Laminate Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS **OR** Grade HSH, **as directed**.
 - c. Colors, Patterns, and Finishes: As indicated **OR** As selected from laminate manufacturer's full range of products, **as directed**.
 - d. Exposed Vertical **OR** Vertical and Top, **as directed**, Edges: Hardwood edges for staining to match faces **OR** Hardwood edges for painting **OR** Plastic laminate that matches faces, applied before faces **OR** Impact-resistant polymer edging, applied after faces, **as directed**.
 - 1) Polymer Edging Color: Beige **OR** Brown **OR** Same color as faces, **as directed**.
 - e. Core: Particleboard **OR** Glued wood stave **OR** Structural composite lumber, **as directed**.
 - f. Construction:
 - 1) Three plies. Stiles and rails are bonded to core, then entire unit abrasive planed before faces are applied. Faces are bonded to core using a hot press, **as directed**.
OR
Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before faces and crossbands are applied. Faces are bonded to core using a hot press, **as directed**.
 - 2. Interior Hollow-Core Doors:
 - a. Grade: Premium **OR** Custom **OR** Economy, **as directed**.
 - b. Plastic-Laminate Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS **OR** Grade HSH, **as directed**.
 - c. Colors, Patterns, and Finishes: As indicated **OR** As selected from laminate manufacturer's full range of products, **as directed**.



- d. Exposed Vertical **OR** Vertical and Top, **as directed**, Edges: Hardwood edges for staining to match faces **OR** Hardwood edges for painting **OR** Plastic laminate that matches faces, applied before faces **OR** Impact-resistant polymer edging, applied after faces, **as directed**.
 - 1) Polymer Edging Color: Beige **OR** Brown **OR** Same color as faces, **as directed**.
- e. Construction: Plastic-laminate faces glued directly to core.

E. Louvers And Light Frames

- 1. Wood Louvers: Door manufacturer's standard solid-wood louvers unless otherwise indicated.
 - a. Wood Species: Same species as door faces **OR** Species compatible with door faces **OR** Any closed-grain hardwood, **as directed**.
- 2. Metal Louvers:
 - a. Blade Type: Vision-proof, inverted V **OR** Vision-proof, inverted Y **OR** Darkroom-type, double inverted V, **as directed**.
 - b. Metal and Finish:
 - 1) Hot-dip galvanized steel, 0.040 inch (1.0 mm) thick, factory primed for paint finish **OR** with baked-enamel- or powder-coated finish, **as directed**.
OR
Extruded aluminum with Class II, clear anodic finish, AA-M12C22A31.
OR
Extruded aluminum with light bronze **OR** medium bronze **OR** dark bronze **OR** black, **as directed**, Class II, color anodic finish, AA-M12C22A32/A34.
- 3. Louvers for Fire-Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire-protection rating of 1-1/2 hours and less.
 - a. Metal and Finish: Hot-dip galvanized steel, 0.040 inch (1.0 mm) thick, factory primed for paint finish **OR** with baked-enamel- or powder-coated finish, **as directed**.
- 4. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads as follows unless otherwise indicated.
 - a. Wood Species: Same species as door faces **OR** Species compatible with door faces **OR** Any closed-grain hardwood, **as directed**.
 - b. Profile: Flush rectangular beads **OR** Recessed tapered beads **OR** Recessed tapered beads with exposed banding **OR** Lipped tapered beads **OR** Manufacturer's standard shape, **as directed**.
 - c. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
- 5. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.
- 6. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; factory primed for paint finish **OR** with baked-enamel- or powder-coated finish, **as directed**; and approved for use in doors of fire-protection rating indicated.

F. Fabrication

- 1. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 - a. Comply with requirements in NFPA 80 for fire-rated doors.
- 2. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
 - a. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 - b. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.



3. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
 - a. Fabricate door and transom panels with full-width, solid-lumber, rabbeted, **as directed**, meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.
 4. Openings: Cut and trim openings through doors in factory.
 - a. Light Openings: Trim openings with moldings of material and profile indicated.
 - b. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Section "Glazing".
 - c. Louvers: Factory install louvers in prepared openings.
 5. Exterior Doors: Factory treat exterior doors with water repellent after fabrication has been completed but before shop priming **OR** factory finishing, **as directed**.
 - a. Flash top of outswinging doors (with manufacturer's standard metal flashing).
- G. Shop Priming
1. Doors for Opaque Finish: Shop prime doors with one coat of wood primer specified in Division 09 Section(s) "Exterior Painting" OR "Interior Painting", **as directed**. Seal all four edges, edges of cutouts, and mortises with primer.
 2. Doors for Transparent Finish: Shop prime doors with stain (if required), other required pretreatments, and first coat of finish as specified in Division 09 Section(s) "Exterior Painting" OR "Interior Painting" OR "Staining And Transparent Finishing", **as directed**. Seal all four edges, edges of cutouts, and mortises with first coat of finish.
- H. Factory Finishing
1. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - a. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom **OR** top and bottom, **as directed**, edges, edges of cutouts, and mortises.
 2. Finish doors at factory.
OR
Finish doors at factory that are indicated to receive transparent finish. Field finish doors indicated to receive opaque finish.
OR
Finish doors at factory where indicated in schedules or on Drawings as factory finished.
 3. Transparent Finish:
 - a. Grade: Premium **OR** Custom, **as directed**.
 - b. Finish:
 - 1) AWI conversion varnish **OR** catalyzed polyurethane, **as directed**, system.
OR
WDMA TR-4 conversion varnish **OR** TR-6 catalyzed polyurethane, **as directed**.
OR
WI System 4 clear conversion varnish **OR** 5 catalyzed polyurethane **OR** 8 UV-curable coating, **as directed**.
 - c. Staining: Match sample **OR** As selected from manufacturer's full range **OR** None required, **as directed**.
 - d. Effect: Open-grain finish **OR** Filled finish **OR** Semifilled finish, produced by applying an additional finish coat to partially fill the wood pores, **as directed**.
 - e. Sheen: Satin **OR** Semigloss, **as directed**.
 4. Opaque Finish:
 - a. Grade: Premium **OR** Custom, **as directed**.
 - b. Finish:
 - 1) AWI conversion varnish **OR** catalyzed polyurethane, **as directed**, system.
OR
WDMA OP-4 conversion varnish **OR** OP-6 catalyzed polyurethane, **as directed**.



OR

WI System 4 conversion varnish **OR** 5 catalyzed polyurethane **OR** 8 UV-curable coating, **as directed**.

- c. Color: Match sample **OR** As selected from manufacturer's full range, **as directed**.
- d. Sheen: Satin **OR** Semigloss **OR** Gloss, **as directed**.

1.3 EXECUTION

A. Installation

1. Hardware: For installation, see Division 08 Section "Door Hardware".
2. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
 - a. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
3. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 - a. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.
 - 1) Comply with NFPA 80 for fire-rated doors.
 - b. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
 - c. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock edge; trim stiles and rails only to extent permitted by labeling agency.
4. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
5. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

B. Adjusting

1. Operation: Rehang or replace doors that do not swing or operate freely.
2. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16 00



Task	Specification	Specification Description
08 14 23 13	01 22 16 00	No Specification Required
08 14 66 00	01 22 16 00	No Specification Required
08 14 73 00	08 14 16 00	Flush Wood Doors
08 15 13 00	08 14 16 00	Flush Wood Doors



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SECTION 08 16 13 00 - FIBERGLASS REINFORCED PLASTIC (FRP) DOORS AND FRAMES

1.1 GENERAL

A. Description of Work

1. This specification covers the furnishing and installation of materials for fiberglass reinforced plastic (FRP) doors and frames. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Fire Rated Fiberglass reinforced Plastic (FRP) Doors certified by Intertek Testing Services for Warnock- Hersey in 45, 60 and 90-minute ratings, meeting all specifications of UL 10(c) fire door test standards. Category A and B.
 - 1) Category A doors are labeled for compliance with UBC 7-2-1997 (Positive Pressure) and do not require the application of an additional edge sealing system.
 - 2) Category B doors are labeled to require the installation of a listed edge sealing system to meet the requirements of UBC 7-2-1997 (Positive Pressure). This seal must be installed per the manufacturers instructions and may be factory or field applied.
 - 3) Category B constructed doors, if requested and with certain restrictions, may be provided with an UL 10 (b) label (Negative Pressure) and at a later date can be upgraded to a UL 10 (c) category B label (Positive Pressure) with the application of a listed seal system.
 - b. Fire Rated Fiberglass Resin Transfer Molded Door Frames certified by Intertek Testing Services for Warnock- Hersey in 45, 60 and 90-minute ratings, meeting all specifications of UL 10(c) fire door test standards, Category C.
 - c. Fire Rated Fiberglass reinforced Plastic (FRP) Doors and Fiberglass Resin Transfer Molded Door Frames certified by Intertek Testing Services for Warnock- Hersey in 20, 45, 60 and 90-minute ratings, meeting all specifications of UL 10(b) fire door test standards.

C. Quality Assurance

1. Manufacturer Qualifications: A company specialized in the manufacture of fiberglass reinforced plastic (FRP) doors and frames as specified herein with a minimum of 25 years documented experience and with a record of successful in-service performance for the applications as required for this project.
2. Installer Qualifications: An experienced installer who has completed fire rated fiberglass door and frame installations similar in material, design, and extent to those indicated and whose work has resulted in construction with a record of successful in-service performance.
3. Source Limitations: Obtain fiberglass reinforced plastic doors and frames through one source fabricated from a single manufacturer, including fire rated fiberglass frames.
4. Source Limitations: Hardware and accessories for all FRP doors as specified in Division 08 Section "Door Hardware" should be provided and installed by the fiberglass door and frame manufacturer.
5. Source Limitations: Glass for windows in doors shall be furnished and installed by door and frame manufacturer in accordance with related section, Division 08 Section "Glazing".

D. Submittals

1. Product technical data including:
 - a. Acknowledgment that products submitted meet requirements of standards referenced
 - b. Manufacturer shall provide certificate of compliance with current local and federal regulations as it applies to the manufacturing process.
 - c. Manufacturer's installation instructions.



- d. Schedule of doors and frames indicating the specific reference numbers as used on drawings, door type, frame type, size, handing and applicable hardware.
- e. Details of core and edge construction. Include factory-construction specifications.
- f. Certification of manufacturer's qualifications.
- 2. Submittal drawings for customer approval shall be submitted prior to manufacture and will include the following information and formatting.
 - a. Summary door schedule indicating the specific reference numbers as used on owner's drawings, with columns noting door type, frame type, size, handing, accessories and hardware.
 - b. A drawing depicting front and rear door elevations showing hardware with bill of material for each door.
 - c. Drawing showing dimensional location of each hardware item and size of each door.
 - d. Individual part drawing and specifications for each hardware item and FRP part or product.
 - e. Construction and mounting detail for each frame type.
- 3. Samples:
 - a. Provide one 21 x 18 inch completely assembled (hinged) door and frame corner section, with faces and edges representing typical color and finish. One edge should be exposed for view of interior door and frame composition.
- 4. Operation and Maintenance Manuals:
 - a. Include recommended methods and frequency for maintaining optimum condition of fiberglass doors and frames under anticipated traffic and use conditions.
 - b. Include one set of final as built drawings with the same requirements as mentioned above.
 - c. Include certificate of warranty for door and frame listing specific door registration numbers.
 - d. Include hardware data sheets and hardware manufacturer's warranties.

E. Delivery, Storage, And Handling

- 1. Each door and frame should be delivered individually crated for protection from damage in cardboard containers, clearly marked with project information, door location, specific reference number as shown on drawings, and shipping information. Each crate should contain all fasteners necessary for installation as well as complete installation instructions.
- 2. Doors should be stored in the original container out of inclement weather for protection against the elements.
- 3. Handle doors pursuant to the manufacturer's recommendations as posted on outside of crate.

F. Warranty

- 1. Warranty all fiberglass doors and frames for a period of 25 years against failure due to corrosion. Additionally, warranty all fiberglass doors and frames on materials and workmanship for a period of 10 years, including warp, separation or delamination, and expansion of the core.

1.2 PRODUCTS

A. Acceptable Manufacturers: Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

- 1. Chem-Pruf Door Co., Ltd., P.O. Box 4560, Brownsville, Texas 78523 Phone: 1-800-444-6924, Fax: 956-544-7943, Website: www.chem-pruf.com
- 2. Substitutions may be considered, provided manufacturer can comply with the specifications as written herein. Requests for substitution must be submitted in writing no less than 10 days prior to bid date.

B. FRP Doors

- 1. Fire rated Fiberglass reinforced Plastic (FRP) Doors certified by Intertek Testing Services for Warnock-Hersey in 20, 45, 60 and 90 minute ratings meeting all specifications of UL 10(c) and UL 10(b) fire door test standards.



2. Doors shall be made of fiberglass reinforced plastic (FRP) using chemically proven fire retardant resins resistant to contaminants typically found in the environment for which these specifications are written. Doors shall be 1-3/4 inch thick and of flush construction, having no seams or cracks. All doors up to 4'-0 x 8'-0 shall have equal diagonal measurements with a maximum tolerance of +/-1/32 inch.
3. Door Plates shall be molded in one continuous piece, starting with a 25-mil gelcoat of the color specified, integrally molded with at least two layers of 1.5 ounce per square foot fiberglass. This will yield a plate ratio of 30/70 glass to resin.
4. Stiles and Rails Core shall be banded with firestop per factory drawings.
5. Core material shall be fire resistant mineral core placed within band structure allowing no voids within.
6. Finish of door and frame shall be identical in color and texture. At time of manufacture, 25 mil of resin rich gelcoat must be integrally molded into both the door and frame. Secondary painting to achieve color is not acceptable.
7. Window openings shall be provided for at time of manufacture and shall be completely sealed so that the interior of the door is not exposed to the environment. Window kits shall be fire rated per U.L. for rating of opening and function.

C. Frames

1. Frames shall be fiberglass and manufactured using the resin transfer method in closed rigid molds to assure uniformity in color and size. Beginning with a minimum 25-mil gel coat and a minimum of two layers continuous strand fiberglass mat saturated with fire retardant resin, the frame will be of one-piece construction with molded stop. All frame profiles shall have a core of firestop and mineral core. Frames must be fiberglass. Frames of dissimilar materials, such as metal or stainless steel will not be accepted.
2. Finish of frame shall be identical in color and texture to the door. 25-mil resin rich gel coat will be integrally molded into the frame at time of manufacture. Secondary painting to achieve color is not acceptable.
3. Jamb/Header connection shall be coped by CNC for tight fit.
4. Internal Reinforcement shall be continuous within the structure to allow for mounting of specified hardware.
5. Mortises for hardware shall be accurately machined by CNC to hold dimensions in all three axis.
6. Hinge pockets shall be accurately machined by CNC to facilitate heavy-duty hinges at all hinge locations, using spacers when standard weight hinges are used.

D. Hardware

1. See Division 08 Section "Door Hardware".
2. Due to the special nature of the material in this section, all related hardware as specified must be furnished and installed by the door and frame manufacturer.

1.3 EXECUTION

A. Installation Conditions

1. Verification of Conditions
 - a. Openings are correctly prepared to receive doors and frames.
 - b. Openings are correct size and depth in accordance with shop drawings or submittals.
2. Installer's Examination
 - a. Have the installer examine conditions under which construction activities of this section are to be performed and submit a written report if conditions are unacceptable.
 - b. Transmit two copies of the installer's report to the architect within 24 hours of receipt.
 - c. Beginning construction activities of this section before unacceptable conditions have been corrected is prohibited.

B. Installation



1. Install door-opening assemblies in accordance with shop drawings and manufacturer's printed installation instructions, using installation methods and materials specified in installation instructions.
 2. Field alteration of doors or frames to accommodate field conditions is strictly prohibited.
 3. Site tolerances: Maintain plumb and level tolerance specified in manufacturers printed installation instructions.
 4. Fire labeled doors and frames must be installed in strict accordance with manufacturer's instructions and the latest revision of NFPA 80.
 5. UL 10 (c) Category B doors require field-applied seal per manufacture's instructions.
- C. Adjusting
1. Adjust doors in accordance with door manufacturer's maintenance instructions to swing open and shut without binding and to remain in place at any angle without being moved by gravitational influence.
 2. Adjust door hardware to operate correctly in accordance with hardware manufacturer's maintenance instructions.
- D. Cleaning
1. Clean surfaces of door opening assemblies and exposed door hardware in accordance with respective manufacturer's maintenance instructions.
- E. Protection Of Installed Products
1. Protect door opening assemblies and door hardware from damage by subsequent construction activities until final inspection.

END OF SECTION 08 16 13 00



SECTION 08 16 13 00a - INSULATED FIBERGLASS DOORS AND FRAMES

1.1 GENERAL

A. Description of Work

1. This specification covers the furnishing and installation of materials for insulated fiberglass doors and frames. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of door.
2. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details; location and extent of hardware blocking; mortises, holes, and cutouts; requirements for veneer matching; factory finishing; fire ratings; and other pertinent data.
3. Samples: For each face material and finish.

C. Quality Assurance

1. Fire-Rated Doors: Doors that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated.

D. Delivery, Storage, And Handling

1. Each door and frame should be delivered individually crated for protection from damage in cardboard containers, clearly marked with project information, door location, specific reference number as shown on drawings, and shipping information. Each crate should contain all fasteners necessary for installation as well as complete installation instructions.
2. Doors should be stored in the original container out of inclement weather for protection against the elements.
3. Handle doors pursuant to the manufacturer's recommendations as posted on outside of crate.

1.2 PRODUCTS

A. Doors

1. Insulated door panel shall be 44mm (1 3/4") thick, IM (Impression Molded) fiberglass skinned door panel. Doors shall be flush or embossed to simulate a panel door, **as directed**.
2. The door skins shall be capable of being painted or stained to simulate the appearance of an oak panel door.

B. Frames

1. Fiberglass frame profiles shall be made from 65% to 85% glass fibers, made by spinning melted silica sand, and 15% to 35% resin, based on a petroleum derived alkide.
2. The frame shall be insulated with expanded polystyrene. Frame corners shall be assembled with polyester corner blocks and sealed with silicone caulk.
3. Fiberglass and aluminum lineals coated with water borne acrylic/urethane shall be available at Owner's option.

C. Brick Mould: Extruded aluminum brick moulds with or without integral nailing fins are available.

D. Sill: Extruded mill finish aluminum clad finger jointed pine with a self draining vinyl crown under the door slab.

E. Weather-Stripping: Kerf mounted low friction elastomeric wrapped open cell urethane. Adjustable self draining multi-finned sweep at sill.



- F. Jamb Extensions: Wood jamb extensions shall be available as directed, in depths required.
- G. Hardware Preparation: Doors shall be prepared to receive hardware at the factory as follows, **unless directed otherwise**:
 - 1. Backset: 70mm (2 3/4"), face bore 54mm (2 1/8"), edge bore 25mm (1").
 - 2. For 30" doors or 32" doors with glass, backset: 59mm (2 3/8"), face bore 54mm (2 1/8"), edge bore 25mm (1").
 - 3. Striker plate area shall be reinforced to resist forced entry.
- H. Glass: The insulating glass shall conform to CAN/CSGB-12.8-M90. High Performance glazing option shall include; insulating spacers, triple glazing, spectrally selective daylighting glass, tinted glass, reflective glass, Heat Mirror™, pyrolitic (hard coat) low emissive glass and sputtered (soft coat) low emissive glass, as well as standard safety glass options.
- I. Glazing: Glass shall be held in place by removable wood or PVC stops with integral coextruded fins and integral drainage, **as directed**.

1.3 EXECUTION

- A. Installation
 - 1. Install door-opening assemblies in accordance with shop drawings and manufacturer's printed installation instructions, using installation methods and materials specified in installation instructions.
 - 2. Field alteration of doors or frames to accommodate field conditions is strictly prohibited.
 - 3. Site tolerances: Maintain plumb and level tolerance specified in manufacturers printed installation instructions.
 - 4. Fire labeled doors and frames must be installed in strict accordance with manufacturer's instructions and the latest revision of NFPA 80.
- B. Adjusting
 - 1. Adjust doors in accordance with door manufacturer's maintenance instructions to swing open and shut without binding and to remain in place at any angle without being moved by gravitational influence.
 - 2. Adjust door hardware to operate correctly in accordance with hardware manufacturer's maintenance instructions.
- C. Cleaning
 - 1. Clean surfaces of door opening assemblies and exposed door hardware in accordance with respective manufacturer's maintenance instructions.
- D. Protection Of Installed Products
 - 1. Protect door opening assemblies and door hardware from damage by subsequent construction activities until final inspection.

END OF SECTION 08 16 13 00a



SECTION 08 16 13 00b - FIBERGLASS REINFORCED POLYESTER (FRP) FLUSH DOORS

1.1 GENERAL

A. Description of Work

1. This specification covers the furnishing and installation of materials for fiberglass reinforced polyester (FRP) flush doors and aluminum frames. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Performance Requirements

1. General: Provide door assemblies that have been designed and fabricated to comply with specified performance requirements, as demonstrated by testing manufacturer's corresponding standard systems.
2. Air Infiltration: For a single door 3'-0" x 7'-0", test specimen shall be tested in accordance with ASTM E 283 at pressure differential of 6.24 psf. Door shall not exceed 0.90 cfm per linear foot of perimeter crack.
3. Water Resistance: For a single door 3'-0" x 7'-0", test specimen shall be tested in accordance with ASTM E 331 at pressure differential of 7.50 psf. Door shall not have water leakage.
4. Hurricane Test Standards, Single Door with Single-Point Latching:
 - a. Uniform Static Load, ASTM E 330: Plus or minus 75 pounds per square foot.
 - b. Forced Entry Test, 300 Pound Load Applied, SFBC 3603.2 (b)(5): Passed.
 - c. Cyclic Load Test, SFBC PA 203: Plus or minus 53 pounds per square foot.
 - d. Large Missile Impact Test, SFBC PA 201: Passed.
5. Swinging Door Cycle Test, Doors and Frames, ANSI A250.4: Minimum of 20,000,000 cycles.
6. Swinging Security Door Assembly, Doors and Frames, ASTM F 476: Grade 40.
7. Salt Spray, Exterior Doors and Frames, ASTM B 117: Minimum of 500 hours.
8. Sound Transmission, Exterior Doors, STC, ASTM E 90: Minimum of 25.
9. Thermal Transmission, Exterior Doors, U-Value, AAMA 1503-98: Maximum of 0.29 BTU/hr x sf x degrees F. Minimum of 55 CRF value.
10. Surface Burning Characteristics, FRP Doors and Panels, ASTM E 84:
 - a. Flame Spread: Maximum of 200, Class C.
 - b. Smoke Developed: Maximum of 450, Class C.
11. Surface Burning Characteristics, Class A Option On Interior Faces of FRP Exterior Panels and Both Faces of FRP Interior Panels, ASTM E 84:
 - a. Flame Spread: Maximum of 25.
 - b. Smoke Developed: Maximum of 450.
12. Impact Strength, FRP Doors and Panels, Nominal Value, ASTM D 256: 15.0 foot-pounds per inch of notch.
13. Tensile Strength, FRP Doors and Panels, Nominal Value, ASTM D 638: 14,000 psi.
14. Flexural Strength, FRP Doors and Panels, Nominal Value, ASTM D 790: 21,000 psi.
15. Water Absorption, FRP Doors and Panels, Nominal Value, ASTM D 570: 0.20 percent after 24 hours.
16. Indentation Hardness, FRP Doors and Panels, Nominal Value, ASTM D 2583: 55.
17. Abrasion Resistance, Face Sheet, Taber Abrasion Test, 25 Cycles at 1,000 Gram Weight with CS-17 Wheel: Maximum of 0.029 average weight loss percentage.
18. Stain Resistance, ASTM D 1308: Face sheet unaffected after exposure to red cabbage, tea, and tomato acid. Stain removed easily with mild abrasive or FRP cleaner when exposed to Sharpie ink pen and white spray paint.
19. Chemical Resistance, ASTM D 543. Excellent rating.
 - a. Acetic acid, 5 percent solution.
 - b. Chlorine bleach, 10 percent solution.
 - c. Sodium hypochlorite, 4 to 6 percent solution.
 - d. Citric acid, 10 percent solution.
 - e. Sodium carbonate, 20 percent solution.



- f. Turpentine.
- 20. Compressive Strength, Foam Core, Nominal Value, ASTM D 1621: 84.2 psi.
- 21. Compressive Modulus, Foam Core, Nominal Value, ASTM D 1621: 448 psi.
- 22. Tensile Adhesion, Foam Core, Nominal Value, ASTM D 1623: 48 psi.
- 23. Thermal and Humid Aging, Nominal Value, 158 Degrees F and 100 Percent Humidity for 14 Days, ASTM D 2126: Minus 4.89 percent volume change.

C. Submittals

- 1. Product Data: Submit manufacturer's product data, including description of materials, components, fabrication, finishes, and installation.
- 2. Shop Drawings: Submit manufacturer's shop drawings, including elevations, sections, and details, indicating dimensions, tolerances, materials, fabrication, doors, panels, framing, hardware schedule, and finish.
- 3. Samples:
 - a. Door: Submit manufacturer's sample of door showing face sheets, core, framing, and finish.
 - b. Color: Submit manufacturer's samples of standard colors of doors and frames.
- 4. Test Reports: Submit certified test reports from qualified independent testing agency indicating doors comply with specified performance requirements.
- 5. Manufacturer's Project References: Submit list of successfully completed projects including project name and location, name of architect, and type and quantity of doors manufactured.
- 6. Maintenance Manual: Submit manufacturer's maintenance and cleaning instructions for doors, including maintenance and operating instructions for hardware.
- 7. Warranty: Submit manufacturer's standard warranty.

D. Quality Assurance

- 1. Manufacturer's Qualifications:
 - a. Continuously engaged in manufacturing of doors of similar type to that specified, with a minimum of 25 years successful experience.
 - b. Door and frame components from same manufacturer.
 - c. Evidence of a compliant documented quality management system.

E. Delivery, Storage, And Handling

- 1. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying opening door mark and manufacturer.
- 2. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.
- 3. Handling: Protect materials and finish from damage during handling and installation.

F. Warranty

- 1. Warrant doors, frames, and factory hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects in hardware installation, and deterioration of finish or construction in excess of normal weathering.
- 2. Warranty Period: Ten years starting on date of shipment.

1.2 PRODUCTS

A. Manufacturer: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- 1. Special-Lite, Inc., PO Box 6, Decatur, Michigan 49045. Toll Free (800) 821-6531. Phone (269) 423-7068. Fax (800) 423-7610. Web Site www.special-lite.com. E-Mail info@special-lite.com.

B. FRP Flush Doors

- 1. Model: SL-17 Flush Doors with SpecLite3 fiberglass reinforced polyester (FRP) face sheets.
- 2. Door Opening Size: As indicated on the Drawings **OR as directed**.



3. Construction:
 - a. Door Thickness: 1-3/4 inches.
 - b. Stiles and Rails: Aluminum Alloy 6063-T5, minimum of 2-5/16-inch depth.
 - c. Corners: Mitered.
 - d. Provide joinery of 3/8-inch diameter full-width tie rods through extruded splines top and bottom as standard tubular shaped stiles and rails reinforced to accept hardware as specified.
 - e. Securing Internal Door Extrusions: 3/16-inch angle blocks and locking hex nuts for joinery. Welds, glue, or other methods are not acceptable.
 - f. Furnish extruded stiles and rails with integral reglets to accept face sheets. Lock face sheets into place to permit flush appearance.
 - g. Rail caps or other face sheet capture methods are not acceptable.
 - h. Extrude top and bottom rail legs for interlocking continuous weather bar.
 - i. Meeting Stiles: Pile brush weatherseals. Extrude meeting stile to include integral pocket to accept pile brush weatherseals.
 - j. Bottom of Door: Install bottom weather bar with nylon brush weatherstripping into extruded interlocking edge of bottom rail.
 4. Face Sheet:
 - a. Material: SpecLite3 FRP, 0.120-inch thickness, finish color throughout. Abuse-resistant engineered surface.
 - b. Texture: Pebble.
 - c. Color: **As directed.**
 5. Core:
 - a. Material: Poured-in-place polyurethane foam.
 - b. Density: Minimum of 5 pounds per cubic foot.
 - c. R-Value: Minimum of 9.
 6. Cutouts:
 - a. Manufacture doors with cutouts for required vision lites, louvers, and panels.
 - b. Factory install vision lites, louvers, and panels.
 7. Hardware:
 - a. Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule.
 - b. Factory install hardware.
- C. Materials
1. Aluminum Members:
 - a. Extrusions: ASTM B 221.
 - b. Sheet and Plate: ASTM B 209.
 - c. Alloy and Temper: As required by manufacturer for strength, corrosion resistance, application of required finish, and control of color.
 2. Components: Door and frame components from same manufacturer.
 3. Fasteners:
 - a. Material: Aluminum, 18-8 stainless steel, or other noncorrosive metal.
 - b. Compatibility: Compatible with items to be fastened.
 - c. Exposed Fasteners: Screws with finish matching items to be fastened.
- D. Fabrication
1. Sizes and Profiles: Required sizes for door and frame units, and profile requirements shall be as indicated on the Drawings.
 2. Coordination of Fabrication: Field measure before fabrication and show recorded measurements on shop drawings.
 3. Assembly:
 - a. Complete cutting, fitting, forming, drilling, and grinding of metal before assembly.
 - b. Remove burrs from cut edges.
 4. Welding: Welding of doors or frames is not acceptable.
 5. Fit:



- a. Maintain continuity of line and accurate relation of planes and angles.
- b. Secure attachments and support at mechanical joints with hairline fit at contacting members.

E. Architectural Panels

1. FRP Panels:
 - a. Model: SL-37 Architectural Panels with SpecLite3 FRP face sheets.
 - b. Size: As indicated on the Drawings **OR as directed**.
 - c. Thickness: 1/4 inch **OR** 1 inch **OR** As indicated on the Drawings **OR as directed**.
2. Face Sheets:
 - a. Material: SpecLite3 FRP, 0.120-inch thickness, finish color throughout. Abuse-resistant engineered surface.
 - b. Texture: Pebble.
 - c. Color: **As directed**.
3. Insulated SpecLite3 FRP Panels:
 - a. Insulated Panels: Two 0.120-inch minimum thickness sheets.
 - b. Core: Foamed polyurethane core of a minimum of 5 pounds per cubic foot density.
 - c. Form components to function as single unit.
 - d. U-Value: Minimum of 0.23 for 1-inch panels.
4. Class A Flame Spread and Smoke Developed Rating, **as directed**:
 - a. Class A flame spread and smoke developed rating on interior faces of exterior panels and both faces of interior panels.
 - b. Flame Spread, ASTM E 84: Maximum of 25.
 - c. Smoke Developed, ASTM E 84: Maximum of 450.

F. Aluminum Door Framing Systems

1. Tubular Framing:
 - a. Size and Type: As indicated on the Drawings.
 - b. Materials: Aluminum Alloy 6063-T5, 1/8-inch minimum wall thickness.
 - c. Applied Door Stops: 0.625-inch high, with screws and weatherstripping. Door stop shall incorporate pressure gasketing for weathering seal. Counterpunch fastener holes in door stop to preserve full metal thickness under fastener head.
 - d. Frame Members: Box type with 4 enclosed sides. Open-back framing is not acceptable.
 - e. Caulking: Caulk joints before assembling frame members.
 - f. Joints:
 - 1) Secure joints with fasteners.
 - 2) Provide hairline butt joint appearance.
 - g. Field Fabrication: Field fabrication of framing using stick material is not acceptable.
 - h. Applied Stops: For side, transom, and borrowed lites and panels. Applied stops shall incorporate pressure gasketing for weathering seal. Reinforce with solid bar stock fill for frame hardware attachments.
 - i. Hardware:
 - 1) Premachine and reinforce frame members for hardware in accordance with manufacturer's standards and hardware schedule.
 - 2) Factory install hardware.
 - j. Anchors:
 - 1) Anchors appropriate for wall conditions to anchor framing to wall materials.
 - 2) Door Jamb and Header Mounting Holes: Maximum of 24-inch centers.
 - 3) Secure head and sill members of transom, side lites, and similar conditions.
 - k. Side Lites:
 - 1) Factory preassemble side lites to greatest extent possible.
 - 2) Mark frame assemblies according to location.
2. Insert Framing System:
 - a. Model: SL-1030 Series, SL-1031 **OR** SL-1032 **OR** SL-1034, **as directed**.
 - b. Insert frame as indicated on the Drawings, using integral stop fitted with weatherstripping.



- c. Corner joints of miter design, secure with furnished aluminum clips, and screw into place.
 - d. Hardware:
 - 1) Premachine and reinforce insert frame members for hardware in accordance with manufacturer's standards and hardware schedule.
 - 2) Factory install hardware.
 - e. Anchors:
 - 1) Anchors of suitable type to fasten insert framing to existing frame materials.
 - 2) Minimum of 5 anchors on jambs up to 7'-4" height, 3 anchors on headers, and 1 additional anchor for each additional foot of frame.
 - 3. Frame Capping:
 - a. Model: SL-70.
 - b. Capping: With insert frame as indicated on the Drawings, **OR as directed**.
 - c. Finish: Match framing.
- G. Hardware
- 1. Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule.
 - 2. Factory install hardware.
 - 3. Hardware Schedule: As specified in Division 08 Section "Door Hardware" **OR** As indicated on the Drawings, **OR as directed**.
 - a. Hinges shall be continuous type.
 - 4. Finish: As specified in Division 08 Section "Door Hardware" **OR** As indicated on the Drawings, **OR as directed**.
- H. Vision Lites
- 1. Factory Glazing: 1/4-inch glass **OR** 1-inch glass insulating units, **as directed**.
 - 2. Lites in Exterior Doors: Allow for thermal expansion.
 - 3. Rectangular Lites:
 - a. Size: 12 inches by 12 inches **OR** Half lite **OR** Full lite **OR** Narrow lite **OR** Double lite **OR** As indicated on the Drawings **OR as directed**.
 - b. Factory glazed with screw-applied aluminum stops anodized to match perimeter door rails.
 - 4. Security Grate: SL-SG349.
 - a. Frame Perimeter: 1-inch by 1-inch by 1/8-inch steel angle.
 - b. Expanded Metal: 1/4-inch diameter, round hole perforated, 14-gauge steel sheet.
 - c. Finish: Factory painted to match door finish.
 - 5. Vandal Screen: SL-SG350.
 - a. Frame Perimeter: Aluminum. Finish to match vision lite.
 - b. Expanded Metal: 1/4-inch diameter, round hole perforated, 16-gauge stainless steel sheet. Powder coat black finish.
- I. Louvers
- 1. Type: Aluminum, inverted Y-type, fixed blade, 12 inches minimum from bottom of door.
 - 2. Size: As indicated on the Drawings **OR** as directed.
 - 3. Installation: Factory installed into standard vision lite kit. Exterior side of louver shall be free of fasteners.
 - 4. Insect screen.
- J. Aluminum Finishes
- 1. Anodized Finish: Class I finish, 0.7 mils thick.
 - a. Clear 215 R1, AA-M10C12C22A41, Class I, 0.7 mils thick.
 - b. Champagne, AA-M10C12C22A44, Class I, 0.7 mils thick.
 - c. Light Bronze, AA-M10C12C22A44, Class I, 0.7 mils thick.
 - d. Medium Bronze, AA-M10C12C22A44, Class I, 0.7 mils thick.
 - e. Dark Bronze, AA-M10C12C22A44, Class I, 0.7 mils thick.
 - f. Black, AA-M10C12C22A44, Class I, 0.7 mils thick.
 - 2. Painted: as directed by the Owner.



1.3 EXECUTION

A. Preparation

1. Ensure openings to receive frames are plumb, level, square, and in tolerance.

B. Installation

1. Install doors in accordance with manufacturer's instructions.
2. Install doors plumb, level, square, true to line, and without warp or rack.
3. Anchor frames securely in place.
4. Separate aluminum from other metal surfaces with bituminous coatings or other means approved by the Owner.
5. Set thresholds in bed of mastic and backseal.
6. Install exterior doors to be weathertight in closed position.
7. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by the Owner.
8. Remove and replace damaged components that cannot be successfully repaired as determined by the Owner.

C. Field Quality Control

1. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for installation of doors.

D. Adjusting

1. Adjust doors, hinges, and locksets for smooth operation without binding.

E. Cleaning

1. Clean doors promptly after installation in accordance with manufacturer's instructions.
2. Do not use harsh cleaning materials or methods that would damage finish.

F. Protection

1. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of Final Completion.

END OF SECTION 08 16 13 00b



Task	Specification	Specification Description
08 17 23 00	08 14 16 00	Flush Wood Doors



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SECTION 08 30 00 00 - MPF SPECIALTY DOORS AND FRAMES**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 – GENERAL

1.1 SUMMARY

- A. Overhead coiling doors.
- B. Rapid roll-up doors.
- C. Traffic/impact doors.

1.2 SUBMITTALS

- A. Shop Drawings: Required.
- B. Product Data: Required.
- C. Samples: Required
- D. Certificates of Quality Assurance: Required

1.3 QUALITY ASSURANCE

- A. Compliance with local governing codes.
- B. Compliance with ASCE-7 for wind loading requirements.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Overhead Coiling Doors
 - 1. Source: Overhead Door, Cornell, Cookson, Atlas.
 - 2. Curtain: Constructed of interlocking flat slat of a min. 18 gauge thick front steel sheet and a min. 24 gauge rear steel sheet, approximately 3" high.



3. Guides: Metal side guides, finish to match curtain.
4. Hood: minimum 24 gauge steel sheet, finish to match curtain.
5. Reversing Safety Edge.
6. Counter Balance Assembly: Heat treated helical torsion springs secured within Steel-pipe barrel with a maximum deflection not to exceed .03 inches per foot of width.
7. Operating Mechanism: Motor operated min. ½ HP, single phase, 120V. Provide disconnect to permit manual chain hoist operation in the event of power failure or motor burn-out. Provide electrical interlock to prevent motor burn-out in case lock remains engaged.
8. Automatic Operation: Wall-mounted single key activated switch or induction loop.
9. Locking: Security lockout capability.
10. Insulation: Provide minimum R-11 insulating value for exterior doors.
11. Finish: Shop primed and field painted.

B. Rapid Roll-up Doors

1. Source
 - a.) Rytec.
 - b.) Marathon
 - c.) Albany
 - d.) Dynaco
 - e.) Rite-Hite
2. Features:
 - a.) Interior Doors
 - i.) Rytec: Model Preda Door 5500, with Impact Release system allowing immediate reset without tools, or equal.
 - ii.) Material: Minimum 71 oz., 2-ply monofilament curtain, color blue. Material to be laterally stiff and vertically flexible for enhanced wind/pressure resistance. Curtain sections connect by two integral extruded panel connecting ribs. Door curtain to have modular design to allow for easy curtain section replacement.
 - iii.) Usage: Door and all components to be designed for heavy-duty cycles and operation.
 - iv.) Bottom Bar: Rigid extruded aluminum with breakaway feature allowing release in either direction upon impact and immediate reset without the use of tools. Wireless with control-reliable 2-way communication, frequency-hopping technology and minimum 3-year battery life. Dual cut-off switches shut off motor when bottom bar is impacted.
 - v.) Motor: Variable-speed, AC drive, 42-50 inches per second opening and 21 inches per second closing. Adjustable, independent opening and closing speeds.
 - vi.) Controls: Programmable self-diagnostic controller with two-line, 32-character external display for status messaging and diagnostics.
 - vii.) Activation Devices: Induction loop and manual push button with time-delay closing.
 - viii.) Safety: Full width pneumatic safety reversing edge and (2) two thru-beam photo eyes.
 - ix.) Travel Limits: Absolute rotary encoder to regulate door travel limits. Limits adjusted, without tools at control panel, not motor. Control software to incorporate a self-adjusting limit feature where the software monitors the door position and adjusts the limits, as required, to maintain a proper seal.
 - x.) Vision Panel: Full width of door, minimum 31" high, replaceable.
 - xi.) Side Frames: Fully bolt-together, anodized aluminum construction.
 - xii.) Weatherseal: Dual, full-height weatherseals to seal against both sides of door panel long with full-width, header seal and full-width seal on bottom bar.
 - xiv.) Warranty: 2-year warranty on door with an extended 5-year warranty on door curtain.
 - b.) Exterior Doors
 - i.) Rytec: Model Fast-Seal FS 1000, or equal.
 - ii.) Material: Minimum 86 oz., 3-ply monofilament curtain, color blue. Material to be laterally stiff and vertically flexible for enhanced wind/pressure resistance.
 - iii.) Usage: Door and all components to be designed for heavy-duty cycles and operation.
 - iv.) Bottom Bar: Rigid extruded aluminum with breakaway feature allowing release in either direction upon impact and immediate reset without the use of tools. Wireless with



- control-reliable 2-way communication, frequency-hopping technology and minimum 3-year battery life. Dual cut-off switches shut off motor when bottom bar is impacted.
- v.) Counterbalance: Custom-Sized, dual counter-weight with life-time warranty on counter-weight system.
- vi.) Curtain Tension: Must be separate from counterbalance system and maintain constant tension on door curtain.
- vii.) Motor: Variable-speed, AC drive, 50 inches per second opening and closing and 21 inches per second closing. Adjustable, independent opening and closing speeds.
- viii.) Controls: Programmable self-diagnostic controller with two-line, 32-character external display for status messaging and diagnostics.
- ix.) Activation Devices: Motion sensors, one on each side with time-delay closing.
- x.) Safety: Full width pneumatic safety reversing edge and (2) two thru-beam photo eyes.
- xi.) Travel Limits: Absolute rotary encoder to regulate door travel limits. Limits adjusted, without tools at control panel, not motor. Control software to incorporate a self-adjusting limit feature where the software monitors the door position and adjusts the limits, as required, to maintain a proper seal.
- xii.) Windbars: Front and/or rear windbars according to manufacturers recommendation.
- xiii.) Vision Panel: Minimum 3 replaceable panels – 17"x17" each.
- xiv.) Side Frames: 11-gauge reinforced side frames with front and rear wind bar guides, 14-gauge hinges access covers.
- xv.) Weatherseals: Dual, full-height weatherseals to seal against both sides of door panel long with full-width, header seal and full-width seal on bottom bar.
- xvi.) Warranty: 1-year warranty on door with an extended 5-year warranty on door curtain.

C. Traffic/Impact Doors

1. This product must be manufactured by a USPS selected vendor and is subject to a USPS price and requirements purchasing agreement. The following vendor contact must be used:
Chase Industries, Inc., Cincinnati, OH
Ordering POC: Arlene Macht (800) 543-4455 ext. 2979, or website "www.chasedoors.com/usps", user name "usps", password is "doors".
2. Section 016000 – Product Requirements: Product options and substitutions. Substitutions: not permitted.
3. Model: Chase Industries: Duralite Series 200
4. Door Construction and Options: Per Manufacturer's USPS Approved Construction.

PART 3 - EXECUTION

3.1. INSTALLATION

- A. Upon completion of installation, provide field inspection and testing.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 3/31/2010

END OF SECTION 08 30 00 00



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SECTION 08 31 13 00 - CSF ACCESS DOORS AND FRAMES

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.08 31 13 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Fire-resistive rated access door and frame units.
 2. Non fire-resistive rated access door and frame units.
 3. Wall and ceiling locations.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 1. Product Data: Sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
 2. Shop Drawings: Indicate exact position of all access door units.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 1. Project Record Documents: Accurately record the following:
 - a. Actual locations of all access units.

1.3 QUALITY ASSURANCE

- A. Qualifications:
 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.



1.4 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
1. J.L. Industries, Bloomington, MN (612) 835-6850. (800) 554-6077.
 2. Karp, Maspeth, NY (800) 888-4212.
 3. Larsen's Manufacturing Company, Minneapolis, MN (800) 527-7367.
 4. Milcor, Holland, OH (800) 861-6452.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 ACCESS DOORS

- A. Non Fire-Rated: 20 gauge recessed steel panel doors to accept field finish of drywall.
- B. Fire-Rated Models: 14 gauge recessed steel panel doors to accept field finish of drywall.

2.3 FABRICATION

- A. Fabricate frames and flanges of 16 gauge (0.058 inch) steel.
- B. Fabricate door panels of 20 gauge (0.359 inch) single thickness steel sheet for non fire rated doors and 14 gauge (0.070 inch) single thickness steel sheet for fire rated doors.
- C. Weld, fill, and grind joints to ensure flush and square unit.
- D. Hardware:
1. Hinge: 175 degree stainless steel piano hinge concealed constant force closure spring type.[]
 2. Lock: Screw driver slot for quarter turn cam lock unit.

2.4 FINISHES

- A. Base Metal Protection: Prime coat units with alkyd primer.



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify that rough openings for door and frame are correctly sized and located.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install units in accordance with manufacturer's published instructions where indicated on Drawings and required for access.
- B. Install frames plumb and level in opening. Secure rigidly in place.
- C. Position unit to provide convenient access to concealed work requiring access.

3.3 CONSTRUCTION

- A. Interface with Other Work: Coordinate with mechanical, electrical, and other Work requiring access units.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



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SECTION 08 33 23 00 - CSF OVERHEAD COILING DOORS**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Folding Grilles (Section 083500) are now standard for closing service counters in new CSF Small Facilities, CSF Medium Facilities and Retail Standard Designs (RSD) for interior tenant improvements. Sectional Overhead Doors (Section 083613) are standard for truck doors on enclosed platforms in new CSF Small Facilities and CSF Medium Facilities. This section may not be used to specify overhead coiling doors as truck doors for enclosed platforms. This section may only be used to replace existing overhead coiling grilles in existing retail areas. A design deviation request must be submitted and approved before overhead coiling doors are installed in new CSF Small, CSF Medium or RSD facilities.

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER. Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.08 33 23 00**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Overhead coiling security door. (manually and electrically operated)
 - 2. Hardware.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 087100 - Door Hardware: Keyed cylinders for door locks.

1.2 REFERENCES

- A. Underwriter's Laboratories (UL):
 - 1. UL #325 - Standard for Door, Drapery, Gate, Louver and Window Operators and Systems.
- B. Door and Access Systems Manufacturing Association (DASMA):
 - 1. DASMA #202-1999 Metal Coiling Slat Door Terminology.
 - 2. DASMA #203-2001 Standards for Non-Fire Rated Rolling Doors.



1.3 DEFINITIONS

- A. Operation cycle: One complete cycle of a door begins with the door in the closed position. The door is then moved to the open position and back to the closed position.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural performance to include providing overhead coiling door capable of withstanding the effects of gravity.
- B. Operating cycle requirements: Design overhead coiling door components and operator to operate for not less than 20,000 cycles.

1.5 SUBMITTALS

- A. Reference section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Submit all manufacturers product data.
 - 2. Shop drawings: Include special conditions not detailed in manufacturers product data and interface with adjacent conditions.
 - 3. Assurance/Control Submittals:
 - a. Test Reports: Submit the following reports directly to Contracting Officer from Testing Laboratory, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements.
 - b. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - c. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
 - d. Manufacturer's Installation Instructions.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Project Record Documents including Operating and Maintenance Manual.
 - 2. Certificate stating properly installed materials that comply with this specification.

1.6 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 - 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience and approved by manufacturer

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

1.8 WARRANTY

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.



PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. AlumaTek, Inc., Greenville, RI (800) 949-9950.
 2. Cornell Ironworks, Mountaintop, PA (800) 233-8366.
 3. Cookson Corporation, Phoenix, AZ (800) 294-4358.
 4. Dynaflair Corporation, Tampa, FL (813) 248-8100 (800) 624-3667.
 5. Dynamic Closures Corporation, Massena, NY (800) 663-4599.
 6. Metro Door, Hauppauge, NY, (800) 669-3667.
 7. Overhead Door Corporation, Farmer's Branch, TX (800) 972-1730.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 COILING DOORS

- A. Model:
 1. AlumaTek: Solid Slat Clear Anodized Aluminum Model SA, Manual or Motor Operated.
 2. Cornell: Rolling Service Door (Motor Operated) Model PFI-5F.
 3. Cookson: Service Door (Motor Operated) Model JRA Manual.
 4. Dynaflair: Overhead Coiling Shutter, Manual or Motor Operated.
 5. Dynamic: Vortex, Manual or Motor Operated.
 6. Metro: Rolling Door CFMA, Motor Operated, Model CFPA, Manual.
 7. Overhead: Service Door Series 610, Manual or Motor Operated.
- B. Curtain: Constructed of interlocking flat slats of a min. #16 B&S gauge (0.050 inch) (1.25 mm) thick aluminum. Each slat face to be approximately 1 ½ inch high and ½ inch deep. Endlock shall prevent slats from shifting side to side.
- C. Guides: Side guides are to be of extruded aluminum with high density polypile inserts. Finish to match curtain.
- D. Bottom Bar: Heavy duty extruded aluminum with key locking cylinders to exterior. Finish to match curtain. On manual lift type provide a vinyl astragal attached to bottom of bottom bar to prevent tile damage. On motor operated door type provide reversing electric sensing edge. Vinyl astragal or sensing edge shall be solid gray or solid black color. Sensing edge shall be a maximum 2 inches high by 2 inches wide.
- E. Hood: Not used in concealed ceiling installations. Otherwise, in exposed installation, aluminum finish to match curtain.
- F. Counter Balance Assembly:
 1. Barrel: Steel pipe capable of supporting curtain and counterbalance weight with maximum deflection of 0.03 inches per foot of width.
 2. Spring Assembly: Oil tempered, heat treated helical torsion spring assembly designed to balance door so maximum effort to operate will not exceed 25 lbs. Provide charge wheel for applying and adjusting spring torque. Design cycle life to be 10,000 cycles.



3. Viscous speed governor to be installed to prevent free fall of curtain.
- G. Brackets: Fabricate reinforced steel end plates not less than 3/16 inch thick to support curtain and counterbalance assembly and form end closure plates. Provide bearing in rotating shaft bracket. Clear anodized finish.
- H. Structural Supports: Provide all required structural steel tube support columns, angles, anchorage, etc. Anchor to floor and roof structure as required. Coordinate with Contractor.
- I. Operation:
 1. Single Counter: Manual hand chain lift or hand crank lift with overhead counterbalance device requiring 25 pounds nominal force to operate.
 2. Two or More Counter Configuration: Motor operated. Provide floor level disconnect chain/cable to permit manual chain hoist operation in the event of power failure or motor burn-out. Provide electrical interlock to prevent motor burn-out in case lock remains engaged. Provide reversing electric sensing edge, with a self-retracting cable on an automatic take-up reel.
- J. Switches: Provide flush-mounted single key activated switch operated by constant pressure contact for each overhead door as listed in UL#325, 30.1.1. Control switch must be located so that the overhead coiling door will be within sight of the person operating the switch. Preferred installation location is just inside Wicket Door on workroom side. If this location is not available, architect to approve alternate location. If installed in public lobby, cover must be installed with non-removable screws. Attach warning label at control switch in accordance with UL #325, 53.3.
- K. Finish: Clear anodized.
- L. Locking Device: Locking mechanism at center bottom of bar with lock bars engaging door guides at both jambs. Door is to be shipped with temporary construction cores. Cylinders and keying shall match previous or adjacent doors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 1. Verify that opening sizes, tolerances, and conditions are as indicated on Drawings.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install door unit assembly in accordance with published manufacturer's instructions.



- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely and rigidly brace components suspended from structure.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- E. Sensing edge bottom is to be above the ceiling edge.

3.3 CONSTRUCTION

- A. Site Tolerances:
 - 1. Maintain dimensional tolerances and alignment with adjacent work.
 - 2. Maximum Variation From Plumb: 1/16 inch.
 - 3. Maximum Variation From Level: 1/16 inch.

3.4 ADJUSTING

- A. Following completion of installation, including related work by others; lubricate, test, and adjust doors for ease of operation, free of warp, distortion or twist.

3.5 CLEANING

- A. Section 017300 - Execution: Cleaning installed work.
- B. Clean surfaces soiled by work as recommended by manufacturer.
- C. Remove labels and visible markings.

3.6 DEMONSTRATION

- A. Demonstrate proper operation to Owner's Representative.
- B. Instruct Owner's Representative in proper maintenance procedures.

USPS CSF Specification to be issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



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SECTION 08 33 36 00 - SIDE COILING GRILLES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for side coiling grilles. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Performance Requirements

1. Operation-Cycle Requirements: Provide side coiling grille components and operators capable of operating for not less than 10,000 **OR** 20,000, **as directed**, cycles and for 10 cycles per day.

C. Submittals

1. Product Data: For each type and size of side coiling grille and accessory.
2. Shop Drawings: Include plans, elevations, sections, details, and attachment to other work.
3. Samples: For each exposed finish.

D. Quality Assurance

1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.

1.2 PRODUCTS

A. Grille Curtain Materials And Construction

1. Grille Curtain: Network of 1/4-inch- (6-mm-) **OR** 5/16-inch- (8-mm-), **as directed**, minimum diameter horizontal rods, or rods covered with tube spacers. Interconnect rods by vertical links approximately 5/8 inch (16 mm) wide and rotating on rods.
 - a. Space rods at approximately 1-1/2 inches (38 mm) o.c.
 - b. Space links approximately 3 inches (76 mm) apart in a straight in-line **OR** staggered, **as directed**, pattern.
 - c. Steel Grille Curtain: Hot-dip zinc-coated (galvanized), complying with ASTM A 123/A 123M, or electrogalvanized complying with ASTM 653/A 653M, and phosphatized before fabrication.
 - d. Stainless-Steel Grille Curtain: ASTM A 666, Type 300 series.
 - e. Aluminum Grille Curtain: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
2. Top Track: Extruded aluminum channel mechanically attached to a support angle with provisions for take-up bolts to compensate for a maximum deflection of 1/2-inch.
3. Bottom Track: Manufacturer's standard, finished to match grille.
4. Coil Box: Entirely enclose coiled grille, operating mechanism, supporting disk and the drum around which the grille will coil.
5. Power Operated Grille: Safety interlock switch to disengage power supply when grille is locked.
6. Manual Grille Operator: Crank or Push-Pull.
7. Electric Grille Operator: Manufacturer's standard type, size, and capacity for grille and operation-cycle requirements specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking grille, and accessories. Comply with NFPA 70.
 - a. Disconnect Device: Hand-operated for automatically engaging chain and sprocket operator and releasing brake for emergency manual operation while disconnecting motor,



without affecting timing of limit switch. Mount to be accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

- b. Grille-Operator Type: Wall- or bracket-mounted unit with electric motor, gear-reduction drive, and chain and sprocket secondary drive.
- 8. Electric Motors: High-starting torque, reversible, continuous-duty, polyphase, Class A insulated, electric motors complying with NEMA MG 1; with overload protection; sized to start, accelerate, and operate grille in either direction from any position, at not less than 2/3 fps (0.2 m/s) and not more than 1 fps (0.3 m/s), without exceeding nameplate ratings or service factor. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.
 - a. Open dripproof-type motor, and controller with NEMA ICS 6, Type 1 enclosure.
 - b. Totally enclosed, nonventilated or fan-cooled motor, fitted with plugged drain, and controller with NEMA ICS 6, Type 4 enclosure where indicated.
- 9. Remote-Control Station: Momentary-contact **OR** Sustained-pressure, **as directed**, three-button control station; fully guarded, weatherproof (if for exterior location), key operated.
- 10. Obstruction Detection Device: External automatic safety sensor capable of protecting full width of grille opening. Activation of sensor immediately stops and reverses grille travel.
- 11. Provide electric operators with ADA-compliant audible alarm and visual indicator lights.

B. Finishes

- 1. Aluminum Anodic Finish: Mill finish **OR** Class II, clear anodic coating complying with AAMA 611, **as directed**.
- 2. Galvanized Steel Finish: Manufacturer's standard primer **OR** Powder-coat finish, **as directed**.
 - a. Color and Gloss: As selected from manufacturer's full range.
 - b. Painting is specified in Division 09 Section(s) "Interior Painting" **OR** "Staining And Transparent Finishing".
- 3. Stainless-Steel Finish: Bright, cold-rolled, unpolished finish: No. 2B finish **OR** Bright, directional polish: No. 4 finish, **as directed**.

1.3 EXECUTION

A. Installation

- 1. General: Install side coiling grilles and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports.
- 2. Lubricate bearings and sliding parts; adjust grilles to operate easily, free of warp, twist, or distortion.

END OF SECTION 08 33 36 00



Task	Specification	Specification Description
08 33 39 00	01 22 16 00	No Specification Required
08 34 13 00	01 22 16 00	No Specification Required



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SECTION 08 35 00 00 - CSF FOLDING DOORS AND GRILLES**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Folding security closures.
 - 2. Hardware.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Provide Products complete with accessories, trim, finish, safety guards, and other devices and details needed for complete installation and intended use and effect.
- D. Related Sections:

1.2 SUBMITTALS

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Operating and Maintenance Data: Operating and maintenance instructions, parts lists and wiring diagrams.
 - 2. Submit written special warranty with forms completed in United States Postal Service name and registered with manufacturer as specified in this Section.
- B. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Construction, component connections, and details for each door type.
 - 2. Shop Drawings: Indicate dimensions, anchorage methods, hardware locations, and installation details for each door type.

1.3 QUALITY ASSURANCE

- A. Qualifications:



1. Installer: Factory authorized company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

1.5 WARRANTY

- A. Comply with Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Manufacturer warranty to cover all material and labor required to repair or replace side folding closures and components for a period of two years from time of acceptance by USPS, within a guaranteed maximum repair response time of ten (10) calendar days.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Prior to including "Mobilflex," the design A/E is to confirm with the project contracting officer that the project's total contracted value will meet the limits set for NAFTA – Canada in Clause B. 402.

2.1 MANUFACTURERS

- A. This Product must be manufactured by a USPS Pre-Approved Vendors and is subject to a USPS price and requirements purchasing agreement. The following vendor contacts must be used:
 1. Dynaflair Corporation, Tampa, FL POC: Gerald Pasternak, (813) 248-8100 (800) 624-3667.
 2. Dynamic Closures Corporation, Massena, NY. POC: Christine Warner, (800) 663-4599.
 3. Mobilflex Inc., Niagra Falls, NY POC: Claire Touzin (800) 216-3539
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Not permitted.

2.2 FOLDING CLOSURES

- A. Solid curtain for enclosure of retail lobby or Full Service Counters: Constructed of continuous solid panels of a minimum 16 gage (0.050 inch) (1.25 mm) thick aluminum. The maximum panel width is 8 inches. Panels to match curtain finish. The closest space between the bottom of the curtain and the floor directly below the track is not to exceed 1/2 inch (1.2 cm).
 1. Dynaflair: Elegance with solid insert.
 2. Dynamic: Opaque.
 3. Mobilflex: Global.
- B. Track: Curtain shall be supported by trolley assemblies capable of carrying 120 pounds per linear foot. Curves and track shall be heavy extruded aluminum with a minimum of 14 inch (36 cm) radius for each 90 degree curve, and a minimum of 10 inch (25 cm) radius for curves greater than 90 degrees.
- C. Locking:



1. Lead member, trailing member and bi-part member (if any) to be provided with manufacturer's high security cylinder on the exterior side with metal security ring.
 2. Lead member to engage a full height striker channel with a single hook latch.
 3. Lead bi-part member to engage a full height striker channel member secured with a single hook latch and bottom drop bolt.
 4. Lead member/channel connection and bi-part member connection to include a horizontal solid metal pin 1/2 inch (13 mm) in diameter. Pins to be 18" AFF and seat a minimum of 1 inch (2.6 cm) into the strike channel or lead member so they are not visible.
 5. Trailing end member to be free floating top and bottom post secured outside the storage pocket with top and bottom drop bolts operated on the exterior side.
 6. Intermediate member(s) to be located at all curves and on straight sections at intervals not to exceed 8 feet (2.44 m).
 7. Solid Curtains at Full Service Counters: Intermediate members to be equipped with drop bolt at the bottom, operated by manufacturer's high-security mortise cylinder on the exterior side with a metal security ring.
 8. All applications other than those listed in Item 7 above: Intermediate members to be equipped with a concealed locking device, drop bolt at the bottom, and control lever on interior side.
 9. Drop bolt to be manufactured with grade 1045 cold roll steel, with the bottom 6 inches (15 cm) of the bolt flame hardened and tempered to 55 Rockwell hardness. Drop bolt to extend not less than 1 inch (2.6 cm) into a dust proof receiver.
 10. Keying of cylinders:
 - a. Furnish cylinders keyed alike during construction.
 - b. Final keying will use specified cylinders, see section 087100.
- D. Stacking: Allow 2.1 inches (5 cm) of stacking per linear foot of closure width, plus 3 inches (8 cm) for each post section.
- E. Finish: Clear anodized frame with matching clear anodized, anodized silver acrylic panels or powder coat paint over steel panels.
- F. Installation Details/Instructions: The Vendor shall produce a package of drawings/details and/or instructions which will be provided by the vendor with each folding closure at the time of delivery. This package shall be of sufficient detail to explain the proper installation and adjustment of folding closures.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 1. Verify that opening sizes, tolerances, and conditions are as indicated on Drawings.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION



- A. Installation company must specialize in performing the Work of this Section with documented experience and be approved by the folding closure manufacturer.
- B. Install closure unit assembly in accordance with published manufacturer's instructions.
- C. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress. Brace and fasten components suspended from structure to be secure and rigid.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

3.3 CONSTRUCTION

- A. Site Tolerances:
 - 1. Maintain dimensional tolerances and alignment with adjacent work.
 - 2. Maximum Variation From Plumb: 1/16 inch (1.6 mm).
 - 3. Maximum Variation From Level: 1/16 inch (1.6 mm).

3.4 ADJUSTING

- A. Adjust closure, hardware, and operating assemblies for smooth and quiet operation.

3.5 CLEANING

- A. Section 017300 - Execution: Cleaning installed work.
- B. Clean closure and components.
- C. Remove labels and visible markings.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION 08 35 00 00



SECTION 08 35 00 00 - MPF FOLDING DOORS AND GRILLES**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

This section includes aluminum or steel grills for lunchrooms.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Folding security closures.
 - 2. Hardware.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Provide Products complete with accessories, trim, finish, safety guards, and other devices and details needed for complete installation and intended use and effect.
- D. Related Sections:

1.2 SUBMITTALS

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Operating and Maintenance Data: Operating and maintenance instructions, parts lists and wiring diagrams.
 - 2. Submit written special warranty with forms completed in United States Postal Service name and registered with manufacturer as specified in this Section.
- B. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Construction, component connections, and details for each door type.
 - 2. Shop Drawings: Indicate dimensions, anchorage methods, hardware locations, and installation details for each door type.

1.3 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Installer: Factory authorized company specializing in performing the Work of this Section with minimum 5 years documented experience.



1.4 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

1.5 WARRANTY

- A. Comply with Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Manufacturer warranty to cover all material and labor required to repair or replace side folding closures and components for a period of two years from time of acceptance by USPS, within a guaranteed maximum repair response time of ten (10) calendar days.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. This Product must be manufactured by a USPS Pre-Approved Vendors and is subject to a USPS price and requirements purchasing agreement. The following vendor contacts must be used:
1. Dynaflair Corporation, Tampa, FL POC: Gerald Pasternak, (813) 248-8100 (800) 624-3667.
 2. Dynamic Closures Corporation, Massena, NY. POC: Christine Warner, (800) 663-4599.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Not permitted.

NOTE TO SPECIFIER

Side folding closures may be used in three separate locations within retail areas. Opaque folding closures are used to close the service lobby in RSD and MSBD facilities that do not have a full Postal Store and to enclose the Full Service Counters in RSD, SSBD and MSBD facilities that do have a full Postal Store. Perforated folding closures are used to enclose Postal Stores in RSD, SSBD and MSBD facilities.

2.2 FOLDING CLOSURES

- A. Perforated curtain for enclosure of retail Postal Store: Constructed of a minimum 16 gage (0.050 inch) (1.25 mm) aluminum or minimum 18-gage (0.040 inch) (1.00 mm) steel with 3/16" perforations and minimum 40% visibility. Maximum panel width is 8 inches. The closest space between the bottom of the curtain and the floor directly below the track is not to exceed 1/2 inch (1.2 cm).
1. Dynaflair: Elegance with perforated insert.
 2. Dynamic: Paravent.
- B. Solid curtain for enclosure of retail lobby or Full Service Counters: Constructed of continuous solid panels of a minimum 16 gage (0.050 inch) (1.25 mm) thick aluminum. The maximum panel width is 8 inches. Panels to match curtain finish. The closest space between the bottom of the curtain and the floor directly below the track is not to exceed 1/2 inch (1.2 cm).
1. Dynaflair: Elegance with solid insert.
 2. Dynamic: Opaque.



- C. Track: Curtain shall be supported by trolley assemblies capable of carrying 120 pounds per linear foot. Curves and track shall be heavy extruded aluminum with a minimum of 14 inch (36 cm) radius for each 90 degree curve, and a minimum of 10 inch (25 cm) radius for curves greater than 90 degrees.
- D. Locking:
 - 1. Lead member, trailing member and bi-part member (if any) to be provided with manufacturer's high security cylinder on the exterior side with metal security ring.
 - 2. Lead member to engage a full height striker channel with a single hook latch.
 - 3. Lead bi-part member to engage a full height striker channel member secured with a single hook latch and bottom drop bolt.
 - 4. Lead member/channel connection and bi-part member connection to include a horizontal solid metal pin 1/2 inch (13 mm) in diameter. Pins to be 18" AFF and seat a minimum of 1 inch (2.6 cm) into the strike channel or lead member so they are not visible.
 - 5. Trailing end member to be free floating top and bottom post secured outside the storage pocket with top and bottom drop bolts operated on the exterior side.
 - 6. Intermediate member(s) to be located at all curves and on straight sections at intervals not to exceed 8 feet (2.44 m).
 - 7. Solid Curtains at Full Service Counters: Intermediate members to be equipped with drop bolt at the bottom, operated by manufacturer's high-security mortise cylinder on the exterior side with a metal security ring.
 - 8. All applications other than those listed in Item 7 above: Intermediate members to be equipped with a concealed locking device, drop bolt at the bottom, and control lever on interior side.
 - 9. Drop bolt to be manufactured with grade 1045 cold roll steel, with the bottom 6 inches (15 cm) of the bolt flame hardened and tempered to 55 Rockwell hardness. Drop bolt to extend not less than 1 inch (2.6 cm) into a dust proof receiver.
 - 10. Keying of cylinders:
 - a. Furnish cylinders keyed alike during construction.
 - b. Final keying will use specified cylinders, see section 087100.
- E. Stacking: Allow 2.1 inches (5 cm) of stacking per linear foot of closure width, plus 3 inches (8 cm) for each post section.
- F. Finish: Clear anodized frame with matching clear anodized, anodized silver acrylic panels or powder coat paint over steel panels.
- G. Installation Details/Instructions: The Vendor shall produce a package of drawings/details and/or instructions which will be provided by the vendor with each folding closure at the time of delivery. This package shall be of sufficient detail to explain the proper installation and adjustment of folding closures.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify that opening sizes, tolerances, and conditions are as indicated on Drawings.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.



3.2 INSTALLATION

- A. Installation company must specialize in performing the Work of this Section with documented experience and be approved by the folding closure manufacturer.
- B. Install closure unit assembly in accordance with published manufacturer's instructions.
- C. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress. Brace and fasten components suspended from structure to be secure and rigid.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

3.3 CONSTRUCTION

- A. Site Tolerances:
 - 1. Maintain dimensional tolerances and alignment with adjacent work.
 - 2. Maximum Variation From Plumb: 1/16 inch (1.6 mm).
 - 3. Maximum Variation From Level: 1/16 inch (1.6 mm).

3.4 ADJUSTING

- A. Adjust closure, hardware, and operating assemblies for smooth and quiet operation.

3.5 CLEANING

- A. Section 017300 - Execution: Cleaning installed work.
- B. Clean closure and components.
- C. Remove labels and visible markings.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 6/29/2010

END OF SECTION 08 35 00 00



SECTION 08 36 13 00 - CSF SECTIONAL DOORS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.08 36 13 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

NOTE TO SPECIFIER

Adjust list below to suit project. Add other types of doors to list below.

1. Doors with insulated steel-framed steel panels.
2. Tracks configured for the following lift types:
 - a. Standard.

- B. Related Documents: The Contract Documents, as defined in Section 011000, Summary of Work apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:

1. Section 087100, Door Hardware: for lock cylinders and keying.
2. Section 099100, Painting: for field-applied paint finish.
3. Section 111300, Loading Dock Equipment: for interlock switch connection.
4. Section 111304, Dock Lift (Scissors Type), for interlock switch connection.
5. Section 260519, Low-Voltage Electrical Power Conductors and Cables: for electrical service and connections for powered operators, and accessories.

1.2 REFERENCES

- A. ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvanealed) By the Hot-Dip Process.
- B. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.



1.3 DEFINITIONS

- A. Operation Cycle: One complete cycle of a door begins with the door in the closed position. The door is then moved to the open position and back to the closed position.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide sectional overhead doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:

NOTE TO SPECIFIER

Insert pressure applicable to project location.

1. Wind Load: Uniform pressure (velocity pressure) of [20][____] lb./sq. ft. (960 Pa), acting inward and outward.
- B. Operation-Cycle Requirements: Design sectional overhead door components and operator to operate for not less than 100,000 cycles.

1.5 SUBMITTALS

- A. Product Data: For each type and size of sectional overhead door and accessory. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:
1. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.
 2. Summary of forces and loads on walls and jambs.
 3. Motors: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.
- B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's data sheets.
1. Wiring Diagrams: Detail wiring for power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring and between components provided by door manufacturer and those provided by others.
- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied finishes.
- D. Samples for Verification: Of each type of exposed finish required, prepared on Samples of size indicated below and of same thickness and material indicated for Work. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.
1. Frame: 6-inch length.
 2. Panel: 6 inches square.
- E. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
- F. Manufacturers' Certificates: Signed by manufacturers certifying that they comply with requirements specified in "Quality Assurance" Article. On request, submit evidence of manufacturing experience.



1.6 QUALITY ASSURANCE

- A. **Installer Qualifications:** Engage an experienced installer who is an authorized representative of the sectional overhead door manufacturer for both installation and maintenance of units required for this Project.
- B. **Manufacturer Qualifications:** Engage a firm experienced in manufacturing sectional overhead doors similar to those indicated for this Project and with a record of successful in-service performance.
- C. **Source Limitations:** Obtain sectional overhead doors through one source from a single manufacturer.
 - 1. Obtain operators and controls from the sectional overhead door manufacturer.
- D. **Product Options:** Drawings indicate size, profiles, and dimensional requirements of sectional overhead doors and accessories and are based on the specific system indicated. Other manufacturers' systems with equal performance and dimensional characteristics may be considered. Refer to Division 1 Section "Substitutions."
- E. **Listing and Labeling:** Provide electrically operated fixtures specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Clopay Building Products Co., Cincinnati, OH (800) 526-4301.
 - 2. Haas Door Co., Wauseon, OH (800) 877-0795.
 - 3. McKee Door, Inc.; Aurora, IL (800) 222-7426.
 - 4. Overhead Door Corporation, Farmer's Branch, TX (800) 972-1730.
 - 5. Raynor Garage Doors, Dixon, IL (800) 472-9667.
 - 6. Wayne-Dalton Corp, Mt. Hope, OH, (800) 764-1457.
 - 7. Windsor Door; Little Rock, AR (800) 946-3767.

2.2 STEEL SECTIONS

- A. Construct door sections from galvanized, structural-quality carbon-steel sheets complying with ASTM A 653 (ASTM A 653M), commercial quality, with a minimum yield strength of 33,000 psi (225 MPa) and a minimum G60 (Z180) zinc coating.
 - 1. Steel Sheet Thickness: 20 gauge for exterior and 26 gauge for interior sheets.
 - 2. Exterior Section Face: Flat.
- B. Fabricate door panels from a single sheet to provide sections not more than 24 inches high and nominally 2 inches deep. Roll horizontal meeting edges to a continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove weathertight seal, with a reinforcing flange return.
- C. Reinforce bottom section with a continuous channel or angle complying with bottom section profile and allowing installation of astragal.
- D. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Provide galvanized steel bars, struts, trusses or strip steel, formed to depth and bolted or welded in place.

- E. Provide reinforcement for hardware attachment.
- F. Insulation: Manufacturer's standard rigid cellular polystyrene or polyurethane-foam-type thermal insulation, foamed in place to completely fill inner core of section, pressure bonded to face sheets to prevent delamination under wind load and with maximum flame-spread and smoke-developed indices of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely, with no exposed insulation material evident.
 - 1. Steel Sheet Inside Face: Manufacturer's standard thickness.
- G. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints, and free of warp, twist, and deformation.
- H. Finish galvanized steel door sections as follows:
 - 1. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 2. Surface Preparation: Clean galvanized surfaces with nonpetroleum solvent so surfaces are free of oil and surface contaminants.
 - 3. Pretreat zinc-coated steel, after cleaning, with a conversion coating of type suited to organic coating applied over it.
 - 4. Apply manufacturer's standard primer and finish coats to interior and exterior door faces after forming, according to coating manufacturer's written instructions for application, thermosetting, and minimum dry film thickness.
 - a. Color: White

2.3 TRACKS, SUPPORTS, AND ACCESSORIES

- A. Tracks: Provide manufacturer's standard, galvanized steel track system, sized for door size and weight, designed for lift type indicated and clearances shown, and complying with ASTM A 653 (ASTM A 653M), for minimum G60 (Z180) zinc coating. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Slot vertical sections of track at 2 inches (50 mm) o.c. for door-drop safety device. Slope tracks at proper angle from vertical or otherwise design to ensure tight closure at jambs when door unit is closed. Weld or bolt to track supports.
- B. Weatherseals: Provide replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and at top of overhead door.
 - 1. Provide motor-operated doors with combination bottom weatherseal and sensor edge.
 - 2. In addition, provide continuous flexible seals at door jambs for a weathertight installation.
- C. Windows: Provide windows of type and size indicated and in arrangement shown. Set glazing in vinyl, rubber, or neoprene glazing channel for metal-framed doors and elastic glazing compound for wood doors, as required. Provide removable stops of same material as door section frames.
 - 1. Size: Manufacturer's standard panel for type of glazing indicated.
 - 2. Clear Polycarbonate Plastic: 6-mm clear, transparent, fire-retardant polycarbonate sheet manufactured by extrusion process, UV resistant.

2.4 HARDWARE

- A. General: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.
- B. Hinges: Provide heavy-duty galvanized steel hinges, of not less than 0.0747-inch-thick uncoated steel, at each end stile and at each intermediate stile, per manufacturer's written recommendations for door



size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is not possible. Provide double-end hinges, where required, for doors exceeding 16 feet in width, unless otherwise recommended by door manufacturer.

- C. Rollers: Provide heavy-duty rollers, with steel ball bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch-diameter roller tires for 3-inch track, 2-inch-diameter roller tires for 2-inch track, and as follows:
 - 1. Case-hardened steel tires.
- D. Push/Pull Handles: For push-up-operated or emergency-operated doors, provide galvanized steel lifting handles on each side of door.
- E. Fabricate locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks.
 - 1. Locking Bars: Both jamb sides, operable from inside only.
- F. Chain Lock Keeper: Suitable for padlock.

2.5 COUNTERBALANCING MECHANISM

- A. Torsion Spring: Operation by torsion-spring counterbalance mechanism consisting of adjustable-tension torsion springs, fabricated from oil-tempered-steel wire mounted on a cross-header tube or steel shaft. Connect to door with galvanized aircraft-type lift cables with cable safety factor of at least 5 to 1. Provide springs calibrated for 100,000 cycles minimum.
- B. Cable Drums: Provide cast-aluminum or gray-iron casting cable drums grooved to receive cable. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of shaft. Provide 1 additional midpoint bracket for shafts up to 16 feet long and 2 additional brackets at one-third points to support shafts more than 16 feet long, unless closer spacing is recommended by door manufacturer.
- C. Cable Safety Device: Include a spring-loaded, steel or bronze cam mounted to bottom door roller assembly on each side, designed to automatically stop door if either cable breaks.
- D. Bracket: Provide anchor support bracket, as required to connect stationary end of spring to the wall, to level shaft and prevent sag.
- E. Provide a spring bumper at each horizontal track to cushion door at end of opening operation.

2.6 MANUAL DOOR OPERATORS

- A. Push-up Operation: Provide lift handles and pull rope for raising and lowering doors, operating with not more than 25-lbf lift or pull.

PART 3 - EXECUTION

3.1 EXAMINATION



- A. Examine wall and overhead areas, including opening framing and blocking, with Installer present, for compliance with requirements for installation tolerances, clearances, and other conditions affecting performance of Work of this Section.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install door, track, and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports according to Shop Drawings, manufacturer's written instructions, and as specified.
- B. Fasten vertical track assembly to framing at not less than 24 inches o.c. Hang horizontal track from structural overhead framing with angle or channel hangers welded and bolt fastened in place. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

3.3 ADJUSTING

- A. Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

3.4 DEMONSTRATION

- A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:
 - 1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 2. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
 - 3. Review data in the maintenance manuals. Refer to Division 1 Section "Contract Closeout."
 - 4. Schedule training with Owner with at least 7 days' advance notice.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



SECTION 08 36 13 00 - MPF SECTIONAL DOORS

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.08 36 13 00

This section pertains to overhead doors for use in Vehicle Maintenance Facilities only

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

NOTE TO SPECIFIER

Adjust list below to suit project. Add other types of doors to list below.

1. Doors with insulated steel-framed steel panels.
2. Tracks configured for the following lift types:
 - a. Standard.

- B. Related Documents: The Contract Documents, as defined in Section 011000, Summary of Work apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:

1. Section 087100, Door Hardware: for lock cylinders and keying.
2. Section 099100, Painting: for field-applied paint finish.
3. Section 111300, Loading Dock Equipment: for interlock switch connection.
4. Section 111304, Dock Lift (Scissors Type), for interlock switch connection.
5. Section 260519, Low-Voltage Electrical Power Conductors and Cables: for electrical service and connections for powered operators, and accessories.

1.2 REFERENCES

- A. ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvanealed) By the Hot-Dip Process.
- B. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 DEFINITIONS

- A. Operation Cycle: One complete cycle of a door begins with the door in the closed position. The door is then moved to the open position and back to the closed position.

1.4 PERFORMANCE REQUIREMENTS



- A. Structural Performance: Provide sectional overhead doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:

NOTE TO SPECIFIER

Insert pressure applicable to project location.

1. Wind Load: Uniform pressure (velocity pressure) of [20][____] lb./sq. ft. (960 Pa), acting inward and outward.

- B. Operation-Cycle Requirements: Design sectional overhead door components and operator to operate for not less than 100,000 cycles.

1.5 SUBMITTALS

- A. Product Data: For each type and size of sectional overhead door and accessory. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:
1. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.
 2. Summary of forces and loads on walls and jambs.
 3. Motors: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.
- B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's data sheets.
1. Wiring Diagrams: Detail wiring for power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring and between components provided by door manufacturer and those provided by others.
- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied finishes.
- D. Samples for Verification: Of each type of exposed finish required, prepared on Samples of size indicated below and of same thickness and material indicated for Work. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.
1. Frame: 6-inch length.
 2. Panel: 6 inches square.
- E. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
- F. Manufacturers' Certificates: Signed by manufacturers certifying that they comply with requirements specified in "Quality Assurance" Article. On request, submit evidence of manufacturing experience.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who is an authorized representative of the sectional overhead door manufacturer for both installation and maintenance of units required for this Project.
- B. Manufacturer Qualifications: Engage a firm experienced in manufacturing sectional overhead doors similar to those indicated for this Project and with a record of successful in-service performance.



- C. Source Limitations: Obtain sectional overhead doors through one source from a single manufacturer.
 - 1. Obtain operators and controls from the sectional overhead door manufacturer.
- D. Product Options: Drawings indicate size, profiles, and dimensional requirements of sectional overhead doors and accessories and are based on the specific system indicated. Other manufacturers' systems with equal performance and dimensional characteristics may be considered. Refer to Division 1 Section "Substitutions."
- E. Listing and Labeling: Provide electrically operated fixtures specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Clopay Building Products Co., Cincinnati, OH (800) 526-4301.
 - 2. Haas Door Co., Wauseon, OH (800) 877-0795.
 - 3. McKee Door, Inc.; Aurora, IL (800) 222-7426.
 - 4. Overhead Door Corporation, Farmer's Branch, TX (800) 972-1730.
 - 5. Raynor Garage Doors, Dixon, IL (800) 472-9667.
 - 6. Wayne-Dalton Corp, Mt. Hope, OH, (800) 764-1457.
 - 7. Windsor Door; Little Rock, AR (800) 946-3767.

2.2 STEEL SECTIONS

- A. Construct door sections from galvanized, structural-quality carbon-steel sheets complying with ASTM A 653 (ASTM A 653M), commercial quality, with a minimum yield strength of 33,000 psi (225 MPa) and a minimum G60 (Z180) zinc coating.
 - 1. Steel Sheet Thickness: 20 gauge for exterior and 26 gauge for interior sheets.
 - 2. Exterior Section Face: Flat.
- B. Fabricate door panels from a single sheet to provide sections not more than 24 inches high and nominally 2 inches deep. Roll horizontal meeting edges to a continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove weathertight seal, with a reinforcing flange return.
- C. Reinforce bottom section with a continuous channel or angle complying with bottom section profile and allowing installation of astragal.
- D. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Provide galvanized steel bars, struts, trusses or strip steel, formed to depth and bolted or welded in place.
- E. Provide reinforcement for hardware attachment.
- F. Insulation: Manufacturer's standard rigid cellular polystyrene or polyurethane-foam-type thermal insulation, foamed in place to completely fill inner core of section, pressure bonded to face sheets to prevent delamination under wind load and with maximum flame-spread and smoke-developed indices of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely, with no exposed insulation material evident.
 - 1. Steel Sheet Inside Face: Manufacturer's standard thickness.

- G. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints, and free of warp, twist, and deformation.
- H. Finish galvanized steel door sections as follows:
 - 1. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 2. Surface Preparation: Clean galvanized surfaces with nonpetroleum solvent so surfaces are free of oil and surface contaminants.
 - 3. Pretreat zinc-coated steel, after cleaning, with a conversion coating of type suited to organic coating applied over it.
 - 4. Apply manufacturer's standard primer and finish coats to interior and exterior door faces after forming, according to coating manufacturer's written instructions for application, thermosetting, and minimum dry film thickness.
 - a. Color: White

2.3 TRACKS, SUPPORTS, AND ACCESSORIES

- A. Tracks: Provide manufacturer's standard, galvanized steel track system, sized for door size and weight, designed for lift type indicated and clearances shown, and complying with ASTM A 653 (ASTM A 653M), for minimum G60 (Z180) zinc coating. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Slot vertical sections of track at 2 inches (50 mm) o.c. for door-drop safety device. Slope tracks at proper angle from vertical or otherwise design to ensure tight closure at jambs when door unit is closed. Weld or bolt to track supports.
- B. Weatherseals: Provide replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and at top of overhead door.
 - 1. Provide motor-operated doors with combination bottom weatherseal and sensor edge.
 - 2. In addition, provide continuous flexible seals at door jambs for a weathertight installation.
- C. Windows: Provide windows of type and size indicated and in arrangement shown. Set glazing in vinyl, rubber, or neoprene glazing channel for metal-framed doors and elastic glazing compound for wood doors, as required. Provide removable stops of same material as door section frames.
 - 1. Size: Manufacturer's standard panel for type of glazing indicated.
 - 2. Clear Polycarbonate Plastic: 6-mm clear, transparent, fire-retardant polycarbonate sheet manufactured by extrusion process, UV resistant.

2.4 HARDWARE

- A. General: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.
- B. Hinges: Provide heavy-duty galvanized steel hinges, of not less than 0.0747-inch-thick uncoated steel, at each end stile and at each intermediate stile, per manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is not possible. Provide double-end hinges, where required, for doors exceeding 16 feet in width, unless otherwise recommended by door manufacturer.
- C. Rollers: Provide heavy-duty rollers, with steel ball bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch-diameter roller tires for 3-inch track, 2-inch-diameter roller tires for 2-inch track, and as follows:



1. Case-hardened steel tires.
- D. Push/Pull Handles: For push-up-operated or emergency-operated doors, provide galvanized steel lifting handles on each side of door.
- E. Fabricate locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks.
 1. Locking Bars: Both jamb sides, operable from inside only.
- F. Chain Lock Keeper: Suitable for padlock.

2.5 COUNTERBALANCING MECHANISM

- A. Torsion Spring: Operation by torsion-spring counterbalance mechanism consisting of adjustable-tension torsion springs, fabricated from oil-tempered-steel wire mounted on a cross-header tube or steel shaft. Connect to door with galvanized aircraft-type lift cables with cable safety factor of at least 5 to 1. Provide springs calibrated for 100,000 cycles minimum.
- B. Cable Drums: Provide cast-aluminum or gray-iron casting cable drums grooved to receive cable. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of shaft. Provide 1 additional midpoint bracket for shafts up to 16 feet long and 2 additional brackets at one-third points to support shafts more than 16 feet long, unless closer spacing is recommended by door manufacturer.
- C. Cable Safety Device: Include a spring-loaded, steel or bronze cam mounted to bottom door roller assembly on each side, designed to automatically stop door if either cable breaks.
- D. Bracket: Provide anchor support bracket, as required to connect stationary end of spring to the wall, to level shaft and prevent sag.
- E. Provide a spring bumper at each horizontal track to cushion door at end of opening operation.

2.6 MANUAL DOOR OPERATORS

- A. Push-up Operation: Provide lift handles and pull rope for raising and lowering doors, operating with not more than 25-lbf lift or pull.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine wall and overhead areas, including opening framing and blocking, with Installer present, for compliance with requirements for installation tolerances, clearances, and other conditions affecting performance of Work of this Section.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION



- A. General: Install door, track, and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports according to Shop Drawings, manufacturer's written instructions, and as specified.
- B. Fasten vertical track assembly to framing at not less than 24 inches o.c. Hang horizontal track from structural overhead framing with angle or channel hangers welded and bolt fastened in place. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

3.3 ADJUSTING

- A. Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

3.4 DEMONSTRATION

- A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:
 - 1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 2. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
 - 3. Review data in the maintenance manuals. Refer to Division 1 Section "Contract Closeout."
 - 4. Schedule training with Owner with at least 7 days' advance notice.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 6/29/2010

END OF SECTION



SECTION 08 36 14 00 - MPF SECTIONAL KNOCKOUT DOORS**

NOTE TO SPECIFIER

Use this section for Mail Processing Facilities only. Use of Sectional Knockout Doors in Customer Service type facilities requires prior submittal to and approval by USPS Design and Construction Facilities Headquarters of a design standards deviation request.

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

This section is for the TKO Cruiserweight door.

THIS IS A SELECTED VENDOR ITEM. CONSTRUCTION SUPPLIERS MUST CONTACT THE SELECTED VENDOR AS DIRECTED FOR APPROVED PRICING AND PURCHASING PROCEDURES

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information must be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 – GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Manually operated sectional overhead doors with insulated composite panels.
 - 2. Tracks configured for the following lift types:
 - a. Standard lift.
 - b. High lift.
 - c. Vertical lift.
- B. Related Documents: The Contract Documents, as defined in Section 011000, Summary of Work apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 087100, Door Hardware: for lock cylinders and keying.
 - 2. Section 099100, Painting: for field-applied paint finish.
 - 3. Section 260500, Common Work Results for Electrical.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.
 - 2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS



- A. Product Data: For each type and size of sectional overhead door and accessory. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:
 - 1. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.
- B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's data sheets.
 - 1. Wiring Diagrams: Detail wiring for signal systems. Differentiate between manufacturer-installed and field-installed wiring and between components provided by door manufacturer and those provided by others.
- C. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Operating and Maintenance Data: Operating and maintenance instructions, parts lists and wiring diagrams.
 - 2. Submit written special warranty with forms completed in United States Postal Service name and registered with manufacturer as specified in this Section.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who is an authorized representative of the sectional overhead door manufacturer for both installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain sectional overhead doors through one source from a single manufacturer.
 - 1. Obtain operators and controls from the sectional overhead door manufacturer.
- C. Listing and Labeling: Provide electrically operated fixtures specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in NFPA #70, Article 100.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. This Product must be manufactured by a USPS Selected Vendor and is subject to a USPS price and requirements purchasing agreement. The following vendor contact must be used:
 - 1. New and replacement doors: TKO Doors, Sussex, WI, Primary Contact: Vickie Borkowski, (262) 246-1332, Vicky.borkowski@4frontes.com
 - 2. Replacement parts: TKO Doors, Sussex, WI, Terri Thimm, (262) 246-1316, terri.thimm@4frontes.com
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Not permitted.

2.2 SECTIONAL KNOCKOUT DOORS

- A. Model:
 - 1. TKO Doors: TKO CruiserWeight.
- B. REQUIRED FEATURES
 - 1. 24" high (max.) with 1/8" thick pre-finished white polymer interior panel and 1/8" thick fiberglass exterior panel factory primed and painted after forming with white Sherwin Williams "Superpaint" series A85 or equivalent according to coating manufacturer's standards written instructions for application and minimum dry film thickness.
 - 2. 1-3/4" thick (min.) foam core insulation.



3. High molecular weight polyethylene (UHMW) track that will allow an outward release when impacted.
4. Replaceable weather seals (top and bottom)
5. Spring-loaded plungers on knockout panels.
6. Counterbalance system rated for 25,000 cycle (min.)
7. Single slide lock

8. Weatherstripping, i.e. lintel brush seal, foamed hypalon bottom seal and loop weather seal attached to the door panels
9. Two (2) push/pull handles
10. One 22" wide x 6" high vision panel
11. Two (2) bumpers at each upper track

NOTE TO SPECIFIER

Track is available in straight-vertical, high-lift and tilt-track styles. Select style appropriate for the project.

12. Track shall be [straight-vertical] [high-lift] [tilt-track] style.

NOTE TO SPECIFIER

Select optional features below if applicable to project or required by contracting officer.

13. Cable break safety device.
14. Manual Chain hoist.
15. High wind Load Door Package.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine wall and overhead areas, including opening framing and blocking, with Installer present, for compliance with requirements for installation tolerances, clearances, and other conditions affecting performance of Work of this Section.
 - a. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install door, track, and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports according to Shop Drawings, manufacturer's written instructions, and as specified.
- B. Hang horizontal track from structural overhead framing with angle or channel hangers bolt fastened in place. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

3.3 ADJUSTING

- A. Adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

3.4 DEMONSTRATION

- A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:
 1. Test and adjust controls and safety features. Replace damaged and malfunctioning controls and equipment.



2. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
3. Review data in the maintenance manuals.
4. Schedule training with Owner with at least 7 days advance notice.

3.5 WARRANTIES

- A. Manufacturer to provide two-year performance warranty on high-impact polymer panel, five-year impact warranty on track and one-year warranty on entire door system covering defects in material or workmanship.

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END OF SECTION 08 36 14 00



SECTION 08 38 00 00 - CSF TRAFFIC DOORS**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

THIS IS A DIRECT VENDOR ITEM. CONSTRUCTION SUPPLIERS MUST CONTACT THE DIRECT VENDOR AS DIRECTED FOR APPROVED PRICING AND PURCHASING PROCEDURES. Text in [brackets] indicates a choice must be made. Brackets with [_____] indicate information may be inserted at that location. Drawing Coordination Items at end of Section.08 38 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Double action impact resistant traffic doors, security type.
 - 2. Door hardware.
 - 3. Security features.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Provide products complete with accessories, trim, finish, safety guards, and other pertinent devices and details needed for a complete installation and intended use.
- D. Related Sections:
 - 1. Section 055000 - Metal Fabrications: Steel door frames for traffic doors.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.
 - 2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Indicate door materials, thickness, configuration, and hardware.



2. Shop Drawings:
 - a. Indicate dimensions, details of construction, and installation.
 - b. Indicate relationship to adjoining related Work where cutting, fitting, reinforcement, and anchorage is required for complete installation.
- B. Section 017704 – Closeout Procedures and Training: Procedures for closeout submittals.
 1. Operating and Maintenance Data: Operating and maintenance instruction and parts lists.
 2. Submit written special warranty with forms completed in United States Postal Service name and registered with manufacturer as specified in this section.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 1. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver product in manufacturer's original unopened packages with labels legible and intact.
- C. Labels shall identify manufacturer, brand name, model size, finish, and location of installation.
- D. Store double action doors and accessories in unopened packages in protected dry area to prevent damage from environmental and construction operations.
- E. Handle double action doors with care to prevent damage.

1.6 WARRANTY

- A. Comply with Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Manufacturer warranty to cover all material and labor required to repair or replace doors and door components for a period of two years from time of acceptance by USPS, within a guaranteed maximum repair response time of ten (10) calendar days.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. This Product must be manufactured by a USPS Direct Vendor and is subject to a USPS price and requirements purchasing agreement. The following vendor contact must be used:
 1. Chase Industries, Inc., Cincinnati, OH. Ordering POC: Arlene Macht, (800) 543-4455, or website "www.chasedoors.com/usps", user name "usps", password is "doors".
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Not Permitted.



2.2 TRAFFIC DOORS

- A. Model:
 - 1. Chase Industries: Durulite Series 200 Security Doors
- B. Color: Selected by Contracting Officer from manufacturer's standard colors.
- C. Door Body:
 - 1. Per manufacturer's USPS approved construction.
 - 2. Panel skin rate of burning, ASTM D635: "HB" (horizontal burning), no combustion.
 - 3. Panel skin flame spread index, ASTM E84: 275 maximum.
- D. Hardware: The upper pivot shall consist of a V-cam capable of carrying a door weighing 200 pounds. Lift shall be 1-3/8 inches with gravity self-closing action. Door shall be adjustable back and forth and/or up and down.
- E. Gaskets: All gasket materials shall be factory applied and shall include wings to prevent accumulation of dirt. Gaskets shall be on leading edge, back and bottom of each door panel.
- F. Top and Hinge Seal Covers: Top seal shall be made of block reinforced nylon, with black anodized aluminum metal. Stainless steel screws shall be used for fastening to frame. Top and bottom hinge seal covers shall be field installed.
- G. Viewing Area:
 - 1. Per manufacturer's USPS approved construction.
- H. Fasteners: All fasteners and washers, including jamb fasteners shall be made of stainless steel.
- I. Black Spring Polyethylene Bumper/Kick Plate.
 - 1. At Carrier Vestibule: 38 inch high bumpers on both sides of doors with no kickplate.
 - 2. At Mail Vestibule: 38 inch high bumpers on both sides of doors with no kickplate.
- J. Steel Door Frames: Specified in Section 055000.
- K. Directional Signs. USPS standard design:
 - 1. Pictograph for enter. Apply to entry side of panels.
 - 2. Pictograph and "NO EXIT". Apply opposite to entry side of panels for doors providing entry to building.
 - 3. Pictograph and "NO ENTRY". Apply opposite to entry side of panels for doors providing exit from building.

2.3 SECURITY FEATURES

- A. In addition to the items specified above, the following features shall be included in the door units:
 - 1. Lower hinge guard.
 - 2. Cane bolts, minimum 5/8-inch round steel, 12 inches long from tip to elbow (upper) and 36 inches long from tip to elbow (lower).
 - 3. 2 inch chain hole with grommet.
 - 4. Dirt free retainer sleeves for each lower cane bolt, with a depth of at least 3 inches.
 - 5. Double glazed polycarbonate security windows with three (3) 1" x 1/4" vertical steel bars. The vertical bars extend from the top of the door to within 33" of the bottom of the door panel, with a maximum horizontal spacing of 7".



2.4 DOOR STOPS

- A. Overhead door stops, header mount with tabs and contact pads.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify that openings are prepared with headers level, jambs plumb, floor level, without projections, and are correctly dimensioned to receive double action doors.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install door unit assembly to manufacturer's published instructions and final shop drawings.
- B. Fit and align door assembly level and plumb.
- C. Use anchorage devices to securely fasten door assembly to door frame construction without distortion or imposed stresses.

3.3 ADJUSTING

- A. Adjust door assembly to provide smooth operation from closed to full open position.

3.4 CLEANING

- A. Section 017300 - Execution: Cleaning installed Work.
- B. Remove protective material from pre-finished surfaces.
- C. Remove labels and visible markings.
- D. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Wipe surfaces clean.



Last revised: 4/12/2011

END OF SECTION



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SECTION 08 38 00 00 - MPF TRAFFIC DOORS**

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

THIS IS A DIRECT VENDOR ITEM. CONSTRUCTION SUPPLIERS MUST CONTACT THE DIRECT VENDOR AS DIRECTED FOR APPROVED PRICING AND PURCHASING PROCEDURES. Text in [brackets] indicates a choice must be made. Brackets with [] indicate information may be inserted at that location.

Drawing Coordination Items at end of Section.08 38 00 00

This section describes BMEU Direct Impact Doors used as exterior doors on the BMEU platform.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Double action impact resistant traffic doors, security type.
 - 2. Door hardware.
 - 3. Security features.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Provide products complete with accessories, trim, finish, safety guards, and other pertinent devices and details needed for a complete installation and intended use.
- D. Related Sections:
 - 1. Section 055000 - Metal Fabrications: Steel door frames for traffic doors.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.
 - 2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Indicate door materials, thickness, configuration, and hardware.
 - 2. Shop Drawings:
 - a. Indicate dimensions, details of construction, and installation.
 - b. Indicate relationship to adjoining related Work where cutting, fitting, reinforcement, and anchorage is required for complete installation.
- B. Section 017704 – Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Operating and Maintenance Data: Operating and maintenance instruction and parts lists.



2. Submit written special warranty with forms completed in United States Postal Service name and registered with manufacturer as specified in this section.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 1. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver product in manufacturer's original unopened packages with labels legible and intact.
- C. Labels shall identify manufacturer, brand name, model size, finish, and location of installation.
- D. Store double action doors and accessories in unopened packages in protected dry area to prevent damage from environmental and construction operations.
- E. Handle double action doors with care to prevent damage.

1.6 WARRANTY

- A. Comply with Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Manufacturer warranty to cover all material and labor required to repair or replace doors and door components for a period of two years from time of acceptance by USPS, within a guaranteed maximum repair response time of ten (10) calendar days.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. This Product must be manufactured by a USPS Direct Vendor and is subject to a USPS price and requirements purchasing agreement. The following vendor contact must be used:
 1. Chase Industries, Inc., Cincinnati, OH. Ordering POC: Arlene Macht, (800) 543-4455, or website "www.chasedoors.com/usps", user name "usps", password is "doors".
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Not Permitted.

2.2 TRAFFIC DOORS

- A. Model:
 1. Chase Industries: Durulite Series 200 Security Doors
- B. Color: Selected by Contracting Officer from manufacturer's standard colors.



- C. Door Body:
 - 1. Per manufacturer's USPS approved construction.
 - 2. Panel skin rate of burning, ASTM D635: "HB" (horizontal burning), no combustion.
 - 3. Panel skin flame spread index, ASTM E84: 275 maximum.
- D. Hardware: The upper pivot shall consist of a V-cam capable of carrying a door weighing 200 pounds. Lift shall be 1-3/8 inches with gravity self-closing action. Door shall be adjustable back and forth and/or up and down.
- E. Gaskets: All gasket materials shall be factory applied and shall include wings to prevent accumulation of dirt. Gaskets shall be on leading edge, back and bottom of each door panel.
- F. Top and Hinge Seal Covers: Top seal shall be made of block reinforced nylon, with black anodized aluminum metal. Stainless steel screws shall be used for fastening to frame. Top and bottom hinge seal covers shall be field installed.
- G. Viewing Area:
 - 1. Per manufacturer's USPS approved construction.
- H. Fasteners: All fasteners and washers, including jamb fasteners shall be made of stainless steel.
- I. Black Spring Polyethylene Bumper/Kick Plate.
 - 1. At Carrier Vestibule: 38 inch high bumpers on both sides of doors with no kick plate.
 - 2. At Mail Vestibule: 38 inch high bumpers on both sides of doors with no kickplate.
- J. Steel Door Frames: Specified in Section 055000.
- K. Directional Signs. USPS standard design:
 - 1. Pictograph for enter. Apply to entry side of panels.
 - 2. Pictograph and "NO EXIT". Apply opposite to entry side of panels for doors providing entry to building.
 - 3. Pictograph and "NO ENTRY". Apply opposite to entry side of panels for doors providing exit from building.

2.3 SECURITY FEATURES

- A. In addition to the items specified above, the following features shall be included in the door units:
 - 1. Lower hinge guard.
 - 2. Cane bolts, minimum 5/8-inch round steel, 12 inches long from tip to elbow (upper) and 36 inches long from tip to elbow (lower).
 - 3. 2 inch chain hole with grommet.
 - 4. Dirt free retainer sleeves for each lower cane bolt, with a depth of at least 3 inches.
 - 5. Double glazed polycarbonate security windows with three (3) 1" x 1/4" vertical steel bars. The vertical bars extend from the top of the door to within 33" of the bottom of the door panel, with a maximum horizontal spacing of 7".

2.4 DOOR STOPS

- A. Overhead door stops, header mount with tabs and contact pads.



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify that openings are prepared with headers level, jambs plumb, floor level, without projections, and are correctly dimensioned to receive double action doors.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install door unit assembly to manufacturer's published instructions and final shop drawings.
- B. Fit and align door assembly level and plumb.
- C. Use anchorage devices to securely fasten door assembly to door frame construction without distortion or imposed stresses.

3.3 ADJUSTING

- A. Adjust door assembly to provide smooth operation from closed to full open position.

3.4 CLEANING

- A. Section 017300 - Execution: Cleaning installed Work.
- B. Remove protective material from pre-finished surfaces.
- C. Remove labels and visible markings.
- D. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Wipe surfaces clean.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 6/29/2010

END OF SECTION



SECTION 08 41 13 00 - CSF ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.08 41 13 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Aluminum entrance doors.
 - 2. Aluminum storefronts
 - 3. Aluminum windows (fixed and operable)
 - 4. Vision glass and glass infill panels.
 - 5. Door hardware for entrance doors.
 - 6. Perimeter sealant.
- B. Related Documents: The Contract Documents, as defined in Section 011000- Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 084229 - Automatic Entrances.
 - 2. Section 087100 - Door Hardware: Hardware for same, and coordination.
 - 3. Section 088000 - Glazing: Requirements for glazing.

1.2 REFERENCES

- A. Aluminum Association (AA):
 - 1. AA-M12 C22 A41.
- B. American Architectural Manufacturers Association (AAMA):
 - 1. AAMA 605.2.
 - 2. AAMA 701.2.
 - 3. AAMA - Curtain Wall Manual #10
- C. American Society for Testing and Materials (ASTM):

1. ASTM B209.
2. ASTM B221.
3. ASTM A36/A36M.
4. ASTM A386.

1.3 SYSTEM DESCRIPTION

- A. Aluminum entrances and storefront system includes tubular aluminum sections, shop fabricated, factory finished, glass and infill, related flashings, anchorage and attachment devices. System is to be glazed from the interior or exterior.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
1. Product Data:
 - a. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.
 2. Shop Drawings:
 - a. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work and expansion and contraction joint location and details.
 3. Samples:
 - a. Aluminum Extrusions: Submit one sample 12 inches (300 mm) long in size illustrating finished aluminum surface.
 - b. Glazing: Submit one sample 12 x 12 inches (300 x 300 mm) in size illustrating finished aluminum glass units, and glazing materials.
 4. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
1. Special Warranty: Submit written special warranty with forms completed in United States Postal Service name and registered with manufacturer as specified in this Section.

1.5 QUALITY ASSURANCE

- A. Qualifications:
1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Handle Products of this section in accordance with AAMA - Curtain Wall Manual #10.



- C. Protect finished aluminum surfaces with strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

1.7 PROJECT CONDITIONS OR SITE CONDITIONS

A. Jobsite Requirements:

1. Install sealants and glazing only when temperature is 40 degrees F. or greater.

NOTE TO SPECIFIER

"REQUIRED Article (ENVIRONMENTAL REQUIREMENTS) follows. Do not revise this Article, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer."

1.8 ENVIRONMENTAL REQUIREMENTS

A. Energy Efficiency:

1. Exterior framing system: Provide frame with thermal break for exterior framing systems; provide weather-stripping for doors in exterior frame.

1.9 WARRANTY

A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.

B. Special Warranty:

1. The manufacturer/installer shall warrant the product and installation to be free from defective material and workmanship for a period of two years after date of substantial completion, and shall replace or repair any defective component or system, in whole or part, as necessary to restore the product to its original intended state and integrity.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:

1. Kawneer Company, Incorporated, Atlanta, GA (770) 449-5555.
2. Other acceptable manufacturers offering equivalent products.
 - a. Amarlite Architectural Aluminum and Glass Co., Tamarac, FL (800) 691-5750.
 - b. EFCO Corporation; Monett, MO. (800) 221-4169.
 - c. Tubelite, Inc., Reed City, MI. (800) 846-2227.
 - d. U.S. Aluminum Corporation, Waxahachie, TX. (800) 627-6440.
 - e. Vistawall Architectural Products, Terrell, TX. (800) 869-4567.



3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

- A. Extruded Aluminum: ASTM B221.
- B. Sheet Aluminum: ASTM B209.
- C. Steel Sections: ASTM A36/A36M; shaped to suit mullion sections.
- D. Fasteners: Stainless steel.

2.3 COMPONENTS

NOTE TO SPECIFIER

Option 1 & 2: Use for Medium Standard and Small Standard Buildings.

- A. Framing System: Trifab 451T, by Kawneer, 2 x 4-1/2 inch (50mm x 113mm) nominal dimension, minimum wall thickness of 0.080 inches, extruded aluminum flush glazed framing system with thermal break.
 - 1. Operable window to include:
 - a. Limiters, allowing 4 inch (10 cm) maximum opening at leading edge of window.
 - b. Insect screen installed with security fasteners.
 - c. Locking devices installed with security fasteners. Awning type and hopper type windows require two locking devices, one on each side of the window.
- B. Column Covers: 0.040 inch aluminum, by Kawneer Company, Inc. Finish to match that of storefront system.
- C. Receptor Channel: Model No. 450-038 and 65-025, by Kawneer Company, Inc. Finish to match that of storefront system.

2.4 ENTRANCE DOORS

- A. Doors: Series 350 swing door, medium stile, by Kawneer Company, Inc. Door sizes indicated on Drawings.
 - 1. Vertical Stile: 3-1/2 inch (88mm), single piece.
 - 2. Top Rail: 3-1/2 inch (88mm), single piece.
 - 3. Bottom Rail: 10 inch (250mm), single piece.
 - 4. Glazing: 1/4 inch (6mm) thick units per Section 088000, with standard bevel glass stops.

2.5 GLASS AND GLAZING MATERIALS

- A. Glazing Materials: As specified in Section 088000.

2.6 SEALANT MATERIALS



- A. Sealant and Backing Materials:
 - 1. Perimeter Sealant: Type as specified in Section 079200.
 - 2. Sealant Used Within System (Not Used for Glazing): Type as specified in Section 079200.

2.7 HARDWARE

- A. Verify hardware components specified in Section 087100.
- B. Closers: See Section 087100.
- C. Hinges: Door manufacturer's standard three pairs of butt hinges with non-removable pins. Finish: #14 Clear Anodized.
- D. Locking Devices: See Section 087100.
- E. Pulls: Type CO-9 pull, by Kawneer Company, Inc. Finish: [#14 Clear Anodized][_____].
- F. Exit Devices: See Section 087100.
- G. Weatherstripping, for Exterior Doors only:
 - 1. Head and Jamb: Replaceable wool, polypropylene, or nylon wool pile with aluminum strip backing, recessed in frame; AAMA 701.2.
 - 2. Sill: Semi-rigid polymeric material on aluminum anodized to match door; EPDM sweep strip; 38-560 by Kawneer or similar by other named manufacturers.
- H. Threshold: See Section 087100.

2.8 FINISHES

- A. Exposed Aluminum Surfaces: Architectural Class I anodic coating, AA-M12 C22 A41, #14 Clear, unless otherwise indicated on Drawings.
- B. Maintain same color range on doors, frames and other components. Do not mix light and dark shades.
- C. Concealed Steel Items: Galvanized in accordance with ASTM A386 to 2.0 oz/sq. ft.
- D. Apply two coats of bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.



- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Coordinate attachment and seal of perimeter air and vapor barrier materials.
- H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- I. Set thresholds in bed of mastic and secure.
- J. Install hardware using templates provided. Refer to Section 087100 for installation requirements.
- K. Install glass in accordance with Section 088000.
- L. Install perimeter sealant, backing materials, and installation criteria in accordance with Section 079200.
- M. Install automatic door operators and actuators in accordance with Section 084229.

3.3 ADJUSTING

- A. Section 017300 - Execution: Adjusting installed work.
- B. Adjust operating hardware [and sash] for smooth operation.

3.4 CLEANING

- A. Section 017300 - Execution: Cleaning installed work.
- B. Remove protective material from pre-finished aluminum surfaces.
- C. Wash down exposed surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- D. Remove excess sealant by method acceptable to sealant manufacturer.



USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



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SECTION 08 41 13 00 - MPF ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 – GENERAL

1.1 SUMMARY

- A. Lobby entrances.
- B. Exterior windows.
- C. Interior doors.
- D. Door hardware (except cylinders).
- E. Perimeter sealant
- F. Security revolving doors are specified in Section 111415 - Turnstiles.

1.2 SUBMITTALS

- A. Product Data: Required
- B. Shop Drawings: Required
- C. Samples: Required

1.3 QUALITY ASSURANCE

- A. Performance Requirements:
 - 1. Air leakage: 0.06 cfm/min/sq ft (0.0003 cu m/s/sq m) of wall area, measured at a reference differential pressure across assembly of 1.57psf (75 Pa).
 - 2. Water leakage: None, when measured in accordance with ASTM E 331 with a Pressure difference of 2.86 lbf/sq ft (136.85 N/sq m.).

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Source: Kawneer, Tubelite, Vistawall.
- B. Frame: 1 3/4" x 4 1/2" profile with thermal break and applied glazing stops.
- C. Doors: Narrow Stile.
- D. Glass and glazing Materials



E. Sealant and Backing Materials

2.2 FABRICATION

A. Reinforced Mullions: Profile as required with internal steel reinforcement.

1. Extruded Aluminum: ASTM B221
2. Sheet Aluminum: ASTM B209
3. Steel Sections: ASTM A36/A36M; shaped to suit mullion sections
4. Fasteners: Stainless Steel

B. Shop/Factory Finishing:

1. Exterior and Interior Installations: Kynar 500 or Hylan Fluoropolymer.

PART 3 – EXECUTION

3.1 Install all products in accordance with manufacturer's guidelines and printed instructions.

USPS Mail Processing Facility Specification issued: 10/1/2013

Last revised: 3/31/2010

END OF SECTION 08 41 13 00



SECTION 08 42 29 00 - CSF AUTOMATIC ENTRANCES**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where automatic entrance doors are part of the Work.

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

The standard plans show swinging entrance doors. They will need to be revised if sliding doors are used. The standard plans show sliding entrance doors. They will need to be revised if swinging doors are used.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Automatic sliding entrance doors with automatic actuators.

NOTE TO SPECIFIER

For standard automatic sliding doors, retain paragraph above and delete paragraph below. For optional automatic swinging doors delete paragraph above and retain paragraph below.

2. Entrance doors with full energy automatic operators and automatic actuators.
3. Entrance doors with low energy automatic operators and push plate actuators.

- #### B. Related Documents:
- The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:

1. Section 084113, Aluminum-Framed Entrances and Storefronts
2. Section 087100, Door Hardware
3. Section 088000, Glazing
4. Division 16, Electrical: 115 volt AC, minimum 15 amp (for two operators), single-phase wiring in conduit between operator enclosure and building power supply and low voltage wiring between enclosure and actuators. Wiring is to be concealed. Surface wiring is not permitted.

- #### D. Automatic doors shall be installed by a factory representative and will include all accessories, trim, finish, safety guards, hardware and other pertinent devices and details needed for a complete installation and intended use.

1.2 REFERENCES

A. American National Standard Institute (ANSI):

1. ANSI/BHMA A156.10, American National Standard for Power Operated Pedestrian Doors.
2. ANSI/BHMA A156.19, American National Standard for Power Assist and Low Energy Power Operated Doors.

NOTE TO SPECIFIER

For optional automatic swinging doors, retain paragraph above and delete paragraph below. For standard automatic sliding doors delete paragraph above and retain paragraph below.

3. ANSI/BHMA A156.10, American National Standard for Power Operated Pedestrian Doors..
4. ANSI A156.3, National Standard for Exit devices.
5. ANSI A156.13 - National Standard for Mortise Locks & Latches.

B. Underwriter's Laboratories (UL):

1. UL #325, Standard for Door, Drapery, Gate, Louver and Window Operators and Systems.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

1. Product Data: Manufacturer's catalog data, detail sheets, installation data and specifications.
 - a. Shop Drawings: Prepared specifically for this project, showing profiles, door dimensions, location of components, joining method and anchorage details, adjacent construction interface, operators, actuators and wiring diagrams.

B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.

1. Operating and Maintenance Data: Operating and maintenance instructions, parts lists and wiring diagrams.
2. Submit written special warranty with forms completed in United States Postal Service name and registered with manufacturer as specified in this Section.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Automatic doors will be manufactured and installed by the Factory Authorized Contractor.

B. Pre-Installation Meetings:

1. Convene a pre-installation meeting one week prior to commencing Work of this Section.
2. Require attendance of parties directly affecting Work of this Section.
3. Review conditions of operations, procedures and coordination with related Work.

1.5 DELIVERY, STORAGE, AND HANDLING

- ### A. Comply with Section 016000 - Product Requirements: Manufacturer will pack and transport Product(s) to the job site. Receive, handle, store, and protect Products.

1.6 WARRANTY

- ### A. Comply with Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.



- B. Manufacturer warranty to cover all material and labor required to repair or replace automatic doors and door components for a period of two years from time of acceptance by USPS, within a guaranteed maximum repair response time of ten (10) calendar days.

1.7 MAINTENANCE

- A. Comply with Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Operating Instruction: Document training by furnishing a sign-in sheet with a description of the training provided, instructors name and organization and those who receive training. Refer to 017704 1.3, 1.4 and 1.5 for more specific training requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Door glazing must be included in the basic door package but is available from supplier.
- B. A two-year warranty on parts and labor is required.
- C. The following manufacturers are basis for design:
 - 1. Stanley Access Technologies LLC, Stanley Security Solutions Company, 735 Thiebes, Labadie, MO 63055,
- D. Alternate equivalent products by the following manufacturers may be used:
 - 1. Besam Assa Abloy, 1900 Airport Road, Monroe, N.C. 28110.
 - 2. Horton Entry Solutions, www.hortondoors.com
- E. Comply with Section 016000 - Product Requirements: Product substitutions: Follow same product solutions.

2.2 AUTOMATIC SLIDING DOORS

- A. MODEL:
 - 1. Stanley: Dura-Glide 2000 Bi-Parting.
- B. MODEL:
 - 1. Stanley: Dura-Glide 2000 Single-Sliding.
 - 2. Stanley: Dura-Glide 2000 By-Pass Sliding.
- C. MATERIALS
 - 1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Headers, stiles, rails, and frames: 6063-T6
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - c. Sheet and Plate: ASTM B 209
 - 2. Sealants and Joint Fillers: Performed under Division 7 Section "Joint Sealants".
- D. AUTOMATIC ENTRANCE DOOR ASSEMBLIES

1. Provide manufacturer's standard automatic entrance door assemblies including doors, sidelites, framing, headers, carrier assemblies, roller tracks, door operators, activation and safety devices, and accessories required for a complete installation.
2. Sliding Automatic Entrance Doors:
 - a. Bi-Parting sliding doors:
 - 1) Configuration: Two sliding leaves and two full sidelites.
 - 2) Traffic Pattern: Two-way.
 - 3) Emergency Breakaway Capability: Sliding leaves only.
 - 4) Mounting: Between jambs
3. Sliding Automatic Entrance Doors:
 - a. Single Slide sliding doors:
 - 1) Configuration: One sliding leaf and one full sidelite.
 - 2) Traffic Pattern: Two-way or Directional (as required).
 - 3) Emergency Breakaway Capability: Sliding leaves only.
 - 4) Mounting: Between jambs
 - b. By-Pass sliding doors:
 - 1) Configuration: Two sliding leaves and one full center lite.
 - 2) Traffic Pattern: Two-way or Directional (as required).
 - 3) Emergency Breakaway Capability: Sliding leaves only.
 - 4) Mounting: Between jambs

E. COMPONENTS

1. Framing Members: Manufacturer's standard extruded aluminum reinforced as required to support imposed loads.
 - a. Nominal Size: 1 3/4 inch by 4 1/2 inch (45 by 115mm)
2. Stile and Rail Doors and Sidelites: Manufacturer's standard 1 3/4 inch (45 mm) thick glazed doors with extruded-aluminum tubular stile and rail members. Incorporate concealed tie-rods that span full length of top and bottom rails or mechanically fasten corners with reinforcing brackets that are welded.
 - a. Glazing Stops and Gaskets: Snap-on, extruded-security aluminum stops and preformed gaskets.
 - b. Stile Design: Narrow stile; 2 inch (51 mm) nominal width.
 - c. Bottom Rail Design: 10 inch (255 mm) nominal height.
 - d. Muntin Bars: Horizontal tubular rail member for each door; 2 inch (51 mm) nominal width.
3. Glazing: 1/4 inch (6mm) clear tempered glass.
4. Headers: Fabricated from extruded aluminum and extending full width of automatic entrance door units to conceal door operators, carrier assemblies, and roller tracks. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.
 - a. Mounting: Concealed, with one side of header flush with framing.
 - b. Capacity: Capable of supporting doors up to 220 lb (100 kg) per leaf over spans up to 14 feet (4.3 m) without intermediate supports.
5. Carrier Assemblies and Overhead Roller Tracks: Manufacturer's standard carrier assembly that allows vertical adjustment of at least 1/8 inch; consisting of urethane with precision steel lubricated ball-bearing wheels, operating on a continuous roller track. Support doors from carrier assembly by 2 inch diameter anti-riser wheels with factory adjusted cantilever and pivot assembly. Minimum two ball-bearing roller wheels and two anti-rise rollers for each active leaf.
 - a. Minimum Load Wheel Diameter: 2 1/2 inch (64 mm).



6. Thresholds: Manufacturer's standard thresholds as indicated below:
 - a. Continuous standard tapered extrusion double bevel.
 - b. All thresholds to conform to details and requirements for code compliance.
7. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.
8. Signage: Provide signage in accordance with ANSI/BHMA A156.10.

F. DOOR OPERATORS

1. Provide door operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, operation under normal traffic load for type of occupancy indicated.
2. Electromechanical Operators: Self-contained overhead unit powered by a minimum of 1/4 horsepower, permanent-magnet DC motor with gear reduction drive, microprocessor controller; and encoder.
 - a. Operation: Power opening and power closing.
 - b. Features:
 - 1) Adjustable opening and closing speeds.
 - 2) Adjustable back-check and latching.
 - 3) Adjustable braking.
 - 4) Adjustable hold-open time between 0 and 30 seconds.
 - 5) Obstruction recycle.
 - 6) On/Off switch to control electric power to operator.
 - 7) Energy conservation switch that reduces door-opening width.
 - 8) Variable rate open/closed speed control.
 - 9) Closed loop speed control with active braking and acceleration.
 - 10) Variable obstruction recycle time delay.
 - 11) Self adjusting stop position.
 - 12) Self adjusting closing compression force.
 - 13) Optional Switch to open/Switch to close operation.
 - c. Mounting: Concealed.
 - d. Drive System: Synchronous belt type.
 - e. Actuators: Stanley SU-100 Motion Sensors and StanGuard presence sensor.
 - f. Door Operators: Completely electro-mechanical. Comply with ANSI A156.10 and UL 325.
3. Electrical service to door operators shall be provided under Division 16 Electrical. Minimum service to be 120 VAC, 10 amps

G. ELECTRICAL CONTROLS

1. Electrical Control System: Electrical control system shall include a microprocessor controller and position encoder. The encoder shall monitor revolutions of the operator shaft and send signals to microprocessor controller to define door position and speed. Systems utilizing external magnets and magnetic switches are not acceptable. A single controller shall be capable of controlling up to 2 operators per entrance system.
2. Life Cycle Data Counter: The microprocessor control shall incorporate a non-re-settable counter to track door operation cycles.
3. Controller Protection: The microprocessor controller shall incorporate the following features to ensure trouble free operation:
 - a. Automatic Reset Upon Power Up
 - b. Fuse Protection



- c. Electronic Surge Protection
 - d. Internal Power Supply Protection.
 - e. Software "Watchdog" protection in the case of software malfunction.
4. Soft Start/Stop: A "soft-start" "soft-stop" motor driving circuit shall be provided for smooth normal opening and recycling.
 5. Safety Search Circuitry: Provide system to recycle the sliding panels when an obstruction is encountered during the closing cycle. If an obstruction is detected, the system shall search for that object on the next closing cycle by reducing door closing speed prior to the previously encountered obstruction location, and will continue to close in check speed until doors are fully closed, at which time the doors will reset to normal speed. If obstruction is encountered again, the door will come to a full stop. The doors shall remain stopped until obstruction is removed and operate signal is given, resetting the door to normal operation.
 6. Programmable Controller: Microprocessor controller shall be programmable and shall be designed for connection to a local configuration tool. Local configuration tool shall be software driven and shall be utilized via Palm® handheld interface. The following parameters may be adjusted via the configuration tool.
 - a. Operating speeds and forces as required to meet ANSI/BHMA A156.10.
 - b. Adjustable and variable features as specified in 2.05, B., 2.
 - c. Reduced opening position.
 - d. Firmware update.
 - e. Trouble Shooting
 - 1) I/O Status.
 - 2) Electrical component monitoring including parameter summary.
 - f. Entrance profile copy/paste.

Software for local configuration tool shall be available as a free download from the sliding automatic entrance manufacturer's internet site.

H. ACTIVATION AND SAFETY DEVICES

1. Motion Sensors: Motion sensors shall be mounted on each side of door header to detect pedestrians in the activating zone, and to provide a signal to open doors in accordance with ANSI/BHMA A156.10. Units shall be programmable for bi-directional or uni-directional operation and shall incorporate K-band microwave frequency to detect all motion in both directions.
2. Presence Sensors: Presence sensors shall be provided to sense people or objects in the threshold safety zone in accordance with ANSI/BHMA A156.10. Units shall be self-contained, fully adjustable, and shall function accordingly with motion sensors provided. The sensor shall be enabled simultaneously with the door-opening signal and shall emit an elliptical shaped infrared presence zone, centered on the doorway threshold line. Presence sensors shall be capable of selectively retuning to adjust for objects which may enter the safety zone; tuning out, or disregarding, the presence of small nuisance objects and not tuning out large objects regardless of the time the object is present in the safety zone. The door shall close only after all sensors detect a clear surveillance field.
3. Photoelectric Beams: In addition to the threshold sensor include a minimum of two (2) doorway holding beams. Photoelectric beams shall be pulsed infrared type, including sender receiver assemblies for recessed mounting.

I. HARDWARE

1. Provide units in sizes and types recommended by automatic entrance door and hardware manufacturers for entrances and uses indicated.



2. Emergency Breakaway Feature: Provide release hardware that allows panel(s) to swing out in direction of egress to full 90 degrees from any position in sliding mode. Maximum force to open panel shall be 50 lbf (222 N) according to ANSI/BHMA A156.10. Interrupt powered operation of panel operator while in breakaway mode.
 - a. Emergency breakaway feature shall include at least one adjustable detent device mounted in the top of each breakaway panel to control panel breakaway force.
3. Deadlocks: Manufacturer's standard deadbolt operated by exterior cylinder and interior thumb turn; with minimum 1 inch (25 mm) long throw bolt; ANSI/BHMA A156.5, Grade 1.
 - a. Cylinders: As specified in Division 8 Section "Door Hardware".
 - b. Hook Latch: Laminated-steel hook, mortise type, BHMA A156.5, Grade 1.
 - c. Two-Point Locking: Provide locking system that incorporates a device in the stile of active door leaves that automatically extends a flush bolt into overhead carrier assembly.
4. Control Switch: Provide manufacturer's standard header mounted rocker switches to allow for full control of the automatic entrance door. Controls to include, but are not limited to:
 - a. Power On/Off
 - b. Reduced Opening
 - c. Open/Closed/Automatic
5. Sliding Weather Stripping: Manufacturer's standard replaceable components complying with AAMA 701; made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
6. Weather Sweeps: Manufacturer's standard adjustable nylon brush sweep mounted to underside of door bottom.

J. FABRICATION

1. Factory fabricates automatic entrance door assembly components to designs, sizes, and thickness indicated and to comply with indicated standards.
 - a. Form aluminum shapes before finishing.
 - b. Use concealed fasteners to greatest extent possible.
 - 1) Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 - 2) Reinforce members as required to receive fastener threads.
2. Framing: Provide automatic entrance doors as prefabricated assemblies.
 - a. Fabricate tubular and channel frame assemblies with manufacturer's standard mechanical or welded joints. Provide sub-frames and reinforcement as required for a complete system to support required loads.
 - b. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
 - c. Form profiles that are sharp, straight, and free of defects or deformations.
 - d. Prepare components to receive concealed fasteners and anchor and connection devices.
 - e. Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
3. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.
4. Door Operators: Factory fabricated and installed in headers, including adjusting and testing.
5. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated.



6. Hardware: Factory install hardware to the greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site.

K. DOOR AND HARDWARE PACKAGE

- 2 ea. Stanley Dura-Glide 2000 Bi-Parting sliding door package (Package Height = 96")
 - Finish: [clear anodized][dark bronze anodized]
 - Glass: 1/4" clear tempered safety glass
 - StanGuard Overhead Safety System
 - Emergency break-away on active leafs
 - Fixed sidelites
 - Narrow stile doors
 - 2" Muntin
 - 10" Bottom rails
 - Alarm contacts
- 4 ea. Stanley SU-100 motion sensor
- 4 ea. Doorway holding beam
- 2 ea. 6" Double beveled thresholds

For exterior door:

- 1 ea. Adams Rite 2-point MS lock [clear anodized][dark bronze anodized] finish
- 1 ea. Best 1E76 C181 RP3 cylinder w/construction core, [626 satin chromium plated][_____]
finish

L. DOORS AND HARDWARE PACKAGE

1. For exterior doors:

- 2 ea. Stanley Dura-Glide 2000 Single-sliding door package
 - Finish: [clear anodized][dark bronze anodized]
 - Glass: 1/4" clear tempered safety glass
 - StanGuard Overhead Safety System
 - Emergency break-away on active leafs
 - Fixed sidelites
 - Narrow stile doors
 - 2" Muntin
 - 10" Bottom rails
 - Alarm contacts
- 4 ea. Stanley SU-100 motion sensor
- 4 ea. Doorway holding beam
- 2 ea. 6" Double beveled thresholds
- 2 ea. Adams Rite 2-point MS lock [clear anodized][dark bronze anodized] finish

For interior storefront doors:

- 1 ea. Stanley Dura-Glide 2000 By-Pass Sliding door package
 - Finish: [clear anodized][dark bronze anodized]
 - Glass: 1/4" clear tempered safety glass
 - StanGuard Overhead Safety System
 - Emergency break-away on active leafs
 - Fixed center lite
 - Narrow stile doors
 - 2" Muntin
 - 10" Bottom rails
 - Alarm contacts
- 4 ea. Stanley SU-100 motion sensor
- 4 ea. Doorway holding beam
- 1 ea. 6" Double beveled thresholds
- 2 ea. Adams Rite 2-point MS lock [clear anodized][dark bronze anodized] finish



NOTE TO SPECIFIER

For standard automatic sliding doors, retain paragraph above and delete paragraph below. For optional automatic swinging doors delete paragraph above and retain paragraph below.

2.3 AUTOMATIC SWINGING DOORS

A. Model:

1. Stanley: Magic Force Swing, set for full energy operation.
2. Stanley: Magic Force Swing, set for low energy operation.

B. MATERIALS

1. Automatic Swinging Doors: Includes all required hardware and accessories except glazing.
 - a. Type: Single swinging with heavy duty extruded aluminum frame.
 - 1) Hinge: Center pivot.
 - 2) Vertical Stile: 3-1/2 inch (88mm), single piece.
 - 3) Top Rail: 3-1/2 inch (88mm), single piece.
 - 4) Bottom Rail: 10 inch (250mm), single piece.
 - b. Finish: [Clear anodized aluminum][Dark bronze anodized aluminum][Factory applied Kynar paint, color to match storefront system. There is a longer than standard lead time for painted finish.].
 - c. Control box with operator arm, as supplied in the standard Stanley package:
 - 1) Surface mounted above door.
 - 2) Finish to match door.
 - 3) On-off key switch.
 - d. Glazing: 1/4" clear tempered glasstype 3 or 7 as shown on drawings and provided in Section 088000, with standard bevel glass stops.
 - e. Weatherstripping: Interior and Exterior Doors
 - 1) Head and Jamb: As supplied in the standard Stanley package.
 - 2) Sill: As supplied in the standard Stanley package.
 - f. Finger Guard: As supplied in the standard Stanley package.
 - g. Signs: Decals applied to doors as supplied in the standard Stanley package, complying with ANSI A156.19 and applicable codes.
2. Door Actuators.
 - a. Actuators: Stanley SU-100 Motion Sensors and Sentrex presence sensor.
 - b. Actuators: Stanley push plate switches on exterior and interior.
 - 1) Material: Stainless steel.
 - 2) Marking: "PRESS TO OPEN" with HC logo.
 - 3) Actuators shall be hard-wired to door operators, per manufacturer's recommendations. Radio controlled actuators are not acceptable.
3. Door Operators: Completely electro-mechanical. Comply with ANSI A156.10 and UL 325.
4. Door Operators: Completely electro-mechanical. Comply with ANSI A156.19 and UL 325.
 - a. Power Open Operation: The operator shall open and stop the door in the open position by electrically reducing the motor voltage and stalling against a field adjustable 80 to 135 degree positive stop.
 - b. Full Energy / Low Energy Selectable: The microprocessor control shall be easily field adjustable to comply with ANSI A156.10 - Full Energy Code requirements or ANSI A156.19 - Low Energy Code requirements. Field adjustments for door-opening speed, door-opening force, door-closing speed, and door-closing force shall be provided without the requirement for additional components.
 - c. Non-Handed Operation: The operator shall have the ability to be converted from right hand to left hand operation with simple field modifications.



- d. Field Adjustable Compression Spring Closing Operation: The operator shall close the door by adjustable spring energy. Employing the motor, as a dynamic brake shall aide-closing speed.
- e. Independent Adjustable Closing and Latching Speed Control: The operator shall employ a rheostat module to allow for easy, independent field adjustment of closing and latching speeds using the motor as a dynamic brake.
- f. Manual Use: The operator shall function as a manual door closer in the direction of swing with or without electrical power.
- g. Emergency Release: The operator shall have a built-in emergency release with controlled spring return to the closed position without manual resetting. While the door is in the emergency release mode, a disconnect switch shall prevent powered operation.
- h. Electrical Controls: Field adjustments for door-opening speed, door-opening force, door-closing speed, door-closing force shall be provided without the requirement for additional components. Provide remotely located "On-Off-Hold Open" key-switch.
- i. Power supply required: 115 volts AC, minimum 15 amps. Control circuits for actuators: Low voltage, NEC Class II.
- j. Operator Enclosure: Overhead enclosure concealing all operating parts except arms and manual control switches.

C. DOORS AND HARDWARE

1. Automatic swinging entrance doors:

- 4 ea. Stanley Magic Force Swing full energy door with concealed header
- 4 ea. Stanley SU-100 motion sensor
- 4 ea. Stanley Sentrex presence sensor
- 8 ea. Guide rails, [clear anodized][dark anodized][] finish
- 4 ea. 4-foot beveled aluminum threshold

For exterior ingress door:

- 1 ea. Adams Rite MS1850S-210 lock [clear anodized][dark bronze anodized] finish
- 2 ea. Best 1E76 C181 RP3 cylinder w/construction core, [626 satin chromium plated][] finish

For exterior egress door:

- 1 ea. PR2403CD EO Exit Device, [628 satin aluminum, clear anodized][] finish
- 1 ea. Best 1E74 C4 RP3 w/construction core, [clear anodized][dark bronze anodized][] finish
- 1 ea. PRTS2403CD Switch

2. Refer to the attached Stanley package for USPS CSF Small Plan 40, 50 and 65a Facilities with automatic swinging entrance doors, which includes the following:

- 3 ea. Stanley Magic Force Swing low energy door with concealed header
- 6 ea. Stanley push plate actuator
- 3 ea. 4-foot beveled aluminum threshold
- 3 ea. PR2403CD 2003C Exit Device, [628 satin aluminum, clear anodized][] finish
- 3 ea. Best 1E72 RP2 cylinder w/construction core, [626 satin chromium plated][] finish
- 3 ea. Best 1E74 C4 RP3 w/construction core for dogging, [clear anodized][dark bronze anodized][] finish

3. Stanley package for USPS CSF Small Plan 80a and 100a Facilities with automatic swinging entrance doors, which includes the following:

- 4 ea. Stanley Magic Force Swing low energy door with concealed header
- 6 ea. Stanley push plate actuator
- 3 ea. 4-foot beveled aluminum threshold

For interior storefront ingress:

- 1 ea. Kawneer CP-2 Push bar, [clear anodized][bronze anodized][] finish
- 1 ea. Adams Rite MS1850S-210 lock with hook deadbolts [clear anodized][dark bronze anodized] finish



2 ea. Best 1E76 C181 RP3 cylinder w/construction core, [626 satin chromium plated][_____] finish

For interior storefront egress:

1 ea. PR2401CD 2001 Exit Device, [628 satin aluminum, clear anodized][_____] finish

1 ea. Best 1E74 C4 RP3 w/construction core, [clear anodized][dark bronze anodized][_____] finish

For exterior doors:

2 ea. PR2403CD 2003C Exit Device, [628 satin aluminum, clear anodized][_____] finish

2 ea. Best 1E72 RP2 cylinder w/construction core, [626 satin chromium plated][_____] finish

2 ea. Best 1E74 C4 RP3 w/construction core, [clear anodized][dark bronze anodized][_____] finish

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify that door openings and doors are properly installed and ready for installation of automatic door equipment.
 - 2. Verify that electrical service is available, properly located and of proper type.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

A. Installation by manufacturer in compliance with ANSI A156.10.

B. Installation by manufacturer in compliance with ANSI A156.10.

NOTE TO SPECIFIER

For standard automatic sliding doors, retain paragraph above and delete paragraph below. For optional automatic swinging doors delete paragraph above and retain paragraph below.

C. Installation by manufacturer in compliance with ANSI A156.10.

- 1. Coordinate the mounting height of the required signs on the doors with USPS "station ID", "Hours of Operation" or other door mounted vinyls.

D. Verify that electrical connections are made correctly.

3.3 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.



3.4 ADJUST AND CLEAN

- A. Adjust doors and operators for proper operation, without binding, scraping or excessive noise.
- B. Adjust operators in compliance with ANSI A156.10.

NOTE TO SPECIFIER

For standard automatic sliding doors, retain paragraph above and delete paragraph below. For optional automatic swinging doors delete paragraph above and retain paragraph below.

- C. Adjust operators for full energy operation, in compliance with ANSI A156.10.
- D. Adjust operators for low energy operation, in compliance with ANSI A156.19.

3.5 PROTECTION

- A. Protect finishes until substantial completion.
- B. OPERATING INSTRUCTION
 - 1. Provide on-site instruction to review the operation of the system and detail any common troubleshooting or maintenance that is required to ensure normal operation.
 - 2. Provide one complete set of equipment operating, installation, and programming manuals that will remain at the installed location.

USPS CSF Specifications issued: 10/1/2013
Last revised: 9/17/2013

END OF SECTION 08 42 29 00



SECTION 08 42 29 00 - MPF AUTOMATIC ENTRANCES**

NOTE TO SPECIFIER

Use this Outline Specification Section for BMEUs at Mail Processing Facilities (MPF) where automatic entrance doors are part of the Work.

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - *****

*****GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Automatic sliding entrance doors with automatic actuators.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 084113, Aluminum-Framed Entrances and Storefronts
 - 2. Section 087100, Door Hardware
 - 3. Section 088000, Glazing
 - 4. Division 16, Electrical: 115 volt AC, minimum 15 amp (for two operators), single-phase wiring in conduit between operator enclosure and building power supply and low voltage wiring between enclosure and actuators. Wiring is to be concealed. Surface wiring is not permitted.
- D. Automatic doors shall be installed by a factory authorized representative and will include all accessories, trim, finish, safety guards, hardware and other pertinent devices and details needed for a complete installation and intended use.

1.2 REFERENCES

- A. American National Standard Institute (ANSI):
 - 1. ANSI/BHMA A156.10, American National Standard for Power Operated Pedestrian Doors.
 - 2. ANSI A156.3, National Standard for Exit devices.
 - 3. ANSI A156.13 - National Standard for Mortise Locks & Latches.
- B. Underwriter's Laboratories (UL):
 - 1. UL #325, Standard for Door, Drapery, Gate, Louver and Window Operators and Systems.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Manufacturer's catalog data, detail sheets, installation data and specifications.
 - a. Shop Drawings: Prepared specifically for this project, showing profiles, door dimensions, location of components, joining method and anchorage details, adjacent construction interface, operators, actuators and wiring diagrams.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.



1. Operating and Maintenance Data: Operating and maintenance instructions, parts lists and wiring diagrams.
2. Submit written special warranty with forms completed in United States Postal Service name and registered with manufacturer as specified in this Section.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 1. Automatic doors will be manufactured and installed by the Factory Authorized Contractor.
- B. Pre-Installation Meetings:
 1. Convene a pre-installation meeting one week prior to commencing Work of this Section.
 2. Require attendance of parties directly affecting Work of this Section.
 3. Review conditions of operations, procedures and coordination with related Work.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Section 016000 - Product Requirements: Manufacturer will pack and transport Product(s) to the job site. Receive, handle, store, and protect Products.

1.6 WARRANTY

- A. Comply with Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Manufacturer warranty to cover all material and labor required to repair or replace automatic doors and door components for a period of two years from time of acceptance by USPS, within a guaranteed maximum repair response time of ten (10) calendar days.

1.7 MAINTENANCE

- A. Comply with Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Operating Instruction: Document training by furnishing a sign-in sheet with a description of the training provided, instructors name and organization and those who receive training. Refer to 017704 1.3, 1.4 and 1.5 for more specific training requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Door glazing **must be** included in the basic door package but is available from supplier.
- B. A two-year warranty on parts and labor is included.
- C. Manufacturer:
 - a. Stanley Access Technologies LLC, Stanley Security Solutions Company, 735 Thiebes, Labadie, MO 63055, Attn.
- D. Alternate equivalent products by the following manufacturers may be used:



1. Besam Assa Abloy, 1900 Airport Road, Monroe, N.C. 28110.
2. Horton Entry Solutions, www.hortonddoors.com

- E. Comply with Section 016000 - Product Requirements: Product substitutions: Follow same product solutions.

2.2 AUTOMATIC SLIDING DOORS

A. Model:

1. Stanley: Dura-Glide 2000 Bi-Parting.

B. MATERIALS

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Headers, stiles, rails, and frames: 6063-T6
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - c. Sheet and Plate: ASTM B 209
2. Sealants and Joint Fillers: Performed under Division 7 Section "Joint Sealants".

C. AUTOMATIC ENTRANCE DOOR ASSEMBLIES

1. Provide manufacturer's standard automatic entrance door assemblies including doors, sidelites, framing, headers, carrier assemblies, roller tracks, door operators, activation and safety devices, and accessories required for a complete installation.
2. Sliding Automatic Entrance Doors:
 - a. Bi-Parting sliding doors:
 - 1) Configuration: Two sliding leaves and two full sidelites.
 - 2) Traffic Pattern: Two-way.
 - 3) Emergency Breakaway Capability: Sliding leaves only.
 - 4) Mounting: Between jambs

D. COMPONENTS

1. Framing Members: Manufacturer's standard extruded aluminum reinforced as required to support imposed loads.
 - a. Nominal Size: 1 3/4 inch by 4 1/2 inch (45 by 115mm)
2. Stile and Rail Doors and Sidelites: Manufacturer's standard 1 3/4 inch (45 mm) thick glazed doors with extruded-aluminum tubular stile and rail members. Incorporate concealed tie-rods that span full length of top and bottom rails or mechanically fasten corners with reinforcing brackets that are welded.
 - a. Glazing Stops and Gaskets: Snap-on, extruded-security aluminum stops and preformed gaskets.
 - b. Stile Design: Narrow stile; 2 inch (51 mm) nominal width.
 - c. Bottom Rail Design: 10 inch (255 mm) nominal height.
 - d. Muntin Bars: Horizontal tubular rail member for each door; 2 inch (51 mm) nominal width.
3. Glazing: 1/4 inch (6mm) clear tempered glass.
4. Thresholds: Manufacturer's standard thresholds as indicated below:
 - a. Continuous standard tapered extrusion double bevel.
 - b. All thresholds to conform to details and requirements for code compliance.
5. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.
6. Signage: Provide signage in accordance with ANSI/BHMA A156.10.

E. DOOR OPERATORS

1. Provide door operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, operation under normal traffic load for type of occupancy indicated.
2. Electrical service to door operators shall be provided under Division 16 Electrical. Minimum service to be 120 VAC, 10 amps.

F. ELECTRICAL CONTROLS

1. Electrical Control System: Electrical control system shall include a microprocessor controller and position encoder. The encoder shall monitor revolutions of the operator shaft and send signals to microprocessor controller to define door position and speed. Systems utilizing external magnets and magnetic switches are not acceptable. A single controller shall be capable of controlling up to 2 operators per entrance system.

G. ACTIVATION AND SAFETY DEVICES

1. Motion Sensors: Motion sensors shall be mounted on each side of door header to detect pedestrians in the activating zone, and to provide a signal to open doors in accordance with ANSI/BHMA A156.10. Units shall be programmable for bi-directional or uni-directional operation and shall incorporate K-band microwave frequency to detect all motion in both directions.
2. Presence Sensors: Presence sensors shall be provided to sense people or objects in the threshold safety zone in accordance with ANSI/BHMA A156.10. Units shall be self-contained, fully adjustable, and shall function accordingly with motion sensors provided. The sensor shall be enabled simultaneously with the door-opening signal and shall emit an elliptical shaped infrared presence zone, centered on the doorway threshold line. Presence sensors shall be capable of selectively retuning to adjust for objects which may enter the safety zone; tuning out, or disregarding, the presence of small nuisance objects and not tuning out large objects regardless of the time the object is present in the safety zone. The door shall close only after all sensors detect a clear surveillance field.
3. Photoelectric Beams: In addition to the threshold sensor include a minimum of two (2) doorway holding beams. Photoelectric beams shall be pulsed infrared type, including sender receiver assemblies for recessed mounting.

H. HARDWARE

1. Provide units in sizes and types recommended by automatic entrance door and hardware manufacturers for entrances and uses indicated.

I. FABRICATION

1. Factory fabricates automatic entrance door assembly components to designs, sizes, and thickness indicated and to comply with indicated standards.
 - a. Form aluminum shapes before finishing.
 - b. Use concealed fasteners to greatest extent possible.
 - 1) Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 - 2) Reinforce members as required to receive fastener threads.
2. Framing: Provide automatic entrance doors as prefabricated assemblies.
 - a. Fabricate tubular and channel frame assemblies with manufacturer's standard mechanical or welded joints. Provide sub-frames and reinforcement as required for a complete system to support required loads.
 - b. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
 - c. Form profiles that are sharp, straight, and free of defects or deformations.
 - d. Prepare components to receive concealed fasteners and anchor and connection devices.



3. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.
4. Door Operators: Factory fabricated and installed in headers, including adjusting and testing.
5. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated.
6. Hardware: Factory install hardware to the greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site.

J. DOORS AND HARDWARE PACKAGE

- 2 ea. Stanley Dura-Glide 2000 Bi-Parting sliding door package

Finish: [clear anodized][dark bronze anodized]

Glass: 1/4" clear tempered safety glass

StanGuard Overhead Safety System

Emergency break-away on active leafs

Fixed sidelites

Narrow stile doors

2" Muntin

10" Bottom rails

Alarm contacts

- 4 ea. Stanley SU-100 motion sensor

- 2 ea. Doorway holding beam

- 2 ea. 6" Double beveled thresholds

For exterior door:

- 1 ea. Adams Rite 2-point MS lock [clear anodized][dark bronze anodized] finish

- 1 ea. Best 1E76 C181 RP3 cylinder w/construction core, [626 satin chromium plated][_____] finish

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 1. Verify that door openings and doors are properly installed and ready for installation of automatic door equipment.
 2. Verify that electrical service is available, properly located and of proper type.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Installation by manufacturer in compliance with ANSI A156.10.
 1. Coordinate the mounting height of the required signs on the doors with USPS "station ID", "Hours of Operation" or other door mounted vinyls.



- B. Verify that electrical connections are made correctly.

3.3 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.

3.4 ADJUST AND CLEAN

- A. Adjust doors and operators for proper operation, without binding, scraping or excessive noise.
- B. Adjust operators in compliance with ANSI A156.10.

3.5 PROTECTION

- A. Protect finishes until substantial completion.

- B. OPERATING INSTRUCTION

1. Provide on-site instruction to review the operation of the system and detail any common troubleshooting or maintenance that is required to ensure normal operation.
2. Provide one complete set of equipment operating, installation, and programming manuals that will remain at the installed location.

USPS Mail Processing Facility Specifications issued: 10/1/2013
Last revised: 9/17/2013

END OF SECTION 08 42 29 00



Task	Specification	Specification Description
08 43 19 00	01 22 16 00	No Specification Required



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SECTION 08 45 00 00 - CSF TRANSLUCENT WALL AND ROOF ASSEMBLIES

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.08 45 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Translucent fiberglass sandwich panel skylight/canopy system.
 2. Translucent cellular polycarbonate skylight/canopy system.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 1. Section 055000 - Metal Fabrications: Security grilles.
 2. Section 076200 - Sheet Metal Flashing and Trim.
 3. Section 088000 - Glazing: Security glazing.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 1. ASTM C236 - Standard Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box.
 2. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference
 3. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.
 4. ASTM D1002 - Standard Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading.
 5. ASTM D1037 - Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials.
 6. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics.
 7. ASTM D2244 - Standard Test Method for Calculation of Color Differences From Instrumentally Measured Color Coordinates.



8. ASTM D2843 - Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics.
9. ASTM E72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
10. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
11. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings.
12. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen.
13. ASTM C297 - Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 1. Shop Drawings:
 - a. Show fabrication details, materials, dimensions, installation methods, anchors, and relationship to adjacent construction.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 1. Special Warranty: Submit written special warranty with forms completed in United States Postal Service name and registered with manufacturer as specified in this Section.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Store skylight panels on the long edge, several inches above the ground, blocked and under cover to prevent warping.

1.6 WARRANTY

- A. Special Warranty:
 1. Manufacturer's complete warranty for materials and workmanship. Warranty is to cover material and installation and is not to be prorated.
 2. Change in color of the panels is not to exceed 4 units Delta per ASTM D2244.
 3. There is to be no delamination of the panel effecting appearance, performance, weatherability or structural integrity of the panels or the completed system.
 4. There is to be no fiberbloom on the panel face.
 5. Warranty Period: 5 years



PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project. Both the fiberglass type panel system and the cellular polycarbonate type panel system may be included in the Project Manual.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:

NOTE TO SPECIFIER

Fiberglass type panel system manufacturers are listed below.

1. Kalwall Corporation, Manchester, NH (800) 258-9777.
2. Major Industries, Incorporated, Wausau, WI (888) 759-2678.
3. Skywall Translucent Systems, Terrell, TX (800) 259-7941.

NOTE TO SPECIFIER

Cellular polycarbonate type panel system manufacturers are listed below.

4. CPI International, Lake Forest, IL (847) 816-1060 (800) 759-6985.
5. Duo-Gard Industries, Incorporated, Canton, MI (313) 207-9700.
6. Wasco Products, Incorporated, Sanford, ME (800) 388-0293.

- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 TRANSLUCENT FACING

- A. Panel material shall be manufactured by one of the companies named above.

B. Weatherability:

1. The full thickness of the panel faces exposed to the outdoors shall not change color more than four Hunter or CIE Units DELTA E by ASTM D2244 after five years outdoor South Florida weathering at five degrees facing south, determined by the average of at least three white samples with and without a protective film or coating to insure maximum, long term color stability.
2. The exposed faces of fiberglass sandwich type panels shall have a permanent erosion barrier embedded integrally to provide maximum long term resistance to reinforcing fiber exposure.

C. Appearance:

1. The face sheets shall be uniform in color to prevent splotchy appearance.
2. Faces shall be completely free of ridges and wrinkles which prevent proper surface contact. Clusters of air bubbles/pinholes which collect moisture and dirt are not acceptable.

- D. Integral perimeter framing system assembly shall be by manufacturer.

NOTE TO SPECIFIER



Select the following two paragraphs, 2.3 and 2.4, for the fiberglass type panel system. Not used for the cellular polycarbonate type panel system.

2.3 NON COMBUSTIBLE GRID CORE

- A. The aluminum I-beams shall be 6063-T6 with provisions for mechanical interlocking of muntin-mullion and perimeter to prevent high and low intersections which do not allow full bonding surface to contact with face material. Width of I-beam shall be no less than 7/16 inch. I-beam grid shall be machined to tolerances of not greater than $\pm .002$ inch for flat panels.

2.4 ADHESIVE

- A. The laminate adhesive shall be heat and pressure resin-type engineered for structural sandwich panel use. Adhesive shall pass testing requirements specified by the International Conference of Building Officials "Acceptance Criteria for Sandwich Panel Adhesive". Minimum strength shall be:
 1. 750 PSI tensile strength by ASTM C297 after two exposures to six cycles each of the aging conditions prescribed by ASTM D1037.
 2. Shear strength after exposure to five separate aging conditions by ASTM D1002:
 - a. 50 percent relative humidity at 73 degrees F: 540 PSI.
 - b. Accelerated Aging by ASTM D1037 at room temperature: 800 PSI.
 - c. Accelerated Aging by ASTM D1037 at 182 degrees F: 250 PSI.
 - d. 500 Hour Oxygen Bomb by ASTM D572: 1,400 PSI.
 - e. 182 degrees F: 100 PSI.

2.5 PANEL CONSTRUCTION

- A. Exterior panel faces shall be [Crystal] [White] [____] in color. Interior panel faces shall be [Crystal] [White] [____] in color.
- B. Panels shall have a "U" factor of [0.53] [0.18] [____]; light transmission of [35] [50] [____] percent.
- C. Flamespread per ASTM E84: [Class One for skylight] [Class Three for canopy].
- D. Smoke density per ASTM E84 maximum: [200 for skylight] [350 for canopy].
- E. Burn Extent per ASTM D635: [1 inch or less for skylight] [2 1/2 inches or less for canopy].
- F. Self-ignition per ASTM D1929: Greater than 650 degrees F.
- G. Air infiltration per ASTM E283 at 6.24 psf: Less than 0.01 CFM/square feet.
- H. Water penetration per ASTM E331 at test pressure of 10 psf: Zero.
- I. Manufacturer responsible for maximum system deflection per applicable building code and without damage to system performance. Criteria to be calculated in engineering compliance.
- J. Proper weepage elements to be incorporated within the perimeter framework of the glazing system for drainage of any condensation or water penetration.
- K. System to accommodate movement within the system; movement between the system and perimeter framing components; dynamic loading and release of loads, and deflection of supporting members. This



should be achieved without damage to system or components, deterioration of weatherseals and fenestration properties specified.

- L. System modules shall be factory assembled to the greatest extent possible. Panels shall be shipped to the job site in rugged shipping units and shall be ready for erection.
- M. All skylights and canopies shall have conspicuous decals affixed to each skylight warning individuals against sitting or stepping on these units, or submit calculations confirming assembly will support minimum 300 pounds point load, to comply with OSHA's regulations for finished construction.
- N. The exterior panel face shall repel an impact of 60 foot pounds without fracture or tear when impacted by a 3 1/2 inch diameter 6.37 pound free falling ball.

NOTE TO SPECIFIER

Select the following item for the fiberglass type panel system. Not used for the cellular polycarbonate type panel system.

- O. Panels shall consist of fiberglass faces laminated to an aluminum I-beam grid core and shall deflect no more than 1.9 inches at 30 PSF in 10 feet per ASTM E-72, without a supporting frame.

2.6 BATTENS AND PERIMETER CLOSURE SYSTEMS

- A. Extruded 6005-T6 aluminum structural and support systems. Extruded 6063-T6 and 6063-T5 aluminum framing systems.
- B. Aluminum closures to be supplied with stainless steel screws (excluding final fasteners to the building) and shall be factory sealed to the panels. Aluminum battens and cap plates shall be field installed.
- C. Exposed aluminum color to be selected from manufacturer's standard range. Corrosion resistant finish shall be one of the following, complying with AAMA 605.2:
 - 1. Oven dried Kynar 500, 2 coats.
 - 2. Baked-on enamel coating.
 - 3. Oven dried acrylic-urethane coating.

2.7 FLEXIBLE SEALING TAPE

- A. Sealing tape shall be manufacturer's standard pre-applied to closure system at the factory under controlled conditions.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare openings including isolating dissimilar materials from aluminum system which may cause damage by electrolysis.

3.2 ERECTION

- A. The erector shall erect translucent skylight/canopy system in strict accordance with approved shop drawings as supplied by manufacturer. Fastening and sealing shall be in strict accordance with manufacturer's shop drawings. Remove all panel protection.



- B. After other trades have completed work on adjacent materials, carefully inspect translucent panel installation and make adjustments necessarily to insure proper installation and weather-tight conditions.
- C. All staging, lifts and hoists required for the complete skylight/canopy system installation, including staging, etc., necessary for field measuring, shall be provided as required.
- D. System is to be installed clean of dirt, debris or staining and thoroughly examined for removal of all protective materials prior to final inspection of the designated area of work.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



SECTION 08 51 13 00 - CSF ALUMINUM WINDOWS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.08 51 13 00

NOTE TO SPECIFIER

This section is to be used ONLY for CSF Small Plans 15 and 20 when directed by the USPS C.O. The standard CSF Small details and specifications are for aluminum storefront systems. Therefore, if directed to use aluminum windows, the standard window details must be revised.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Single hung aluminum windows.
2. Fixed aluminum windows.

B. Related Documents: The Contract Documents, as defined in Section 011000- Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:

1. Section 084113 – Aluminum-Framed Entrances and Storefronts.

1.2 REFERENCES

A. Aluminum Association (AA):

1. AA-M12 C22 A41.
2. AA-M12 C22 A44.

B. American Architectural Manufacturers Association (AAMA):

1. AAMA 611.



2. AAMA 2605.
3. AAMA 2604.
4. AAMA 910.
5. AAMA 503.1.
6. AAMA1503.
7. AAMA1302.5.
8. AAMA 502.

C. American Society for Testing and Materials (ASTM):

1. ASTM E283.
2. ASTM E547.
3. ASTM E331.
4. ASTM E330.
5. ASTM F588.
6. ASTM B221.
7. ASTM C864.
8. ASTM C1036.
9. ASTM E774.
10. ASTM C1043.
11. ASTM E783.
12. ASTM E1105.

D. American National Standards Institute (ANSI):

1. ANSI/AAMA 101.
2. ANSI H35.2.
3. ANSI Z97.1.

1.3 SYSTEM DESCRIPTION

- A. Commercial Grade Aluminum windows including glass and factory glazing, trims, sills, stools, perimeter seals, accessories and anchors required for a complete installation.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.

1. Product Data:
 - a. Product Data: Indicate construction details, material descriptions, glazing, fabrication methods, dimensions of components, profiles, hardware and finishes.
2. Shop Drawings:
 - a. Shop Drawings: Include plans, elevations and sections of aluminum windows and trim, head, sill and jamb details, hardware, accessories, required clearances, installation details including anchors, flashing and sealants.
3. Samples:
 - a. Aluminum Extrusions: Submit samples 12 inches (300 mm) long in size for each color of finished aluminum surface specified.
 - b. Hardware: Submit full size sample for each type of hardware and finish specified.
 - c. Glazing: Submit 12 x 12 inches (300 x 300 mm) in size samples illustrating finished glass units, and glazing materials.
4. Window Schedule:
 - a. Use same window designations indicated on drawings.



5. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.

1. Special Warranty: Submit written special warranty with forms completed in United States Postal Service name and registered with manufacturer as specified in this Section.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.6 PROJECT CONDITIONS

A. Field measurements:

1. Verify dimensions of openings to receive aluminum windows prior to window fabrication.

1.7 WARRANTY

A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.

B. Special Warranty:

1. The manufacturer/installer shall warrant the product and installation to be free from defective material and workmanship and shall replace or repair any defective component or system, in whole or part, as necessary to restore the product to its original intended state and integrity. Failures include the following:
 - a. Failure to meet performance requirements.
 - b. Structural failures including excessive deflection, water leakage, condensation and air infiltration.
 - c. Faulty operation of movable sash and hardware.
 - d. Failure of insulating glass.
 - e. Deterioration of materials and finishes beyond normal weathering.
2. Warranty Period:
 - a. Window: [] years from date of Substantial Completion.
 - b. Glazing Units: [] years from date of Substantial Completion.
 - c. Aluminum Finish: [] years from date of Substantial Completion.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.



2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. EFCO Corporation; Monett, MO. (800) 221-4169.
 2. Graham Architectural Products Corp.; York, PA. (800) 755-6274.
 3. Kawneer North America.; Norcross, GA. (770) 449-5555.
 4. Peerless Products Inc.; Fort Scott, KS. (866) 420-4000.
 5. TRACO.; Cranberry Township, PA. (800) 837-7002.
 6. YKK AP America Inc.; Austell, GA. (678) 838-6000.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 PERFORMANCE REQUIREMENTS

- A. Product Standard: Definitions and minimum standards of performance, materials, components, accessories and fabrication to comply with AAMA/WDMA 101/I.S.2/NAFS unless more stringent requirements are indicated.
1. Attach label indicating AMMA Certification to each window.
- B. Performance Class and Grade:
1. Minimum Performance Class: C.

NOTE TO SPECIFIER

Verify Minimum Performance Grade meets design pressure requirements of local authority having jurisdiction, local wind velocity pressures and building design characteristics.

2. Minimum Performance Grade: 30.

NOTE TO SPECIFIER

Options indicated below correspond to Energy Star requirements for Northern Climate Zone, North-Central Climate Zone, South-Central Climate Zone and the Southern Climate Zone respectively.

- C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of [0.30 Btu/sq. ft. x h x deg F (1.71 W/sq.m x K)] [0.32 Btu/sq. ft. x h x deg F (1.83 W/sq. m x K)] [0.35 Btu/sq. ft. x h x deg F (2.0 W/sq.m x K)] [0.32 Btu/sq. ft. x h x deg F (1.83 W/sq. m x K)] [0.60 Btu/sq. ft. x h x deg F (3.43 W/sq.m x K)] [____].

NOTE TO SPECIFIER

Options indicated below correspond to Energy Star requirements for North-Central Climate Zone, South-Central Climate Zone and the Southern Climate Zone respectively.

- D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of [0.40] [0.30] [0.27] [____].



- E. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, indicating a CRF of [45] [52] [__].
- F. Thermal Movements: Provide aluminum windows and anchorages that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, overstressing of components, joint and connection failures.

NOTE TO SPECIFIER

Revise Temperature Range values below if required to suit local conditions. Values indicated are acceptable for most areas of the United States.

- 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C) material surfaces.
- G. Sound Transmission Class (STC): Rated for not less than [__] STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.
- H. Outside-Inside Transmission Class (OITC): Rated for not less than [__] OITC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.

NOTE TO SPECIFIER

Paragraph below is for projects located in hurricane-prone areas. Delete if not required. Verify requirements of authorities having jurisdiction.

- I. Windborne-Debris Resistance: Capable of resisting impact from windborne debris based on testing glazed windows identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 and requirements of authorities having jurisdiction.

2.3 ALUMINUM WINDOWS

- A. Provide single hung aluminum windows as indicated.
- B. Provide fixed aluminum windows as indicated.
- C. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440. Fabricate frames and sashes with integral, concealed, thermal barriers between exterior and interior materials that eliminates metal-to-metal contact.
- D. Glass: Clear annealed glass, ASTM C1036, Type 1, Class 1, q3. Provide fully tempered where indicated on drawings or where required by applicable building code.
- E. Provide Energy Star Label on glazing indicating compliance with DOE Energy Star requirements.
- F. Insulating Glass Units: ASTM E 2190.
 - 1. Glass: ASTM C 1036, Type 1, q3.
 - 2. Tint: [__].
 - 3. Provide fully tempered units where indicated on drawings or where required by applicable building code.
 - 4. Filling: Fill space between glass lites with [air].
 - 5. Low-E Coating: Sputtered on second or third surface.
- G. Glazing System: Manufacturer's standard factory-glazing system.



- H. Hardware: Provide manufacturer's standard hardware designed to accommodate sash weight and dimensions, and fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material.
 - 1. Hardware Finish: As indicated or if not indicated, as selected by Architect from manufacturer's full range.
 - 2. Provide custodial locks.
- G. Provide full perimeter weather stripping for operable sash.
- H. Provide non-corrosive fasteners compatible with hardware, window framing members, anchors and other window components. Do not use exposed fasteners to the greatest extent possible.

2.4 WINDOW SCREENS

- A. Provide outside window screen for each operable sash. Window screens to be integrated with window frame.
- B. Provide manufacturers standard aluminum frame with aluminum wire fabric.

2.5 FABRICATION

- A. Fabricate aluminum windows in sizes indicated. Fabricate with integral weep holes to conduct water to exterior.
- B. Factory glaze windows.
- C. Weather strip each operable sash.
- D. Complete fabrication assembly, finishing, hardware installation, glazing and other work to greatest extent possible in factory.

2.6 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage with temporary, strippable protective covering.
- C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA611.
- D. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA611.
 - 1. Color: [_____].
- E. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: Thermosetting,



modified-acrylic or polyester enamel primer/topcoat system complying with AAMA 2603, medium gloss). Apply baked enamel complying with paint manufacturers written instructions for cleaning, conversion coating and painting.

- F. High-Performance Organic Finish (Two-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

1. Color: [_____].

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install aluminum windows, hardware, accessories and other components in accordance with aluminum window manufacturer's written instructions and approved shop drawings.
- B. Install windows plumb and level, free of warp or twist. Maintain dimensional tolerances, aligning with adjacent work.
- C. Provide thermal isolation where aluminum windows penetrate or disrupt building insulation.
- D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to drain to exterior.
- E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
- F. Coordinate attachment and seal of perimeter air and vapor barrier materials.
- G. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

3.3 ADJUSTING



- A. Section 017300 - Execution: Adjusting installed work.
- B. Adjust operating hardware and sash for smooth operation.

3.4 CLEANING

- A. Section 017704 - Closeout Procedures and Training: Cleaning installed work.
- B. Clean exposed surfaces immediately after installation. Avoid damaging protective coatings and finishes. Protective films and coverings to remain in place until final cleaning.
- C. Remove and replace glass that has been broken, chipped, cracked, scratched or otherwise damaged during construction period.
- D. Protect window surfaces from contact with contaminating substances from construction operations. If contact occurs, remove contaminants immediately in accordance with window manufacturer's written instructions.

USPS CSF Specifications issued: 10/1/2013
Last revised: 6/10/2011

END OF SECTION



Task	Specification	Specification Description
08 51 19 00	01 22 16 00	No Specification Required



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SECTION 08 52 00 00 - CSF WOOD WINDOWS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Wood Windows are part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.08 52 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Factory fabricated plastic clad wood windows with fixed sash.
 2. Factory glazing.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 ENVIRONMENTAL REQUIREMENTS

- A. Wood windows must have the ENERGY STAR label.

1.3 WARRANTY

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Special Warranty:
 1. Include coverage for degradation of color finish.
 2. Include coverage for delamination or separation of finish cladding from window member
 3. Warranty Period: 5 years.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Wood: Clear pine, cedar, or fir species, preservative treated to NWWDA IS-4 of type suitable for transparent for opaque interior finish.

- B. Plastic Cladding (Exterior Surface): ASTM D1784, Extruded PVC, low sheen surface, factory fit to profile of wood members, and exterior exposed surfaces.
- C. Fasteners: Stainless steel.

2.2 FABRICATION

- A. Fabricate window to size and configuration indicated on Drawings.
- B. Fabricate framing and sash members with mortise and tenon joints. Glue and steel pin joints to hairline fit, weather tight.
- C. Finger joints permitted if wood matches in color and grain texture.
- D. Form sills and stools in one piece. Slope sills for wash.
- E. Form glass stops of extruded PVC to match cladding sloped for wash.
- F. Provide weather stop flange for perimeter of unit.
- G. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet allowing installation and dynamic movement of perimeter seal.
- H. Arrange fasteners to be concealed from view.
- I. Factory glaze window units with glazing specified in Section 088000.

2.3 FINISHES

- A. Exterior Surfaces: Cladding. Color selected by Contracting Officer.
- B. Interior Surfaces: Opaque as specified in Section 099100.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install window frames in accordance with manufacturers instructions.
- B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.
- C. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.
- D. Install sills.
- E. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.



- F. Coordinate attachment and seal of perimeter air and vapor barrier materials.
- G. Install perimeter sealant backing materials, and installation as specified in Section 079200.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



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SECTION 08 53 13 00 - VINYL WINDOWS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for fixed and operable vinyl framed windows. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes fixed and operable vinyl-framed windows.

C. Definitions

1. Performance class designations according to AAMA/WDMA 101/I.S.2/NAFS:
 - a. AW: Architectural.
 - b. HC: Heavy Commercial.
 - c. C: Commercial.
 - d. LC: Light Commercial.
 - e. R: Residential.
2. Performance grade number according to AAMA/WDMA 101/I.S.2/NAFS:
 - a. Design pressure number in pounds force per square foot (pascals) used to determine the structural test pressure and water test pressure.
3. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.
4. Minimum Test Size: Smallest size permitted for performance class (gateway test size). Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

D. Performance Requirements

1. General: Provide vinyl windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified, and that are of test size indicated below:
 - a. Size required by AAMA/WDMA 101/I.S.2/NAFS for gateway performance **OR** optional performance grade, **as directed**.
 - b. Size indicated on Drawings **OR** in a schedule, **as directed**.
2. Structural Performance: Provide vinyl windows capable of withstanding the effects of the following loads, based on testing units representative of those indicated for Project that pass AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Structural Test:
 - a. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour (meters per second) at 33 feet (10 m) above grade, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.
 - 1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s), **as directed**.
 - 2) Importance Factor.
 - 3) Exposure Category: A **OR** B **OR** C **OR** D, **as directed**.
3. Windborne-Debris Resistance: Provide glazed windows capable of resisting impact from windborne debris, based on the pass/fail criteria as determined from testing glazed windows identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 or AAMA 506 and requirements of authorities having jurisdiction.

E. Submittals

1. Product Data: For each type of vinyl window indicated.



2. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, and installation details.
3. Samples: For each exposed finish.
4. Product Schedule: Use same designations indicated on Drawings.
5. Product test reports.
6. Maintenance data.
7. Warranty: Special warranty specified in this Section.

F. Quality Assurance

1. Installer: A qualified installer, approved by manufacturer to install manufacturer's products.
2. Fenestration Standard: Comply with AAMA/WDMA 101/I.S.2/NAFS, "North American Fenestration Standard Voluntary Performance Specification for Windows, Skylights and Glass Doors," for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - a. Provide AAMA **OR** WDMA, **as directed**, -certified vinyl windows with an attached label.
3. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.
4. Preinstallation Conference: Conduct conference at Project site.

G. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace vinyl windows that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Failure to meet performance requirements.
 - 2) Structural failures including excessive deflection, water leakage, air infiltration, or condensation.
 - 3) Faulty operation of movable sash and hardware.
 - 4) Deterioration of vinyl, other materials, and finishes beyond normal weathering.
 - 5) Failure of insulating glass.
 - b. Warranty Period:
 - 1) Window: Two **OR** Three **OR** 10, **as directed**, years from date of Final Completion.
 - 2) Glazing: Five **OR** 10, **as directed**, years from date of Final Completion.
 - 3) Vinyl Finish: Five years from date of Final Completion.

1.2 PRODUCTS

A. Materials

1. Vinyl Extrusions: Rigid (unplasticized) hollow PVC extrusions, formulated and extruded for exterior applications, complying with AAMA/WDMA 101/I.S.2/NAFS and the following:
 - a. PVC Resins: 100 percent virgin resin.
 - b. PVC Formulation: High impact, low heat buildup, lead free, nonchalking, and color and UV stabilized.
 - c. Extrusion Wall Thickness: Not less than 0.060 inch (1.5 mm) **OR** 0.090 inch (2.3 mm) **OR** 0.125 inch (3.2 mm), **as directed**.
 - d. Multichamber Extrusions: Profile designed with two chambers **OR** three chambers **OR** multichambers, **as directed**, between interior and exterior faces of the extrusions.
2. Vinyl Trim and Glazing Stops: Material and finish to match frame members.
3. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with vinyl window members, cladding, trim, hardware, anchors, and other components.
 - a. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.



4. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
 5. Reinforcing Members: Aluminum, or nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
 6. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action, and for complete concealment when vinyl window is closed.
 - a. Weather-Stripping Material: Elastomeric cellular preformed gaskets complying with ASTM C 509.
 - b. Weather-Stripping Material: Dense elastomeric gaskets complying with ASTM C 864.
 - c. Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/WDMA 101/I.S.2/NAFS.
 7. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.
 - a. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.
 8. Replaceable Weather Seals: Comply with AAMA 701/702.
- B. Window
1. Window Type: Casement **OR** Double hung **OR** Fixed **OR** Horizontal sliding **OR** Projected awning **OR** Single hung **OR** Bay **OR** Bow **OR** Specialty product **OR** As indicated on Drawings **OR** As indicated on a schedule, **as directed**.
 2. AAMA/WDMA Performance Requirements: Provide vinyl windows of performance indicated that comply with AAMA/WDMA 101/I.S.2/NAFS unless more stringent performance requirements are indicated.
 - a. Performance Class and Grade: R15 **OR** R20 **OR** R25, **as directed**.
 - b. Performance Class and Grade: LC25 **OR** LC30 **OR** LC35, **as directed**.
 - c. Performance Class and Grade: C30 **OR** C35 **OR** C40, **as directed**.
 - d. Performance Class and Grade: HC40 **OR** HC45 **OR** HC50, **as directed**.
 - e. Performance Class and Grade: AW40 **OR** AW45 **OR** AW50, **as directed**.
 - f. Performance Class and Grade: As indicated.
 - g. Performance Class (if test performance method is selected for specifying windows and designating a performance class does not conflict with basic wind speed and performance testing indicated): R **OR** LC **OR** C **OR** HC **OR** AW, **as directed**.
 3. Condensation-Resistance Factor (CRF): Provide vinyl windows tested for thermal performance according to AAMA 1503, showing a CRF of 45 **OR** 52 **OR** 65, **as directed**.
 4. Thermal Transmittance: Provide vinyl windows with a whole-window, U-factor maximum indicated at 15-mph (24-km/h) exterior wind velocity and winter condition temperatures when tested according to AAMA 1503 **OR** ASTM E 1423 **OR** NFRC 100, **as directed**.
 - a. U-Factor: 0.35 Btu/sq. ft. x h x deg F (2.0 W/sq. m x K) **OR** 0.40 Btu/sq. ft. x h x deg F (2.3 W/sq. m x K) **OR** 0.43 Btu/sq. ft. x h x deg F (2.5 W/sq. m x K) **OR** 0.60 Btu/sq. ft. x h x deg F (3.4 W/sq. m x K), **as directed**, or less.
 5. Solar Heat-Gain Coefficient (SHGC): Provide vinyl windows with a whole-window SHGC maximum of 0.40 **OR** 0.50 **OR** 0.55, **as directed**, determined according to NFRC 200 procedures.
 6. Sound Transmission Class (STC): Provide glazed windows rated for not less than 26 **OR** 30 **OR** 35, **as directed**, STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.
 7. AAMA/WDMA 101/I.S.2/NAFS, Air Infiltration Test.
 - a. Maximum Rate: 0.3 cfm/sq. ft. (5 cu. m/h x sq. m) of area at an inward test pressure of 1.57 lbf/sq. ft. (75 Pa) which is equivalent to 25-mph (40-km/h) wind speed and is typically used to test R, C, and LC performance classes.



- b. Maximum Rate: 0.3 cfm/sq. ft. (5 cu. m/h x sq. m) of area at an inward test pressure of 6.24 lbf/sq. ft. (300 Pa) which is equivalent to a 50-mph (80-km/h) wind speed and is typically used to test HC and AW performance classes.
- 8. Water Resistance: No water leakage as defined in AAMA/WDMA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/WDMA 101/I.S.2/NAFS, Water Resistance Test.
 - a. Test Pressure: 15 percent of positive design pressure, but not less than 2.86 lbf/sq. ft. (140 Pa) or more than 15 lbf/sq. ft. (720 Pa).
 - b. Test Pressure: 20 percent of positive design pressure, but not more than 15 lbf/sq. ft. (720 Pa).
- 9. Forced-Entry Resistance: Comply with Performance Grade 10 **OR** 20 **OR** 30 **OR** 40, **as directed**, requirements when tested according to ASTM F 588.
- 10. Life-Cycle Testing: Test according to AAMA 910 and comply with AAMA/WDMA 101/I.S.2/NAFS.
- 11. Operating Force and Auxiliary (Durability) Tests: Comply with AAMA/WDMA 101/I.S.2/NAFS for operating window types indicated.

C. Glazing

- 1. Glass: Clear, insulating-glass units **OR** Clear, insulating-glass units, with low-E coating pyrolytic on second surface or sputtered on second or third surface, **OR** Clear, insulating-glass units, argon gas filled, with low-E coating pyrolytic on second surface or sputtered on second or third surface, **as directed**, complying with Division 08 Section "Glazing".
- 2. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal **OR** Manufacturer's standard factory-glazing system that produces weathertight seal and complies with requirements for windborne-debris resistance **OR** Manufacturer's standard factory-glazing system as indicated in Division 08 Section "Glazing", **as directed**.

D. Hardware

- 1. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with vinyl; designed to smoothly operate, tightly close, and securely lock vinyl windows, and sized to accommodate sash or ventilator weight and dimensions. Do not use aluminum in frictional contact with other metals. Where exposed, provide solid bronze **OR** extruded, cast, or wrought aluminum **OR** die-cast zinc with special coating finish **OR** nonmagnetic stainless steel, **as directed**.
- 2. Counterbalancing Mechanism: Comply with AAMA 902.
 - a. Sash-Balance Type: Concealed, tape-spring **OR** spiral-tube **OR** spring-loaded, block-and-tackle, **as directed**, type, of size and capacity to hold sash stationary at any open position.
- 3. Sill Cap/Track: Extruded-aluminum track with natural anodized finish **OR** Rigid PVC or other weather-resistant plastic track with manufacturer's standard integral color, **as directed**, of thickness, dimensions, and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior.
- 4. Locks and Latches: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only. Provide custodial locks, **as directed**.
- 5. Roller Assemblies: Low-friction design.
- 6. Push-Bar Operators: Provide telescoping-type, push-bar operator designed to open and close ventilators with fixed screens.
- 7. Gear-Type Rotary Operators: Comply with AAMA 901 when tested according to ASTM E 405, Method A.
 - a. Operation Function: All ventilators move simultaneously and securely close at both jams without using additional manually controlled locking devices.
- 8. Four- or Six-Bar Friction Hinges: Comply with AAMA 904.
 - a. Locking mechanism and handles for manual operation.
 - b. Friction Shoes: Provide friction shoes of nylon or other nonabrasive, nonstaining, noncorrosive, durable material.



9. Limit Devices: Provide concealed friction adjustor, adjustable stay bar **OR** concealed support arms with adjustable, limited, hold-open, **as directed**, limit devices designed to restrict sash or ventilator opening.
 - a. Safety Devices: Limit clear opening to 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, for ventilation; with custodial key release.
 10. Pole Operators: Tubular-shaped anodized aluminum; with rubber-capped lower end and standard push-pull hook at top to match hardware design; of sufficient length to operate window without reaching more than 60 inches (1500 mm) above floor; 1 pole operator and pole hanger per room that has operable windows more than 72 inches (1800 mm) above floor.
- E. Insect Screens
1. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Fabricate insect screens to fully integrate with window frame. Locate screens on inside **OR** outside, **as directed**, of window and provide for each operable exterior sash or ventilator.
 - a. Aluminum Tubular Frame Screens: Comply with SMA 1004, "Specifications for Aluminum Tubular Frame Screens for Windows," Residential R-20 **OR** Architectural C-24 **OR** Monumental M-32, **as directed**, class.
 2. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, adjustable rollers, **as directed**, and removable PVC spline/anchor concealing edge of frame.
 - a. Aluminum Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet with minimum wall thickness as required for class indicated.
 - b. Finish: Anodized aluminum **OR** Baked-on organic coating, **as directed**, in manufacturer's standard color.
 - c. Finish: Anodized aluminum **OR** Baked-on organic coating, **as directed**, in color selected from manufacturer's full range.
 - d. Finish: Manufacturer's standard.
 3. Glass-Fiber Mesh Fabric: 18-by-14 (1.1-by-1.4-mm) or 18-by-16 (1.0-by-1.1-mm) **OR** 20-by-20 (0.85-by-0.85-mm) or 20-by-30 (0.85-by-0.42-mm), **as directed**, mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration, in the following color. Comply with ASTM D 3656.
 - a. Mesh Color: Charcoal gray **OR** Silver gray **OR** Aquamarine, **as directed**.
 4. Aluminum Wire Fabric: 18-by-16 (1.1-by-1.3-mm) mesh of 0.011-inch- (0.28-mm-) diameter, coated aluminum wire.
 - a. Wire-Fabric Finish: Natural bright **OR** Charcoal gray **OR** Black, **as directed**.
 5. Wickets: Provide sliding **OR** hinged, **as directed**, wickets, framed and trimmed for a tight fit and for durability during handling.
- F. Accessories
1. Dividers (False Muntins): Provide dividers in designs indicated for each sash lite, one per sash, removable from the exposed surface of interior lite of the sash **OR** two per sash, removable from the exposed surfaces of interior and exterior lites of the sash **OR** one permanently located between glazing lites in the airspace, **as directed**.
 - a. Material: Extruded, rigid PVC **OR** Aluminum, **as directed**.
 - b. Design: Rectangular **OR** Diamond, **as directed**.
 - c. Color: White **OR** Beige, **as directed**.
- G. Fabrication
1. Fabricate vinyl windows in sizes indicated. Include a complete system for assembling components and anchoring windows.
 - a. Welded Frame and Sash/Ventilator Corners: Miter-cut and fusion **OR** chemically, **as directed**, welded.
 - b. Mechanically Fastened Frame and Sash/Ventilator Corners: Double-butt coped and fastened with concealed screws, **as directed**.

2. Fabricate vinyl windows that are reglazable without dismantling sash or ventilator framing.
3. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator, unless otherwise indicated.
 - a. Double-Hung Windows: Provide weather stripping only at horizontal rails of operable sash.
4. Mullions: Provide mullions and cover plates as shown, compatible with window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units. Provide manufacturer's standard finish to match window units.
5. Subframes: Provide subframes with anchors for window units as shown, of profile and dimensions indicated but not less than 0.062-inch- (1.6-mm-) thick extruded aluminum. Miter or cope corners, and weld and dress smooth with concealed mechanical joint fasteners. Provide manufacturer's standard finish to match window units. Provide subframes capable of withstanding design loads of window units.
6. Factory-Glazed Fabrication: Except for light sizes in excess of 100 united inches (2500 mm width plus length), glaze vinyl windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 08 Section "Glazing" and with AAMA/WDMA 101/I.S.2/NAFS.
7. Glazing Stops: Provide nailed or snap-on glazing stops coordinated with Division 08 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.
8. Hardware: Mount hardware through double walls of vinyl extrusions or provide corrosion-resistant steel reinforcement complying with requirements for reinforcing members, or do both.
9. Bow **OR** Bay, **as directed**, Windows: Provide vinyl windows in configuration indicated. Provide window frames, fixed and operating sash, operating hardware, and other trim and components necessary for a complete, secure, and weathertight installation, including the following:
 - a. Angled mullion posts with interior and exterior trim.
 - b. Angled interior and exterior extension and trim.
 - c. Clear pine head and seat boards.
 - d. Top and bottom plywood platforms.
 - e. Exterior head and sill casings and trim.
 - f. Support brackets.
10. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

H. Vinyl Finishes

1. Integral Finish and Color: Uniform, solid, homogeneous white **OR** beige, **as directed**, interior and exterior.
2. Organic Pigmented Finish: Manufacturer's standard finish, interior and exterior, complying with AAMA 613 **OR** AAMA 615, **as directed**, and paint manufacturer's written specifications for cleaning and painting.
 - a. Color: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.

1.3 EXECUTION

A. Installation

1. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.
2. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
3. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.



4. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
- B. Adjusting, Cleaning, And Protection
1. Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.
 2. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
 3. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
 4. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
 5. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

END OF SECTION 08 53 13 00



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Task	Specification	Specification Description
08 53 66 00	08 53 13 00	Vinyl Windows
08 54 13 00	08 53 13 00	Vinyl Windows
08 54 66 00	08 53 13 00	Vinyl Windows



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SECTION 08 62 00 00 - CSF UNIT SKYLIGHTS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Preformed plastic skylights with integral metal frame.
 2. Integral insulated curb.
 3. Security grille/glazing.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 1. ASTM A 627 - Specification for Homogeneous Tool-Resisting Steel Bars for Security Applications.
 2. ASTM B 209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 3. ASTM B 221 - Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- B. Federal Specifications (FS):
 1. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.

1.3 SYSTEM DESCRIPTION

- A. Performance Requirements:
 1. Allow for expansion and contraction within system components caused by a cycling surface temperature range of 170 F degrees without causing detrimental effects to system or components.
 2. Withstand minimum live load of 40 psf.

**NOTE TO SPECIFIER**

Edit below for Light Transmittance, Ultraviolet Transmission and Shading Coefficient for specific Project. Provide U-value (based on 4 foot x 4 foot skylight) = 0.74 maximum for opening dimension and 0.57 maximum for plan dimension; light transmittance = 72 percent maximum; shading coefficient = 66 percent minimum.

3. Provide glazing system with minimum visible light transmittance of [____] percent, maximum ultraviolet transmission of [____] percent and shading coefficient of [____].
4. Provide minimum U-value [____].

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 1. Product Data: Structural, thermal, and daylighting performance values.
 2. Shop Drawings:
 - a. Indicate skylight configurations, dimensions, locations, fastening methods, and installation details.
 - b. Indicate construction and installation of security grille or security glazing assembly. Detail attachment to building structure. Specify fastening devices and spacing.
 3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
 - c. Manufacturer's Instructions: Indicate special procedures, and perimeter conditions requiring special attention.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 1. Special Warranty: Submit written special warranty with forms completed in United States Postal Service name and registered with manufacturer as specified in this Section.

1.5 QUALITY ASSURANCE

- A. Qualifications:
 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

1.7 WARRANTY

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Special Warranty:
 1. Correct defective work, including leakage due to defective skylight materials or workmanship,
 2. Warranty Period: 5 years.



PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. APC Corporation, Hawthorn, NJ (800) 222-0201.
 2. Bristolite Skylights, Santa Anna, CA (800) 854-8618.
 3. Hi Pro International, Knoxville, TN (865) 637-1711 (800) 947-0997.
 4. Naturalite/EPI, Incorporated, Terrell, TX (800) 527-4018.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 COMPONENTS

- A. Plastic Unit Skylight: Factory-assembled glazing in aluminum frame; double dome.
 1. Circular domed shape.
 2. Nominal Size: Indicated on Drawings.
- B. Double Glazing: Polycarbonate plastic; factory sealed, conforming to Occupational Health and Safety Administration (OSHA) requirements for skylight glazing and construction.
 1. Outer Glazing: Gray tinted transparent.
 2. Inner Glazing: Clear transparent.
- C. Frames: ASTM B 221 Extruded aluminum, thermally broken, reinforced and welded corner joints, concealed fasteners, integral curb frame mounting flange to receive roofing flashing system, with integral condensation collection drainage gutter, glazing retainer; clear anodized finish.
- D. Support Curbs: ASTM B 209 Sheet aluminum, sandwich construction; 1 inch thick, height as indicated on Drawings; rigid plastic insulation; with integral flange for anchorage to roof deck.

NOTE TO SPECIFIER

Delete the following security grille/glazing at 24 hour facilities only. Verify with Contracting Officer.

2.3 SECURITY GRILLE/GLAZING

- A. Furnish and install a security grille or security glazing. Contractor option.
 1. Grille: Factory fabricated 1/2 inch diameter, ASTM A 627, tool-resistant, round steel bars spaced 4 inches on center, interlocked with 3/8 inch x 2 inch horizontal flats at 18 inches on center.
 2. Glazing: 5/16 inch thick safety tempered laminated sheets of glass with an interlayer of 0.075 inch vinyl or 1/4 inch polycarbonate in steel "U" shape glazing frame with mitered corners.

2.4 ACCESSORIES

- A. Anchorage Devices: Type recommended by manufacturer, concealed.



- B. Protective Back Coating: Bituminous, FS TT-C-494.
- C. Sealant: Specified in Section 079200 - Joint Sealants.

2.5 FABRICATION

- A. Fabricate free of visual distortion and defects.
- B. Fabricate to achieve leakproof, weathertight assembly.
- C. Fabricate components to allow for expansion and contraction with minimum clearance and shim spacing around perimeter of assembly.
- D. Furnish and install decals on skylight glazing, clearly visible at exterior, warning persons not to sit or step on skylight unit, in conformance with OSHA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify that opening sizes and locations are as indicated on Drawings.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Apply protective back coating on aluminum surfaces of skylight units that will be in contact with cementitious materials or dissimilar metals.

3.3 INSTALLATION

- A. Install aluminum curb assembly, fastening securely to roof decking.
- B. Place skylight units and secure to curb assembly. Install counterflashing as required.
- C. Apply sealant to achieve watertight assembly.
- D. Install security grille or security glazing assembly, within skylight roof deck opening, to steel roof structure. Rigidly attach using methods approved by U.S. Postal Inspection Service through Contracting Officer.



3.4 CONSTRUCTION

- A. Interface with Other Work: Coordinate skylight installation with roofing insulation and roofing membrane installation.

3.5 CLEANING

- A. Remove protective material from prefinished aluminum surfaces.
- B. Wash down exposed surfaces; wipe surfaces clean.
- C. Remove excess sealant.

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END OF SECTION 08 62 00 00



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SECTION 08 63 00 00 - FIBERGLASS-SANDWICH-PANEL ASSEMBLIES**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of material for fiberglass-sandwich-panel assemblies. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes assemblies incorporating fiberglass sandwich panels and aluminum frame systems as follows:
 - a. Wall assemblies.
 - b. Roof (sloped, overhead) assemblies.
 - c. Skylight assemblies.

C. Performance Requirements

1. Provide assemblies, including anchorage, capable of withstanding, without failure, the effects of the following:
 - a. Structural loads.
 - b. Thermal movements.
 - c. Movements of supporting structure.
 - d. Dimensional tolerances of building frame and other adjacent construction.
2. Failure includes the following:
 - a. Deflection exceeding specified limits.
 - b. Water leakage.
 - c. Thermal stresses transferred to building structure.
 - d. Noise or vibration created by wind and thermal and structural movements.
 - e. Loosening or weakening of fasteners, attachments, and other components.
 - f. Delamination of fiberglass-sandwich-panel faces from panel cores.
3. Structural Loads:
 - a. Wind Loads: As indicated by structural design data on Drawings **OR as directed**.
 - b. Snow Loads: As indicated by structural design data on Drawings **OR as directed**.
 - c. Concentrated Live Loads on Overhead Assemblies: 300 lbf (1334 N) applied to assemblies at locations that will produce greatest stress or deflection.
 - d. Seismic Loads: As indicated by earthquake design data on Drawings **OR as directed**.
 - e. Load Combinations: Calculate according to requirements of applicable code indicated on Drawings **OR as directed**.
4. Deflection of Assemblies:
 - a. Vertical Assemblies: Limited to 1/60 **OR** 1/90 **OR** 1/180, **as directed**, of clear span for each assembly component.
 - b. Overhead Assemblies: Limited to 1/60 **OR** 1/90 **OR** 1/180, **as directed**, of clear span for each assembly component.
5. Roof Assemblies: Class A per ASTM E 108 or UL 790.
6. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Performance Testing



1. Provide assemblies that comply with test-performance requirements indicated, as evidenced by reports of tests performed on manufacturer's standard assemblies by a qualified independent testing agency.
2. Structural-Performance Test: ASTM E 330.
 - a. Performance at Design Load: When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 - b. Performance at Maximum Test Load: When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main supporting members exceeding 0.2 percent of span.
 - c. Test Durations: As required by design wind velocity but not less than 10 seconds.
3. Air-Infiltration Test: ASTM E 283.
 - a. Minimum Static-Air-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa) **OR** 6.24 lbf/sq. ft. (300 Pa), **as directed**.
 - b. Maximum Air Leakage: 0.06 cfm/sq. ft. (0.30 L/s per sq. m), **as directed**.
4. Test for Water Penetration under Static Pressure: ASTM E 331.
 - a. Minimum Static-Air-Pressure Difference: 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft. (479 Pa).
 - b. Water Leakage: None.
5. Test for Water Penetration under Dynamic Pressure: AAMA 501.1.
 - a. Dynamic Pressure: 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft. (718 Pa).
 - b. Water Leakage: None, as defined by AAMA 501.1 **OR** No uncontrolled water penetrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation, **as directed**. Water controlled by flashing and gutters that is drained to exterior and cannot damage adjacent materials or finishes is not considered water leakage.
6. Water-Penetration, Wind-Driven-Rain Test: Wind-driven-rain test in ICBO ES AC07, "Special Roofing Systems."
 - a. Water Leakage: None.

E. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For sealants used inside of the weatherproofing system, documentation including printed statement of VOC content.
3. Shop Drawings: For assemblies. Include plans, elevations, sections, details, and attachments to other work.
 - a. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
4. Field quality-control test reports.
5. Product test reports.
6. Maintenance data.
7. Special warranties specified in this Section.

F. Quality Assurance

1. Installer Qualifications: Entity capable of assuming engineering responsibility, including preparation of Shop Drawings, and performing work of this Section and who is acceptable to manufacturer.
2. Manufacturer Qualifications: For fiberglass sandwich panels, a qualified manufacturer whose facilities, processes, and products are monitored by an independent, accredited quality-control agency for compliance with applicable requirements in ICBO ES AC04, "Sandwich Panels."
3. Fire-Test-Response Characteristics: Where fire-test-response characteristics are indicated for assemblies and components, provide products identical to those tested per test method indicated by an independent testing and inspecting agency acceptable to authorities having jurisdiction.



4. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."
5. NFRC Certification: Provide fiberglass sandwich panels that are certified for U-factors indicated according to NFRC 100 and listed in its "National Fenestration Council Incorporated - Certified Products Directory."
6. Preinstallation Conference: Conduct conference at Project site.

G. Warranty

1. Special Assembly Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of assemblies that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Structural failures including, but not limited to, excessive deflection.
 - 2) Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 3) Water leakage.
 - b. Warranty Period: Two **OR** Five, **as directed**, years from date of Final Completion.
2. Special Fiberglass-Sandwich-Panel Warranty: Manufacturer's standard form in which manufacturer agrees to replace panels that exhibit defects in materials or workmanship.
 - a. Defects include, but are not limited to, the following:
 - 1) Fiberbloom.
 - 2) Delamination of coating, if any, from exterior face sheet.
 - 3) Discoloration of exterior face sheet of more than 8.0 units Delta E when measured according ASTM D 2244.
 - 4) Delamination of panel face sheets from panel cores.
 - b. Warranty Period: 10 years from date of Final Completion.
3. Special Aluminum-Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
 - a. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.
 - b. Warranty Period: Five **OR** 10 **OR** 20, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Aluminum Frame Systems

1. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
 - c. Extruded Structural Pipe and Tubes: ASTM B 429.
2. Components: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.
 - a. Construction: One-piece extruded-aluminum components **OR** Thermally broken; framing members are composite assemblies of two separate extruded-aluminum components permanently bonded by a material of low thermal conductance, **as directed**.
3. Exposed Flashing and Closures: Manufacturer's standard aluminum components not less than 0.040 inch (1.016 mm) **OR** 0.060 inch (1.524 mm), **as directed**, thick.
4. Frame-System Gaskets: Manufacturer's standard.
5. Frame-System Sealants: As recommended in writing by manufacturer **OR** specified in Division 07 Section "Joint Sealants", **as directed**.
 - a. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Anchors, Fasteners, and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding; compatible with adjacent materials.

- a. At closures, retaining caps, or battens, use ASTM A 193/A 193M, 300 series stainless-steel screws.
 - b. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 - c. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.
 7. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
 8. Anchor Bolts: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), hot-dip zinc coating, ASTM A 153/A 153M, Class C **OR** mechanically deposited zinc coating, ASTM B 695, Class 50, **as directed**.
 9. Frame System Fabrication:
 - a. Fabricate components before finishing.
 - b. Fabricate components that, when assembled, have the following characteristics:
 - 1) Profiles that are sharp, straight, and free of defects or deformations.
 - 2) Accurately fitted joints with ends coped or mitered.
 - 3) Internal guttering systems or other means to drain water passing joints, condensation occurring within components, and moisture migrating within the assembly to exterior.
 - c. Fabricate sill closures with weep holes and for installation as continuous component.
 - d. Reinforce components as required to receive fastener threads.
 - e. Weld components in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- B. Fiberglass Sandwich Panels
1. Panel Construction: Assembly of uniformly colored, translucent, thermoset, fiberglass-reinforced-polymer face sheets bonded to both sides of a grid core and complying with requirements applicable to panel materials in ICBO ES AC04, "Sandwich Panels."
 - a. Face-Sheet, Self-Ignition Temperature: 650 deg F (343 deg C) or more per ASTM D 1929.
 - b. Face-Sheet Burning Extent: 1 inch (25 mm) or less per ASTM D 635.
 - c. Face-Sheet, Smoke-Developed Index: 450 or less per ASTM E 84.
 - d. Interior Face-Sheet, Flame-Spread Index: Not more than 25 **OR** 75, **as directed**, per ASTM E 84.
 - e. Roof-Covering Class: Class A **OR** Class A, burning brand test (only), **as directed**, per ASTM E 108 or UL 790.
 2. Panel Thickness: 2-3/4 inches (70 mm) **OR** 1-1/2 to 1-9/16 inches (38 to 40 mm), **as directed**.
 3. Panel U-Factor: Not more than 0.70 (3.97) **OR** 0.53 (3.01) **OR** 0.44 (2.50) **OR** 0.40 (2.27) **OR** 0.29 (1.65) **OR** 0.28 (1.59) **OR** 0.26 (1.48) **OR** 0.24 (1.36) **OR** 0.23 (1.31) **OR** 0.22 (1.25) **OR** 0.18 (1.02) **OR** 0.15 (0.85) **OR** 0.14 (0.79) **OR** 0.10 (0.57), **as directed**, measured in Btu/sq. ft. x h x deg F (W/sq. m x K) according to NFRC 100 or ASTM C 1363 using procedures described in ASTM C 1199 and ASTM E 1423.
 4. Panel Strength Characteristics:
 - a. Maximum Panel Deflection: 3-1/2 inches (89 mm) when a 4-by-12-foot (1.2-by-3.6-m) panel is tested according to ASTM E 72 at 34 lbf/ sq. ft. (1.6 kPa), with a maximum 0.090-inch (2.3-mm) set deflection after 5 minutes.
 - b. Panel Support Strength: Capable of supporting, without failure, a 300-lbf (1334 N) concentrated load when applied to a 3-inch- (76-mm-) diameter disk according to ASTM E 661.
 5. Grid Core: Mechanically interlocked extruded-aluminum I-beams, with a minimum flange width of 7/16 inch (11.1 mm).
 - a. Extruded Aluminum: ASTM B 221 (ASTM B 221M), in alloy and temper recommended in writing by manufacturer.



- b. I-Beam Construction: One-piece extruded-aluminum components **OR** Thermally broken; two separate extruded-aluminum components permanently bonded by a material of low thermal conductance, **as directed**.
 - c. Grid Pattern: Inline rectangle, nominal 12 by 24 inches (305 by 610 mm) **OR** Staggered rectangle, nominal 12 by 24 inches (305 by 610 mm) **OR** Square, nominal 12 inches (305 mm) **OR** As indicated on Drawings, **as directed**.
 - 6. Exterior Face Sheet:
 - a. Thickness: 0.070 inches (1.778 mm) **OR** 0.060 inches (1.524 mm) **OR** 0.052 inches (1.321 mm), **as directed**.
 - b. Color: White **OR** Crystal **OR** As selected from manufacturer's full range, **as directed**.
 - c. Color Stability: Not more than 3.0 **OR** 4.0 **OR** 7.0, **as directed**, units Delta E when measured according to ASTM D 2244 after outdoor weathering in southern Florida according to procedures in ASTM D 1435 with panels mounted facing south and as follows:
 - 1) Panel Mounting Angle: Not more than 5 **OR** 45, **as directed**, degrees from horizontal.
 - 2) Exposure Period: 60 months **OR** 30 months **OR** 60 months for vertical assemblies, 30 months for components of Class A roof assemblies, **as directed**.
 - d. Erosion Protection: Manufacturer's standard **OR** Integral, embedded glass erosion barrier **OR** Surface-applied, polyvinyl fluoride film not less than 1.0 mils (0.03 mm) thick, **as directed**.
 - e. Impact Resistance: No fracture or tear at impact of 60 ft. x lbf (81 J) **OR** 70 ft. x lbf (95 J) **OR** 230 ft. x lbf (312 J), **as directed**, by a 3-1/4-inch- (83-mm-) diameter, 5-lb (2.3-kg) free-falling ball according to test procedure in UL 972.
 - 7. Interior Face Sheet:
 - a. Thickness: 0.045 inch (1.143 mm) **OR** 0.060 inch (1.524 mm), **as directed**.
 - b. Color: White **OR** Crystal **OR** As selected from manufacturer's full range, **as directed**.
 - 8. Fiberglass-Sandwich-Panel Adhesive: ASTM D 2559.
 - a. Compatible with facing and core materials.
 - b. Tensile and shear bond strength of aged adhesive ensures permanent adhesion of facings to cores, as evidenced by testing according to ASTM C 297 and ASTM D 1002 after accelerated aging procedures that comply with aging requirements for adhesives with high resistance to moisture in ICBO ES AC05, "Sandwich Panel Adhesives."
 - 9. Panel Fabrication: Factory assemble and seal panels.
 - a. Laminate face sheets to grid core under a controlled process using heat and pressure to produce straight adhesive bonding lines that cover width of core members and that have sharp edges.
 - 1) White spots indicating lack of bond at intersections of grid-core members are limited in number to 4 for every 40 sq. ft. (3.7 sq. m) of panel and limited in diameter to 3/64 inch (1.2 mm).
 - b. Fabricate with grid pattern that is symmetrical about centerlines of each panel.
 - c. Fabricate panel to allow condensation within panel to escape.
 - d. Reinforce panel corners.
- C. Accessory Materials
 - 1. Insulating Materials: Specified in Division 07 Section "Thermal Insulation".
 - 2. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.
- D. Aluminum Finishes
 - 1. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 2. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 - 3. Aluminum Anodic Finish: Class I, clear anodic coating complying with AAMA 611 **OR** Class I, color anodic coating complying with AAMA 611, **as directed**.



- a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** Match sample **OR** As selected from full range of industry colors and densities, **as directed**.
- 4. Aluminum High-Performance Organic Finish: Two-coat **OR** Three-coat, **as directed**, thermocured system with fluoropolymer topcoats containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2604 **OR** AAMA 2605, **as directed**.
 - a. Color: Match sample **OR** As selected from manufacturer's full range, **as directed**.

1.3 EXECUTION

A. Installation

1. General:
 - a. Comply with manufacturer's written instructions.
 - b. Do not install damaged components.
 - c. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
 - d. Rigidly secure nonmovement joints.
 - e. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 - f. Weld aluminum components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
 - g. Seal joints watertight, unless otherwise indicated.
2. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with bituminous paint or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.
3. Install continuous aluminum sill closure with weatherproof expansion joints and locked and sealed or welded corners. Locate weep holes at rafters.
4. Install components to drain water passing joints, condensation occurring within aluminum members and panels, and moisture migrating within assembly to exterior.
5. Install components plumb and true in alignment with established lines and elevations.
6. Install insulation materials as specified in Division 07 Section "Thermal Insulation".
7. Erection Tolerances: Install assemblies to comply with the following maximum tolerances:
 - a. Alignment: Limit offset from true alignment to 1/32 inch (0.8 mm) where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches (76 mm); otherwise, limit offset to 1/8 inch (3.2 mm).
 - b. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3.2 mm in 3.7 m); 1/2 inch (13 mm) over total length.

B. Field Quality Control

1. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
2. Testing Services: Testing and inspecting of representative areas to determine compliance of installed assemblies with specified requirements shall take place as follows and in successive stages as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
 - a. Water Penetration under Static Pressure: Before installation of interior finishes has begun, areas shall be tested according to ASTM E 1105.
 - 1) Test Procedures: Test under uniform and cyclic static air pressure.
 - 2) Static-Air-Pressure Difference: as directed by the Owner.
 - 3) Water Penetration: None.
 - b. Water-Spray Test: Before installation of interior finishes has begun, assemblies shall be tested according to AAMA 501.2 and shall not evidence water penetration.
3. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.



4. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 08 63 00 00



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SECTION 08 71 00 00 - MPF DOOR HARDWARE**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. Evaluation of hardware to be specified for each door is to be based on the door's use and frequency. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 – GENERAL

1.2 SUMMARY

- A. Finish Hardware for hollow metal and wood doors.
- B. Lock cylinders for aluminum doors.

1.3 SUBMITTALS

- A. Product Data: Required
- B. Samples: Required
- C. Door Schedule: Required

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: USPS Handbook RE-4 Standards for Handicapped Accessibility and Handbook RE-5 security.
- B. Hardware for fire-rated openings shall be in compliance with NFPA Standard No. 80, UL10B and UL305.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Door Hardware: Obtain each type of hardware from a single manufacturer.
 - 1. Locksets: By Best, Corbin Russwin, Sargent, Schlage, Yale or approved equal. All mortise locks shall be ANSI A156.13 Grade 1, with cast or forged lever handles.
 - 2. Lock cylinder: Integral type by same manufacturer of locksets.
 - 3. Hinges: Full mortise type with stainless steel pins by Hager, McKinney, Stanley, Lawrence or Soss.
 - 1). Non-removable pins (NRP) at exterior doors and public interior exposure.
 - 2). Ball bearing at fire rated doors, oversized doors and doors with closers.
 - 4. Closers: Heavy duty overhead exposed type complying with ANSI/BHMA A156.4, sized to door conditions or adjustable for door size and barrier free by LCN, Norton, Yale or approved equal.
 - 5. Exit devices: Crash bar or push bar type by Corbin Russwin, Yale, Von Duprin or approved equal.
 - 6. Kick Plates: 6" stainless steel high surface mounted with counter sunk screws.
 - 7. Miscellaneous hardware: Dead locks, bolts, push/pull units, stops, holders, bumpers, thresholds, weatherstripping, silencers, astragals, etc. to be provided as required.
 - 8. Finishes: Satin stainless steel (US32D).



E. SCHEDULES

1. Submit Hardware Schedule based on ANSI series standards and functions.

PART 3 – EXECUTION

- 3.1 Install all products in accordance with manufacturer's guidelines and printed instructions.

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END OF SECTION 08 71 00 00



SECTION 08 71 00 00 - CSF DOOR HARDWARE**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. Evaluation of the type of door and hardware to be specified for each door is to be based on the door's use and frequency. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Sets may be added as required for additional doors.

COORDINATE THE HARDWARE SET NUMBERS WITH THE DOOR NUMBERING SYSTEM ON THE FLOOR PLAN AND DOOR SCHEDULE.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Finish Hardware items which are required for swing, sliding and folding doors, except special types of unique and non-matching hardware specified in the same section as the door and door frame.
2. Hinges.
3. Locks and latches.
4. Operating trim.
5. Accessories for pairs of doors and exit devices.
6. Closing devices.
7. Door controls.
8. Stops and holders.
9. Miscellaneous hardware.

B. Related Sections:

1. Section 083500 - Folding Doors and Grilles: Lockable closures.
2. Section 083613 - Sectional Doors.
3. Section 084113 - Aluminum-Framed Entrances and Storefronts: Hardware for same, and coordination.
4. Section 084229 - Automatic Entrances.
5. Section 016000, Product Requirements.

1.2 REFERENCES

A. American National Standards Institute (ANSI);

1. ANSI A156.3 - National Standard for Exit devices.
2. ANSI A156.4 - National Standard for Door Controls - Closers.



3. ANSI A156.6 - National Standard for Architectural Door Trim.
4. ANSI A156.13 - National Standard for Mortise Locks & Latches.

B. National Fire Protection Association (NFPA):

1. NFPA 80 - Fire Doors and Windows.
2. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures.
3. NFPA 252 - Fire Tests of Door Assemblies.

C. Underwriters Laboratories (UL):

1. UL 10B - Fire Tests of Door Assemblies.
2. UL 305 - Panic Hardware.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
- B. Product Data: Submit manufacturers' technical product data for each item of hardware. Include whatever information may be necessary to show compliance with requirements, and include instructions for installation and for maintenance of operating parts and finishes.
- C. Hardware Schedule: Submit final hardware schedule in manner indicated below. Coordinate hardware with doors, frames and related work to ensure proper size, thickness, hand, function and finish of hardware.
 1. Final Hardware Schedule Content: Based on finish hardware indicated, organize hardware schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:
 - a. Type, style, function, size and finish of each hardware item.
 - b. Name and manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.
 - e. Explanation of all abbreviations, symbols, codes, etc. contained in schedule.
 - f. Mounting locations for hardware.
 - g. Door and frame sizes and materials.
 - h. Keying information.
 2. Submittal Sequence: Submit schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work (e.g., hollow metal frames) which is critical in the project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by finish hardware, and other information essential to the coordinated review of hardware schedule.
- D. Samples: Prior to submittal of the final hardware schedule and prior to final ordering of finish hardware, submit one sample of each type of exposed hardware unit, as selected by the Contracting Officer, finished as required, and tagged with full description for coordination with schedule.
 1. Samples will be returned to the supplier. Units which are acceptable and remain undamaged through submittal, review and field comparison procedures may, after final check of operation, be used in the work, within limitations of keying coordination requirements.
- E. Templates: Furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware. Upon request, check shop drawings of such other work, to confirm that adequate provisions are made for proper location and installation of hardware.
- F. Written Report: Before final inspection, a detailed written report shall be made to the Contracting Officer covering application and condition of the Finish Hardware.



1.4 QUALITY ASSURANCE

- A. Perform work in accordance with the following requirements:
1. ANSI A117.1
 2. NFPA 101.
 3. NFPA 80.
 4. NFPA 252.
 5. UL 10B.
 6. UL 305.
- B. Regulatory Requirements:
1. Conform to applicable code for requirements applicable to fire rated doors and frames.
 2. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., and acceptable to the public authority as suitable for the purpose specified and indicated.
 3. Conform to United States Postal Service "Standards for Facility Accessibility by the Physically Handicapped" Handbook RE-4 for mounting heights and locations of accessories.
- C. Manufacturer: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.
- D. Supplier: A recognized architectural finish hardware supplier, with warehousing facilities, who has been furnishing hardware to similar projects for a period of not less than 2 years, and who employs an experienced architectural hardware consultant (AHC) who is available, at reasonable times during the course of the work, for consultation about project's hardware requirements.
- E. Fire-Rated Openings: Provide hardware for fire-rated openings in compliance with NFPA Standard No. 80 and local building code requirements.

NOTE TO SPECIFIER

REQUIRED Part (PART 2 PRODUCTS) is indicated below. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN & CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Within each Article in Part 2 hardware products from a few manufacturers are specified to establish a standard of quality and minimum functional requirements.
- B. All items of a particular hardware category i.e. locksets, closers, hinges shall be of the same manufacturer.
- C. Hardware Manufacturers:
- | | | |
|----|---|----------------|
| 1. | Adams Rite, City of Industry, CA | |
| 2. | Alarm Lock Systems, Amityville, NY | (800) 252-5625 |
| 3. | Baldwin Hardware Corp., Reading, PA | (888) 592-2216 |
| 4. | Bommer, Landrum, SC | (800) 334-1654 |
| 5. | Best Access Systems, Indianapolis, IN | (800) 311-1705 |
| 6. | Corbin Russwin, Berlin, CT | (800) 543-3658 |
| 7. | Detex Corporation, New Brannfels, TX | (800) 729-3839 |
| 8. | Falcon/Dor-O-Matic, Harwood Heights, IL | (800) 815-1517 |
| 9. | Door Controls International, Dexter, MI | (800) 742-3634 |



10.	Folger Adam Company, Lemont, IL	(800) 260-9001
11.	Glynn-Johnson, Indianapolis, IN	(877) 613-8766
12.	Hager Companies, St. Louis, MO	(800) 255-3590
13.	Hiawatha, Inc., Bloomington, MN	(800) 777-1686
14.	H. B. Ives, Wallingford, CT	(888) 371-7331
15.	Knape & Vogt Manufacturing Co., Grand Rapids, MI	(800) 253-1561
16.	LCN Closers, Princeton, IL	(800) 526-2400
17.	McKinney Hinge, Scranton, PA	(800) 346-7707
18.	National Guard Products, Incorporated, Memphis, TN	(800) 647-7874
19.	Norton, Charlotte, NC	(800) 393-1097
20.	NT Falcon, Brea, CA	(914) 632-9774
21.	NT Monarch, Shepherdsville, KY	(800) 826-5792
22.	OSI Security Devices, Chula Vista, CA	(619) 628-1000
23.	PDQ Manufacturing, Leola, PA	(800) 441-9692
24.	Pemko, Ventura, CA	(800) 824-3018
25.	Precision Hardware, Romulus, MI	(317) 849-2250
26.	Reese Enterprises, Incorporated, Rosemount, MN	(800) 328-0953
27.	Rixson-Firemark, Franklin Park, IL	(866) 474-9766
28.	Rockwood Manufacturing, Rockwood, PA	(800) 458-2424
29.	Sargent, New Haven, CT	(800) 727-5477
30.	Sargent & Greenleaf, Nicholasville, KY	(800) 826-7652
31.	Schlage, Colorado Springs, CO	(800) 847-1864
32.	Securitech Group Incorporated, Maspeth, NY	(800) 622-5625
33.	Simplex Access Controls	(800) 746-7539
34.	Soss, Pioneer, OH	(800) 922-6957
35.	Stanley, New Britain, CT	(877) 334-6791
36.	Trimco, Los Angeles, CA	(323) 262-4191
37.	Von Duprin, Indianapolis, IN	(317) 613-8302
38.	Wooster Products Incorporated, Wooster, OH	(800) 321-4936
39.	Yale, Charlotte, NC	(800) 438-1951
40.	Zero International, Bronx, NY	(800) 635-5335

- D. Section 016000 - Product Requirements: Unless noted otherwise, substitution of specified products with equivalent products from the above approved manufacturers is permitted in accordance with Product Options and Substitutions in Section 016000.

2.2 HINGES

- A. Subject to compliance with requirements, provide hinges of one of the following manufacturers and as specified below:
1. Hager.
 2. McKinney.
 3. Stanley.
 4. Soss.

B. Material:

1. For interior doors, provide full mortise-type steel hinges with steel pins; non-rising for non-security exposure, flat button with matching plugs.
2. For exterior doors, provide full mortise-type stainless steel hinges with stainless steel pins; non-removable, flat button with matching plugs.
3. Ball-bearing Type: Swaged, inner leaf beveled, square corners.

NOTE TO SPECIFIER



Finish Type Key below indicates ANSI A156.18 National Standard For Materials and Finishes used for hardware finished in this schedule.

Finish Type Key:

Code	Description	Basis Material	Nearest Former US Category Equivalent
626	Satin Chromium, Plated	Brass, Bronze	A US 26D
630	Satin Stainless Steel	Stainless Steel	A US 32D
652	Satin Chromium Plated	Steel	E US 26D
689	Aluminum Painted	Any	E US 28

C. Hinges/pivots by types:

1. Type H-1: Medium weight door, average frequency, steel.
 - a. Hinge FBB179 4-1/2 x 4-1/2 652 Stanley
 - b. Hinge BB1279 4-1/2 x 4-1/2 652 Hager
 - c. Hinge TA2714 4-1/2 x 4-1/2 652 McKinney
2. Type H-2: Medium weight door, average frequency, steel, non-removable pins. Hinges on interior doors shall be satin chrome plated finish 652. Hinges on exterior doors shall be completely stainless steel finish 630.
 - a. Hinge FBB179 4-1/2 x 4-1/2 NRP Stanley
 - b. Hinge BB1279 4-1/2 x 4-1/2 NRP Hager
 - c. Hinge TA2714 4-1/2 x 4-1/2 NRP McKinney
3. Type H-3: Concealed, medium weight door, average frequency, steel.
 - a. Hinge 216 US26D Soss
4. Type H-4: Medium weight door, average frequency, steel. (Continuous Piano hinge)
 - a. Hinge STS314 1/4 626 Stanley
5. Type H-5: Medium weight door, average frequency, steel, 5-inch high, non-removable pins. Hinges on interior doors shall be satin chrome plated finish 652. Hinges on exterior doors shall be completely stainless steel finish 630.
 - a. Hinge FBB179 4-1/2 x 5 NRP Stanley
 - b. Hinge BB1279 4-1/2 x 5 NRP Hager
 - c. Hinge TA2714 4-1/2 x 5 NRP McKinney

2.3 LOCKS, LATCHES, AND BOLTS

- A. Subject to compliance with requirements, provide locks, latches and bolts of one of the following manufacturers and as specified below:
1. Best.
 2. Corbin Russwin.
 3. Sargent.
 4. Schlage.
 5. Yale.
- B. Materials:
1. Mortise Locks: ANSI A156.13, Grade 1, equipped with 6-pin tumbler. Provide 2-3/4 inch backset. Provide three keys per cylinder.
 2. Latch Sets: Provide release by turning lever, closing door, or turning emergency release key through hole in outside knob.
 3. Strikes: ANSI Strikes, 1-1/4 x 4-7/8 inches, with curved lip. Wrought box strikes, with extended lip for latch bolts, except open strike plates may be used in wood frames. Provide dustproof strikes for foot bolts.
 4. Tactile Warning: Provide lever handles with manufacturer's standard tactile warning per handicapped codes when required by local authority.



C. Keying

1. General:

- a. Incorporate a security system to ensure that keys used during construction do not open doors after United States Postal Service occupancy.
- b. Key side of locks shall be on the public side.
- c. Master and submaster key system shall conform to United States Postal Service criteria. Doors at exterior of facility, from public area to workroom, Stamped Envelope Storage and Postal Store areas shall not be on the master/submaster keying schedule. Other areas, based on need or local preference, may be excluded from master/submaster keying schedule.

2. Construction Keying:

- a. Furnish exterior door lock sets with keyed alike removable construction core cylinders for use during construction.
- b. Restrict distribution of construction keys. Maintain record of persons who have received keys and deliver copies of record to Contracting Officer upon request.
- c. Provide permanent cores to Postmaster prior to substantial completion. Postmaster shall store them securely until needed. At substantial completion and at Contracting Officer direction, remove construction cores and replace with permanent cores in presence of Postmaster. Provide keys to Postmaster and return construction cores to manufacturer.

3. Permanent Keying:

- a. Master locks and cylinders are to match the United States Postal Service existing keying system if a system exists.
- b. Master to open all doors, except entrance doors to facility, doors from public area to workroom, Stamped Envelope Room and Postal Store shall not be on any master key system.

4. Permanent Keying:

- a. Master locks and cylinders are to match the United States Postal Service existing I/C core system.
- b. Master to open all doors, except Stamped Envelope Room and Postal Store shall not be on any master key system.

D. Cylinders and Thumbturns by types:

1. Type B-1: Rim Cylinder.

- | | | | | |
|----|----------|----------|-----|----------------|
| a. | Cylinder | 1109 | 626 | Yale |
| b. | Cylinder | 20-022 | 626 | Schlage |
| c. | Cylinder | 3000-200 | 626 | Corbin Russwin |

2. Type B-2: Mortise Cylinder.

- | | | | | |
|----|----------|-------------------------|-----|----------------|
| a. | Cylinder | 2153 w/ 1161 series cam | 626 | Yale |
| b. | Cylinder | 20-013 | 626 | Schlage |
| c. | Cylinder | 1000-A03 | 626 | Corbin Russwin |

3. Type B-3: Cylinder Guard

- | | | | | |
|----|----------------|--------|-----|------------|
| a. | Cylinder Guard | MS4043 | 630 | Adams Rite |
|----|----------------|--------|-----|------------|

E. Locks and Latches by types:

1. Type L-1 Hotel Lock (similar to ANSI F15)

- | | | | |
|----|------------------------------|-----|----------------|
| a. | AUR 8832FL w/security collar | 626 | Yale |
| b. | ML2029 NSA w/security collar | 626 | Corbin Russwin |
| c. | L9485P-06 w/security collar | 626 | Schlage |

2. Type L-2 Classroom Lock (ANSI F84)

- | | | | |
|----|-----------|-----|----------------|
| a. | AU 5408LN | 626 | Yale |
| b. | CL 3555 | 626 | Corbin Russwin |
| c. | ND70PD | 626 | Schlage |



- | | | | | |
|----|-------------------------------|------------------------------|-----|----------------|
| 3. | Type L-3 | Entrance Lock (ANSI F20) | | |
| a. | AUR 8847FL w/security collar | | 626 | Yale |
| b. | ML2067 w/ security collar | | 626 | Corbin Russwin |
| c. | L9453P-06A w/ security collar | | 626 | Schlage |
| 4. | Type L-4 | Storeroom Lock (ANSI F86) | | |
| a. | AU 5405LN | | 626 | Yale |
| b. | CL3557 | | 626 | Corbin Russwin |
| c. | ND80PD | | 626 | Schlage |
| 5. | Type L-5 | Privacy Lock (ANSI F76) | | |
| a. | AU 5402LN | | 626 | Yale |
| b. | CL3520 | | 626 | Corbin Russwin |
| c. | ND40S | | 626 | Schlage |
| 6. | Type L-6 | Closet Deadbolt (ANSI E2151) | | |
| a. | 3611B | | 626 | Yale |
| b. | 470 | | 626 | Sargent |

2.4 PUSH/PULL UNITS

- A. Pulls and Pushes Manufacturers: Subject to compliance with requirements, provide from one of the following manufacturers as specified below.
1. H. B. Ives.
 2. Trimco.
 3. Rockwood.
 4. Baldwin.
 5. Adams Rite
- B. Materials: ANSI A156.6 for 0.050 inch thickness.
- C. Push and Pulls by types:
1. Type P-1: Push 4 inch x 16 inch.

a.	1001-3	630	Trimco
b.	70C	630	Rockwood
 2. Type P-2 Pull: 4 inch x 16 inch.

a.	1010-3	630	Trimco
b.	132 x 70C	630	Rockwood
 3. Type P-3 Pull: 2.75 inch x 11.5 inch.

a.	3001 fixed pull	629	Adams Rite
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2.5 EXIT DEVICES

- A. Exit Devices: Subject to compliance with requirements, provide exit devices of one of the following manufacturers and as specified below.
1. Corbin Russwin.
 2. Yale.
 3. Von Duprin.
 4. Adams Rite.
 5. Jackson Exit Device.
 6. Monarch.
 7. Sargent.
 8. Securitech Group Inc.
- B. Exit Only Door Alarms:
1. SDA103



C. Materials:

1. Provide exposed metal to match hardware.
2. Size and mount units indicated or, if not indicated, to comply with manufacturer's recommendations for exposure condition. Reinforce substrate as recommended.

D. Exit Devices by types:

1. Type E-1: Exit Device (F01) (for wood and metal doors)
 - a. 8700 w/ security interlock nose guard/strike 628 Adams Rite
2. Type E-2: Exit Device (F04) (for narrow stile rim for aluminum doors)
 - a. 8800 x cyl. dog w/ security interlock nose guard/strike 630 Adams Rite
3. Type E-3: Exit Device (F03) (for wood and metal doors)
 - a. 8700 x cyl. dog w/ security interlock nose guard/strike 628 Adams Rite
4. Type E-3: Not Used

NOTE TO SPECIFIER

SELECT APPROPRIATE PRODUCT FROM THE THREE MANUFACTURERS BASED ON THE PROJECT AND FACILITY SECURITY REQUIREMENTS.

5. Type E-4: Access Control Device

- a. Centurion PEDS Series
- b. Trilogy 3500 SERIES 628 ALARM LOCK
- c. Omnilock 2000 Series 628 OSI

(For use at facilities with less than three (3) access control devices, but with more than 100 employees and high turn-over rate.)

6. Type E-5: Time Lock Exit Device system (for entrance doors)

- a. USPSTL-FA-200 or approved equal 628 Securitech
- (includes exit device, power supply, timer, power transfer)

2.6 CLOSERS

A. Closers: Subject to compliance with requirements, provide closers of one of the following manufacturers and as specified below.

1. LCN.
2. Norton.
3. Yale.

B. Materials & Features:

1. ANSI A156.4, Grade 1.
2. ADA/ANSI A117.1
3. U.L. listed. Provide closers for fire rated openings in compliance with NFPA 80, NFPA 101, and local building codes.
4. Non-Sized; adjustable 1 to 5 pounds.
5. 180 degree door opening.
6. Heavy Duty parallel arm.
7. Standard Cover.
8. Provide exposed metal to match hardware.
9. Mounting: Mount closers as follows unless indicated otherwise:
 - a. Interior side of exterior doors.



- b. Opposite side of public side.
 - c. Workroom side of doors leading to or from the Workroom.
 - d. Room side of corridor doors.
- 10. Size and mount units indicated or, if not indicated, to comply with manufacturer's recommendations for exposure condition. Reinforce substrate as recommended.
- 11. Closers to be installed to allow door swing as shown on drawings.
- C. Closers by types:
 - 1. Type C-1:

a. 4011	689	LCN
b. P7500	689	Norton
c. 4400	689	Yale
 - 2. Type C-2: Parallel arm.

a. 4111	689	LCN
b. P7500	689	Norton
c. 4400	689	Yale

2.7 STOPS, HOLDERS AND BUMPERS

- A. Stop and Holder, Floor and Wall Stop, and Bumper Manufacturers: Subject to compliance with requirements, provide from one of the following manufacturers as specified below.
 - 1. H. B. Ives.
 - 2. Quality Hardware Manufacturing Co., Inc.
 - 3. Trimco.
 - 4. Dor-O-Matic.
 - 5. Glenn-Johnson.
- B. Materials:
 - 1. Door stop mounting: Methods to suit substrates encountered (plastic anchor, drywall anchor, expansion shield).
 - 2. Provide grey rubber exposed resilient parts.
 - 3. Do not furnish aluminum floor stops.
 - 4. Where a door stop is specified in the Hardware Schedule, provide a wall stop type (S-1). However, if circumstances prevent a wall stop installation (door too far from perpendicular wall, door swing into adjacent glass, etc.) then substitute a type (S-2) or (S-3) floor stop as indicated for use intended.
 - 5. Adjust height of floor stops to suit undercut of adjacent door.
- C. D. Stops, Holders and Bumpers by types:
 - 1. Type S-1: Wall Stop - Install with appropriate anchors for substrate encountered.

a. 1270W	630	Trimco
b. 407 1/2C	630	Ives
 - 2. Type S-2: Floor Stop - Install with appropriate anchors for substrate encountered.

a. 1201	626	Trimco
b. FS444	626	Ives
 - 3. Type S-3: Floor Stop - Install with appropriate anchors for substrate encountered.

a. W1211	630	Trimco
b. FS436	630	Ives
c. 331ES	630	Quality

2.8 THRESHOLDS

- A. Threshold Manufacturers: Subject to compliance with requirements, provide from one of the following manufacturers as specified below.
1. Pemko.
 2. National Guard.
 3. Reese.
 4. Zero.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- C. Thresholds by types:
1. Type T-2:
Saddle threshold for floor finish at doors
(either VCT tile or VCT to VCT or sealed concrete to tile.)
 - a. VCT to VCT

154	Pemko
HD5A	Reese
425E	National
 - b. VCT to Tile/Concrete

158	Pemko
S514A	Reese
653	National
 2. Type T-3 (with weather seal):

a. S483AV	Alum	Reese
b. 2005AT		Pemko
c. 896V		National

2.9 WEATHERSTRIPPING

- A. Weatherstripping Manufacturers: Subject to compliance with requirements, provide from one of the following manufacturers as specified below.
1. Pemko.
 2. Reese.
 3. Zero.
 4. National Guard.
- B. Weatherstripping by types:
1. Type W-1: Door Gaskets.
 - a. 807A

	Reese
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2.10 MISCELLANEOUS HARDWARE

- A. Miscellaneous Hardware Manufacturers: Subject to compliance with requirements, provide from the manufacturers specified below.
- B. Provide door silencers for all doors unless indicated otherwise.
- C. Miscellaneous Hardware by types:
1. Type M-1: Acoustical Perimeter Door Seal
 - a. 105NA

	Alum	National
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 2. Type M-2: Dead Lock, (ANSI E0191) - w/ No exposed trim on lobby side.



- | | | | |
|-----|---|------|----------|
| a. | 3300 Series | 630 | Yale |
| 3. | Type M-3: Security Viewer. Mounted/installed, centered at 5'-0" AFF. | | |
| a. | 1756 | 630 | Hager |
| 4. | Type M-4: Astragal | | |
| a. | 184A | Alum | Reese |
| 5. | Type M-5: Silencers | | |
| a. | 1229A | Gray | Trimco |
| b. | SR64 | | Ives |
| 6. | Type M-6: Flushbolts | | |
| a. | 3917 | 626 | Trimco |
| b. | 555 | 626 | Rockwood |
| 7. | Type M-7: Astragal | | |
| a. | 276C | Alum | Reese |
| 8. | Type M-8: Kick Plates | | |
| a. | K0050 8 x 34 | 630 | Trimco |
| b. | KP18 8 x 34 | 630 | Rockwood |
| 9. | Type M-9: Armor Plate; 40" H x 46" W (both sides of door) | 630 | |
| 10. | Type M-10: Emergency Exit Alarm w/ Contacts: | | |
| a. | SDA103 | | SGI |
| | 1) Provide concealed door contacts and a separate alarm unit. Alarm will have local 110 db (min). Audible alarm and a visual alarm (strobe light) operated on 24vac, utilizing 110v. AC current to continually charge the battery. Battery operated door or panic bar mounted alarms are not allowed. | | |
| | 2) Alarm to be located above the door, within 2 feet of the door. Provide door sign indicating alarm will sound when opened and labeled, "EMERGENCY EXIT ONLY - RE-ENTRY NOT AUTHORIZED". | | |
| 11. | Type M-11: Reinforcing Pivot Hinges | | |
| a. | 253 | 652 | Hager |
| 12. | Type M-12: Bumper | | |
| a. | 170-19 | 630 | Bommer |
| b. | Install on push side of door at same height as lockset, in line with lever handle of lockset and approximately 2 inches away from the handle. | | |
| 13. | Type M-13: Door Bottom Shoe | | |
| a. | CGSS-4-3.5, 1 3/4" width | 630 | Hiawatha |

2.11 FABRICATION

- A. Finish and Base Material Designations: Number indicate BHMA Code or nearest traditional U.S. commercial finish.
- B. Where base material and quality of finish are not otherwise indicated, provide at least commercially recognized quality specified in applicable Federal Specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 1. Verify that doors and frames are ready to receive Work and dimensions are as instructed by the manufacturer.



2. Verify that electric power is available to power operated devices and of the correct characteristics.

- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Where not specified under other sections to be performed by manufacturer or suppliers, machine, fit and drill wood and metal doors.
- B. Prepare doors of various types to receive hardware, using templates and instructions provided with the hardware items for jobsite work.
- C. Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations, and except as may be otherwise directed by Contracting Officer.
 - 1. Conform to requirements United States Postal Service "Standards for Facility Accessibility by the Physically Handicapped" Handbook RE-4.
- D. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protections with finishing work specified in the Division-9 sections. Do not install surface-mounted items until finishes have been completed on the substrate.
- E. Installer of security hardware is to be trained and familiar with product.
- F. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- G. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- H. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant.

3.3 ADJUSTING

- A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.
- B. Clean adjacent surfaces soiled by hardware installation.
- C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.



- D. Instruct United States Postal Service Personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.
- E. Continued Maintenance Service: Approximately six months after the acceptance of hardware in each area, the Installer, accompanied by the representative of the latch and lock manufacturer, shall return to the project and re-adjust every item of hardware to restore proper function of doors and hardware. Consult with and instruct United States Postal Service personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.4 HARDWARE SCHEDULE

- A. General requirements, see respective paragraphs above for details:
 - 1. Ensure that keys used during construction cannot open doors after United States Postal Service occupancy.
 - 2. Provide door silencers for all doors unless indicated otherwise.

SET 1

CSF Small 15-30: Exterior storefront
 CSF Small 25-100A Box Lobby exit
 Carrier Admin entrance (120)
 CSF Medium Box Lobby exit (301A)
 BMEU Lobby Exterior Entry (701B)
 Carrier Admin: Mail Pick-up to exterior (CA101A)
 Each set to have:

- 1 ea. (E-2) Exit Device F04
- 1 ea. (B-1) Rim Cylinder
- 1 ea. (B-2) Mortise Cylinder
- 1 ea. (B-3) Cylinder Guard
- 1 ea. (T-3) Threshold
- 1 ea. Closer

All other hardware is furnished by Storefront supplier as specified in Section 084113.

SET 1 A

CSF Small 15-30: Time Lock Lobby Exterior Entry
 CSF Medium Time Lock Lobby Exterior Entry
 BMEU Lobby Time Lock Lobby Exterior Entry
 Each set to have:

- 1 ea. (E-5) Time Lock Exit Device System
- 1 ea. (B-1) Rim Cylinder
- 1 ea. (B-3) Cylinder Guard
- 1 ea. (T-3) Threshold
- 1 ea. Closer

All other hardware is furnished by Storefront supplier as specified in Section 084113.

SET 2



CSF Small 15-30: Retail Lobby to Box Lobby/Self-Service, interior storefront

Each set to have:

1 ea.	(E-2)	Exit Device F04
1 ea.	(B-1)	Rim Cylinder
1 ea.	(B-2)	Mortise Cylinder
1 ea.	(B-3)	Cylinder Guard
1 ea.		Door Stop
1 ea.		Closer

All other hardware is furnished by Storefront supplier as specified in Section 084113.

Not Used

SET 3

Automatic Storefront Doors (201A and B) (202A and B):

Provide final cylinder cores. Coordinate with Section 084229.

All other hardware is furnished by Automatic Entrance Door supplier as specified in Section 084229.

SET 4

Workroom to Box Lobby

Admin Corridor to Lobby (100B)

Workroom to Box Lobby (301B)

Each set to have:

3 ea.	(H-2)	Hinges
1 ea.	(L-1)	Hotel Lock (Similar to F15)
1 ea.	(T-2)	Threshold
1 ea.	(M-3)	Security Viewer
1 ea.	(M-13)	Door Bottom Shoe
1 ea.		Door Stop
1 ea.		Closer

SET 5

Toilet - single occupancy (111)

Each set to have:

3 ea.	(H-1)	Hinges
1 ea.	(L-5)	Privacy Lock (F76)
1 ea.	(T-1)	Threshold
1 ea.		Door Stop
1 ea.		Closer

SET 6

Toilet - multiple occupancy

Admin to Full Service (100C)

Admin to Workroom (100D)

Carrier Vestibule Personnel to Workroom (401F)

Lunchroom (601)



Each set to have:

3 ea.	(H-1)	Hinges
1 ea.	(P-1)	Push
1 ea.	(P-2)	Pull
1 ea.	(M-8)	Kick Plate
1 ea.		Door Stop
1 ea.		Closer

SET 7

CSF Small 15-30: Mail and Carrier Vestibules to Exterior and to Workroom

Each set to have:

3 ea.	(H-5)	Hinges (5-inch)
1 ea.	(L-3)	Entrance Lock (ANSI F20)
1 ea.	(T-2)	Threshold
1 set	(W-1)	Door Gaskets
2 ea.	(M-9)	Armor Plate
1 ea.	(M-11)	Reinforcing Pivot Hinge
1 ea.	(M-12)	Bumper
1 ea.	(M-13)	Door Bottom Shoe
1 ea.		Door Stop (interior door only)
1 ea.		Closer

Not Used

SET 8

NOTE TO SPECIFIER

If the facility has less than 20 employees then use this set for the Mail Vestibule Personnel to Workroom and to Exterior door, and mark hardware set 9 as Not Used.

Mail Vestibule Personnel to Workroom and to Exterior (if <20 employees)

Carrier Vestibule Personnel to Exterior

Enclosed Platform: Carrier Vestibule Personnel to Exterior

Building and Grounds Room (single door)

BMEU to Scale room and to Workroom (701A)

BMEU Customer Service to Workroom (702)

Each set to have:

3 ea.	(H-2)	Hinges
1 ea.	(L-3)	Entrance Lock (ANSI F20)
1 ea.	(T-2)	Threshold
1 ea.	(M-13)	Door Bottom Shoe
1 ea.		Door Stop (interior doors only)
1 ea.		Closer

SET 9

NOTE TO SPECIFIER

If the facility has 20 or more employees then retain this hardware set.



Mail Vestibule Personnel to Workroom and to Exterior (if >=20 employees)

Carrier Vestibule Personnel to Exterior (411C)

Enclosed Platform: Platform to Dock Stairs (501C)

Mail Vestibule Personnel to Exterior (502C) and to Workroom (502F)

Each set to have:

- 3 ea. (H-2) Hinges
- 1 ea. (E-4) Access Control Device (PEDS), (includes 1 electric hinge)
- 1 ea. (T-2) Threshold
- 1 ea. (M-13) Door Bottom Shoe
- 1 ea. Door Stop
- 1 ea. Closer

SET 10

Mail and Carrier Vestibule Impact Doors

Mail and Carrier Vestibule Impact Doors (411A, B, D, E) (502 A, B, D, E)

All hardware furnished by Impact Door supplier as specified in Section 083800.

SET 11

SSDB 15-20: Mechanical Room to Mail Vestibule

Office Door to Retail Lobby (public)

Telephone Equipment Room to Workroom

Stamped Envelopes to Workroom

Stamped Envelope Room (206)

Each set to have:

- 3 ea. (H-2) Hinges
- 1 ea. (L-1) Hotel Lock (Similar to F15)
- 1 ea. (T-2) Threshold
- 1 ea. (M-13) Door Bottom Shoe
- 1 ea. Door Stop
- 1 ea. Closer

SET 12

Storage/Janitor's Closet to Workroom

Storage Room to Workroom

Mechanical Room to Workroom

Folding Grille Closet Access Door

Electrical Room to Workroom (113) (603A)

Equipment Room to Workroom (114) (604)

Storage Room to Admin Corridor (107)

Folding Grille Closet Access Door (205C)

Storage Room to Workroom (207) (614)

Custodial Supplies (610)

Postal Equipment Room - single door (611)

Postal Records (612)

Postal Supplies (613)

Recycling Room to Workroom (615B)

BMEU Storage to Workroom (705)

Each set to have:



3 ea. (H-1) Hinges
 1 ea. (L-4) Storeroom Lock (F86)
 1 ea. Door Stop
 1 ea. Closer

SET 13

Office to Workroom
 Work Area to Office
 Janitor's Closet to Workroom
 Postmaster's Office to Admin Corridor (101)
 Carrier Admin: Admin Area to Workroom (103A, B)
 CS Manager's Office to Admin Corridor (104)
 Conference Room to Admin Corridor (106)
 Janitor's Closet to Workroom (112) (602)
 Carrier Admin: Meeting Room (121)
 Carrier Admin: Closet (122) (123)
 Each set to have:

3 ea. (H-1) Hinges
 1 ea. (L-2) Classroom Lock (F84)
 1 ea. Door Stop
 1 ea. Closer

SET 14

Folding Closure Pocket (204B and C) (205B)
 Each set to have:

4 ea. (H-3) Hinges
 1 ea. (L-6) Closet Deadbolt

SET 15

Folding Closure (204A) (205A)
 Each set to have:

2 ea. (B-2) Rim Cylinder

All other hardware furnished by Folding Closure Door Supplier as specified in Section 083500.

Note: Provide cylinder at each end of each 8 foot long folding closure section, and any intermediate openings.

SET 16

CSF Small "A" Plans: Wicket door
 Each set to have:

Door:
 3 ea. (H-1) Hinges
 1 ea. (L-4) Storeroom Lock (F86)
 1 ea. (T-2) Threshold
 1 ea. Door Stop



1 ea. Closer

Wicket Panel:

1 ea. (H-4) Continuous Piano Hinge
 1 ea. (M-2) Deadlock (ANSI E0191)
 1 ea. (M-3) Security Viewer
 1 ea. (M-4) Astragal

Not Used

NOTE TO SPECIFIER

Retain either the set above or the set below depending on the CSF Small plan. The set above is only used on CSF Small Plans 40, 50, 65A, 80A, and 100A, where the wicket door is inside the secured Lobby (101). The set below is used on CSF Small Plans 65B, 80B, and 100B, where the wicket door is always accessible to the public.

SET 17

Wicket Door (202C) (CA101)

Each set to have:

Door:

3 ea. (H-2) Hinges
 1 ea. (L-1) Hotel Lock (Similar to F15)
 1 ea. (T-2) Threshold
 1 ea. (M-13) Door Bottom Shoe
 1 ea. Door Stop
 1 ea. Closer

Wicket Panel:

1 ea. (H-4) Continuous Piano Hinge
 1 ea. (M-2) Deadlock (ANSI E0191)
 1 ea. (M-3) Security Viewer
 1 ea. (M-4) Astragal

SET 18

Mail Platform Sectional Overhead Door (501D, E, F, G, H, I): All hardware furnished by Sectional Overhead Door supplier as specified in Section 083613.

SET 19

CIO to Workroom (CIO1A)

Each set to have:

3 ea. (H-2) Hinges
 1 ea. (L-1) Hotel Lock (Similar to F15), Note: the lock must be the specified model from Yale, substitutions are not permitted.
 1 ea. Cylinder, USPS Furnished (PSIN# 0931A0), Contractor Installed
 1 ea. (T-3) Threshold
 1 ea. (M-13) Door Bottom Shoe
 1 ea. (M-1) Acoustical perimeter seal
 1 ea. Door Stop
 1 ea. Closer



SET 20

CIO Covert Entry to Exterior (CIO1)

Each set to have:

- 3 ea. (H-2) Hinges w/ NRP
- 1 ea. (L-1) Hotel Lock (Similar to F15), Note: the lock must be the specified model from Yale, substitutions are not permitted.
- 1 ea. Cylinder, USPS Furnished (PSIN#091SP), Contractor Installed
- 1 ea. (T-3) Threshold
- 1 set (W-1) Door Gaskets
- 1 ea. (M-3) Security Viewer
- 1 ea. (M-13) Door Bottom Shoe
- 1 ea. Door Stop
- 1 ea. Closer

SET 21

Not Used

Electrical to Exterior (603B)

Recycling to Exterior (615A)

Each set to have:

- 3 ea. (H-2) Hinges
- 1 ea. (L-1) Hotel Lock (Similar to F15)
- 1 ea. (T-3) Threshold
- 1 set (W-1) Door Gaskets
- 1 ea. Closer

SET 22

Not Used

Admin to Exterior Exit (100A)

Each set to have:

- 3 ea. (H-2) Hinges
- 1 ea. (E-1) Exit Device
- 1 ea. (T-3) Threshold
- 1 ea. Closer

NOTE TO SPECIFIER*Add the following item if door is used only for emergency egress and will be alarmed.*

- 1 ea. (M-10) Alarm System

NOTE TO SPECIFIER*If the door can be used to re-enter the building then replace the E-1 exit device with the following exit device;*

- 1 ea. (E-3) Exit Device

And add the following items:

- 1 ea. (P-3) Fixed Pull
- 1 ea. (B-1) Rim Cylinder
- 1 ea. (B-3) Cylinder Guard



SET 23

Workroom to Exterior Exit (401A, B, C)

Each set to have:

3 ea. (H-2) Hinges
 1 ea. (E-1) Exit Device
 1 ea. (T-3) Threshold
 1 set (W-1) Door Gaskets
 1 ea. (M-10) Alarm System
 1 ea. Closer

SET 24

Enclosed Platform to Exterior (double-doors) (501A and B)

Building and Grounds Room (double-doors) (609)

Each set to have:

6 ea. (H-2) Hinges
 1 ea. (L-1) Hotel Lock (Similar to F15)
 1 ea. (T-3) Threshold
 1 set (W-1) Door Gaskets
 1 ea. (M-6) Flushbolts
 1 ea. (M-7) Astragal
 1 ea. (S-1) Door Stop (Doors 501A and B only)
 1 ea. Closer

SET 25

Postal Equipment to Workroom (double-doors) (611)

Each set to have:

6 ea. (H-1) Hinges
 1 ea. (L-4) Storeroom Lock (F86)
 1 ea. (M-6) Flushbolts
 1 ea. (M-7) Astragal
 2 ea. Door Stop
 1 ea. Closer

SET 26

BMEU Lobby to Mail Platform (701C)

Each set to have:

3 ea. (H-2) Hinges
 1 ea. (L-3) Entrance Lock (F20)
 1 ea. (T-3) Threshold
 1 set (W-1) Door Gaskets
 1 ea. (M-13) Door Bottom Shoe
 1 ea. Closer

SET 27



BMEU Scale Room to Staging Area in Workroom (703)

Each set to have:

3 ea.	(H-5)	Hinges (5-inch)
1 ea.	(L-4)	Storeroom Lock (F86)
1 ea.		Door Stop
1 ea.		Closer

SET 28

BMEU Scale Room to Mail Platform (double-doors) (704)

Each set to have:

6 ea.	(H-2)	Hinges
1 ea.	(L-1)	Hotel Lock
1 ea.	(T-3)	Threshold
1 set	(W-1)	Door Gaskets
1 ea.	(M-6)	Flushbolts
1 ea.	(M-7)	Astragal
2 ea.	(M-13)	Door Bottom Shoe
1 ea.		Closer

USPS CSF Specifications issued: 10/1/2013

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END OF SECTION 08 71 00 00



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Task	Specification	Specification Description
08 71 16 00	01 22 16 00	No Specification Required



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SECTION 08 80 00 00 - MPF GLAZING

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 – GENERAL

1.1 SUMMARY

- A. Insulating glass units for entrances, storefronts and windows.
- B. Wall vision glazing panels.
- C. Door vision glazing panels.
- D. Glazing compounds and accessories.

1.2 SUBMITTALS

- A. Product Data: Required.
- B. Samples: Required

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with FGMA Glazing Manual and ANSI Z97.1.
- B. Special Warranty for sealed glass units from seal failure, interpane dusting or misting: 10 years.
- C. Tempered glass glazing to be identified permanently by manufacturer.
- D. Handbook RE-5 for Security.

PART 2 – PRODUCTS

2.1 MANUFACTURERS/PRODUCTS

- A. Source: PPG, Viracon, Falconer Glass, Libbey-Owens-Ford or approved equal.
- B. Insulated Glass Units: Comply with glazing and low E requirements defined in the MPF Design Criteria for the following:
 - 1. Insulating glass units.
 - 2. Safety insulating glass units if required by applicable codes and regulations.
 - 3. Insulating glass units with security film.
- C. Tempered Glass: Clear or tinted, fully tempered, 1/4" thick, complying with ASTM C 1048.
- D. Wire Glass: Comply with NFPA 80 and UL listings for fire rated door and wall vision panels.



- E. One - Way Reflective Mirror Glass: Insulated glass unit to improve sound attenuation. Unit to comply with ASTM C1036.
- F. Bullet-resistant Glass complying with UL 752 "Standard for Bullet Resisting Equipment".
- G. Glazing Compounds and Accessories recommended by glazing manufacturer.

PART 3 – EXECUTION

- 3.1 Install all products in accordance with manufacturer's guidelines and printed instructions.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 9/7/2010

END OF SECTION 08 80 00 00



SECTION 08 80 00 00 - CSF GLAZING

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items at end of Section.08 80 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Insulated glass units, low E.
 2. Insulated tempered glass units, low E.
 3. Clear tempered glass.
 4. Wire glass.
 5. One-way reflective mirror glass.
 6. Insulated glass units with security film, low E.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 1. Section 084113 - Aluminum-Framed Entrances and Storefronts: Glazed doors and storefronts.
 2. Section 084229 - Automatic Entrances.

1.2 REFERENCES

- A. American National Standards Institute (ANSI):
 1. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings.
- B. American Society for Testing and Materials (ASTM):
 1. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
 2. ASTM C1036 - Standard Specification for Flat Glass.
 3. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.
 4. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications.
 5. ASTM F1233 - Standard Test Method for Security Glazing Materials and Systems.



C. Consumer Product Safety Standards for Architectural Glazing. CPSC 16 CFR, Part 1201.

D. Flat Glass Marketing Association (FGMA):

1. FGMA - Glazing Manual and Glazing Sealing Systems Manual.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

1. Product Data:

a. Glass: Structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

b. Glazing compound: Provide chemical, functional, and environmental characteristics, limitations, special application requirements.

2. Samples:

a. Glazing: Submit one sample 12 x 12 inches (300 x 300 mm) in size of each type of glazing, illustrating tinting, and finish of glazing materials. Label each sample indicating kind, quality and manufacturer.

3. Assurance/Control Submittals:

a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.

b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

B. Section 017704 – Closeout Procedures and Training: Procedures for closeout submittals.

1. Submit written special warranty with forms completed in United States Postal Service name and registered with manufacturer as specified in this section.

1.4 QUALITY ASSURANCE

A. Identification: Each unit of tempered glass and burglar resistant glazing shall be permanently identified by the manufacturer. The identification shall be etched or ceramic fired on the glass and be visible when the unit is glazed.

B. Provide Energy Star Label on glazing indicating compliance with DOE Energy Star requirements.

C. Perform Work in accordance with FGMA Glazing Manual.

D. Installer Qualifications: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

A. Environmental Requirements:

1. Do not install glazing when ambient temperature is less than 40 degrees F.



2. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.7 WARRANTY

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Special Warranty:
 1. Include coverage for cracking, breakage, and replacement of same.
 - a. Warranty Period: 1 year.
 2. Include coverage for sealed glass units from seal failure, interpane dusting or misting, and replacement of same.
 - a. Warranty Period: 10 years.
 3. Include coverage for delamination of laminated glass and replacement of same.
 - a. Warranty Period: 5 years.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. Pilkington Libbey-Owens-Ford, Toledo, OH (800)221-0444.
 2. PPG Industries, Pittsburgh, PA (412) 434-2858 (800) 377-5267.
 3. Viracon, Owatonna, MN (800) 533-2080.
- B. Subject to compliance with project requirements, manufacturers offering polycarbonate products which may be incorporated in the Work include the following:
 1. Sheffield Plastics, Incorporated Sheffield, MA (413) 229-8711 (800) 628-5084.
 2. GE Plastics, Pittsfield, MA (800) 451-3147.
- C. Subject to compliance with project requirements, manufacturers offering security film products which may be incorporated in the Work include the following:
 1. 3M, St. Paul, MN (800) 480-1704.
- D. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 GLASS MATERIALS

NOTE TO SPECIFIER

Verify if tempered glass is required by code.

NOTE TO SPECIFIER



*These specifications are based on using tempered glass where "safety" glass is required by code. If laminated glass is required by code then revise the tempered glass types to laminated glass.
In climates below 3000 HDD, the low-E coating shall be placed on the second surface (inner side of outer panel);
in climates above 3000 HDD, the low-E coating shall be placed on the third surface (outer side of inner panel).*

At retail service lobby, self-service area, box lobby, walk-up, and drive-up windows visible reflectance should be 15 percent maximum and visible transmittance should be 65 percent minimum.

- A. Glass Type 1 - Insulated Glass Units, Low E: Double pane units with inner pane of clear annealed glass and outer pane of tinted annealed glass. [Coating on inner side of outer panel.] [Coating on outer side of inner panel.]
 - 1. Where required by code, provide Glass Type 2 (tempered).
 - 2. Glass Thickness, Inner: 1/4 inch (6 mm).
 - 3. Glass Thickness, Outer: 1/4 inch (6 mm).
 - 4. Tint Color: [Gray] [Bronze] [Selected by Contracting Officer].
 - 5. Visible Reflectance: [Maximum 15 percent] [_____].
 - 6. Visible Transmittance: [Minimum 65 percent] [_____].
 - 7. Unit Thickness: 1 inch (25 mm) thick units. 1/4 inch (6 mm) thick, clear inner pane. 1/4 inch (6 mm) thick, tinted outer pane. 1/2 inch (12 mm) air space between panes.
- B. Glass Type 2 - Insulated Tempered Glass Units, Low E: Double pane units with inner pane of clear tempered glass and outer pane of tinted tempered glass. [Coating on inner side of outer panel.] [Coating on outer side of inner panel.]
 - 1. Glass Thickness, Inner: 1/4 inch (6 mm).
 - 2. Glass Thickness, Outer: 1/4 inch (6 mm).
 - 3. Tint Color: [Gray] [Bronze] [Selected by Contracting Officer].
 - 4. Visible Reflectance: [Maximum 15 percent] [_____].
 - 5. Visible Transmittance: [Minimum 65 percent] [_____].
 - 6. Unit Thickness: 1 inch (25 mm) thick units. 1/4 inch (6 mm) thick, clear inner pane. 1/4 inch (6 mm) thick, tinted outer pane. 1/2 inch (12 mm) air space between panes.
- C.
- D. Glass Type 3 - Clear Tempered Glass: ASTM C 1048, Kind FT (Fully Tempered), Condition A (Uncoated), Type I (Transparent Glass, Flat), Class 1 (Clear), Quality q3 (Glazing Select). Conform to ANSI Z97.1 and CPSC 16CFR Part 1201.
 - 1. Thickness: 1/4 inch (6 mm), unless indicated otherwise.

NOTE TO SPECIFIER

Confirm if the documents contain glazing within a fire barrier and if required by code. Add the requirement to provide wire glass. Identify specific locations.

- E. Glass Type 4 - Wire Glass: (Fire Safety Glass) ASTM C 1036, Type II (Wired Glass Flat), Class 1 (Clear), Form 1 (Wired, Polished Both Sides), Quality q8 (Glazing), Mesh m2 (Square) woven stainless steel wire of 1/2 inch (12 mm) grid size. Wire glass is used for door vision panels.
 - 1. Thickness: 1/4 inch (6 mm), unless indicated otherwise.
- F. Glass Type 5 - One-Way Reflective Mirror Glass : ASTM C1036, Type 1 transparent flat, Class 1 (clear), Quality q3 (Glazing Select);
 - 1. Thickness (at ceiling panel): 1/4 inch (6 mm), tempered per ANSI Z97.1.
 - 2. Unit Thickness (at Criminal Investigative Office): 1 inch (25 mm) thick units. 1/4 inch (6 mm) thick clear inner pane. 1/4 inch (6 mm) thick mirrored outer pane. 1/2 inch (12 mm) air space between panes.

NOTE TO SPECIFIER



For facilities without an Intrusion Detection System, provide type 6 glass on all exterior windows and sidelights at the security perimeter (exterior walls and security walls) that meet the criteria in the CSF Design Criteria (Chapter 2-6.1.2)

- G. Glass Type 6 - Insulated Glass Units with Security Film, Low E: Double pane units with inner pane of clear annealed glass and outer pane of tinted annealed glass. [Coating on inner side of outer panel.] [Coating on outer side of inner panel.] Security film of a minimum 0.007 inch (0.1778 mm) on the inner side of the inner panel.
1. Glass Thickness, Inner: 1/4 inch (6 mm).
 2. Glass Thickness, Outer: 1/4 inch (6 mm).
 3. Tint Color: [Gray] [Bronze] [Selected by Contracting Officer].
 4. Visible Reflectance: [Maximum 15 percent] [_____].
 5. Visible Transmittance: [Minimum 65 percent] [_____].
 6. Unit Thickness: 1 inch (25 mm) thick units. 1/4 inch (6 mm) thick, clear inner pane. 1/4 inch (6 mm) thick, tinted outer pane. 1/2 inch (12 mm) air space between panes.

NOTE TO SPECIFIER

For facilities without an Intrusion Detection System, provide type 7 glass on all interior windows, sidelights, and storefronts systems at the security perimeter that meet the criteria in the CSF Design Criteria (Chapter 2-6.1.2)

- H. Glass Type 7 - Clear Tempered Glass with Security Film: ASTM C 1048, Kind FT (Fully Tempered), Condition A (Uncoated), Type I (Transparent Glass, Flat), Class 1 (Clear), Quality q3 (Glazing Select). Conform to ANSI Z97.1 and CPSC 16CFR Part 1201. Security film of a minimum 0.007 inch (0.1778 mm) on the inner side of panel.
1. Thickness: 1/4 inch (6 mm), unless indicated otherwise.

2.3 GLAZING COMPOUNDS

- A. Polysulphide Sealant: Two component, chemical curing, non-sagging type; cured Shore A hardness of 15-25.
- B. Silicone Sealant: Single component, chemical curing; capable of water immersion without loss of properties; non-bleeding, non-staining; cured Shore A hardness of 15-25.
 1. Color: Clear.
- C. Acrylic terpolymer compounded especially for glazing; non-hardening, non-staining, and non-bleeding.

2.4 GLAZING ACCESSORIES

- A. Setting Blocks: Resilient blocks of 70 to 90 Shore A durometer hardness; compatible with glazing sealant.
- B. Spacers: Resilient blocks of 40 to 50 Shore A durometer hardness; self adhesive on one side; compatible with glazing sealant.
- C. Filler Rods: Closed cell or jacketed foam rods of polyethylene, butyl, neoprene, polyurethane, or vinyl; compatible with glazing sealant.
- D. Joint Cleaners, Primers, and Sealers: As recommended by glazing sealant manufacturer.
- E. Gaskets: ASTM D2000, SBC 415 to 3BC 620; extruded or molded neoprene or EPDM, black.



- F. Mastic: Non-solvent type adhesive as recommended by mirrored glass manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify that openings for glazing are correctly sized and within tolerance.
 - 2. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant.

3.3 GLAZING

- A. Locate setting blocks at quarter points of sill; set in sealant if heel or toe bead is required.
- B. Install spacers inside and out except where preshimmed tape or glazing gaskets are to be used.
- C. Set each piece in a series to other pieces in pattern draw, bow, or other visually perceptible characteristics.
- D. Provide glazing sealants and gaskets as required for particular glazing application. Coordinate with other Sections for material compatibility.
- E. Gaskets:
 - 1. Provide adequate anchorage, particularly for driven-in wedge gaskets.
 - 2. Miter and weld ends of channel gaskets at corners to provide continuous gaskets.
 - 3. Seal face gaskets at corners with sealant to close opening and prevent withdrawal of gaskets from corners.
- F. Do not leave voids in glazing channels except as specifically indicated or recommended by glass manufacturer. Force sealant into channel to eliminate voids. Tool exposed surfaces to slight wash away from joint. Trim and clean promptly.



- G. Do not allow sealant to close weeps of aluminum framing.
- H. Provide filler rod where sealants are used in the following locations:
 - 1. Head and jamb channels.
 - 2. Colored glass over 75 united inches in size.
 - 3. Clear glass over 125 united inches in size.

3.4 INSTALLATION - BUTT GLAZED METHOD

- A. Temporarily brace tempered glass in position for duration of glazing process. Mask edges of glass at adjoining glass edges and between glass edges and framing members.
- B. Temporarily secure a small diameter non-adhering foamed rod on back side of joint.
- C. Apply silicone sealant to open side of joint in continuous operation; thoroughly fill the joint without displacing the foam rod. Tool the sealant surface smooth to concave profile.
- D. Permit sealant to cure then remove foam backer rod. Apply sealant to opposite side, tool smooth to concave profile.
- E. Remove masking tape.

3.5 CONSTRUCTION

- A. Interface with Other Work: Coordinate glazing with installation of entrances and storefronts specified in Section 084113.

3.6 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Inspect preparation and installation of glass.

3.7 CLEANING

- A. Section 017300 - Execution: Cleaning installed work.
- B. Remove glazing materials from finish surfaces.
- C. Remove labels after Work is complete.
- D. Clean glass and adjacent surfaces.

3.8 PROTECTION

- A. Section 017300 - Executions: Protecting installed work.
- B. After installation, mark pane with an 'X' by using removable plastic tape or paste. Do not mark reflective glass units.



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END OF SECTION

SECTION 08 87 14 00 - MPF SOLAR CONTROL GLAZING FILMS

SECTION 088714 - SOLAR CONTROL GLAZING FILMS

***** NOTE

TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. THIS SECTION IS A "PERFORMANCE" SPECIFICATION. The Section describes the design requirements for the Fire Alarm System. The Fire Alarm Contractor will design the system and prepare detailed Fire Alarm Drawings to be used for the installation of the Fire Alarm System.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.08 87 14 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes film products applied to glass surfaces to impart solar control performance for solar heat and UV reduction, glare reduction, privacy, fade protection, or aesthetic characteristics.

1.2 DEFINITIONS

- A. Dual Reflective Films: Films where interior visible light reflectance is less than the exterior visible light reflectance. The lower interior reflectance provides improved visibility from the interior to the outdoors without affecting the film's solar performance.
- B. Emissivity: The ability of a surface to absorb far-infrared heat and to reflect it. The lower the emissivity, the lower the far-infrared heat absorption and the greater the far-infrared heat reflectance.
- C. Far-Infrared Heat: Heat radiated from objects at temperatures below 1300 deg F such as heat radiated from: room objects, objects heated by the sun, or a home heating system. Far-infrared heat is different from near-infrared heat that is heat radiated from objects at highly elevated temperatures such as the sun.
- D. Low Emissivity (Low-E) Films: Films with improved far-infrared heat reflection, with the ability to reduce winter heat loss through windows. The reflection of far-infrared heat also reduces the need for summer cooling by reducing the transmission of far-infrared heat from outdoor objects through windows into the interior of a home or building.
- E. Low Reflective Films: Films whose visible light reflectance values are very close to that of ordinary glass.
- F. Luminous Efficacy: Ratio of visible light transmission to shading coefficient for a glazing system.
- G. Neutral Solar Films: Films that allow visible light to pass without distortion of color and that have equal visible light transmission properties at all wavelengths in the visible range from 380 to 780 nanometers.
- H. Light to Solar Heat Gain Ratio: Ratio of visible light transmission to Solar Heat Gain Coefficient for a glazing system.
- I. Solar Heat Gain Coefficient: The fraction of incident solar radiation that actually passes through that window, including solar energy that is both directly transmitted and that which is absorbed and subsequently released inwardly by re-radiation and conduction. SHGC is expressed as a number between 0 and 1. The lower a window's solar heat gain coefficient, the less solar heat it transmits. This number is the mathematical complement of the TSER value: The sum of the TSER (Total Solar Energy Rejection, in decimal form) of a glazing system and its SHGC value is 1; therefore, 1 - TSER = SHGC



- J. Spectrally Selective Solar Films: Films that reduce solar heat gain mainly by reducing the transmission of near-infrared solar radiation with minimal reduction of visible light transmission. Films with a Light to Solar Heat Gain Ratio of above 1.00 are spectrally selective.

1.03 REFERENCES

- A. Section makes references to the following:
1. ASTM E-84, "Test Method for Surface Burning Characteristics of Building Materials".
 2. ASTM E 903, "Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres."
 3. ASTM D 1044, "Test Method for Resistance of Transparent Plastics to Surface Abrasion."

1.04 PERFORMANCE REQUIREMENTS

- A. Thermal and Optical Performance Properties: Provide glazing films with performance properties specified (on 1/8 inch clear glass) based on manufacturer's published test data, as determined according to procedures indicated in ASHRAE Handbook of Fundamentals:

B. NOTE TO SPECIFIER

Performance values required to be determined on an individual case by case basis. Determination of existing conditions, sun exposures, energy enhancements and aesthetics will determine choice of available products and required characteristics. Any film product selected must meet the requirements of R.E. 5.

1. Solar Energy Rejected:
 2. Shading Coefficient:
 3. Solar Reflectance:
 4. Solar Absorptance:
 5. Solar Transmittance:
 6. Visible Light Transmittance:
 7. Emissivity:
 8. U-Value (winter median):
 9. Light to Solar Heat Gain Ratio:
 10. Solar Heat Gain Coefficient:
 11. Ultraviolet Transmission: Provide films with UV absorbing materials that limit the weighted UV Transmission to less than 0.1 percent when measured in accordance with ASTM E 903.
- B. Scratch Resistance: Provide films that have 5.0 percent maximum haze increase when tested to ASTM D 1044, using 100 revolutions, a CS-10F Taber abraser and 500 g weights.
- C. Ultraviolet Transmission: Provide films with UV absorbing materials that limit the weighted UV Transmission to less than 0.1 percent when measured in accordance with ASTM E 903.
- D. Surface Burning Characteristics: Provide films that have Flame Spread Index of 0 and Smoke Development Index of 30 or less when tested in accordance to ASTM E 84.

1.5 SUBMITTALS

- A. Product Data (on 1/8 inch clear glass): For each film product indicated.
- B. Samples for Color Selection: Manufacturer's standard sample sets showing the full range of colors available for each type of product indicated.
- C. Samples for Verification: 12-inch square samples of each glazing film, of each product color specified.



- D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- E. Closeout Submittals: Upon completion of the Work, submit the following:
 - 1. Executed warranty.
 - 2. Maintenance (cleaning) and replacement instructions.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Engage a firm experienced in manufacturing systems similar to those indicated for this Project and meeting the standards of the International Standards Organization (ISO), ISO 9001 Quality Assurance in Production and Installation.
- B. Installer Qualifications: Engage an experienced installer certified, licensed, or otherwise qualified by film manufacturer as having the necessary experience, staff, and training to install manufacturer's products according to specified requirements.
- C. Mockups: Apply glazing films in locations as directed to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.
 - 1. Obtain approval of field samples before continuing with remainder of installation.
 - 2. Maintain field samples during remainder of installation in an undisturbed condition as a standard for judging the completed Work.
 - 3. Approved field samples may become part of the completed Work.
- D. Preinstallation Conference: Before installing glazing films, conduct conference at Project site. Conduct preinstallation conference in conjunction with installation of mockup.
 - 1. Meet with Owner, Architect, glazing film Installer and glazing film manufacturer's representative.
 - 2. Review methods and procedures related to installation, including manufacturer's written instructions.
 - 3. Examine substrate conditions for compliance with requirements.
 - 4. Review temporary protection measures required during and after installation.
 - 5. Document proceedings, including corrective measures or actions required, and furnish copy of record to each participant.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing films according to manufacturer's written instructions and as needed to prevent damage condensation, temperature changes, direct exposure to sun, or other causes.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with film installation when ambient and substrate temperature conditions are outside limits permitted by manufacturer and when glass substrates are wet from frost, condensation, or other causes.

1.9 WARRANTY

- A. Manufacturer's standard warranty agreeing to replace films that fail within [10 or 15 years] from date of original installation. [Warranty period dependant on specific product.]

PART 2 - PRODUCTS

2.1 MANUFACTURERS/PRODUCTS

- A. Provide one of the following products:



1. CPFilms Inc.; Vista® Film.
2. 3m Commercial Prestige Series Window Film.
3. Panorama Premier Plus Commercial Window Film.

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

- B. Product Description: Multi-layered product applied to interior glass surfaces, consisting of from outboard surface to inboard surface:
 1. Removable release liner.
 2. CDF adhesive.
 3. Clear or dyed ultraviolet absorbing layer of polyester film.
 4. Single or multiple layers of metallized or sputtered polyester film.
 5. Laminating adhesive.
 6. Scratch resistant coating.
- C. Color: [Blue-Gray][Light Green][Bronze][Neutral][Warm Gray].

2.2 GLAZING FILM ACCESSORIES

- A. General: Provide products complying with requirements of glazing film manufacturer for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Adhesive: Water activated, dry adhesive system that forms a molecular bond between the film and glass.
 1. Protect adhesive form contamination by applying a release liner that will be removed and discarded at installation.
- C. Cleaners, Primers, and Sealers: Types recommended by glazing film manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine glass and surrounding adjacent surfaces for conditions affecting installation.
 1. Report conditions that may adversely affect installation. In report, include description of any glass that is broken, chipped, cracked, abraded, or damaged in any way.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Beginning of installation means acceptance of conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Immediately before beginning installation of films, clean glass surfaces of substances that could impair glazing film's bond, including mold, mildew, oil, grease, dirt and other foreign materials.
- C. Protect window frames and surrounding conditions from damage during installation.



3.3 INSTALLATION

- A. General: Comply with glazing film manufacturers' written installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
 - 1. Install film continuously, but not necessarily in one continuous length. Install with no gaps or overlaps.
 - a. If seamed, install with no gaps or overlaps. Install seams vertical and plumb. No horizontal seams allowed.
 - 2. Do not remove release liner from film until just before each piece of film is cut and ready for installation.
 - 3. Install film with mounting solution and custom cut to the glass with neat, square corners and edges to within 1/8 inch of the window frame.
 - 4. Remove air bubbles, wrinkles, blisters, and other defects.
- B. After installation, view film from a distance of 10 feet against a bright uniform sky or background. Film shall appear uniform in appearance with no visible streaks, banding, thin spots or pinholes.
 - 1. If installed film does not meet these criteria, remove and replace with new film.

3.4 CLEANING

- A. Remove excess mounting solution at finished seams, perimeter edges, and adjacent surfaces.
- B. Use cleaning methods recommended by glazing film manufacturer.
- C. Replace films that cannot be cleaned.

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END OF SECTION



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SECTION 08 87 14 00 - CSF SOLAR CONTROL GLAZING FILMS

NOTE TO SPECIFIER

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PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes film products applied to glass surfaces to impart solar control performance for solar heat and UV reduction, glare reduction, privacy, fade protection, or aesthetic characteristics.

1.2 DEFINITIONS

- A. Dual Reflective Films: Films where interior visible light reflectance is less than the exterior visible light reflectance. The lower interior reflectance provides improved visibility from the interior to the outdoors without affecting the film's solar performance.
- B. Emissivity: The ability of a surface to absorb far-infrared heat and to reflect it. The lower the emissivity, the lower the far-infrared heat absorption and the greater the far-infrared heat reflectance.
- C. Far-Infrared Heat: Heat radiated from objects at temperatures below 1300 deg F such as heat radiated from: room objects, objects heated by the sun, or a home heating system. Far-infrared heat is different from near-infrared heat that is heat radiated from objects at highly elevated temperatures such as the sun.
- D. Low Emissivity (Low-E) Films: Films with improved far-infrared heat reflection, with the ability to reduce winter heat loss through windows. The reflection of far-infrared heat also reduces the need for summer cooling by reducing the transmission of far-infrared heat from outdoor objects through windows into the interior of a home or building.
- E. Low Reflective Films: Films whose visible light reflectance values are very close to that of ordinary glass.
- F. Luminous Efficacy: Ratio of visible light transmission to shading coefficient for a glazing system.
- G. Neutral Solar Films: Films that allow visible light to pass without distortion of color and that have equal visible light transmission properties at all wavelengths in the visible range from 380 to 780 nanometers.
- H. Light to Solar Heat Gain Ratio: Ratio of visible light transmission to Solar Heat Gain Coefficient for a glazing system.
- I. Solar Heat Gain Coefficient: The fraction of incident solar radiation that actually passes through that window, including solar energy that is both directly transmitted and that which is absorbed and subsequently released inwardly by re-radiation and conduction. SHGC is expressed as a number between 0 and 1. The lower a window's solar heat gain coefficient, the less solar heat it transmits. This number is the mathematical complement of the TSER value: The sum of the TSER (Total Solar Energy Rejection, in decimal form) of a glazing system and its SHGC value is 1; therefore, $1 - \text{TSER} = \text{SHGC}$
- J. Spectrally Selective Solar Films: Films that reduce solar heat gain mainly by reducing the transmission of near-infrared solar radiation with minimal reduction of visible light transmission. Films with a Light to Solar Heat Gain Ratio of above 1.00 are spectrally selective.

1.03 REFERENCES

- A. Section makes references to the following:
1. ASTM E-84, "Test Method for Surface Burning Characteristics of Building Materials".
 2. ASTM E 903, "Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres."
 3. ASTM D 1044, "Test Method for Resistance of Transparent Plastics to Surface Abrasion."

1.04 PERFORMANCE REQUIREMENTS

- A. Thermal and Optical Performance Properties: Provide glazing films with performance properties specified (on 1/8 inch clear glass) based on manufacturer's published test data, as determined according to procedures indicated in ASHRAE Handbook of Fundamentals:

NOTE TO SPECIFIER

Performance values required to be determined on an individual case by case basis. Determination of existing conditions, sun exposures, energy enhancements and aesthetics will determine choice of available products and required characteristics. Any film product selected must meet the requirements of R.E. 5.

1. Solar Energy Rejected:
 2. Shading Coefficient:
 3. Solar Reflectance:
 4. Solar Absorptance:
 5. Solar Transmittance:
 6. Visible Light Transmittance:
 7. Emissivity:
 8. U-Value (winter median):
 9. Light to Solar Heat Gain Ratio:
 10. Solar Heat Gain Coefficient:
 11. Ultraviolet Transmission: Provide films with UV absorbing materials that limit the weighted UV Transmission to less than 0.1 percent when measured in accordance with ASTM E 903.
- B. Scratch Resistance: Provide films that have 5.0 percent maximum haze increase when tested to ASTM D 1044, using 100 revolutions, a CS-10F Taber abraser and 500 g weights.
- C. Ultraviolet Transmission: Provide films with UV absorbing materials that limit the weighted UV Transmission to less than 0.1 percent when measured in accordance with ASTM E 903.
- D. Surface Burning Characteristics: Provide films that have Flame Spread Index of 0 and Smoke Development Index of 30 or less when tested in accordance to ASTM E 84.

1.5 SUBMITTALS

- A. Product Data (on 1/8 inch clear glass): For each film product indicated.
- B. Samples for Color Selection: Manufacturer's standard sample sets showing the full range of colors available for each type of product indicated.
- C. Samples for Verification: 12-inch square samples of each glazing film, of each product color specified.
- D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.



- E. Closeout Submittals: Upon completion of the Work, submit the following;
 1. Executed warranty.
 2. Maintenance (cleaning) and replacement instructions.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Engage a firm experienced in manufacturing systems similar to those indicated for this Project and meeting the standards of the International Standards Organization (ISO), ISO 9001 Quality Assurance in Production and Installation.
- B. Installer Qualifications: Engage an experienced installer certified, licensed, or otherwise qualified by film manufacturer as having the necessary experience, staff, and training to install manufacturer's products according to specified requirements.
- C. Mockups: Apply glazing films in locations as directed to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.
 1. Obtain approval of field samples before continuing with remainder of installation.
 2. Maintain field samples during remainder of installation in an undisturbed condition as a standard for judging the completed Work.
 3. Approved field samples may become part of the completed Work.
- D. Preinstallation Conference: Before installing glazing films, conduct conference at Project site. Conduct preinstallation conference in conjunction with installation of mockup.
 1. Meet with Owner, Architect, glazing film Installer and glazing film manufacturer's representative.
 2. Review methods and procedures related to installation, including manufacturer's written instructions.
 3. Examine substrate conditions for compliance with requirements.
 4. Review temporary protection measures required during and after installation.
 5. Document proceedings, including corrective measures or actions required, and furnish copy of record to each participant.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing films according to manufacturer's written instructions and as needed to prevent damage condensation, temperature changes, direct exposure to sun, or other causes.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with film installation when ambient and substrate temperature conditions are outside limits permitted by manufacturer and when glass substrates are wet from frost, condensation, or other causes.

1.9 WARRANTY

- A. Manufacturer's standard warranty agreeing to replace films that fail within [10 or 15 years] from date of original installation. [Warranty period dependant on specific product.]

PART 2 - PRODUCTS

2.1 MANUFACTURERS/PRODUCTS

- A. Provide one of the following products:
 1. CPFilms Inc.; Vista® Film.
 2. 3m Commercial Prestige Series Window Film.
 3. Panorama Premier Plus Commercial Window Film.

**NOTE TO SPECIFIER**

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

- B. Product Description: Multi-layered product applied to interior glass surfaces, consisting of from outboard surface to inboard surface:
 - 1. Removable release liner.
 - 2. CDF adhesive.
 - 3. Clear or dyed ultraviolet absorbing layer of polyester film.
 - 4. Single or multiple layers of metallized or sputtered polyester film.
 - 5. Laminating adhesive.
 - 6. Scratch resistant coating.
- C. Color: [Blue-Gray][Light Green][Bronze][Neutral][Warm Gray].

2.2 GLAZING FILM ACCESSORIES

- A. General: Provide products complying with requirements of glazing film manufacturer for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Adhesive: Water activated, dry adhesive system that forms a molecular bond between the film and glass.
 - 1. Protect adhesive form contamination by applying a release liner that will be removed and discarded at installation.
- C. Cleaners, Primers, and Sealers: Types recommended by glazing film manufacturer.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine glass and surrounding adjacent surfaces for conditions affecting installation.
 - 1. Report conditions that may adversely affect installation. In report, include description of any glass that is broken, chipped, cracked, abraded, or damaged in any way.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Beginning of installation means acceptance of conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Immediately before beginning installation of films, clean glass surfaces of substances that could impair glazing film's bond, including mold, mildew, oil, grease, dirt and other foreign materials.
- C. Protect window frames and surrounding conditions from damage during installation.

3.3 INSTALLATION

- A. General: Comply with glazing film manufacturers' written installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
 - 1. Install film continuously, but not necessarily in one continuous length. Install with no gaps or overlaps.



- a. If seamed, install with no gaps or overlaps. Install seams vertical and plumb. No horizontal seams allowed.
 2. Do not remove release liner from film until just before each piece of film is cut and ready for installation.
 3. Install film with mounting solution and custom cut to the glass with neat, square corners and edges to within 1/8 inch of the window frame.
 4. Remove air bubbles, wrinkles, blisters, and other defects.
- B. After installation, view film from a distance of 10 feet against a bright uniform sky or background. Film shall appear uniform in appearance with no visible streaks, banding, thin spots or pinholes.
1. If installed film does not meet these criteria, remove and replace with new film.

3.4 CLEANING

- A. Remove excess mounting solution at finished seams, perimeter edges, and adjacent surfaces.
- B. Use cleaning methods recommended by glazing film manufacturer.
- C. Replace films that cannot be cleaned.

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END OF SECTION



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SECTION 08 87 53 00 - FRAGMENT RETENTION FILM FOR GLASS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of fragment retention film for glass. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.
2. Samples: For each type of product indicated.
3. Test Reports: Certified test reports including analysis and interpretation of test results. Each report shall identify the manufacturer, the specific product name, the film thickness, the adhesive type and thickness, and the glass type and thickness. Test reports shall clearly identify the methods used and shall include the results recorded.
4. Certificates: On applications where the film will contact the glazing beads or gaskets, a certificate from the Contractor stating that the glazing compounds and gaskets are compatible with the fragment retention film and adhesive.

C. Delivery, Storage, And Handling

1. Deliver, store, and handle in accordance with the manufacturer's recommendations. Glass, including glass in windows or doors, that has the film factory applied shall be stored in a dry location free of dust, water, and other contaminants. Glass with factory applied film shall be delivered, stored, and handled so that the film is not damaged, scratched, or abraded and shall be stored in a manner which permits easy access for inspection and handling. Each roll of film shall have a tamperproof label containing full details of the roll and the batch number.

D. Warranty

1. Provide a 5 year warranty for fragment retention film material. The warranty shall provide for replacement of film if cracking, crazing, peeling, or inadequate adhesion occurs.

1.2 PRODUCTS

- A. Standard Products:** Fragment retention film shall be the standard product of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

- B. Fragment Retention Film:** Fragment retention film shall be polyester, polyethylene terephthalate, or a composite. Fragment retention film shall be optically clear and free of waves, distortions, impurities, and adhesive lines. The film may be a single layer or laminated. Lamination of the film shall only occur at the factory of the fragment retention film manufacturer. The film shall include an abrasion resistant coating on the surface that does not receive the film adhesive. Fragment retention film shall be a minimum thickness of 0.004 inch (0.10 mm), as required to meet Project requirements, and shall be clear **OR** tinted, **OR** reflective, **as directed**. The film shall be supplied with an optically clear weatherable pressure sensitive adhesive. The adhesive shall contain ultraviolet inhibitors to protect the film for its required life and shall limit ultraviolet transmission to not more than 8 percent of the radiation between 300 and 380 nanometers. The adhesive shall not be water activated.

1. Impact Performance: Test fragment retention film for impact in accordance with ANSI Z97.1 or 16 CFR 1201.



2. Tensile Strength: The fragment retention film samples tested shall exhibit a minimum tensile strength at break of 25,000 psi (172.4 MPa) when tested in accordance with ASTM D882, Method A.
3. Peel Strength: The fragment retention film shall exhibit a minimum peel strength of 5.3 pounds/inch (930 N/m) for 0.004 inch (0.10 mm) thick film when tested in accordance with ASTM D3330, Method A.
4. Surface Abrasion: The fragment retention film shall exhibit a change in haze not to exceed 3.2 percent following 100 turns, using 500-gram weights on a CS 10F abrasive wheel when tested in accordance with ASTM D1044.
5. Flame Spread and Smoke Density: The fragment retention film shall exhibit a flame spread index not exceeding 25 and a smoke density index not exceeding 100 when tested in accordance with ASTM E84.

1.3 EXECUTION

- A. Surface Preparation: The glass surface to which the fragment retention film is to be applied shall be cleaned of paint, foreign compounds, smears, and spatters. After the initial cleaning, the surface to receive the film shall be further cleaned in accordance with the film manufacturer's instructions.
- B. Application: Provide fragment retention film on window and door glass where indicated. After surface preparation, apply the fragment retention film in accordance with the manufacturer's recommendations and instructions. Apply film to the interior (room) side of the glass for both single and double glazed sheets, unless otherwise indicated. Multiple applications of film to achieve specified thicknesses will not be allowed. The film shall not be applied if there are visible dust particles in the air, if there is frost on the glazing, or if any room condition such as temperature and humidity do not meet the manufacturer's instructions. After film application, maintain room conditions as required by the manufacturer's instructions to allow for proper curing of the adhesive.
 1. Application to New Glass Before Glazing: Apply fragment retention film so that it extends edge to edge of the glass sheet. Set the film reinforced glass into the frame with glazing compounds or gaskets as specified in Division 08 Section "Glazing". When contact between the glazing compounds and/or gaskets and the film occurs, the Contractor shall ensure compatibility. The Contractor shall be responsible for delivery of the fragment retention film to the appropriate location for application. Coordinate fragment retention film application and curing with the glass supplier and window or door manufacturer prior to glazing installation.
 2. Application to Existing Glass Involving Dismantlement: Remove the existing glazing compound, gaskets, and/or stops as required to expose the existing glass pane. If necessary, remove the glass so that the film can be applied. Apply the film so that it extends edge to edge of the glass sheet. Install existing gaskets and/or stops and replace any removed glazing compounds with new glazing compounds. Scrap removed glazing compounds. Glazing compounds shall be in accordance with GANA Sealant Manual. Glazing methods shall be in accordance with GANA Glazing Manual. When contact between the glazing compounds and/or gaskets and the film occurs, the Contractor shall ensure compatibility. Replace and reinstall any damaged or broken glazing and gaskets in kind.
 3. Application to Existing Glass Without Dismantlement: Apply fragment retention film so that it extends to within 1/16-inch (1.6 mm), with a maximum of 1/8 inch (3 mm), of the edge of the visible glass area.
 4. Application to Existing Glass and Frame Without Dismantlement: Apply fragment retention film past the edge of the visible glass and extend onto the frame. Amount of film overlap, edge connection to the frame, and adhesive for adhering film to frame shall be as recommended by the film manufacturer. When contact between the glazing compounds and/or gaskets and the film occurs, the Contractor shall ensure compatibility.
 5. Splicing: Splices or seams in fragment retention film shall be permitted only when a sheet of glass has a dimension exceeding 58 inches (1.475 m) in both directions. All seams shall be



applied with a minimum overlap of 1/4 inch (6 mm) unless submitted test reports indicate impact performance is not diminished when seam is applied with a different overlap or a gap.

- C. Cleaning: Clean the fragment retention film in accordance with the manufacturer's instructions.

END OF SECTION 08 87 53 00



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SECTION 08 90 00 00 - MPF LOUVERS AND VENTS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. THIS SECTION IS A "PERFORMANCE" SPECIFICATION. The Section describes the design requirements for the Fire Alarm System. The Fire Alarm Contractor will design the system and prepare detailed Fire Alarm Drawings to be used for the installation of the Fire Alarm System.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.08 90 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fixed aluminum wall louvers.
 - 2. Fixed steel wall louvers.
 - 3. Insect screening.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 079200 - Joint Sealants: Perimeter sealant at louver frames.
 - 2. Section 055000 - Metal Fabrications: Security grille at louvers.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM B221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.
 - 2. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, tolerances; head, jamb and sill details; blade configuration, screens, blankout areas required, and frames.
 - 3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

1.4 QUALITY ASSURANCE

- A. Qualifications:



1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. The Arolite Company, Marietta, OH (740) 373-7676..
 2. Airoline.
 3. Construction Specialties, Incorporated, Cranford, NJ (908) 272-5200.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 ALUMINUM LOUVERS

- A. Type: 4 inch deep with blades on 45 degree slope. ASTM B221, extruded shape, prefinished with shop applied flouropolymer polyvinylidene fluoride finish. Coordinate color finish with Architect.
- B. Fabrication: Material thickness of 0.081 inch minimum, integral and lateral rain water stops positioned on blade.
- C. Frame: Channel shape, mechanically fastened corner joints, material thickness of 0.081 inch minimum.

2.3 STEEL LOUVERS

- A. Type: 6 inch deep with blades on 45 degree slope with center baffle and return bend, heavy channel frame, birdscreen with 1/2 inch square mesh for exhaust and 3/4 inch for intake.
- B. Fabrication: 16 gage thick galvanized steel or welded assembly, with factory baked enamel finish as scheduled on Drawings. Coordinate color finish with Architect.
- C. Mounting: Furnish with exterior flat flange for installation.

2.4 INSECT SCREENS

- A. 18 x 16 size aluminum mesh, set in aluminum frame.



- B. Install screen mesh in shaped frame, reinforce corner construction, shop install to louver with fasteners.

2.5 ACCESSORIES

- A. Fasteners and Anchors: Stainless steel type.
- B. Flashings: Of same material as louver frame. Extruded to required shape, single length in one piece per location.
- C. Sealants: Specified in Section 079200.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install louver assembly in accordance with manufacturer's published instructions.
- B. Install louvers level and plumb.
- C. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
- D. Secure louvers in opening framing with concealed fasteners.
- E. Install perimeter sealant in accordance with Section 079200.
- F. Install security grille in accordance with Section 055000.

USPS Mail Processing Facility Specifications issued: 10/1/2013
Last revised: 6/29/2010

END OF SECTION



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SECTION 08 90 00 00 - CSF LOUVERS AND VENTS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.08 90 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fixed aluminum wall louvers.
 - 2. Fixed steel wall louvers.
 - 3. Insect screening.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 089200 - Joint Sealants: Perimeter sealant at louver frames.
 - 2. Section 055000 - Metal Fabrications: Security grille at louvers.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM B221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.
 - 2. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, tolerances; head, jamb and sill details; blade configuration, screens, blankout areas required, and frames.
 - 3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.



- b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. The Arolite Company, Marietta, OH (740) 373-7676..
 2. Airoline.
 3. Construction Specialties, Incorporated, Cranford, NJ (908) 272-5200.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 ALUMINUM LOUVERS

- A. Type: 4 inch deep with blades on 45 degree slope. ASTM B221, extruded shape, prefinished with shop applied flouropolymer polyvinylidene fluoride finish. Coordinate color finish with Architect.
- B. Fabrication: Material thickness of 0.081 inch minimum, integral and lateral rain water stops positioned on blade.
- C. Frame: Channel shape, mechanically fastened corner joints, material thickness of 0.081 inch minimum.

2.3 STEEL LOUVERS

- A. Type: 6 inch deep with blades on 45 degree slope with center baffle and return bend, heavy channel frame, birdscreen with 1/2 inch square mesh for exhaust and 3/4 inch for intake.
- B. Fabrication: 16 gage thick galvanized steel or welded assembly, with factory baked enamel finish as scheduled on Drawings. Coordinate color finish with Architect.



- C. Mounting: Furnish with exterior flat flange for installation.

2.4 INSECT SCREENS

- A. 18 x 16 size aluminum mesh, set in aluminum frame.
- B. Install screen mesh in shaped frame, reinforce corner construction, shop install to louver with fasteners.

2.5 ACCESSORIES

- A. Fasteners and Anchors: Stainless steel type.
- B. Flashings: Of same material as louver frame. Extruded to required shape, single length in one piece per location.
- C. Sealants: Specified in Section 079200.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install louver assembly in accordance with manufacturer's published instructions.
- B. Install louvers level and plumb.
- C. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
- D. Secure louvers in opening framing with concealed fasteners.
- E. Install perimeter sealant in accordance with Section 079200.
- F. Install security grille in accordance with Section 055000.



USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



Task	Specification	Specification Description
08 91 16 00	05 58 16 00	Ornamental Formed Metal
08 91 19 00	05 58 16 00	Ornamental Formed Metal
08 95 13 00	01 22 16 00	No Specification Required
08 95 16 00	01 22 16 00	No Specification Required



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Task	Specification	Specification Description
09 01 30 91	09 31 00 00	Ceramic Tile



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SECTION 09 01 60 00 - PORTLAND CEMENT TERRAZZO FLOORING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for portland cement terrazzo flooring. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Poured-in-place portland cement terrazzo flooring and base.
 - b. Poured-in-place rustic terrazzo flooring.
 - c. Precast terrazzo units.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For marble chips, aggregates, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement that indicates cost for each product having recycled content.
 - b. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
3. Shop Drawings: Include terrazzo installation requirements. Include plans, elevations, sections, component details, and attachments to other work.
4. Samples: For each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected
5. Qualification data.
6. Material certificates.
7. Maintenance data.

D. Quality Assurance

1. Installer Qualifications: An installer who is a contractor member of NTMA.
2. NTMA Standards: Comply with NTMA's "Terrazzo Specifications and Design Guide" and with written recommendations for terrazzo type indicated unless more stringent requirements are specified.
3. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling

1. Deliver materials to Project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number if any.
2. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

F. Project Conditions

1. Environmental Limitations: Maintain temperature above 50 deg F (10 deg C) for 48 hours before and during terrazzo installation.
2. Weather Limitations: Proceed with rustic terrazzo installation only when forecasted weather conditions permit work to be performed according to NTMA's written recommendations and temperatures remain above 45 deg F (7.2 deg C).
3. Field Measurements: Verify actual dimensions of construction contiguous with precast terrazzo by field measurements before fabrication.



4. Control and collect dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.
 - a. Provide dustproof partitions and temporary enclosures to limit dust migration and to isolate areas from noise.

1.2 PRODUCTS

A. Portland Cement Terrazzo

1. Portland Cement Terrazzo Type: Sand cushion **OR** Structural **OR** Bonded **OR** Monolithic **OR** Installed over metal deck, **as directed**.
2. Materials:
 - a. Portland Cement: ASTM C 150, Type 1.
 - 1) Color for Exposed Matrix: As required by mix indicated **OR** White **OR** Gray, **as directed**.
 - b. Water: Potable.
 - c. Sand: ASTM C 33.
 - d. Marble Chips **OR** Aggregates, **as directed**: Complying with NTMA gradation standards for mix indicated and containing no deleterious or foreign matter.
 - 1) Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C 131 and ASTM C 535, **as directed**.
 - 2) 24-Hour Absorption Rate: Less than 0.75 percent.
 - 3) Dust Content: Less than 1.0 percent by weight.
 - e. Matrix Pigments: Pure mineral or synthetic pigments, alkali resistant, durable under exposure to sunlight, and compatible with terrazzo matrix.
 - f. Bonding Agent: Neat portland cement or epoxy or acrylic bonding agents formulated for use with topping indicated.
 - g. Underbed Reinforcement: Galvanized welded-wire reinforcement, 2 by 2 inches (51 by 51 mm) by 0.062-inch- (1.57-mm-) diameter wire, complying with ASTM A 185 and ASTM A 82, except for minimum wire size.
 - h. Isolation Membrane: Polyethylene sheeting, ASTM D 2103, Type 13300, 4 mils (0.1 mm) thick; or unperforated asphalt felt, ASTM D 226, Type I (No. 15).
3. Mixes:
 - a. Underbed (for structural portland cement terrazzo or portland cement terrazzo installed over metal deck): Structural-concrete underbed as specified in Division 03 Section "Cast-in-place Concrete".
 - b. Underbed (for sand-cushion or bonded portland cement terrazzo): Comply with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated for component proportions and mixing.
 - c. Portland Cement Terrazzo (below for NTMA-formulated design mixes): Comply with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated for matrix and marble-chip proportions and mixing.
 - 1) Formulated Mix Color and Pattern: As selected from NTMA standard-terrazzo plates **OR** As selected from NTMA Venetian-terrazzo plates, **as directed**.
 - d. Portland Cement Terrazzo (for custom design mixes): Comply with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated for matrix and marble-chip **OR** aggregate, **as directed**, proportions and mixing.
 - 1) Custom Mix Color and Pattern: Match sample **OR** Match existing, **as directed**.

B. Rustic Terrazzo

1. Rustic Terrazzo Type: Structural **OR** Bonded **OR** Monolithic **OR** Unbonded, **as directed**.
2. Materials:
 - a. Portland Cement: ASTM C 150, Type 1.
 - 1) Color for Exposed Matrix: As required by mix indicated.
 - b. Water: Potable.



- c. Sand: ASTM C 33.
 - d. Marble Chips **OR** Aggregates, **as directed**: As required for mix indicated, sizes complying with NTMA gradation standards, 0.25 percent maximum 24-hour absorption rate, and containing no deleterious or foreign matter.
 - e. Matrix Pigments: Pure mineral or synthetic pigments, alkali resistant, durable under exposure to sunlight and weather, and compatible with matrix binder.
 - f. Air-Entraining Agent (for underbed of structural, bonded, or unbonded rustic terrazzo): Complying with NTMA's written recommendations and recommended by supplier for intended use.
 - g. Underbed Bonding Agent (for bonded rustic terrazzo): Neat portland cement.
 - h. Topping Bonding Agent (for monolithic rustic terrazzo): Neat portland cement, or epoxy or acrylic bonding agents formulated for use with topping indicated.
 - i. Isolation Membrane (for unbonded rustic terrazzo): Polyethylene sheeting, ASTM D 2103, Type 13300, 4 mils (0.1 mm) thick.
3. Mixes:
- a. Underbed (for structural or unbonded rustic terrazzo): Structural-concrete underbed as specified in Division 03 Section "Cast-in-place Concrete".
 - b. Underbed (for bonded rustic terrazzo): Comply with NTMA's "Terrazzo Specifications and Design Guide" for component proportions and mixing.
 - 1) Exterior Applications: Provide air-entraining agent.
 - c. Rustic Terrazzo (for NTMA-formulated design mixes): Comply with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated for matrix and marble-chip proportions and mixing.
 - 1) Formulated Mix Color and Pattern: As selected from NTMA rustic-terrazzo plates.
 - d. Rustic Terrazzo (for custom design mixes): Comply with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated for matrix and marble-chip **OR** aggregate, **as directed**, proportions and mixing.
 - 1) Custom Mix Color and Pattern: Match sample **OR** Match existing, **as directed**.
- C. Strip Materials
- 1. Standard Divider Strips: One-piece, flat-type strips for grouting into sawed joints prepared in concrete slab or underbed.
 - a. Material: As indicated **OR** White-zinc alloy **OR** Brass, **as directed**.
 - b. Depth: As indicated **OR** 3/4 inch (19 mm) **OR** 1-1/4 inches (32 mm) **OR** 2 inches (51 mm), **as directed**.
 - c. Width: As indicated **OR** 0.05 inch (1.27 mm) **OR** 1/8 inch (3.2 mm) **OR** 1/4 inch (6.4 mm), **as directed**.
 - 2. Heavy-Top Divider Strips: One-piece, flat-type strips for grouting into sawed joints prepared in concrete slab or underbed.
 - a. Base-Section Material: As indicated **OR** White-zinc alloy **OR** Galvanized steel, **as directed**.
 - b. Top-Section Material: As indicated **OR** White-zinc alloy **OR** Brass **OR** Plastic, in color selected from manufacturer's full range, **as directed**.
 - c. Depth: As indicated **OR** 3/4 inch (19 mm) **OR** 1-1/4 inches (32 mm) **OR** 2 inches (51 mm), **as directed**.
 - d. Top-Section Width: As indicated **OR** 1/8 inch (3.2 mm) **OR** 1/4 inch (6.4 mm) **OR** 1/2 inch (12.7 mm), **as directed**.
 - 3. Heavy-Top Angle Divider Strips: One-piece, L-type angle strips with anchoring device and in depth required for topping thickness indicated.
 - a. Material: As indicated **OR** White-zinc alloy **OR** Brass **OR** Plastic, in color selected from manufacturer's full range, **as directed**.
 - b. Top-Section Width: As indicated **OR** 1/8 inch (3.2 mm) **OR** 1/4 inch (6.4 mm) **OR** 3/8 inch (9.5 mm) **OR** 1/2 inch (12.7 mm), **as directed**.
 - 4. Control-Joint Strips: Separate, double L-type angles, positioned back to back, that match material, thickness, and color of divider strips and in depth required for topping thickness indicated.



5. Expansion-Joint Strips (for structural portland cement terrazzo or for any type of rustic terrazzo): Brass **OR** Plastic strips in color selected from manufacturer's full range, **as directed**, with removable zip-strip top for installing sealant; in width indicated **OR** minimum 1/2 inch (12.7 mm) wide, **as directed**.
 6. Accessory Strips: Match divider strip width, material, and color unless otherwise indicated. Use the following types of accessory strips as required to provide a complete installation:
 - a. Base-bead strips for exposed top edge of terrazzo base.
 - b. Edge-bead strips for exposed edges of terrazzo.
 - c. Nosings for terrazzo stair treads and landings.
 7. Abrasive Strips (for terrazzo stair treads and landings): Silicon carbide or aluminum oxide, or combination of both, in epoxy-resin binder and set in channel.
 - a. Width: 1/2 inch (12.7 mm).
 - b. Depth: As required by terrazzo thickness.
 - c. Length: 4 inches (100 mm) less than stair width **OR** As indicated, **as directed**.
 - d. Color: As selected from manufacturer's full range.
- D. Miscellaneous Accessories
1. Strip Adhesive: Adhesive recommended by manufacturer for this use.
 - a. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Anchoring Devices:
 - a. Strips: Provide mechanical anchoring devices for strip materials as required for secure attachment to substrate.
 - b. Precast Terrazzo: Provide mechanical anchoring devices as recommended by fabricator for proper anchorage and support of units for conditions of installation and support.
 3. Isolation and Expansion-Joint Material: Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, and nonoutgassing in unruptured state; butyl rubber; rubber; or cork; in width indicated **OR** minimum 1/2 inch (12.7 mm) wide, **as directed**.
 4. Portland Cement Terrazzo Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by cleaner manufacturer for use on terrazzo type indicated.
 5. Rustic Terrazzo Cleaner: Solution of muriatic acid and water for use on terrazzo type indicated.
 6. Sealer: Slip- and stain-resistant, penetrating-type sealer that is chemically neutral with pH factor between 7 and 10; does not affect color or physical properties of terrazzo; is recommended by sealer manufacturer; and complies with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated.
 - a. Rustic Terrazzo: Use solvent acrylic-type sealer.
- E. Precast Terrazzo
1. Precast Terrazzo Base Units: Minimum 3/4-inch- (19-mm-) thick, reinforced portland cement terrazzo units cast in maximum lengths possible, but not less than 36 inches (900 mm).
 - a. Type: As indicated **OR** Coved with minimum 3/4-inch (19-mm) radius **OR** Straight **OR** Splayed, **as directed**.
 - b. Top Edge: Straight, unfinished if top edge is concealed **OR** Beveled with polished top surface **OR** Radius edge with polished top surface, **as directed**.
 - c. Metal Toe Strip (for coved-toe bases): Zinc **OR** Brass, **as directed**.
 - d. Outside Corner Units: With finished returned edges at outside corner.
 - e. Color, Pattern, and Finish: As selected from manufacturer's full range **OR** Match sample **OR** Match adjacent poured-in-place terrazzo flooring, **as directed**.
 2. Precast Terrazzo Units for Stair Treads, Thresholds, Sills, Benches and Planters: Comply with NTMA's written recommendations for fabricating precast terrazzo units in sizes and profiles indicated. Reinforce units as required by unit sizes, profiles, and thicknesses and as recommended by manufacturer.
 - a. Stair Treads: Three-line **OR** Two-line **OR** One-line **OR** Abrasive nosing strip and two-line, **as directed**, abrasive inserts at nosings.



- b. Color, Pattern, and Finish: As selected from manufacturer's full range **OR** Match sample **OR** Match adjacent poured-in-place terrazzo flooring, **as directed**.
 - 3. Precast Terrazzo Finishing (for custom precast terrazzo components):
 - a. Finish exposed-to-view edges or reveals to match face finish.
 - b. Ease exposed edges to 1/8-inch (3-mm) radius.

1.3 EXECUTION

A. Preparation

1. Clean substrates to produce clean, dry, and neutral substrate for terrazzo application.
 - a. Remove substances, including oil, grease, and curing compounds, that might impair bond of terrazzo system.
 - b. Roughen concrete substrates before installing terrazzo system according to NTMA's written recommendations.
2. Protect other work from dust generated by grinding operations. Control dust to prevent air pollution and comply with environmental protection regulations.
 - a. Erect and maintain temporary enclosures and other suitable methods to limit dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

B. Installation, General

1. Comply with NTMA's written recommendations for terrazzo and accessory installation.
2. Installation Tolerance: Limit variation in terrazzo surface from level to 1/4 inch in 10 feet (6 mm in 3 m); noncumulative.
3. Structural Portland Cement **OR** Structural Rustic **OR** Bonded Rustic **OR** Monolithic Rustic **OR** Unbonded Rustic, **as directed**, Terrazzo: Install isolation and expansion material where terrazzo and underbed abut **OR** terrazzo abuts, **as directed**, adjacent construction and directly above substrate expansion joints.
4. Underbed (for structural portland cement terrazzo or portland cement terrazzo installed over metal deck, or for structural or unbonded rustic terrazzo): Install structural-concrete underbed according to requirements specified in Division 03 Section "Cast-in-place Concrete".
5. Underbed (for sand-cushion or bonded portland cement terrazzo or for bonded rustic terrazzo):
 - a. Comply with NTMA's "Terrazzo Specifications and Design Guide" for underbed installation.
 - b. For sand-cushion portland cement terrazzo only:
 - 1) Cover entire surface to receive terrazzo with dusting of sand.
 - 2) Install isolation membrane over sand, overlapping ends and edges a minimum of 3 inches (75 mm).
 - 3) Install welded wire reinforcement, overlapping at edges and ends at least two squares. Stop mesh a minimum of 1 inch (25 mm) short of expansion joints.
 - c. Place underbed and screed to elevation indicated below finished floor elevation.
6. Strip Materials:
 - a. Divider and Control-Joint Strips:
 - 1) Locate divider strips over each edge of steel beams and girders **OR** centered over steel beams and joists **OR** directly over control joints, breaks, and saw cuts in concrete slabs **OR** in locations indicated, **as directed**.
 - 2) Install control-joint strips back to back and directly above concrete-slab control joints **OR** in locations indicated, **as directed**.
 - 3) Install control-joint strips with 1/4-inch (6.4-mm) gap between strips, and install sealant in gap.
 - 4) Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.
 - b. Expansion-Joint Strips (for structural portland cement terrazzo or for any type of rustic terrazzo): Form expansion joints using divider strips and install directly above concrete-slab expansion joints.

- c. Accessory Strips: Install accessory strips as required to provide a complete installation.
 - d. Abrasive Strips: Install with surface of abrasive strip positioned 1/16 inch (1.6 mm) **OR** 1/32 inch (0.8 mm), **as directed**, higher than terrazzo surface.
- 7. Repair: Cut out and replace terrazzo areas that evidence lack of bond with substrate or underbed, including areas that emit a "hollow" sound if tapped. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by the Owner.
- C. Portland Cement Terrazzo Installation
 - 1. Pour in place, cure, and finish portland cement terrazzo according to NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated.
 - 2. Terrazzo Topping Thickness: As indicated.
 - 3. Finishing:
 - a. Seed additional marble chips **OR** aggregates, **as directed**, in matrix to uniformly distribute granular material on surface.
 - b. Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted.
 - c. Fine Grinding: Grind with stones 120 grit or finer until all grout is removed from surface. Repeat rough grinding, grout coat, and fine grinding if large voids exist after initial fine grinding. Produce surface with a minimum of 70 percent aggregate exposure.
- D. Rustic Terrazzo Installation
 - 1. Pour in place, cure, and finish rustic terrazzo according to NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated.
 - 2. Terrazzo Topping Thickness: As indicated.
 - 3. Finishing:
 - a. Seed additional marble chips **OR** aggregates, **as directed**, in matrix to uniformly distribute granular material on surface.
- E. Precast Terrazzo Installation
 - 1. Install precast terrazzo units using method recommended by NTMA and manufacturer unless otherwise indicated.
 - 2. Installation Tolerance: Set units with alignment level and true to dimensions, varying 1/8 inch (3.2 mm) maximum in length, height, or width; noncumulative.
 - 3. Do not install units that are chipped, cracked, discolored, or improperly finished.
 - 4. Seal joints between units with cement grout matching precast terrazzo matrix **OR** joint sealant, **as directed**.
- F. Cleaning And Protection
 - 1. Portland Cement Terrazzo and Precast Terrazzo Cleaning:
 - a. Remove grinding dust from installation and adjacent areas.
 - b. Wash surfaces with cleaner immediately after grouting precast terrazzo units and final cleaning of terrazzo flooring.
 - c. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow to dry thoroughly.
 - 2. Rustic Terrazzo Cleaning: Clean surfaces with 1:10 solution of muriatic acid in water. Legally contain and dispose of runoff from cleaning operations. Rinse surfaces with water and allow to dry thoroughly.
 - 3. Sealing:
 - a. Seal surfaces according to NTMA's written recommendations.
 - b. Apply sealer according to sealer manufacturer's written instructions.
 - 4. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that terrazzo is without damage or deterioration at time of Final Completion.



END OF SECTION 09 01 60 00



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Task	Specification	Specification Description
09 01 60 00	01 22 16 00	No Specification Required



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SECTION 09 22 13 00 - GYPSUM PLASTER

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for gypsum plaster. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Gypsum plasterwork on expanded-metal lath, unit masonry and monolithic concrete.
 - b. Solid-plaster partitions.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
 - b. Product Data for Credit EQ 4.1: For sealants, including printed statement of VOC content.
3. Shop Drawings: Show locations and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other work.

D. Quality Assurance

1. Fire-Resistance Ratings: Where indicated, provide gypsum plaster assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
2. Sound Transmission Characteristics: Where indicated, provide gypsum plaster assemblies identical to those of assemblies tested for STC ratings per ASTM E 90 and classified according to ASTM E 413 by a qualified testing agency.

E. Delivery, Storage, And Handling

1. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

F. Project Conditions

1. Comply with ASTM C 842 requirements or gypsum plaster manufacturer's written recommendations, whichever are more stringent.
2. Room Temperatures: Maintain temperatures at not less than 55 deg F (13 deg C) or greater than 80 deg F (27 deg C) for at least seven days before application of gypsum plaster, continuously during application, and for seven days after plaster has set or until plaster has dried.
3. Avoid conditions that result in gypsum plaster drying out too quickly.
 - a. Distribute heat evenly; prevent concentrated or uneven heat on plaster.
 - b. Maintain relative humidity levels for prevailing ambient temperature that produce normal drying conditions.
 - c. Ventilate building spaces in a manner that prevents drafts of air from contacting surfaces during plaster application and until plaster is dry.

1.2 PRODUCTS

A. Steel Framing For Solid-Plaster Partitions

1. Components, General: Comply with ASTM C 841. For steel sheet components not included in ASTM C 841, comply with ASTM C 645 requirements for metal unless otherwise indicated.
2. Channel Studs: Cold-rolled channels, 3/4 inch (19.1 mm) **OR** 1-1/2 inches (38.1 mm), **as directed**, deep.
3. Runners: L-runners with perforated or plain legs to suit lath attachment requirements, in 0.033-inch (0.84-mm) base-metal thickness where attached to overhead support and in 0.043-inch (1.1-mm) base-metal thickness where attached to floor.

B. Expanded-Metal Lath

1. Expanded-Metal Lath: ASTM C 847, cold-rolled carbon-steel sheet, ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coated.
 - a. Recycled Content: Provide steel products with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
 - b. Paper Backing: Kraft paper factory bonded to back of lath.
 - c. Diamond-Mesh Lath: Flat **OR** Self-furring, **as directed**, 2.5 lb/sq. yd. (1.4 kg/sq. m) **OR** 3.4 lb/sq. yd. (1.8 kg/sq. m), **as directed**.
 - d. Flat Rib Lath: Rib depth of not more than 1/8 inch (3.1 mm), 2.75 lb/sq. yd. (1.5 kg/sq. m) **OR** 3.4 lb/sq. yd. (1.8 kg/sq. m), **as directed**.
 - e. 3/8-Inch (9.5-mm) Rib Lath: 3.4 lb/sq. yd. (1.8 kg/sq. m) **OR** 4 lb/sq. yd. (2.2 kg/sq. m), **as directed**.

C. Accessories

1. General: Comply with ASTM C 841 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.
2. Metal Accessories:
 - a. Cornerite: Fabricated from expanded-metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
 - b. Striplath: Fabricated from expanded-metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
 - c. Cornerbeads: Fabricated from zinc or zinc-coated (galvanized) steel.
 - 1) Small nose cornerbead with expanded flanges; use unless otherwise indicated.
 - 2) Small nose cornerbead with perforated flanges; use on curved corners.
 - 3) Small nose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing unit masonry corners.
 - 4) Bull nose cornerbead, radius 3/4 inch (19.1 mm) minimum, with expanded flanges; use at locations indicated on Drawings.
 - d. Casing Beads: Fabricated from zinc or zinc-coated (galvanized) steel; square-edged style; with expanded flanges.
 - e. Control Joints: Fabricated from zinc or zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
 - f. Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
 - g. Two-Piece Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; formed to produce slip-joint and square-edged reveal that is adjustable from 1/4 to 5/8 inch (6 to 16 mm) wide; with perforated flanges.
3. Plastic Accessories: Fabricated from high-impact PVC.
 - a. Cornerbeads: With perforated flanges.
 - 1) Small nose cornerbead; use unless otherwise indicated.
 - 2) Bull nose cornerbead, radius 3/4 inch (19.1 mm) minimum; use at locations indicated on Drawings.



- b. Casing Beads: With perforated flanges in depth required to suit plaster bases indicated and flange length required to suit applications indicated.
 - 1) Square-edge style; use unless otherwise indicated.
 - 2) Bull-nose style, radius 3/4 inch (19.1 mm) minimum; use at locations indicated on Drawings.
 - c. Control Joints: One-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
 - d. Expansion Joints: Two-piece type, formed to produce slip-joint and square-edged 1/2-inch- (13-mm-) **OR** 1-inch- (25.4-mm-) **OR** 1-1/2-inch- (38.1-mm-), **as directed**, wide reveal; with perforated concealed flanges.
 - 4. Aluminum Trim: Extruded accessories of profiles and dimensions indicated on Drawings.
 - a. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
 - b. Finish: Mill **OR** Chemical-conversion coating, ASTM D 1730, Type B, compatible with field-applied finish coatings specified, **as directed**.
- D. Miscellaneous Materials
 - 1. Water for Mixing and Finishing Plaster: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
 - 2. Bonding Compound: ASTM C 631.
 - 3. Steel Drill Screws: For metal-to-metal fastening, ASTM C 1002 or ASTM C 954, as required by thickness of metal being fastened; with pan head that is suitable for application; in lengths required to achieve penetration through joined materials of no fewer than three exposed threads.
 - 4. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 841.
 - 5. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch (1.21-mm) diameter, unless otherwise indicated.
 - 6. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - a. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of rated assembly.
 - b. Recycled Content: Provide blankets with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
 - 7. Acoustical Sealant: As specified in Division 7 Section "Joint Sealants."
 - a. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Base-Coat Plaster Materials
 - 1. Base-Coat Plasters, General: ASTM C 28/C 28M.
 - 2. Lightweight Gypsum Ready-Mixed Plaster: With mill-mixed perlite aggregate.
 - 3. Gypsum Neat Plaster: For use with job-mixed aggregates.
 - 4. Gypsum Wood-Fibered Plaster:
 - 5. High-Strength Gypsum Neat Plaster: With a minimum, average, dry compressive strength of 2800 psi (19 MPa) per ASTM C 472 for a mix of 100 lb (45 kg) of plaster and 2 cu. ft. (0.06 cu. m) of sand.
 - 6. Aggregates for Base-Coat Plasters: ASTM C 35, sand and perlite.
- F. Finish-Coat Plaster Materials
 - 1. Gypsum Gaging Plaster: ASTM C 28/C 28M.
 - 2. Gypsum Ready-Mixed Finish Plaster: Manufacturer's standard, mill-mixed, gaged, interior finish.
 - 3. High-Strength Gypsum Gaging Plaster: ASTM C 28/C 28M, with a minimum, average, dry compressive strength of 5000 psi (34 MPa) per ASTM C 472 for a neat mix.
 - 4. Gypsum Keene's Cement: ASTM C 61/C 61M.
 - 5. Lime: ASTM C 206, Type S, special finishing hydrated lime.



6. Lime: ASTM C 206, Type N, normal finishing hydrated lime.
7. Aggregates for Float Finishes: ASTM C 35, sand **OR** perlite, **as directed**; graded per ASTM C 842.

G. Plaster Mixes

1. Mixing: Comply with ASTM C 842 and manufacturer's written instructions for applications indicated.

1.3 EXECUTION

A. Examination

1. Examine nonstructural and structural metal framing, substrates, and hollow-metal frames, for compliance with requirements and other conditions affecting performance of the Work.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

1. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

C. Installation, General

1. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.
2. STC-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.
 - a. Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations.
 - b. Comply with ASTM C 919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
3. Sound Attenuation Blankets: Where required, install blankets before installing lath unless blankets are readily installed after lath has been installed on one side.
4. Acoustical Sealant: Where required, seal joints between edges of plasterwork and abutting construction with acoustical sealant.

D. Installing Steel Framing For Solid-Plaster Partitions

1. Install according to ASTM C 841.
2. Framing for Solid-Plaster Partitions: Provide channel stud to support expanded-metal lath construction.
 - a. Space channel studs at 16 inches (406 mm) **OR** 24 inches (610 mm), **as directed**, o.c. unless otherwise indicated.
3. Framing for Studless Solid-Plaster Partition: Provide top and bottom L-track runners to support expanded-metal lath.

E. Installing Expanded-Metal Lath

1. Expanded-Metal Lath: Install according to ASTM C 841.
 - a. Partition Framing and Vertical Furring: Install flat diamond-mesh **OR** flat rib, **as directed**, lath.
 - b. Flat-Ceiling and Horizontal Framing: Install flat diamond-mesh **OR** flat rib, **as directed**, lath.
 - c. Curved-Ceiling Framing: Install flat diamond-mesh lath.
 - d. On Solid Surfaces, Not Otherwise Furred: Install self-furring, diamond-mesh lath.
 - e. Solid-Plaster Partitions: Where supported by channel studs, install flat rib **OR** flat diamond-mesh, **as directed**, lath.



- f. Studless Solid-Plaster Partitions: Install 3/8-inch (9.5-mm) rib lath.

F. Installing Accessories

1. General: Install according to ASTM C 841.
2. Cornerbeads: Install at external corners.
3. Casing Beads: Install at terminations of plasterwork, except where plaster passes behind and is concealed by other work and where metal screeds, bases, or frames act as casing beads.
4. Control Joints: Install control joints at locations indicated on Drawings **OR** with spacing between joints in either direction not exceeding the following and in specific locations approved by Architect for visual effect, **as directed**:
 - a. Partitions: 30 feet (9 m).
 - b. Ceilings: 50 feet (15 m) **OR** 30 feet (9 m), **as directed**.

G. Plaster Application

1. General: Comply with ASTM C 842.
 - a. Do not deviate more than plus or minus 1/8 inch in 10 feet (3.1 mm in 3 m) from a true plane in finished plaster surfaces, as measured by a 10-foot (3-m) straightedge placed on surface.
 - b. Grout hollow-metal frames, bases, and similar work occurring in plastered areas, with base-coat plaster material, before lathing where necessary. Except where full grouting is indicated or required for fire-resistance rating, grout at least 6 inches (152 mm) at each jamb anchor.
 - c. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
 - d. Provide plaster surfaces that are ready to receive field-applied finishes indicated.
2. Bonding Compound: Apply on unit masonry and concrete plaster bases.
3. Base Coats:
 - a. Base Coats over Expanded-Metal Lath: High-strength gypsum **OR** Gypsum neat, **as directed**, plaster with job-mixed sand for scratch and brown coats.
 - b. Base Coats over Expanded-Metal Lath:
 - 1) Scratch Coat: Gypsum wood-fibered plaster; neat or with job-mixed sand.
 - 2) Brown Coat: Gypsum wood-fibered plaster with job-mixed sand **OR** neat plaster with job-mixed sand **OR** lightweight ready-mixed plaster **OR** neat plaster with job-mixed perlite, **as directed**.
 - c. Base Coats over Unit Masonry: Gypsum wood-fibered plaster with job-mixed sand **OR** neat plaster with job-mixed sand **OR** lightweight ready-mixed plaster, **as directed**.
 - d. Base-Coat Mix over Monolithic Concrete: Gypsum neat plaster with job-mixed sand.
4. Finish Coats:
 - a. Finish-Coat Mix for Smooth-Troweled Finishes: Gypsum gaging plaster **OR** Gypsum ready-mixed finish plaster **OR** High-strength gypsum gaging plaster **OR** Gypsum Keene's cement, **as directed**.
 - b. Finish-Coat Mix for Float Finishes: Gypsum gaging plaster **OR** Gypsum Keene's cement, **as directed**.
 - c. Finish-Coat Mix for Sprayed Finishes: Gypsum ready-mixed finish plaster.
 - d. Finish-Coat Mix for Textured Finishes: Gypsum ready-mixed finish plaster.
5. Plaster Finishes:
 - a. Provide troweled finish unless otherwise indicated **OR** where indicated, **as directed**.
 - b. Provide float finish unless otherwise indicated **OR** where indicated, **as directed**.
 - c. Provide sprayed finish unless otherwise indicated **OR** where indicated, **as directed**.
 - 1) Sprayed Finish: Match sample.
 - d. Provide textured finish where indicated.
 - 1) Textured Finish: Match sample.
6. Concealed Plaster:



- a. Where plaster application will be concealed behind built-in cabinets, similar furnishings, and equipment, apply finish coat.
- b. Where plaster application will be concealed above suspended ceilings and in similar locations, finish coat may be omitted.
- c. Where plaster application will be used as a base for adhesive application of tile and similar finishes, finish coat may be omitted.

H. Plaster Repairs

- 1. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

I. Cleaning And Protection

- 1. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 09 22 13 00



SECTION 09 22 13 00a - GYPSUM VENEER PLASTER

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for gypsum veneer plastering. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Gypsum veneer plaster and gypsum base for veneer plaster.
 - b. Gypsum veneer plaster over cementitious backer units.
 - c. Gypsum veneer plaster over masonry surfaces.
 - d. Gypsum veneer plaster over monolithic concrete surfaces.

C. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Show locations, fabrication, and installation of control joints, and reveals and trim; include plans, elevations, sections, details of components, and attachments to other work.
3. Samples: For the following products:
 - a. Trim Accessories: Full-size Sample in 12-inch (300-mm) length for each trim accessory.
 - b. Textured Finishes: Manufacturer's standard size for each textured finish and on rigid backing.
4. LEED Submittals:
 - a. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
 - b. Product Data for Credit MR 4.1 and MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.

D. Quality Assurance

1. Source Limitations: Obtain gypsum veneer plaster products, including gypsum base for veneer plaster, **OR** cementitious base units, **as directed**, joint reinforcing tape, and embedding material, from a single manufacturer.
2. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by a testing and inspecting agency.
3. STC-Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by a testing and inspecting agency.

E. Delivery, Storage, And Handling

1. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier.
2. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.
3. Stack panels flat on leveled supports off floor or slab to prevent sagging.

F. Project Conditions

1. Environmental Limitations: Comply with ASTM C 843 requirements or gypsum veneer plaster manufacturer's written recommendations, whichever are more stringent.



2. Room Temperatures: Maintain not less than 55 deg F (13 deg C) or more than 80 deg F (27 deg C) for 7 days before application of gypsum base and gypsum veneer plaster, continuously during application, and after application until veneer plaster is dry.
3. Avoid conditions that result in gypsum veneer plaster drying too rapidly.
 - a. Distribute heat evenly; prevent concentrated or uneven heat on veneer plaster.
 - b. Maintain relative humidity levels, for prevailing ambient temperature, that produce normal drying conditions.
 - c. Ventilate building spaces in a manner that prevents drafts of air from contacting surfaces during veneer plaster application until it is dry.
4. Do not install panels that are wet, moisture damaged, or mold damaged.
 - a. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - b. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

1.2 PRODUCTS

A. Gypsum Veneer Plaster Materials

1. One-Component Gypsum Veneer Plaster: ASTM C 587, formulated for application directly over substrate without use of separate base-coat material.
2. High-Strength, One-Component Gypsum Veneer Plaster: ASTM C 587, ready-mixed, smooth, finish-coat veneer plaster containing mill-mixed, fine silica sand; with a compressive strength of 3000 psi (20 MPa) when tested according to ASTM C 472; and formulated for application directly over substrate without use of separate base-coat material.
3. Two-Component Gypsum Veneer Plaster: ASTM C 587, with separate formulations; one for base-coat and one for finish-coat application over substrates.
4. High-Strength, Two-Component Gypsum Veneer Plaster: ASTM C 587, ready-mixed, base-coat plaster and smooth finish-coat veneer plaster containing mill-mixed, fine silica sand; with a compressive strength of 3000 psi (20 MPa) when tested according to ASTM C 472.
5. Radiant-Heat, Two-Component Gypsum Veneer Plaster: ASTM C 587, and approved in writing by gypsum veneer plaster manufacturer for application with embedded electric heating cables.
 - a. Provide ready-mixed **OR** job-aggregated, **as directed**, components, as standard for manufacturer, to comply with manufacturer's written recommendations.
 - b. Aggregate: For job-aggregated base coat and texture finish coat, provide white silica sand passing a No. 30 (0.6-mm) sieve.

B. Panel Products

1. Recycled Content: Provide gypsum panel products with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
2. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
3. Gypsum Base for Veneer Plaster: ASTM C 588/C 588M.
 - a. Regular Type: In thickness indicated **OR** 1/2 inch (13 mm) thick, unless otherwise indicated, **as directed**.
 - b. Type X: In thickness indicated **OR** 5/8 inch (16 mm) thick, **as directed**.
 - c. Foil-Backed, Regular-Type Core: In thickness indicated **OR** 1/2 inch (13 mm) thick, unless otherwise indicated, **as directed**.
 - d. Type C: In thickness indicated **OR** 5/8 inch (16 mm) thick **OR** 1/2 inch (13 mm) thick, **as directed**.
 - e. Abuse-Resistant Base: With specially reinforced core for greater resistance to surface indentation, 5/8-inch (16-mm) thick, Type X core **OR** 1/2-inch (13-mm) thick, regular-type core, **as directed**.



- f. High-Impact Base: With Type X core, plastic film laminated to back side for greater resistance to through-penetration (impact resistance), and in thickness indicated **OR** 5/8 inch (16 mm) thick, **as directed**.
 - 1) Plastic-Film Thickness: 0.010 inch (0.254 mm) **OR** 0.020 inch (0.508 mm) **OR** 0.030 inch (0.762 mm) **OR** 0.081 inch (2.057 mm), **as directed**.
 - g. Moisture- and Mold-Resistant Base: With moisture- and mold-resistant core, glass-mat facing on both sides of panel, and in thickness indicated **OR** 5/8-inch (16-mm) thick, Type X core **OR** 1/2-inch (13-mm) thick, regular-type core, **as directed**.
 - 1) Mold Resistance: ASTM D 3273; no mold growth after four weeks' exposure.
 4. Backing Panels for Multilayer Applications: ASTM C 588/C 588M gypsum base or ASTM C 36/C 36M gypsum board, as recommended by gypsum veneer plaster manufacturer, for application method and thicknesses indicated.
 - a. Core: Matching face layer, unless otherwise indicated.
 - b. Thickness: Matching face layer, unless otherwise indicated.
 5. Cementitious Backer Units: ANSI A118.9, in thickness indicated **OR** 1/2 inch (13 mm) thick, **as directed**.
- C. Trim Accessories
 1. Standard Trim: ASTM C 1047, provided or approved by manufacturer for use in gypsum veneer plaster applications indicated.
 - a. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet **OR** Galvanized or aluminum-coated steel sheet or rolled zinc **OR** Plastic **OR** Paper-faced galvanized steel sheet, **as directed**.
 - b. Shapes:
 - 1) Cornerbead.
 - 2) Bullnose bead.
 - 3) LC-Bead: J-shaped; exposed long flange receives joint compound.
 - 4) L-Bead: L-shaped; exposed long flange receives joint compound.
 - 5) U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - 6) Curved-Edge Cornerbead: With notched or flexible flanges.
 - 7) Control joints.
 2. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
 - a. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
 - b. Finish: Manufacturer's standard Architectural Class II, Clear Anodic Finish AA-M12C22A31, complying with AAMA 611 **OR** chemical conversion coat finish **OR** prime paint finish, **as directed**.
- D. Joint Reinforcing Materials
 1. General: Comply with joint strength requirements in ASTM C 587 and with gypsum veneer plaster manufacturer's written recommendations for each application indicated.
 2. Joint Tape:
 - a. Gypsum Base for Veneer Plaster: As recommended by gypsum veneer plaster manufacturer for applications indicated **OR** Paper **OR** Open-mesh, glass fiber, **as directed**.
 - b. Cementitious Backer Units: As recommended by cementitious backer unit manufacturer.
 3. Embedding Material for Joint Tape:
 - a. Gypsum Base for Veneer Plaster: As recommended by gypsum veneer plaster manufacturer for use with joint-tape material and gypsum veneer plaster applications indicated.
 - b. Cementitious Backer Units: As recommended by cementitious backer unit manufacturer for applications indicated.
- E. Auxiliary Materials
 1. General: Provide auxiliary materials that comply with referenced product standards and manufacturer's written recommendations.

2. Bonding Agent: ASTM C 631, polyvinyl acetate.
3. Laminating Adhesive: Adhesive or joint compound recommended by manufacturer for directly adhering gypsum base face-layer panels to backing-layer panels in multilayer construction.
 - a. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - a. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
5. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
6. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing), produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - a. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 - b. Recycled Content: Provide blankets with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
7. Acoustical Sealant: As specified in Division 07 Section "Thermal Insulation".
 - a. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
8. Patching Mortar: Dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

F. Gypsum Veneer Plaster Mixes

1. Mechanically mix gypsum veneer plaster materials to comply with ASTM C 843 and with gypsum veneer plaster manufacturer's written recommendations.

1.3 EXECUTION

A. Preparation

1. Monolithic Concrete Substrates: Prepare according to gypsum veneer plaster manufacturer's written recommendations and as follows:
 - a. Clean surfaces to remove dust, loose particles, grease, oil, incompatible curing compounds, form-release agents, and other foreign matter and deposits that could impair bond with gypsum veneer plaster.
 - b. Remove ridges and protrusions greater than 1/8 inch (3 mm) and fill depressions greater than 1/4 inch (6 mm) with patching mortar. Allow to set and dry.
 - c. Apply bonding agent on dry and cured concrete substrates.
2. Masonry Substrates: Prepare according to gypsum veneer plaster manufacturer's written recommendations and as follows:
 - a. Clean surfaces to remove dirt, grease, oil, and other foreign matter and deposits that could impair bond with gypsum veneer plaster.
 - b. Apply bonding agent on dry masonry substrates.

B. Installing Panels, General

1. Gypsum Base for Veneer Plaster: Apply according to ASTM C 844 unless manufacturer's written recommendations are more stringent.
 - a. Do not allow gypsum base to degrade from exposure to sunlight as evidenced by fading of paper facing.
 - b. Erection Tolerance: No more than 1/16-inch (1.6-mm) offsets between planes of gypsum base panels, and 1/8 inch in 8 feet (3 mm in 2.4 m) noncumulative, for level, plumb, warp, and bow.



2. Install sound attenuation blankets before installing gypsum base for veneer plaster unless blankets are readily installed after panels have been installed on one side.
3. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
4. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.6 mm) of open space between panels. Do not force into place.
5. Locate edge and end joints over supports except in ceiling applications where intermediate supports or back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints, other than control joints, at corners of framed openings.
6. Attach panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
7. Attach panels to framing provided at openings and cutouts.
8. Form control joints with space between edges of adjoining panels.
9. Cover both sides of steel stud partition framing with panels in concealed spaces, including above ceilings, except in internally braced chases.
 - a. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.74 sq. m) in area.
 - b. Fit panels around ducts, pipes, and conduits.
 - c. Where partitions intersect open concrete coffer, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut panels to fit profile formed by coffer, joists, and other structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints; seal joints with acoustical sealant.
10. Wood Framing: Install panels over wood framing, with "floating" internal corner construction. Do not attach panels across the flat grain of wide-dimension lumber, including floor joists and headers. "Float" panels over these members or provide control joints to counteract wood shrinkage.
11. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
12. Fastener Spacing: Comply with ASTM C 844, manufacturer's written recommendations, and fire-resistance-rating requirements.
 - a. Space screws a maximum of 12 inches (305 mm) o.c. along framing members for wall or ceiling application.
 - b. Space fasteners in cementitious backer units a maximum of 8 inches (200 mm) o.c. along framing members for wall applications and 6 inches (150 mm) o.c. along framing members for ceiling applications.

C. Installing Panels

1. Install gypsum base panels for veneer plaster in the following locations:
 - a. Regular Type: As indicated on Drawings **OR** Vertical surfaces, unless otherwise indicated, **as directed**.
 - b. Ceiling Type: As indicated on Drawings **OR** Ceiling surfaces, **as directed**.
 - c. Type X: As indicated on Drawings **OR** Where required for fire-resistance-rated assembly **OR** Vertical surfaces, unless otherwise indicated, **as directed**.
 - d. Type C: As indicated on Drawings **OR** Where required for specific fire-resistance-rated assembly indicated, **as directed**.
 - e. Foil-Backed, Regular-Type Core: As indicated on Drawings **OR as directed**.
 - f. Abuse-Resistant Base: As indicated on Drawings **OR as directed**.
 - g. High-Impact Base: As indicated on Drawings **OR as directed**.
 - h. Moisture- and Mold-Resistant Base: As indicated on Drawings **OR as directed**.
2. Single-Layer Application:

- a. On ceilings, apply gypsum base panels before wall panels, to the greatest extent possible and at right angles to framing, unless otherwise indicated.
- b. On walls, apply gypsum base panels vertically and parallel **OR** horizontally and perpendicular, **as directed**, to framing, unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - 1) Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - 2) At stairwells and other walls higher than 30 feet (9.0 m), install gypsum base panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
- c. On Z-furring, apply gypsum base panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
- 3. Multilayer Application on Ceilings: Apply backing panels for ceilings before applying backing panels for partitions; apply gypsum-base face layers in same sequence. Apply backing panels at right angles to framing members and offset gypsum-base face-layer joints a minimum of 16 inches (400 mm) from parallel backing panel joints, unless otherwise required by fire-resistance-rated assembly.
- 4. Multilayer Application on Partitions: Apply backing panels indicated and gypsum-base face layers vertically (parallel to framing) with joints of backing panels located over stud or furring members and gypsum-base face-layer joints offset at least one stud or furring member from backing-panel joints, unless otherwise required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 - a. Z-Furring: Apply backing panels vertically (parallel to framing) and gypsum-base face layer either vertically or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of backing panels over furring members.
- 5. Single-Layer Fastening Methods: Apply gypsum base panels to supports with steel drill screws.
- 6. Multilayer Fastening Methods: Fasten backing panels and gypsum-base face layers separately to supports with screws **OR** with screws; fasten gypsum-base face layers with adhesive and supplementary fasteners, **as directed**.
- 7. Curved Partitions: Comply with gypsum base manufacturer's written installation recommendations.
- 8. Cementitious Backer Units: Install according to ANSI A108.11.
 - a. Where cementitious backer units abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

D. Installing Trim Accessories

- 1. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- 2. Control Joints: Install at locations indicated on Drawings **OR** according to ASTM C 844 and in specific locations approved by the Owner, **as directed**.
- 3. Trim: Install in the following locations:
 - a. Cornerbead: Use at outside corners, unless otherwise indicated.
 - b. Bullnose Bead: Use at outside corners **OR** where indicated, **as directed**.
 - c. LC-Bead: Use at exposed panel edges.
 - d. L-Bead: Use where indicated.
 - e. U-Bead: Use at exposed panel edges **OR** where indicated, **as directed**.
 - f. Curved-Edge Cornerbead: Use at curved openings.
- 4. Aluminum Trim:
 - a. Install aluminum trim according to manufacturer's written recommendations.
 - b. Apply and embed joint tape over flanges of aluminum trim accessories if recommended by trim manufacturer.

E. Installing Joint Reinforcement



1. Gypsum Base for Veneer Plaster: Reinforce interior angles and flat joints with joint tape and embedding material to comply with ASTM C 843 and with gypsum veneer plaster manufacturer's written recommendations.
 2. Abuse-Resistant Base: Reinforce joints between abuse-resistant panels with joint tape and embedding material according to panel manufacturer's written recommendations.
 3. Impact-Resistant Base: Reinforce joints between impact-resistant panels with joint tape and embedding material according to panel manufacturer's written recommendations.
 4. Moisture- and Mold-Resistant Base: Reinforce joints between moisture- and mold-resistant panels with joint tape and embedding material according to panel manufacturer's written recommendations.
 5. Cementitious Backer Units: Reinforce joints between cementitious backer units with joint tape and embedding material according to unit manufacturer's written recommendations.
- F. Gypsum Veneer Plastering
1. Bonding Agent: Apply bonding agent on dry monolithic concrete **OR** masonry **OR** abuse-resistant base panels **OR** cementitious backer units, **as directed**, according to gypsum veneer plaster manufacturer's written recommendations.
 2. Gypsum Veneer Plaster Application: Comply with ASTM C 843 and with veneer plaster manufacturer's written recommendations.
 - a. One-Component Gypsum Veneer Plaster: Trowel apply base coat over substrate to uniform thickness of 1/16 to 3/32 inch (1.6 to 2.4 mm). Fill all voids and imperfections. Allow plaster to set, then scratch and immediately double back with gypsum veneer plaster to uniform total thickness of 3/16 inch (4.8 mm).
 - b. Two-Component Gypsum Veneer Plaster:
 - 1) Base Coat: Trowel apply base coat over substrate to uniform thickness of 1/16 to 3/32 inch (1.6 to 2.4 mm). Fill all voids and imperfections.
 - 2) Finish Coat: Trowel apply finish-coat plaster over base-coat plaster to uniform thickness of 1/16 to 3/32 inch (1.6 to 2.4 mm).
 - c. Where gypsum veneer plaster abuts only metal door frames, windows, and other units, groove finish coat to eliminate spalling.
 - d. Do not apply veneer plaster to gypsum base if paper facing has degraded from exposure to sunlight. Before applying veneer plaster, use remedial methods to restore bonding capability to degraded paper facing according to manufacturer's written recommendations and as approved by the Owner.
 3. Radiant-Heat, Two-Component Gypsum Veneer Plaster Ceilings: Comply with ASTM C 843 and with radiant-heat veneer plaster manufacturer's written recommendations.
 - a. Base Coat: Apply plaster base coat to sufficiently cover electric heating cables. Trowel plaster parallel in direction of cables to uniform thickness of 3/16 inch (4.8 mm). Completely cover cables.
 - b. Finish Coat: After base coat has developed sufficient bond, apply finish coat. Trowel plaster to uniform thickness of 1/16 to 3/32 inch (1.6 to 2.4 mm).
 4. Concealed Surfaces: Do not omit gypsum veneer plaster behind cabinets, furniture, furnishings, and similar removable items. Omit veneer plaster in the following areas where it will be concealed from view in the completed Work unless otherwise indicated or required to maintain fire-resistance and STC ratings:
 - a. Above suspended ceilings.
 - b. Behind wood paneling.
 5. Gypsum Veneer Plaster Finish: Smooth-troweled finish, unless otherwise indicated **OR** Textured finish matching the Owner's sample, **as directed**.
- G. Protection
1. Protect installed gypsum veneer plaster from damage from weather, condensation, construction, and other causes during remainder of the construction period.
 2. Remove and replace gypsum veneer plaster and gypsum base panels that are wet, moisture damaged, or mold damaged.



- a. Indications that gypsum base panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
- b. Indications that gypsum base panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 22 13 00a



SECTION 09 22 13 00b - PORTLAND CEMENT PLASTER

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for portland cement plaster. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Interior portland cement plasterwork on metal lath, unit masonry and monolithic concrete.
 - b. Exterior portland cement plasterwork (stucco) on metal lath, unit masonry and monolithic concrete.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
 - b. Product Data for Credit EQ 4.1: For sealants, including printed statement of VOC content.
3. Shop Drawings: Show locations and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other work.
4. Samples: For each type of factory-prepared, colored or textured finish coat indicated; 12 by 12 inches (305 by 305 mm), and prepared on rigid backing.

D. Quality Assurance

1. Fire-Resistance Ratings: Where indicated, provide portland cement plaster assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
2. Sound-Transmission Characteristics: Where indicated, provide portland cement plaster assemblies identical to those of assemblies tested for STC ratings per ASTM E 90 and classified according to ASTM E 413 by a qualified testing agency.
3. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling

1. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

F. Project Conditions

1. Comply with ASTM C 926 requirements.
2. Interior Plasterwork: Maintain room temperatures at greater than 40 deg F (4.4 deg C) for at least 48 hours before plaster application, and continuously during and after application.
 - a. Avoid conditions that result in plaster drying out during curing period. Distribute heat evenly; prevent concentrated or uneven heat on plaster.
 - b. Ventilate building spaces as required to remove water in excess of that required for hydrating plaster in a manner that prevents drafts of air from contacting surfaces during plaster application and until plaster is dry.
3. Exterior Plasterwork:



- a. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
- b. Apply plaster when ambient temperature is greater than 40 deg F (4.4 deg C).
- c. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.
- 4. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

1.2 PRODUCTS

A. Metal Lath

- 1. Expanded-Metal Lath: ASTM C 847 with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
 - a. Recycled Content: Provide steel products with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
 - b. Diamond-Mesh Lath: Flat **OR** Self-furring, **as directed**, 2.5 lb/sq. yd. (1.4 kg/sq. m) **OR** 3.4 lb/sq. yd. (1.8 kg/sq. m), **as directed**.
 - c. Flat Rib Lath: Rib depth of not more than 1/8 inch (3.1 mm), 2.75 lb/sq. yd. (1.5 kg/sq. m) **OR** 3.4 lb/sq. yd. (1.8 kg/sq. m), **as directed**.
 - d. 3/8-Inch (9.5-mm) Rib Lath: 3.4 lb/sq. yd. (1.8 kg/sq. m) **OR** 4 lb/sq. yd. (2.2 kg/sq. m), **as directed**.
- 2. Wire-Fabric Lath:
 - a. Welded-Wire Lath: ASTM C 933; self-furring, 1.4 lb/sq. yd. (0.8 kg/sq. m) **OR** 1.95 lb/sq. yd. (1.1 kg/sq. m), **as directed**.
 - b. Woven-Wire Lath: ASTM C 1032; self-furring, with stiffener wire backing, 1.1 lb/sq. yd. (0.6 kg/sq. m) **OR** 1.4 lb/sq. yd. (0.8 kg/sq. m), **as directed**.
- 3. Paper Backing: FS UU-B-790, Type I, Grade D, Style 2 vapor-permeable paper **OR** Grade B, Style 1a vapor-retardant paper, **as directed**.
 - a. Provide paper-backed lath unless otherwise indicated **OR** at exterior locations **OR** in locations indicated on Drawings, **as directed**.

B. Accessories

- 1. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.
- 2. Metal Accessories:
 - a. Foundation Weep Screed: Fabricated from hot-dip galvanized-steel sheet, ASTM A 653/A 653M, G60 (Z180) zinc coating.
 - b. Cornerite: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
 - c. External-Corner Reinforcement: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
 - d. Cornerbeads: Fabricated from zinc or zinc-coated (galvanized) steel.
 - 1) Small nose cornerbead with expanded flanges; use unless otherwise indicated.
 - 2) Small nose cornerbead with perforated flanges; use on curved corners.
 - 3) Small nose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing masonry corners.
 - 4) Bull nose cornerbead, radius 3/4 inch (19.1 mm) minimum, with expanded flanges; use at locations indicated on Drawings.
 - e. Casing Beads: Fabricated from zinc or zinc-coated (galvanized) steel; square-edged style; with expanded flanges.



- f. Control Joints: Fabricated from zinc or zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
 - g. Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
 - h. Two-Piece Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; formed to produce slip-joint and square-edged reveal that is adjustable from 1/4 to 5/8 inch (6.34 to 16 mm) wide; with perforated flanges.
 - 3. Plastic Accessories: Fabricated from high-impact PVC.
 - a. Cornerbeads: With perforated flanges.
 - 1) Small nose cornerbead; use unless otherwise indicated.
 - 2) Bull nose cornerbead, radius 3/4 inch (19.1 mm) minimum; use at locations indicated on Drawings.
 - b. Casing Beads: With perforated flanges in depth required to suit plaster bases indicated and flange length required to suit applications indicated.
 - 1) Square-edge style; use unless otherwise indicated.
 - 2) Bull-nose style, radius 3/4 inch (19.1 mm) minimum; use at locations indicated on Drawings.
 - c. Control Joints: One-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
 - d. Expansion Joints: Two-piece type, formed to produce slip-joint and square-edged 1/2-inch- (13-mm-) **OR** 1-inch- (25-mm-) **OR** 1-1/2-inch- (38-mm-), **as directed**, wide reveal; with perforated concealed flanges.
- C. Miscellaneous Materials
 - 1. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
 - 2. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch (13 mm) long, free of contaminants, manufactured for use in portland cement plaster.
 - 3. Bonding Compound: ASTM C 932.
 - 4. Steel Drill Screws: For metal-to-metal fastening, ASTM C 1002 or ASTM C 954, as required by thickness of metal being fastened; with pan head that is suitable for application; in lengths required to achieve penetration through joined materials of no fewer than three exposed threads.
 - 5. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063.
 - 6. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch (1.21-mm) diameter, unless otherwise indicated.
 - 7. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - a. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 - b. Recycled Content: Provide blankets with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
 - 8. Acoustical Sealant: As specified in Division 7 Section "Joint Sealants".
 - a. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Plaster Materials
 - 1. Portland Cement: ASTM C 150, Type I **OR** Type II, **as directed**.
 - a. Color for Finish Coats: White **OR** Gray, **as directed**.
 - 2. Masonry Cement: ASTM C 91, Type N.
 - a. Color for Finish Coats: White **OR** Gray, **as directed**.
 - 3. Plastic Cement: ASTM C 1328.
 - 4. Colorants for Job-Mixed Finish Coats: Colorfast mineral pigments that produce finish plaster color to match sample.

5. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.
6. Sand Aggregate: ASTM C 897.
 - a. Color for Job-Mixed Finish Coats: White **OR** In color matching sample, **as directed**.
7. Perlite Aggregate: ASTM C 35.
8. Exposed Aggregates for Finish Coats: For marblecrete finish, clean, sound, crushed marble matching color and size gradation of sample.
9. Ready-Mixed Finish-Coat Plaster: Mill-mixed portland cement, aggregates, coloring agents, and proprietary ingredients.
 - a. Color: As selected from manufacturer's full range.
10. Acrylic-Based Finish Coatings: Factory-mixed acrylic-emulsion coating systems, formulated with colorfast mineral pigments and fine aggregates; for use over portland cement plaster base coats. Include manufacturer's recommended primers and sealing topcoats for acrylic-based finishes.
 - a. Color: As selected from manufacturer's full range.

E. Plaster Mixes

1. General: Comply with ASTM C 926 for applications indicated.
 - a. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. (0.6 kg of fiber/cu. m) of cementitious materials.
2. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork as follows:
 - a. Portland Cement Mixes:
 - 1) Scratch Coat: For cementitious material, mix 1 part portland cement and 0 to 3/4 **OR** 3/4 to 1-1/2, **as directed**, parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
 - 2) Brown Coat: For cementitious material, mix 1 part portland cement and 0 to 3/4 **OR** 3/4 to 1-1/2, **as directed**, parts lime. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.
 - b. Masonry Cement Mixes:
 - 1) Scratch Coat: 1 part masonry cement and 2-1/2 to 4 parts aggregate.
 - 2) Brown Coat: 1 part masonry cement and 3 to 5 parts aggregate, but not less than volume of aggregate used in scratch coat.
 - c. Portland and Masonry Cement Mixes:
 - 1) Scratch Coat: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
 - 2) Brown Coat: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.
 - d. Plastic Cement Mixes:
 - 1) Scratch Coat: 1 part plastic cement and 2-1/2 to 4 parts aggregate.
 - 2) Brown Coat: 1 part plastic cement and 3 to 5 parts aggregate, but not less than volume of aggregate used in scratch coat.
 - e. Portland and Plastic Cement Mixes:
 - 1) Scratch Coat: For cementitious material, mix 1 part plastic cement and 1 part portland cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
 - 2) Brown Coat: For cementitious material, mix 1 part plastic cement and 1 part portland cement. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.
3. Base-Coat Mixes: Single base coats for two-coat plasterwork as follows:
 - a. Portland Cement Mix: For cementitious material, mix 1 part portland cement and 0 to 3/4 part lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
 - b. Portland and Masonry Cement Mix: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
 - c. Plastic Cement Mix: Use 1 part plastic cement and 2-1/2 to 4 parts aggregate.



4. Base-Coat Mixes: Single base coats for two-coat plasterwork as follows:
 - a. Portland Cement Mix: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
 - b. Masonry Cement Mix: Use 1 part masonry cement and 2-1/2 to 4 parts aggregate.
 - c. Plastic Cement Mix: Use 1 part plastic cement and 2-1/2 to 4 parts aggregate.
5. Job-Mixed Finish-Coat Mixes:
 - a. Portland Cement Mix: For cementitious materials, mix 1 part portland cement and 3/4 to 1-1/2 **OR** 1-1/2 to 2, **as directed**, parts lime. Use 1-1/2 to 3 parts aggregate per part of cementitious material.
 - b. Masonry Cement Mix: 1 part masonry cement and 1-1/2 to 3 parts aggregate.
 - c. Portland and Masonry Cement Mix: For cementitious materials, mix 1 part portland cement and 1 part masonry cement. Use 1-1/2 to 3 parts aggregate per part of cementitious material.
 - d. Plastic Cement Mix: 1 part plastic cement and 1-1/2 to 3 parts aggregate.
6. Factory-Prepared Finish-Coat Mixes: For ready-mixed finish-coat plasters or acrylic-based finish coatings, comply with manufacturer's written instructions.

1.3 EXECUTION

- A. Examination
 1. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
 2. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Preparation
 1. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.
 2. Prepare solid substrates for plaster that are smooth or that do not have the suction capability required to bond with plaster according to ASTM C 926.
- C. Installation, General
 1. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.
 2. Sound Attenuation Blankets: Where required, install blankets before installing lath unless blankets are readily installed after lath has been installed on one side.
 3. Acoustical Sealant: Where required, seal joints between edges of plasterwork and abutting construction with acoustical sealant.
- D. Installing Metal Lath
 1. Expanded-Metal Lath: Install according to ASTM C 1063.
 - a. Partition Framing and Vertical Furring: Install flat diamond-mesh **OR** flat rib **OR** welded-wire **OR** woven-wire, **as directed**, lath.
 - b. Flat-Ceiling and Horizontal Framing: Install flat diamond-mesh **OR** flat rib **OR** 3/8-inch (9.5-mm) rib lath **OR** welded-wire **OR** woven-wire, **as directed**, lath.
 - c. Curved-Ceiling Framing: Install flat diamond-mesh **OR** welded-wire **OR** flat woven-wire, **as directed**, lath.
 - d. On Solid Surfaces, Not Otherwise Furred: Install self-furring, diamond-mesh **OR** welded-wire **OR** woven-wire, **as directed**, lath.
- E. Installing Accessories
 1. Install according to ASTM C 1063 and at locations indicated on Drawings.
 2. Reinforcement for External Corners:
 - a. Install lath-type, external-corner reinforcement at exterior locations.
 - b. Install cornerbead at interior and exterior, **as directed**, locations.



3. Control Joints: Install control joints at locations indicated on Drawings **OR** in specific locations approved for visual effect as follows, **as directed**:
 - a. As required to delineate plasterwork into areas (panels) of the following maximum sizes:
 - 1) Vertical Surfaces: 144 sq. ft. (13.4 sq. m).
 - 2) Horizontal and other Nonvertical Surfaces: 100 sq. ft. (9.3 sq. m).
 - b. At distances between control joints of not greater than 18 feet (5.5 m) o.c.
 - c. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
 - d. Where control joints occur in surface of construction directly behind plaster.
 - e. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

F. Plaster Application

1. General: Comply with ASTM C 926.
 - a. Do not deviate more than plus or minus 1/4 inch in 10 feet (6.4 mm in 3 m) from a true plane in finished plaster surfaces, as measured by a 10-foot (3-m) straightedge placed on surface.
 - b. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
 - c. Provide plaster surfaces that are ready to receive field-applied finishes indicated.
2. Bonding Compound: Apply on unit masonry and concrete plaster bases.
3. Walls; Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork, on masonry or on concrete; 3/4-inch (19-mm) thickness.
 - a. Portland cement mixes.
 - b. Masonry cement mixes.
 - c. Portland and masonry cement mixes.
 - d. Plastic cement mixes.
 - e. Portland and plastic cement mixes.
4. Ceilings; Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork; 1/2 inch (13 mm) thick **OR** 3/4 inch (19 mm) thick on concrete, **as directed**.
 - a. Portland cement mixes.
 - b. Masonry cement mixes.
 - c. Portland and masonry cement mixes.
 - d. Plastic cement mixes.
 - e. Portland and plastic cement mixes.
5. Walls; Base-Coat Mix: Scratch coat for two-coat plasterwork, 3/8 inch (10 mm) thick on concrete masonry **OR** 1/4 inch (6 mm) thick on concrete, **as directed**.
 - a. Portland cement mixes.
 - b. Masonry cement mixes.
 - c. Portland and masonry cement mixes.
 - d. Plastic cement mixes.
 - e. Portland and plastic cement mixes.
6. Ceilings; Base-Coat Mix: Scratch coat for two-coat plasterwork, 1/4 inch (6 mm) thick on concrete.
 - a. Portland cement mixes.
 - b. Masonry cement mixes.
 - c. Portland and masonry cement mixes.
 - d. Plastic cement mixes.
 - e. Portland and plastic cement mixes.
7. Plaster Finish Coats: Apply to provide float **OR** dash **OR** scraped trowel-textured **OR** skip trowel-textured **OR** brocade (knock-down dash) **OR** trowel sweep **OR** combed **OR** sacked (California mission) **OR** English **OR** marblecrete, **as directed**, finish to match sample.



8. Acrylic-Based Finish Coatings: Apply coating system, including primers, finish coats, and sealing topcoats, according to manufacturer's written instructions.
 9. Concealed Exterior Plasterwork: Where plaster application will be used as a base for adhered finishes, omit finish coat.
 10. Concealed Interior Plasterwork:
 - a. Where plaster application will be concealed behind built-in cabinets, similar furnishings, and equipment, apply finish coat.
 - b. Where plaster application will be concealed above suspended ceilings and in similar locations, finish coat may be omitted.
 - c. Where plaster application will be used as a base for adhesive application of tile and similar finishes, omit finish coat.
- G. Plaster Repairs
1. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.
- H. Protection
1. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 09 22 13 00b



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SECTION 09 22 16 00 - CSF NON-STRUCTURAL METAL FRAMING

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.09 22 16 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Interior non load-bearing steel stud framing and furring 20 gage and lighter.
 2. Metal furring.
 3. Wood blocking.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 1. ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
 2. ASTM C 645 - Specification for Non-Structural Steel Framing Members.
 3. ASTM C 754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
 4. ASTM C 954 - Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 inches to 0.112 inches in Thickness.
- B. United States Department of Commerce Product Standard (PS):
 1. PS 20 - American Softwood Lumber Standard.
- C. Southern Pine Inspection Bureau (SPIB):
 1. Grading Rules.
- D. Western Wood Products Association (WWPA):
 1. Western Lumber Grading Rules.



1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data:
 - a. Framing Members: Standard materials and finish, product criteria, sizes and lengths, load charts, and limitations.
 - b. Fasteners and Anchorage Devices: Standard materials and finish, sizes, and load charts.
 - 2. Shop Drawings:
 - a. Indicate prefabricated work, component details, framing layout, framed openings, anchorage to structure, type and location of fasteners, and accessories or items required of other related work.
 - b. Indicate methods of securing studs and framing to tracks, splicing, suspension, and for blocking and reinforcement to framing connections.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 - 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Protect metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- C. Store and protect metal framing with weatherproof covering, and ventilate to avoid condensation.
- D. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- 1. Manufacturers: Subject to compliance with project requirements, alternate manufacturers offering specified items which may be incorporated in the Work include the following:
 - a. Dale/Incor, Dearborn, MI (800) 882-7883.
 - b. National Gypsum Company, Gold Bond Building Products, Charlotte, NC. (800) 628-4662.
 - c. Clark Steel Framing Systems, Middletown, OH (800) 543-7140.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.



2.2 MATERIALS

- A. Interior Nonload-Bearing Partition Framing: ASTM A 653 and ASTM C 645; galvanized sheet steel, channel shaped, punched for utility access, depth as indicated on Drawings, gages as indicated below unless indicated on Drawings.
 - 1. 2-1/2 Inch Studs - Unbraced Length 13 Feet or Less: Minimum 20 gage.
 - 2. 3-5/8 Inch Studs - Unbraced Length 17 Feet or Less: Minimum 22 gage.
 - 3. 3-5/8 Inch Studs - Unbraced Length 18 Feet or Less: Minimum 20 gage.
 - 4. 6 Inch Studs - Unbraced Length 25 Feet or Less: Minimum 22 gage.
 - 5. 6 Inch Studs - Unbraced Length Greater Than 25 Feet: Minimum 20 gage.
 - 6. Limiting heights are for 5/8 inch thick gypsum board panels on each side of partition and 5 pounds per square foot uniform load perpendicular to partition.
- B. Partition Floor Tracks and Runners: ASTM A 653 and ASTM C 645; galvanized sheet steel, channel shaped, same depth and gage as studs, tight fit; solid web.
- C. Wall Furring and Partition Bracing: ASTM A 653 and ASTM C 645; galvanized sheet steel.
 - 1. Studs: 2-1/2 inch deep, 22 gage.
 - 2. Studs: 3-5/8 inch deep, 20 gage.
 - 3. Hat-Shaped Channels: 7/8 inch deep x 1-1/2 inch wide, 25 gage.
 - 4. Cold-Rolled Channels: 3/4 x 1/2 inch and 1-1/2 x 17/32 inch, 16 gage.
 - 5. Z Furring Channel: 1-1/2 inch deep, 25 gage.
 - 6. Clip Angles: 2 inches x 2 inches x 16 gage x 1/4 inch less than stud width.
- D. Partition Framing Fasteners: Corrosion-resistant self-drilling self-tapping steel screws.
 - 1. 22 Gage Framing: ASTM C 1002; 3/8 inch Type S pan head.
 - 2. 20 Gage and Heavier Framing: ASTM C 954; 5/8 inch Type S-12 low-profile head.
- E. Partition Floor Track Anchorage Device: Low velocity powder-actuated drive pins; minimum 0.140 inch shank diameter x 1-1/2 inch shank length with 7/8 inch diameter washer.
 - 1. DX 451 System using X-DNI Pins with R23 washers, by Hilti, Tulsa, OK. (800) 879-8000.
 - 2. Ramset/Red Head System using 4700SD Pins, by ITW Ramset/Redhead, Wood Dale, IL (708) 350-1858.
 - 3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- F. Wall Furring to Concrete or Masonry Wall Fasteners: Hex head sleeve anchors; minimum 1/4 inch diameter x minimum 1-1/8 inch embedment.
 - 1. Slv Anch HX 5/16X2-1/2, by Hilti, Tulsa, OK (800) 879-8000.
 - 2. Dynabolt HN-1413, by ITW Ramset/Redhead, Wood Dale, IL (708) 350-1558.
 - 3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- G. Furring Channel to Masonry or Concrete Surface Fasteners: Low velocity powder-actuated drive pins of size to suit application.
- H. Flat Straps and Plates: ASTM A 653; galvanized sheet steel, gage, shape, and configuration as indicated on Drawings.
- I. Wood Blocking Attached to Partition Framing:
 - 1. PS 20; S4S. Maximum of 19 percent moisture content, surfaced dry, No. 2 any species graded under WWPA grading rules or No. 3 Grade Southern Pine graded under SPIB grading rules.
 - 2. Full sized, sound lumber without splits, warps, wane, or loose knots.
- J. Security Mesh: 1/2 inch #16 galvanized carbon steel flattened expanded metal sheets or 22ga. sheet metal.



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify that building framing components are ready to receive Work.
 - 2. Verify that rough-in utilities are in-place and located where required.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install studs and fasteners in accordance with manufacturer's published instructions and ASTM C 754.
- B. Metal Stud Spacing: 16 inches on center, maximum.
- C. Align stud web openings horizontally.
- D. Splice studs with minimum 8 inch nested lap, fasten each stud flange with minimum two screws.
- E. Construct corners using minimum three studs.
- F. Double stud at wall openings and door jambs, maximum 2 inches from each side of openings.
- G. Place studs as indicated on Drawings, minimum 2 inches from abutting walls.
- H. Install framing between studs for attachment of mechanical and electrical items.
- I. Install intermediate studs above and below openings to match wall stud spacing.
- J. Fasten studs adjacent to door frames, partition intersections, and corners to top and bottom runner flanges in double-stud fashion with metal lock fastener tools.
 - 1. Securely fasten studs to jamb and head anchor clips of door and borrowed-light frames.
 - 2. Place horizontally a cut-to-length section of runner with web-flange bend at each end, fasten with minimum one screw per flange.
 - 3. Position a cut-to-length stud (extending to top runner) at vertical panel joints over door frame header.
- K. Blocking: Screw attach wood blocking between studs for support of surface mounted items.
 - 1. Plumbing fixtures.
 - 2. Toilet partitions.
 - 3. Wall cabinets.
 - 4. Toilet accessories
 - 5. Hardware.
 - 6. Architectural woodwork.
 - 7. Grab bars.



8. Handrails and railings.
 9. Signage.
 10. Other items requiring backing for attachment.
- L. Install batt insulation in walls, where indicated on Drawings, as specified in Section 072100.
- M. Framing Fastening: Fasten framing in accordance with manufacturer's published instructions and schedule below, unless indicated otherwise on Drawings.

CONNECTION	FASTENER
Floor and Top Track to Concrete	1 - Pin at 32 inches on center.
Partition Stud to Floor Track	1 - Screw each side at each flange.
Plates and Straps to Studs	2 - Screws.
Stud Web to Stud Web	2 - Screws.
Runner to Header	1 - Screw at 16 inches on center, max. 6 inches from each end.

3.3 INSTALLATION - SECURITY MESH

- A. Attach security mesh to metal framing, where indicated on Drawings, with modified truss head screws and washers spaced at 12 inches on center.

3.4 INSTALLATION - FURRING

- A. Furring Channels:
1. Attach vertically spaced at maximum 16 inches on center, to masonry and concrete surfaces with hammer set or powder driven fasteners staggered 24 inches on center on opposite flanges.
 2. Nest channels 8 inches at splices and anchor with 2 fasteners in each wing.
- B. Wall Furring:
1. Secure top and bottom runners to structure.
 2. Space metal studs at maximum 16 inches on center.

3.5 CONSTRUCTION

- A. Interface with Other Work:
1. Coordinate erection of studs at openings and with hollow metal door frames.
 2. Coordinate installation of anchors, supports, and blocking for mechanical, electrical, and building accessory items installed within framing.
- B. Site Tolerances:
1. Maximum Variation From True Position: 3 mm in 3 m.
 2. Maximum Variation From Plumb: 3 mm in 3 m.

3.6 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Inspect metal framing erection, placement, spacing, fasteners, and connections to building.
- C. Inspect security mesh installation, fastener type, spacing, and attachment to metal framing.



USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



SECTION 09 22 16 13 - NON-LOAD-BEARING STEEL FRAMING

1.1 GENERAL

- A. Description Of Work
 - 1. This specification covers the furnishing and installation of materials for non-load bearing steel framing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.
- B. Summary
 - 1. This Section includes non-load-bearing steel framing members for the following applications:
 - a. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
 - b. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).
- C. Submittals
 - 1. Product Data: For each type of product indicated.
 - 2. LEED Submittal:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
- D. Quality Assurance
 - 1. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
 - 2. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.2 PRODUCTS

- A. Non-Load-Bearing Steel Framing, General
 - 1. Recycled Content of Steel Products: Provide products with average recycled content of steel products such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
 - 2. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - a. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
 - b. Protective Coating: ASTM A 653/A 653M, G40 (Z120) **OR** ASTM A 653/A 653M, G60 (Z180) **OR** Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40 (Z120), **as directed**, hot-dip galvanized, unless otherwise indicated.
- B. Suspension System Components
 - 1. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.
 - 2. Hanger Attachments to Concrete:
 - a. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.



- 1) Type: Cast-in-place anchor, designed for attachment to concrete forms **OR** Postinstalled, chemical anchor **OR** Postinstalled, expansion anchor, **as directed**.
 - b. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
 3. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch (4.12-mm) diameter.
 4. Flat Hangers: Steel sheet, in size indicated on Drawings **OR** 1 by 3/16 inch (25.4 by 4.76 mm) by length indicated, **as directed**.
 5. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch (1.37 mm) and minimum 1/2-inch- (12.7-mm-) wide flanges.
 - a. Depth: As indicated on Drawings **OR** 2-1/2 inches (64 mm) **OR** 2 inches (51 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
 6. Furring Channels (Furring Members):
 - a. Cold-Rolled Channels: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges, 3/4 inch (19.1 mm) deep.
 - b. Steel Studs: ASTM C 645.
 - 1) Minimum Base-Metal Thickness: As indicated on Drawings **OR** 0.0179 inch (0.45 mm) **OR** 0.0312 inch (0.79 mm), **as directed**.
 - 2) Depth: As indicated on Drawings **OR** 1-5/8 inches (41.3 mm) **OR** 2-1/2 inches (63.5 mm) **OR** 3-5/8 inches (92.1 mm), **as directed**.
 - c. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22.2 mm) deep.
 - 1) Minimum Base Metal Thickness: As indicated on Drawings **OR** 0.0179 inch (0.45 mm) **OR** 0.0312 inch (0.79 mm), **as directed**.
 - d. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep members designed to reduce sound transmission.
 - 1) Configuration: Asymmetrical **OR** Hat shaped, **as directed**.
 7. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
- C. Steel Framing For Framed Assemblies
1. Steel Studs and Runners: ASTM C 645.
 - a. Minimum Base-Metal Thickness: As indicated on Drawings **OR** 0.0179 inch (0.45 mm) **OR** 0.027 inch (0.7 mm) **OR** 0.0312 inch (0.79 mm), **as directed**.
 - b. Depth: As indicated on Drawings **OR** 3-5/8 inches (92.1 mm) **OR** 6 inches (152.4 mm) **OR** 4 inches (101.6 mm) **OR** 2-1/2 inches (63.5 mm) **OR** 1-5/8 inches (41.3 mm), **as directed**.
 2. Slip-Type Head Joints: Where indicated, provide one of the following:
 - a. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- (50.8-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
 - b. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- (50.8-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
 - c. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 3. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 4. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - a. Minimum Base-Metal Thickness: As indicated on Drawings **OR** 0.0179 inch (0.45 mm) **OR** 0.027 inch (0.7 mm) **OR** 0.0312 inch (0.79 mm), **as directed**.



5. Cold-Rolled Channel Bridging: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges.
 - a. Depth: As indicated on Drawings **OR** 1-1/2 inches (38.1 mm), **as directed**.
 - b. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38.1 by 38.1 mm), 0.068-inch- (1.73-mm-) thick, galvanized steel.
6. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 - a. Minimum Base Metal Thickness: As indicated on Drawings **OR** 0.0179 inch (0.45 mm) **OR** 0.0312 inch (0.79 mm), **as directed**.
 - b. Depth: As indicated on Drawings **OR** 7/8 inch (22.2 mm) **OR** 1-1/2 inches (38.1 mm), **as directed**.
7. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep, steel sheet members designed to reduce sound transmission.
 - a. Configuration: Asymmetrical **OR** Hat shaped, **as directed**.
8. Cold-Rolled Furring Channels: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges.
 - a. Depth: As indicated on Drawings **OR** 3/4 inch (19.1 mm), **as directed**.
 - b. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 0.0312 inch (0.79 mm).
 - c. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.
9. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (31.8 mm), wall attachment flange of 7/8 inch (22.2 mm), minimum bare-metal thickness of 0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.

D. Auxiliary Materials

1. General: Provide auxiliary materials that comply with referenced installation standards.
 - a. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
2. Isolation Strip at Exterior Walls: Provide one of the following:
 - a. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
 - b. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

1.3 EXECUTION

A. Preparation

1. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - a. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
2. Coordination with Sprayed Fire-Resistive Materials:
 - a. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches (600 mm) o.c.
 - b. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

B. Installation, General

1. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.



- a. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
- b. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
- c. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
- d. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
2. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
3. Install bracing at terminations in assemblies.
4. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

C. Installing Suspension Systems

1. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
2. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
3. Suspend hangers from building structure as follows:
 - a. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - 1) Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - b. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - 1) Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 - c. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - d. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - e. Do not attach hangers to steel roof deck.
 - f. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 - g. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 - h. Do not connect or suspend steel framing from ducts, pipes, or conduit.
4. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
5. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
6. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
7. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

D. Installing Framed Assemblies

1. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.



2. Install studs so flanges within framing system point in same direction.
 - a. Space studs as follows:
 - 1) Single-Layer Application: 16 inches (406 mm) **OR** 24 inches (610 mm) **OR** 400 mm **OR** 600 mm, **as directed**, o.c., unless otherwise indicated.
 - 2) Multilayer Application: 16 inches (406 mm) **OR** 24 inches (610 mm) **OR** 400 mm **OR** 600 mm, **as directed**, o.c., unless otherwise indicated.
 - 3) Tile backing panels: 16 inches (406 mm) **OR** 400 mm, **as directed**, o.c., unless otherwise indicated.
3. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 - a. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - b. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - 1) Install two studs at each jamb, unless otherwise indicated.
 - 2) Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (12.7-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
 - 3) Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - c. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - d. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - 1) Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 - e. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 - f. Curved Partitions:
 - 1) Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - 2) Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches (150 mm) o.c.
4. Direct Furring:
 - a. Screw to wood framing.
 - b. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.
5. Z-Furring Members:
 - a. Erect insulation (specified in Division 7 Section "Building Insulation") vertically and hold in place with Z-furring members spaced 24 inches (610 mm) **OR** 600 mm, **as directed**, o.c.
 - b. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (600 mm) o.c.
 - c. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (300 mm) from corner and cut insulation to fit.
6. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

END OF SECTION 09 22 16 13



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Task	Specification	Specification Description
09 22 36 13	09 22 13 00	Gypsum Plaster
09 22 36 13	09 22 13 00a	Gypsum Veneer Plaster
09 22 36 13	09 22 13 00b	Portland Cement Plaster



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SECTION 09 22 36 23 - LATH AND PLASTER RENOVATION

GENERAL

Description Of Work

1. This specification covers the furnishing and installation of materials for lath and plaster renovation. Products shall be as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

Quality Assurance

2. Regulatory Requirements:
 - a. Plaster Partitions: Listed and labeled for fire-protective ratings as indicated or scheduled.
 - b. Plaster Floor/Ceilings and Roof/Ceiling Assemblies: Listed and labeled for fire-protective ratings as indicated or scheduled.
 - c. Fire Rated Assemblies: Comply with UL 05, FM P8016, or GA 600 for required fire-rated assembly.

Submittals

3. Product Data: Submit in accordance with Detailed Scope of Work. Include each type of plaster material, metal lath, and lathing accessories to be installed.

Delivery, Storage, And Handling

4. General:
 - a. Plastering Materials: Deliver in original unopened containers and store off ground and under cover.
 - b. Metal Lath and Accessories: Protect from rusting during storage.
 - c. Rusted or Water Damaged Materials: Subject to rejection before or after installation.

Project Conditions

5. Environmental Requirements: Comply with Detailed Scope of Work.
 - a. Cold-Weather Protection: Do not apply plaster if ambient temperature is less than 4 degrees C (40 degrees F) or more than 26 degrees C (80 degrees F). Maintain this temperature range in all areas 7 days prior to application, during application, and for 7 days after plaster is set.
 - b. Hot-Weather Protection: Protect plaster against uneven or excessive evaporation during dry, hot weather and from strong blasts of dry air, either natural or artificial.
 - c. Ventilation: Ventilate building spaces as required to remove water in excess of that required for hydration of plaster. Begin ventilation immediately after plaster is applied and continue until it sets.
6. Existing Conditions: See Division 1 Section "Summary of Work". Do not interfere with use of occupied buildings or portions of buildings. Maintain free and safe passage to and from occupied areas.
7. Protection: Protect grounds, plantings, buildings, and any other facilities or property from damage caused by construction operations.

Scheduling And Sequencing

8. Scheduling and Completion: Comply with Detailed Scope of Work.
 - a. Sequence plaster application with installation and protection of other work so that neither will be damaged by installation of other.

PRODUCTS

Materials

9. **Materials for Patching, Extending, and Matching:**
 - a. Provide same products or types of construction as existing structure, as needed to patch, extend, or match existing work.
 - 1) Generally, Contract Documents will not define products or standards of workmanship present in existing construction. Determine products by inspection and any necessary testing, and workmanship by use of existing as sample of comparison.
 - 2) Patching, extending, and matching of existing work and systems shall result in complete, finished system.
 - b. Presence of product, finish, or type of construction, requires that patching, extending, or matching shall be performed as necessary to make work complete and consistent.
10. **Partition Metals: ASTM C 645, galvanized steel:**
 - a. Interior Steel Studs: Minimum 0.46 mm (25 gage), provide sizes and gages to match existing, or as indicated.
 - 1) Provide minimum of 0.84 mm (20 gage) studs both sides of hollow metal frames.
 - b. Steel Stud Runners: Match studs. Provide long leg runners for slip joint at structure above to allow for deflection.
 - c. Furring Channels: Hat-shaped furring channels, minimum 0.46 mm (25 gage).
 - d. Sheet Metal Reinforcement (Alternate to Wood Blocking): 1.52 mm (16 gage) minimum.
11. **Suspended Ceiling Metals:**
 - a. Main Runners (Primary Members): ASTM C 754 cold-rolled steel channels with rust-inhibitive finish.
 - 1) 50 mm (2 inches) deep, 88 kg per 100 m (590 pounds per 1,000 LF).
 - 2) 38 mm (1-1/2 inch) deep, 70 kg per 100 m (475 pounds per 1,000 LF).
 - 3) 19 mm (3/4 inch) deep, 45 kg per 100 m (300 pounds per 1,000 LF).
 - b. Cross Furring (Furring Channels): Hat-shaped galvanized steel furring channels, minimum 0.46 mm (25 gage).
 - c. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.
 - 1) Hanger Wire: Minimum 4.1 mm (8 gage).
 - 2) Tie Wire: 6 mm (16 gage).
12. **Lath:**
 - a. Metal Lath: ASTM C 847, galvanized expanded metal.
 - 1) Weight: In compliance with ASTM C 841 for conditions and spacing of supports.
 - b. Gypsum Lath: ASTM C 37, plain. Provide Type X at fire-rated assemblies.
 - 1) Thickness: As indicated or specified and in compliance with ASTM C 841 for conditions and spacing of supports.
13. **Fasteners:**
 - a. Screws: ASTM C 1002, corrosion-resistant. Provide types as recommended by manufacturer for each application.
 - 1) To Metal Framing: Minimum 25 mm (1 inch), Type S.
 - 2) To Wood Framing: Minimum 32 mm (1-1/4 inch), Type W bugle head.
14. **Accessories: ASTM C 841, galvanized steel.**
 - a. Comer Beads: Small nose with expanded flanges, unless otherwise indicated.
 - b. Casing Beads: Square-edged style. with short or expanded flanges to suit kinds of plaster bases indicated.
 - c. Control Joints: Prefabricated folded pair of non-perforated screeds in M-shaped configuration, with expanded or perforated flanges.
 - 1) Provide removable protective tape on plaster face of control joints.
 - d. Cornerite: Galvanized expanded metal lath in accordance with ASTM C 841.
15. **Gypsum Plaster Materials: ASTM C 28.**
 - a. Base Coat Plasters: One of following:
 - 1) Gypsum ready-mixed plaster with mill-mixed perlite aggregate.
 - 2) Gypsum wood-fibered plaster, ASTM C 28, Type N.
 - b. Finish Coat Plasters: One of following:
 - 1) Gypsum ready-mixed finished plaster, manufacturers standard mill-mixed gauged interior finish.



- 2) Gypsum Gauging Plaster: ASTM C 28, Type G.
 - c. Quicklime: ASTM C 5.
 - d. Sand: ASTM C 35.
 - e. Finishing Hydrated Limes: ASTM C 206, Type S, special hydrated lime for finishing purposes.
 - f. Bonding Compound for Gypsum Plaster: ASTM C 631.
 - g. Water: Clean and free from injurious amounts of oils, acids, alkalis, salts, organic materials, or substances that may be deleterious to plaster or metals in contact with plaster.
- 16. Sound-Isolation Materials:
 - a. Sound Insulation: ASTM C 665, Type I (unfaced) mineral-fiber blankets, 12 to 16 kg per cu m (0.75 to 1 PCF), thickness as indicated or scheduled, or required by fire-rated assembly.
 - b. Acoustical Sealant:
 - 1) Concealed: ASTM C 919 nondrying, non-hardening, non-skinning, non-bleeding, and non-staining.
 - 2) Exposed: ASTM C 919 non-oxidizing and skinning, permanently elastic, and paintable.
 - c. Ductwork Penetrations Packing: Low-density fiberglass.
- 17. Gypsum Plaster Mixes: As recommended by manufacturer:
 - a. Scratch Coat:
 - 1) Over Metal Lath: Gypsum wood-fibered plaster, neat or with job-mixed sand.
 - 2) Over Gypsum Lath: Gypsum neat plaster with job-mixed sand.
 - 3) Over Unit Masonry: Gypsum wood-fibered plaster, neat or with job-mixed sand.
 - b. Brown Coat:
 - 1) Over Metal Lath: Gypsum wood-fibered plaster, with job-mixed sand.
 - 2) Over Gypsum Lath: Gypsum neat plaster with job-mixed sand.
 - 3) Over Unit Masonry: Gypsum wood-fibered plaster with job-mixed sand.
 - c. Finish Coat: Proportion materials for finish coats to comply with ASTM C 842 for each type of finish coat and texture indicated.
 - 1) Gypsum Gauging Plaster 1 part plaster and 2 parts lime.
 - a) Over lightweight aggregate base coats, add 15 L (1/2 cubic foot) of perlite fines or 23 kg (50 pounds) of No. 1 white silica sand per 45 kg (100 pounds) of plaster.
 - 2) Gypsum Ready-mixed Finish Plaster Neat.
 - d. Mechanically mix cementitious and aggregate materials for plasters to comply with applicable referenced application standard and with recommendations of plaster manufacturer.

EXECUTION

Examination

- 18. Units, Spaces, and Areas to be renovated: Comply with Detailed Scope of Work.
 - a. Verify that surfaces to receive rough carpentry are prepared to required grades and dimensions.

Preparation

- 19. Dust Protection: Comply with Detailed Scope of Work.
- 20. Building Occupation: Carry out demolition and renovation work to cause as little inconvenience to occupants as possible. See Detailed Scope of Work.
- 21. Protection: Comply with Detailed Scope of Work.
 - a. Protection: Provide drapes and drop cloths necessary to protect walls, floors, ductwork and piping, electrical work, etc. during plastering operations.
- 22. Selective Demolition: Comply with Detailed Scope of Work.
- 23. Surface Preparation: Clean projections, dust, loose particles, grease, bond breakers, and foreign matter from surfaces to receive plaster.



- a. Do not apply plaster directly to surfaces (1) of masonry or concrete that have been coated with bituminous compound or other waterproofing agents, or (2) that have been painted or previously plastered.
- b. Before plaster work is started, wet masonry and concrete surfaces thoroughly with fine fog spray of clean water to produce uniformly moist surface.
- c. Do not apply plaster to surfaces containing frost.

Laying-Out Work

24. Discrepancies: Verify dimensions and elevations indicated in layout of existing work.
 - a. Prior to commencing work, carefully compare and check Drawings (if any) for discrepancies in locations or elevations of work to be executed.
 - b. Refer discrepancies among Drawings (if any), Specifications, and existing conditions to the Owner for adjustment before work affected is performed.
 - 1) Failure to make such notification shall place responsibility on Contractor to carry out work in satisfactory, workmanlike manner.
25. Contractor: Responsible for location and elevation of construction contemplated by Construction Documents.

Performance

26. Patching: Patch and extend existing work using skilled mechanics who are capable of matching existing quality of workmanship.
 - a. Quality of Patched or Extended Work: Not less than specified for new work. If similar new work is not specified, equal to existing work.
27. Damaged Surfaces: Comply with Detailed Scope of Work.
28. Transitions from Existing to New Work: Comply with Detailed Scope of Work.
29. Isolation: Where lathing and metal support system abuts building structure horizontally and where partition/wall work abuts overhead structure, isolate work from structural movement sufficiently to prevent transfer of loads to work from building structure. Install slip or cushion-type joints to absorb deflections but maintain lateral support.
 - a. Frame both sides of control and expansion joints independently, and do not bridge joints with furring and lathing or accessories.

Installation Of Suspended Steel Framing

30. General: Construct ceilings of lath and plaster on suspended steel framing system in accordance with manufacturer's recommendations and Reference Standards.
31. Hanger Installation: Attach hangers to structure above ceiling to comply with NAAMM ML/SFA 920.
32. Ceiling Suspension System Components: Install in sizes and at spacings indicated but not in smaller sizes or greater spacings than those required by ASTM C 841 and NAAMM ML/SFA 920.
 - a. Wire Hangers: Space and install wire hangers in accordance with ASTM C 841 and within 150 mm (6 inches) of channel ends, unless closer spacing indicated or required for fire-resistance rated assembly.
 - b. Main Runners (Primary Members): Space and install channels in accordance with ASTM C 841, unless closer spacing indicated or required for fire-resistance rated assembly.
 - c. Cross Furring (Furring Channels): Space and install furring channels in accordance with ASTM C 841, unless closer spacing indicated or required for fire-resistance rated assembly.
33. Framing Around Openings: Frame channels and lath on suspended soffits and ceilings and at furring to receive electric lights, etc. as indicated or as necessary to complete work. Furnish and install in furring, plaster rings or access panels furnished under other sections.

Installation Of Steel Stud Partitions

34. General: Install steel stud partition support systems in accordance with manufacturer's recommendations and Reference Standards.
35. Steel Stud Systems: Comply with ASTM C 754.



- a. To Receive Metal Lath: Space studs in accordance with ASTM C 841 and NAAMM ML/SFA 920.
- b. To Receive Gypsum Lath: Space studs in accordance with ASTM C 841.
- 36. Extend partition support systems to finish ceilings and attach to ceiling suspension members, unless otherwise indicated.

Metal Furring

- 37. General: Install in accordance with ASTM C 841 and NAAMM ML/SFA 920.
 - a. Install supplementary framing, blocking, and bracing at terminations in work and for support of fixtures, equipment services, heavy trim, grab bars, bath accessories, furnishings, and similar work to comply with manufacturer's recommendations.
- 38. Metal Furring to Receive Gypsum Lath: Space furring channels in accordance with ASTM C 841.
- 39. Metal Furring Systems:
 - a. To Receive Metal Lath: Space furring in accordance with ASTM C 841 and NAAMM ML/SFA 920.
 - b. To Receive Gypsum Lath: Space furring in accordance with ASTM C 841.
- 40. Isolation: Where lathing and metal support system abuts building structure horizontally and where partition/wall work abuts overhead structure, isolate work from structural movement sufficiently to prevent transfer of loads to work from building structure. Install slip or cushion-type joints to absorb deflections but maintain lateral support.
 - a. Frame both sides of control and expansion joints independently, and do not bridge joints with furring and lathing or accessories.

Installation Of Suspended Steel Framing

- 41. General: Construct ceilings of lath and plaster on suspended steel framing system in accordance with manufacturer's recommendations and Reference Standards.
- 42. Hanger Installation: Attach hangers to structure above ceiling to comply with NAAMM ML/SFA 920.
- 43. Ceiling Suspension System Components: Install in sizes and at spacings indicated but not in smaller sizes or greater spacings than those required by ASTM C 841 and NAAMM ML/SFA 920.
 - a. Wire Hangers: Space and install wire hangers in accordance with ASTM C 841 and within 150 mm (6 inches) of channel ends, unless closer spacing indicated or required for fire-resistance rated assembly.
 - b. Main Runners (Primary Members): Space and install channels in accordance with ASTM C 841, unless closer spacing indicated or required for fire-resistance rated assembly.
 - c. Cross Furring (Furring Channels): Space and install furring channels in accordance with ASTM C 841, unless closer spacing indicated or required for fire-resistance rated assembly.
- 44. Framing Around Openings: Frame channels and lath on suspended soffits and ceilings and at furring to receive electric lights, etc. as indicated or as necessary to complete work. Furnish and install in furring, plaster rings or access panels furnished under other sections.

Installation Of Steel Stud Partitions

- 45. General: Install steel stud partition support systems in accordance with manufacturer's recommendations and Reference Standards.
- 46. Steel Stud Systems: Comply with ASTM C 754.
 - a. To Receive Metal Lath: Space studs in accordance with ASTM C 841 and NAAMM ML/SFA 920.
 - b. To Receive Gypsum Lath: Space studs in accordance with ASTM C 841.
- 47. Extend partition support systems to finish ceilings and attach to ceiling suspension members, unless otherwise indicated.

Metal Furring

- 48. General: Install in accordance with ASTM C 841 and NAAMM ML/SFA 920.
 - a. Install supplementary framing, blocking, and bracing at terminations in work and for support of fixtures, equipment services, heavy trim, grab bars, bath accessories, furnishings, and similar work to comply with manufacturer's recommendations.



49. Metal Furring to Receive Gypsum Lath: Space furring channels in accordance with ASTM C 841.
50. Metal Furring Systems:
 - a. To Receive Metal Lath: Space furring in accordance with ASTM C 841 and NAAMM ML/SFA 920.
 - b. To Receive Gypsum Lath: Space furring in accordance with ASTM C 841.

Lathing

51. Metal Lathing: Install in accordance with ASTM C 841 and NAAMM ML/SFA 920.
 - a. At Metal Framing: Attach metal lath to furring channels with long dimension of sheet at right angles to furring channels with gage wire ties spaced not over 150 mm (6 inches) apart.
 - b. At Wood Framing: Nail metal lath to wood framing with long dimension of sheet at right angles to framing member.
 - c. Place ties where sides of sheets laps at supports and at side laps of sheets between supports. Lap metal lath not less than 13 mm (1/2 inch) at sides of sheets and 25 mm (1 inch) at ends of sheets.
 - d. Suspended and Furred Ceilings: Use 1.8 kg/sq m (3.4 pounds/SY) minimum weight diamond mesh lath.
 - e. Ceramic Tile Setting Beds: Use 1.8 kg/sq m (3.4 pounds/SY) minimum weight diamond mesh lath.
52. Gypsum Lath: Install in accordance with ASTM C 841.
 - a. Wood Framing and Furring: Install lath as follows:
 - 1) With screws to comply with lath manufacturer's directions.
 - 2) With nails.
 - 3) Provide floating angle construction.
 - b. Suspended and Furred Ceilings: Install lath to furring members with clips.
 - c. Vertical Metal Framing and Furring: Install lath as follows:
 - 1) With screws.
 - 2) With clips, supplemented by screws where required by lath manufacturer.
 - 3) Where sound-rated partitions are indicated, attach lath with resilient clips.

Installation Of Accessories

53. Accessories: Install as required to repair area of work to match existing. Install in accordance with ASTM C 841. Miter or cope accessories at corners; Install with tight joints and in alignment. Attach accessories securely to plaster bases to hold accessories in place and alignment during plastering.
54. Interior Corners: Apply cornerite.
55. Corner Beads: Install corner beads tightly secured to lath at exposed exterior corners.
56. Casing Beads: Install at terminations of plaster work, except where plaster passes behind and is concealed by other work and where metal screeds, bases, or metal frames act as casing beads.
57. Control Joints: Install at locations indicated or, if not indicated, at spacings and locations required by Reference Standards. Coordinate specific locations with the Owner.
58. Access Panels: Provide access panels as required for maintenance of concealed plumbing work in coordination with Division 15 Section "Plumbing." Tiled Areas: Coordinate with Division 9 Section "Ceramic Tile."
59. Sound-Rated Plaster Work: Where sound-rated plaster work is indicated by STC ratings or other notation:
 - a. Acoustical Sealant: Seal work at perimeters, control joints, openings, and penetrations with continuous bead of acoustical sealant. Comply with ASTM C 919 and plastering manufacturer's recommendations for location of sealant beads.
 - b. Sound Insulation: Install insulation blankets within stud cavities of sound-rated partition assemblies where indicated.

Plastering

60. Plastering: Comply with ASTM C 842 in thickness to match existing.



- a. Preparation: Remove loose, fractured, or separated plaster to face of substrate. repairing lath at substrate to ensure repair area bounded by solid and sound existing plaster construction.
 - 1) Prepare monolithic surfaces for bonded base coats and use bonding compound to comply with Reference Standards for conditioning of monolithic surfaces.
- b. Grout hollow metal frames, bases, and similar work with base-mat plaster material, and prior to lathing where necessary. Except where full grouting is indicated or required for fire-resistance rating, grout at least 150 mm (6 inches) at each jamb anchor dip.
- c. Plaster flush with metal frames and other built-in metal items or accessories that act as plaster ground, unless otherwise indicated. Where plaster is not terminated at metal by casing beads, cut base coat free from metal before plaster sets and groove finish coat at junctures with metal.
- 61. Preparation: Check metal grounds, corner beads, screeds, and other accessories carefully for alignment before starting plaster application. Check expansion and control joints and supporting metal structures to ensure that expansion and control joints can move unrestrained.
- 62. Plaster: Apply in accordance with ASTM C 842 in thickness to match existing:
 - a. Use three-coat work over following plaster bases:
 - 1) Metal lath.
 - 2) Gypsum lath attached to ceiling supports by clips.
 - 3) Gypsum lath attached to ceiling supports spaced over 400 mm (16 inches) OC.
 - 4) Gypsum lath, 9.5 mm (3/8 inch) thick, with separate vapor retarder behind.
 - b. Use two-coat work over following bases.
 - 1) Gypsum lath except for installations requiring three-coat work.
 - 2) Unit masonry.
 - 3) Concrete, cast-in-place or precast when surface condition complies with ASTM C 842 for plaster bonded to solid base.
 - c. First Coat: Apply first coat of plaster with such force to secure good key.
 - d. Finish Coats: Apply troweled finish coats unless otherwise indicated.
- 63. Workmanship: Perform work true to line, straight, and plumb.
 - a. Finished Surfaces: Free from waves, dents, bumps, cracks, pits, checks, streaks, catfaces, blisters, or other defects. Cutout and properly replace defective areas.
 - b. Execute work to avoid any irregularity occurring at point or place where one section is joined to another.
 - c. Arises and Angles: True and sharp.
- 64. Tolerances: Plaster surface plane within plus/minus 3 mm in 3 000 mm (1/8 inch in 10 feet).

Integrating Existing Work

- 65. Protection: Comply with Detailed Scope of Work.

Adjustments

- 66. Partition Removal: Comply with Detailed Scope of Work.

Dust Control

- 67. Dust: Comply with Detailed Scope of Work.

Patching And Cleaning

- 68. Cutting and Patching: Do necessary cutting, patching, and repairing and pointing up of plastering after other work is in place to restore defective areas. Repair or replace work to eliminate blisters, buckles, excessive crazing and check-cracking, dry outs, efflorescence, sweat-outs, and similar defects and where bond to substrate has failed.
 - a. Sand smooth-troweled finishes lightly to remove trowel marks and arises.
- 69. Cleaning: As rapidly as plastering is completed in each space, clean up rubbish, utensils, and surplus material, sweep floor and leave in neat condition for work of others.
 - a. When general plastering is concluded, remove plastering rubbish, equipment, and surplus materials from premises.
 - b. Clean surfaces splattered with plaster.



END OF SECTION 09 22 36 23



Task	Specification	Specification Description
09 22 36 23	09 22 13 00	Gypsum Plaster
09 22 36 23	09 22 13 00a	Gypsum Veneer Plaster
09 22 36 23	09 22 13 00b	Portland Cement Plaster
09 22 36 33	09 22 13 00	Gypsum Plaster
09 22 36 33	09 22 13 00a	Gypsum Veneer Plaster
09 22 36 33	09 22 13 00b	Portland Cement Plaster
09 22 36 33	09 22 36 23	Lath and Plaster Renovation



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SECTION 09 23 13 00 - GYPSUM BOARD RENOVATION**GENERAL****Description Of Work**

1. This specification covers the furnishing and installation of materials for gypsum board renovation. Products shall be as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

Submittals

2. Quality Assurance/Control Submittals
 - a. Certificates: Manufacturer's written certification that gypsum products meet or exceed specified requirements.

Quality Assurance

3. Regulatory Requirements:
 - a. Gypsum Board Partitions: Listed and labeled for fire-protective ratings as indicated or scheduled.
 - b. Gypsum Board Floor/Ceilings and Roof/Ceiling Assemblies: Listed and labeled for fire protective ratings as indicated or scheduled.
 - c. Fire-Rated Assemblies: Comply with UL 05, FM P8016, or GA 600 for required fire-rated assembly.

Delivery, Storage, And Handling

4. Storage and Protection: Store wallboard off ground to protect it from weather and damage due to moisture damage.
 - a. Wallboard: Dry, free of warpage, and have bundling tape intact immediately prior to use.

Project Conditions

5. Environmental Requirements: Comply with Detailed Scope of Work.
 - a. During gypsum-panel application and finishing, maintain indoor temperatures within range of 13 degrees C (55 degrees F) to 21 degrees C (70 degrees F). Provide adequate ventilation to carry off excess moisture.
6. Existing Conditions: See Division 1 Section "Summary of Work". Do not interfere with use of occupied buildings or portions of buildings. Maintain free and safe passage to and from occupied areas.
7. Protection: Protect grounds, plantings, buildings and any other facilities or property from damage caused by construction operations.

Scheduling And Sequencing

8. Scheduling and Completion: Comply with Detailed Scope of Work.

PRODUCTS**Materials**

9. Materials for Patching, Extending, and Matching:

- a. Provide same products or types of construction as in existing structure, as needed to patch, extend, or match existing work.
 - 1) Generally, Contract Documents will not define products present in existing construction. Determine products by Inspection and any necessary testing.
 - 2) Patching, extending, and matching of existing work and systems shall result in a complete, finished system.
- b. Presence of product, finish, or type of construction requires that patching, extending, or matching be performed as necessary to make work complete and consistent.

Metals

- 10. Partition Metals: ASTM C 645, galvanized steel:
 - a. Interior Steel Studs: Minimum 0.46 mm (25 gage), provide sizes and gages to match existing or as indicated.
 - 1) Provide minimum of 0.84 mm (20 gage) studs both sides of hollow metal frames.
 - b. Steel Stud Runners: Match studs. Provide long leg runners for slip joint at structure above to allow for deflection.
 - c. Furring Channels: Hat-shaped furring channels, minimum 0.46 mm (25 gage).
 - d. Resilient Furring Channels: Manufacturer's standard product designed to reduce sound transmission by resilient attachment of gypsum board, 13 mm (1/2 inch) deep.
 - e. Sheet-Metal Reinforcement (Alternate to Wood Blocking): 1.52 mm (16 gage) minimum.
- 11. Suspended Coiling Metals:
 - a. Runner Channels: ASTM C 754 cold-rolled steel channels with rust-inhibitive finish.
 - 1) 50 mm (2 Inches) deep, 88 kg per 100 m (590 pounds per 1,000 LF).
 - 2) 38 mm (1-1/2 inch) deep, 70 kg per 100 m (475 pounds per 1,000 LF).
 - 3) 19 mm (3/4 Inch) deep, 45 kg per 100 m (300 pounds per 1,000 LF).
 - b. Furring Channels: Hat-shaped galvanized-steel furring channels, minimum 0.46 mm (25 gage).
 - c. Steel Studs: Galvanized steel as specified above, minimum 0.46 mm (25 gage).
 - d. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.
 - 1) Hanger Wire: Minimum 4.1 mm (8 gage).
 - 2) Tie Wire: 6 mm (16 gage).

Gypsum Board And Related Materials

- 12. Gypsum Board: GA216 and ASTM C 36
 - a. Size: 12.7 mm and 15.9 mm (1/2 inch and 5/8 inch) thick to match existing, as indicated or scheduled. Provide boards 1 200 mm (48 inches) wide by length required to minimize cross joints.
 - b. Regular Tapered-edge gypsum panels.
 - 1) Provide Type X gypsum panels at fire-rated assemblies.
 - c. Water-Resistant: ASTM C 630, paintable, tapered-edge gypsum panels.
 - 1) Provide Type X water-resistant gypsum panels at fire-rated assemblies.
- 13. Cementitious Backer Units (CBU): ANSI A118.9, nailable/screwable backer board composed of stable portland cement, aggregates, and reinforcements with ability to remain unaffected by prolonged exposure to moisture, 12.7 mm (1/2 inch) thick.
- 14. Fasteners:
 - a. Screws: ASTM C 1002, drywall screws, corrosion resistant. Provide types as recommended by manufacturer for each application.
 - 1) Wallboard to Metal Framing: Minimum 25 mm (1 inch), Type S.
 - 2) Wall board to Wood Framing: Minimum 32 mm (1-1/4 inch) Type W bugle head.

- 3) Wall board to Wallboard: Type G.
 - b. Nails: ASTM C 514.
- 15. Accessories: GA 216 and ASTM C 1047, galvanized steel.
 - a. Comer Bead: GA 216 Type CB-114 x 114.
 - b. Metal Trim (Casing Beads): GA 216 Type L, in depth to match gypsum-board thickness.
 - c. Control Joint: V-shaped control joint.
 - d. Adhesive: ASTM C 557 multi-purpose adhesive.
- 16. Finishing Materials: ASTM C 475.
 - a. Joint Tape: Provide type as recommended by panel manufacturer.
 - b. Joint Treatment: Joint compound, adhesive, water, and fasteners.
- 17. Sound-Isolation Materials:
 - a. Sound Insulation: ASTM C 665, Type I (unfaced) mineral fiber blankets, 3.7 to 4.9 kg per sq m (3/4 to 1 PCF), thickness as indicated, scheduled, or required by fire-rated assembly.
 - b. Acoustical Sealant:
 - 1) Concealed: ASTM C 919 nondrying, non-hardening, and non-skinning; non-bleeding; and non-staining.
 - 2) Exposed: ASTM C 919 non-oxidizing and skinning; permanently elastic; and paintable.
 - c. Ductwork Penetrations Packing: Low-density fiberglass.

EXECUTION

Examination

- 18. Units, Spaces, and Areas to be Renovated: Comply with Detailed Scope of Work.
 - a. Existing Conditions: Before beginning installation, examine substrates and framing to receive gypsum board for defects or conditions adversely affecting quality and execution of installation.

Preparation

- 19. Dust Protection: Comply with Detailed Scope of Work.
- 20. Building Occupation: Carry out demolition and renovation work to cause as little inconvenience to occupants as possible. See Detailed Scope of Work.
- 21. Protection: Comply with Detailed Scope of Work.
 - a. Protection: Provide drapes and drop cloths necessary to protect walls, floors, ductwork and piping, electrical work, etc. during drywall finishing operations.
- 22. Selective Demolition: Comply with Detailed Scope of Work.

Laying Out Work

- 23. Discrepancies: Verify dimensions and elevations indicated in layout of existing work.
 - a. Prior to commencing work, carefully compare and check Drawings (if any) for discrepancies in locations or elevations of work to be executed.
 - b. Refer discrepancies among Drawings (if any), Specifications, and existing conditions to the Owner or adjustment before work affected is performed.
 - 1) Failure to make such notification shall place responsibility on Contractor to carry out work in satisfactory, workmanlike manner.
 - c. Contractor: Responsible for location and elevation of construction indicated by Construction Documents.

Performance

24. Patching: Patch and extend existing work using skilled mechanics capable of matching existing quality of workmanship.
 - a. Quality of Patched or Extended Work: Not less than specified for new work. If similar new work is not specified, equal to existing work.
25. Damaged Surfaces: Comply with Detailed Scope of Work.
26. Transitions from Existing to New Work: Comply with Detailed Scope of Work.

Erection Of Drywall Stud Partitions

27. Reference Standard: Erect steel framing in accordance with ASTM C 754.
28. Layouts: Align partition studs accurately according to partition layout.
29. Anchoring: Anchor runner channels to concrete slabs with concrete stub nails or power-driven anchors at 600 mm (24 inches) OC. Anchor runner channels to coiling grid, where applicable, with stove bolts. Where studs extend above ceiling system, install headers where required to receive runners.
30. Studs: Position studs vertically in runners. Where studs are located adjacent to openings or partition intersections and comers. anchor studs to runners with manufacturer's metal lock fastener or with 13 mm (1/2 inch) Type S pan-head screws.
 - a. Space studs at 400 mm (16 Inches) and 600 mm (24 inches) OC as indicated or scheduled.
 - 1) Cementitious Backer Units (CBU): Space studs at maximum of 400 mm (16 inches) OC.
 - 2) Limiting Heights: Comply with ASTM C 754 for transverse load of 240 Pa (5 lb-force/SF) without exceeding either allowable stress or deflection of L/240. Comers and Intersections: Locate studs no more than 50 mm (2 inches) from abutting partitions, comers, etc.
 - b. Openings: Locate studs not more than 50 mm (2 inches) from opening frames. Anchor studs to frame anchor clips by bolt or screw attachment. Install headers over openings as recommended by the manufacturer.
 - 1) Solid-Core Wood Doors and Hollow Metal Doors: Provide two full-height studs at jambs fastened together back to back.
 - 2) Fire-Rated Openings: Comply with GA 219.
31. Bracing: Provide diagonal bracing at head of studs that terminate above the ceiling level. Bracing shall consist of metal studs bent to V-shape and extending at 45 degrees from partition head to structure above. Locate bracing 1 200 mm (48 inches) maximum OC.
32. Wood Blocking or Metal Reinforcement:
 - a. Wood Blocking: See Division 6 Section "Rough Carpentry."
 - b. Install metal reinforcement of size required for support of toilet and bath accessories, hardware, cabinets, shelving, counters, and other wall-mounted items.
 - c. Set true to line, level, or plumb well-secured in stud wall and flush with back of drywall or other wall finish.
 - d. Coordinate exact locations with other sections.

Miscellaneous Framing And Furring

33. General: Provide necessary framing and furring for special framing at recesses, offsets, specialty items, and at wall-mounted casework, shelving, and equipment.
34. Furring Channels: Install furring channels over back-up material. Position channels vertically at 600 mm (24 inches) OC. Use power-activated fasteners or stub nails at 600 mm (24 Inches) OC along alternating flanges. Shim channels level as required.
 - a. Cementitious Backer Units (CBU): Space furring at maximum of 400 mm (16 inches) OC.

35. Resilient Furring Channels: Screw-attach In accordance with manufacturer's recommendations.
 - a. Spacing: 600 mm (24 inches) OC for framing at 16 inches OC and 400 mm (16 inches) OC for framing at 24 Inches OC.

Ceiling Grillage Erection

36. Reference Standard: Erect steel framing In accordance with ASTM C 754.
37. Hangers: Install wire hangers spaced not over 1 200 mm (48 inches) OC in direction of 38 mm (1-1/2 inch) main runner channels and within 150 mm (6 inches) of ends of main runners or interruptions of ceiling continuity. Hang from structure above.
38. Runners: Place main runners not over 1 200 mm (48 inches) OC. Provide, position, and level hangers with hangers saddle-tied along runners. Space furring channels at 600 mm (24 inches) OC at right angles to runner channels and secure with furring channel clips.
39. Reinforcement: At light troffers or other openings, reinforce grillage with 19 mm (3/4 inch) cold-rolled channels wired atop and parallel to main runner channels.
 - a. Provide lateral seismic bracing as required by code.
40. Special Shapes: Provide necessary framing and suspension for off sets, verticals, etc.

Insulation

41. Sound Insulation: Place sound Insulation blankets in partitions tight within spaces, around cut openings. behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
 - a. Ductwork Penetrations: Provide one-inch wide clearance around ductwork and pack with fiberglass ready for joint sealers.

Installation Of Gypsum Drywall

42. Reference Standards: Apply and finish gypsum board in accordance with GA 216 and ASTM C 840.
43. Partition Gypsum Board Layout: Apply gypsum wallboard panels vertically with abutting ends and edges occurring over stud flanges or furring.
 - a. Joints on Opposite Sides of Partitions: Stagger; joints shall not occur over same stud.
 - b. Two Layer Construction: Stagger Joints between layers.
44. Ceiling Gypsum Board: Apply gypsum board of maximum practical length with long dimensions at right angles to furring channels. End and edge joints shall occur over furring channels with end joints staggered. Properly support gypsum board around cutouts and openings.
45. Fasteners: Apply board to studs or furring with drywall screws spaced 300 mm (12 inches) OC in field of board and 200 mm (8 inches) OC staggered along abutting edges.
46. Water-Resistant: Apply gypsum wallboard manufacturer's recommended sealant to raw cut edges and screw heads.
47. Cementitious Backer Units (CBU): Install in accordance with ANSI A108.11 and manufacturer's recommendations.
48. Accessories:
 - a. Comer Bead: Apply as recommended by manufacturer at exposed outer corners.
 - b. Trim (Casing Beads): Apply as recommended by manufacturer, where gypsum board abuts other materials, and as indicated.
 - c. Control Joints: Comply with GA 216.
 - 1) Walls: Install at not more than 9 m (30 feet) OC.
 - 2) Ceilings: Install at not more than 15 m (50 feet) OC and where framing changes direction.
 - 3) Coordinate locations with the Owner.
49. Access Panels: Securely install access panels furnished under other sections. Set plumb and square to align with finish surface.

50. Acoustical Sealant: Seal perimeter and penetrations on both sides of sound-rated partitions and partitions with sound-attenuation blankets with minimum of single 6 mm (1/4 inch) bead of sealant
 - a. Locations:
 - 1) Seal around gypsum-board perimeter in angle formed by gypsum-board panels and abutting dissimilar materials.
 - 2) Seal intersections of gypsum board with dissimilar materials.
 - 3) Seal pipe, conduit, ductwork, penetrations, etc.
 - 4) Seal around cutouts for lights, cabinets, pipes, ductwork, electrical boxes, etc.
 - 5) Seal gypsum board panel terminations in door and window frames.
 - 6) Seal control-joint locations before installing control Joints to panels.
 - b. Installation: Comply with ASTM C 919 and requirements of indicated sound-rated assembly. Provide number and positions of beads to comply with sound rating of assembly.
51. Tolerances: Gypsum-board surface plane within plus or minus 3 mm in 3 000 mm (1/8 inch in 10 feet).
52. Finishing: Finish in accordance with GA 214.
 - a. Concealed Locations (Not Exposed to View in Rooms): Level 1
 - b. Beneath Tile: Level 2.
 - c. Other Finished Areas: Level 4. Finish joints, trim, and fastener dimples. Sand smooth.
 - d. Cementitious Backer Units (CBU): Treat joints in accordance with ANSI A108.11 and manufacturer's recommendations.

END OF SECTION 09 23 13 00



Task	Specification	Specification Description
09 23 13 00	09 22 13 00	Gypsum Plaster
09 23 13 00	09 22 13 00a	Gypsum Veneer Plaster
09 23 13 00	09 22 13 00b	Portland Cement Plaster
09 23 13 00	09 22 36 23	Lath and Plaster Renovation
09 24 23 00	09 22 13 00b	Portland Cement Plaster
09 24 33 00	01 22 16 00	No Specification Required
09 28 13 00	09 22 13 00a	Gypsum Veneer Plaster
09 28 13 00	09 31 00 00	Ceramic Tile



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SECTION 09 29 00 00 - CSF GYPSUM BOARD**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.09 29 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Gypsum board and joint treatment.
 2. Gypsum sheathing.
 3. Cementitious backer board.
 4. Sound attenuation blankets.
 5. Finishing.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 1. Section 061000 - Rough Carpentry: Wood framing for attachment of gypsum board.
 2. Section 092216 - Non-Structural Metal Framing: Metal framing for attachment of gypsum board.
 3. Section 099100 - Painting: Field paint finish on gypsum board.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 1. ASTM C36 - Specification for Gypsum Wallboard.
 2. ASTM C79 - Test Method for Gypsum Sheathing Board.
 3. ASTM C557 - Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
 4. ASTM C630 - Specification for Water-Resistant Gypsum Backing Board
 5. ASTM C954 - Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs From 0.033 inches to 0.112 inches in Thickness.
 6. ASTM C1002 - Specification Steel Drill Screws for the Application of Gypsum Panel Products.
 7. ASTM C1177 - Specification for Glass Mat Gypsum Substrate for Use As Sheathing.
 8. ASTM C1178 - Specifications for Glass Mat Water Resistant Gypsum Backing Panel.
 9. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.



10. ASTM E119 - Test Methods for Fire Tests of Building Construction and Materials.

B. Gypsum Association (GA):

1. GA-214 - Recommended Levels of Gypsum Board Finish.
2. GA-216 - Application and Finishing of Gypsum Board.
3. GA-253 - Application of Gypsum Sheathing.
4. GA-600 - Fire Resistance Design Manual.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

- a. Product Data: Data on gypsum board, joint materials, and finish materials.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- C. Stack gypsum board flat to prevent sagging.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

A. Jobsite Requirements:

1. Establish and maintain environmental conditions for applying and finishing gypsum board in conformance with GA-216.
2. Maintain minimum 50 degrees F for 48 hours before application and finishing of gypsum board. Maintain temperature continuously until dry. Do not exceed 95 degrees F when using temporary heat sources.
3. Ventilate building spaces as required to dry joint treatment materials. Prevent drafts during hot, dry weather to avoid finishing materials from drying too rapidly.

NOTE TO SPECIFIER

"REQUIRED Article (ENVIRONMENTAL REQUIREMENTS) follows. Do not revise this Article, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer."

1.7 ENVIRONMENTAL REQUIREMENTS



- A. Resource Management:
1. Recycled Content: Provide gypsum board products with paper backing manufactured from 100 percent post-consumer recycled paper and gypsum core containing minimum 10 percent recycled gypsum.
 - a. Soil amendment from recycled scrap gypsum: Coordinate with Section 329200 - Turf and Grasses to identify requirements for gypsum soil amendment and to prepare scrap gypsum board for use as soil amendment.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Georgia-Pacific Gypsum Products, Atlanta, GA (800) 225-6119.
 2. National Gypsum Company, Gold Bond Building Products, Charlotte, NC (800) 628-4662.
 3. United States Gypsum Company, Chicago, IL (800) 874-4968.
 4. Allied Stud Co., Phoenix, AZ, (800) 877-8823.
 5. Consolidated Fabricators Corp., Paramount, CA, (800) 635-8335
 6. Steeler, Inc., Seattle, WA (800) 275-2279
 7. Western Metal Lath, Inc., Riverside, CA (909) 360-3500
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

- A. Standard Gypsum Board: ASTM C 36; 1/2 inch and 5/8 inch thick 48 inch width, maximum permissible length; ends square cut, tapered edges.
- B. Type X Gypsum Wallboard (Fire Resistant): ASTM C36; 1/2 inch and 5/8 inch thick, 48 inch width, maximum permissible length; ends square cut, edges tapered, providing at least 1-hour fire-retardant rating for boards 5/8 inch thick or 3/4-hour fire-resistance classification for boards 1/2 inch thick, when tested in accordance with ASTM E119.
- C. Water-Resistant Gypsum Backing Board: ASTM C630; 1/2 and 5/8 inch thick, 48 inch width, maximum permissible length; ends and edges straight and solid, edges tapered. Board consisting of a noncombustible water-resistant gypsum core, surfaced on face and back with water-repellent paper bonded to the core.
- D. Water-Resistant Glass Mat Embedded Gypsum Backing Board: ASTM C1178; 1/4 and 1/2 inch thick, 32 inch or 48 inch width, maximum permissible length; ends and edges straight and solid, edges square. Board consisting of a noncombustible water-resistant gypsum core, with glass mat embedded on front and back with the face surface with a heat cured copolymer water and vapor retardant coating. For janitor and toilet rooms where tile is the finish material.
- E. Type X Water-Resistant Gypsum Backing Board (fire-resistant): ASTM C630; 1/2 and 5/8 inch thick, 48 inch width, maximum permissible length; ends and edges straight and solid, edges tapered. Board consisting of a noncombustible water-resistant gypsum core, surfaced on face and back with water-



repellent paper bonded to the core. Providing at least 1-hour fire-retardant rating for boards 5/8 inch thick, or 3/4-hour fire-retardant rating for boards 1/2 inch thick, when tested in accordance with ASTM E119.

- F. Type X Water-Resistant Glass Mat Embedded Gypsum Backing Board (fire-resistant): ASTM C1178; 5/8 inch thick, 48 inch width and 8 foot length; ends and edges straight and solid, edges squared. Board consisting of a noncombustible water-resistant gypsum core, embedded on face and back with water resistant fiberglass mat bonded into the core. Providing at least 1-hour fire-retardant rating for boards 5/8 inch thick, or 3/4-hour fire-retardant rating for boards 1/2 inch thick, when tested in accordance with ASTM E119.
- G. Gypsum Sheathing Board: ASTM C79; moisture resistant type; 1/2 inch (13 mm) thick, maximum available size in place; ends square cut, tongue and grooved edges; water repellent paper faces. Exterior wall sheathing where noted.
- H. Gypsum Sheathing Glass Mat Embedded Board: ASTM C1177; moisture resistant type; 1/2 inch (13 mm) and 5/8 inch thick type X, maximum available size in place; ends and edges straight and solid, edges squared. Water resistant glass mat embossed both sides and edges, treated water resistant gypsum core with alkali resistant coating/primer. Flame spread: 0, smoke developed: 0 when tested in accordance with ASTM E84. Exterior wall sheathing where noted.
- I. Cementitious Backing Board: High density, glass fiber reinforced, 1/2 inch (13 mm) thick x 26 inches or 48 inches x length as required; 2 inch (50 mm) wide, coated glass fiber tape for joints and corners; For janitor and toilet rooms where tile is the finish material.
- J. Sound Attenuation Blankets: Semi-rigid, paperless spun mineral fiber blankets or uniform dimension controlled density of 3 lb./cu. ft. Minimum thickness shall be 1-1/2 inch.
- K. Gypsum Board Fasteners:
 - 1. Metal Framing: ASTM C 954 and C 1002, Type S-12 bugle head, corrosion-resistant self-drilling self-tapping steel screws.
 - a. One Layer 1/2 Inch: 1 inch.
 - b. One Layer 5/8 Inch: 1-1/8 inch.
- L. Gypsum Board Accessories:
 - 1. Corner Beads: 1 1/4 inch by 1 1/4 inch galvanized steel corner bead.
 - 2. Edge Trim: Galvanized steel casing.
 - a. L bead for tight abutment at edges.
 - b. J bead at other locations.
 - 3. Control Joint: No. 093 roll-formed zinc.
 - 4. Joint Materials:
 - a. Reinforcing Tape: Sheetrock Joint Tape. Paper; fiberglass joint tape not permitted.
 - b. Joint Compound: Ready-Mixed All-Purpose Joint Compound.
 - c. Adhesive: Commercial Adhesive complying with ASTM C 557.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.



- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.
- E. Design non-axial load-bearing framing to accommodate 1/2 inch (13 mm) vertical deflection.

3.2 INSTALLATION

- A. Install gypsum board in accordance with manufacturer's published instructions, GA-201 and GA-216.
- B. Where applicable, install ceiling panels before the installation of wall panels.
- C. Erect single layer gypsum board in most economical direction, with attachment to firm bearing surfaces over framing members. Do not align panel joints with edges of openings.
- D. Treat cut edges, holes, fastener heads and joints, including those at angle intersections, in water resistant gypsum board and exterior gypsum soffit board with specified joint compound. Treat cut edges, holes, fastener heads and joints in water resistant glass mat embedded backing board with mastic or mortar. Treat prior to tile installation.
- E. Place gypsum panels over supporting framing members with panel ends aligning and parallel with framing members.
- F. Install fasteners from center of field of panel toward ends and edges. Install fasteners 3/8 inch from ends and edges of panels, and as follows:
 - 1. Ceiling: 12 inches on center, perimeter and field.
 - 2. Walls: 16 inches on center, perimeter and field.

3.3 GYPSUM SHEATHING INSTALLATION

- A. Install gypsum board sheathing in accordance with manufacturer's published instructions, GA-216, GA-253 and GA-600, all latest editions.
 - 1. Erect single layer gypsum board horizontally, with edges butted tight, tongue up with attachment to firm bearing. Glass mat embedded board may be installed horizontally or vertically.
- B. Provide construction control joints at maximum 30 feet on center, at inside corners, and at intersections.
 - 1. Locate panel, allowing 1/4 inch space between edge of panel and adjacent walls, beams, columns, and fascia construction.
- C. Place edge trim where gypsum board abuts dissimilar materials. Use longest practical length.
- D. Using screws, secure panels in place at maximum 12 inches on center to supporting substrate.
- E. Protect all exposed gypsum core at perimeter edges, and penetrations by covering core with metal trim.

3.4 JOINT TREATMENT

- A. Reinforce interior and exterior corners at ceiling and wall surfaces. Apply 3 inch wide initial coating of joint compound, pressing tape firmly into joint compound. Wipe off excess joint compound. Apply



second coat of joint compound with tools of sufficient width to extend beyond joint center, approximately 4 inches. Draw joint compound down to a smooth even plane.

- B. After drying or setting, sand or sponge joints, edges, and corners, eliminating high spots and excessive joint compound to produce smooth finish surface. Prepare surfaces to receive subsequent finishes to height of 6 inches above finish ceiling. Feather coats onto adjoining surfaces resulting in maximum camber of 1/32-inch in 12.
- C. Sand after second and third applications of joint compound. Do not to raise nap of paper when sanding.
- D. Install control joints full height of partition, consistent with lines of building spaces, with 1/2 inch between boards. Apply sealant at base of joint and control joint accessory piece at face.
- E. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.

3.5 FINISH

- A. Apply gypsum board finish in accordance with manufacturer's published instructions and GA-214 Finish Levels.
 - 1. Level 1: All joints and interior angles shall have tape embedded in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.
 - a. Application: In plenum areas above ceilings, in attics, in mechanical rooms, in areas where the assembly is generally concealed, and other areas not normally open to view. Accessories not required, unless shown or required by rating. Where a fire resistance rating is required for the gypsum board assembly, details of construction shall be in accordance with reports of fire tests of assemblies that have met the fire rating requirement.
 - 2. Level 4: All joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. Prepared surface shall be coated with a drywall primer/sealer prior to the application of finish paint. Refer to specification section 099100.
 - a. Application: For use where gloss semi-gloss, enamel, or nontextured flat paints are specified or where severe lighting conditions occur. Generally in all areas except where noted otherwise.

3.6 CONSTRUCTION

- A. Interface with Other Work:
 - 1. Coordinate installation of firestopping Specified in Section 078400 at penetrations through fire-restive rated gypsum board partitions.
 - 2. Coordinate installation of joint sealers specified in Section 079200 at penetrations of non fire-restive rated partitions.

NOTE TO SPECIFIER

"REQUIRED Article (SITE ENVIRONMENTAL PROCEDURES) follows. Do not revise this Article, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer."



USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



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SECTION 09 29 00 00 - MPF GYPSUM BOARD**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 – GENERAL

1.1 SUMMARY

- A. SECTION INCLUDES
 - 1. Interior partitions
 - 2. Security walls and ceilings.
 - 2. Exterior soffits
 - 3. Exterior walls.

1.2 SUBMITTALS

- A. Product Data: Required
 - 1. Technical Sheet: Indicating manufacturer, product composition, V.O.C. content.
 - 2. Schedule of product locations within product.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements: Applicable code for fire rated assemblies:
 - 1. Partitions: UL Assemblies.
 - 2. Ceiling and soffits: UL Assemblies.
- B. Quality Standards: GA-216 - Recommended Specifications for the Application and Finishing of Gypsum Board.
- C. Performance Requirements- Acoustic Attenuation for Interior Partitions: Meet minimum requirements of USPS Standard Design Criteria.
- D. Security Requirements: USPS Handbook RE-5.

PART 2 – PRODUCTS

2.1 MANUFACTURERS/PRODUCTS

- A. Studs and Tracks: Galvanized sheet steel, 20 gage.
- B. Gypsum Board (Recycled 100% paper backing and 20% core if applicable):
 - 1. Interior partitions: Standard, moisture resistant and fire rated, 5/8 inch thick, with tapered edges.
 - 2. Exterior sheathing: 1/2 inch thick, square edges.
 - 3. Exterior soffit board: 3/4 inch thick, tapered edges.

2.2 ACCESSORIES/MIXES

- A. Acoustical Insulation: Preformed mineral wool, unfaced, 3 ½ or 6 inch thick.
- B. Corner Beads and Edge Trim: GA 201 and GA 216.



- C. Joint Materials: Reinforcing tape and joint compound.
- D. Fasteners: Type S12 screws.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Metal stud spacing: 24 inches o.c.
- B. Metal stud spacing for security walls and ceilings: 8 inches o.c.
- C. Wall furring spacing: 24 inches o.c.
- D. Fasten gypsum board to furring or framing with screws.
- E. Tape, fill, and sand joints. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile.
- F. Stencil ratings on firewalls above ceiling at maximum of 10'-0" o.c.

3.2 SCHEDULES

- A. Interior Partitions:
 - 1. Metal Studs: Minimum size 3 - 5/8" inch, 20 gage. Design studs based on loading requirements
 - 2. Gypsum Wall Board:
 - a) Moisture resistant at toilet rooms and wet areas.
 - b) Foil faced in rooms with humidity control.
- B. Wall Furring: 7/8 inch deep hat shaped furring channels at 24 inches on center, zee - furring and rigid board insulation where required for thermal resistance ratings.
- C. Exterior Walls: Size of metal studs and spacing are to be designed based on loading requirement.

3.3 FINISH LEVEL SCHEDULE

- A. Level 1: Above finished ceilings concealed from view.
 - 1. Tape in joint compound at joints and interior angles. Tool marks and ridges acceptable.
- B. Level 2: Utility areas and areas behind cabinetry.
 - 1. Level 1, plus separate coat of compound at joints, angles, fasteners, and accessories. Tool marks and ridges acceptable.
- C. Level 4: Walls and ceilings scheduled to receive flat or eggshell paint finish.
 - 1. Level 1, plus three separate coats of compound at joints, angles, fasteners, and accessories. Compound shall be smooth and free of tool marks and ridges.
- D. Level 5: Walls and ceilings scheduled to receive semi-gloss or gloss paint finish.
 - 1. Level 4, plus separate skim coat of compound over entire surface of gypsum board.



END OF SECTION 09 29 00 00



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Task	Specification	Specification Description
09 29 00 00	01 22 16 00	No Specification Required
09 29 00 00	09 23 13 00	Gypsum Board Renovation
09 30 13 00	09 31 00 00	Ceramic Tile
09 30 16 00	09 31 00 00	Ceramic Tile



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SECTION 09 31 00 00 - CERAMIC TILE**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for ceramic tile. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Ceramic tile.
 - b. Stone thresholds.
 - c. Waterproof membrane.
 - d. Crack isolation membrane.
 - e. Tile backing panels.
 - f. Metal edge strips.

C. Definitions

1. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
2. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."
3. Module Size: Actual tile size plus joint width indicated.
4. Face Size: Actual tile size, excluding spacer lugs.

D. Performance Requirements

1. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
 - a. Level Surfaces: Minimum 0.6.
 - b. Step Treads: Minimum 0.6.
 - c. Ramp Surfaces: Minimum 0.8.

E. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
3. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
4. Samples:
 - a. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.

OR

Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches (300 mm) square, but not fewer than 4 tiles. Use grout of type and in color or colors approved for completed Work.



- b. Full-size units of each type of trim and accessory for each color and finish required.
- c. Stone thresholds in 6-inch (150-mm) lengths.
- d. Metal edge strips in 6-inch (150-mm) lengths.
- 5. Qualification Data: For qualified Installer.
- 6. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- 7. Product Certificates: For each type of product, signed by product manufacturer.
- 8. Material Test Reports: For each tile-setting and -grouting product and special purpose tile.

F. Quality Assurance

- 1. Source Limitations for Tile: Obtain tile of each type and color or finish **OR** tile of each type **OR** tile of each color or finish **OR** tile, **as directed**, from one source or producer.
 - a. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- 2. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.
- 3. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
 - a. Stone thresholds.
 - b. Waterproof membrane.
 - c. Crack isolation membrane.
 - d. Joint sealants.
 - e. Cementitious backer units.
 - f. Metal edge strips.
- 4. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling

- 1. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- 2. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- 3. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- 4. Store liquid materials in unopened containers and protected from freezing.
- 5. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

H. Project Conditions

- 1. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.2 PRODUCTS

A. Products, General

- 1. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 - a. Provide tile complying with Standard grade requirements unless otherwise indicated.
- 2. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 1.2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.



3. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
4. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
 - a. Where tile is indicated for installation in swimming pools, on exteriors or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.
5. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

B. Tile Products

1. Tile Type: Factory-mounted unglazed **OR** glazed, **as directed**, ceramic mosaic tile.
 - a. Composition: Porcelain **OR** Impervious natural clay or porcelain **OR** Vitreous or impervious natural clay or porcelain, **as directed**.
 - b. Module Size: 1 by 1 inch (25.4 by 25.4 mm) **OR** 1 by 2 inches (25.4 by 50.8 mm) **OR** 2 by 2 inches (50.8 by 50.8 mm), **as directed**.
 - c. Thickness: 1/4 inch (6.35 mm).
 - d. Face: Plain **OR** Pattern of design indicated, **as directed**, with cushion edges.
 - e. Surface (for unglazed tile): Smooth, without **OR** Slip-resistant, with, **as directed**, abrasive admixture.
 - f. Finish (for glazed tile): Bright, opaque **OR** Bright, clear **OR** Mat, opaque **OR** Mat, clear **OR** Semimat, opaque **OR** Semimat, clear **OR** Vellum, opaque **OR** Vellum, clear **OR** Crystalline, **as directed**, glaze.
 - g. Tile Color and Pattern: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - h. Grout Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - i. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile, **as directed**. Provide shapes as follows, selected from manufacturer's standard shapes:
 - 1) Base Cove: Cove, module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm), **as directed**.
 - 2) Base Cap for Portland Cement Mortar Installations: Bead (bullnose), module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm), **as directed**.
 - 3) Base Cap for Thin-Set Mortar Installations: Surface bullnose, module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm) **OR** 2 by 2 inches (50.8 by 50.8 mm), **as directed**.
 - 4) Wainscot Cap for Portland Cement Mortar Installations: Bead (bullnose), module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm), **as directed**.
 - 5) Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose, module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm) **OR** 2 by 2 inches (50.8 by 50.8 mm), **as directed**.
 - 6) Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining flat tile.
 - 7) External Corners for Portland Cement Mortar Installations: Bead (bullnose), module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm), **as directed**.
 - 8) External Corners for Thin-Set Mortar Installations: Surface bullnose, module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm) **OR** 2 by 2 inches (50.8 by 50.8 mm), **as directed**.
 - 9) Internal Corners: Cove, module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm), **as directed**.

OR



- Internal Corners: Field-butt square corners. For coved base and cap, use angle pieces designed to fit with stretcher shapes.
- 10) Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch (12.7 to 6.35 mm) across nominal 4-inch (100-mm) dimension.
2. Tile Type: Unglazed **OR** Glazed, **as directed**, square-edged quarry tile.
 - a. Face Size: 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm) **OR** 6 by 3 inches (152 by 76 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 8 by 3-7/8 inches (203 by 98 mm) **OR** 8 by 8 inches (203 by 203 mm), **as directed**.
 - b. Thickness: 3/8 inch (9.5 mm) **OR** 1/2 inch (12.7 mm) **OR** 3/4 inch (19 mm), **as directed**.
 - c. Wearing Surface (for unglazed tile): Nonabrasive, smooth **OR** Abrasive aggregate embedded in surface, **as directed**.
 - d. Finish (for glazed tile): Bright, opaque **OR** Bright, clear **OR** Mat, opaque **OR** Mat, clear **OR** Semimat, opaque **OR** Semimat, clear **OR** Vellum, opaque **OR** Vellum, clear **OR** Crystalline, **as directed**, glaze.
 - e. Tile Color and Pattern: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - f. Grout Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - g. For furan-grouted quarry tile, precoat with temporary protective coating.
 - h. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile, **as directed**. Provide shapes as follows, selected from manufacturer's standard shapes:
 - 1) Base: Coved with surface bullnose top edge, **as directed**, face size 6 by 6 inches (152 by 152 mm) **OR** 8 by 3-7/8 inches (203 by 98 mm), **as directed**.
 - 2) Wainscot Cap: Surface bullnose, face size 6 by 6 inches (152 by 152 mm) **OR** 8 by 3-7/8 inches (203 by 98 mm), **as directed**.
 - 3) Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining flat tile.
 3. Tile Type: Unglazed **OR** Glazed, **as directed**, paver tile.
 - a. Composition: Porcelain **OR** Impervious natural clay or porcelain **OR** Vitreous or impervious natural clay or porcelain **OR** Natural clay or porcelain, **as directed**.
 - b. Face Size: 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 7-3/4 by 3-7/8 inches (197 by 98 mm) **OR** 7-7/8 by 7-7/8 inches (200 by 200 mm) **OR** 11-13/16 by 11-13/16 inches (300 by 300 mm) **OR** 165 by 333 mm **OR** 200 by 250 mm **OR** 250 by 250 mm **OR** 165 by 333 mm **OR** 333 by 333 mm **OR** 400 by 400 mm, **as directed**.
 - c. Thickness: 1/4 inch (6.35 mm) **OR** 3/8 inch (9.5 mm) **OR** 1/2 inch (12.7 mm), **as directed**.
 - d. Face: Plain with square or cushion edges **OR** Plain with square edges **OR** Plain with cushion edges **OR** Pattern of design indicated, with square or cushion edges **OR** As indicated, **as directed**.
 - e. Finish (for glazed tile): Bright, opaque **OR** Bright, clear **OR** Mat, opaque **OR** Mat, clear **OR** Semimat, opaque **OR** Semimat, clear **OR** Vellum, opaque **OR** Vellum, clear **OR** Crystalline, **as directed**, glaze.
 - f. Tile Color and Pattern: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - g. Grout Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 4. Tile Type: Glazed wall tile **OR** Decorative thin wall tile, **as directed**.
 - a. Module Size: 4-1/4 by 4-1/4 inches (108 by 108 mm) **OR** 6 by 4-1/4 inches (152 by 108 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 200 by 200 mm **OR** 250 by 250 mm **OR** 200 by 300 mm, **as directed**.
 - b. Thickness: 5/16 inch (8 mm).



- c. Face: Plain with modified square edges or cushion edges **OR** Plain with modified square edges **OR** Plain with cushion edges **OR** Pattern of design indicated, with manufacturer's standard edges, **as directed**.
- d. Finish: Bright, opaque **OR** Bright, clear **OR** Mat, opaque **OR** Mat, clear **OR** Semimat, opaque **OR** Semimat, clear **OR** Vellum, opaque **OR** Vellum, clear **OR** Crystalline, **as directed**, glaze.
- e. Tile Color and Pattern: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
- f. Grout Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
- g. Mounting: Factory, back mounted.
- h. Mounting: PregROUTED sheets of tiles factory assembled and grouted with manufacturer's standard white silicone rubber.
- i. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile, **as directed**. Provide shapes as follows, selected from manufacturer's standard shapes:
 - 1) Base for Portland Cement Mortar Installations: Coved, module size 4-1/4 by 4-1/4 inches (108 by 108 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 6 by 3-3/4 inches (152 by 95 mm), **as directed**.
 - 2) Base for Thin-Set Mortar Installations: Straight, module size 4-1/4 by 4-1/4 inches (108 by 108 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 6 by 2 inches (152 by 51 mm), **as directed**.
 - 3) Wainscot Cap for Portland Cement Mortar Installations: Bullnose cap, module size 4-1/4 by 4-1/4 inches (108 by 108 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 6 by 2 inches (152 by 51 mm), **as directed**.
 - 4) Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose, module size 4-1/4 by 4-1/4 inches (108 by 108 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 6 by 2 inches (152 by 51 mm), **as directed**.
 - 5) Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining flat tile.
 - 6) External Corners for Portland Cement Mortar Installations: Bullnose shape with radius of at least 3/4 inch (19 mm) unless otherwise indicated.
 - 7) External Corners for Thin-Set Mortar Installations: Surface bullnose, same size as adjoining flat tile.
 - 8) Internal Corners: Field-butt square corners. For coved base and cap use angle pieces designed to fit with stretcher shapes.
- 5. Accessories: Provide vitreous china accessories of type and size indicated, suitable for installing by same method as adjoining wall tile.
 - a. One soap holder with grab handle, **as directed**, for each shower and tub indicated.
 - b. One paper holder at each water closet.
 - c. Color and Finish: Match adjoining glazed wall tile **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range **OR** White, bright glaze, **as directed**.

C. Thresholds

- 1. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
 - a. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch (12.7 mm) or less above adjacent floor surface.
- 2. Granite Thresholds: ASTM C 615, with polished **OR** honed, **as directed**, finish.
 - a. Description: Uniform, fine **OR** medium, **as directed**, -grained, white **OR** gray **OR** black, **as directed**, stone without veining.
OR
Description: Match sample.



3. Marble Thresholds: ASTM C 503, with a minimum abrasion resistance of 10 **OR** 12, **as directed**, per ASTM C 1353 or ASTM C 241 and with honed finish.
 - a. Description: Uniform, fine- to medium-grained white stone with gray veining.
OR
Description: Match sample.
 4. Slate Thresholds: ASTM C 629, Classification I Exterior **OR** II Interior, **as directed**, with fine, even grain and honed finish.
 - a. Description: Uniform, black **OR** blue-black **OR** gray **OR** blue-gray **OR** green, **as directed**, stone and unfading.
OR
Description: Match sample.
- D. Tile Backing Panels
1. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325, in maximum lengths available to minimize end-to-end butt joints.
 - a. Thickness: 1/4 inch (6.4 mm) **OR** 1/2 inch (12.7 mm) **OR** 5/8 inch (15.9 mm) **OR** As indicated, **as directed**.
 2. Fiber-Cement Underlayment: ASTM C 1288, in maximum lengths available to minimize end-to-end butt joints.
 - a. Thickness: 1/4 inch (6.4 mm) **OR** 1/2 inch (12.7 mm) **OR** As indicated, **as directed**.
- E. Waterproof Membrane
1. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
 2. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch (0.76-mm) nominal thickness.
 3. PVC Sheet: Two layers of PVC sheet heat-fused together and to facings of nonwoven polyester; 0.040-inch (1.01-mm) nominal thickness.
 4. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch (0.203-mm) nominal thickness.
 5. Fabric-Reinforced, Modified-Bituminous Sheet: Self-adhering, SBS-modified-bituminous sheet with woven reinforcement facing; 0.040-inch (1.01-mm) nominal thickness.
 6. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.
 7. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
 8. Latex-Portland Cement: Flexible mortar consisting of cement-based mix and latex additive.
 9. Urethane Waterproofing and Tile-Setting Adhesive: One-part, liquid-applied urethane, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), in a consistency suitable for trowel application and intended for use as both waterproofing and tile-setting adhesive in a two-step process.
- F. Crack Isolation Membrane
1. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for standard **OR** high, **as directed**, performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
 2. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch (0.76-mm) nominal thickness.
 3. PVC Sheet: Two layers of PVC sheet heat-fused together and to facings of nonwoven polyester; 0.040-inch (1.01-mm) nominal thickness.
 4. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch (0.203-mm) nominal thickness.
 5. Corrugated Polyethylene: Corrugated polyethylene with dovetail-shaped corrugations and with anchoring webbing on the underside; 3/16-inch (4-mm) nominal thickness.



6. Fabric-Reinforced, Modified-Bituminous Sheet: Self-adhering, modified-bituminous sheet with fabric reinforcement facing; 0.040-inch (1.01-mm) nominal thickness.
7. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and fabric reinforcement.
8. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
9. Latex-Portland Cement: Flexible mortar consisting of cement-based mix and latex additive.
10. Urethane Crack Isolation Membrane and Tile-Setting Adhesive: One-part, liquid-applied urethane, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), in a consistency suitable for trowel application and intended for use as both waterproofing and tile-setting adhesive in a two-step process.

G. Setting Materials

1. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.
 - a. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils (0.1 mm) thick.
 - b. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches (50.8 by 50.8 mm) by 0.062-inch (1.57-mm) diameter; comply with ASTM A 185 and ASTM A 82 except for minimum wire size.
 - c. Expanded Metal Lath: Diamond-mesh lath complying with ASTM C 847.
 - 1) Base Metal and Finish for Interior Applications: Uncoated or zinc-coated (galvanized) steel sheet, with uncoated steel sheet painted after fabrication into lath.
 - 2) Base Metal and Finish for Exterior Applications: Zinc-coated (galvanized) steel sheet.
 - 3) Configuration over Studs and Furring: Flat.
 - 4) Configuration over Solid Surfaces: Self furring.
 - 5) Weight: 2.5 lb/sq. yd. (1.4 kg/sq. m) **OR** 3.4 lb/sq. yd. (1.8 kg/sq. m), **as directed**.
 - d. Latex Additive: Manufacturer's standard, acrylic resin or styrene-butadiene-rubber water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.
2. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.
 - a. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.1.
3. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
 - a. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
OR
Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
 - b. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
4. Medium-Bed, Latex-Portland Cement Mortar: Comply with requirements in ANSI A118.4. Provide product that is approved by manufacturer for application thickness of 5/8 inch (16 mm).
 - a. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
OR
Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
5. EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar (Thin Set): ANSI A118.11.
 - a. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 - b. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
6. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).



- a. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 deg F (60 deg C) and 212 deg F (100 deg C), respectively, and certified by manufacturer for intended use.
7. Chemical-Resistant Furan Mortar: ANSI A118.5, with carbon filler.
8. Organic Adhesive: ANSI A136.1, Type I, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

H. Grout Materials

1. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.
2. Standard Cement Grout: ANSI A118.6.
3. Polymer-Modified Tile Grout: ANSI A118.7.
 - a. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.

OR

Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.
4. Water-Cleanable Epoxy Grout: ANSI A118.3.
 - a. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 deg F (60 deg C) and 212 deg F (100 deg C), respectively, and certified by manufacturer for intended use.
5. Chemical-Resistant Furan Grout: ANSI A118.5, with carbon filler.
6. Grout for Pregrouted Tile Sheets: Same product used in factory to pregrout tile sheets.

I. Elastomeric Sealants

1. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 7 Section "Joint Sealants."
 - a. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.
2. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.
3. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
4. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.
5. Chemical-Resistant Sealants: For chemical-resistant floors, provide chemical-resistant elastomeric sealant of type recommended and produced by chemical-resistant mortar and grout manufacturer for type of application indicated, with proven service record and compatibility with tile and other setting materials, and with chemical resistance equivalent to mortar/grout.

J. Miscellaneous Materials

1. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
2. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; half-hard brass **OR** white zinc alloy **OR** nickel silver **OR** stainless-steel, ASTM A 666, 300 Series, **as directed**, exposed-edge material.



3. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
 - a. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F (49 to 60 deg C) per ASTM D 87.
 - b. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.
4. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
5. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.

K. Mixing Mortars And Grout

1. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
2. Add materials, water, and additives in accurate proportions.
3. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

1.3 EXECUTION

A. Examination

1. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - a. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - b. Verify that concrete substrates for tile floors installed with adhesives, bonded mortar bed or thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - 1) Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - 2) Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 - c. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 - d. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

1. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
2. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.
3. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.



4. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

C. Tile Installation

1. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
 - a. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
 - 1) Exterior tile floors.
 - 2) Tile floors in wet areas.
 - 3) Tile swimming pool decks.
 - 4) Tile floors in laundries.
 - 5) Tile floors composed of tiles 8 by 8 inches (200 by 200 mm) or larger.
 - 6) Tile floors composed of rib-backed tiles.
2. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
3. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
4. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - a. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - b. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - c. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
5. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
 - a. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).
 - b. Quarry Tile: 1/4 inch (6.35 mm) **OR** 3/8 inch (9.5 mm), **as directed**.
 - c. Paver Tile: 1/4 inch (6.35 mm) **OR** 3/8 inch (9.5 mm), **as directed**.
 - d. Glazed Wall Tile: 1/16 inch (1.6 mm).
 - e. Decorative Thin Wall Tile: 1/16 inch (1.6 mm).
6. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
7. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - a. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
 - b. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants".
8. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
 - a. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-portland cement mortar (thin set).
 - b. Do not extend cleavage membrane, waterproofing or crack isolation membrane under thresholds set in dry-set portland cement or latex-portland cement mortar. Fill joints between such thresholds and adjoining tile set on cleavage membrane, waterproofing or crack isolation membrane with elastomeric sealant.



9. Metal Edge Strips: Install at locations indicated **OR** where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile **OR** where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated, **as directed**.
 10. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.
- D. Tile Backing Panel Installation
1. Install cementitious backer units and fiber-cement underlayment and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.
- E. Waterproofing Installation
1. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.
 2. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.
- F. Crack Isolation Membrane Installation
1. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.
 2. Do not install tile or setting materials over crack isolation membrane until membrane has cured.
- G. Cleaning And Protecting
1. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - a. Remove epoxy and latex-portland cement grout residue from tile as soon as possible.
 - b. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
 - c. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.
 2. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
 3. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
 4. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.
- H. Exterior Tile Installation Schedule
1. Exterior Floor Installations:
 - a. Tile Installation F101: Cement mortar bed (thickset) bonded to concrete **OR** over waterproof membrane on concrete **OR** over waterproof membrane on concrete where indicated and bonded to concrete where membrane is not indicated, **as directed**; TCA F101 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.



- 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- b. Tile Installation F102: Thin-set mortar on concrete **OR** over waterproof membrane on concrete **OR** over waterproof membrane on concrete where indicated and on concrete where membrane is not indicated, **as directed**; TCA F102.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
2. Exterior Wall Installations, Masonry or Concrete:
 - a. Tile Installation W201: Cement mortar bed (thickset) on metal lath over waterproof membrane; TCA W201 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - b. Tile Installation W202: Thin-set mortar; TCA W202.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- I. Interior Tile Installation Schedule
 1. Interior Floor Installations, Concrete Subfloor:
 - a. Tile Installation F111: Cement mortar bed (thickset) with cleavage membrane; TCA F111 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - b. Tile Installation F112: Cement mortar bed (thickset) bonded to concrete; TCA F112 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - c. Tile Installation F113: Thin-set mortar; TCA F113.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.



- 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- d. Tile Installation F114: Cement mortar bed (thickset) with cleavage membrane; epoxy **OR** furan, **as directed**, grout; TCA F114 and ANSI A108.1B.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Water-cleanable epoxy **OR** Chemical-resistant furan, **as directed**, grout.
- e. Tile Installation F115: Thin-set mortar; epoxy **OR** furan, **as directed**, grout; TCA F115.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Water-cleanable epoxy **OR** Chemical-resistant furan, **as directed**, grout.
- f. Tile Installation F116: Organic adhesive **OR** Water-cleanable, tile-setting epoxy, **as directed**; TCA F116.
 - 1) Tile Type: as directed by the Owner.
 - 2) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- g. Tile Installation F121: Cement mortar bed (thickset) on waterproof membrane; TCA F121 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- h. Tile Installation F122: Thin-set mortar on waterproof membrane; TCA F122.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Polymer-modified sanded **OR** unsanded, **as directed**, grout.
- i. Tile Installation F125A: Thin-set mortar on crack isolation membrane; TCA F125A.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- j. Tile Installation F131: Water-cleanable, tile-setting epoxy; epoxy grout; TCA F131.
 - 1) Tile Type: as directed by the Owner.
 - 2) Grout: Water-cleanable epoxy grout.
- k. Tile Installation F132: Water-cleanable, tile-setting epoxy on cured cement mortar bed bonded to concrete subfloor **OR** installed over cleavage membrane, **as directed**; epoxy grout; TCA F132.
 - 1) Tile Type: as directed by the Owner.
 - 2) Grout: Water-cleanable epoxy grout.
- l. Tile Installation F133: Chemical-resistant furan mortar **OR** Water-cleanable, tile-setting epoxy, **as directed**; furan grout. TCA F133 except use water-cleanable, tile-setting epoxy instead of chemical-resistant furan mortar for setting tile.
 - 1) Tile Type: as directed by the Owner.
 - 2) Grout: Chemical-resistant furan grout.
2. Interior Floor Installations, Wood Subfloor:
 - a. Tile Installation F121: Cement mortar bed (thickset) on waterproof membrane; TCA F121 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.



- 1) Tile Type: as directed by the Owner.
- 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
- 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- b. Tile Installation F141: Cement mortar bed (thickset) with cleavage membrane; TCA F141 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- c. Tile Installation F142: Organic adhesive; TCA F142.
 - 1) Tile Type: as directed by the Owner.
 - 2) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- d. Tile Installation F143: Water-cleanable, tile-setting epoxy; epoxy grout; TCA F143.
 - 1) Tile Type: as directed by the Owner.
 - 2) Grout: Water-cleanable epoxy grout.
- e. Tile Installation F144: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCA F144.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- f. Tile Installation F150/160: Thin-set mortar on exterior-glue plywood; TCA F150 or TCA F160.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: EGP latex-portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
3. Interior Radiant Heat Floor Installations, Concrete Subfloor:
 - a. Tile Installation RH110: Thin-set mortar on crack isolation membrane; hydronic piping installed in concrete; TCA RH110.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - b. Tile Installation RH115: Thin-set mortar; electric radiant system encapsulated in thin-set mortar; TCA RH115.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.



- c. Tile Installation RH116: Thin-set mortar on crack isolation membrane; electric radiant system encapsulated in cementitious self-leveling underlayment; TCA RH116.
 - 1) Tile Type: as directed by the Owner.
 - 2) Cementitious Self-Leveling Underlayment: Specified in Division 03 Section "Hydraulic Cement Underlayment".
 - 3) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - 4. Interior Radiant Heat Floor Installations, Wood Subfloor:
 - a. Tile Installation RH130: Thin-set mortar on exterior-glue plywood; electric radiant system encapsulated in thin-set mortar; TCA RH130.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: EGP latex-portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - b. Tile Installation RH135: Thin-set mortar on cementitious backer units or fiber cement underlayment; electric radiant system encapsulated in thin-set mortar; TCA RH135.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - c. Tile Installation RH140: Thin-set mortar on crack isolation membrane; electric radiant system encapsulated in cementitious self-leveling underlayment; TCA RH140.
 - 1) Tile Type: as directed by the Owner.
 - 2) Cementitious Self-Leveling Underlayment: Specified in Division 03 Section "Hydraulic Cement Underlayment".
 - 3) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - 5. Interior Wall Installations, Masonry or Concrete:
 - a. Tile Installation W202: Thin-set mortar; TCA W202.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - b. Tile Installation W211: Cement mortar bed (thickset) bonded to substrate; TCA W211 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.



- c. Tile Installation W221: Cement mortar bed (thickset) on metal lath over waterproof membrane, **as directed**; TCA W221 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- d. Tile Installation W222: One-coat cement mortar bed (thickset) on metal lath over waterproof membrane, **as directed**; TCA W222 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- e. Tile Installation W223: Organic adhesive; TCA W223.
 - 1) Tile Type: as directed by the Owner.
 - 2) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- 6. Interior Wall Installations, Wood Studs or Furring:
 - a. Tile Installation W221: Cement mortar bed (thickset) over waterproof membrane, **as directed**, on solid backing; TCA W221 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - b. Tile Installation W222: One-coat cement mortar bed (thickset) over waterproof membrane, **as directed**, on solid backing; TCA W222 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - c. Tile Installation W223: Organic adhesive on solid backing; TCA W223.
 - 1) Tile Type: as directed by the Owner.
 - 2) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.



- d. Tile Installation W231: Cement mortar bed (thickset); TCA W231 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- e. Tile Installation W243: Thin-set mortar on gypsum board; TCA W243.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- f. Tile Installation W244: Thin-set mortar on cementitious backer units or fiber cement underlayment over cleavage membrane, **as directed**; TCA W244.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- g. Tile Installation W245: Thin-set mortar **OR** Organic adhesive, **as directed**, on coated glass-mat, water-resistant gypsum backer board; TCA W245.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- 7. Interior Wall Installations, Metal Studs or Furring:
 - a. Tile Installation W221: Cement mortar bed (thickset) over waterproof membrane, **as directed**, on solid backing; TCA W221 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - b. Tile Installation W222: One-coat cement mortar bed (thickset) over waterproof membrane, **as directed**, on solid backing; TCA W222 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - c. Tile Installation W223: Organic adhesive on solid backing; TCA W223.
 - 1) Tile Type: as directed by the Owner.



- 2) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- d. Tile Installation W241: Cement mortar bed (thickset); TCA W241 and ANSI A108.1B.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- e. Tile Installation W242: Organic adhesive on gypsum board; TCA W242.
 - 1) Tile Type: as directed by the Owner.
 - 2) Grout: Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- f. Tile Installation W243: Thin-set mortar on gypsum board; TCA W243.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- g. Tile Installation W244: Thin-set mortar on cementitious backer units or fiber cement underlayment over cleavage membrane, **as directed**; TCA W244.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- h. Tile Installation W245: Thin-set mortar **OR** Organic adhesive, **as directed**, on coated glass-mat, water-resistant gypsum backer board; TCA W245.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
8. Bathtub Wall Installations, Wood **OR** Metal, **as directed**, Studs or Furring:
 - a. Tile Installation B413: Thin-set mortar **OR** Organic adhesive, **as directed**, on water-resistant gypsum board; TCA B413.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
9. Bathtub/Shower Wall Installations, Wood **OR** Metal, **as directed**, Studs or Furring:
 - a. Tile Installation B411: Cement mortar bed (thickset); TCA B411 and ANSI A108.1A.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - b. Tile Installation B412: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCA B412.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.



- 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- c. Tile Installation B419: Thin-set mortar **OR** Organic adhesive, **as directed**, on coated glass-mat, water-resistant backer board; TCA B419.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
10. Shower Receptor and Wall Installations, Concrete or Masonry:
 - a. Tile Installation B414: Cement mortar bed (thickset); TCA B414 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - b. Tile Installation B421: Thin-set mortar on waterproof membrane; TCA B421.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex-portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - c. Tile Installation B422: Thin-set mortar on waterproof membrane with integrated bonding flange for bonded membranes; TCA B422.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
11. Shower Receptor and Wall Installations, Wood **OR** Metal, **as directed**, Studs or Furring:
 - a. Tile Installation B414: Cement mortar bed (thickset); TCA B414 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - b. Tile Installation B415: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCA B415.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - c. Tile Installation B420: Thin-set mortar on coated glass-mat, water-resistant backer board; TCA B420.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.



- 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- d. Tile Installation B421: Thin-set mortar on waterproof membrane over cementitious backer units or fiber cement underlayment; TCA B421.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex-portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- e. Tile Installation B422: Thin-set mortar on waterproof membrane over cementitious backer units or fiber cement underlayment with integrated bonding flange for bonded membranes; TCA B422.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex-portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

END OF SECTION 09 31 00 00



Task	Specification	Specification Description
09 32 00 00	09 31 00 00	Ceramic Tile
09 34 00 00	09 31 00 00	Ceramic Tile
09 35 00 00	09 31 00 00	Ceramic Tile



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SECTION 09 51 13 00 - CSF ACOUSTICAL PANEL CEILINGS**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.09 51 13 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Suspended metal grid ceiling system.
 - 2. Acoustical panels.
 - 3. Perimeter trim.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 210000 - Fire Suppression: Sprinkler heads in ceiling system.
 - 2. Section 233713 - Diffusers Registers and Grilles: Air diffusion devices in ceiling system.
 - 3. Section 265100 - Interior Lighting: Light fixtures attached to ceiling system.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM C 635 - Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
 - 2. ASTM C 636 - Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
 - 3. ASTM E 84 Test Method for Surface Burning Characteristics of Building Materials.

NOTE TO SPECIFIER

Use ASTM E 580 in Seismic Zones where seismic restraint design of ceiling suspension system is a part of the Work. Delete for other zones.

- 4. ASTM E 580 - Specification for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Requiring Seismic Restraint.



1.3 SYSTEM DESCRIPTION

- A. Design Requirements: Rigidly secure acoustical ceiling system including integral mechanical and electrical components with maximum deflection of 1/360.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for Submittals.
1. Product Data: Metal grid suspension system components and acoustical panel units.
 2. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other work or ceiling finishes, interrelation of mechanical and electrical items related to system.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of this Section with minimum 5 years documented experience.
- B. Regulatory Requirements: Surface Burning Characteristics in Accordance with ASTM E 84 for Class III or C finish:
1. Flame Spread: Less than 200.
 2. Smoke Density: Less than 450.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements Transport, handle, store, and protect products.
- B. Deliver acoustical units in manufacturer's original unopened containers with brand name and type clearly marked.
- C. Store under cover in dry, watertight conditions.
- D. Prior to installation, store acoustical units for 24 hours minimum at same temperature and relative humidity as space where Work will be installed.

1.7 PROJECT CONDITIONS

- A. Jobsite Requirements: Maintain uniform temperature range of 60-85 degrees F, and humidity of no more than 70 percent relative humidity prior to, during, and after installation.

NOTE TO SPECIFIER

REQUIRED ARTICLE (Environmental Requirements) follows. Do not revise this Article, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Resource Management:
1. Recycled Content:



- a. Acoustical panels type ACT-1: Manufactured from minimum 20 percent recycled newsprint.
- b. Acoustical panels type ACT-2: Manufactured from minimum 65 percent recovered slag.
- c. Suspension system: Manufactured from minimum 20 percent recycled steel.

1.9 MAINTENANCE

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Extra Materials: Provide 1 box of extra acoustical panels for each panel type, pattern, and color to Contracting Officer.

NOTE TO SPECIFIER

“REQUIRED Part (Products) follows. Do not revise this Part, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer.”

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Suspension System: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 - 1. Armstrong World Industries, Incorporated, Lancaster, PA (800) 448-1405.
 - 2. Chicago Metallic Corporation, Chicago, IL (800) 323-7164.
 - 3. USG Interiors, Chicago, IL (800) 950-3839.
 - 4. Certainteed Ceilings (800) 346-7978
- B. Acoustical Panels: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 - 1. Armstrong World Industries Incorporated, Lancaster, PA (800) 448-1405.
 - 2. USG Interiors, Chicago, IL (800) 950-3839.
 - 3. Certainteed Ceilings (800) 346-7978
- C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 SUSPENSION SYSTEM

- A. Model:
 - 1. Armstrong: Prelude 15/16 inch Exposed Tee System.
 - 2. Chicago Metallic: 1200 System.
 - 3. USG: Donn DX System.
 - 4. Certainteed: Classic Stab CS12-12-15
- B. Description:
 - 1. Grid: ASTM C 635, intermediate duty, steel exposed T; nominal 1 inch width; stab-in connections.
 - 2. Accessories: Stabilizer bars, clips, and splices.
 - 3. Grid Finish: White.
 - 4. Support System: Hot or cold rolled steel channels; galvanized hanger wire, minimum 12 gage.
 - 5. Edge Moldings: Metal channel with exposed flange to match suspension system.

**NOTE TO SPECIFIER**

Use **COMPRESSION STRUTS** in Seismic Zones where seismic restraint design of ceiling suspension system is a part of the Work. Delete for other zones.

6. Compression Struts: Indicated on Drawings.

NOTE TO SPECIFIER

Coordinate the Acoustical Ceiling Tile Identification Numbers (ACT-1, ACT-2, etc.) used herein with Numbers used to identify each tile type on the Drawings.

2.3 ACOUSTICAL PANELS

A. Type ACT-1:

1. Model:

- a. Armstrong: Fine Fissured #1729.
- b. Certaineed : HHF – 157
- c. USG: Auratone, Radar #2310.

2. Description:

- a. Size: 24 x 48 x 5/8 inches.
- b. Edge: Square lay-in.
- c. Weight: minimum 0.60 pounds per square foot.
- d. Surface Finish: Factory-applied vinyl latex paint, perforated, and scored.
- e. Color: White.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify that layout of hangers will not interfere with other Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION - SUSPENSION SYSTEM

NOTE TO SPECIFIER

Use **ASTM E 580** in Seismic Zones where seismic restraint design of ceiling suspension system is a part of the Work. Delete for other zones.

- A. Install system in accordance with ASTM C 636 [ASTM E 580] and manufacturer's published instructions.



- B. Provide metal hanger tabs and clips attached to metal deck where required for attachment of suspension wires.
- C. Hang system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest affected hangers and related carrying channels to span extra distance.
- D. Locate system on room axis according to Reflected Ceiling Plan, where indicated on Drawings, or locate system to a balanced grid design with edge units no less than 50 percent of acoustical panel size where Reflected Ceiling Plan not shown on Drawings
- E. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Do not eccentrically load system, or produce rotation of runners.
- F. Install edge molding at intersection of ceiling and vertical surfaces using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions. Secure at 16 inches (41 cm) on center.
- G. Install hold-down clips within five feet of doors.

NOTE TO SPECIFIER

Use CROSS TEE RIVETS in Seismic Zones where seismic restraint design of ceiling suspension system is a part of the Work. Delete for other zones.

- H. Rivet cross tee's at 4 feet on center to edge mould.

NOTE TO SPECIFIER

Use COMPRESSION STRUTS in Seismic Zones where seismic restraint design of ceiling suspension system is a part of the Work. Delete for other zones.

- I. Install compression struts and secure system with tie wires as indicated on Drawings.
 - 1. Provide hanger wires, splayed 45 degrees, within 3 inches of intersection between main runner and cross runner.
 - 2. Provide compression strut and splayed hanger wires as follows:
 - a. One assembly for each light fixture.
 - b. Located within 6 feet of wall.
 - c. Located at maximum 12 feet on center or as indicated on Drawings.

3.3 INSTALLATION - ACOUSTICAL PANELS

- A. Fit acoustic units in place free from damaged edges or other defects. Install acoustic units level, in uniform plane, and free from twist, warp, and dents.

3.4 CONSTRUCTION

- A. Interface with Other Work:
 - 1. Do not install acoustical ceilings until building is enclosed, heating is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
 - 2. Schedule installation of acoustic units after interior wet work is completed.
 - 3. Install after major above ceiling work is complete.



4. Coordinate location of hangers with other Work.

B. Site Tolerances:

1. Variation from Flat and Level Surface: 1/8 inch in 12 feet.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection.

- B. Inspect acoustical panel placement, ceiling grid suspension system installation and connection to structure.

NOTE TO SPECIFIER

"REQUIRED Article (SITE ENVIRONMENTAL PROCEDURES) follows. Do not revise this Article, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer."

3.6 SITE ENVIRONMENTAL PROCEDURES

- A. Indoor Air Quality:

1. Temporary ventilation: As specified in Section 013543 - Environmental Procedures.
 - a. Ventilate products prior to installation. Remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources and residues. Provide a temperature range of 60 degrees F minimum to 90 degree F maximum continuously for minimum 72 hours. Do not ventilate within limits of Work unless otherwise approved by USPS Contracting Officer.

3.7 CLEANING

- A. Section 017300 - Execution: Cleaning installed Work.

- B. Clean exposed surfaces of acoustical ceilings including trim, edge mouldings, and suspension system members.

USPS CSF Specifications issued: 10/1/2013

Last revised: 4/12/2011

END OF SECTION



SECTION 09 51 13 00 - MPF ACOUSTICAL PANEL CEILINGS**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 – GENERAL

1.1 SUMMARY

- A. Acoustical tile and suspension system.

1.2 SUBMITTALS

- A. Product Data: Required.
- B. Shop Drawings: Required.
- C. Samples: Required.

1.3 QUALITY ASSURANCE

- A. Quality Standards:
 - 1. Acoustical Panels, ASTM E, 1264 Class A.
 - 2. Suspension System ASTM C 635, for seismic requirements ASTM E 580.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Suspension System (Fabricate with 20% recycled steel):
 - 1. Heavy duty exposed T with 15/16 inch wide face, cold rolled galvanized steel, white color.
 - 2. Source: Armstrong, USG, Chicago Metallic.
- B. Acoustical Panels (Fabricate with 65% recycled slag):
 - 1. Size: 24 x 48 inches.
 - 2. Thickness: ¾ inches.
 - 3. Edge: Tegular.
 - 4. Surface finish: Non-directional fissured (vinyl faced panels where required).
 - 5. Source: Armstrong, USG, Celotex.
- C. Acoustical Insulation:
 - 1. Fiberglass blanket type (25% recycled glass).
 - 2. Install fiberglass blanket insulation on top of acoustical ceiling panels where required to achieve acoustical control requirements.

PART 3 – EXECUTION

- 3.1 Install all products in accordance with manufacturer's guidelines and printed instructions.



USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 3/31/2010

END OF SECTION 09 51 13 00



SECTION 09 51 23 00 - ACOUSTICAL TILE CEILINGS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for acoustical tile ceilings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes acoustical tiles for ceilings and the following:
 - a. Concealed suspension systems.
 - b. Direct attachment of tiles to substrates with adhesive.
 - c. Direct attachment of tiles to substrates with staples.
2. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

C. Definitions

1. AC: Articulation Class.
2. CAC: Ceiling Attenuation Class.
3. LR: Light-Reflectance coefficient.
4. NRC: Noise Reduction Coefficient.

D. Submittals

1. Product Data: For each type of product indicated.
2. Coordination Drawings: Drawn to scale and coordinating acoustical tile ceiling installation with hanger attachment to building structure and ceiling mounted items. Show size and location of initial access modules.
3. Samples: For each exposed finish.
4. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
 - b. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
5. Field quality-control test reports.
6. Product test reports.
7. Research/evaluation reports.
8. Maintenance data.

E. Quality Assurance

1. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
2. Fire-Test-Response Characteristics: Provide acoustical tile ceilings that comply with the following requirements:
 - a. Fire-Resistance Characteristics: Where indicated, provide acoustical tile ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1) Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.



- 2) Identify materials with appropriate markings of applicable testing and inspecting agency.
 - b. Surface-Burning Characteristics: Provide acoustical tiles with the following surface-burning characteristics complying with ASTM E 1264 for Class A **OR B OR C**, **as directed**, materials as determined by testing identical products per ASTM E 84:
 - 1) Smoke-Developed Index: 450 or less.
 3. Seismic Standard: Provide acoustical tile ceilings designed and installed to withstand the effects of earthquake motions according to the following:
 - a. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
 - b. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings--Seismic Zones 0-2."
 - c. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4."
 - d. UBC Standard 25-2, "Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings."
 - e. ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."
 4. Preinstallation Conference: Conduct conference at Project site.
- F. Delivery, Storage, And Handling
1. Deliver acoustical tiles, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
 2. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.
 3. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

1.2 PRODUCTS

A. Acoustical Tiles, General

1. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
 - a. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.
2. Acoustical Tile Colors and Patterns: Match appearance characteristics indicated for each product type.
 - a. Where appearance characteristics of acoustical tiles are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by the Owner from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.
3. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical tiles treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.
4. Antimicrobial Fungicide Treatment: Provide acoustical tiles with face and back surfaces coated with antimicrobial treatment consisting of manufacturer's standard formulation with fungicide



added to inhibit growth of mold and mildew and showing no mold or mildew growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

B. Acoustical Tiles For Acoustical Tile Ceiling

1. Classification: Provide fire-resistance-rated, **as directed**, tiles complying with ASTM E 1264 for type, form, and pattern as follows:
 - a. Type III, mineral base with painted finish; Form 1, nodular **OR** 2, water felted **OR** 4, cast or molded, **as directed**.
 - b. Pattern: C (perforated, small holes) **OR** CD (perforated, small holes and fissured) **OR** CE (perforated, small holes and lightly textured) **OR** D (fissured) **OR** E (lightly textured) **OR** F (heavily textured) **OR** G (smooth) **OR** I (embossed) **OR** J (embossed-in-register) **OR** As indicated by manufacturer's designation, **as directed**.
2. Color: White **OR** As selected from manufacturer's full range **OR** Match sample **OR** As indicated by manufacturer's designation **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
3. LR: Not less than 0.65 **OR** 0.70 **OR** 0.75 **OR** 0.80, **as directed**.
4. NRC: Not less than 0.50 **OR** 0.55 **OR** 0.60 **OR** 0.65 **OR** 0.70, **as directed**.
5. CAC: Not less than 20 **OR** 25 **OR** 30 **OR** 35 **OR** 40, **as directed**.
6. AC: Not less than 170 **OR** 180 **OR** 190 **OR** 200 **OR** 210, **as directed**.
7. Edge/Joint Detail: Square, kerfed and rabbeted, or tongue and grooved, or butt **OR** Beveled, kerfed and rabbeted, or tongue and grooved, or butt **OR** Beveled, kerfed and rabbeted long edges and square, butt on short edges, **as directed**.
8. Thickness: 5/8 inch (15 mm) **OR** 3/4 inch (19 mm) **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
9. Modular Size: 12 by 12 inches (305 by 305 mm) **OR** 300 by 300 mm **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
10. Antimicrobial Treatment: Broad spectrum fungicide and bactericide **OR** Fungicide, **as directed**, based.

C. Metal Suspension Systems, General

1. Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
2. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
3. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
4. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
 - a. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - 1) Type: Cast-in-place **OR** Postinstalled expansion **OR** Postinstalled bonded, **as directed**, anchors.
 - 2) Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
 - 3) Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchors.
 - b. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without



failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

5. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - a. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - b. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) **OR** 0.135-inch- (3.5-mm-), **as directed**, diameter wire.
6. Hanger Rods **OR** Flat Hangers, **as directed**: Mild steel, zinc coated or protected with rust-inhibitive paint.
7. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.
8. Seismic Struts: Manufacturer's standard compression struts designed to accommodate lateral forces.
9. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical tiles in-place.

D. Metal Suspension System For Acoustical Tile Ceiling

1. Direct-Hung, Double-Web, Fire-Rated, **as directed**, Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, G30 (Z90) coating designation.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. Access: Upward **OR** Downward, **as directed**, and end pivoted, **OR** side pivoted, **as directed**, with initial access openings of size indicated below and located throughout ceiling within each module formed by main and cross runners, with additional access available by progressively removing remaining acoustical tiles.
2. Indirect-Hung, Fire-Rated, **as directed**, Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, G30 (Z90) coating designation.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. Carrying Channels: Cold-rolled steel, 0.059850-inch- (1.52-mm-) minimum base (uncoated) metal thickness, not less than 3/16-inch- (4.7-mm-) wide flanges by 1-1/2-inch- (38-mm-) deep steel channels, 475 lb/1000 feet (0.707 kg/m), with rust-inhibitive paint finish **OR** hot-dip galvanized according to ASTM A 653/A 653M, G60 (Z180) coating designation, **as directed**.
 - c. Access: Where access is indicated, provide special cross runners or split splines to allow for removal of acoustical units in indicated access areas. Identify access tile with manufacturer's standard unobtrusive markers for each access unit.

E. Metal Edge Moldings And Trim

1. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
 - a. Provide manufacturer's standard edge moldings that fit acoustical tile edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.
 - b. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
2. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:
 - a. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability



properties of aluminum extrusions complying with ASTM B 221 (ASTM B 221M) for Alloy and Temper 6063-T5.

- b. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.
- c. Conversion-Coated Finish: AA-M12C42 (Chemical Finish: cleaned with inhibited chemicals; acid-chromate-fluoride-phosphate conversion coating).
- d. Conversion-Coated and Factory-Primed Finish: AA-M12C42R1x (Chemical Finish: cleaned with inhibited chemicals; acid-chromate-fluoride-phosphate conversion coating; organic coating as follows):
 - 1) Manufacturer's standard factory-applied prime-coat finish ready for field painting.
- e. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
- f. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; organic coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
 - 1) Organic Coating: Thermosetting, enamel primer/topcoat system with a minimum dry film thickness of 0.8 to 1.2 mils (0.02 to 0.03 mm).

F. Acoustical Sealant

1. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
2. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), recommended for sealing interior concealed joints to reduce airborne sound transmission.

G. Miscellaneous Materials

1. Tile Adhesive: Type recommended by tile manufacturer, bearing UL label for Class 0-25 flame spread.
 - a. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Staples: 5/16-inch- (8-mm-) long, divergent-point staples.

1.3 EXECUTION

A. Preparation

1. Testing Substrates: Before installing adhesively applied tiles on wet-placed substrates such as cast-in-place concrete or plaster, test and verify that moisture level is below tile manufacturer's recommended limits.
2. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

B. Installation, Suspended Acoustical Tile Ceilings

1. General: Install acoustical tile ceilings to comply with ASTM C 636 **OR** UBC Standard 25-2, **as directed**, and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
 - a. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.
2. Suspend ceiling hangers from building's structural members and as follows:

- a. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
- b. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
OR
Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
- c. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
- d. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
OR
Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
- e. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
- f. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
- g. Do not attach hangers to steel deck tabs.
- h. Do not attach hangers to steel roof deck. Attach hangers to structural members.
- i. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
- j. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
3. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
4. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical tiles.
 - a. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 - b. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
 - c. Do not use exposed fasteners, including pop rivets, on moldings and trim.
5. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
6. Arrange directionally patterned acoustical tiles as follows:
 - a. As indicated on reflected ceiling plans.
OR
Install tiles with pattern running in one direction parallel to long **OR** short, **as directed**, axis of space.
OR



- Install tiles in a basket-weave pattern.
7. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.
 - a. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile.
 - b. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tile and moldings, spaced 12 inches (305 mm) o.c.
 - c. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.
- C. Installation, Directly Attached Acoustical Tile Ceilings
1. Adhesive Installation: Install acoustical tile by bonding to substrate, using amount of adhesive and procedure recommended in writing by tile manufacturer and as follows:
 - a. Remove loose dust from backs of tiles by brushing and prime them with a thin coat of adhesive.
 - b. Install splines in joints between tiles; maintain level of bottom surface of tiles to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m) and not exceeding 1/4 inch (6.35 mm) cumulatively.
 - c. Maintain tight butt joints, aligned in both directions and coordinated with ceiling fixtures.
 2. Stapled Installation: Fasten acoustical tile to substrate using a minimum of two staples per tile that are installed in flanges of tile and as follows:
 - a. Form double-lapped joint between tiles by securely pressing tile tongues into corresponding tile grooves.
 - b. Maintain level of bottom surface of tiles to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m) and not exceeding 1/4 inch (6.35 mm) cumulatively. Shim tile or correct substrate as required to maintain tolerance.
 - c. Maintain tight butt joints, aligned in both directions and coordinated with ceiling fixtures.
 3. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical units.
 4. Arrange directionally patterned acoustical tiles as follows:
 - a. As indicated on reflected ceiling plans.
OR
 Install tiles with pattern running in one direction parallel to long axis of space.
OR
 Install tiles with pattern running in one direction parallel to short axis of space.
OR
 Install tiles in a basket-weave pattern.
- D. Field Quality Control
1. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
 2. Tests and Inspections: Testing and inspecting of completed installations of acoustical tile ceiling hangers and anchors and fasteners shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with installations of acoustical tile ceiling hangers for the next area until test results for previously completed installations of acoustical tile ceiling hangers show compliance with requirements.
 - a. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no tiles have been installed.
 - 1) Within each test area, testing agency will select 1 of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every 2 postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
 - 2) When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.



3. Remove and replace acoustical tile ceiling hangers and anchors and fasteners that do not pass tests and inspections and retest as specified above.

E. Cleaning

1. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 23 00



SECTION 09 51 33 00 - ACOUSTICAL METAL PAN CEILINGS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for acoustical metal pan ceilings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes clip-in, lay-in, snap-in, and torsion-spring acoustical metal pans and the following suspension system for ceilings:
 - a. Direct hung, exposed tee and slot-bolt grid.
 - b. Direct-hung and Indirect-hung, concealed grid designed to support metal pans.
2. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

C. Definitions

1. CAC: Ceiling Attenuation Class.
2. LR: Light Reflectance coefficient.
3. NRC: Noise Reduction Coefficient.

D. Performance Requirements

1. Structural Performance: Exterior snap-in metal pan ceilings shall withstand exterior exposure and the effects of gravity loads and the following loads and stresses without showing permanent deformation of ceiling system components including pans and suspension system; noise or metal fatigue caused by vibration, deflection, and displacement of ceiling units; or permanent damage to fasteners and anchors.
 - a. Wind Load: Uniform pressure of 20 lbf/sq. ft. (960 Pa) **OR** of 30 lbf/sq. ft. (1436 Pa) **OR** as indicated on Drawings, **as directed**, acting inward or outward.
2. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 100 deg F (55 deg C).

E. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
 - b. Product Data for Credit EQ 4.1: For sealants, including printed statement of VOC content.
3. Samples: For each exposed finish.
4. Performance Data: For installed products indicated to comply with design loads and other criteria, include structural analysis and other analytical data signed and sealed by the qualified professional engineer responsible for their preparation.
5. Coordination Drawings: Drawn to scale and coordinating and showing the following:
 - a. Ceiling suspension members.
 - b. Method of attaching hangers to building structure.
 - c. Ceiling-mounted items.
 - d. Ceiling perimeter and penetrations through the ceiling; and trim and moldings.
6. Product test reports.



7. Evaluation reports.
8. Field quality-control reports.
9. Maintenance data.

F. Quality Assurance

1. Acoustical Testing Agency Qualifications: An independent testing laboratory or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
2. Surface-Burning Characteristics: Complying with ASTM E 1264 for Class A materials as determined by testing identical products according to ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
3. Seismic Standard: Provide acoustical metal pan ceilings designed and installed to withstand the effects of earthquake motions according to the following:
 - a. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
 - b. CISCAs Recommendations for Acoustical Ceilings: Comply with CISCAs "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings - Seismic Zones 0-2."
 - c. CISCAs Guidelines for Systems Requiring Seismic Restraint: Comply with CISCAs "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies - Seismic Zones 3 & 4."
 - d. UBC Standard 25-2, "Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings."
 - e. SEI/ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."
4. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling

1. Deliver acoustical metal pans, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
2. Handle acoustical metal pans, suspension system components, and accessories carefully to avoid damaging units and finishes in any way.

1.2 PRODUCTS

A. Acoustical Metal Ceiling Pans

1. Acoustical Metal Pan Standard: Provide manufacturer's standard acoustical metal pans of configuration indicated that comply with ASTM E 1264 classifications as designated by types, acoustical ratings, and light reflectances unless otherwise indicated.
 - a. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.
2. Sheet Metal Characteristics: For metal components exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, roughness, stains, or discolorations.
 - a. Aluminum Sheet: Roll-formed aluminum sheet, complying with ASTM B 209 (ASTM B 209M); alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
 - b. Steel Sheet: Commercial-quality, cold-rolled, carbon-steel sheet; stretcher leveled; with protective coating complying with ASTM C 635.



- 1) Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- 2) Painted Finishes: Electrolytic zinc-coated steel complying with ASTM A 591/A 591M, 40Z (12G) coating, surface treatment as recommended by finish manufacturer for type of use and finish indicated.
- 3) Chemical/Mechanical Finishes: Uncoated steel sheet complying with ASTM A 1008/A 1008M with luster or bright finish as required by finisher for applying electroplating or other metallic-finishing processes.
- c. Stainless-Steel Sheet: Complying with ASTM A 240/A 240M, Type 304 **OR** Type 430, **as directed**.
3. Sound-Absorbent Fabric Layer: Provide fabric layer, sized to fit concealed surface of pan, and consisting of black, nonwoven, nonflammable, sound-absorbent material with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing per ASTM E 84.
 - a. Bond fabric layer to panels in the factory with manufacturer's standard nonflammable adhesive.
4. Sound-Absorbent Pads: Provide width and length to completely fill concealed surface of pan, with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing per ASTM E 84, and to comply with the following requirements:
 - a. Plastic Sheet-Wrapped Mineral-Fiber Insulation: Pads consisting of nonrigid, PVC plastic sheet encapsulating unfaced mineral-fiber insulation complying with ASTM C 553, Type I, II, or III, and as follows:
 - 1) Mineral-Fiber Type and Thickness: Glass fiber; 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 3 inches (76 mm), **as directed**.
 - 2) Mineral-Fiber Density: 3/4 lb/cu. ft. (12 kg/cu. m) **OR** 1 lb/cu. ft. (16 kg/cu. m) **OR** 1-1/2 lb/cu. ft. (24 kg/cu. m), **as directed**.
 - 3) Plastic Sheet Thickness and Color: Not less than 0.003 inch (0.076 mm); clear **OR** flat black **OR** white, **as directed**.
 - b. Unwrapped, Glass-Fiber Insulation: Black coated, unfaced, complying with ASTM C 553, Type I, II, or III; not less than 1-lb/cu. ft. (16-kg/cu. m) density; treated to be nondusting; and as follows:
 - 1) Thickness: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
 - c. Spacer Grids: Provide manufacturer's standard aluminum **OR** galvanized-steel, **as directed**, grid units that provide an air cushion between metal pans and insulation pads and that act to improve sound absorption.
 - d. Sound Attenuation Panels: Provide manufacturer's standard aluminum **OR** galvanized-steel, **as directed**, unperforated metal backing unit that acts as a sound-attenuating pan to reduce the travel of sound through ceiling plenum into adjoining rooms.
 - 1) Sound-Absorbent Pads: Provide secondary sound-absorbent pads, same as specified for primary pads, for placement over sound attenuation pan to reduce plenum sound.
- B. Aluminum Pans For Acoustical Metal Pan Ceiling
 1. Classification: Units complying with ASTM E 1264 for Type VII, perforated aluminum facing (pan) with mineral- or glass-fiber-base backing **OR** Type XX, other types described as perforated aluminum facing (pan) units with sound-absorbent fabric backing **OR** Type XX, other types described as unperforated aluminum facing (pan) units, **as directed**.
 - a. Pattern: Pattern A (perforated, regularly spaced large holes), arranged in diagonal **OR** parallel, **as directed**, alignment to pan edge with uniform perforations of dimension, holes per square foot or inch, and percent open area as indicated by product designation **OR** selected from manufacturer's full range, **as directed**.
OR



Pattern: Pattern C (perforated, small holes) regularly spaced, with uniform perforations of dimension, holes per square foot or inch, and percent open area as specified by product designation **OR** selected from manufacturer's full range, **as directed**.

2. Pan Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, formed from metal indicated and finished to comply with requirements indicated.
 - a. Lay-in Pans: Formed to set in exposed suspension grid.
 - b. Clip-in Pans: Designed to clip-in and be securely retained in exposed suspension grid by formed edges or accessory clips.
 - c. Snap-in Pans: Designed with dimples or continuous beads on flanges for snap-in, secure engagement with concealed suspension system.
 - d. Torsion-Spring-Hinged Pans: Designed to be securely retained in preslotted exposed suspension grid by torsion springs.
3. Pan Thickness: Not less than 0.020 inch (0.5 mm) **OR** 0.025 inch (0.6 mm) **OR** 0.032 inch (0.8 mm) **OR** 0.040 inch (1.0 mm), **as directed**.
4. Pan Edge Detail: Square **OR** Beveled **OR** Reveal **OR** Manufacturer's standard edge detail, **as directed**.
OR
Pan Joint Detail: Butt **OR** Wide reveal, not less than 15/16 inch (24 mm) wide **OR** Narrow reveal, not greater than 9/16 inch (15 mm) wide **OR** Flush narrow reveal, not greater than 9/16 inch (15 mm) wide, **as directed**.
5. Pan Size: 12 by 12 inches (305 by 305 mm) **OR** 12 by 24 inches (305 by 610 mm) **OR** 12 by 36 inches (305 by 915 mm) **OR** 24 by 24 inches (610 by 610 mm) **OR** 24 by 48 inches (610 by 1220 mm) **OR** 24 by 60 inches (610 by 1525 mm) **OR** 30 by 30 inches (760 by 760 mm) **OR** 30 by 60 inches (760 by 1525 mm) **OR** As indicated on Drawings, **as directed**.
6. Scoring: Score pans at intervals to appear as 12-by-12-inch (305-by-305-mm) ceiling units.
7. Pan Face Finish: Mill **OR** Lacquered mill **OR** Clear anodized **OR** Clear mirror-anodized **OR** Painted white **OR** Painted to match color indicated by product designation **OR** Painted to match sample **OR** Painted in color selected from manufacturer's full range **OR** Bright-reflective metallic finish selected from manufacturer's full range, **as directed**.
8. LR: Not less than 0.70 **OR** 0.75, **as directed**.
9. NRC: Not less than 0.60 **OR** 0.65 **OR** 0.70 **OR** 0.75 **OR** 0.80 **OR** 0.85 **OR** 0.90 **OR** 0.95, **as directed**.
10. CAC: Not less than 35 **OR** 40 **OR** 45, **as directed**.

C. Steel Pans For Acoustical Metal Pan Ceiling

1. Classification: Units complying with ASTM E 1264 for Type V, perforated steel facing (pan) with mineral- or glass-fiber-base backing **OR** Type XX, other types described as perforated steel facing (pan) units with sound-absorbent fabric backing **OR** Type XX, other types described as unperforated steel facing (pan) units, **as directed**.
 - a. Pattern: Pattern A (perforated, regularly spaced large holes), arranged in diagonal **OR** parallel, **as directed**, alignment to pan edge with uniform perforations of dimension, holes per square foot or inch, and percent open area as indicated by product designation **OR** selected from manufacturer's full range, **as directed**.
OR
Pattern: Pattern C (perforated, small holes) regularly spaced, with uniform perforations of dimension, holes per square foot or inch, and percent open area as specified by product designation **OR** selected from manufacturer's full range, **as directed**.
2. Pan Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, formed from metal indicated and finished to comply with requirements indicated.
 - a. Lay-in Pans: Formed to set in exposed suspension grid.
 - b. Clip-in Pans: Designed to clip-in and be securely retained in exposed suspension grid by formed edges or accessory clips.
 - c. Snap-in Pans: Designed with dimples or continuous beads on flanges for snap-in, secure engagement with concealed suspension system.



- d. Torsion-Spring-Hinged Pans: Designed to be securely retained in preslotted exposed suspension grid by torsion springs.
3. Pan Thickness: Not less than 0.010-inch (0.25-mm) **OR** 0.020-inch (0.5-mm) **OR** 0.024-inch (0.6-mm) **OR** 0.030-inch (0.75-mm) **OR** 0.036-inch (0.9-mm), **as directed**, nominal thickness.
4. Pan Edge Detail: Square **OR** Beveled **OR** Reveal **OR** Manufacturer's standard edge detail, **as directed**.
OR
Pan Joint Detail: Butt **OR** Wide reveal, not less than 15/16 inch (24 mm) wide **OR** Narrow reveal, not greater than 9/16 inch (15 mm) wide **OR** Flush narrow reveal, not greater than 9/16 inch (15 mm) wide, **as directed**.
5. Pan Size: 12 by 12 inches (305 by 305 mm) **OR** 12 by 24 inches (305 by 610 mm) **OR** 12 by 36 inches (305 by 915 mm) **OR** 24 by 24 inches (610 by 610 mm) **OR** 24 by 48 inches (610 by 1220 mm) **OR** 24 by 60 inches (610 by 1525 mm) **OR** 30 by 30 inches (760 by 760 mm) **OR** 30 by 60 inches (760 by 1525 mm) **OR** As indicated on Drawings, **as directed**.
6. Scoring: Score pans at intervals to appear as 12-by-12-inch (305-by-305-mm) ceiling units.
7. Pan Face Finish: Painted white **OR** Painted to match color indicated by product designation **OR** Painted to match sample **OR** Painted in color selected from manufacturer's full range **OR** Plated with metallic finish, as selected from manufacturer's full range **OR** Bright-reflective metallic finish selected from manufacturer's full range, **as directed**.
8. LR: Not less than 0.70 **OR** 0.75, **as directed**.
9. NRC: Not less than 0.60 **OR** 0.65 **OR** 0.70 **OR** 0.75 **OR** 0.80 **OR** 0.85 **OR** 0.90 **OR** 0.95, **as directed**.
10. CAC: Not less than 35 **OR** 40 **OR** 45, **as directed**.

D. Stainless-Steel Pans For Acoustical Metal Pan Ceiling

1. Classification: Units complying with ASTM E 1264 for Type VI, perforated stainless-steel facing (pan) with mineral- or glass-fiber-base backing **OR** Type XX, other types described as perforated stainless-steel facing (pan) units with sound-absorbent fabric backing **OR** Type XX, other types described as unperforated stainless-steel facing (pan) units, **as directed**.
 - a. Pattern: Pattern A (perforated, regularly spaced large holes), arranged in parallel alignment to pan edge with uniform perforations of 0.109-inch (2.8-mm) diameter, 1800 holes/sq. ft. or inch, and 11.8 percent open area.
2. Pan Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, formed from metal indicated and finished to comply with requirements indicated.
 - a. Lay-in Pans: Formed to set in exposed suspension grid.
 - b. Clip-in Pans: Designed to clip-in and be securely retained in exposed suspension grid by formed edges or accessory clips.
 - c. Snap-in Pans: Designed with dimples or continuous beads on flanges for snap-in, secure engagement with concealed suspension system.
 - d. Torsion-Spring-Hinged Pans: Designed to be securely retained in preslotted exposed suspension grid by torsion springs.
3. Pan Thickness: Not less than 0.019 inch (0.5 mm) **OR** 0.025 inch (0.65 mm) **OR** 0.030 inch (0.76 mm), **as directed**.
4. Pan Edge Detail: Square **OR** Beveled **OR** Reveal **OR** Manufacturer's standard edge detail, **as directed**.
OR
Pan Joint Detail: Butt **OR** Wide reveal, not less than 15/16 inch (24 mm) wide **OR** Narrow reveal, not greater than 9/16 inch (15 mm) wide **OR** Flush narrow reveal, not greater than 9/16 inch (15 mm) wide, **as directed**.
5. Pan Size: 12 by 12 inches (305 by 305 mm) **OR** 12 by 24 inches (305 by 610 mm) **OR** 12 by 36 inches (305 by 915 mm) **OR** 24 by 24 inches (610 by 610 mm) **OR** 24 by 48 inches (610 by 1220 mm) **OR** 30 by 30 inches (760 by 760 mm) **OR** As indicated on Drawings, **as directed**.
6. Scoring: Score pans at intervals to appear as 12-by-12-inch (305-by-305-mm) ceiling units.
7. Pan Face Finish: Brushed, directional polish **OR** Satin, directional polish **OR** Mirrorlike reflective, nondirectional polish, **as directed**.



8. NRC: Not less than 0.60 **OR** 0.65 **OR** 0.70 **OR** 0.75 **OR** 0.80 **OR** 0.85 **OR** 0.90 **OR** 0.95, **as directed**.
9. CAC: Not less than 35 **OR** 40 **OR** 45, **as directed**.

E. Metal Suspension Systems

1. Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
2. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.
3. Suspension Systems: Provide systems complete with carriers, runners, splice sections, connector clips, alignment clips, leveling clips, hangers, molding, trim, retention clips, load-resisting struts, and other suspension components required to support ceiling units and other ceiling-supported construction.
4. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
 - a. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - 1) Type: Cast-in-place **OR** Postinstalled expansion **OR** Postinstalled bonded, **as directed**, anchors.
 - 2) Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
 - 3) Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
 - 4) Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.
 - b. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
5. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - a. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - b. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
 - c. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
 - d. Size: Select wire diameter so its stress at 3 times the hanger design load indicated in ASTM C 635, Table 1, Direct Hung will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) **OR** 0.135-inch- (3.5-mm-), **as directed**, diameter wire.
6. Hanger Rods **OR** Flat Hangers, **as directed**: Mild steel, zinc coated or protected with rust-inhibitive paint.
7. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1.0-mm-) thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.
8. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
9. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
10. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical metal pans in place.
11. Hold-Down Clips: Manufacturer's standard hold-down clips spaced to secure acoustical metal pans in place to molding and trim at perimeter **OR** at each pan, **as directed**.



12. Exposed Metal Edge Moldings and Trim: Provide exposed members as indicated or as required to comply with seismic requirements of authorities having jurisdiction, to conceal edges of and penetrations through ceiling, to conceal edges of pans and runners, for fixture trim and adapters, for fasciae at changes in ceiling height, and for other conditions; of metal and finish matching acoustical metal pan ceiling units, unless otherwise indicated.
 - a. For Circular Penetrations of Ceiling: Fabricate edge moldings to diameter required to fit penetration exactly.
- F. Direct-Hung, Standard-Grid, Metal Suspension System For Acoustical Metal Pan Ceiling
1. Suspension System: For clip-in **OR** lay-in **OR** torsion-spring, **as directed**, pans.
 2. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytic zinc-coated or hot-dip galvanized according to ASTM A 653/A 653M, G30 (Z90) coating designation, with prefinished, cold-rolled, 15/16-inch- (24-mm-) wide sheet metal caps on flanges.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. End Condition of Cross Runners: Override (stepped) **OR** Butt-edge, **as directed**, type.
 - c. Face Design: Flat, flush.
 - d. Cap Material: Steel **OR** Aluminum, **as directed**, cold-rolled sheet.
 - e. Cap Finish: Painted white **OR** Painted in color as selected from manufacturer's full range **OR** Painted to match color indicated by manufacturer's designation **OR** Painted to match color of metal pan **OR** Plated with metallic finish, as selected from manufacturer's full range **OR** Plated with metallic finish indicated by manufacturer's designation **OR** Natural finish for aluminum, **as directed**.
 3. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytic zinc-coated or hot-dip galvanized according to ASTM A 653/A 653M, G30 (Z90) coating designation, with prefinished, cold-rolled, 9/16-inch- (15-mm-) wide sheet metal caps on flanges.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. End Condition of Cross Runners: Override (stepped) **OR** Butt-edge, **as directed**, type.
 - c. Face Design: Flat, flush **OR** Flanges formed with an integral center reveal, **as directed**.
 - d. Cap Material: Steel **OR** Aluminum, **as directed**, cold-rolled sheet.
 - e. Cap Finish: Painted white **OR** Painted in color as selected from manufacturer's full range **OR** Painted to match color indicated by manufacturer's designation **OR** Painted to match color of metal pan **OR** Plated with metallic finish, as selected from manufacturer's full range **OR** Plated with metallic finish indicated by manufacturer's designation **OR** Natural finish for aluminum, **as directed**.
 4. Narrow-Face, Uncapped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytic zinc-coated or hot-dip galvanized, to produce structural members with 9/16-inch- (15-mm-) wide faces.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. Face Design: With 1/8-inch- (3.2-mm-) wide, slotted, box-shaped flange **OR** With 1/4-inch- (6.35-mm-) wide, slotted, box-shaped flange, **as directed**.
 - c. Face Finish: Painted white **OR** in color as selected from manufacturer's full range **OR** to match color indicated by manufacturer's designation **OR** to match color of metal pan, **as directed**.
 5. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, hot-dip galvanized according to ASTM A 653/A 653M, G60 (Z180) coating designation, with prefinished, cold-rolled, 15/16-inch- (24-mm-) wide aluminum caps on flanges.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. Face Design: Flat, flush.
 - c. Face Finish: Painted white **OR** Painted to match color indicated by manufacturer's designation **OR** Painted to match color of acoustical unit **OR** Natural finish, **as directed**.
 6. Wide-Face, Capped, Double-Web, Stainless-Steel Suspension System: Main and cross runners roll formed from and capped with Type 304 or 316 stainless-steel sheet, with prefinished, cold-rolled, 15/16-inch- (24-mm-) wide stainless-steel caps on flanges.



- a. Structural Classification: Intermediate-duty system.
 - b. Face Design: Flat, flush.
- 7. Suspension System for Torsion-Spring Metal Pans: Provide runners with factory-cut slots fabricated to accept torsion-spring attachment.
- G. Metal Suspension System For Acoustical Snap-In Metal Pan Ceiling
 - 1. Indirect-Hung, Snap-Tee **OR** Bar, **as directed**, System: Designed to support metal pans that snap into main runners, consisting of main runners connected to carrying channels that are attached by hangers to building structure, and complying with the following requirements:
 - a. Main Runners: Formed from the following metal:
 - 1) Aluminum Sheet: Alloy and temper recommended by aluminum producer and finisher for type of use indicated and manufacturer's standard finish, complying with ASTM B 209 (ASTM B 209M).
 - 2) Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, with not less than 80Z (24G) zinc coating.
 - 3) Hot-Dip Galvanized Steel: ASTM A 653/A 653M, not less than G60 (Z180) zinc coating.
 - 4) Stainless-Steel Sheet: ASTM A 666, Type 302 or 304, stretcher leveled, with cold-rolled mill finish.
 - 5) Metal Sheet: Metal as standard with ceiling system manufacturer with factory-applied protective finish complying with ASTM C 635.
 - b. Carrying Channels: Same member and metal as indicated for main runners.
OR
Carrying Channels: Cold-rolled steel, not less than 0.060-inch (1.5-mm) nominal thickness of base (uncoated) metal and 7/16-inch- (11-mm-) wide flanges, protected with rust-inhibitive paint **OR** hot-dip galvanized according to ASTM A 653/A 653M, G60 (Z180) coating designation, **as directed**, and as follows:
 - 1) Depth and Weight: 1-1/2 inches and 475 lb/1000 feet (38 mm and 215 kg/305 m) **OR** 2 inches and 590 lb/1000 feet (51 mm and 268 kg/305 m), **as directed**.
 - c. Exterior Bracing Channels and Angles: Cold-rolled steel, hot-dip galvanized to comply with ASTM A 653/A 653M, G60 (Z180) coating designation; size and profile as required to withstand wind load.
 - 2. Direct-Hung, Snap-Tee **OR** Bar, **as directed**, System: Designed to support metal pans that snap into main runners, consisting of main runners supported by hangers attached directly to building structure, and complying with the following requirements:
 - a. Hangers: Angles or channels, as standard with ceiling system manufacturer, formed from same metal as main runners.
 - b. Main Runners: Rolled aluminum sheet; alloy and temper recommended by aluminum producer and finisher for type of use indicated and manufacturer's standard finish, complying with ASTM B 209 (ASTM B 209M).
 - 3. Access Panels: For access at locations indicated, provide acoustical snap-in metal pan ceiling units, accessible by key or tool **OR** two access knobs; place one access knob at each end of panel near corners, **as directed**.
 - a. Access Key or Tool: Provide manufacturer' standard key or tool for opening access panels; one **OR** two, **as directed**.
- H. Acoustical Sealant
 - 1. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 2. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant, with a VOC content of 250 g/L or



less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), recommended for sealing interior concealed joints to reduce airborne sound transmission.

- I. General Finish Requirements
 1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - a. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.
 2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
 3. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- J. Aluminum Finishes
 1. Mill Finish: AA-M10C10 (Mechanical Finish: as fabricated, unspecified; Chemical Finish: chemically cleaned).
 2. Lacquered Mill Finish: AA-M10C10R1x (Mechanical Finish: as fabricated, unspecified; Chemical Finish: chemically cleaned; Organic Coating: as specified below).
 - a. Organic Coating: Manufacturer's standard clear organic coating.
 3. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
 4. Clear Mirror Anodic Finish: AA-M21C12A212, 0.005 mm or thicker.
 5. Color-Coated Finish: Manufacturer's standard powder-coat, **as directed**, baked paint complying with coating manufacturer's written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.
 6. Bright-Reflective Finish: Manufacturer's standard chemical/mechanical bright-reflective metallic finish complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, protective coating, and minimum thickness to produce a finish uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unfinished areas, and other visible defects.
- K. Galvanized-Steel Sheet Finishes
 1. Color-Coated Finish: Manufacturer's standard powder-coat, **as directed**, baked paint complying with coating manufacturer's written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.
- L. Steel Sheet Finishes
 1. Electroplated Finish: Electroplating process complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, and minimum thickness to produce a coating uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unplated areas, and other visible defects.
 2. Bright-Reflective Finish: Manufacturer's standard chemical/mechanical bright-reflective metallic finish complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, protective coating, and minimum thickness to produce a finish uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unfinished areas, and other visible defects.
- M. Stainless-Steel Finishes
 1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

1.3 EXECUTION

A. Preparation

1. Measure each ceiling area and establish layout of acoustical metal pans to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width pans at borders, and comply with layout shown on reflected ceiling plans and Coordination Drawings.

B. Installation

1. Install acoustical metal pan ceilings to comply with ASTM C 636 **OR** UBC Standard 25-2, **as directed**, and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
2. Suspend ceiling hangers from building's structural members and as follows:
 - a. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - b. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - c. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - d. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
OR
Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved.
 - e. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - f. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - g. Do not attach hangers to steel deck tabs.
 - h. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - i. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
 - j. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
3. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
4. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical metal pans.
 - a. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 - b. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
 - c. Do not use exposed fasteners, including pop rivets, on moldings and trim.
5. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.



6. Cut acoustical metal pan units for accurate fit at borders and at interruptions and penetrations by other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet.
7. Install acoustical metal pans in coordination with suspension system and exposed moldings and trim.
 - a. For lay-in square-edge pans, install pans with edges fully hidden from view by flanges of suspension system runners and moldings.
 - b. For lay-in reveal-edge pans on suspension system runners, install pans with bottom of reveal in firm contact with top surface of runner flanges.
 - c. For lay-in reveal-edge pans on suspension system members with box-shaped flanges, install pans with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
 - d. For clip-in **OR** torsion-spring-hinged, **as directed**, pans, position pans according to manufacturer's written instructions.
 - e. For snap-in pans, fit adjoining units to form flush, tight joints.
 - f. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions unless otherwise indicated.
 - g. Fit adjoining units to form flush, tight joints.
 - h. Install directionally patterned or textured metal pans in directions indicated.
 - i. Install sound-absorbent fabric layers in perforated metal pans.
 - j. Install sound-absorbent pads in perforated metal pans over metal spacer grids, **as directed**.
8. Install sound attenuation panels in areas indicated by reflected ceiling plans or room finish schedules. Lay panels directly on ceiling system and close major openings to form complete coverage in required areas. Lay second sound-absorbent pads on sound attenuation panels.
9. Install hold-down clips where indicated.

C. Field Quality Control

1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Tests and Inspections: Testing and inspecting of completed installations of acoustical panel ceiling hangers and anchors and fasteners shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements.
 - a. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.
 - 1) Within each test area, testing agency will select 1 of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every 2 postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
 - 2) When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.
3. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.
4. Prepare test and inspection reports.

D. Cleaning

1. Clean exposed surfaces of acoustical metal pan ceilings, including trim and edge moldings after removing strippable, temporary protective covering, if any. Comply with manufacturer's written instructions for stripping of temporary protective covering, cleaning, and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented and bent units.



END OF SECTION 09 51 33 00



SECTION 09 54 23 00 - CSF LINEAR METAL CEILINGS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where linear metal ceilings are part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.09 54 23 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Suspended metal grid ceiling system and perimeter trim.
 - 2. Linear, formed metal soffit panels.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
 - 2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - 3. ASTM C636 - Standard Method for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
 - 4. ASTM E580 - Standard Method for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint.

1.3 PERFORMANCE REQUIREMENTS

NOTE TO SPECIFIER

Verify project requirements with local codes and conditions.

- A. Exterior Soffit And Suspension System: Resist wind uplift [in accordance with applicable code] [of [_____] psf without damage.



NOTE TO SPECIFIER

- B. Resist seismic loads [required by applicable code.] [by using practices specified in ASTM E580.]

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
1. Product Data:
 - a. Product Data: Furnish for component profiles, materials, perimeter and integral trim, and space closures.
 2. Shop Drawings:
 - a. Shop Drawings: Indicate soffit system reflected plan, location of mechanical and electrical components, details of junction with dissimilar materials, and points of suspension.
 3. Samples:
 - a. Samples: Submit two samples 8 x 24 inch in size illustrating color and finish of exposed to view components.
 4. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

1.5 QUALITY ASSURANCE

- A. Qualifications:
1. Designer Qualifications for Seismic Design: Under direct supervision of a Professional Structural Engineer experienced in design of work of this section and licensed at the place where the Project is located.
 2. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 3. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Accept factory-finished products on site in manufacturer's unopened factory packaging only; reject opened packages.
- C. Protect factory-finished products from damage to appearance by storing products in manufacturer's unopened factory packaging in dry storage area.

1.7 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Supply hanger clips during steel deck erection. Supply additional hangers and inserts as required.



PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 - 1. Hunter Douglas Architectural Products, Norcross, GA, (800) 366-4327. Model: "Linear Box 8 Ceiling Panels".
 - 2. AEP Span, Dallas, TX, (800) 527-2503. Model [_____].
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

- A. Linear Panels:
 - 1. Linear Panels: Aluminum sheet, ASTM B209, 0.032 inch thick.
 - 2. Profile: Box shape, 5/8 x 7-5/32 inch forming 8 inch module.
 - 3. Edge: Square.
 - 4. Length: [Equal] [Unequal].

NOTE TO SPECIFIER

Verify color at time of Project Manual preparation for Project.

- 5. Sight-exposed Surface Finish: Enamel finish; of color [from manufacturer's standard range.] [as selected.]
- 6. Edge Molding, [Expansion Joints,] and Splices: Same material, thickness, and finish as linear panels.
- 7. End Caps: [Molded plastic,] [Formed metal,] same color and finish as sight-exposed surfaces of linear panels.
- 8. Space Closures: [Recessed,] [Flush,] [extruded vinyl] [formed steel] [formed aluminum] sections, [black] [_____] color [as selected]; snap fit between exposed linear panels.

2.3 ACCESSORIES

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, code requirements, and availability at time of Project Manual preparation for Project.

- A. [Stabilizer bars,] [clips,] [hold down clips,] [and] [_____] as required for suspended grid system; sight-exposed surfaces same color and finish as sight-exposed surfaces of linear panels.

NOTE TO SPECIFIER

The suspension members may be comprised of solid wire or formed metal sections (angles or channel shaped) to brace the grid members from sway or movement.



- B. Suspension Members: Formed [steel] [aluminum] sections, with integral attachment points; [galvanized] [primed] finish; size and type to suit application [, seismic requirements,] and ceiling system flatness requirement specified.

***** [OR] *****

- C. Suspension Wire: Steel, annealed, [galvanized] [plain] finish, [[9] [____] gage_diameter.] [size and type for application, [seismic requirements,] and ceiling system flatness requirement specified.]
- D. Subgirt Members: [ASTM A653/A653M,] [galvanized with [G90] [____] ([Z275] [____]) zinc coating,] formed to resist imposed loads and to provide attachment for linear panels and accessories.
- E. Access Panel: Provide matching hinged panel [with frameless appearance], swinging downward, with spring latch; [____x____] feet in size.

2.4 FABRICATION

- A. Shop cut linear panels to accommodate mechanical and electrical items.
- B. Form internal and external corners of same material, thickness, finish, and profile to match exposed linear panels [; back brace internal corners].
- C. Ceiling Panels: Edges formed to snap onto carriers with a positive locking action,

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify that layout of hangers will not interfere with other work.
 - 2. Verify that required utilities are available, in proper location, and ready for use.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Suspension Components: Install after above soffit work is complete in accordance with ASTM C636 [and ASTM E580].
 - 1. Hang carrying members independent of walls, columns, ducts, light fixtures, pipe, and conduit; where carrying members are spliced, avoid visible displacement of face panels with adjacent panels.



2. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest adjacent hangers to span the required distance.
 3. Locate suspension system for linear panel layout parallel to building lines according to [reflected plan.] [_____].
- C. Linear Panels: [Stagger end joints minimum 12 inches (300 mm.)] [Align end] joints.
1. [Butt interior end joints tight.] [Set exterior end joints with [1/16] [____] inch gap for expansion and contraction.]
 2. Provide [expansion] [control] joints to accommodate plus or minus [1] [____] inch movement and maintain visual closure.

NOTE TO SPECIFIER

The space closures described in the following paragraph are optional. Use caution in specifying these closures between exterior panels; wind uplift of the whole system becomes a greater factor.

3. Install recessed space closures between linear panels at exterior locations.
4. Install edge moldings at intersections of soffit, junctions with other finishes, and at vertical surfaces; use maximum piece lengths.
5. [Where bullnose masonry units occur, install radiused closures to fit edge molding.]
6. [Install end caps at sight-exposed ends of linear panels.]
7. [Field miter corners.] [Install prefabricated corner sections.]
8. Exercise care when site cutting sight-exposed finished components to ensure surface finish is not defaced.

3.3 ERECTION TOLERANCES

NOTE TO SPECIFIER

Coordinate this article with the suspension system members selected and the performance statements indicated.

- A. Tolerances:
1. Maximum Variation from Flat and Level Surface: [1/8] [____] inch in 10 feet .
 2. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: [2] [____] degrees.
 3. Maximum Variation From Dimensioned Position: [1/4] [____] inch.

3.4 CLEANING

- A. Section 017300 - Execution: Cleaning installed work.
- B. Remove protective coating or film.
- C. Replace damaged or abraded components.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



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Task	Specification	Specification Description
09 54 23 00	09 51 33 00	Acoustical Metal Pan Ceilings



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SECTION 09 62 15 00 – JURATILE FLOORING

Detailed Guidelines for Installing the J.W. Spec 14 TM JuraTile TM Floor System THE JENNISON WRIGHT CO., CLEVELAND OHIO (216)671-5900

Scope of Work

Work shall include the furnishing of all labor and materials necessary to complete J.W. Spec-14 JuraTile Floor with JuraTile Seal-(W)right TM SWT-102 TM Black Finish as scheduled throughout the building. Prior to delivery and installation, purchaser agrees to furnish a dry, smooth, true and level concrete foundation in perfect contour with the surface of the finished floor, swept broom clean of dirt and debris. The building must be dry, entirely enclosed, heated to a minimum of 55 degrees and weather proof before the installation of the floor is started. All materials shall be those manufactured by The Jennison Wright Company, Cleveland Ohio.

Materials - (Premium Quality)

JURATILE shall be manufactured from recycled High Density Polyethylene Polymers and Kiln Dried Untreated Hardwood Fibers and shall be machined with square edges. JuraTile and installation materials shall be those manufactured by The Jennison Wright Company of Cleveland Ohio, 216-671-5900.

JURATILE FLOORING ADHESIVE No. JT-1280 TM : Adhesive.

JURATILE SEAL-(W)RIGHT SWT-102: Black Water Based Sealer and Finish.

Concrete Base

A semi-hard, hand or machine troweled float finish is required. Curing of the concrete shall be accomplished without the use of curing compounds as directed by the architect. It is of major importance that the thoroughly seasoned concrete base be free of all defects that would cause an uneven bearing surface for the individual JuraTiles. The defects include, but are not limited to, ridges, depressions, projections, variation of elevations, uneven finish particularly at columns, manholes, drains, machine bases saw cut control joints, etc. Elevations should be checked throughout the base, and especially at any transitions to other floor surfaces. The same should be done for construction joints in the slab (if any exist). The above repairs can be accomplished by using a standard skim coat polymer-modified one component product for leveling and smoothing concrete. After the base is deemed to be in satisfactory condition it shall be broom cleaned, (and/or) vacuumed immediately before commencing installation of the JuraTile floor.

Note:

Transverse expansion joints in either the JuraTile or concrete base are not recommended. If such joints are specified in the concrete, a non extruding type should be used or the expansion joints must be left far enough below the surface of the concrete so that, when expansion of the concrete occurs, the expansion joint material will not be forced above the surface and raise the JuraTiles above the finished floor level.

JuraTile Acclimation

Prior to commencement of the floor installation, the JuraTiles should be placed in the room receiving the JuraTile floor to allow adjustment to the ambient temperature consistent with the conditions of the building as it will be maintained when occupied. This is best accomplished by opening the pallets and stacking the

individual bundles of JuraTile to allow air movement between each bundle's side, alternating each stacked row 90 degrees until the JuraTiles reach the ambient building temperature.

Adhesive

Apply JuraTile Flooring Adhesive JT-1280 as it comes from the container with a 1/8 inch notched trowel or rake to the completely seasoned, thoroughly cleaned, concrete slab. Work the adhesive into the concrete and trowel away excess. Apply at the rate of 40-60 square feet per gallon. The JuraTiles should be installed within 10 minutes after the application of the adhesive while it is still fresh. Do NOT allow the adhesive to turn black and set. For this reason, apply the Adhesive no further ahead of the JuraTile laying as determined by the rate of JuraTile thus being laid.

Installation of JuraTile

Upon the prepared base the JuraTiles shall be laid tightly together making certain the rows of JuraTiles are kept straight and parallel. A header row of (1) JuraTile wide is to be placed along both sides of the floor and at columns and other vertical obstructions (see Detail No. 1). Allow a 1/4" gap for expansion at walls and other obstructions to be concealed by cove base supplied by others. When starting rows, alternate between full and half size JuraTile. All joints shall be broken by a minimum lap of 2 inch (see Detail No. 1). To keep the JuraTiles properly aligned and fitted together, use a 2 inch x 4 inch x 3-4 foot straight edge with a hammer. Do this continuously along the line every 10-18 rows of JuraTiles, or every 30 minutes, whichever occurs first. Keep JuraTiles tight lengthwise by tapping on the end with another JuraTile or mallet every 15-25 JuraTiles of each row. See Detail No. 2 (Caution: Do NOT allow the adhesive to work up between the joints, should this occur, reduce the amount of adhesive being applied and do not slide the JuraTile into place).

At the end of each row, when cutting the JuraTiles into the header row at side perimeters, columns or other vertical obstructions, keep the cuts straight. Never use JuraTiles that are less than 2 inch in length or width; see detail No. 3. Immediately after the JuraTile installation is completed, make a careful inspection and remove any JuraTiles that may need to be replaced or may have chips, stones or debris under them and replace. JuraTiles to be replaced include, but are not limited to, distorted JuraTiles, chipped corners, high and low JuraTiles, etc.

Finishing

After the floor has been culled for any low, high or damaged tiles and deemed satisfactory, the entire floor shall be broom cleaned and/or vacuumed to remove all dust and debris. Any adhesive must be removed from the surface. The entire floor should then be lightly sanded or screened (60 grit) with a circular disc sanding machine typically used for wood floors to remove any contaminants and level any irregular edges between tiles. Sweep all dust from the surface allowing the sanding dust to fill any joints and apply two to three applications of JuraTile Seal-(W)right SWT-102 with a closed cell sponge rubber squeegee. Care must be taken to apply the coating evenly to produce a uniform finish. Additional coats may be necessary to insure a uniform gloss. Depending on ambient temperature and ventilation allow at least 1 hour between applications and at least 24 hours before placing floor in service for foot and light duty traffic. The coating should be allowed to cure for at least 2 days prior to heavy wheeled traffic.

Note

These specifications are based upon optimum site conditions which require exact adherence to the Specifications installed by personnel thoroughly experienced in installing JuraTile Flooring Systems.

However, since conditions at the installation site are critical, variations in these Specifications may be required depending on all site conditions. Therefore, we cannot accept responsibility for results of installation by others. This attractive floor system and others similar require routine maintenance and inspection by qualified personnel to provide a premium quality floor surface.

JURATILE WARRANTY LIMITATION: Jennison Wright Co warrants for a period of one year from date of sale that JuraTile products are free from defects in materials and workmanship. Our liability is expressly limited to replacement of defective goods. Jennison Wright Co. shall not be liable for incidental and consequential damages, directly or indirectly sustained, nor for any loss caused by application of these goods. Plastic and wood from which this product is produced is made from recycled materials and considerable variance will occur between the individual JuraTiles with regard to color, and general appearance. Therefore, the product ultimately delivered may vary from the characteristics represented by any samples presented or specifications contained in any literature. Purchasers should make their own test to determine the suitability of this product for their particular purpose. This product is sold without warranties, expressed or implied, without limitation, implied warranties of merchantability or fitness for a particular purpose, other than the limited warranty set forth above. Any claim shall be deemed waived unless made in writing to us within thirty (30) days from the date it was, or reasonably should have been, discovered. Specifications are subject to change without notice.

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SECTION 09 65 00 00 - CSF RESILIENT FLOORING**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.09 65 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Resilient tile flooring.
 - 2. Resilient base.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections: Related work specified elsewhere includes but may not be limited to
 - 1. Section 017704 - Closeout Procedures and Training.
 - 2. Section 033000 - Cast-In-Place Concrete.
 - 3. Section 123504 – Postal Casework.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM F710
 - 2. ASTM F1066
 - 3. ASTM 1869-98 ASTM F2170-02
 - 4. ASTM F2170-02
 - 5. ASTM F2195
- B. Manufacturer's Guides:
 - 1. Armstrong Installation Systems Guide F-5061
 - 2. Forbo MCT Installation Fast Facts v1.0 04/08
 - 3. Armstrong Maintenance Guide F-8663
 - 4. Forbo MCT Maintenance Manual 02/08/MDW



1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - a. Product Data: Data describing physical and performance characteristics; including sizes, patterns and colors including manufacturer's product sheet.
 - 1) Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, accessories, finish colors, patterns and textures.
 - 2) Samples: Submit selection and verification samples for finishes, colors, and textures.
 - 3) Quality Assurance Submittals: Submit the following:
 - i. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
 - ii. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria, and physical requirements.
 - iii. Manufacturer's Instructions: Manufacturer's installation instructions.
 - 4) Closeout Submittals: Submit the following:
 - i. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.
 - ii. Warranty: Warranty documents specified herein.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of this Section with minimum 5 years documented experience.
 - 1. Engage installer certified, as a "manufacturer's approved mechanic."
 - 2. Certificate: When requested, submit certificate indicating qualification.
- B. Regulatory Requirements:
 - 1. Critical Radiant Flux in Accordance with ASTM E 684: More than 0.45 Watts per square centimeter.
 - 2. Specific Optical Smoke Density in Accordance with ASTM E 662: Less than 450.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, Handle, Store, and Protect Products.
- B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- C. Deliver tiles and installation accessories to site in original manufacturer's unopened cartons and containers each bearing names of product and manufacturer, project identification, and shipping and handling instructions.
- D. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.
 - 1. Material should be stored in areas that are fully enclosed, weathertight with the permanent HVAC system set at a uniform temperature of at least 68 degrees F (20 degrees C) for 72 hrs. prior to, and during installation.
 - 2. Store tiles on flat surfaces.

1.6 SEQUENCING AND SCHEDULING



- A. Finishing Operations: Install tile flooring after finishing operations, including painting and ceiling operations, have been completed.
- B. Concrete Curing: Do not install tile flooring over concrete substrates until substrates have cured and are dry to bond with adhesive as determined by resilient flooring manufacturer's recommended bond, moisture test, and pH test.

1.7 WARRANTY

- A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.
 - 1. Warranty Period: Five (5) year limited warranty commencing on Date of Substantial Completion.

1.8 MAINTENANCE

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Extra Materials:
 - 1. Provide 1 box of extra floor tiles for each tile type, panel, and color.
 - 2. Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Tile: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 - 1. Armstrong World Industries, Lancaster, PA Representative Contact: Lien Chu (800) 356-9301, ext. 8274.
 - 2. Forbo flooring systems, Hazelton, PA Representative Contact: Tim J. Brown (302) 419-8492
 - 3. Johnsonite, Donna Heffernan Sission (703) 250-0714
- B. Wall Base: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 - 1. Allstate Rubber Corporation, Ozone Park, NY (718) 526-7890.
 - 2. Armstrong World Industries, Lancaster, PA (800) 448-1405. Representative Contact: Lien Chu (800) 356-9301, ext. 8274.
 - 3. Forbo Flooring Systems, Hazelton, PA Representative Contact: Tim J. Brown (302) 419-8492.
 - 4. Johnsonite, Donna Heffernan Sission (703) 250-0714
 - 5. Vinyl Plastics, Inc., Sheboygan, WI (800) 874-4240.
- C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

NOTE TO SPECIFIER

For administrative areas, other colors can be selected from the manufacturer's standard colors, with the approval of USPS Headquarters Design & Construction, Contracting officer.



2.2 MATERIALS

A. Floor Tile

1. Armstrong Migrations (BBT), ASTM F1066 Class 2
 - a. Size: 12 inch x 12 inch
 - b. Thickness: 0.125 in (3.2 mm)
 - c. Style and Color:
 - 1) RFT-1: T3518 Denim Blue
 - 2) RFT-2: T3506 Glacier Gray
2. Forbo Marmoleum Composition Tile (MCT)
 - a. Size: 13 inch x 13 inch Approx (33 cm x 33 cm), ASTM F2195
 - b. Thickness: 0.080 in (2.0 mm).
 - c. Style and Color:
 - 1) RFT-1: 3030 Blue
 - 2) RFT-2: 3055 Fresco Blue
3. Johnsonite Linoleum
 - a. Size: 12 inch x 12 inch
 - b. Thickness: 0.080 in (2.0 mm)
 - c. Style and Color:
 - 1) RFT-1: 688 Downpour
 - 2) RFT-2: 666 Raindrop

B. Wall Base:

1. Height: 4 inches
2. Thickness: 1/8 inch.
3. Coved.
4. Length: Roll.
5. Material Color: Color to be coordinate with adjacent resilient floor tile and as approved by the Contracting Officer.

2.3 ACCESSORIES

- A. Subfloor Filler: Latex underlayment, mixed with undiluted latex liquid furnished by the selected manufacturer.
 1. Underlayment and Patching Compound: Refer to Section 033000 Cast-In-Place Concrete for portland cement based underlayments and patching compounds.
- B. Primers and Adhesives: Waterproof; clear; of types as approved by resilient flooring manufacturer for specific material and substrates encountered. Zero VOC.
- C. Base Accessories: Premolded end stops and internal, and external corners of same material, size, and color as base.
- D. Expansion Joint Covers: Refer to other specification section for expansion joint covers to be used with resilient flooring.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.



- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work and are acceptable for product installation in accordance with manufacturer's instructions.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.
- E. Material Inspection: In accordance with manufacturer's installation requirements, visually inspect materials prior to installation. Material with visual defects shall not be installed and shall not be considered as a legitimate claim.

3.2 PREPARATION

- A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.
- B. Surface Preparation:
 - 1. General: Prepare floor substrate in accordance with manufacturer's instructions.
 - 2. Floor Substrate: Prepare floor substrate to be smooth, rigid, flat, level, permanently dry, clean and free of foreign materials such as dust, paint, grease, oils, solvent, curing and hardening compounds, sealers, asphalt and old adhesive residue.
 - 3. Concrete Floor Substrate: Concrete floor substrate shall have a minimum compressive strength of 3500 psi. Refer to Division 3 Concrete sections for patching and repairing crack materials, and leveling compounds with Portland cement based compounds. Do not use or install flooring over gypsum based leveling or patching materials
 - 4. Reference Standard: Comply with ASTM F 710 Practice for Preparing Concrete Floors and Other Monolithic Floors to Receive Resilient Flooring.
- C. Concrete Moisture Test:
 - 1. ASTM F1869-98 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Sub floor Using Anhydrous Calcium Chloride: The moisture emission from the concrete shall not exceed 5.0 lbs. per 1000 sq. ft. in 24 hrs (verify using the calcium chloride test as per ASTM F 1869-98). A diagram of the area showing the location and results of each test shall be submitted to the Contracting Officer. If the test results exceed the limitations, the installation shall not proceed until the problem has been corrected.
 - 2. ASTM F2170-02 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes. The relative humidity measured from the center of the concrete slab should not exceed 75%. If the test results exceed the limitations, the installation must not proceed until the problem has been corrected.
 - 3. The test area shall be conditioned with the permanent HVAC system set at a uniform temperature of at least 68 degrees F (20 degrees C) for 72 hrs prior to and during testing.
- D. Concrete pH Test: Perform pH tests on concrete floors regardless of the age or grade level. If the pH is greater than 10, it must be neutralized prior to beginning the installation.
- E. Prohibit traffic until filler is cured.
- F. Vacuum clean substrate.

3.3 INSTALLATION - TILE FLOORING



- A. Install resilient tile flooring in accordance with manufacturer's published instructions referenced above.
 - 1. Installation environment should be conditioned to a constant temperature and humidity conditions. Site should have permanent windows and doors, fully enclosed, weather tight with permanent HVAC system (not temporary) set at a uniform temperature of at least 68 degrees F (20 degrees C) for 72 hours prior to, during, and 72 hours after installation.
- B. Open number of floor tile cartons to provide quantity of flooring material required to cover each area; mix tile pieces to ensure shade variations do not occur within any one area.
- C. Spread only enough adhesive to permit installation of floor materials before initial set.
- D. Set flooring in place, press with a 150 pound resilient flooring roller to attain full adhesion.
- E. Lay flooring from center marks established parallel to building walls.
 - 1. Allow minimum 1/2 full size tile width at room or area perimeter.
 - 2. Adjust tile layout as required to avoid use of units less than 1/2 tile.
- F. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar. Where flooring continues through door opening, continue established pattern with no interruption.
- G. Install edge strips at unprotected or exposed edges where flooring terminates.
- H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- I. Extend flooring into toe spaces, door reveals, closets, and similar openings.
- J. Do not install resilient flooring over expansion joints. Use expansion joint covers manufactured for use with resilient flooring. Refer to other specifications sections for expansion joint covers.
- K. Adhere resilient flooring to flooring substrate without producing open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections in completed flooring installation.
 - 1. Use adhesive applied to substrate in compliance with flooring manufacturer's recommendations, including those for trowel notching, adhesive mixing, and adhesive open and working times.
- L. The specified resilient tiles are factory finished; no finishing is required after installation. Refer to manufacturer's instructions referenced above for detailed recommendations for initial and restorative maintenance.

3.4 INSTALLATION – WALL BASE

- A. Install wall base in accordance with manufacturer's published instructions.
- B. Fit joints tight and vertical. Maintain minimum measurement of 18 inches between joints.
- C. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
- D. Install wall base on solid backing. Bond tight to wall and floor surfaces.
- E. Apply the base to the cabinet toe kicks. If necessary, use a hot air gun to make the base pliable enough to turn the corners of the toe kick. Minimize or eliminate base seams on the toe kick. If the cabinet butts into a wall, start the base where the wall and cabinet meet and continue around the exposed area of the toe kick.



NOTE TO SPECIFIER

"REQUIRED Article (SITE ENVIRONMENTAL PROCEDURES) follows. Do not revise this Article, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, Contracting Officer."

3.5 SITE ENVIRONMENTAL PROCEDURES

A. Indoor Air Quality:

1. Temporary ventilation: As specified in Section 013543 - Environmental Procedures.
 - a. Ventilate products prior to installation. Remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources and residues. Provide a temperature range of minimum 60 degrees F to maximum 90 degree F continuously for minimum 72 hours. Do not ventilate within limits of Work unless otherwise approved by USPS Contracting Officer.

3.6 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field inspection.

1. Manufacturer's Field Services: Upon Owner's request and with at least 2-3 week notice, provide manufacturer's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with manufacturer's instructions.

B. Inspect resilient flooring and base installation, pattern, layout, and attachment to substrate.

3.7 CLEANING

A. Section 017300 - Execution: Cleaning installed Work.

- B. Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.
 1. Remove visible adhesive and other surface blemishes using cleaning methods recommended by tile floor manufacturer.
 2. Sweep and vacuum floor after installation.
 3. Do not wash floor until after time period recommended by tile flooring manufacturer.
 4. Damp mop tile flooring to remove black marks and soil.

3.8 PROTECTION

- A. Protection: Protect installed product and finish surfaces from damage during construction. Remove and legally dispose of protective covering at time of Substantial Completion.

3.9 INITIAL MAINTENANCE PROCEDURES FOR LINOLEUM.

- A. Drying Room Film: Expose installed linoleum to either natural or artificial light to allow "drying room film" (the yellow film is a natural occurrence of the oxidation of the linseed oil in linoleum products) on installed linoleum flooring to disappear prior to initiating temporary protection procedures.



USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



SECTION 09 65 00 00 - MPF RESILIENT FLOORING**

NOTE TO SPECIFIER

Use this section for Mail Processing Facilities.

****THIS ENTIRE SECTION CONSISTS OF REQUIRED PARTS OR ARTICLES. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Resilient tile flooring.
 - 2. Resilient base.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections: Related work specified elsewhere includes but may not be limited to
 - 1. Section 017704: Closeout Procedures and Training.
 - 2. Section 033000: Cast-In-Place Concrete.
 - 3. Section 123504 – Postal Casework.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM F710
 - 2. ASTM F1066
 - 3. ASTM 1869-98 ASTM F2170-02
 - 4. ASTM F2170-02
 - 5. ASTM F2195
- B. Manufacturer's Guides:
 - 1. Armstrong Installation Systems Guide F-5061
 - 2. Forbo MCT Installation Fast Facts v1.0 04/08
 - 3. Armstrong Maintenance Guide F-8663
 - 4. Forbo MCT Maintenance Manual 02/08/MDW

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - a. Product Data: Data describing physical and performance characteristics; including sizes, patterns and colors including manufacturer's product sheet.
 - 1) Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, accessories, finish colors, patterns and textures.
 - 2) Samples: Submit selection and verification samples for finishes, colors, and textures.
 - 3) Quality Assurance Submittals: Submit the following:



- i. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
- ii. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria, and physical requirements.
- iii. Manufacturer's Instructions: Manufacturer's installation instructions.
- 4) Closeout Submittals: Submit the following:
 - i. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.
 - ii. Warranty: Warranty documents specified herein.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of this Section with minimum 5 years documented experience.
 - 1. Engage installer certified, as a "manufacturer's approved mechanic."
 - 2. Certificate: When requested, submit certificate indicating qualification.
- B. Regulatory Requirements:
 - 1. Critical Radiant Flux in Accordance with ASTM E 684: More than 0.45 Watts per square centimeter.
 - 2. Specific Optical Smoke Density in Accordance with ASTM E 662: Less than 450.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, Handle, Store, and Protect Products.
- B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- C. Deliver tiles and installation accessories to site in original manufacturer's unopened cartons and containers each bearing names of product and manufacturer, project identification, and shipping and handling instructions.
- D. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.
 - 1. Material should be stored in areas that are fully enclosed, weathertight with the permanent HVAC system set at a uniform temperature of at least 68 degrees F (20 degrees C) for 72 hrs. prior to and during installation.
 - 2. Store tiles on flat surfaces.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Jobsite Requirements:
 - 1. Environmental Requirements/Conditions: In accordance with manufacturer's recommendations, areas to receive flooring shall be clean, fully enclosed, weather tight with the permanent HVAC set at a uniform temperature of at least 68 degrees F. The flooring material should be conditioned in the same manner. Maximum temperature should not exceed 100 degrees F after installation.
 - 2. Temperature Requirements: Maintain air temperature in spaces where products will be installed for time period before, during, and after installation as recommended by manufacturer.



- a. Temperature Conditions: 68 degrees F (20 degrees C) for 72 hours prior to, during and after installation.
3. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.7 SEQUENCING AND SCHEDULING

- A. Finishing Operations: Install tile flooring after finishing operations, including painting and ceiling operations, have been completed.
- B. Concrete Curing: Do not install tile flooring over concrete substrates until substrates have cured and are dry to bond with adhesive as determined by resilient flooring manufacturer's recommended bond, moisture test, and pH test.

1.8 WARRANTY

- A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.
 1. Warranty Period: Five (5) year limited warranty commencing on Date of Substantial Completion.

1.9 MAINTENANCE

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Extra Materials:
 1. Provide 1 box of extra floor tiles for each tile type, panel, and color.
 2. Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Tile: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 1. Allstate Rubber Corporation, Ozone Park, NY (718) 526-7890.
 2. Armstrong World Industries, Lancaster, PA Representative Contact: Lien Chu (800) 356-9301 ext. 8274.
 3. Forbo Flooring Systems, Hazelton, PA Representative Contact: Tim J. Brown (302) 419-8492.
 4. Johnsonite, Donna Heffernan Sission (703) 250-0714
 5. Vinyl Plastics, Inc., Sheboygan, WI (800) 874-4240.
- B. Wall Base: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 1. Allstate Rubber Corporation, Ozone Park, NY (718) 526-7890.
 2. Armstrong World Industries, Lancaster, PA (800) 448-1405.
 3. Vinyl Plastics, Inc., Sheboygan, WI (800) 874-4240.
- C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

**NOTE TO SPECIFIER**

For administrative areas, other colors can be selected from the manufacturer's standard colors, with the approval of USPS Headquarters Design & Construction, Contracting officer.

2.2 MATERIALS**A. Floor Tile**

1. Armstrong Migration (BBT), ASTM F1066 Class 2
 - a. Size: 12 inch x 12 inch
 - b. Thickness: 0.125 in (3.2 mm)
 - c. Style and Color:
 - 1) RFT-1: T3518 Denim Blue
 - 2) RFT-2: T3506 Glacier Gray
2. Forbo Marmoleum Composition Tile (MCT)
 - a. Size: 13 inch x 13 inch Approx (33 cm x 33 cm), ASTM F2195
 - b. Thickness: 0.080 in (2.0 mm)
 - c. Style and Color:
 - 1) RFT-1: 3030 Blue
 - 2) RFT-2: 3055 Fresco Blue
3. Johnsonite Linoleum
 - a. Size: 12 inch x 12 inch
 - b. Thickness: 0.080 in (2.0 mm)
 - c. Style and Color:
 - 1) RFT-1: 688 Downpour
 - 2) RFT-2: 666 Raindrop

B. Wall Base:

1. Height: 4 inches
2. Thickness: 1/8 inch.
3. Coved.
4. Length: Roll.
5. Material/Color: Color to be coordinate with adjacent resilient floor tile and as approved by the Contracting Officer.

2.3 ACCESSORIES

- A. Subfloor Filler: Latex underlayment, mixed with undiluted latex liquid furnished by the selected manufacturer.
 1. Underlayment and Patching Compound: Refer to Section 033000 Cast-In-Place Concrete for portland cement based underlayments and patching compounds.
- B. Primers and Adhesives: Waterproof; clear; of types as approved by resilient flooring manufacturer for specific material and substrates encountered. Zero VOC.
- C. Base Accessories: Premolded end stops and internal, and external corners of same material, size, and color as base.
- D. Expansion Joint Covers: Refer to other specification section for expansion joint covers to be used with resilient flooring.



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work and are acceptable for product installation in accordance with manufacturer's instructions.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.
- E. Material Inspection: In accordance with manufacturer's installation requirements, visually inspect materials prior to installation. Material with visual defects shall not be installed and shall not be considered as a legitimate claim.

3.2 PREPARATION

- A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.
- B. Surface Preparation:
 - 1. General: Prepare floor substrate in accordance with manufacturer's instructions.
 - 2. Floor Substrate: Prepare floor substrate to be smooth, rigid, flat, level, permanently dry, clean and free of foreign materials such as dust, paint, grease, oils, solvent, curing and hardening compounds, sealers, asphalt and old adhesive residue.
 - 3. Concrete Floor Substrate: Concrete floor substrate shall have a minimum compressive strength of 3500 psi. Refer to Division 3 Concrete sections for patching and repairing crack materials, and leveling compounds with Portland cement based compounds. Do not use or install flooring over gypsum based leveling or patching materials
 - 4. Reference Standard: Comply with ASTM F 710 Practice for Preparing Concrete Floors and Other Monolithic Floors to Receive Resilient Flooring.
- C. Concrete Moisture Test:
 - 1. ASTM F1869-98 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Sub floor Using Anhydrous Calcium Chloride: The moisture emission from the concrete shall not exceed 5.0 lbs. per 1000 sq. ft. in 24 hrs (verify using the calcium chloride test as per ASTM F 1869-98). A diagram of the area showing the location and results of each test shall be submitted to the Contracting Officer. If the test results exceed the limitations, the installation shall not proceed until the problem has been corrected.
 - 2. ASTM F2170-02 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes. The relative humidity measured from the center of the concrete slab should not exceed 75%. If the test results exceed the limitations, the installation must not proceed until the problem has been corrected.
 - 3. The test area shall be conditioned with the permanent HVAC system set at a uniform temperature of at least 68 degrees F (20 degrees C) for 72 hrs prior to and during testing.
- D. Concrete pH Test: Perform pH tests on concrete floors regardless of the age or grade level. If the pH is greater than 10, it must be neutralized prior to beginning the installation.



- E. Prohibit traffic until filler is cured.
- F. Vacuum clean substrate.

3.3 INSTALLATION - TILE FLOORING

- A. Install resilient tile flooring in accordance with manufacturer's published instructions referenced above.
 - 1. Installation environment should be conditioned to a constant temperature and humidity conditions. Site should have permanent windows and doors, fully enclosed, weather tight with permanent HVAC system (not temporary) set at a uniform temperature of at least 68 degrees F (20 degrees C) for 72 hours prior to, during, and 72 hours after installation.
- B. Open number of floor tile cartons to provide quantity of flooring material required to cover each area; mix tile pieces to ensure shade variations do not occur within any one area.
- C. Spread only enough adhesive to permit installation of floor materials before initial set.
- D. Set flooring in place, press with a 150 pound resilient flooring roller to attain full adhesion.
- E. Lay flooring from center marks established parallel to building walls.
 - 1. Allow minimum 1/2 full size tile width at room or area perimeter.
 - 2. Adjust tile layout as required to avoid use of units less than 1/2 tile.
- F. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar. Where flooring continues through door opening, continue established pattern with no interruption.
- G. Install edge strips at unprotected or exposed edges where flooring terminates.
- H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- I. Extend flooring into toe spaces, door reveals, closets, and similar openings.
- J. Do not install resilient flooring over expansion joints. Use expansion joint covers manufactured for use with resilient flooring. Refer to other specifications sections for expansion joint covers.
- K. Adhere resilient flooring to flooring substrate without producing open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections in completed flooring installation.
 - 1. Use adhesive applied to substrate in compliance with flooring manufacturer's recommendations, including those for trowel notching, adhesive mixing, and adhesive open and working times.
- L. The specified resilient tiles are factory finished; no finishing is required after installation. Refer to manufacturer's instructions referenced in 1.2B for detailed recommendations for initial and restorative maintenance.
- M. Wait at least 5 days after installation before conducting wet cleaning. Scrub floor with a neutral pH detergent/cleaner.

3.4 INSTALLATION - BASE

- A. Install wall base in accordance with manufacturer's published instructions.
- B. Fit joints tight and vertical. Maintain minimum measurement of 18 inches between joints.



- C. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
- D. Install wall base on solid backing. Bond tight to wall and floor surfaces.
- E. Apply the base to the cabinet toe kicks. If necessary, use a hot air gun to make the base pliable enough to turn the corners of the toe kick. Minimize or eliminate base seams on the toe kick. If the cabinet butts into a wall, start the base where the wall and cabinet meet and continue around the exposed area of the toe kick.

NOTE TO SPECIFIER

"REQUIRED Article (SITE ENVIRONMENTAL PROCEDURES) follows. Do not revise this Article, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, Contracting Officer."

3.5 SITE ENVIRONMENTAL PROCEDURES

- A. Indoor Air Quality:
 - 1. Temporary ventilation: As specified in Section 013543 - Environmental Procedures.
 - a. Ventilate products prior to installation. Remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources and residues. Provide a temperature range of minimum 60 degrees F to maximum 90 degree F continuously for minimum 72 hours. Do not ventilate within limits of Work unless otherwise approved by USPS Contracting Officer.

3.6 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection.
 - 1. Manufacturer's Field Services: Upon Owner's request and with at least 2-3 week notice, provide manufacturer's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with manufacturer's instructions.
- B. Inspect resilient flooring and base installation, pattern, layout, and attachment to substrate.

3.7 CLEANING

- A. Section 017300 - Execution: Cleaning installed Work.
- B. Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.
 - 1. Remove visible adhesive and other surface blemishes using cleaning methods recommended by tile floor manufacturer.
 - 2. Sweep and vacuum floor after installation.
 - 3. Do not wash floor until after time period recommended by tile flooring manufacturer.
 - 4. Damp mop tile flooring to remove black marks and soil.

3.8 PROTECTION

- A. Protection: Protect installed product and finish surfaces from damage during construction. Remove and legally dispose of protective covering at time of Substantial Completion.



3.9 INITIAL MAINTENANCE PROCEDURES FOR LINOLEUM.

- A. Drying Room Film: Expose installed linoleum to either natural or artificial light to allow "drying room film" (the yellow film is a natural occurrence of the oxidation of the linseed oil in linoleum products) on installed linoleum flooring to disappear prior to initiating temporary protection procedures.

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Last revised: 3/31/2010

END OF SECTION 09 65 00 00



SECTION 09 65 13 13 - CORK FLOORING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for cork flooring. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Cork floor tile.
 - b. Engineered cork floor tile.
 - c. Cork rubber floor tile.
 - d. Cork floating floor system.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit MR 6.0: For cork flooring, including printed statement of costs for each rapidly renewable material.
 - b. Product Data for Credit EQ 4.1: For adhesive, including printed statement of VOC content.
 - c. Product Data for Credit EQ 4.2: For field-applied sealer and finish coatings, including printed statement of VOC content.
 - d. Product Data for Credit EQ 4.4: For cork flooring and MDF, including printed statement indicating that the bonding agent and adhesive contain no urea-formaldehyde resins.
3. Shop Drawings: For each type of cork flooring. Include cork flooring layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
4. Samples: Full-size units of each shade and finish **OR** shade, pattern, and finish **OR** color and pattern, **as directed**, of cork flooring required.
5. Maintenance Data: For each type of cork flooring to include in maintenance manuals.

D. Quality Assurance

1. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - a. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm **OR** Class II, not less than 0.22 W/sq. cm, **as directed**.
2. Product Certificates: For cork floating floor system, from manufacturer, certifying that MDF core contains no urea-formaldehyde resins.

E. Delivery, Storage, And Handling

1. Store cork flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store cork flooring on flat surfaces.

F. Project Conditions

1. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F (18 deg C) or more than 75 deg F (24 deg C) where relative humidity is between 45 and 65 percent, in spaces to receive cork flooring during the following time periods:
 - a. 72 hours before installation.
 - b. During installation.
 - c. 72 hours after installation.



2. Until Final Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F (18 deg C) or more than 75 deg F (24 deg C).
3. Close spaces to traffic during cork flooring installation.
4. Close spaces to traffic for 72 hours after cork flooring installation.
5. Install cork flooring after other finishing operations, including painting, have been completed.

1.2 PRODUCTS

A. Cork Floor Tile

1. Cork Floor Tile: Composed of 100 percent natural cork bark and recycled cork granules and set in a natural or synthetic, flexible resin matrix; homogeneous and uniform in composition throughout the tile thickness.
2. Provide cork floor tile made with adhesives and binders that do not contain urea-formaldehyde resins.
3. Minimum Density: 30 lb/cu. ft. (480 kg/cu. m) **OR** 34 lb/cu. ft. (544 kg/cu. m) **OR** 37 lb/cu. ft. (592 kg/cu. m), **as directed**.
4. Thickness: Nominal 0.180 inch (4.8 mm) **OR** Nominal 0.312 inch (8.0 mm), **as directed**.
5. Size: 12 by 12 inches (305 by 305 mm) **OR** 12 by 24 inches (305 by 610 mm) **OR** 24 by 24 inches (610 by 610 mm), **as directed**.
6. Shade: Light **OR** Medium **OR** Dark **OR** As indicated by manufacturer's designations **OR** Match sample, **as directed**.
7. Finish: Sanded or unfinished **OR** Waxed **OR** Polyurethane **OR** Polyurethane containing UV inhibitors **OR** Acrylic **OR** As indicated by manufacturer's designations **OR** Match sample, **as directed**.

B. Engineered Cork Floor Tile

1. Engineered Cork Floor Tile: Composed of 100 percent natural cork bark and recycled cork granules with laminated, patterned cork veneers and set in a natural or synthetic, flexible resin matrix; homogeneous and uniform in composition throughout the tile thickness.
2. Provide cork floor tile made with adhesives and binders that do not contain urea-formaldehyde resins.
3. Minimum Density: 30 lb/cu. ft. (480 kg/cu. m) **OR** 34 lb/cu. ft. (544 kg/cu. m) **OR** 37 lb/cu. ft. (592 kg/cu. m), **as directed**.
4. Thickness: Nominal 0.180 inch (4.8 mm) **OR** Nominal 0.312 inch (8.0 mm), **as directed**.
5. Size: 12 by 12 inches (305 by 305 mm) **OR** 12 by 24 inches (305 by 610 mm) **OR** 24 by 24 inches (610 by 610 mm), **as directed**.
6. Shade: Light **OR** Medium **OR** Dark **OR** As indicated by manufacturer's designations **OR** Match sample, **as directed**.
7. Pattern: As indicated by manufacturer's designations **OR** Match sample, **as directed**.
8. Finish: Sanded or unfinished **OR** Waxed **OR** Polyurethane **OR** Polyurethane containing UV inhibitors **OR** Acrylic **OR** As indicated by manufacturer's designations **OR** Match sample, **as directed**.

C. Cork Rubber Floor Tile

1. Cork Rubber Floor Tile: Composed of 70 percent natural cork granules and 30 percent rubber granules combined with fade-resistant pigments; homogeneous and uniform in composition throughout the tile thickness.
2. Provide cork rubber floor tile made with adhesives and binders that do not contain urea-formaldehyde resins.
3. Physical Characteristics:
 - a. Minimum Density: 78 lb/cu. ft. (1249 kg/cu. m).
 - b. Minimum Tensile Strength: 700 psi (4.8 MPa).
4. Thickness: Nominal 0.125 inch (3.2 mm).
5. Size: 18 by 18 inches (450 by 450 mm).



6. Texture: Lightly textured wear surface.
 7. Colors and Patterns: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from full range of industry colors, **as directed**.
- D. Cork Floating Floor System
1. Cork Floating Floor System: Laminated planks made of two cork layers, top and bottom, sandwiched around an MDF core and containing no urea-formaldehyde resins.
 2. Plank Density:
 - a. Cork Top Layer: 28 lb/cu. ft. (448 kg/cu. m) **OR** Manufacturer's standard density, **as directed**.
 - b. Interlocking MDF Core: 45 lb/cu. ft. (720 kg/cu. m) **OR** Manufacturer's standard density, **as directed**.
 - c. Cork Underlayment Layer: 13 lb/cu. ft. (208 kg/cu. m) **OR** Manufacturer's standard density, **as directed**.
 3. Plank Thickness: Nominal 0.450-inch (11.4-mm) overall thickness made up as follows:
 - a. Cork Top Layer: Nominal 0.125 inch (3.2 mm) **OR** Manufacturer's standard dimension, **as directed**.
 - b. Interlocking MDF Core: Nominal 0.250 inch (6.3 mm) **OR** Manufacturer's standard dimension, **as directed**.
 - c. Cork Underlayment Layer: Nominal 0.078 inch (2.0 mm) **OR** Manufacturer's standard dimension, **as directed**.
 4. Plank Size: 18 by 18 inches (450 by 450 mm) **OR** 36 by 12 inches (900 by 305 mm), **as directed**.
 5. Plank Edge: Tongue-and-groove type **OR** Manufacturer's standard interlock, **as directed**.
 6. Shade: Light **OR** Medium **OR** Dark **OR** As indicated by manufacturer's designations **OR** Match sample, **as directed**.
 7. Pattern: As indicated by manufacturer's designations **OR** Match sample, **as directed**.
 8. Finish: Sanded or unfinished **OR** Waxed **OR** Polyurethane **OR** Polyurethane containing UV inhibitors **OR** Acrylic **OR** As indicated by manufacturer's designations **OR** Match sample, **as directed**.
- E. Installation Materials
1. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement-based or blended hydraulic-cement-based formulation provided or approved by cork flooring manufacturer for applications indicated.
 2. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 6.0 mils (0.15 mm) **OR** 8.0 mils (0.2 mm), **as directed**, thick.
 3. Adhesive: Water-resistant products as recommended by manufacturer to suit cork flooring and substrate conditions indicated.
 - a. Use adhesives that have a VOC content of not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Field-Applied Finishes
1. Cork Sealer: Product as recommended by cork flooring manufacturer.
 - a. Use sealers that have a VOC content of not more than 350 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Paste Wax: Products as recommended by cork flooring manufacturer.
 3. Finish Coatings: Products containing UV inhibitors as recommended by cork flooring manufacturer.
 - a. Use finish coatings that have a VOC content of not more than 350 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 4. Cork Rubber Tile Sealer: Product as recommended by cork rubber floor tile manufacturer.
 - a. Use sealers that have a VOC content of not more than 350 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1.3 EXECUTION

A. Preparation

1. Prepare substrates according to cork flooring manufacturer's written instructions to ensure adhesion of cork flooring.
2. Concrete Substrates: Prepare according to ASTM F 710.
 - a. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - b. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - c. Alkalinity and Adhesion Testing: Perform tests recommended by cork flooring manufacturer. Proceed with installation only after substrates pass testing.
 - d. Moisture Testing: Perform tests recommended by cork flooring manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - 1) Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - 2) Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
3. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.
4. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
5. Do not install cork flooring until materials are same temperature as space where they are to be installed.
 - a. Move cork flooring products and installation materials into spaces where they will be installed at least 72 hours in advance of installation.
6. Immediately before installation, sweep and vacuum clean substrates to be covered by cork flooring products.

B. Floor Tile Installation

1. Comply with cork flooring manufacturer's written instructions for installing cork flooring.
2. Mix floor tiles from each carton together to ensure uniform distribution of shade.
3. Discard broken, cracked, chipped, or deformed floor tiles.
4. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
5. Lay floor tiles square with room axis **OR** at a 45-degree angle with room axis **OR** in ashlar or staggered joint pattern **OR** in pattern indicated, **as directed**.
6. Apply adhesive to substrate and set floor tiles in adhesive.
7. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
8. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
9. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
10. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of shade and finish **OR** shade, pattern, and finish **OR** color and pattern, **as directed**, between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

C. Cork Floating Floor System Installation



1. Comply with manufacturer's written instructions for installing cork floating floor system.
 2. Install continuous vapor retarder over substrate, taping side and end laps.
 3. Mix floor planks from several cartons to ensure uniform distribution of shade.
 4. Discard broken, cracked, chipped, or deformed floor planks.
 5. Do not attach floor planks to substrate.
 6. Tightly interlock and adhere plank edges with adhesive. Remove excess adhesive from top surface of planks.
 7. Lay floor planks in pattern indicated.
 8. Use spacers to keep planks from shifting as subsequent rows are added. Remove spacers after installing cork floating floor system.
 9. Maintain expansion space at walls and other obstructions and terminations of flooring as indicated on Drawings **OR** of not less than 3/8 inch (9.5 mm), **as directed**.
 10. Extend floor planks into toe spaces, door reveals, closets, and similar openings. Extend floor planks to center of door openings.
 11. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor planks as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
- D. Field-Applied Finishes
1. Apply finishes according to cork flooring manufacturer's written instructions.
 2. Cork Sealer: Apply one **OR** two, **as directed**, coat(s).
 3. Paste Wax: Apply one **OR** two **OR** three, **as directed**, coat(s).
 4. Finish Coatings: Apply two **OR** three, **as directed**, coat(s).
 5. Cork Rubber Tile Sealer: Apply one **OR** two, **as directed**, coat(s).
- E. Cleaning And Protection
1. Comply with manufacturer's written instructions for cleaning and protecting cork flooring.
 2. Remove adhesive and other blemishes from exposed surfaces.
 3. Sweep and vacuum surfaces thoroughly.
 4. Damp-mop surfaces to remove marks and soil.
 5. Protect cork flooring products from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
 6. Cover cork flooring until Final Completion.

END OF SECTION 09 65 13 13



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Task	Specification	Specification Description
09 65 13 23	09 65 13 13	Cork Flooring
09 65 13 33	01 22 16 00	No Specification Required
09 65 13 33	09 65 13 13	Cork Flooring
09 65 16 23	09 65 13 13	Cork Flooring
09 65 19 19	09 65 13 13	Cork Flooring
09 65 19 23	09 65 13 13	Cork Flooring
09 65 19 33	09 65 13 13	Cork Flooring
09 66 13 00	09 01 60 00	Portland Cement Terrazzo Flooring
09 66 16 00	09 01 60 00	Portland Cement Terrazzo Flooring



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SECTION 09 66 23 16 - RESINOUS MATRIX TERRAZZO FLOORING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for resinous matrix terrazzo flooring. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Thin-set epoxy-resin terrazzo flooring and base.
 - b. Precast terrazzo units.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For marble chips, aggregates, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement that indicates cost for each product having recycled content.
 - b. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
3. Shop Drawings: Include terrazzo installation requirements. Include plans, elevations, sections, component details, and attachments to other work.
4. Samples: For each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected.
5. Installer certificates.
6. Qualification data.
7. Material certificates.
8. Maintenance data.

D. Quality Assurance

1. Installer Qualifications: A qualified installer who is acceptable to terrazzo manufacturer to install manufacturer's products.
 - a. Engage an installer who is certified in writing by terrazzo manufacturer as qualified to install manufacturer's products.
 - b. Engage an installer who is a contractor member of NTMA.
2. NTMA Standards: Comply with NTMA's "Terrazzo Specifications and Design Guide" and with written recommendations for terrazzo type indicated unless more stringent requirements are specified.
3. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling

1. Deliver materials to Project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number if any.
2. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

F. Project Conditions

1. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting terrazzo installation.

2. Field Measurements: Verify actual dimensions of construction contiguous with precast terrazzo by field measurements before fabrication.
3. Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during terrazzo installation.
4. Close spaces to traffic during terrazzo application and for not less than 24 hours after application unless manufacturer recommends a longer period.
5. Control and collect dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.
 - a. Provide dustproof partitions and temporary enclosures to limit dust migration and to isolate areas from noise.

1.2 PRODUCTS

A. Epoxy-Resin Terrazzo

1. Materials:
 - a. Flexible Reinforcing Membrane: Manufacturer's resinous membrane for substrate crack preparation and reflective crack reduction.
 - 1) Reinforcement: Fiberglass scrim.
 - b. Primer: Manufacturer's product recommended for substrate and use indicated.
 - c. Epoxy-Resin Matrix: Manufacturer's standard recommended for use indicated and in color required for mix indicated.
 - 1) Physical Properties without Marble Chips **OR** Aggregates, **as directed**:
 - a) Hardness: 60 to 85 per ASTM D 2240, Shore D.
 - b) Minimum Tensile Strength: 3000 psi (20.7 MPa) per ASTM D 638 for a 2-inch (51-mm) specimen made using a "C" die per ASTM D 412.
 - c) Minimum Compressive Strength: 10,000 psi (6.9 MPa) per ASTM D 695, Specimen B cylinder.
 - d) Chemical Resistance: No deleterious effects by contaminants listed below after seven-day immersion at room temperature per ASTM D 1308.
 - i. Distilled water.
 - ii. Mineral water.
 - iii. Isopropanol.
 - iv. Ethanol.
 - v. 0.025 percent detergent solution.
 - vi. 1.0 percent soap solution.
 - vii. 10 percent sodium hydroxide.
 - viii. 10 percent hydrochloric acid.
 - ix. 30 percent sulfuric acid.
 - x. 5 percent acetic acid.
 - 2) Physical Properties with Marble Chips **OR** Aggregates, **as directed**: For resin blended with Georgia white marble, ground, grouted, and cured per requirements in NTMA's "Terrazzo Specifications and Design Guide," comply with the following:
 - a) Flammability: Self-extinguishing, maximum extent of burning 0.25 inch (6.35 mm) per ASTM D 635.
 - b) Thermal Coefficient of Linear Expansion: 0.0025 inch/inch per deg F (0.0025 mm/mm per 0.5556 deg C) for temperature range of minus 12 to plus 140 deg F (minus 24 to plus 60 deg C) per ASTM D 696.
 - d. Marble Chips **OR** Aggregates, **as directed**: Complying with NTMA gradation standards for mix indicated and containing no deleterious or foreign matter.
 - 1) Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C 131.
 - 2) 24-Hour Absorption Rate: Less than 0.75 percent.
 - 3) Dust Content: Less than 1.0 percent by weight.
 - e. Finishing Grout: Resin based.



2. Terrazzo (for NTMA-formulated design mixes): Comply with NTMA's "Terrazzo Specifications and Design Guide" and manufacturer's written instructions for matrix and marble-chip proportions and mixing.
 - a. Formulated Mix Color and Pattern: As selected by the Owner from manufacturer's full range **OR** As selected from NTMA standard-terrazzo plates **OR** As selected from NTMA thin-set terrazzo plates, **as directed**.
 3. Terrazzo (for custom design mixes): Comply with NTMA's "Terrazzo Specifications and Design Guide" and manufacturer's written instructions for matrix and marble-chip **OR** aggregate, **as directed**, proportions and mixing.
 - a. Custom Mix Color and Pattern: Match sample **OR** Match existing, **as directed**.
- B. Strip Materials
1. Thin-Set Divider Strips: L-type angle or T-type, 1/4 inch (6.4 mm) deep.
 - a. Material: White-zinc alloy **OR** Brass **OR** Aluminum **OR** Plastic, in color selected from manufacturer's full range, **as directed**.
 - b. Top Width: 1/8 inch (3.2 mm) **OR** 1/4 inch (6.4 mm), **as directed**.
 2. Heavy-Top Divider Strips: L-type angle in depth required for topping thickness indicated.
 - a. Bottom-Section Material: Galvanized steel **OR** Matching top-section material, **as directed**.
 - b. Top-Section Material: White-zinc alloy **OR** Brass **OR** Aluminum **OR** Plastic, in color selected from manufacturer's full range, **as directed**.
 - c. Top-Section Width: 1/8 inch (3.2 mm) **OR** 1/4 inch (6.4 mm) **OR** 3/8 inch (9.5 mm) **OR** 1/2 inch (12.7 mm), **as directed**.
 3. Control-Joint Strips: Separate, double L-type angles, positioned back to back, that match material, thickness, and color of divider strips and in depth required for topping thickness indicated.
 4. Accessory Strips: Match divider strip width, material, and color unless otherwise indicated. Use the following types of accessory strips as required to provide a complete installation:
 - a. Base-bead strips for exposed top edge of terrazzo base.
 - b. Edge-bead strips for exposed edges of terrazzo.
 - c. Nosings for terrazzo stair treads and landings.
 5. Abrasive Strips (for terrazzo stair treads and landings): Silicon carbide or aluminum oxide, or combination of both, in epoxy-resin binder and set in channel.
 - a. Width: 1/2 inch (12.7 mm).
 - b. Depth: As required by terrazzo thickness.
 - c. Length: 4 inches (100 mm) less than stair width **OR** As indicated, **as directed**.
 - d. Color: As selected from manufacturer's full range.
- C. Miscellaneous Accessories
1. Strip Adhesive: Epoxy-resin adhesive recommended by adhesive manufacturer for this use and acceptable to terrazzo manufacturer.
 - a. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Anchoring Devices:
 - a. Strips: Provide mechanical anchoring devices for strip materials as required for secure attachment to substrate.
 - b. Precast Terrazzo: Provide mechanical anchoring devices as recommended by fabricator for proper anchorage and support of units for conditions of installation and support.
 3. Patching and Fill Material: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.
 4. Joint Compound: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.
 5. Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by sealer manufacturer for use on terrazzo type indicated.
 6. Sealer: Slip- and stain-resistant penetrating-type sealer that is chemically neutral with pH factor between 7 and 10; does not affect color or physical properties of terrazzo; is recommended by



sealer manufacturer; and complies with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated **OR** Acrylic **OR** Urethane **OR** Chemical-resistant epoxy, **as directed**.

D. Precast Terrazzo

1. Precast Terrazzo Units: Precast epoxy-resin terrazzo base, stair tread, threshold, bench, and planter units.
2. Precast Terrazzo Base Units: 1/4 inch (6.4 mm) thick; cast in maximum lengths possible, but not less than 36 inches (900 mm); with rounded, finished top edge.
 - a. Type: Coved with minimum 3/4-inch (19-mm) radius **OR** Straight **OR** Splayed **OR** As indicated, **as directed**.
 - b. Height: 6 inches (152 mm) **OR** 4 inches (101 mm) **OR** As indicated, **as directed**.
 - c. Outside Corner Units: With finished returned edges at outside corner.
 - d. Color, Pattern, and Finish: As selected from manufacturer's full range **OR** Match sample **OR** Match adjacent poured-in-place terrazzo flooring, **as directed**.
3. Precast Terrazzo Stair Treads: 1/2 inch (12.7 mm) thick with rounded nosing edge.
 - a. Abrasive Strips: Three-line **OR** Two-line **OR** One-line **OR** Abrasive nosing strip and two-line, **as directed**, abrasive inserts at nosings.
 - b. Color, Pattern, and Finish: As selected from manufacturer's full range **OR** Match sample **OR** Match adjacent poured-in-place terrazzo flooring, **as directed**.
4. Precast Terrazzo Finishing (for custom precast terrazzo components):
 - a. Finish exposed-to-view edges or reveals to match face finish.
 - b. Ease exposed edges to 1/8-inch (3-mm) radius.

1.3 EXECUTION

A. Preparation

1. Clean substrates of substances, including oil, grease, and curing compounds, that might impair terrazzo bond. Provide clean, dry, and neutral substrate for terrazzo application.
2. Concrete Slabs:
 - a. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with terrazzo.
 - 1) Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 - 2) Repair damaged and deteriorated concrete according to terrazzo manufacturer's written recommendations.
 - 3) Use patching and fill material to fill holes and depressions in substrates according to terrazzo manufacturer's written instructions.
 - b. Verify that concrete substrates are visibly dry and free of moisture.
 - c. Moisture Testing:
 - 1) Test for moisture by anhydrous calcium chloride method according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - 2) Test for moisture by relative humidity probe and digital meter method according to ASTM F 2170. Proceed with installation only after substrates have a maximum relative-humidity-measurement reading of 70 to 75 percent in 24 hours.
 - 3) Test for moisture content by method recommended in writing by terrazzo manufacturer. Proceed with installation only after substrates pass testing.
3. Protect other work from dust generated by grinding operations. Control dust to prevent air pollution and comply with environmental protection regulations.
 - a. Erect and maintain temporary enclosures and other suitable methods to limit dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.



4. Installation of terrazzo indicates acceptance of surfaces and conditions.
- B. Epoxy-Resin Terrazzo Installation
1. General:
 - a. Comply with NTMA's written recommendations for terrazzo and accessory installation.
 - b. Place, rough grind, grout, cure grout, fine grind, and finish terrazzo according to manufacturer's written instructions and NTMA's "Terrazzo Specifications and Design Guide."
 - c. Installation Tolerance: Limit variation in terrazzo surface from level to 1/4 inch in 10 feet (6 mm in 3 m); noncumulative.
 - d. Ensure that matrix components and fluids from grinding operations do not stain terrazzo by reacting with divider and control-joint strips.
 - e. Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted.
 2. Thickness: 1/4 inch (6.4 mm) **OR** 3/8 inch (9.5 mm) **OR** As indicated, **as directed**, nominal.
 3. Flexible Reinforcing Membrane:
 - a. Prepare and prefill substrate cracks with membrane material.
 - b. Install membrane to produce full substrate coverage in areas to receive terrazzo.
 - c. Reinforce membrane with fiberglass scrim.
 - d. Prepare membrane according to manufacturer's written instructions before applying substrate primer.
 4. Primer: Apply to terrazzo substrates according to manufacturer's written instructions.
 5. Strip Materials:
 - a. Divider and Control-Joint Strips:
 - 1) Locate divider strips in locations indicated.
 - 2) Install control-joint strips back to back directly above concrete-slab control joints **OR** in locations indicated, **as directed**.
 - 3) Install control-joint strips with 1/4-inch (6.4-mm) gap between strips, and install sealant in gap.
 - 4) Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.
 - b. Accessory Strips: Install accessory strips as required to provide a complete installation **OR** in locations indicated, **as directed**.
 - c. Abrasive Strips: Install with surface of abrasive strip positioned 1/16 inch (1.6 mm) **OR** 1/32 inch (0.8 mm), **as directed**, higher than terrazzo surface.
 6. Fine Grinding: Grind with stones 120 grit or finer until all grout is removed from surface. Repeat rough grinding, grout coat, and fine grinding if large voids exist after initial fine grinding. Produce surface with a minimum of 70 percent aggregate exposure.
 7. Repair: Remove and replace terrazzo areas that evidence lack of bond with substrate. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by the Owner.
- C. Precast Terrazzo Installation
1. Install precast terrazzo units using method recommended NTMA and manufacturer unless otherwise indicated.
 2. Installation Tolerance: Set units with alignment level and true to dimensions, varying 1/8-inch (3.2-mm) maximum in length, height, or width; noncumulative.
 3. Do not install units that are chipped, cracked, discolored, or not properly finished.
 4. Seal joints between units with joint compound matching precast terrazzo matrix **OR** joint sealant, **as directed**.
- D. Cleaning And Protection
1. Cleaning:
 - a. Remove grinding dust from installation and adjacent areas.



- b. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow to dry thoroughly.
2. Sealing:
 - a. Seal surfaces according to NTMA's written recommendations.
 - b. Apply sealer according to sealer manufacturer's written instructions.
3. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that terrazzo is without damage or deterioration at time of Final Completion.

END OF SECTION 09 66 23 16



Task	Specification	Specification Description
09 66 33 00	09 66 23 16	Resinous Matrix Terrazzo Flooring



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SECTION 09 67 23 00 - MPF RESINOUS FLOORING

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 – GENERAL

1.1 SUMMARY

- A. Epoxy flooring.

1.2 SUBMITTALS

- A. Product Data: Required
- B. Samples: Required
- C. Color: Light Gray, to be selected from manufacturer's standard colors and approved by the Contracting Officer.

1.3 QUALITY ASSURANCE

- A. Applicator to be certified and licensed by the flooring manufacturer.
- B. Field samples to be approved and serve as minimum acceptable standards for finished work.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Stonhard;
 - 1. Floor Product: Stonclad GS
- B. Crossfield Products Corporation;
 - 1. Floor Product: Dex-O-Tex Decor-flor
- C. General Polymers
- D. Florock
- E. Dur-A-Flex Inc.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Apply coating systems in accordance with manufacturer instructions for material and substrate involved.
- B. Provide ample ventilation during application.



USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 7/2/2010

END OF SECTION 09 67 23 00



SECTION 09 67 23 00 - CSF RESINOUS FLOORING

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.09 67 23 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Epoxy coating with integral slip-resistant abrasive additive on Toilet Room floors.

1.2 REFERENCES

- A. Comply with the following American Society for Testing and Materials (ASTM) standards:
 1. E-84: Test Method for Surface Burning Characteristics of Building Materials
 2. D-4060: Test Method for Abrasion Resistance of Organic Coatings
 3. D-714: Test Method for Evaluating degree of blistering of Paints
 4. D-4585: Standard Practice for Testing Water Resistance of Coatings

1.3 SUBMITTALS

- A. Product Data: Required
- B. Samples: Required

NOTE TO SPECIFIER

Color to be selected from manufacturer's standard colors and approved by the Contracting Officer.

- C. Color: [_____]

1.4 QUALITY ASSURANCE

- A. Applicator to be certified and licensed by the flooring manufacturer.
- B. Field samples to be approved and serve as minimum acceptable standards for finished work.



PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design:

1. Manufacturer: Stonhard, Maple Shade, NJ (800) 257-7953

a. Floor Product: Stonclad GS.

B. Equal Products by one of the following Manufacturers may be substituted:

1. Crossfield Products, Dex-O-Tex, Rancho Dominguez, CA (310) 886-9100
2. General Polymers, Cincinnati, OH (800) 543-7694
3. Florock, Chicago, IL (800) 356-7625
4. Dur-A-Flex, East Hartford, CT (800) 253-3539

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Apply coating system in strict accordance with manufacturer instructions for material and substrate involved.
- B. Provide ample ventilation during application.

USPS CSF Specifications issued: 10/1/2013

Last revised: 4/12/2011

END OF SECTION



Task	Specification	Specification Description
09 67 23 00	09 66 23 16	Resinous Matrix Terrazzo Flooring



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SECTION 09 68 00 00 - MPF CARPET

REMINDER TO USPS MASTER SPEC REVIEWERS

Where the text for each Program differs, it is identified by colored highlighting

Yellow highlighted text is for MSBD only.

Blue highlighted text is for SSBD and RSD only.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER. REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION.

NOTE TO SPECIFIER

USE THIS SECTION CARPET TILE ONLY IN ADMINISTRATIVE OFFICES. DO NOT USE IN POSTMASTER OFFICES.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Carpet tile loose laid with edges and control grid adhered. Product and color selections are indicated on the Finish Schedule on the drawings.
 - 2. Surface preparation and repair.
 - 3. Removal of existing carpet.
 - 4. Accessories.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 REFERENCES

- A. ASTM D 2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials.
- B. ASTM E 648 - Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
- B. CRI 104 - Standard for Installation of Commercial Textile Floorcovering Materials; Carpet and Rug



Institute.

- C. CRI (GLA) - Green Label Testing Program - Approved Adhesive Products; www.carpet-rug.org; current edition.
- D. CRI (GLC) - Green Label Testing Program - Approved Product Categories for Carpet; www.carpet-rug.org; current edition.
- E. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; National Fire Protection Association.
- F. NFPA 258.
- G. DOC-FF-1-70 Pill Test
- H. AATCC Red 40 Stain Scale
- I. AATCC Test Method 175

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
- B. Shop Drawings: Indicate layout plan indicating colors and areas to be adhered.
- C. Product Data: Provide data on specified products, describing physical and performance characteristics, sizes, patterns, colors available, and method of installation.
- D. Samples: Submit two samples 24 x 24 inch (609.6 mm) in size illustrating color and pattern for each carpet and cushion material specified.
- E. Manufacturer's Installation Instructions: Indicate special procedures.
- F. Maintenance Data: Include maintenance procedures, recommended

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in stalling carpet with minimum three years' experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.



1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements:

1.7 WARRANTY

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.

1.8 MAINTENANCE

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Extra Products: At completion of installation, deliver to Contracting Officer.
 - 1. Section 016000 – Product Requirements, for additional requirements.

1.9 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the work include the following:
 - 1. Lees Carpets Contact: Mike Barry, 248-515-8212, mike_barry@mohawkind.com
- B. Section 016000 – Product Requirements: Product options and substitutions. Substitution permitted.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, product numbers, and availability at time of project manual preparation for project.

2.1 MANUFACTURERS

- A. General: This Finish Schedule on the drawings indicate specific products and colors which have been developed as part of a project-specific color scheme. Where products other than those indicated on the Finish Schedule are proposed, colors/textures of proposed products shall match, as determined by the Architect, the selected colors/textures.
- B. Carpet:
 - 1. Substitutions: See Section 016000 - Product Requirements.



NOTE TO SPECIFIER

Edit this section by adding a carpet type designation to each carpet, match to finish schedule, verify manufacturer information, product numbers and availability at time of project manual preparation for project.

2.2 MATERIALS

A. Carpet Type []:

1. Product: Lees Carpet.
2. Style: GT097 – Integrated Circuit Modular.
3. Size: 24in x 24 in.
4. Color: As shown on Finish Schedule on Drawings.
5. Installation Method: As recommended by manufacturer.
6. Critical Radiant Flux: Minimum of 0.45 watts/sq cm, when tested in accordance with ASTM E 648 or NFPA 253.
7. Surface Flammability Ignition: Pass DOC-FF-1-70 (the “pill test”).
8. VOC Content: Provide CRI Green Label certified product in lieu of labeling, independent test report showing compliance is acceptable.
9. Substitutions: See Section 016000 – Product Requirements.

B. Carpet Type []:

1. Product: Lees Carpet.
2. Style: GT071- It's a Sign Modular.
3. Size: 24in x 24 in.
4. Color: As shown on Finish Schedule on Drawings.
5. Installation Method: As recommended by manufacturer.
6. Critical Radiant Flux: Minimum of 0.45 watts/sq cm, when tested in accordance with ASTM E 648 or NFPA 253.
7. Surface Flammability Ignition: Pass DOD-FF-1-70 (the “pill test”).
8. VOC Content: Provide CRI Green Label certified product; in lieu of labeling, independent test report showing compliance is acceptable.
9. Substitutions: See Section 016000 – Product Requirements.

C. Carpet Type []:

1. Product: Lees Carpet.
2. Style: GT098 – Micro Stream Modular.
3. Size: 24in x 24in
4. Color: As shown on Finish Schedule on Drawings.
5. Installation Method: As recommended by manufacturer.
6. Critical Radiant Flux: Minimum of 0.45 watts/sq cm, when tested in accordance with ASTM E 648 or NFPA 253.
7. Surface Flammability Ignition: Pass DOC-FF-1-70 (the “pill test”).
8. VOC Content: Provide CRI Green Label certified product; in lieu of labeling, independent test report showing compliance is acceptable.
9. Substitutions: See Section 016000 - Product Requirements.

2.3 ACCESSORIES

- A. Sub-Floor Filler: Type recommended by carpet manufacturer.



- B. Moldings and Edge Strips: Embossed aluminum, color compatible with carpet color as selected by Owner's Representative.
- C. Adhesives – General: compatible with materials being adhered; maximum VOC content of 50 g/L; CRI Green Label certified; in lieu of labeled product, independent test report showing compliance is acceptable.
- D. Contact Adhesive: Recommended by carpet manufacturer; releasable type.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive carpet.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet.
- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesives to sub floor surfaces.
- D. Verify interior design coordination requirements with Architect prior to installation.
- E. Verify that required floor-mounted utilities are in correct location.

NOTE TO SPECIFIER

For R&A projects include Item A. For new construction rename B, C and D to A, B and C.

3.2 PREPARATION

- A. Remove existing carpet and carpet cushion.
- B. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.
- C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic, until filler is cured.
- D. Clean substrate.

3.3 INSTALLATION - GENERAL

- A. Install carpet and cushion in accordance with manufacturer's instructions and CRI 104.
- B. Verify carpet match before cutting to ensure minimal variation between dye lots.



3.4 CLEANING

- A. Remove excess adhesive from floor and wall surfaces without damage.
- B. Clean and vacuum carpet surfaces.

USPS Master Specifications issued: 10/1/2013
Last revised: 6/17/2013

END OF SECTION 09 68 00 00

**SECTION 09 91 00 00 - CSF PAINTING****

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.09 91 00 00

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes:
 - 1. Surface preparation and field application of paints and finishes for interior and exterior surfaces.
 - 2. Schedule of Items to be painted.
 - 3. Exterior painting and finishing schedule.
 - 4. Interior painting and finishing schedule.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 055000 - Metal fabrications:
 - 2. Section 081100 - Metal Doors and Frames: Shop priming.
 - 3. Section 083323 - Overhead Coiling Doors: Shop priming.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM E 84 - Test Method for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Submit product data for each type of paint specified.
 - a. Technical data sheets indicating manufacturer's catalog number, paint type description, and VOC content.
 - b. Painting Schedule listing surfaces to be painted with cross reference to the specific painting and finishing system and application. Identify each paint material by manufacturer's catalog number and general classification.



2. Samples: Submit color brush-out sample for each paint color and sheen specified.
 - a. Three samples on 8 1/2 inch x 11 inch card stock for color and sheen verification.
 - b. Identify each sample by paint manufacturer, paint type, color, and sheen.
3. Assurance/Control Submittals:
 - a. Test Reports: Submit manufacturer's Material Safety Data Sheets (MSDS) for each paint type proposed.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing Work of this Section with minimum five years documented experience.
- B. Regulatory Requirements:
 1. Surface Burning Characteristics in Accordance with ASTM E-84 for Class I or A finish:
 - a. Flame Spread (Non-Combustible Surfaces): Less than 25.
 - b. Smoke Density (Non-Combustible Surfaces): Less than 450.
 2. Provide paint and coating materials that conform to Federal, State, and Local restrictions for Volatile Organic Compounds (VOC) content.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Deliver paint materials in sealed original labeled containers, bearing manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and/or reducing.
- C. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's published instructions.
- D. Prevent fire hazards and spontaneous combustion.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements:
 1. Apply paint finishes only when moisture content of surfaces is within manufacturer's acceptable ranges for type of finish being applied.
 2. Surface temperatures or surrounding air temperature to be above 40 degrees F before applying alkyd finishes; above 45 degrees F for interior latex, and 50 degrees F for exterior latex work. Minimum for varnish and transparent finishes is 65 degrees F.
 3. Provide continuous ventilation and heating facilities to maintain temperatures above 45 degrees F for 24 hours prior to, during and 48 hours after application of finishes.
 4. Do not apply paint in areas where dust is being generated.
 5. Provide lighting level in areas being painted of 80 foot candles measured mid-height at substrate surface.

1.7 MAINTENANCE

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Extra Materials:



1. Provide one gallon of each color, type and sheen to Contracting Officer.
2. Label each container with color, type, texture, room locations, in addition to the manufacturer's label.

NOTE TO SPECIFIER

“REQUIRED Part (Products) follows. Do not revise this Part, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer.”

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the work include the following:
 1. Benjamin Moore and Company, Montvale, NJ (201) 573-9600.
 2. Comex Group (Color Wheel/Frazer/Kwal/Parker), 5575 Dtc Pkwy, Greenwood Village, CO 80111, (303)307-2100
 3. Duron Paints and Wallcoverings, Beltsville, MD (800) 723-8766.
 4. Devoe (ICI), Cleveland, OH (888) 681-6353.
 5. Glidden (ICI), Cleveland, OH (888) 681-6353.
 6. Pittsburgh Paints, Pittsburgh, PA (800) 441-9695.
 7. Sherwin-Williams Company, Cleveland, OH (800) 321-8194.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

- A. Paints:
 1. Manufacturer's "Best Grade" for each type specified.
 2. Ready-mixed; pigments fully ground maintaining a soft paste consistency, capable of readily and uniformly dispersing to a complete homogeneous mixture.
 3. Providing good flowing and brushing properties and be capable of drying or curing free of streaks or sags.
 4. VOC limits (g/L) for exterior and interior paint applications:
 - a. Exterior- Steel-Shop Primed
 - 1) Top Coat – Non-Flat: 150
 - 2) Top Coat - Gloss: 250
 - b. Exterior- Steel - Galvanized
 - 1) Primer Coat: 200
 - 2) Top Coat - Non-Flat: 150
 - 3) Top Coat - Gloss: 250
 - c. Interior Wood – Transparent
 - 1) Stain: 250
 - 2) Varnish: 350
 - d. Interior Concrete, Concrete Block
 - 1) Block filler: 300



- 2) Top Coat – Flat: 100
- 3) Top Coat – Non-Flat: 150
- 4) Top Coat – Gloss: 250
- e. Interior Steel – Unprimed
 - 1) Rust Prime Coat: 400
 - 2) Top Coat – Non-Flat: 150
 - 3) Top Coat – Gloss: 250
- f. Interior Steel – Primed
 - 1) Top Coat – Flat: 100
 - 2) Top Coat – Non-Flat: 150
 - 3) Top Coat – Gloss: 250
- g. Interior Steel – Galvanized
 - 1) Top Coat – Non-Flat: 150
 - 2) Top Coat – Gloss: 250
- h. Interior Plaster, Gypsum Board
 - 1) Undercoater: 200
 - 2) Top Coat - Flat: 100
 - 3) Top Coat – Non-Flat: 150
 - 4) Top Coat – Gloss: 250
- i. Interior Exposed Structural Steel and Metal Deck
 - 1) Industrial Maintenance - Primer: 340
 - 2) Industrial Maintenance – Top Coat: 340

B. Primers and Undercoaters: Manufactured by same manufacturer as finish coat materials.

C. Paint Accessory Materials: Linseed oil, shellac, turpentine and other materials not specifically indicated herein but required to achieve the finishes specified of high quality and approved manufacturer.

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.3 EXTERIOR PAINT SYSTEMS

A. Benjamin Moore:

- 1. Ferrous Metal: Semi-Gloss, Water Base, Alkyd Primer/Acrylic Latex.
 - a. Primer: M04 Acrylic Metal Primer; MDF 2.0 mils.
 - b. Each Finish Coat: M29 DTM Acrylic Semi-Gloss; MDF 2.0 mils.
- 2. Galvanized Metal: Semi-Gloss, Water Base, Alkyd Primer/Acrylic Latex.
 - a. Primer: M04 Acrylic Metal Primer; MDF 2.0 mils.
 - b. Each Finish Coat: M29 DTM Acrylic Semi-Gloss; MDF 2.0 mils.

B. Comex Group (Color Wheel/Frazee/Kwal/Parker)

- 1. Ferrous Metal: Semi-Gloss, Water Base, Alky Primer/Acrylic Latex.
 - a. Primer: Ultra-Tech C309 Universal water-Based Metal Primer, MDF 1.96 mils.
 - b. Each Finish Coat: Ultra-Tech C218 (Southeast)/C229 (Southwest)/C206 (Midwest) Exterior 100% Acrylic Semi-Gloss Enamel, MDF 1.44 mils.
- 2. Galvanized Metal: Semi-Gloss, Water Base, Alkyd Primer/Acrylic Latex.
 - a. Primer: Ultra-Tech C309 Universal water-Based Metal Primer, MDF 1.96 mils.
 - b. Each Finish Coat: Ultra-Tech C218 (Southeast)/C229 (Southwest)/C206 (Midwest) Exterior 100% Acrylic Semi-Gloss Enamel, MDF 1.44 mils.



- C. Duron:
1. Ferrous Metal: Semi-Gloss, Water Base, Alkyd Primer/Acrylic Latex.
 - a. Primer: Dura Clad Universal Acrylic Metal Primer, 33-105; MDF 2.4 mils. (MPI xx, Approved)
 - b. Each Finish Coat: Dura Clad DTM Acrylic Coating Gloss 95-30X, MDF 3.0 mils. (MPI 110-G6)
 2. Galvanized Metal: Semi-Gloss, Water Base, Alkyd Primer/Acrylic Latex.
 - a. Primer: Dura Clad Acrylic Galvanized Metal Primer, 33-100; MDF 1.4 mils. (MPI 134, Approved)
 - b. Each Finish Coat: Dura Clad DTM Acrylic Coating Gloss 95-30X, MDF 3.0 mils. (MPI 110-G6)
- D. Devoe (ICI):
1. Ferrous Metal: Semi-Gloss, Water Base, Alkyd Primer/Acrylic Latex.
 - a. Primer: Mirrolac W/B DTM Primer DP85XX.
 - b. Each Finish Coat: Mirrolac W/B Semi-Gloss Enamel DP83XX.
 2. Galvanized Metal: Semi-Gloss, Water Base, Alkyd Primer/Acrylic Latex.
 - a. Primer: Mirrolac W/B DTM Primer, DP85XX.
 - b. Each Finish Coat: Mirrolac W/B Semi-Gloss Enamel DP83XX.
- E. Frazee:
1. Ferrous Metal: Semi-Gloss, Water Base, Alkyd Primer/Acrylic Latex.
 - a. Primer: 661F774Metal Prime; MDF 1.7 mils.
 - b. Each Finish Coat: 128 Satin Glide Semi Gloss Acrylic, 03-Series; MDF 1.4 mils.
 2. Galvanized Metal: Semi-Gloss, Water Base, Alkyd Primer/Acrylic Latex.
 - a. Primer: 661F774 Metal Prime, 33-100; MDF 1.4 mils.
 - b. Each Finish Coat: 128 Satin Glide Semi Gloss Acrylic , 03-Series; MDF 1.4 mils.
- F. Pittsburgh:
1. Ferrous Metal: Semi-Gloss, Water Base, Alkyd Primer/Acrylic Latex.
 - a. Primer: 90-709 DTM Interior/Exterior Primer; MDF 3.0 mils.
 - b. Each Finish Coat: 90-474 Acrylic Enamel Satin; MDF 3.0 mils.
 2. Galvanized Metal: Semi-Gloss, Water Base, Alkyd Primer/Acrylic Latex.
 - a. Primer: 90-709 DTM Interior/Exterior Primer; MDF 3.0 mils.
 - b. Each Finish Coat: 90-474 Acrylic Enamel Satin; MDF 3.0 mils.
- G. Sherwin-Williams:
1. Ferrous Metal: Semi-Gloss, Low VOC, Alkyd Primer/Acrylic Latex.
 - a. Primer: Pro-Cryl Universal Water-Based Primer, B66-310, MDF 3.0 mils.
 - b. Each Finish Coat: DTM Acrylic B66 Series; MDF 3.0 mils.
 2. Galvanized Metal: Semi-Gloss, Water Base, Alkyd Primer/Acrylic Latex.
 - a. Primer: Pro-Cryl Universal Water Based Primer, B66-310, MDF 3.0 mils.
 - b. Each Finish Coat: DTM Acrylic B66 Series; MDF 3.0 mils.

2.4 INTERIOR PAINT SYSTEMS

- A. Benjamin Moore:
1. Gypsum Board: Eggshell, Water Base, Acrylic Latex.
 - a. Primer: 284 Moorecraft Superhide Interior Latex Primer/Undercoater; MDF 1.5 mils.
 - b. Each Finish Coat: Moorecraft Super-Hide Eggshell 286.
 2. Masonry: Eggshell, Water Base, Acrylic Latex.
 - a. Primer: Moorecraft Super Hide Interior/Exterior Latex Blockfiller 285; MDF 11.0 mils.
 - b. Each Finish Coat: Moorecraft Super-Hide Eggshell 286.



3. Metal: Satin, Water Base, Acrylic Latex.
 - a. Each Finish Coat: Moorecraft Super-Hide Eggshell 286.
4. Wood and Wood Doors : Satin, Water Base, Acrylic Latex.
 - a. Primer: 253 Moorecraft Latex Enamel Undercoater and Primer Sealer; 2.0 mils.
 - b. Each Finish Coat: Moorecraft Super-Hide Eggshell 286.
5. Concrete: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: Moorecraft Super Hide Interior/Exterior Latex Blockfiller 285; MDF 11.0 mils.
 - b. Each Finish Coat: 276 Moorecraft Acrylic Latex; MDF 1.5 mils.
6. Ferrous Metal: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: M04 Acrylic Metal Primer; MDF 2.0 mils.
 - b. Each Finish Coat: 276 Moorecraft Acrylic Latex; MDF 1.5 mils.
7. Wood Cabinets and Wood Shelves: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Enamel Undercoater: Moorecraft Acrylic Latex Underbody 269.
 - b. Each Finish Coat: 276 Moorecraft Acrylic Latex; MDF 1.5 mils.
8. Wood Bumpers:
 - a. Stain: 234 Benwood Penetrating Stain.

NOTE TO SPECIFIER

Select "Low Lustre" or "High-Gloss" polyurethane. Verify with USPS.

- b. Benwood Stays Clear Acrylic Polyurethane: 423 Benwood Low Lustre Polyurethane.
- c. Benwood Stays Clear Acrylic Polyurethane: 422 Benwood High-Gloss Polyurethane.

B. Comex Group (Color Wheel/Frazee/Kwal/Parker):

1. Gypsum Board: Eggshell, Water Base, Acrylic Latex.
 - a. Primer: Ultra-Tech C152 Interior Latex Primer-Sealer; MDF 1.12 mils.
 - b. Each Finish Coat: Ultra-Tech C106 Interior Latex Eggshell Enamel; MDF 1.36 mils.
2. Masonry: Eggshell, Water Base, Acrylic Latex.
 - a. Primer: Ultra-Tech C302 Interior-Exterior Acrylic Block Filler; MDF 6.29 mils.
 - b. Each Finish Coat: Ultra-Tech C106 Interior Latex Eggshell Enamel; MDF 1.36 mils.
3. Metal: Satin, Water Base, Acrylic Latex.
 - a. Each Finish Coat: Ultra-Tech C141 Interior 100% Acrylic Low-Sheen Enamel; MDF 1.44 mils.
4. Wood and Wood Doors: Satin, Water Base, Acrylic Latex.
 - a. Primer: Ultra-Tech C312 Interior-Exterior 100% Acrylic Wood Primer; MDF 1.8 mils.
 - b. Each Finish Coat: Ultra-Tech C141 Interior 100% Acrylic Low-Sheen Enamel; MDF 1.44 mils.
5. Concrete: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: Ultra-Tech C302 Interior-Exterior Acrylic Block Filler; MDF 6.29 mils.
 - b. Each Finish Coat: Ultra-Tech C119 Interior Latex Semi-Gloss Enamel; MDF 1.6 mils.
6. Ferrous Metal: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: Ultra-Tech C309 Universal Water-Based Metal Primer; MDF 1.96 mils.
 - b. Each Finish Coat: Ultra-Tech C119 Interior Latex Semi-Gloss Enamel; MDF 1.6 mils.
7. Wood Cabinets and Wood Shelves: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: Ultra-Tech C312 Interior-Exterior 100% Acrylic Wood Primer; MDF 1.8 mils.
 - b. Each Finish Coat: Ultra-Tech C119 Interior Latex Semi-Gloss Enamel; MDF 1.6 mils.
8. Wood Bumpers:
 - a. Stain: ZAR Interior Penetrating Oil Wood Stain; MDF N/A.
 - b. Clear Polyurethane: 2002 Flecto Varathane Interior Clear Polyurethane Sealer/Finish; MDF 0.9 mils.

C. Duron:

1. Gypsum Board: Eggshell, Water Base, Acrylic Latex.
 - a. Primer: Interior Latex Drywall Primer 04-124: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm). (MPI 50, Approved)



- b. Each Finish Coat: Acrylic Latex Eggshell (Low Sheen) Enamel 36 Series; MDF 1.4 mils.(MPI 44, Approved)
 - 2. Masonry: Eggshell, Water Base, Acrylic Latex.
 - a. Primer: Block Kote Interior/Exterior Latex Block Filler 08-128; MDF 10.2 mils.
 - b. Each Finish Coat: Acrylic Latex Eggshell (Low Sheen) Enamel 36Series; MDF 1.4 mils. (MPI 44, Approved)
 - 3. Metal: Satin, Water Base, Acrylic Latex.
 - a. Each Finish Coat: Ultra Deluxe Interior Acrylic Latex Eggshell (Low Sheen) Enamel 36 Series; MDF 1.4 mils.
 - 4. Wood and Wood Doors : Satin, Water Base, Acrylic Latex.
 - a. Primer: Interior Acrylic Enamel Undercoater 04-123; MDF 1.6mils. (MPI 50, Approved)
 - b. Each Finish Coat: Ultra Deluxe Interior Acrylic Latex Eggshell (Low Sheen) Enamel 36 Series; MDF 1.4 mils.
 - 5. Concrete: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: Block Kote Interior/Exterior Latex Block Filler 08-128; MDF 10.2 mils.
 - b. Each Finish Coat: Genesis Odor-Free Interior Latex Semi-Gloss Enamel, 83-Series, MDF 1.5 mils.
 - 6. Ferrous Metal: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: Dura Clad Universal Acrylic Metal Primer, White 33-015; MDF x.x mils. (MPI 76, Approved)
 - b. Each Finish Coat: Genesis Odor-Free Interior Latex Semi-Gloss Enamel, 83-Series, MDF 1.5 mils.
 - 7. Wood Cabinets and Wood Shelves: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer/Sealer: Interior Acrylic Enamel Undercoater 04-123; MDF 1.6 mils.(MPI 50, Approved)
 - b. Each Finish Coat: Genesis Odor-Free Interior Latex Semi-Gloss Enamel, 83-Series, MDF 1.5 mils.
 - 8. Wood Bumpers:
 - a. Stain: Interior Penetrating Oil Wood Stain 28-100; MDF N/A.
 - b. Clear Polyurethane: Heirloom "Clean Air" Formula Gloss Polyurethane 80-06010. (MPI 130, Approved)
- D. Devoe (ICI):
 - 1. Gypsum Board: Eggshell, Water Base, Acrylic Latex.
 - a. Primer: Wonder-Tones Primer DR50801; MDF 1.5 mil.
 - b. Each Finish Coat: Wonder-Tone Eggshell Enamel DR34XX; MDF 1.5 mil.
 - 2. Masonry: Eggshell, Water Base, Acrylic Latex.
 - a. Primer: Bloxfil 4000 Interior/Exterior Heavy Duty Acrylic Block Filler 4000-1000; 7.0-14.5 MDF
 - b. Each Finish Coat: Wonder-Tone Eggshell Latex Enamel DR34XX; MDF 1.5 mil.
 - 3. Metal: Satin, Water Base, Acrylic Latex.
 - a. Each Finish Coat: Mirrolac W/B Semi-Gloss Enamel DP83XX; MDF 1.5 mil.
 - 4. Wood and Wood Doors : Satin, Water Base, Acrylic Latex.
 - a. Primer: Wonder-Prime DR51701; MDF 1.5 mil.
 - b. Each Finish Coat: Devflex 4216HP High Performance Waterborne Acrylic Semi-Gloss Enamel; MDF 1.5 mil.
 - 5. Concrete: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: Bloxfil 4000 Interior/Exterior Heavy Duty Acrylic Block Filler 4000-1000; 7.0-14.5 MDF
 - b. Each Finish Coat: Mirrolac W/B Semi-Gloss Latex Enamel DP83XX; MDF 1.5 mil.
 - 6. Ferrous Metal: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: Mirrolac W/B DTM Primer DP85XX; MDF 1.5 mil.
 - b. Each Finish Coat: Mirrolac W/B Semi-Gloss DP83XX.
 - 7. Wood Cabinets and Wood Shelves: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer/Sealer: Wonder-Prime DR51701; MDF 1.5 mil.
 - b. Each Finish Coat: Devflex 4216HP High Performance Waterborne Acrylic Semi-Gloss Enamel; MDF 1.5 mil.
 - 8. Wood Bumpers:



- a. Stain: Penchrome Interior Solventborne Semi-Transparent Oil Stain, DF 2XX; MDF 1.5 mil.
- b. Clear Polyurethane: Penchrome Interior 100% Acrylic Finishes, DF 400 Satin; MDF 1.5 mil.

E. Frazee:

- 1. Gypsum Board: Eggshell, Water Base, Acrylic Latex.
 - a. Primer :063 PVA Aqua Seal Drywall Vinyl Primer Sealer; MDF 1.4 mils.
 - b. Each Finish Coat: 026 Speed Sheen Interior Acrylic Eggshell Enamel; MDF 1.6 mils.
- 2. Masonry: Eggshell, Water Base, Acrylic Latex.
 - a. Primer: 262 Block Filler Latex Block Filler; MDF 10.2 mils.
 - b. Each Finish Coat: 026 Speed Sheen Interior Acrylic Eggshell Enamel; MDF 1.6 mils.
- 3. Metal: Satin, Water Base, Acrylic Latex.
 - a. Each Finish Coat: 126 Mirro Glide Interior Low Sheen Acrylic Enamel; MDF 1.4 mils.
- 4. Wood and Wood Doors : Satin, Water Base, Acrylic Latex.
 - a. Primer: 172 Grip N Seal Enamel Undercoater; MDF 2.2 mils.
 - b. Each Finish Coat: 126 Mirro Glide Interior Low Sheen Acrylic Enamel; MDF 1.4 mils.
- 5. Concrete: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: 262 Block Filler Latex Block Filler; MDF 10.2 mils.
 - b. Each Finish Coat: 024 Speed Sheen Semi-Gloss Enamel; MDF 1.7 mils.
- 6. Ferrous Metal: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: 661F774 Metal Prime Alkyd Metal Primer; MDF 1.7 mils.
 - b. Each Finish Coat: 123 Satin Glide Semi-Gloss Enamel; MDF 1.7 mils.
- 7. Wood Cabinets and Wood Shelves: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer/Sealer: 172 Grip N Seal Enamel Undercoater MDF 2.2 mils.
 - b. Each Finish Coat: 024 Speed Sheen Semi-Gloss Enamel; MDF 1.7 mils.
- 8. Wood Bumpers:
 - a. Stain: ZAR Interior Penetrating Oil Wood Stain; MDF N/A.
 - b. Clear Polyurethane: 2002 Fleco Varathane Interior Clear Polyurethane Sealer/Finish; MDF 0.9

F. Glidden(ICI):

- 1. Gypsum Board: Eggshell, Water Base, Acrylic Latex.
 - a. Primer: ProMaster Interior Latex Primer-Sealer MP-5111; MDF 1.5 mil.
 - b. Each Finish Coat: ProMaster Interior Latex Eggshell MP-6800; MDF 1.5 mil.
- 2. Masonry: Eggshell, Water Base, Acrylic Latex.
 - a. Primer: Bloxfil 4000 Interior/Exterior Heavy Duty Acrylic Block Filler 4000-1000; MDF 11 mil
 - b. Each Finish Coat: ProMaster Interior Latex Eggshell MP-6800; MDF 1.5 mil.
- 3. Metal: Satin, Water Base, Acrylic Latex.
 - a. Each Finish Coat: Devflex 4214HP High Performance Waterborne Acrylic Semi-Gloss Enamel; MDF 1.5 mil.
- 4. Wood and Wood Doors : Satin, Water Base, Acrylic Latex.
 - a. Primer: Prime Interior 100% Acrylic Multi-Purpose Latex Stain Killer, PC 1000; MDF 1.5 mil.
 - b. Each Finish Coat: Devflex 4216 HP High Performance Waterborne Acrylic Semi-Gloss Enamel; MDF 1.5 mil.
- 5. Concrete: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: Bloxfil 4000 Interior/Exterior Heavy Duty Acrylic Block Filler 4000-1000; MDF 11 mil
 - b. Each Finish Coat: Devflex 4216 HP High Performance Waterborne Acrylic Semi-Gloss Enamel; MDF 1.5 mil.
- 6. Ferrous Metal: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: Devflex 4020 PF Direct to Metal Primer & Flat Finish; MDF 1.5 mil.



- b. Each Finish Coat: Devflex 4216 HP High Performance Waterborne Acrylic Semi-Gloss Enamel; MDF 1.5 mil.
 - 7. Wood Cabinets and Wood Shelves: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer/Sealer: Prime Interior 100% Acrylic Multi-Purpose Latex Stain Killer, PC 1000; MDF 1.5 mil.
 - b. Each Finish Coat: Devflex 4216 HP High Performance Waterborne Acrylic Semi-Gloss Enamel; MDF 1.5 mil.
 - 8. Wood Bumpers:
 - a. Stain: DF200 semi-transparent; MDF 1.5 mil.
 - b. Clear Polyurethane: Penchrome Interior 100% Acrylic Finishes, DF 400 Satin; MDF 1.5 mil.
- G. Pittsburgh:
 - 1. Gypsum Board: Eggshell, Water Base, Acrylic Latex.
 - a. Primer: 6-2 Speedhide Latex Sealer; MDF 1.0 mils.
 - b. Each Finish Coat: 6-411 Speedhide Eggshell Latex; MDF 1.5 mils.
 - 2. Masonry: Eggshell, Water Base, Acrylic Latex.
 - a. Primer: 6-2 Speedhide Latex Sealer; MDF 1.0 mils.
 - b. Each Finish Coat: 6-411 Speedhide Eggshell Latex; MDF 1.5 mils.
 - 3. Metal: Satin, Water Base, Acrylic Latex.
 - a. Each Finish Coat: 90-474 DTM Acrylic Satin; MDF 1.5 mils.
 - 4. Wood and Wood Doors : Satin, Water Base, Acrylic Latex.
 - a. Primer: 6-855 Interior Water Base Undercoater; MDF 1.5 mils.
 - b. Each Finish Coat: 90-474 DTM Acrylic Satin; MDF 1.5 mils.
 - 5. Concrete: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: 6-7 Speedhide Block Filler; MDF 6.0 - 12.0 mils.
 - b. Each Finish Coat: 6-500 Speedhide Semi-Gloss Latex; MDF 1.2 mils.
 - 6. Ferrous Metal: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Each Finish Coat: 90-474 DTM Acrylic Satin; MDF 1.5 mils.
 - 7. Wood Cabinets and Wood Shelves: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer/Sealer: 6-855 Interior Water Base Undercoater; MDF 1.5 mils.
 - b. Each Finish Coat: 90-474 DTM Acrylic Satin; MDF 1.5 mils.
 - 8. Wood Bumpers:
 - a. Stain: 77-560 Interior Oil Stain
 - b. Clear Polyurethane: 77-89 Interior Oil Satin Polyurethane
- H. Sherwin Williams:
 - 1. Gypsum Board: Low VOC, Eg-shell, Water Base, Acrylic Latex.
 - a. Primer: Harmony Latex Primer, MDF 1.6 mils.
 - b. Each Finish Coat: Harmony Latex Eg-Shel, MDF 1.6 mils.
 - 2. Masonry: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: ProMar Interior/Exterior Block Filler, B25W25; MDF 10.0 mils
 - b. Each Finish Coat: ProMar 200 Interior Latex Egg Shell: MDF 1.5 mils.
 - 3. Metal: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Each Finish Coat: DTM Acrylic S-G, B66W200; MDF 3.0 mils.
 - 4. Wood and Wood Doors : Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: PrepRite Classic Primer, B28W101, MDF 1.6 mils.
 - b. Each Finish Coat: ProClassic Waterborne S-G, MDF 1.4 mils.
 - 5. Concrete: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: ProMar Interior/Exterior Block Filler, B25W25; MDF 10.0 mils.
 - b. Each Finish Coat: ProClassic Waterborne S-G, MDF 1.4 mils.
 - 6. Ferrous Metal: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: Pro-Cryl Universal Water Based Primer, B66-310, MDF 3.0 mils.
 - b. Each Finish Coat: DTM Acrylic S-G, B66W200; MDF 3.0 mils.
 - 7. Wood Cabinets and Wood Shelves: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer/Sealer: PrepRite Classic Latex Primer, B28W300, MDF 1.6 mils.
 - b. Each Finish Coat: ProClassic Waterborne S-G, MDF 1.4 mils.



8. Wood Bumpers:
 - a. One Coat: Stain: Oil Stain, A48 Series.
 - b. Each Coat: Clear Polyurethane: WoodClassic Waterborne Polyurethane Varnish; A68 series MDF 1.0 mil.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, and conditions otherwise detrimental to formation of a durable paint film.
- B. Perform preparation and cleaning procedures in accordance with paint manufacturer's published instructions for each particular substrate condition.
 1. Provide barrier coats over incompatible primers or remove and reprime as required.
 2. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be painted or provide surface applied protection prior to surface preparation and painting operations. Reinstall all removed items after completion of paint work.
 3. Clean surfaces to be painted before applying paint of surface treatment. Remove oil and grease prior to mechanical cleaning.
- C. Ferrous Metals: Clean ferrous surfaces, that are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.
 1. Touch-up shop-applied prime coats, where damaged or bare. Clean and touch-up with same type shop primer.
- D. Galvanized Surfaces: Clean free of oil and surface contaminants with non-petroleum based solvent. Apply coat of etching primer if required by paint manufacturer.
- E. Cementitious Materials: Prepare cementitious surfaces to be painted by removing efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze.
 1. Determine alkalinity and moisture content of surfaces to be painted by performing appropriate tests.
 - a. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct condition before application of paint.
 2. Do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed instructions.



3. Clean floor surfaces scheduled to be painted with a commercial solution of muriatic acid, or other etching cleaner. Flush floor with clean water to neutralize acid, and allow to dry before painting.
- F. Wood: Clean wood surfaces to be painted of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view, and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer, before application of priming coat. After priming, fill holes, and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dried.
 1. Prime, stain, or seal wood required to be job-painted immediately upon delivery to job. Prime edges, ends faces, undersides, and backsides of such wood, including cabinets and counters.
 2. Seal tops, bottoms, and cut-outs with a heavy coat of varnish or equivalent sealer immediately upon delivery to job.
 - G. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

3.3 APPLICATION

- A. Apply paint products in accordance with manufacturer's published instructions using application procedures approved for the particular application and substrate to the specified Minimum Dry Film Thickness (MDF). Apply each coat to uniform finish.
- B. Apply each coat slightly darker than preceding coat unless otherwise approved by Contracting Officer. Sand lightly between coats to achieve specified finish.
- C. Do not apply finishes on surfaces that are not dry.
- D. Number of coats and film thickness required is same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer.
- E. Apply additional coats when undercoats, stains, or other conditions show through final coat until paint film is of uniform finish, color, and appearance. Surfaces, including edges, corners, crevices, welds, and exposed fasteners to receive minimum dry film thickness equivalent to that of flat surfaces.
- F. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate. Provide minimum dry film thickness (MDF) of the entire coating system as indicated in Painting and Finishing Schedule at end of this Section.
- G. Block Fillers: Apply block fillers to concrete masonry units at rate to provide complete coverage with pores filled.
- H. Prime Coats: Before application of finish coats, apply a prime coat of material as recommended by manufacturer to material scheduled to be painted or finished that has not been shop primed. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to assure a finish coat with no burn through or other defects due to insufficient sealing.
- I. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, laps, brush marks, runs, sags, or other surface imperfections will not be acceptable.
- J. Hollow Metal Doors: Paint each door edge.
- K. Completed Work: Match Contracting Officer approved field samples for color and sheen.

3.4 MECHANICAL AND ELECTRICAL EQUIPMENT



- A. Clean or replace identification markings on mechanical or electrical equipment when painted over or spattered.
- B. Paint both sides and edges of plywood backboards for electrical equipment before installing backboards and mounting equipment on them.
- C. Prepaint Gas piping prior to installation. (Touch-up paint after installation.)
 - 1. Color:
 - a. Roof (Yellow): OSHA Standard "Safety Yellow."
 - b. Other Areas: Match adjacent surfaces.
- D. At Workroom locations, paint red background on wall behind fire extinguisher extending 6 inches on both sides of the extinguisher and from floor to ceiling, or to 12 feet above floor, whichever is lower. Color is to be OSHA Standard "Safety Red" and in accordance with ANSI Z53.1.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Inspect painting and coating application for scheduled material, color, sheen, specified thickness (MDF), and coverage.

3.6 CLEANING

- A. As work proceeds and upon completion, promptly remove paint where spilled, splashed, or spattered.
- B. During progress of work keep premises free from any unnecessary accumulation of tools, equipment, surplus materials, and debris.
- C. Collect waste, cloths, and material which may constitute a fire hazard, place in closed metal containers and remove daily from site.
- D. Upon completion of work leave premises neat and clean.

3.7 PROTECTION

- A. Protect other surfaces from paint and damage. Repair damage as a result of inadequate or unsuitable protection.

NOTE TO SPECIFIER

"REQUIRED Article (Color Schedule) follows. Do not revise this Article, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer."

Color Schedule is usually on the Drawings. Use Color Schedule in Specification when colors are not indicated on the Drawings. Verify colors with USPS Contracting Officer.

3.8 COLOR SCHEDULE

- A. Any proposal to substitute a color is to include manufacturer's certification that the color matches the specified Munsell notation.



- B. P-1 White (Munsell notation: #5Y 9.25/0.5NN)
 - 1. Benjamin Moore: #968.
 - 2. Comex Group (Color Wheel/Frazer/Kwal/Parker)/Duron/Frazer: #7760, Weaverbird.
 - 3. Glidden (ICI): #50YY 83/057.
 - 4. Pittsburgh: #512-1, Winter Mood.
- C. P-2 Light Gray (Munsell notation: #N8.0)
 - 1. Benjamin Moore: #1612 Base 1.
 - 2. Devoe (ICI): #1H51G, Catkin.
 - 3. Glidden (ICI): #50BG 62/007.
 - 4. Comex Group (Color Wheel/Frazer/Kwal/Parker)/Duron/Frazer: # 5441W.
- D. P-3 (Not Used)
- E. P-4 Red (Not Used)
- F. P-5 Blue (Munsell notation: #6.4PB3.24/11.0)
 - 1. Benjamin Moore: #819.
- G. P-6 Medium Gray (Munsell notation: #10B7/1)
 - 1. Sherwin Williams: SW#1232, Dublin Gray.
 - 2. ICI Dulux, #90BG41/040: Dauphin Gray.
 - 3. Comex Group (Color Wheel/Frazer/Kwal/Parker)/Duron/Frazer, # 5452M: Battleship.
- H. P-7 Semi-gloss Black

3.9 SCHEDULE OF ITEMS TO BE PAINTED

NOTE TO SPECIFIER

The following items to be painted are typically used. Edit as relating to the particular Project.

- A. Painted finishes shall be provided for, but not limited to, the following items. Refer to Drawings and Paint Color Schedule at end of this Section for designated finishes and colors of areas.
 - 1. Exterior: All exterior surfaces including, but not limited to:
 - a. Hollow metal doors and frames.
 - b. Metal opening frames and trim.
 - c. Metal flashing (if exposed from ground level) and downspout.
 - d. Metal gravelstops (vertical face).
 - e. Pipe Bollards, if not to receive plastic covers specified in Section 055000.
 - f. Metal railings.
 - g. Roof hatch.
 - h. Canopy supporting steel structure.
 - i. Wall louvers.
 - 2. Interior: All interior surfaces as scheduled on Drawings including, but not limited to:
 - a. Hollow metal doors and frames.
 - b. Hollow metal window frames.
 - c. Metal opening frames and trim.
 - d. Gypsum wallboard.
 - e. Exposed concrete unit masonry.
 - f. Pipe Bollards.
 - g. Metal railings.
 - h. Exposed structure columns.
 - i. Metal stair stringers and handrails.
 - j. Exposed wood trim.

B. Do not paint the following items:

1. Pre-finished items:
 - a. Aluminum, brass, bronze, stainless steel, and chrome plated steel.
 - b. Pre-finished items, such as toilet compartments, acoustical ceiling materials, mechanical, and electrical equipment.
 - c. UL, FM, and other code-required labels.
 - d. Equipment identification, performance rating, and name plates.
 - e. Finish hardware.
 - f. Factory finished metal wall panels, metal wall panel trim, and metal gravel stops.
2. Exposed items:
 - a. Exposed mechanical ductwork, hangers, and supports.
 - b. Exposed piping and conduit, hangers and supports.
 - c. Exposed fire protection piping, hangers and supports.
 - d. Exposed roof structure.
 - e. Exposed roof deck.

3.10 PAINTING AND FINISHING SCHEDULE

- A. Interior Paint Systems:
1. Interior Gypsum Wallboard:
 - a. 1 coat Latex Wall Primer.
 - b. 1 coat Latex Eggshell Enamel
 2. Interior Masonry:
 - a. 1 coat Latex Block Filler
 - b. 1 coat Latex Eggshell Enamel
 3. Interior Metal:
 - a. 2 coats Latex Satin
 4. Interior Wood (painted):
 - a. 1 coat Enamel Undercoat
 - b. 2 coats Alkyd Semi-Satin Enamel
 5. Cast-In-Place Concrete:
 - a. One coat of Latex Masonry Block Filler.
 - b. Two tinted coats of Acrylic Latex Semi-Gloss Enamel.
 6. Wood Doors - Painted.
 - a. One coat Enamel Undercoat.
 - b. Two tinted coats of Latex Semi-Gloss Enamel.
 7. Ferrous Metals
 - a. Touch up Prime Coat.
 - b. Two tinted coats of Alkyd Enamel Semi-Gloss.
 8. Wood Cabinets, Shelves, etc. - exposed surfaces.
 - a. One coat Primer-Sealer.
 - b. One coat Enamel Undercoat.
 - c. One coat Alkyd Enamel Semi-Gloss Enamel.



9. Wood Bumpers.
 - a. Penetrating Oil Stain.
 - b. Two Coats of Clear Polyurethane Semi-Gloss Finish.
- B. Exterior Paint Systems:
 1. Galvanized Metal:
 - a. Touch up Prime Coat.
 - b. Two tinted coats Exterior Alkyd Enamel Semi-Gloss Enamel.
 2. Ferrous Metals:
 - a. Touch up Prime Coat.
 - b. Two tinted coats Exterior Alkyd Enamel Semi-Gloss Enamel.

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END OF SECTION



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SECTION 09 91 00 00 - MPF PAINTING**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Surface preparation and field application of paints and finishes for interior and exterior surfaces.
 - 2. Schedule of Items to be painted.
 - 3. Exterior painting and finishing schedule.
 - 4. Interior painting and finishing schedule.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 055000 - Metal fabrications
 - 2. Section 055213 - Pipe and Tube Railings
 - 3. Section 081100 - Metal Doors and Frames: Shop priming.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM E 84 - Test Method for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. Section 013300 - Submittals: Procedures for submittals.
 - 1. Product Data: Submit product data for each type of paint specified.
 - a. Technical data sheets indicating manufacturer's catalog number, paint type description, and VOC content.
 - b. Painting Schedule listing surfaces to be painted with cross reference to the specific painting and finishing system and application. Identify each paint material by manufacturer's catalog number and general classification.



2. Samples: Submit color brush-out sample for each paint color and sheen specified.
 - a. Three samples on 8 1/2 inch x 11 inch card stock for color and sheen verification.
 - b. Identify each sample by paint manufacturer, paint type, color, and sheen.
3. Assurance/Control Submittals:
 - a. Test Reports: Submit manufacturer's Material Safety Data Sheets (MSDS) for each paint type proposed.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing Work of this Section with minimum five years documented experience.
- B. Regulatory Requirements:
 1. Surface Burning Characteristics in Accordance with ASTM E-84 for Class I or A finish:
 - a. Flame Spread (Non-Combustible Surfaces): Less than 25.
 - b. Smoke Density (Non-Combustible Surfaces): Less than 450.
 2. Provide paint and coating materials that conform to Federal, State, and Local restrictions for Volatile Organic Compounds (VOC) content.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Deliver paint materials in sealed original labeled containers, bearing manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and/or reducing.
- C. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's published instructions.
- D. Prevent fire hazards and spontaneous combustion.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements:
 1. Apply paint finishes only when moisture content of surfaces is within manufacturer's acceptable ranges for type of finish being applied.
 2. Surface temperatures or surrounding air temperature to be above 40 degrees F before applying alkyd finishes; above 45 degrees F for interior latex, and 50 degrees F for exterior latex work. Minimum for varnish and transparent finishes is 65 degrees F.
 3. Provide continuous ventilation and heating facilities to maintain temperatures above 45 degrees F for 24 hours prior to, during and 48 hours after application of finishes.
 4. Do not apply paint in areas where dust is being generated.
 5. Provide lighting level in areas being painted of 80 foot candles measured mid-height at substrate surface.

1.7 MAINTENANCE

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Extra Materials:



1. Provide one gallon of each color, type and sheen to Contracting Officer.
2. Label each container with color, type, texture, room locations, in addition to the manufacturer's label.

NOTE TO SPECIFIER

"REQUIRED Part (Products) follows. Do not revise this Part, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer."

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the work include the following:
 1. Benjamin Moore and Company, Montvale, NJ (201) 573-9600.
 2. Duron Paints and Wall Coverings, Beltsville, MD (800) 723-8766.
 3. Devoe (ICI), Cleveland, OH (888) 681-6353.
 4. Glidden (ICI), Cleveland, OH (888) 681-6353.
 5. Frazee Paint Company, Los Angeles, CA (800) 826-9048.
 6. Pittsburgh Paints, Pittsburgh, PA (800) 441-9695.
 7. Sherwin-Williams Company, Cleveland, OH (800) 321-8194.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

- A. Paints:
 1. Manufacturer's "Best Grade" for each type specified.
 2. Ready-mixed; pigments fully ground maintaining a soft paste consistency, capable of readily and uniformly dispersing to a complete homogeneous mixture.
 3. Providing good flowing and brushing properties and be capable of drying or curing free of streaks or sags.
 4. VOC limits (g/L) for exterior and interior paint applications:
 - a. Exterior- Steel-Shop Primed
 - 1) Top Coat – Non-Flat: 150
 - 2) Top Coat - Gloss: 250
 - b. Exterior- Steel - Galvanized
 - 1) Primer Coat: 200
 - 2) Top Coat - Non-Flat: 150
 - 3) Top Coat - Gloss: 250
 - c. Interior Wood – Transparent
 - 1) Stain: 250
 - 2) Varnish: 350
 - d. Interior Concrete, Concrete Block
 - 1) Block filler: 300
 - 2) Top Coat – Flat: 100
 - 3) Top Coat – Non-Flat: 150



- 4) Top Coat – Gloss: 250
- e. Interior Steel – Unprimed
 - 1) Rust Prime Coat: 400
 - 2) Top Coat – Non-Flat: 150
 - 3) Top Coat – Gloss: 250
- f. Interior Steel – Primed
 - 1) Top Coat – Flat: 100
 - 2) Top Coat – Non-Flat: 150
 - 3) Top Coat – Gloss: 250
- g. Interior Steel – Galvanized
 - 1) Top Coat – Non-Flat: 150
 - 2) Top Coat – Gloss: 250
- h. Interior Plaster, Gypsum Board
 - 1) Undercoater: 200
 - 2) Top Coat - Flat: 100
 - 3) Top Coat – Non-Flat: 150
 - 4) Top Coat – Gloss: 250

B. Primers and Undercoaters: Manufactured by same manufacturer as finish coat materials.

C. Paint Accessory Materials: Linseed oil, shellac, turpentine and other materials not specifically indicated herein but required to achieve the finishes specified of high quality and approved manufacturer.

NOTE TO SPECIFIER

Verify Product numbers and availability at time of Project Manual preparation for Project.

2.3 EXTERIOR PAINT SYSTEMS

A. Benjamin Moore:

- 1. Ferrous Metal: Semi-Gloss, Water Base, Alkyd Primer/Acrylic Latex.
 - a. Primer: M04 Acrylic Metal Primer; MDF 2.0 mils.
 - b. Each Finish Coat: M29 DTM Acrylic Semi-Gloss; MDF 2.0 mils.
- 2. Galvanized Metal: Semi-Gloss, Water Base, Alkyd Primer/Acrylic Latex.
 - a. Primer: M04 Acrylic Metal Primer; MDF 2.0 mils.
 - b. Each Finish Coat: M29 DTM Acrylic Semi-Gloss; MDF 2.0 mils.
- 3. Concrete/Masonry: Semi-Gloss Acrylic Latex.
 - a. Primer: Moorlastic 100'6 Acrylic Elastametic Waterproof Coating – Flat 056, 11 mils.
 - b. Each Finish Coat: Aura Waterborne Exterior Paint Semi-Gloss Finish 632, 1.5 mils.

B. Duron:

- 1. Ferrous Metal: Semi-Gloss, Water Base, Alkyd Primer/Acrylic Latex.
 - a. Primer: Dura Clad Universal Acrylic Metal Primer, 33-105; MDF 2.4 mils. (MPI xx, Approved)
 - b. Each Finish Coat: Dura Clad DTM Acrylic Coating Gloss 95-30X, MDF 3.0 mils. (MPI 110-G6)
- 2. Galvanized Metal: Semi-Gloss, Water Base, Alkyd Primer/Acrylic Latex.
 - a. Primer: Dura Clad Acrylic Galvanized Metal Primer, 33-100; MDF 1.4 mils. (MPI 134, Approved)
 - b. Each Finish Coat: Dura Clad DTM Acrylic Coating Gloss 95-30X, MDF 3.0 mils. (MPI 110-G6)
- 3. Concrete/Masonry Semi-Gloss Acrylic Latex.
 - a. Primer: Dura Crete Waterborne Acrylic Masonry Primer, 11 mils.
 - b. Each Finish Coat: MaxFlex Premium Elastomeric 1.5 mils.



C. Devoe (ICI):

1. Ferrous Metal: Semi-Gloss, Water Base, Alkyd Primer/Acrylic Latex.
 - a. Primer: Mirrolac W/B DTM Primer DP85XX.
 - b. Each Finish Coat: Mirrolac W/B Semi-Gloss Enamel DP83XX.
2. Galvanized Metal: Semi-Gloss, Water Base, Alkyd Primer/Acrylic Latex.
 - a. Primer: Mirrolac W/B DTM Primer, DP85XX.
 - b. Each Finish Coat: Mirrolac W/B Semi-Gloss Enamel DP83XX.
3. Concrete/Masonry Semi-Gloss Acrylic Latex MDF 1.5 mil.
 - a. Primer: Blaxfil 4000 Exterior Heavy Duty Acrylic Block Filler 4000-1000 7.0-14.5 MDF.
 - b. Each Finish Coat: Mirrolac W/B Semi-Gloss Latex Enamel DP83XX MDF 1.5 mil.

D. Frazee:

1. Ferrous Metal: Semi-Gloss, Water Base, Alkyd Primer/Acrylic Latex.
 - a. Primer: 661F774Metal Prime; MDF 1.7 mils.
 - b. Each Finish Coat: 128 Satin Glide Semi Gloss Acrylic, 03-Series; MDF 1.4 mils.
2. Galvanized Metal: Semi-Gloss, Water Base, Alkyd Primer/Acrylic Latex.
 - a. Primer: 661F774 Metal Prime, 33-100; MDF 1.4 mils.
 - b. Each Finish Coat: 128 Satin Glide Semi Gloss Acrylic , 03-Series; MDF 1.4 mils.
3. Concrete/Masonry Semi-Gloss Acrylic Latex MDF 1.5 mil.
 - a. Primer: 262 Acrylic Block Filler 7.0 MDF.
 - b. Each Finish Coat: 520 DTM Semi-Gloss Exterior Industrial Maintenance Semi-Gloss 1.5 mil.

E. Pittsburgh:

1. Ferrous Metal: Semi-Gloss, Water Base, Alkyd Primer/Acrylic Latex.
 - a. Primer: 90-709 DTM Interior/Exterior Primer; MDF 3.0 mils.
 - b. Each Finish Coat: 90-474 Acrylic Enamel Satin; MDF 3.0 mils.
2. Galvanized Metal: Semi-Gloss, Water Base, Alkyd Primer/Acrylic Latex.
 - a. Primer: 90-709 DTM Interior/Exterior Primer; MDF 3.0 mils.
 - b. Each Finish Coat: 90-474 Acrylic Enamel Satin; MDF 3.0 mils.
3. Concrete/Masonry Semi-Gloss Acrylic Latex MDF 1.5 mil.
 - a. Primer: Perma Crete High Build 100% Acrylic Primer 7.0 mil.
 - b. Each Finish Coat: Perma Crete High Build Acrylic Top Coat 1.5 mil.

F. Sherwin-Williams:

1. Ferrous Metal: Semi-Gloss, Low VOC, Alkyd Primer/Acrylic Latex.
 - a. Primer: Pro-Cryl Universal Water-Based Primer, B66-310, MDF 3.0 mils.
 - b. Each Finish Coat: DTM Acrylic B66 Series; MDF 3.0 mils.
2. Galvanized Metal: Semi-Gloss, Water Base, Alkyd Primer/Acrylic Latex.
 - a. Primer: Pro-Cryl Universal Water Based Primer, B66-310, MDF 3.0 mils.
 - b. Each Finish Coat: DTM Acrylic B66 Series; MDF 3.0 mils.
3. Concrete/Masonry Semi-Gloss Acrylic Latex MDF 1.5 mil.
 - a. Primer: Promar Exterior Block Filler B25W25 MDF 10.0 mils.
 - b. Each Finish Coat: DMT Acrylic B66 Series MDF 3.0 mils.

2.4 INTERIOR PAINT SYSTEMS

A. Benjamin Moore:

1. Gypsum Board: Eggshell, Water Base, Acrylic Latex.
 - a. Primer: 284 Moorecraft Superhide Interior Latex Primer/Undercoater; MDF 1.5 mils.
 - b. Each Finish Coat: Moorecraft Super-Hide Eggshell 286.
2. Masonry: Eggshell, Water Base, Acrylic Latex.
 - a. Primer: Moorecraft Super Hide Interior/Exterior Latex Blockfiller 285; MDF 11.0 mils.
 - b. Each Finish Coat: Moorecraft Super-Hide Eggshell 286.



3. Metal: Satin, Water Base, Acrylic Latex.
 - a. Each Finish Coat: Moorecraft Super-Hide Eggshell 286.
4. Wood: Satin, Water Base, Acrylic Latex.
 - a. Primer: 253 Moorecraft Latex Enamel Undercoater and Primer Sealer; 2.0 mils.
 - b. Each Finish Coat: Moorecraft Super-Hide Eggshell 286.
5. Concrete: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: Moorecraft Super Hide Interior/Exterior Latex Blockfiller 285; MDF 11.0 mils.
 - b. Each Finish Coat: 276 Moorecraft Acrylic Latex; MDF 1.5 mils.
6. Ferrous Metal: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: M04 Acrylic Metal Primer; MDF 2.0 mils.
 - b. Each Finish Coat: 276 Moorecraft Acrylic Latex; MDF 1.5 mils.
7. Wood Cabinets and Wood Shelves: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Enamel Undercoater: Moorecraft Acrylic Latex Underbody 269.
 - b. Each Finish Coat: 276 Moorecraft Acrylic Latex; MDF 1.5 mils.

B. Duron:

1. Gypsum Board: Eggshell, Water Base, Acrylic Latex.
 - a. Primer: Interior Latex Drywall Primer 04-124: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm). (MPI 50, Approved)
 - b. Each Finish Coat: Acrylic Latex Eggshell (Low Sheen) Enamel 36 Series; MDF 1.4 mils.(MPI 44, Approved)
2. Masonry: Eggshell, Water Base, Acrylic Latex.
 - a. Primer: Block Kote Interior/Exterior Latex Block Filler 08-128; MDF 10.2 mils.
 - b. Each Finish Coat: Acrylic Latex Eggshell (Low Sheen) Enamel 36Series; MDF 1.4 mils. (MPI 44, Approved)
3. Metal: Satin, Water Base, Acrylic Latex.
 - a. Each Finish Coat: Ultra Deluxe Interior Acrylic Latex Eggshell (Low Sheen) Enamel 36 Series; MDF 1.4 mils.
4. Wood: Satin, Water Base, Acrylic Latex.
 - a. Primer: Interior Acrylic Enamel Undercoater 04-123; MDF 1.6mils. (MPI 50, Approved)
 - b. Each Finish Coat: Ultra Deluxe Interior Acrylic Latex Eggshell (Low Sheen) Enamel 36 Series; MDF 1.4 mils.
5. Concrete: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: Block Kote Interior/Exterior Latex Block Filler 08-128; MDF 10.2 mils.
 - b. Each Finish Coat: Genesis Odor-Free Interior Latex Semi-Gloss Enamel, 83-Series, MDF 1.5 mils.
6. Ferrous Metal: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: Dura Clad Universal Acrylic Metal Primer, White 33-015; MDF x.x mils. (MPI 76, Approved)
 - b. Each Finish Coat: Genesis Odor-Free Interior Latex Semi-Gloss Enamel, 83-Series, MDF 1.5 mils.
7. Wood Cabinets and Wood Shelves: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer/Sealer: Interior Acrylic Enamel Undercoater 04-123; MDF 1.6 mils.(MPI 50, Approved)
 - b. Each Finish Coat: Genesis Odor-Free Interior Latex Semi-Gloss Enamel, 83-Series, MDF 1.5 mils.

C. Devoe (ICI):

1. Gypsum Board: Eggshell, Water Base, Acrylic Latex.
 - a. Primer: Wonder-Tones Primer DR50801; MDF 1.5 mil.
 - b. Each Finish Coat: Wonder-Tone Eggshell Enamel DR34XX, MDF 1.5 mil.
2. Masonry: Eggshell, Water Base, Acrylic Latex.
 - a. Primer: Bloxfil 4000 Interior/Exterior Heavy Duty Acrylic Block Filler 4000-1000; 7.0-14.5 MDF.
 - b. Each Finish Coat: Wonder-Tone Eggshell Latex Enamel DR34XX; MDF 1.5 mil.
3. Metal: Satin, Water Base, Acrylic Latex.
 - a. Each Finish Coat: Mirrolac W/B Semi-Gloss Enamel DP83XX; MDF 1.5 mil.



4. Wood: Satin, Water Base, Acrylic Latex.
 - a. Primer: Wonder-Prime DR51701.
 - b. Each Finish Coat: Devflex 4216HP High Performance Waterborne Acrylic Semi-Gloss Enamel; MDF 1.5 mil.
 5. Concrete: Semi-Gloss, Water Base, Acrylic Latex; MDF 1.5 mil.
 - a. Primer: Bloxfil 4000 Interior/Exterior Heavy Duty Acrylic Block Filler 4000-1000; 7.0-14.5 MDF.
 - b. Each Finish Coat: Mirrolac W/B Semi-Gloss Latex Enamel DP83XX; MDF 1.5 mil.
 6. Ferrous Metal: Semi-Gloss, Water Base, Acrylic Latex; MDF 1.5 mil.
 - a. Primer: Mirrolac W/B DTM Primer DP85XX; MDF 1.5 mil.
 - b. Each Finish Coat: Mirrolac W/B Semi-Gloss DP83XX; MDF 1.5 mil.
 7. Wood Cabinets and Wood Shelves: Semi-Gloss, Water Base, Acrylic Latex; MDF 1.5 mil.
 - a. Primer/Sealer: Wonder-Prime DR51701.
 - b. Each Finish Coat: Devflex 4216HP High Performance Waterborne Acrylic Semi-Gloss Enamel; MDF 1.5 mil.
- D. Frazee:
1. Gypsum Board: Eggshell, Water Base, Acrylic Latex.
 - a. Primer :063 PVA Aqua Seal Drywall Vinyl Primer Sealer; MDF 1.4 mils.
 - b. Each Finish Coat: 026 Speed Sheen Interior Acrylic Eggshell Enamel; MDF 1.6 mils.
 2. Masonry: Eggshell, Water Base, Acrylic Latex.
 - a. Primer: 262 Block Filler Latex Block Filler; MDF 10.2 mils.
 - b. Each Finish Coat: 026 Speed Sheen Interior Acrylic Eggshell Enamel; MDF 1.6 mils.
 3. Metal: Satin, Water Base, Acrylic Latex.
 - a. Each Finish Coat: 126 Mirro Glide Interior Low Sheen Acrylic Enamel; MDF 1.4 mils.
 4. Wood: Satin, Water Base, Acrylic Latex.
 - a. Primer: 172 Grip N Seal Enamel Undercoater; MDF 2.2 mils.
 - b. Each Finish Coat: 126 Mirro Glide Interior Low Sheen Acrylic Enamel; MDF 1.4 mils.
 5. Concrete: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: 262 Block Filler Latex Block Filler; MDF 10.2 mils.
 - b. Each Finish Coat: 024 Speed Sheen Semi-Gloss Enamel; MDF 1.7 mils.
 6. Ferrous Metal: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: 661F774 Metal Prime Alkyd Metal Primer; MDF 1.7 mils.
 - b. Each Finish Coat: 123 Satin Glide Semi-Gloss Enamel; MDF 1.7 mils.
 7. Wood Cabinets and Wood Shelves: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer/Sealer: 172 Grip N Seal Enamel Undercoater MDF 2.2 mils.
 - b. Each Finish Coat: 024 Speed Sheen Semi-Gloss Enamel; MDF 1.7 mils.
- E. Glidden(ICI):
1. Gypsum Board: Eggshell, Water Base, Acrylic Latex.
 - a. Primer: ProMaster Interior Latex Primer-Sealer MP-5111; MDF 1.5 mil.
 - b. Each Finish Coat: ProMaster Interior Latex Eggshell MP-6800; MDF 1.5 mil.
 2. Masonry: Eggshell, Water Base, Acrylic Latex.
 - a. Primer: Bloxfil 4000 Interior/Exterior Heavy Duty Acrylic Block Filler 4000-1000; MDF 11 mil.
 - b. Each Finish Coat: ProMaster Interior Latex Eggshell MP-6800; MDF 1.5 mil.
 3. Metal: Satin, Water Base, Acrylic Latex.
 - a. Each Finish Coat: Devflex 4214HP High Performance Waterborne Acrylic Semi-Gloss Enamel; MDF 1.5 mil.
 4. Wood: Satin, Water Base, Acrylic Latex; MDF 1.5 mil.
 - a. Primer: Prime Interior 100% Acrylic Multi-Purpose Latex Stain Killer, PC 1000; MDF 1.5 mil.
 - b. Each Finish Coat: Devflex 4216 HP High Performance Waterborne Acrylic Semi-Gloss Enamel; MDF 1.5 mil.
 5. Concrete: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: Bloxfil 4000 Interior/Exterior Heavy Duty Acrylic Block Filler 4000-1000; MDF11 mil.



- b. Each Finish Coat: Devflex 4216 HP High Performance Waterborne Acrylic Semi-Gloss Enamel; MDF 1.5 mil.
 - 6. Ferrous Metal: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: Devflex 4020 PF Direct to Metal Primer & Flat Finish; MDF 1.5 mil.
 - b. Each Finish Coat: Devflex 4216 HP High Performance Waterborne Acrylic Semi-Gloss Enamel.
 - 7. Wood Cabinets and Wood Shelves: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer/Sealer: Prime Interior 100% Acrylic Multi-Purpose Latex Stain Killer, PC 1000; MDF 1.5 mil.
 - b. Each Finish Coat: Devflex 4216 HP High Performance Waterborne Acrylic Semi-Gloss Enamel; MDF 1.5 mil.
- F. Pittsburgh:
 - 1. Gypsum Board: Eggshell, Water Base, Acrylic Latex.
 - a. Primer: 6-2 Speedhide Latex Sealer; MDF 1.0 mils.
 - b. Each Finish Coat: 6-411 Speedhide Eggshell Latex; MDF 1.5 mils.
 - 2. Masonry: Eggshell, Water Base, Acrylic Latex.
 - a. Primer: 6-7 Speedhide Block Filler; MDF 10.2 mils.
 - b. Each Finish Coat: 6-411 Speedhide Eggshell Latex; MDF 1.5 mils.
 - 3. Metal: Satin, Water Base, Acrylic Latex.
 - a. Each Finish Coat: 90-474 DTM Acrylic Satin; MDF 1.5 mils.
 - 4. Wood: Satin, Water Base, Acrylic Latex.
 - a. Primer: 6-855 Interior Water Base Undercoater; MDF 1.5 mils.
 - b. Each Finish Coat: 90-474 DTM Acrylic Satin; MDF 1.5 mils.
 - 5. Concrete: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: 6-7 Speedhide Block Filler; MDF 10.2 mils.
 - b. Each Finish Coat: 6-500 Speedhide Semi-Gloss Latex; MDF 1.2 mils.
 - 6. Ferrous Metal: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Each Finish Coat: 90-474 DTM Acrylic Satin; MDF 1.5 mils.
 - 7. Wood Cabinets and Wood Shelves: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer/Sealer: 6-855 Interior Water Base Undercoater; MDF 1.5 mils.
 - b. Each Finish Coat: 90-474 DTM Acrylic Satin; MDF 1.5 mils.
- G. Sherwin Williams:
 - 1. Gypsum Board: Low VOC, Eg-shell, Water Base, Acrylic Latex.
 - a. Primer: Harmony Latex Primer, MDF 1.6 mils.
 - b. Each Finish Coat: Harmony Latex Eg-Shel, MDF 1.6 mils.
 - 2. Masonry: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: ProMar Interior/Exterior Block Filler, B25W25; MDF 10.0 mils.
 - b. Two Finish Coats: ProMar 200 Interior Latex Egg Shell; MDF 1.5 mils.
 - 3. Metal: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Each Finish Coat: DTM Acrylic S-G, B66W200; MDF 3.0 mils.
 - 4. Wood: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: PrepRite Classic Primer, B28W101, MDF 1.6 mils.
 - b. Each Finish Coat: ProClassic Waterborne S-G, MDF 1.4 mils.
 - 5. Concrete: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: ProMar Interior/Exterior Block Filler, B25W25; MDF 10.0 mils.
 - b. Each Finish Coat: ProClassic Waterborne S-G, MDF 1.4 mils.
 - 6. Ferrous Metal: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer: Pro-Cryl Universal Water Based Primer, B66-310, MDF 3.0 mils.
 - b. Each Finish Coat: DTM Acrylic S-G, B66W200; MDF 3.0 mils.
 - 7. Wood Cabinets and Wood Shelves: Semi-Gloss, Water Base, Acrylic Latex.
 - a. Primer/Sealer: PrepRite Classic Latex Primer, B28W300, MDF 1.6 mils.
 - b. Each Finish Coat: ProClassic Waterborne S-G, MDF 1.4 mils.



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, and conditions otherwise detrimental to formation of a durable paint film.
- B. Perform preparation and cleaning procedures in accordance with paint manufacturer's published instructions for each particular substrate condition.
 - 1. Provide barrier coats over incompatible primers or remove and reprime as required.
 - 2. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be painted or provide surface applied protection prior to surface preparation and painting operations. Reinstall all removed items after completion of paint work.
 - 3. Clean surfaces to be painted before applying paint or surface treatment. Remove oil and grease prior to mechanical cleaning.
- C. Ferrous Metals: Clean ferrous surfaces, that are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.
 - 1. Touch-up shop-applied prime coats, where damaged or bare. Clean and touch-up with same type shop primer.
- D. Galvanized Surfaces: Clean free of oil and surface contaminants with non-petroleum based solvent. Apply coat of etching primer if required by paint manufacturer.
- E. Cementitious Materials: Prepare cementitious surfaces to be painted by removing efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze.
 - 1. Determine alkalinity and moisture content of surfaces to be painted by performing appropriate tests.
 - a. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct condition before application of paint.
 - 2. Do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed instructions.
 - 3. Clean floor surfaces scheduled to be painted with a commercial solution of muriatic acid, or other etching cleaner. Flush floor with clean water to neutralize acid, and allow to dry before painting.
- F. Wood: Clean wood surfaces to be painted of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view, and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer, before application of priming coat. After priming, fill holes, and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dried.



1. Prime, stain, or seal wood required to be job-painted immediately upon delivery to job. Prime edges, ends faces, undersides, and backsides of such wood, including cabinets and counters.
2. Seal tops, bottoms, and cut-outs with a heavy coat of varnish or equivalent sealer immediately upon delivery to job.

G. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

3.3 APPLICATION

- A. Apply paint products in accordance with manufacturer's published instructions using application procedures approved for the particular application and substrate to the specified Minimum Dry Film Thickness (MDF). Apply each coat to uniform finish.
- B. Apply each coat slightly darker than preceding coat unless otherwise approved by Contracting Officer. Sand lightly between coats to achieve specified finish.
- C. Do not apply finishes on surfaces that are not dry.
- D. Number of coats and film thickness required is same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer.
- E. Apply additional coats when undercoats, stains, or other conditions show through final coat until paint film is of uniform finish, color, and appearance. Surfaces, including edges, corners, crevices, welds, and exposed fasteners to receive minimum dry film thickness equivalent to that of flat surfaces.
- F. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate. Provide minimum dry film thickness (MDF) of the entire coating system as indicated in Painting and Finishing Schedule at end of this Section.
- G. Block Fillers: Apply block fillers to concrete masonry units at rate to provide complete coverage with pores filled.
- H. Prime Coats: Before application of finish coats, apply a prime coat of material as recommended by manufacturer to material scheduled to be painted or finished that has not been shop primed. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to assure a finish coat with no burn through or other defects due to insufficient sealing.
- I. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, laps, brush marks, runs, sags, or other surface imperfections will not be acceptable.
- J. Hollow Metal Doors: Paint each door edge.
- K. Completed Work: Match Contracting Officer approved field samples for color and sheen.

3.4 MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Clean or replace identification markings on mechanical or electrical equipment when painted over or spattered.
- B. Paint both sides and edges of plywood backboards for electrical equipment before installing backboards and mounting equipment on them.



- C. Prepaint Gas piping prior to installation. (Touch-up paint after installation.)
 - 1. Color:
 - a. Roof (Yellow): OSHA Standard "Safety Yellow."
 - b. Other Areas: Match adjacent surfaces.
- D. At Workroom locations, paint red background on wall and columns behind fire extinguisher extending 6 inches on both sides of the extinguisher and from floor to ceiling, or to 12 feet above floor, whichever is lower. Color is to be OSHA Standard "Safety Red" and in accordance with ANSI Z53.1.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Inspect painting and coating application for scheduled material, color, sheen, specified thickness (MDF), and coverage.

3.6 CLEANING

- A. As work proceeds and upon completion, promptly remove paint where spilled, splashed, or spattered.
- B. During progress of work keep premises free from any unnecessary accumulation of tools, equipment, surplus materials, and debris.
- C. Collect waste, cloths, and material which may constitute a fire hazard, place in closed metal containers and remove daily from site.
- D. Upon completion of work leave premises neat and clean.

3.7 PROTECTION

- A. Protect other surfaces from paint and damage. Repair damage as a result of inadequate or unsuitable protection.

NOTE TO SPECIFIER

"REQUIRED Article (Color Schedule) follows. Do not revise this Article, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer."

Color Schedule is usually on the Drawings. Use Color Schedule in Specification when colors are not indicated on the Drawings. Verify colors with USPS Contracting Officer.

3.8 COLOR SCHEDULE

- A. Any proposal to substitute a color is to include manufacturer's certification that the color matches the specified Benjamin Moore color.
- B. P-101: Benjamin Moore #969, "Soft Chamois".
- C. P-105: Benjamin Moore #860, "Apparition".
- D. P-111: Benjamin Moore #2108-40, "Stardust".



3.9 SCHEDULE OF ITEMS TO BE PAINTED

NOTE TO SPECIFIER

The following items to be painted are typically used. Edit as relating to the particular Project. Verify painting of exterior concrete with USPS Contracting Officer.

- A. Painted finishes shall be provided for, but not limited to, the following items. Refer to Drawings and Paint Color Schedule above for designated finishes and colors of areas.
 - 1. Exterior: All exterior surfaces including, but not limited to:
 - a. Hollow metal doors and frames.
 - b. Metal opening frames and trim.
 - c. Metal flashing (if exposed from ground level) and downspout.
 - d. Metal gravelstops (vertical face).
 - e. Pipe Bollards, if not to receive plastic covers specified in Section 055000.
 - f. Metal railings.
 - g. Roof hatch.
 - h. Canopy supporting steel structure.
 - i. Wall louvers.
 - j. Exposed concrete.
 - k. Exposed concrete masonry.
 - l. Stucco/cement plaster.
 - 2. Interior: All interior surfaces as scheduled on Drawings including, but not limited to:
 - a. Hollow metal doors and frames.
 - b. Hollow metal window frames.
 - c. Metal opening frames and trim.
 - d. Gypsum wallboard.
 - e. Exposed concrete unit masonry.
 - f. Pipe Bollards.
 - g. Metal railings.
 - h. Exposed structure columns.
 - i. Metal stair stringers and handrails.
 - j. Exposed wood trim.

- B. Do not paint the following items:
 - 1. Pre-finished items:
 - a. Aluminum, brass, bronze, stainless steel, and chrome plated steel.
 - b. Pre-finished items, such as toilet compartments, acoustical ceiling materials, mechanical, and electrical equipment.
 - c. UL, FM, and other code-required labels.
 - d. Equipment identification, performance rating, and name plates.
 - e. Finish hardware.
 - f. Factory finished metal wall panels, metal wall panel trim, and metal gravel stops.
 - 2. Exposed items:
 - a. Exposed mechanical ductwork, hangers, and supports.
 - b. Exposed piping and conduit, hangers and supports.
 - c. Exposed fire protection piping, hangers and supports.
 - d. Exposed roof structure.
 - e. Exposed roof deck.

3.10 PAINTING AND FINISHING SCHEDULE

- A. Interior Paint Systems:



1. Interior Gypsum Wallboard:
 - a. 1 coat Latex Wall Primer.
 - b. 1 coat Latex Eggshell Enamel
 2. Interior Masonry:
 - a. 1 coat Latex Block Filler
 - b. 1 coat Latex Eggshell Enamel
 3. Interior Metal:
 - a. 2 coats Latex Satin
 4. Interior Wood (painted):
 - a. 1 coat Enamel Undercoat
 - b. 2 coats Alkyd Semi-Satin Enamel
 5. Cast-In-Place Concrete:
 - a. One coat of Latex Masonry Block Filler.
 - b. Two tinted coats of Acrylic Latex Semi-Gloss Enamel.
 6. Wood Doors - Painted.
 - a. One coat Enamel Undercoat.
 - b. Two tinted coats of Latex Semi-Gloss Enamel.
 7. Ferrous Metals
 - a. Touch up Prime Coat.
 - b. Two tinted coats of Alkyd Enamel Semi-Gloss.
 8. Wood Cabinets, Shelves, etc. - exposed surfaces.
 - a. One coat Primer-Sealer.
 - b. One coat Enamel Undercoat.
 - c. One coat Alkyd Enamel Semi-Gloss Enamel.
- B. Exterior Paint Systems:
1. Galvanized Metal:
 - a. Touch up Prime Coat.
 - b. Two tinted coats Exterior Alkyd Enamel Semi-Gloss Enamel.
 2. Ferrous Metals:
 - a. Touch up Prime Coat.
 - b. Two tinted coats Exterior Alkyd Enamel Semi-Gloss Enamel.
 3. Concrete/Masonry/Stucco
 - a. Prime Coat.
 - b. Two tinted coats Exterior Acrylic Latex Semi-Gloss.

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END OF SECTION 09 91 00 00



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SECTION 09 91 13 00 - HIGH-TEMPERATURE-RESISTANT COATINGS

1.1 GENERAL

- A. Description Of Work
 - 1. This specification covers the furnishing and installation of materials for high-temperature-resistant coatings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.
- B. Summary
 - 1. This Section includes surface preparation and application of high-temperature-resistant coating systems on steel substrates subject to high temperatures.
- C. Submittals
 - 1. Product Data: For each type of product indicated.
 - 2. Samples: For each coating and for each color and texture required.
 - 3. LEED Submittal:
 - a. Product Data for Credit EQ 4.2: For coatings, including printed statement of VOC content and chemical components.
- D. Quality Assurance
 - 1. Master Painters Institute (MPI) Standards:
 - a. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List" **OR** "MPI Maintenance Repainting Manual," **as directed**.
 - b. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" **OR** "MPI Maintenance Repainting Manual," **as directed**, for products and coating systems indicated.
- E. Delivery, Storage, And Handling
 - 1. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 - a. Maintain containers in clean condition, free of foreign materials and residue.
 - b. Remove rags and waste from storage areas daily.
- F. Project Conditions
 - 1. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 104 deg F (10 and 40 deg C).
 - 2. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.2 PRODUCTS

- A. High-Temperature-Resistant Coatings
 - 1. VOC Content of Interior Paints and Coatings: Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24) :
 - a. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
 - b. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
 - c. Anticorrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC content of not more than 250 g/L.
 - d. Flat Interior Topcoat Paints: VOC content of not more than 50 g/L.
 - e. Nonflat Interior Topcoat Paints: VOC content of not more than 150 g/L.



- f. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
- g. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
- h. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.
- 2. Chemical Components of Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
 - a. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing 1 or more benzene rings).
 - b. Restricted Components: Paints and coatings shall not contain any of the following:
 - 1) Acrolein.
 - 2) Acrylonitrile.
 - 3) Antimony.
 - 4) Benzene.
 - 5) Butyl benzyl phthalate.
 - 6) Cadmium.
 - 7) Di (2-ethylhexyl) phthalate.
 - 8) Di-n-butyl phthalate.
 - 9) Di-n-octyl phthalate.
 - 10) 1,2-dichlorobenzene.
 - 11) Diethyl phthalate.
 - 12) Dimethyl phthalate.
 - 13) Ethylbenzene.
 - 14) Formaldehyde.
 - 15) Hexavalent chromium.
 - 16) Isophorone.
 - 17) Lead.
 - 18) Mercury.
 - 19) Methyl ethyl ketone.
 - 20) Methyl isobutyl ketone.
 - 21) Methylene chloride.
 - 22) Naphthalene.
 - 23) Toluene (methylbenzene).
 - 24) 1,1,1-trichloroethane.
 - 25) Vinyl chloride.
- 3. Colors: As selected from manufacturer's full range **OR** Match samples, **as directed**.
- 4. Primer: Undercoating recommended in writing for use in coating system by manufacturer of high-temperature-resistant coating under conditions indicated.
- 5. Heat-Resistant Enamel (Gloss): MPI #21.
 - a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
- 6. Inorganic Zinc Primer: MPI #19.
 - a. VOC Content: Minimum E Range of 0 **OR** E1 **OR** E2 **OR** E3, **as directed**.
- 7. Aluminum Heat-Resistant Enamel: MPI #2.
 - a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
- 8. High-Heat-Resistant Coating: MPI #22.
 - a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.

1.3 EXECUTION

A. Preparation



1. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" **OR** "MPI Maintenance Repainting Manual," **as directed**, applicable to substrates indicated.
 2. Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
 - a. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.
 3. Clean steel substrates of substances that could impair bond of coatings, including dirt, oil, grease, and incompatible paints and encapsulants.
 - a. Remove incompatible primers as required to produce coating systems indicated.
- B. Application
1. Apply high-temperature-resistant coating systems according to manufacturer's written instructions.
 - a. Use applicators and techniques suited for coating and substrate indicated.
 - b. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 - c. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
- C. Field Quality Control
1. Contractor shall invoke the following procedure at any time and as often as necessary during the period when coatings are being applied:
 - a. Engage the services of a qualified testing agency to sample coating material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - b. Testing agency will perform tests for compliance with specified requirements.
 - c. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with specified requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.
- D. Cleaning And Protection
1. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
 2. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
 3. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by the Owner, and leave in an undamaged condition.
 4. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.
- E. High-Temperature-Resistant Coating Schedule
1. Heat-Resistant Enamel (Gloss) Coating System (System below corresponds with MPI EXT 5.2A and MPI INT 5.2A coating systems) {suitable for use on surfaces that reach a maximum temperature of 400 deg F (205 deg C)}:
 - a. Surface Preparation: Clean using methods recommended in writing by finish-coat manufacturer, but not less than blast cleaning according to SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning **OR** SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning," **as directed**.
 - b. Prime Coat: Primer.



- c. Finish Coat(s): Heat-resistant enamel (gloss), MPI #21, in number of coats recommended in writing by manufacturer for conditions indicated.
 2. Inorganic Zinc Primer Coating System (System below corresponds with MPI EXT 5.2C and MPI INT 5.2C coating systems) {suitable for use on surfaces that reach a maximum temperature of 750 deg F (400 deg C)}:
 - a. Surface Preparation: Clean using methods recommended in writing by finish-coat manufacturer, but not less than blast cleaning according to SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning **OR** SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning," **as directed**.
 - b. Prime Coat: Primer.
 - c. Finish Coat(s): Inorganic zinc primer, MPI #19, in number of coats recommended in writing by manufacturer for conditions indicated.
 3. Aluminum Heat-Resistant Enamel Coating System (System below corresponds with MPI EXT 5.2B and MPI INT 5.2B coating systems) {suitable for use on surfaces that reach a maximum temperature of 800 deg F (427 deg C)}:
 - a. Surface Preparation: Clean using methods recommended in writing by finish-coat manufacturer, but not less than blast cleaning according to SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning **OR** SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning," **as directed**.
 - b. Prime Coat: Primer.
 - c. Finish Coat(s): Aluminum heat-resistant enamel, MPI #2, in number of coats recommended in writing by manufacturer for conditions indicated.
 4. High-Heat-Resistant Coating System (System below corresponds with MPI EXT 5.2D and MPI INT 5.2D coating systems) {suitable for use on surfaces that reach a maximum temperature of 1100 deg F (593 deg C)}:
 - a. Surface Preparation: Clean using methods recommended in writing by finish-coat manufacturer, but not less than blast cleaning according to SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning **OR** SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning," **as directed**.
 - b. Prime Coat: Primer.
 - c. Finish Coat(s): High-heat-resistant coating, MPI #22, in number of coats recommended in writing by manufacturer for conditions indicated.

END OF SECTION 09 91 13 00



Task	Specification	Specification Description
09 91 13 00	01 22 16 00	No Specification Required



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SECTION 09 91 23 00 - INTERIOR PAINTING**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for interior painting. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes surface preparation and the application of paint systems on the following interior substrates:
 - a. Concrete.
 - b. Clay masonry.
 - c. Concrete masonry units (CMU).
 - d. Steel.
 - e. Galvanized metal.
 - f. Aluminum (not anodized or otherwise coated).
 - g. Wood.
 - h. Gypsum board.
 - i. Plaster.
 - j. Spray-textured ceilings.
 - k. Cotton or canvas insulation covering.

C. Submittals

1. Product Data: For each type of product indicated.
2. Samples: For each finish and for each color and texture required.
3. Product List: Printout of current "MPI Approved Products List" for each product category specified in Part 1.2, with the proposed product highlighted.
4. LEED Submittal:
 - a. Product Data for Credit EQ 4.2: For paints, including printed statement of VOC content and chemical components.

D. Quality Assurance

1. MPI Standards:
 - a. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
 - b. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

E. Delivery, Storage, And Handling

1. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 - a. Maintain containers in clean condition, free of foreign materials and residue.
 - b. Remove rags and waste from storage areas daily.

F. Project Conditions

1. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
2. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.2 PRODUCTS

A. Paint, General

1. Material Compatibility:
 - a. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - b. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
2. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
 - a. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
 - b. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
 - c. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 - d. Floor Coatings: VOC not more than 100 g/L.
 - e. Shellacs, Clear: VOC not more than 730 g/L.
 - f. Shellacs, Pigmented: VOC not more than 550 g/L.
 - g. Flat Topcoat Paints: VOC content of not more than 50 g/L.
 - h. Nonflat Topcoat Paints: VOC content of not more than 150 g/L.
 - i. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 - j. Floor Coatings: VOC not more than 100 g/L.
 - k. Shellacs, Clear: VOC not more than 730 g/L.
 - l. Shellacs, Pigmented: VOC not more than 550 g/L.
 - m. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
 - n. Dry-Fog Coatings: VOC content of not more than 400 g/L.
 - o. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.
 - p. Pre-Treatment Wash Primers: VOC content of not more than 420 g/L.
3. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
 - a. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
 - b. Restricted Components: Paints and coatings shall not contain any of the following:
 - 1) Acrolein.
 - 2) Acrylonitrile.
 - 3) Antimony.
 - 4) Benzene.
 - 5) Butyl benzyl phthalate.
 - 6) Cadmium.
 - 7) Di (2-ethylhexyl) phthalate.
 - 8) Di-n-butyl phthalate.
 - 9) Di-n-octyl phthalate.
 - 10) 1,2-dichlorobenzene.
 - 11) Diethyl phthalate.
 - 12) Dimethyl phthalate.
 - 13) Ethylbenzene.
 - 14) Formaldehyde.
 - 15) Hexavalent chromium.
 - 16) Isophorone.



- 17) Lead.
 - 18) Mercury.
 - 19) Methyl ethyl ketone.
 - 20) Methyl isobutyl ketone.
 - 21) Methylene chloride.
 - 22) Naphthalene.
 - 23) Toluene (methylbenzene).
 - 24) 1,1,1-trichloroethane.
 - 25) Vinyl chloride.
4. Colors: As selected from manufacturer's full range **OR** Match samples **OR** As indicated in a color schedule, **as directed**.
- B. Block Fillers
1. Interior/Exterior Latex Block Filler: MPI #4.
 - a. VOC Content: E Range of E2 **OR** E3, **as directed**.
- C. Primers/Sealers
1. Interior Latex Primer/Sealer: MPI #50.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
 2. Interior Alkyd Primer/Sealer: MPI #45.
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
 3. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.
- D. Metal Primers
1. Alkyd Anticorrosive Metal Primer: MPI #79.
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
 2. Quick-Drying Alkyd Metal Primer: MPI #76.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 3. Rust-Inhibitive Primer (Water Based): MPI #107.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
 4. Cementitious Galvanized-Metal Primer: MPI #26.
 - a. VOC Content: E Range of E1.
 5. Waterborne Galvanized-Metal Primer: MPI #134.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
 6. Vinyl Wash Primer: MPI #80.
 - a. VOC Content: E Range of E2 **OR** E3, **as directed**.
 7. Quick-Drying Primer for Aluminum: MPI #95.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
- E. Wood Primers
1. Interior Latex-Based Wood Primer: MPI #39.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
- F. Latex Paints
1. Interior Latex (Flat): MPI #53 (Gloss Level 1).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 0.5 **OR** EPR 1.5 **OR** EPR 2.5, **as directed**.
 2. Interior Latex (Low Sheen): MPI #44 (Gloss Level 2).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
 3. Interior Latex (Eggshell): MPI #52 (Gloss Level 3).



- a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
- 4. Interior Latex (Satin): MPI #43 (Gloss Level 4).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1.5 **OR** EPR 2 **OR** EPR 2.5 **OR** EPR 3.5, **as directed**.
- 5. Interior Latex (Semigloss): MPI #54 (Gloss Level 5).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 2 **OR** EPR 3 **OR** EPR 4, **as directed**.
- 6. Interior Latex (Gloss): MPI #114 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 2 **OR** EPR 3 **OR** EPR 4, **as directed**.
- 7. Institutional Low-Odor/VOC Latex (Flat): MPI #143 (Gloss Level 1).
 - a. VOC Content: E Range of E3.
 - b. Environmental Performance Rating: EPR 4 **OR** EPR 5.5, **as directed**.
- 8. Institutional Low-Odor/VOC Latex (Low Sheen): MPI #144 (Gloss Level 2).
 - a. VOC Content: E Range of E3.
 - b. Environmental Performance Rating: EPR 4.5.
- 9. Institutional Low-Odor/VOC Latex (Eggshell): MPI #145 (Gloss Level 3).
 - a. VOC Content: E Range of E3.
 - b. Environmental Performance Rating: EPR 4.5.
- 10. Institutional Low-Odor/VOC Latex (Semigloss): MPI #147 (Gloss Level 5).
 - a. VOC Content: E Range of E3.
 - b. Environmental Performance Rating: EPR 3 **OR** EPR 5.5, **as directed**.
- 11. High-Performance Architectural Latex (Low Sheen): MPI #138 (Gloss Level 2).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 4 **OR** EPR 5 **OR** EPR 6, **as directed**.
- 12. High-Performance Architectural Latex (Eggshell): MPI #139 (Gloss Level 3).
 - a. VOC Content: E Range of E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 5 **OR** EPR 6, **as directed**.
- 13. High-Performance Architectural Latex (Satin): MPI #140 (Gloss Level 4).
 - a. VOC Content: E Range of E1 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 4.5 **OR** EPR 6.5, **as directed**.
- 14. High-Performance Architectural Latex (Semigloss): MPI #141 (Gloss Level 5).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 5 **OR** EPR 6 **OR** EPR 7, **as directed**.
- 15. Exterior Latex (Flat): MPI #10 (Gloss Level 1).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
- 16. Exterior Latex (Semigloss): MPI #11 (Gloss Level 5).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
- 17. Exterior Latex (Gloss): MPI #119 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.

G. Alkyd Paints

- 1. Interior Alkyd (Flat): MPI #49 (Gloss Level 1).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
- 2. Interior Alkyd (Eggshell): MPI #51 (Gloss Level 3).
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
- 3. Interior Alkyd (Semigloss): MPI #47 (Gloss Level 5).
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
- 4. Interior Alkyd (Gloss): MPI #48 (Gloss Level 6).
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.

H. Quick-Drying Enamels



1. Quick-Drying Enamel (Semigloss): MPI #81 (Gloss Level 5).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 2. Quick-Drying Enamel (High Gloss): MPI #96 (Gloss Level 7).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - I. Textured Coating
 1. Latex Stucco and Masonry Textured Coating: MPI #42.
 - a. VOC Content: E Range of E2 **OR** E3, **as directed**.
 - J. Dry Fog/Fall Coatings
 1. Latex Dry Fog/Fall: MPI #118.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
 2. Waterborne Dry Fall: MPI #133.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
 3. Interior Alkyd Dry Fog/Fall: MPI #55.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - K. Aluminum Paint
 1. Aluminum Paint: MPI #1.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - L. Floor Coatings
 1. Interior Concrete Floor Stain: MPI #58.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 2.
 2. Interior/Exterior Clear Concrete Floor Sealer (Water Based): MPI #99.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 3. Interior/Exterior Clear Concrete Floor Sealer (Solvent Based): MPI #104.
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
 4. Interior/Exterior Latex Floor and Porch Paint (Low Gloss): MPI #60 (maximum Gloss Level 3).
 - a. VOC Content: E Range of E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 3.
 5. Exterior/Interior Alkyd Floor Enamel (Gloss): MPI #27 (Gloss Level 6).
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
 - b. Additives: Manufacturer's standard additive to increase skid resistance of painted surface.
- 1.3 EXECUTION
- A. Preparation
1. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
 2. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - a. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
 - b. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 3. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 - a. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.



4. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
5. Clay Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content of surfaces or alkalinity of mortar joints to be painted exceed that permitted in manufacturer's written instructions.
6. Concrete Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
7. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.
8. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
9. Aluminum Substrates: Remove surface oxidation.
10. Wood Substrates:
 - a. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - b. Sand surfaces that will be exposed to view, and dust off.
 - c. Prime edges, ends, faces, undersides, and backsides of wood.
 - d. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
11. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.
12. Plaster Substrates: Do not begin paint application until plaster is fully cured and dry.
13. Spray-Textured Ceiling Substrates: Do not begin paint application until surfaces are dry.
14. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

B. Application

1. Apply paints according to manufacturer's written instructions.
 - a. Use applicators and techniques suited for paint and substrate indicated.
 - b. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - c. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
2. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
3. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
4. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
5. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:
 - a. Mechanical Work:
 - 1) Uninsulated metal piping.
 - 2) Uninsulated plastic piping.
 - 3) Pipe hangers and supports.
 - 4) Tanks that do not have factory-applied final finishes.
 - 5) Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
 - 6) Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.



- 7) Mechanical equipment that is indicated to have a factory-primed finish for field painting.
- b. Electrical Work:
 - 1) Switchgear.
 - 2) Panelboards.
 - 3) Electrical equipment that is indicated to have a factory-primed finish for field painting.
- C. Field Quality Control
 1. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:
 - a. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - b. Testing agency will perform tests for compliance with product requirements.
 - c. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.
- D. Cleaning And Protection
 1. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
 2. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
 3. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by the Owner, and leave in an undamaged condition.
 4. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.
- E. Interior Painting Schedule
 1. Concrete Substrates, Nontraffic Surfaces:
 - a. Latex System: MPI INT 3.1E.
 - 1) Prime Coat: Interior latex matching topcoat.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Sealer System: MPI INT 3.1A.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Latex Over Latex Aggregate System: MPI INT 3.1B.
 - 1) Prime Coat: Latex stucco and masonry textured coating.
 - 2) Intermediate Coat (for MPI Premium Grade system): Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - d. Alkyd System: MPI INT 3.1D.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - e. Institutional Low-Odor/VOC Latex System: MPI INT 3.1M.
 - 1) Prime Coat: Institutional low-odor/VOC interior latex matching topcoat.

- 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
- 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
- f. High-Performance Architectural Latex System: MPI INT 3.1C.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
2. Concrete Substrates, Traffic Surfaces:
 - a. Latex Floor Enamel System: MPI INT 3.2A.
 - 1) Prime Coat: Interior/exterior latex floor and porch paint (low gloss).
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior/exterior latex floor and porch paint (low gloss).
 - 3) Topcoat: Interior/exterior latex floor and porch paint (low gloss).
 - b. Alkyd Floor Enamel System: MPI INT 3.2B.
 - 1) Prime Coat: Exterior/interior alkyd floor enamel (gloss).
 - 2) Intermediate Coat (for MPI Premium Grade system): Exterior/interior alkyd floor enamel (gloss).
 - 3) Topcoat: Exterior/interior alkyd floor enamel (gloss).
 - c. Concrete Stain System: MPI INT 3.2E.
 - 1) First Coat (for MPI Premium Grade system): Interior concrete floor stain.
 - 2) Topcoat: Interior concrete floor stain.
 - d. Clear Sealer System: MPI INT 3.2F.
 - 1) First Coat: Interior/exterior clear concrete floor sealer (solvent based).
 - 2) Topcoat: Interior/exterior clear concrete floor sealer (solvent based).
 - e. Water-Based Clear Sealer System: MPI INT 3.2G.
 - 1) First Coat: Interior/exterior clear concrete floor sealer (water based).
 - 2) Topcoat: Interior/exterior clear concrete floor sealer (water based).
3. Clay-Masonry Substrates:
 - a. Latex System: MPI INT 4.1A.
 - 1) Prime Coat: Interior latex matching topcoat.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Alkyd System: MPI INT 4.1D.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Latex Aggregate System: MPI INT 4.1B.
 - 1) Prime Coat: As recommended in writing by topcoat manufacturer.
 - 2) Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - 3) Topcoat: Latex stucco and masonry textured coating.
 - d. Institutional Low-Odor/VOC Latex System: MPI INT 4.1M.
 - 1) Prime Coat: Institutional low-odor/VOC interior latex matching topcoat.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
 - e. High-Performance Architectural Latex System: MPI INT 4.1L.
 - 1) Prime Coat: High-performance architectural latex matching topcoat.
 - 2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.



- 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
4. CMU Substrates:
 - a. Latex System: MPI INT 4.2A.
 - 1) Prime Coat: Interior/exterior latex block filler.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Alkyd System: MPI INT 4.2C.
 - 1) Prime Coat: Interior/exterior latex block filler.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd Over Latex Sealer System: MPI INT 4.2N.
 - 1) Prime Coat: Interior/exterior latex block filler.
 - 2) Sealer Coat: Interior latex primer/sealer.
 - 3) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 4) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - d. Institutional Low-Odor/VOC Latex System: MPI INT 4.2E.
 - 1) Prime Coat: Interior/exterior latex block filler.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
 - e. High-Performance Architectural Latex System: MPI INT 4.2D.
 - 1) Prime Coat: Interior/exterior latex block filler.
 - 2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
5. Steel Substrates:
 - a. Quick-Drying Enamel System: MPI INT 5.1A.
 - 1) Prime Coat: Quick-drying alkyd metal primer.
 - 2) Intermediate Coat: Quick-drying enamel matching topcoat.
 - 3) Topcoat: Quick-drying enamel (semigloss) **OR** (high gloss), **as directed**.
 - b. Water-Based Dry-Fall System: MPI INT 5.1C.
 - 1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
 - 2) Topcoat: Latex dry fog/fall **OR** Waterborne dry fall, **as directed**.
 - c. Alkyd Dry-Fall System: MPI INT 5.1D.
 - 1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
 - 2) Topcoat: Interior alkyd dry fog/fall.
 - d. Latex Over Alkyd Primer System: MPI INT 5.1Q.
 - 1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - e. Alkyd System: MPI INT 5.1E.
 - 1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - f. Aluminum Paint System: MPI INT 5.1M.
 - 1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Aluminum paint.
 - 3) Topcoat: Aluminum paint.



- g. Institutional Low-Odor/VOC Latex System: MPI INT 5.1S.
 - 1) Prime Coat: Rust-inhibitive primer (water based).
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
- h. High-Performance Architectural Latex System: MPI INT 5.1R.
 - 1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
- 6. Galvanized-Metal Substrates:
 - a. Water-Based Dry-Fall System: MPI INT 5.3H.
 - 1) Prime Coat: Waterborne dry fall.
 - 2) Topcoat: Waterborne dry fall.
 - b. Alkyd Dry-Fall System: MPI INT 5.3F.
 - 1) Prime Coat: Cementitious galvanized-metal primer.
 - 2) Topcoat: Interior alkyd dry fog/fall.
 - c. Latex System: MPI INT 5.3A.
 - 1) Prime Coat: Cementitious galvanized-metal primer.
 - 2) Intermediate Coat: Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - d. Latex Over Waterborne Primer System: MPI INT 5.3J.
 - 1) Prime Coat: Waterborne galvanized-metal primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - e. Alkyd System: MPI INT 5.3C.
 - 1) Prime Coat: Cementitious galvanized-metal primer.
 - 2) Intermediate Coat: Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - f. Aluminum Paint System: MPI INT 5.3G.
 - 1) Prime Coat: Cementitious galvanized-metal primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Aluminum paint.
 - 3) Topcoat: Aluminum paint.
 - g. Institutional Low-Odor/VOC Latex System: MPI INT 5.3N.
 - 1) Prime Coat: Waterborne galvanized-metal primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
 - h. High-Performance Architectural Latex System: MPI INT 5.3M.
 - 1) Prime Coat: Waterborne galvanized-metal primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
- 7. Aluminum (Not Anodized or Otherwise Coated) Substrates:
 - a. Latex System: MPI INT 5.4H.
 - 1) Prime Coat: Quick-drying primer for aluminum.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.



- b. Alkyd Over Vinyl Wash Primer System: MPI INT 5.4A.
 - 1) Prime Coat: Vinyl wash primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd Over Quick-Drying Primer System: MPI INT 5.4J.
 - 1) Prime Coat: Quick-drying primer for aluminum.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - d. Aluminum Paint System: MPI INT 5.4D.
 - 1) Prime Coat: Vinyl wash primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Aluminum paint.
 - 3) Topcoat: Aluminum paint.
 - e. Institutional Low-Odor/VOC Latex System: MPI INT 5.4G.
 - 1) Prime Coat: Quick-drying primer for aluminum.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
 - f. High-Performance Architectural Latex System: MPI INT 5.4F.
 - 1) Prime Coat: Quick-drying primer for aluminum.
 - 2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
 - 8. Glue-Laminated Beam and Column Substrates:
 - a. Latex System: MPI INT 6.1M.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat: Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Alkyd Primer System: MPI INT 6.1A.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd System: MPI INT 6.1B.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - d. Institutional Low-Odor/VOC Latex System: MPI INT 6.1Q.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
 - e. High-Performance Architectural Latex System: MPI INT 6.1N.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat: High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
 - 9. Dressed Lumber Substrates: Including architectural woodwork and doors.
 - a. Latex System: MPI INT 6.3T.
 - 1) Prime Coat: Interior latex-based wood primer.



- 2) Intermediate Coat: Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Alkyd Primer System: MPI INT 6.3U.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd System: MPI INT 6.3B.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - d. Institutional Low-Odor/VOC Latex System: MPI INT 6.3V.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
 - e. High-Performance Architectural Latex System: MPI INT 6.3A.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat: High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
10. Wood Panel Substrates: Including painted plywood, medium-density fiberboard, and hardboard.
- a. Latex System: MPI INT 6.4R.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat: Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Alkyd Primer System: MPI INT 6.4A.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd System: MPI INT 6.4B.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - d. Institutional Low-Odor/VOC Latex System: MPI INT 6.4T.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat : Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
 - e. High-Performance Architectural Latex System: MPI INT 6.4S.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat: High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
11. Dimension Lumber Substrates, Nontraffic Surfaces: Including exposed joists and exposed beams.
- a. Latex System: MPI INT 6.2D.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat: Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Alkyd Primer System: MPI INT 6.2A.



- 1) Prime Coat: Interior alkyd primer/sealer.
- 2) Intermediate Coat : Interior latex matching topcoat.
- 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
- c. Alkyd System: MPI INT 6.2C.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
- d. Institutional Low-Odor/VOC Latex System: MPI INT 6.2L.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
- e. High-Performance Architectural Latex System: MPI INT 6.2B.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
12. Wood Substrates, Traffic Surfaces:
 - a. Latex Floor Paint System: MPI INT 6.5G.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat: Interior/exterior latex floor and porch paint (low gloss).
 - 3) Topcoat: Interior/exterior latex floor and porch paint (low gloss).
 - b. Alkyd Floor Enamel System: MPI INT 6.5A.
 - 1) Prime Coat: Exterior/interior alkyd floor enamel (gloss).
 - 2) Intermediate Coat: Exterior/interior alkyd floor enamel (gloss).
 - 3) Topcoat: Exterior/interior alkyd floor enamel (gloss).
13. Gypsum Board Substrates:
 - a. Latex System: MPI INT 9.2A.
 - 1) Prime Coat: Interior latex primer/sealer (for MPI Premium Grade system) **OR** matching topcoat, **as directed**.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Alkyd Over Latex Primer System: MPI INT 9.2C.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Institutional Low-Odor/VOC Latex System: MPI INT 9.2M.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
 - d. High-Performance Architectural Latex System: MPI INT 9.2B.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
14. Plaster Substrates:
 - a. Latex System: MPI INT 9.2A.

- 1) Prime Coat: Interior latex primer/sealer (for MPI Premium Grade system) **OR** matching topcoat, **as directed**.
- 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
- 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
- b. Latex Over Alkyd Primer System: MPI INT 9.2K.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat: Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
- c. Alkyd Over Latex Primer System: MPI INT 9.2C.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
- d. Institutional Low-Odor/VOC Latex System: MPI INT 9.2M.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
- e. High-Performance Architectural Latex System: MPI INT 9.2B.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
15. Spray-Textured Ceiling Substrates:
 - a. Latex (Flat) System: MPI INT 9.1A, spray applied.
 - 1) Prime Coat: Interior latex primer/sealer **OR** (flat), **as directed**.
 - 2) Topcoat: Interior latex (flat).
 - b. Latex System: MPI INT 9.1E, spray applied.
 - 1) Prime Coat: Interior latex matching topcoat.
 - 2) Intermediate Coat: Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
 - c. Latex Over Alkyd Primer System: MPI INT 9.1B.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - d. Alkyd (Flat) System: MPI INT 9.1C.
 - 1) Prime Coat: Interior alkyd (flat).
 - 2) Topcoat: Interior alkyd (flat).
 - e. Alkyd System: MPI INT 9.1D.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
16. Cotton or Canvas Insulation-Covering Substrates: Including pipe and duct coverings.
 - a. Latex System: MPI INT 10.1A.
 - 1) Prime Coat: Interior latex primer/sealer (for MPI Premium Grade system) **OR** matching topcoat, **as directed**.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.



- b. Alkyd Over Latex Primer System: MPI INT 10.1B.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
- c. Aluminum Paint System: MPI INT 10.1C.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Aluminum paint.
 - 3) Topcoat: Aluminum paint.
- d. Institutional Low-Odor/VOC Latex System: MPI INT 10.1D.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.

END OF SECTION 09 91 23 00



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Task	Specification	Specification Description
09 91 33 00	09 91 13 00	High-Temperature-Resistant Coatings



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SECTION 09 96 56 00 - CSF EPOXY COATINGS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.09 96 56 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Epoxy wall coating.

1.2 REFERENCES

- A. Comply with the following American Society for Testing and Materials (ASTM) standards:
 1. ASTM D695: Test Method for Compressive Strength
 2. ASTM D638: Test Method for Elongation
 3. ASTM D2240 Shore D: Test Method for Surface Hardness
 4. ASTM D2794: Test for Impact Resistance

1.3 SUBMITTALS

- A. Product Data: Required
- B. Samples: Required

NOTE TO SPECIFIER

Color to be selected from manufacturer's standard colors and approved by the Contracting Officer.

- C. Color: [_____]

1.4 QUALITY ASSURANCE

- A. Applicator to be certified and licensed by the epoxy wall coating manufacturer.
- B. Field samples to be approved and serve as minimum acceptable standards for finished work.



PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design:

1. Manufacturer: Stonhard, Maple Shade, NJ (800) 257-7953

- a. Wall Product: Stonglaze.

B. Equal Products by one of the following Manufacturers may be substituted:

1. Crossfield Products, Dex-O-Tex, Rancho Dominguez, CA (310) 886-9100

- a. Wall Product: Dex-o-tex Wallcote E.

2. Sherwin-Williams, Cleveland, OH (800) 524-5979

- a. Wall Product: Tile-Clad High Solids 2-part epoxy-polyamide coating.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Apply coating system in strict accordance with manufacturer instructions for material and substrate involved.
- B. Provide ample ventilation during application.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



SECTION 09 96 56 00 - MPF EPOXY COATINGS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 – GENERAL

1.1 SUMMARY

- A. Epoxy wall coating.

1.2 SUBMITTALS

- A. Product Data: Required
- B. Samples: Required
- C. Color: Light Gray, to be selected from manufacturer's standard colors and approved by the Contracting Officer.

1.3 QUALITY ASSURANCE

- A. Applicator to be certified and licensed by the epoxy wall coating manufacturer.
- B. Field samples to be approved and serve as minimum acceptable standards for finished work.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Stonhard;
 - 1. Wall Product: Stonglaze VSC
- B. Crossfield Products Corporation;
 - 1. Wall Product: Dex-o-tex Wallcote E
- C. General Polymers
- D. Florock
- E. Dur-A-Flex Inc.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Apply coating systems in accordance with manufacturer instructions for material and substrate involved.
- B. Provide ample ventilation during application.



USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 7/2/2010

END OF SECTION 09 96 56 00



SECTION 09 96 56 00b - FIBERGLASS REINFORCED EPOXY COATING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for fiberglass reinforced epoxy coating. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each coating system specified.

C. Material Storage

1. Store materials in a temperature controlled environment (50°F - 90°F) and out of direct sunlight.
2. Keep resins, hardeners, and solvents separated from each other and away from sources of ignition. One year shelf life is expected for products stored between 50°F - 90°F.

1.2 PRODUCTS

A. Materials

1. Multi-Layer, High Build Wall and Ceiling Surfacing System
 - a. Primer
 - 1) Water-based epoxy base coating.
 - b. Base Coat
 - 1) High performance epoxy coating.
 - c. Fiberglass Mesh Reinforcement
 - 1) Bound fiberglass cloth, 5.6 oz.
 - d. Saturant
 - 1) High performance epoxy coating.
 - e. Level Coat
 - 1) High performance epoxy coating.
 - f. Chemical Resistant Finish Coat
 - 1) 100% solids polyurethane.

1.3 EXECUTION

A. Primer

1. Mixing and Application: Water Based Epoxy Wall Coating should only be used on unpainted, porous surfaces. If the surface is painted with latex or an epoxy coating, clean and abrade the surface then apply the primer.
2. Premix resin and hardener separately, using a low speed drill and Jiffy mixer. Mix for three minutes and until uniform, exercising caution not to whip air into the materials.
3. Add 2 parts resin to 1 part hardener, mix with low speed drill and Jiffy mixer for three minutes and until uniform. Apply material using a 1/4" short nap roller at a spread rate of 300-350 sq. ft. per gallon to yield 5 mils WFT.
4. Allow to cure for a minimum of 3 hours depending upon air movement. Lightly "pole sand" smooth rough edges of the flake before applying base coat.

B. Base Coat

1. Mixing and Application



- a. Premix resin and hardener separately, using a low speed drill and Jiffy mixer. Mix for three minutes and until uniform, exercising caution not to introduce air into the material.
 - b. Add 3 parts resin to 1 part hardener by volume. Mix with low speed drill and Jiffy mixer for three minutes and until uniform. To insure proper system cure and performance, strictly follow mix ratio recommendations.
 - c. Base coat may be applied via spray, roller or brush. Apply using a 1/4" nap roller at a spread rate of 200-250 sq. ft. per gallon to yield 6-8 mils WFT evenly with no runs. Coverage will vary depending upon porosity of the substrate and surface texture.
- C. Fiberglass Reinforcement
 1. Apply 5.6 oz. bound fiberglass cloth for walls and 4 oz. for ceilings directly into wet resin. Do not allow material to cure or recoating will be necessary.
 2. Hang fiberglass cloth directly to the wall similar to hanging wallpaper so seams are uniform and even. Overlap each strip using a double cut method. Remove the trimmed material behind the front strip.
 3. After hand affixing to wall, use a broad knife to remove air pockets, wrinkles or any irregularities.
- D. Saturant Coat
 1. Mixing and Application
 - a. Premix resin and hardener separately, using a low speed drill and Jiffy mixer. Mix for three minutes and until uniform, exercising caution not to introduce air into the material.
 - b. Add 3 parts 3548PA (resin) to 1 part 3548B (hardener) by volume. Mix with low speed drill and Jiffy mixer for three minutes and until uniform. To insure proper system cure and performance, strictly follow mix ratio recommendations.
 - c. Saturant coat may be applied via spray, roller or brush. Apply at a spread rate of 250-400 sq. ft. per gallon to yield 4-6 mils WFT evenly with no runs. Allow to cure overnight (minimum 10 hours) before lightly sanding seams, bumps and other imperfections with 60-80 grit sandpaper caused by the saturant coat.
- E. Level Coat
 1. Mixing and Application
 - a. Apply leveling coat as described in previous step.
 - b. Allow to cure overnight.
 - c. An additional level coat may be applied.
 - d. Sand any imperfections prior to applying finish coat.
- F. Finish Coat
 1. Mixing and Application
 - a. Premix resin using a low speed drill and Jiffy mixer. Mix for three minutes and until uniform, exercising caution not to introduce air into the material.
 - b. Add 1 part resin to 1 part hardener by volume. Mix with low speed drill and Jiffy mixer for three minutes and until uniform. To insure proper system cure and performance, strictly follow mix ratio recommendations.
 - c. Finish coat may be applied via spray, roller or brush. Apply using a 1/4" nap non-shedding, urethane enamel roller at a spread rate of 250-400 sq. ft. per gallon to yield 4-6 WFT mils evenly with no runs. If second coat is required, the surface must be abraded with 80-120 grit paper or screen and tack wiped prior to second application.
 - d. Allow to cure 48 hours for water exposure and 7 days for chemical exposure. In cool and/or high humidity conditions, a surface film may form which can be washed with soap and water.

END OF SECTION 09 96 56 00b



Task	Specification	Specification Description
09 97 63 00	01 22 16 00	No Specification Required



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Task	Specification	Specification Description
10 12 00 00	01 22 16 00	No Specification Required



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SECTION 10 14 04 00 - CSF POSTAL SIGNAGE**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

THIS SECTION INCLUDES A DIRECT VENDOR ITEM. CONSTRUCTION SUPPLIERS MUST CONTACT THE DIRECT VENDOR AS DIRECTED FOR APPROVED PRICING AND PURCHASING PROCEDURES. Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.10 14 04 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior signage - building identification, directional and parking regulatory signs.
2. Interior signage for retail spaces.

B. The USPS Direct Vendor for supplying the exterior signage - building identification, directional and parking regulatory signs listed in this specification through the contractor is Gable Signs. No substitutions allowed.

1. In the Offer, include the estimated exterior signage cost from the Exterior Signage Pricing Form at the end of this section. This amount includes the exterior signage and shipping. It does not include installation which is part of the Work. Contractor may negotiate with the Direct Vendor for installation.
2. The contractor is to order the exterior signage from the Direct Vendor based on the Exterior Signage Pricing Form and Drawings in time to meet the schedule. Payment is to be received by the Direct Vendor from the contractor prior to shipment of the exterior signage.

C. The USPS Direct Vendor for supplying the interior signage listed in this specification through the contractor is Gable Signs. No substitutions allowed.

1. In the Offer, include the estimated interior signage cost from the Interior Signage Pricing Form at the end of this section. This amount includes the interior signage and shipping. It does not include installation which is part of the Work.
2. The contractor is to order the interior signage from the Direct Vendor based on the Interior Signage Pricing Form and Drawings in time to meet the schedule. Payment is to be received by the Direct Vendor from the contractor prior to shipment of the interior signage.

D. Related Documents:



1. The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 1. USPS Exterior Signage vendor shop drawings have been approved by USPS Headquarters; no additional submittals are required from this vendor. Signs included in this agreement are building identification, directional and parking regulatory signs. DOT signs are not included in this agreement.
 2. USPS Interior Signage vendor shop drawings have been approved by USPS Headquarters; no additional submittals are required from this vendor.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Store in original packaging, off the ground and under protective covering.
- C. Handle so as to prevent damage.

NOTE TO SPECIFIER

"REQUIRED Part (Products) is included below. Do not revise these without a written Deviation from USPS Headquarters Design and Construction, through the Contracting Officer."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Exterior Signage - building identification, directional and parking regulatory signs: Gable Signs, Eric Crowe, Director of Sales & Account Management, 7440 Fort Smallwood Road, Baltimore, MD 21226, Phone (443) 817-0303, eric.crowe@gablesigns.com. USPS reserves the right to update these products through the Direct Vendor agreement.
- B. Interior Signage: Gable Signs, Eric Crowe, Director of Sales & Account Management, 7440 Fort Smallwood Road, Baltimore, MD 21226, Phone (443) 817-0303, eric.crowe@gablesigns.com. USPS reserves the right to update these products through the Direct Vendor agreements.
- C. Section 016000 - Product Requirements:
 1. Exterior Signage: Substitutions are not permitted.
 2. Interior Signage: Substitutions are not permitted.



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions by Contractor is required: Verify through field measurements that contract Documents are in accordance with actual site conditions. Verify that all sign site locations, wall surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Examine free standing sign placement locations, walls, doors, soffit and other areas scheduled to receive signs for conditions that would affect quality and execution of work.
 - 2. Check that electrical distribution for illuminated signs is complete and ready to receive signs.
 - 3. Contractor is responsible for obtaining any required permits.
- C. Contractor is to report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.
- E. Contractor is responsible for reviewing contract documents to provide required electrical service to sign positions shown in the Drawings.

3.2 PREPARATION

- A. Contractor is responsible for the removal of any existing signs in preparation to receive new sign elements. Contractor will patch affected surfaces to match existing materials. Contractor must dispose of all signs in accordance with all state and local codes and ordinances. Recycling and re-use of existing sign materials is greatly encouraged. Contractor must consider the salvage value of removed signs in the cost of work.
- B. Contractor must verify that all signs ordered fit the as-built conditions of the facility.

3.3 INSTALLATION

- A. Install sign units and components at the locations shown in Drawings, securely mount with fasteners appropriate to the substrate conditions.
- B. Install signs on facility property clear of public right of ways and utilities.
- C. Install foundations for all free standing signs.
- D. Verify that all internal roadway, street and traffic conditions are in accordance with the signs selected and shown on Contract Documents prior to purchase and installation of exterior signage.
- E. Connect signs to control devices and electrical service as required in the Drawings. Coordinate with the USPS Sign Vendor time clock settings and power service required for checking lighting and operational status of all sign hardware.



- F. Install interior sign units and components at the locations shown or scheduled, securely mount with concealed theft-resistant fasteners. Attach signs to substrates in accordance with the manufacturer's instructions.
- G. Install level, plumb, and at the proper height and alignments. Cooperate with other trades for installation of sign units to finish surfaces.
 - 1. Coordinate the mounting height of the USPS "station ID", "Hours of Operation" or other door mounted vinyls with any code-required signs for automatic doors.
- H. Sign manufacturer to provide template for spacing of letters.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Inspect signage locations, attachments, and messages to verify installation conforms with Drawings.

NOTE TO SPECIFIER

Attach Exterior Signage Pricing Form here.

USPS CSF Specifications issued: 10/1/2013
Last revised: 5/31/2011

END OF SECTION



SECTION 10 14 04 00 - MPF POSTAL SIGNAGE**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 – GENERAL

1.1 SUMMARY

- A. Exterior signage – building identification, directional and parking regulatory signs.
- B. Department of Transportation (DOT) traffic control signs.
- C. Monument signage.

1.2 SUBMITTALS

- A. Product data: Required
- B. Shop drawings: Required

1.3 QUALITY CONTROL

- A. Installer's certification of minimum five years documented experience.
- B. DOT traffic signs shall be in compliance with all state and local codes and ordinances.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Exterior Signage – building identification, directional and parking regulatory signs:
 - 1. Source: The USPS Direct Vendor for supplying the exterior signage is Gable Signs, Eric Crowe, Director of Sales & Account Management, 7440 Fort Smallwood Road, Baltimore, MD 21226, Phone (443) 817-0303, eric.crowe@gablesigns.com. No substitutions allowed.
 - 2. Vendor shop drawings have been approved by USPS Headquarters; no additional submittals are required from this vendor.
- B. DOT Traffic Control Signs:



1. Sign posts shall be galvanized heavy steel hat channels.
2. Sign face background shall be 0.063 inch aluminum plate, cut to size and attached to sign post with non-corrosive 3/8" machine bolts with washers, two per sign.

C. Monument Signage:

1. Provide signage according to Functional Design Specification.
2. Source: The USPS Direct Vendor for supplying the monument sign is Gable Signs, Eric Crowe, Director of Sales & Account Management, 7440 Fort Smallwood Road, Baltimore, MD 21226, Phone (443) 817-0303, eric.crowe@gablesigns.com. No substitutions allowed.
3. Provide electric service as called for.

PART 3 – EXECUTION

- 3.1 Install all products in accordance with manufacturer's guidelines and printed instructions.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 5/31/2011

END OF SECTION 10 14 04 00



SECTION 10 14 14 00 - CSF MISCELLANEOUS SIGNAGE

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.10 14 14 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

NOTE TO SPECIFIER

For exterior signs, see Section 101404, "Postal Signage". For interior retail signs, see Section 101404, "Postal Signage".

1. Miscellaneous building signage.

- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

1. Shop Drawings:

- a. Indicate sign styles, lettering font, foreground and background colors, locations, and overall dimensions of each sign.
- b. Setting details for installation in concrete footings.

2. Samples: Submit two sample signs 12 inches (30 cm) x 12 inches (30 cm) in size illustrating type, style, letter font, and colors specified; method of attachment.

3. Assurance/Control Submittals:

- a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
- b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
- c. Manufacturer's Instructions: Include installation template, attachment devices, and procedures for care of finished surfaces.



1.3 QUALITY ASSURANCE

- A. Qualifications:
1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver materials to project site in manufacturer's original unopened protective packaging.
- C. Identify contents, manufacturer, brand name, thermal values, and applicable standards.
- D. Store in original packaging, off the ground and under protective covers.
- E. Handle so as to prevent damage.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Insert manufacturer information and Product numbers for miscellaneous interior signs, as required.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. APCO, Atlanta, GA (404) 688-9000.
 2. ASI Sign Systems, Incorporated, Dallas, TX (800) 274 7732.
 3. Gable Signs, Eric Crowe, Director of Sales & Account Management, 7440 Fort Smallwood Road, Baltimore, MD 21226, Phone (443) 817-0303, eric.crowe@gablesigns.com
 4. Neokraft Signs, Incorporated, Lewiston, ME (800) 339-2258.
 5. Vomar Products, Incorporated, Van Nuys, CA (800) 521-2737.
 6. 2/90 Sign Systems, Grand Rapids, MI (800) 777-4310.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 SIGNAGE

- A. Construction Site Sign:
1. Silk-screened, painted or pressure-sensitive vinyl letters applied to Medium Density Overlay plywood sign.
 2. Red: Match Benjamin Moore OP-67.
 3. Blue: Match PPG 7062 Federal Blue.
 4. White background.
- B. Pictographs:



1. AIGA Symbol Signs reproducible art developed for the U.S. Department of Transportation is to be used whenever possible. Room signs shall have 1/32 inch raised one inch high Arial Medium (upper and lower case) lettering and Braille.
2. Size: As indicated on drawings.
3. Material: Plastic.
4. Color: Use colors below, unless designated by AIGA.
 - a. Foreground (Characters and/or Graphics): White: Match P-1 in Section # 099100, Painting.
 - b. Background: Blue: Match P-5 in Section # 099100, Painting.

C. Room and Directional Signage

1. Room signs shall have 1/32 inch raised one inch high Arial Medium (upper and lower case) lettering and Braille.
2. Size: 16 inches (40 cm).
3. Material: Plastic.
4. Color:
 - a. Foreground (Characters and/or Graphics): White: Match P-1 in Section # 099100, Painting.
 - b. Background: Blue: Match P-5 in Section # 099100, Painting.

D. Egress Signage:

1. When required by public authority, provide signage in one inch high Arial Medium (upper and lower case) letters, in contrasting color to background to read: "This Door To Remain Unlocked During Business Hours." Doors requiring signage will be indicated on either the hardware schedule or door schedule.

E. Exit Door Tactile Sign

1. Provide signage to read "Exit" at egress doors. In contrasting color to background, signs shall have 1/32 inch raised one inch high Arial Medium (upper and lower case) lettering and Braille.
2. Product: Same as Room and Directional signage.
3. Size: 6 inch (15 cm)
4. Color:
 - a. Foreground (Characters and/or Graphics): White: Match P-1 in Section # 099100, Painting.
 - b. Background: Blue: Match P-5 in Section # 099100, Painting.

2.3 FASTENERS AND OTHER MATERIALS

- A. Provide non-corrosive fasteners, hangers, and mounting devices which are compatible with sign material and finish.
- B. Other materials, not specifically described, but required for a complete and proper installation of signs, shall be as selected and subject to approval of the Contracting Officer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.



1. Examine foundations, walls, doors, ceilings and other areas scheduled to receive signs for conditions that would affect quality and execution of work.

C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

A. Install signage in accordance with manufacturer's published instructions.

B. Install sign units and components at the locations shown or scheduled, securely mount with concealed theft-resistant fasteners. Attach signs to substrates in accordance with the manufacturer's instructions.

C. Install level, plumb, and at the proper height. Cooperate with other trades for installation of sign units to finish surfaces.

D. Sign manufacturer to provide template for spacing of letters.

3.3 CONSTRUCTION

A. Interface with Other Work:

1. Furnish full-size spacing templates for individually bundled letters and numbers for coordination with work of other trades.

3.4 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field testing and inspection.

B. Inspect signage locations, attachments, and messages to verify installation conforms to Drawings.

NOTE TO SPECIFIER

Verify requirements with USPS Contracting Officer and list miscellaneous interior signage below.

3.5 MISCELLANEOUS INTERIOR SIGNAGE

Item number	Description
1.	FIRST AID
2.	FIRE EXTINGUISHER
3.	NO SMOKING
4.	ELECTRICAL HAZARD
5.	TOILETS, MEN
6.	TOILETS, WOMEN
7.	TOILETS, UNISEX
8.	LUNCH ROOM
9.	OFFICE



10. STORAGE
11. CUSTOMER SERVICE MANAGER
12. POSTMASTER OFFICE
13. MANAGER
14. MEETING ROOM
15. CONFERENCE ROOM
16. EXIT (Tactile Sign)
17. JANITOR'S CLOSET
18. EQUIPMENT ROOM
19. STAMP ENVELOPE
20. ELECTRICAL ROOM
21. MEN'S LOCKER ROOM
22. WOMEN'S LOCKER ROOM
23. POSTAL SUPPLIES
24. CUSTODIAL SUPPLIES
25. POSTAL EQUIPMENT
26. POSTAL RECORDS
27. RECYCLING ROOM
28. BATTERY CHARGING ROOM
29. FLAMMABLE LIQUID STORAGE
30. SCALE ROOM
32. TEL.EQUIP. ROOM
33. FOLDING GRILLE DOOR
34. [_____].

USPS CSF Specifications issued: 10/1/2013
Last revised: 9/3/2013

END OF SECTION



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SECTION 10 14 14 00 - MPF MISCELLANEOUS SIGNAGE

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. THIS SECTION IS A "PERFORMANCE" SPECIFICATION. The Section describes the design requirements for the Fire Alarm System. The Fire Alarm Contractor will design the system and prepare detailed Fire Alarm Drawings to be used for the installation of the Fire Alarm System.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.10 14 14 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

NOTE TO SPECIFIER

For exterior signs, see Section 101404, "Postal Signage".

1. Miscellaneous building signage.

- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

1. Shop Drawings:
 - a. Indicate sign styles, lettering font, foreground and background colors, locations, and overall dimensions of each sign.
 - b. Setting details for installation in concrete footings.
2. Samples: Submit two sample signs 12 inches (30 cm) x 12 inches (30 cm) in size illustrating type, style, letter font, and colors specified; method of attachment.
3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
 - c. Manufacturer's Instructions: Include installation template, attachment devices, and procedures for care of finished surfaces.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.



1.4 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver materials to project site in manufacturer's original unopened protective packaging.
- C. Identify contents, manufacturer, brand name, thermal values, and applicable standards.
- D. Store in original packaging, off the ground and under protective covers.
- E. Handle so as to prevent damage.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Insert manufacturer information and Product numbers for miscellaneous interior signs, as required.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. APCO, Atlanta, GA (404) 688-9000.
 - 2. ASI Sign Systems, Incorporated, Dallas, TX (800) 274 7732.
 - 3. Gable Signs, Eric Crowe, Director of Sales & Account Management, 7440 Fort Smallwood Road, Baltimore, MD 21226, Phone (443) 817-0303, eric.crowe@gablesigns.com
 - 4. Neokraft Signs, Incorporated, Lewiston, ME (800) 339-2258.
 - 5. Vomar Products, Incorporated, Van Nuys, CA (800) 521-2737.
 - 6. 2/90 Sign Systems, Grand Rapids, MI (800) 777-4310.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 SIGNAGE

- A. Pictographs:
 - 1. AIGA Symbol Signs reproducible art developed for the U.S. Department of Transportation is to be used whenever possible. Room signs shall have 1/32 inch raised one inch high Arial Medium (upper and lower case) lettering and Braille.
 - 2. Size: As indicated on drawings.
 - 3. Material: Plastic.
 - 4. Color: Use colors below, unless designated by AIGA.
 - a. Foreground (Characters and/or Graphics): White: Match P-1 in Section # 099100, Painting.
 - b. Background: Blue: Match P-5 in Section # 099100, Painting.
- B. Room and Directional Signage
 - 1. Room signs shall have 1/32 inch raised one inch high Arial Medium (upper and lower case) lettering and Braille.
 - 2. Size: 16 inches (40 cm).
 - 3. Material: Plastic.
 - 4. Color:
 - a. Foreground (Characters and/or Graphics): White: Match P-1 in Section # 099100, Painting.



- b. Background: Blue: Match P-5 in Section # 099100, Painting.

C. Egress Signage:

- 1. When required by public authority, provide signage in one inch high Arial Medium (upper and lower case) letters, in contrasting color to background to read: "This Door To Remain Unlocked During Business Hours." Doors requiring signage will be indicated on either the hardware schedule or door schedule.

D. Exit Door Tactile Sign

- 1. Provide signage to read "Exit" at egress doors. In contrasting color to background, signs shall have 1/32 inch raised one inch high Arial Medium (upper and lower case) lettering and Braille.
- 2. Product: Same as Room and Directional signage.
- 3. Size: 6 inch (15 cm)
- 4. Color:
 - a. Foreground (Characters and/or Graphics): White: Match P-1 in Section # 099100, Painting.
 - b. Background: Blue: Match P-5 in Section # 099100, Painting.

2.3 FASTENERS AND OTHER MATERIALS

- A. Provide non-corrosive fasteners, hangers, and mounting devices which are compatible with sign material and finish.
- B. Other materials, not specifically described, but required for a complete and proper installation of signs, shall be as selected and subject to approval of the Contracting Officer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Examine foundations, walls, doors, ceilings and other areas scheduled to receive signs for conditions that would affect quality and execution of work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install signage in accordance with manufacturer's published instructions.
- B. Install sign units and components at the locations shown or scheduled, securely mount with concealed theft-resistant fasteners. Attach signs to substrates in accordance with the manufacturer's instructions.



- C. Install level, plumb, and at the proper height. Cooperate with other trades for installation of sign units to finish surfaces.
- D. Sign manufacturer to provide template for spacing of letters.

3.3 CONSTRUCTION

- A. Interface with Other Work:
 - 1. Furnish full-size spacing templates for individually bundled letters and numbers for coordination with work of other trades.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Inspect signage locations, attachments, and messages to verify installation conforms to Drawings.

NOTE TO SPECIFIER

Verify requirements with USPS Contracting Officer and list miscellaneous interior signage below. Include an Office/Area signage table as per the table in the following page, modify as required.

3.5 MISCELLANEOUS INTERIOR SIGNAGE

Item number	Description
	OFFICES
	Plant Manager
	Secretary/ Reception Area
	Manager, In-Plant Support
	I.T. Manager
	Comp. System Ops
	Ops Support Specialist
	QWL Improv. Specialist
	Manager, Transportation
	Supv. Transportation Oprns.
	Vehicle Oprns Analyst
	Network Analyst
	General Clerk
	District Domicile General Office
	Mgr., Maintenance
	Supv., Maint. Operations
	Maint. Support Clerks
	CIO/Remote Breakout
	Filing Space
	Office Supplies
	Conference Area
	Reference Room
	Mail/Copy Room
	Break Area
	MDF/LAN Room (in CCR)
	Toilets



PEDC:
 Classroom
 Library/Self Study
 Storage

LOBBIES/HALLWAYS
 Admin. Hallway
 Employee Hallway
 Mechanical/Maintenance Hallways
 Security Lobby and Vestibule

EMPLOYEE FACILITIES
 Employee Lunchroom
 Supplemental Services
 Multi-Purpose Room
 Vending Machine Supply Storage
 Public Service Area
 Toilets Female / Male
 Exterior Break Area

GENERAL SUPPORT AREA
 Storage:
 Archived Paperwork Room
 General Supplies (Non-custodial)
 Mail Processing Equipment Storage
 Miscellaneous:
 Platform Supervisor/Vehicle Dispatch
 Manager, Distribution Operations
 Supervisor, Distribution Operations
 Label Room
 TACS Site
 Contract Drivers
 Contract Drivers Toilets
 Computer/Process Control Room (CCR)
 Telephone Switching Equipment (in CCR)
 Locker Area
 Supervisor Break Room
 BMEU:
 Business Mail Entry Unit (BMEU)

MAINTENANCE SUPPORT
 Stockroom
 Custodial Storage
 Custodial Closet
 Building and Ground Storage
 General Shop (including welding)
 Training Room/Library
 Storage (Flammable)
 Electronics Room
 Shower Room
 Machine Shop (Large Facilities Only)

WORKROOM
 Workroom
 Reg. Disp. Security Cage
 Satellite Label / Placard Areas
 BMEU Cleared Mail Staging



Satellite Maint Shops (Cage)
Battery Charging
Nixie Station
Satellite Vending Areas
Satellite Restrooms
TACS
Empty Equipment
Trash and Recycling

OTHER
Mech./Electric Room
Platforms
VMF Service and Maintenance bays
VMF Pressure Cleaning bays

USPS Major Processing Facility Specification issued: 10/1/2013
Last revised: 5/31/2011

END OF SECTION



Task	Specification	Specification Description
10 14 19 00	01 22 16 00	No Specification Required



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SECTION 10 14 53 00 - CSF TRAFFIC SIGNAGE**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section. 10 14 53 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Department of Transportation (DOT) traffic control signs.

B. Related Documents:

1. The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

1. Signage Schedule: Submit signage selection schedule indicating quantity and location of each type of DOT sign required to Contracting Officer.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

B. Store in original packaging, off the ground and under protective covering.

C. Handle so as to prevent damage.

NOTE TO SPECIFIER

"REQUIRED Part (Products) is included below. Do not revise these without a written Deviation from USPS Headquarters Design and Construction, through the Contracting Officer."



PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. DOT (Department of Transportation) Traffic Control Signs. The Contractor is responsible to furnish and install (including foundations) all DOT Traffic Control Signs as indicated in the Drawings.
- B. Section 016000 - Product Requirements:
 - 1. DOT Traffic Control Signs. See Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

- A. Contractor is responsible to purchase and install all exterior DOT (Department of Transportation) traffic control signage as shown in the Drawings.
 - 1. Traffic Signs: Sign post are to be [steel tubes painted blue to match exterior signage by direct vendor] [galvanized heavy steel hat channels painted blue to match exterior signage by direct vendor]. Size of posts and heights of signs are as indicated on the drawings. Sign face background is 0.063 inch aluminum plate, cut to size and attached to sign post with non-corrosive 3/8 inch machine bolts with washers, two per sign.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions by Contractor is required: Verify through field measurements that contract Documents are in accordance with actual site conditions. Verify that all sign site locations, wall surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Examine free standing sign placement locations, walls, doors, soffit and other areas scheduled to receive signs for conditions that would affect quality and execution of work.
 - 2. Check that electrical distribution for illuminated signs is complete and ready to receive signs.
 - 3. Contractor is responsible for obtaining any required permits.
- C. Contractor is to report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.
- E. Contractor is responsible for reviewing contract documents to provide required electrical service to sign positions shown in the Drawings.



3.2 PREPARATION

- A. Contractor is responsible for the removal of any existing signs in preparation to receive new sign elements. Contractor will patch affected surfaces to match existing materials. Contractor must dispose of all signs in accordance with all state and local codes and ordinances. Recycling and re-use of existing sign materials is greatly encouraged. Contractor must consider the salvage value of removed signs in the cost of work.
- B. Contractor must verify that all signs ordered fit the as-built conditions of the facility.

3.3 INSTALLATION

- A. Install sign units and components at the locations shown in Drawings, securely mount with fasteners appropriate to the substrate conditions.
- B. Install signs on facility property clear of public right of ways and utilities.
- C. Install foundations for all free standing signs.
- D. Verify that all Department of Transportation (DOT) traffic control signs shown in the Drawings are accurate and in compliance with all state and local codes and ordinances.
- E. Verify that all internal roadway, street and traffic conditions are in accordance with the signs selected and shown on Contract Documents prior to purchase and installation of DOT traffic control signs.
- F. Install level, plumb, and at the proper height. Cooperate with other trades for installation of sign units in all locations and to all finished surfaces.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Inspect signage locations, attachments, and messages to verify installation conforms with Drawings.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



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SECTION 10 15 00 00 - CSF BULLETIN BOARDS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Bulletin Boards are part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section. 10 15 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Glass enclosed metal framed bulletin boards.
 - 2. Fabric wrapped bulletin boards.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Claridge Products and Equipment, Incorporated, Harrison, AR (870) 743-2200.
 - 2. Greensteel, Incorporated, Dixonville, PA (800) 766-4204.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 METAL FRAMED BULLETIN BOARDS

- A. Manufacturer: Claridge.
- B. Model 294 and 296 including the following:
 - 1. Sizes:
 - a. 294: 36 inches high by 48 inches wide.
 - b. 296: 36 inches high by 72 inches wide.



2. Doors: Two 1/4 inch thick tempered glass, sliding, with integral cylinder lock device.
3. Door Shoe, Channel and Track Material: Heavy gauge extruded aluminum.
4. Door Shoe, Channel and Track Finish: Clear anodized brushed aluminum.
5. Back Panel: No. 930, Hook Fab, with 7/32 inch cork underlay.
6. Back Panel Color: #949 "Cloud".

2.3 FABRIC WRAPPED BULLETIN BOARDS

- A. Manufacturer: Claridge
- B. Designer Series 3104EW
 1. Size: As indicated
 2. Color: Selected from manufacturer's standard colors.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install bulletin boards in accordance with manufacturer's published instructions in locations indicated on Drawings.
- B. Mount bulletin board plumb and level.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



SECTION 10 21 13 00 - CSF WIRE MESH PARTITIONS**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Wire Mesh Partitions are part of the Work.

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.10 21 13 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Wire Mesh Partitions for walls and ceiling.
 2. Sliding and swing door panels.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 1. Product Data: Data for screen materials and finishes.
 2. Shop Drawings: Indicate plan and vertical dimensions, elevations, component details; head, jamb, and sill details; location of hardware. Provide component details, framed openings, bearing, anchorage, loading, welds, type and location of fasteners, and accessories or items required of related work.
 3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

1.3 QUALITY ASSURANCE

- A. Qualifications:
 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.



2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver materials to job site in unopened containers bearing manufacturer's name and content identification.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 1. Acorn Wire and Iron Works, Chicago, IL (800) 552-2676.
 2. Indiana Wire Products, Incorporated, Greensburg, IN (800) 451-0406.
 3. Kentucky Metal Products Company, Louisville, KY (800) 331-3461.
 4. Central Wire and Iron Works, Des Moines, IA (800) 397-0041.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 WIRE MESH ENCLOSURES

- A. Framing and Wire Mesh:
 1. Wire: 10 gauge steel wire woven into 1-1/2 inch mesh, securely clinched to frames.
 2. Vertical Frames: 1-1/4 inch x 5/8 inch cold rolled 'C' section channels with 1/4 inch bolt holes 12 inches on center; horizontal frames 1 inch x 1/2 inch cold rolled channels. All joints mortised and tenoned. Frame thickness.
 3. Center Reinforcing Bar: 1 inch x 1/2 inch cold rolled channel tenoned to side frames. All wires shall pass through center bar.
 4. Top Capping Bar: 2-1/4 inch x 1 inch cold rolled channel with 1/4 inch 'U' bolts 2 feet and 4 inches on center.
 5. Ceiling mesh and postless ceiling framing, capable of supporting mesh and specified light fixtures. Limit deflection to L/120.
 6. Corner Posts: 1-1/4 inch x 1-1/4 inch angles with 1/4 inch bolt holes to match partitions.
 7. Floor Sockets (aluminum): 2-1/2 inch high with set screw adjustment.
 8. Floor Angle: 1-1/4 inch x 1-1/4 inch angles.
- B. Door and Frame:
 1. Door Frames: 1-1/4 inch x 1/2 inch channel with 1-1/4 inch x 1/8 inch flat bar covering three sides, 1-3/8 inch x 3/4 inch x 1/8 inch angle riveted to lock side.
 2. Doors:
 - a. Hinged: 1-1/2 pairs butt hinges riveted to both door and transom bar.



- b. Closer: Provide a door design or a mechanism that automatically closes and latches the door.
 - 3. Locks:
 - a. Mortise type cylinder locks operated by key from outside, recessed knob inside, compatible with key system.
 - b. Manufacturer: Marks Locks W3700.
 - 4. Fasteners: Bolts, hardware, and accessories as required.
- C. Window:
 - 1. Provide sliding window per drawings.
 - 2. Window to be lockable with a padlock.
- D. Shelf:
 - 1. Provide shelf as shown in drawings.
- E. Finish: Finish of the mesh, posts and frames shall be factory painted gray. Bolts, fasteners and washers shall be galvanized.
- F. Security protection for registry cage: ¼ inch clear acrylic sheet with light transmission of 92% or higher, as manufactured by Plastolite, Inc, Columbus OH 866-832-9315, Alro Plastics, Philadelphia, PA 800-877-2576 or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install Work under this Section in accordance with manufacturer's printed recommendations.
- B. Determine location of partition. Secure floor sockets to floor with suitable fasteners. Shim as required for vertical installation. Shims for horizontal alignment will not be allowed.
- C. Erect partitions in a secure manner, level and plumb. Install floor angles to tolerance to prevent an individual from sliding a registered letter along the floor to outside the cage.
- D. Insure that door(s) operate without binding including all latching hardware.
- E. Install all accessories required for a complete installation.



3.3 CLEANING

- A. Clean all surfaces and leave installation ready for field painting.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



SECTION 10 21 13 00 - MPF WIRE MESH PARTITIONS**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 – GENERAL

1.1 SUMMARY

- A. Wire mesh partitions, doors, ceilings and accessories.

1.2 SUBMITTALS

- A. Product Data: Required.
- B. Shop Drawings: Required.

1.3 QUALITY ASSURANCE

- A. Security: Comply with USPS Handbook RE-5

PART 2 – PRODUCTS

2.1 MANUFACTURERS/PRODUCTS

- A. Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 1. Acorn Wire and Iron Works, Chicago, IL.
 2. Indiana Wire Products, Incorporated, Greensburg, IN.
 3. Kentucky Metal Products Company, Louisville, KY.
 4. Central Wire and Iron Works, Des Moines, IA.

2.2 WIRE MESH PARTITIONS

- A. Partition Frame and Wire Mesh:
 1. Wire: 10 gauge steel wire woven into 1-1/2 inch mesh, securely clinched to frames.
 2. Vertical Frames: 1-1/4 inch x 5/8 inch cold rolled 'C' section channels with 1/4inch bolt holes 12 inches on center; horizontal frames 1 inch x 1/2 inch cold rolled channels. All joints mortised and tenoned. Frame thickness.
 3. Center Reinforcing Bar: 1 inch x 1/2 inch cold rolled channel tenoned to side frames. All wires shall pass through center bar.



4. Top Capping Bar: 2-1/4 inch x 1 inch cold rolled channel with 1/4 inch 'U' bolts 2 feet and 4 inches on center.
 5. Corner Posts: 1-1/4 inch x 1-1/4 inch angles with 1/4 inch bolt holes to match partitions.
 6. Floor Sockets (aluminum): 2-1/2 inch high with set screw adjustment.
 7. Floor Angle: 1/1/4 inch x 1-1/4 inch angles.
- B. Door and Frame:
1. Door Frames: 1-1/4 inch x 1/2 inch channel with 1-1/4 inch x 1/8 inch flat bar covering three sides, 1-3/8 inch x 3/4 inch x 1/8 inch angle riveted to lock side.
 2. Doors:
 - a. Hinged: 1-1/2 pairs butt hinges riveted to both door and transom bar.
 - b. Sliding: Manufacturer's standard hardware assembly, including top support track and floor guide and complete roller assemblies.
 - c) Closer: Provide a door design or a mechanism that automatically closes and latches the door.
 3. Locks:
 - a. Mortise type cylinder locks operated by key from outside, recessed knob inside, compatible with key system.
 - b. Manufacturer:
 - Hinged Doors: Marks Locks W3700.
 - Sliding Doors: Marks Locks W3800.
 4. Fasteners: Bolts, hardware, and accessories as required.
- C. Window:
1. Provide sliding window per drawings.
 2. Window to be lockable with a padlock.
- D. Shelf:
1. Provide shelf as shown in drawings.
- E. Finish: Finish of the mesh, posts and frames shall be factory painted gray. Bolts, fasteners and washers shall be galvanized.
- F. Security protection for registry cage: 1/4 inch clear acrylic sheet with light transmission of 92% or higher, as manufactured by Plastolite, Inc, Columbus OH 866-832-9315, Alro Plastics, Philadelphia, PA 800-877-2576 or approved equal.

PART 3 – EXECUTION

- 3.1 Install all products in accordance with manufacturer's guidelines and printed instructions.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 3/31/2010

END OF SECTION 10 21 13 00



Task	Specification	Specification Description
10 21 13 13	01 22 16 00	No Specification Required
10 21 13 16	01 22 16 00	No Specification Required



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SECTION 10 21 13 19 - SOLID SURFACE MATERIAL TOILET COMPARTMENTS

1.1 GENERAL

- A. Description Of Work:
 - 1. This specification covers the furnishing and installation of materials for solid surface material toilet compartments. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.
- B. Submittals
 - 1. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 2. Samples:
 - a. Panel: 1'-0" by 1'-0" panel showing construction with two sides and two edges, including one finished corner condition.
 - b. Hardware: Actual hardware item
 - 3. Manufacturer's installation and maintenance instructions.
- C. Warranty
 - 1. Special Warranty: Solid surface material compartment manufacturer's three year warranty against defects in fabricated products. Provide for product replacement only; labor not included. Damage caused by physical or chemical abuse is not warrantied.

1.2 PRODUCTS

- A. Manufactured Units
 - 1. Product standard of quality: E.I. DuPont de Nemours and Company, Inc.; Privacy Partitions.
- B. Types:
 - 1. Floor supported, overhead braced compartments.
 - 2. Wall hung urinal screens.
- C. Materials:
 - 1. Partitions, panels, headrails, and doors:
 - a. Material: E.I. DuPont de Nemours and Company, Inc.; Corian, or approved equivalent.
 - b. Characteristics:
 - 1) Material type: Homogeneous filled methyl methacrylate sheet, not coated.
 - 2) Meet ANSI Z124.3 and 6, Type Six.
 - 3) Thickness: 1/2".
 - a) Partition panels and doors: 1/2".
 - b) Urinal screen panels: 1/2".
 - c. Colors: Selected from manufacturer's color selection.
 - d. Finish: Matte.
 - 2. Pilasters, hardware, and fittings: Note requirements in FABRICATION Article for hardware concealment.
 - a. Pilaster material: Same material as panels; 1" thickness.
 - b. Acceptable hardware manufacturer: Jack Knob Hardware, or approved equivalent.
 - c. Hinges:
 - 1) ANSI Type 304 stainless steel; surface mounted; self closing pivot hinge type, two per door; matt finish.
 - 2) Type: Adjustable to return door by gravity to preset position when not latched.
 - d. Wall brackets:



- 1) Material: ASTM B209-90, extruded aluminum alloy 6463-T5, mill finish, full length continuous wall brackets; extrusion weighing not less than 1.685 lbs. per LF.
- 2) Predrill by manufacturer; holes spaced 6" along full bracket length; tamper resistant bolt attachment.
- e. Pilaster hanger:
 - 1) Manufacturer's standard galvanized anchorage device for attachment of pilaster to structural support and for leveling compartment.
 - 2) Hanger consists of threaded rods, saddle, lock washers, and leveling nuts.
 - 3) Design pilaster hangers to transmit loads to above-ceiling support system, not finished ceiling.
- f. Pilaster base:
 - 1) Type: Manufacturer's standard galvanized anchorage devices for attachment of pilaster to supporting floor and for leveling of compartment. Base consists of threaded rods, saddle, lock washers, leveling nuts, and minimum of two brass or lead expansion shields per base.
 - 2) Anchor penetration: Penetrate floor at least 1" for overhead braced compartments.
- g. Latch and keeper: AISI Type 304 Type stainless steel; 360 deg. pivot on latch; ADA compatible; surface mounted.
- h. Door stop/bumper: AISI Type 304 Type stainless steel; surface mounted.
- i. Door pull: Same material as panels; meet ADA requirements on handicap stalls.
- j. Coat hook; one per unit: Same material as panels; surface mounted.
- k. Grab bar mounting plate: Same material as panels; recessed back; complete with "T" nuts and screws; one per each mounting location to divider panel.
- l. Headrail for overhead braced units: ASTM B209-90, 6063-T6 extruded aluminum, satin anodized finish.

D. Accessories:

1. Exposed fasteners: Stainless steel or chrome plated brass with theft resistant one-way heads,
2. Unexposed fasteners: Galvanized steel, hot-dip coated following fabrication.
3. Inserts for door hardware, hinges, latches, and coat hooks: Threaded steel.
4. Adhesives: Type recommended by panel material manufacturer for joints.
5. Silicone sealant: Specified in Joints Sealants Section.

E. Fabrication

1. Shop assembly:
 - a. Fabricate components in accord with manufacturers standards, without face or edge seams in solid plastic material; bevel exposed edges.
 - b. Factory install metal inserts into components for screw fastened hardware; fasteners secured directly into core are prohibited.
 - c. Pre-notch and predrill panels for hardware at factory. Exposed hardware in completed installation includes only the following items or portion of items:
 - 1) Door hinge barrel.
 - 2) Door latch and keeper.
 - 3) Door striker.
 - d. Cover hardware with 1/2" solid surfacing material strips, except as indicated above.
 - e. Secure templates and factory cut panels for installation of accessories furnished under other Sections.
 - f. Doors: Inswing and outswing type indicated.
 - g. Exposed surfaces free from marks and blemishes; completely hide through material joints.
2. Tolerances; variation in size: $\pm 1/8$ "

1.3 EXECUTION

A. Installation



1. General:
 - a. Erect solid surface material compartment system plumb; attach to supporting structure indicated on reviewed shop drawings.
 - b. Attach solid surface material compartment system to back-up construction; use fasteners indicated on reviewed shop drawings.
 - c. Secure solid surface material panels to walls with continuous mounting flanges.
 - d. Locate wall brackets aligning holes for fasteners with masonry or tile joints.
 - e. Floor supported, overhead braced compartments:
 - 1) Attach pilasters to supporting floor with pilaster base indicated on reviewed shop drawings.
 - 2) Level and plumb compartments. Tighten pilaster base fasteners.
 - 3) Secure pilaster shoes in position against finished floor.
 - 4) Secure headrail to panels with minimum of two fasteners per face. Provide cover plates for exposed ends.
 - 5) Set door tops parallel with headrail when doors are in closed position.
 - f. Wall hung screens:
 - 1) Attach screens to wall construction with brackets and fasteners, indicated on reviewed shop drawings.
 - 2) Position and level units. Tighten fasteners in place.
- B. Application
 1. Tolerances:
 - a. Between panel and pilaster: 1/2", except where concealed fasteners are used.
 - b. Between door edge and pilaster: 1/4"
 - c. Between panel and wall: 1".
 2. Conceal evidence of drilling, cutting, and fitting to room finishes.
- C. Adjustment And Cleaning
 1. Adjustment:
 - a. Lubricate and adjust hardware. Tighten fasteners.
 - b. Set hinges on in-swing doors to hold doors open approximately 15 deg. from closed position when unlatched.
 - c. Set hinges on out-swing doors to return to closed position.
 2. Cleaning:
 - a. Remove protective coverings from compartments and hardware.
 - b. Clean exposed surfaces of compartments and hardware using materials and methods recommended by solid surface material compartment system manufacturer.

END OF SECTION 10 21 13 19



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Task	Specification	Specification Description
10 21 13 43	01 22 16 00	No Specification Required



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SECTION 10 21 14 00 - CSF TOILET COMPARTMENTS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where metal toilet compartments are indicated.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.10 21 14 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Metal toilet compartments, floor anchored and overhead braced.
 2. Metal urinal screens, wall mounted.
 3. Attachment hardware.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 1. Section 061000 - Rough Carpentry: Framing and plates within walls for partition attachment.
 2. Section 102813 - Toilet Accessories: Coordinate compartment installation with subsequent accessory installation.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):

NOTE TO SPECIFIER

Use ASTM A 167 for Stainless Steel finish partitions. Obtain USPS Contracting Officer approval before using Stainless Steel.

1. ASTM A 167 - Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.



1. Product Data: Panel construction, hardware, and accessories.
2. Shop Drawings: Partition plan, elevation views, dimensions, door swings, details of wall and floor supports and connections.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Conform to United States Postal Service "Standards for Facility Accessibility by the Physically Handicapped" for operation of toilet compartment door and hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturer's offering specified items which may be incorporated in the Work include the following:
 1. Accurate Partitions Corporation, Lyons, IL (708) 442-6801.
 2. Hadrian Manufacturing, Incorporated, Mentor, OH (800) 536-1469.
 3. Metpar Corporation, Westbury, NY (516) 333-2600.
 4. Sanymetal, Somerset, KY (606) 678-2700.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

NOTE TO SPECIFIER

Painted steel or plastic toilet compartments are standard for CSF Medium and CSF Small facilities. (See Section 102115 for plastic compartments.) Use of Stainless Steel finish partitions requires the prior submittal to and approval of a design deviation request by Headquarters Design and Construction.

- A. Galvanized Steel Sheet.

2.3 ACCESSORIES

- A. Pilaster Shoe: Formed ASTM A 167 Type 304 stainless steel, 3 inch high, with adjustable screw jack.
- B. Attachments, Screws, and Bolts: Stainless steel; heavy duty extruded aluminum brackets.
- C. Through Bolts and Nuts: Stainless steel.
- D. Hardware: Manufacturer's standard.
 1. Pivot hinges, gravity type, adjustable for door close positioning.
 2. Nylon bearings.
 3. Thumb turn door latch.
 4. Door strike and keeper with rubber bumper.



5. Coat hook with rubber bumper.
6. Door pull for outswinging doors.

2.4 FABRICATION

- A. Fabricate components of steel sheet as follows:
 1. Panel Doors and Faces: 20 gage.
 2. Pilaster Faces: 18 gage.
 3. Reinforcement: 12 gage.
- B. Doors and Panels:
 1. Thickness: 1 inch.
 2. Door Width: 24 or 26 inches.
 3. Door Width for Handicapped Use: 36 inches, out-swinging.
 4. Height: 58 inch.
- C. Urinal Screens:
 1. Thickness: 1 inch.
 2. Panel Depth: 24 inches.
 3. Panel Height: 42 inches.
 4. Wall mounted.
- D. Pilasters: 1-1/4 inch thick, of sizes required to suit cubicle width and spacing.
- E. Door, Panel and Pilaster: Steel sheet face, pressure bonded to sound deadening core. Form and close ends, miter and weld corners, grind smooth or finished with pre-formed stainless steel reinforcements.
- F. Interior Reinforcement: Provide in areas of attached hardware and fittings. Mark locations of reinforcement for partition mounted toilet accessories.
- G. Floor Mounted Anchorage: Corrosion-resistant anchoring assemblies with threaded rods, lock washers, and leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

2.5 FINISHES

- A. Clean, degrease, and neutralize panels.
- B. Follow immediately with a phosphatizing treatment, prime coat and two finish coats baked enamel.

NOTE TO SPECIFIER

Use COLOR below for Baked Enamel finish. Select compartment color. Insert manufacturer, color name, and color number.

- A. Single Color: [_____].



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify correct spacing of plumbing fixtures.
 - 2. Verify correct location or built-in framing, anchorage, and bracing.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install partitions secure, rigid, plumb, level, and square in accordance with published manufacturer's instructions.
- B. Maintain 1/2 inch space between wall and panels, and between wall and pilasters. Attach panel brackets securely to walls using anchor devices.
- C. Attach panels and pilasters to bracket with through sleeve tamperproof bolts and nuts.
- D. Anchor urinal screen panels to walls with two panel brackets and vertical upright consisting of pilaster anchored to floor.
- E. Provide for adjustment of floor variations with screw jack through steel saddles integral with pilaster. Conceal floor fastenings with stainless steel shoes.
- F. Equip each door with hinges, one door latch, and one coat hook and bumper. Align hardware to uniform clearance at vertical edges of doors, not exceeding 3/16 inch.
 - 1. Provide hardware at handicapped toilet with operating hardware complying with ANSI A117.1.

3.3 CONSTRUCTION

- A. Interface with Other Work:
 - 1. Coordinate placement of support framing and anchors in walls.
- B. Site Tolerances:
 - 1. Maximum Variation From True Position: 1/4 inch.
 - 2. Maximum Variation From Plumb: 1/8 inch.

3.4 ADJUSTING

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.



- B. In Swinging Doors: Adjust hinges to locate doors in partial open position when unlatched.
- C. Out Swinging Doors: Adjust hinges to gently return doors to closed position.
- D. Adjust adjacent components for consistency of line or plane.

3.5 CLEANING

- A. Remove protective masking. Clean surfaces.

USPS CSF Specifications issued: 10/1/2013
Last revised: 6/10/2011

END OF SECTION



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SECTION 10 21 15 00 - CSF TOILET COMPARTMENTS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.10 21 15 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Includes:
 - 1. Solid plastic toilet compartments, floor mounted, head rail braced.
 - 2. Solid plastic urinal screens, wall mounted.
 - 3. Attachment hardware.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 061000 - Rough Carpentry: Framing and plates within walls for partition attachment.
 - 2. Section 102813 - Toilet Accessories: Coordinate compartment installation with subsequent accessory installation.

1.2 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible To and Usable by Physically Handicapped People.
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM A 167 - Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
 - 2. ASTM E-84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Panel construction, hardware, and accessories.



2. Shop Drawings: Partition plan, elevation views, dimensions, door swings, details of wall and floor supports and connections.
3. Samples: Two 2 inch x 3 inch samples of partition indicating finish and color.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 1. Conform to ANSI A117.1 code for access for the handicapped operation of toilet compartment door and hardware.
 2. IBC 2006 for Flame Spread/Smoke Development requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Resource Management:
 1. Recycled Content: Provide solid plastic compartments and screens with core manufactured from minimum 50 percent recycled plastic.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 1. Capitol Partitions, Incorporated, Columbia, MD (410) 740-8870.
 2. Comtec Industries, Moosic, PA (717) 348-0997 or (800) 551-6993.
 3. Metpar, Corporation, Westbury, NY (516) 333-2600.
 4. Santana, Scranton, PA (800) 368-5002 or (717) 343-7921.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

- A. Solid plastic compartments and screens: water resistant; graffiti resistant; non-absorbent; with plastic face sheets permanently fused to plastic core.
 1. Panels: 1 inch thickness, 58 inches in height.
 2. Doors: 1 inch thickness, 58 inches in height.
 3. Pilasters: 1 inch thickness.
 4. Urinal screens: 1 inch thickness, 24 inches in depth, 42 inches in height, wall mounted.
- B. Pilaster Shoes: 3 inches high and one of the following:
 1. One piece molded polypropylene or high density polyethylene (HDPE).
 2. 20 gage stainless steel.
- C. Attachments:
 1. Screws, and Bolts: Stainless steel; tamper proof type.



2. Wall Mounting Brackets: Continuous, full height heavy duty plastic or bight anodized aluminum brackets in accordance with toilet compartment manufacturer's instructions.

- D. Hardware: Chrome plated non-ferrous cast pivot hinges, gravity type, adjustable for door close positioning; nylon bearings; black anodized aluminum door latch; door strike and keeper with rubber bumper; cast alloy chrome plated coat hook and bumper.

2.3 FABRICATION

- A. Solid Plastic: 1/4 inch radius beveled edges.
- B. Hardware and Attachments: Pre-drilled by manufacturer; provide for protection of dissimilar metals.
 1. Floor Mounted Anchorage: Corrosion-resistant anchoring assemblies with threaded rods, lock washers, and leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

2.4 FINISHES

NOTE TO SPECIFIER

Select compartment color. Insert manufacturer, color name, and color number.

- A. Compartments and Screens:
 1. Capitol Partitions: [_____].
 2. Comtec: [_____].
 3. Metpar: [_____].
 4. Santana: [_____].
- B. Plastic Pilaster Shoes: Color to match core of solid plastic compartments and screens.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 1. Verify correct spacing of plumbing fixtures.
 2. Verify correct location or built-in framing, anchorage, and bracing.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION



- A. Install partitions secure, rigid, plumb, level, and square in accordance with published manufacturer's instructions.
 - 1. Provide for adjustment due to minor floor variations.
 - 2. Install adjacent components for consistency of line and plane.
- B. Maintain 1/2 inch space between wall and panels, and between wall and pilasters. Attach panel brackets securely to walls using anchor devices.
- C. Attach panels and pilasters to bracket with through sleeve tamperproof bolts and nuts. Locate head rail joints at pilaster center lines.
- D. Anchor urinal screen panels to walls and anchored to floor in accordance with manufacturer's instructions to suit supporting wall construction.
- E. Conceal floor fastenings with pilaster shoes.
- F. Equip each door with hinges, one door latch, and one coat hook and bumper. Align hardware to uniform clearance at vertical edges of doors, not exceeding 1/4 inch.
 - 1. Provide hardware at handicapped toilet with operating hardware complying with ANSI A117.1.

3.3 CONSTRUCTION

- A. Interface with Other Work:
 - 1. Coordinate placement of support framing and anchors in walls.
- B. Site Tolerances:
 - 1. Maximum Variation From True Position: 1/4 inch.
 - 2. Maximum Variation From Plumb: 1/8 inch.

3.4 ADJUSTING

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.
- B. In Swinging Doors: Adjust hinges to locate doors in partial open position when unlatched.
- C. Out Swinging Doors: Adjust hinges to gently return doors to closed position.
- D. Adjust adjacent components for consistency of line or plane.

3.5 ENVIRONMENTAL PROCEDURES

- A. Indoor Air Quality:
 - 1. Clean Surfaces: Use non-toxic materials and procedures.
 - 2. Remove protective masking.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



SECTION 10 21 15 00 - MPF TOILET COMPARTMENTS

NOTE TO SPECIFIER

Use this Outline Specification Section for Major Facilities only. This Specification defines "level of quality" for Major Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Includes:
 1. Solid plastic toilet compartments, floor mounted, head rail braced.
 2. Solid plastic urinal screens, wall mounted.
 3. Attachment hardware.

1.2 REFERENCES

- A. American National Standards Institute (ANSI):
 1. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible To and Usable by Physically Handicapped People.
- B. American Society for Testing and Materials (ASTM):
 1. ASTM A 167 - Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
 2. ASTM E-84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
 1. Conform to ANSI A117.1 code for access for the handicapped operation of toilet compartment door and hardware.
 2. IBC 2006 for Flame Spread/Smoke Development requirements.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Resource Management:
 1. Recycled Content: Provide solid plastic compartments and screens with core manufactured from minimum 50 percent recycled plastic.

PART 2 - PRODUCTS

2.1 MANUFACTURERS



- A. Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 - 1. Capitol Partitions, Incorporated, Columbia, MD (410) 740-8870.
 - 2. Comtec Industries, Moosic, PA (717) 348-0997 or (800) 551-6993.
 - 3. Metpar, Corporation, Westbury, NY (516) 333-2600.
 - 4. Santana, Scranton, PA (800) 368-5002 or (717) 343-7921.

2.2 MATERIALS

- A. Solid plastic compartments and screens: water resistant; graffiti resistant; non-absorbent; with plastic face sheets permanently fused to plastic core.
 - 1. Panels: 1 inch thickness, 58 inches in height.
 - 2. Doors: 1 inch thickness, 58 inches in height.
 - 3. Pilasters: 1 inch thickness.
 - 4. Urinal screens: 1 inch thickness, 24 inches in depth, 42 inches in height, wall mounted.
- B. Pilaster Shoes: 3 inches high and one of the following:
 - 1. One piece molded polypropylene or high density polyethylene (HDPE).
 - 2. 20 gage stainless steel.
- C. Attachments:
 - 1. Screws, and Bolts: Stainless steel; tamper proof type.
 - 2. Wall Mounting Brackets: Continuous, full height heavy duty plastic or bight anodized aluminum brackets in accordance with toilet compartment manufacturer's instructions.
- D. Hardware: Chrome plated non-ferrous cast pivot hinges, gravity type, adjustable for door close positioning; nylon bearings; black anodized aluminum door latch; door strike and keeper with rubber bumper; cast alloy chrome plated coat hook and bumper.

2.3 FABRICATION

- A. Solid Plastic: 1/4 inch radius beveled edges.
- B. Hardware and Attachments: Pre-drilled by manufacturer; provide for protection of dissimilar metals.
 - 1. Floor Mounted Anchorage: Corrosion-resistant anchoring assemblies with threaded rods, lock washers, and leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

PART 3 – EXECUTION

- 3.1 Install all products in accordance with manufacturer's guidelines and printed instructions.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 6/29/2010

END OF SECTION 10 21 15 00



SECTION 10 21 16 00 - CUBICLE CURTAINS AND TRACKS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for cubicle curtains and tracks. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Curtain tracks and curtain carriers.
 - b. IV tracks and hangers.
 - c. Cubicle, dressing area, tub, and shower curtains.

C. Definition

1. IV: Intravenous.

D. Performance Requirements

1. Curtains: Provide curtain fabrics with the following characteristics:
 - a. Fabrics are launderable to a temperature of not less than 160 deg F (71 deg C) **OR** 90 deg F (32 deg C), **as directed**.
 - b. Fabrics are flame resistant and are identical to those that have passed NFPA 701 when tested by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1) Identify fabrics with appropriate markings of applicable testing and inspecting agency.

E. Submittals

1. Product Data: Include durability, laundry temperature limits, fade resistance, and fire-test-response characteristics for each type of curtain fabric indicated.
 - a. Include data on each type of applied curtain treatment.
2. Shop Drawings: Show layout and types of cubicles, sizes of curtains, number of carriers, anchorage details, and conditions requiring accessories. Indicate dimensions taken from field measurements.
 - a. Include details on blocking above ceiling and in walls.
3. Samples: For each type of product required.
4. Curtain and Track Schedule: Use same designations indicated on Drawings.
5. Operation and Maintenance Data.

1.2 PRODUCTS

A. Curtain Tracks

1. Extruded-Aluminum Track: Not less than 1-1/4 inches wide by 3/4 inch high (32 mm wide by 19 mm high) **OR** 5/8 inch wide by 1/2 inch high (16 mm wide by 13 mm high), **as directed**; with minimum wall thickness of 0.050 inch (1.27 mm) **OR** 0.058 inch (1.47 mm) **OR** 0.062 inch (1.57 mm), **as directed**.
 - a. Curved Track: Factory-fabricated, 12-inch- (305-mm-) **OR** 14-inch- (356-mm-) **OR** 18-inch- (457-mm-), **as directed**, radius bends.
 - b. Finish: Clear anodized **OR** Satin anodized **OR** Baked enamel, acrylic, or epoxy, **as directed**.
2. PVC Track: Not less than 1-1/4 inches wide by 15/16 inch high (32 mm wide by 24 mm high).
 - a. Curved Track: Factory-fabricated, 12-inch- (305-mm-) radius bends.



3. Track Accessories: Fabricate splices, end caps, connectors, end stops, coupling and joining sleeves, wall flanges, brackets, ceiling clips, and other accessories from same material and with same finish as track.
 - a. Suspended Track Support: Not less than 5/8-inch- (16-mm-) square **OR** 7/8-inch- (22.2-mm-) OD, **as directed**, tube.
 - b. End Stop: Nonremovable **OR** Removable with carrier hook, **as directed**.
 - c. Switch Unit: Shuttle and coupling device for rerouting and securing cubicle curtain, with pull chain for switching track.
 - d. Hinged Loading Unit: Detachable hinge and lock unit factory assembled on 60-inch (1524-mm) section of manufacturer's extruded-aluminum track. Provide 1 operating wand for every 10 cubicles.
4. Curtain Carriers: Two nylon rollers and nylon axle with chrome-plated steel **OR** nylon **OR** aluminum, **as directed**, hook.
5. Curtain Carriers: One-piece nylon glide with chrome-plated steel **OR** nylon, **as directed**, hook.
6. Breakaway Curtain Carriers: One-piece nylon **OR** Velcro, **as directed**, breakaway curtain carriers designed to allow curtains to detach from tracks with a pulling force of no more than 5 lbf (22.2 N).
7. Exposed Fasteners: Stainless steel.
8. Concealed Fasteners: Hot-dip galvanized **OR** Stainless steel, **as directed**.

B. IV Support Systems

1. Extruded-Aluminum IV Track: Not less than 1-1/4 inches wide by 3/4 inch high (32 mm wide by 19 mm high); with minimum wall thickness of 0.058 inch (1.47 mm) **OR** 0.062 inch (1.57 mm), **as directed**.
 - a. Curved Track: Factory fabricated 12-inch- (305-mm-) **OR** 14-inch- (356-mm-) **OR** 18-inch- (457-mm-), **as directed**, radius bends.
 - b. Finish: Clear anodized **OR** Satin anodized **OR** Baked enamel, acrylic, or epoxy, **as directed**.
2. IV Carriers: Four nylon rollers and nylon **OR** steel or stainless-steel, **as directed**, axles, with ball bearings, **as directed**, with hanger loop fabricated from 1/4-inch- (6-mm-) diameter stainless steel.
3. Stationary IV Hangers: 24-inch (610-mm) **OR** 30-inch (762-mm) **OR** 36-inch (914-mm) **OR** 42-inch (1067-mm) **OR** 48-inch (1219-mm), **as directed**, overall height with stainless-steel shaft; with 4 **OR** 8, **as directed**, folding **OR** nonfolding, **as directed**, 1/4-inch (6-mm) stainless-steel arms with loops, a stainless-steel bottom loop, and a stainless-steel top loop to attach to carrier.
 - a. Top Loop: Coated for nonconductivity **OR** Uncoated, **as directed**.
4. Telescoping IV Hangers: 28-inch (711-mm) **OR** 39-inch (991-mm) **OR** 45-inch (1143-mm) **OR** 51-inch (1295-mm) **OR** 57-inch (1448-mm), **as directed**, overall height with a 3/4-inch (19-mm) stainless-steel main shaft and a 3/8-inch (9.5-mm) stainless-steel inner shaft, minimum vertical adjustment of 16 inches (406 mm); with 4 **OR** 8, **as directed**, folding **OR** nonfolding, **as directed**, 1/4-inch (6-mm) stainless-steel arms with loops and a stainless-steel top loop to attach to carrier.
 - a. Top Loop: Coated for nonconductivity **OR** Uncoated, **as directed**.
 - b. Adjustment Control: Push button **OR** Release ring, **as directed**.

C. Curtains

1. Cubicle Curtain and Dressing Area Fabric: Curtain manufacturer's standard, 100 percent polyester, inherently and permanently flame resistant, stain resistant, and antimicrobial.
 - a. Pattern: **<Insert manufacturer's style name.>**
 - b. Color: As selected from manufacturer's full range.
2. Shower and Tub Curtain Fabric: Curtain manufacturer's standard. Polyester-reinforced vinyl fabric; flame resistant, stain resistant, and antimicrobial.
 - a. Pattern: **<Insert manufacturer's style name.>**
 - b. Color: As selected from manufacturer's full range.
3. Curtain Grommets: Two-piece, rolled-edge, rustproof, nickel-plated brass; spaced not more than 6 inches (152 mm) o.c.; machined into top hem.



4. Mesh Top: No. 50 **OR** 40 **OR** 42, **as directed**, nylon mesh.
5. Beaded-Chain Curtain Drop: 6 inches (152 mm) **OR** 9 inches (229 mm) **OR** 12 inches (305 mm) **OR** 15 inches (381 mm) **OR** 18 inches (457 mm), **as directed**, long; nickel-plated steel, with aluminum hook.
6. PVC-Strip Curtain Drop: 16 inches (406 mm) **OR** 18 inches (457 mm), **as directed**, long, with chrome-plated steel hook.
 - a. Curtain Movers: In-line hinged nylon spacers that connect to the top of PVC-strip curtain drops to provide tangle-free operation.
7. Curtain Tieback: Nickel-plated brass chain; one at each curtain termination.

D. Curtain Fabrication

1. Fabricate curtains to comply with the following requirements:
 - a. Width: Equal to track length from which curtain is hung plus 10 percent added fullness, but not less than 12 inches (305 mm) added fullness.
 - b. Length: Equal to floor-to-ceiling height minus depth of track and carrier at top, and minus distance above the finished floor at bottom as follows:
OR
 Length: Equal to floor-to-ceiling height, with 20-inch (508-mm) mesh top, and minus distance above the finished floor at bottom as follows:
OR
 Length: Equal to floor-to-ceiling height minus 18 inches (457 mm) from finished ceiling at top, and minus distance above the finished floor at bottom as follows:
 - 1) Cubicle Curtains: 12 inches (305 mm) **OR** 15 inches (381 mm), **as directed**.
 - 2) Dressing Area Curtains: 4 inches (102 mm) **OR** 6 inches (152 mm), **as directed**.
 - 3) Tub Curtains: 6 inches (152 mm).
 - 4) Shower Curtains: 1/2 inch (13 mm).
 - c. Top Hem: Not less than 1 inch (25.4 mm) and not more than 1-1/2 inches (38 mm) wide, triple thickness, reinforced with integral web, and double lock stitched.
 - d. Mesh Top: Top hem not less than 1 inch (25.4 mm) and not more than 1-1/2 inches (38 mm) wide, triple thickness, reinforced with integral web, and double lock stitched. Double lock stitch bottom of mesh directly to 1/2-inch (13-mm) triple thickness, top hem of curtain fabric.
 - e. Bottom Hem: Not less than 1 inch (25.4 mm) and not more than 1-1/2 inches (38 mm) wide, double thickness and single **OR** double thickness and double **OR** triple thickness, reinforced, and double, **as directed**, lock stitched.
 - f. Side Hems: Not less than 1/2 inch (13 mm) and not more than 1-1/4 inches (32 mm) wide, with double **OR** triple, **as directed**, turned edges, and single lock stitched.
2. Vertical Seams: Not less than 1/2 inch (13 mm) wide, double turned and double stitched.

1.3 EXECUTION

A. Installation

1. General: Install tracks level and plumb, according to manufacturer's written instructions.
2. Up to 16 feet (4.9 m) **OR** 20 feet (6.0 m), **as directed**, in length, provide track fabricated from 1 continuous length.
 - a. Curtain Track Mounting: Surface **OR** Suspended **OR** Recessed **OR** As indicated on Drawings, **as directed**.
 - b. IV Track Mounting: Surface.
3. Surface Track Mounting: Fasten surface-mounted tracks at intervals of not less than 24 inches (610 mm). Fasten support at each splice and tangent point of each corner. Center fasteners in track to ensure unencumbered carrier operation. Attach track to ceiling as follows:
 - a. Mechanically fasten directly to bottom of concrete deck with post-installed anchors.
 - b. Mechanically fasten directly to finished ceiling with toggle bolts.
 - c. Mechanically fasten to furring through suspended ceiling with screw and tube spacer.
 - d. Mechanically fasten to suspended ceiling grid with screws.



- e. Attach track to suspended ceiling grid with manufacturer's proprietary clip.
 - 4. Suspended Track Mounting: Install track with suspended supports at intervals of not more than 48 inches (1219 mm). Fasten support at each splice and tangent point of each corner. Secure ends of track to wall with flanged fittings or brackets.
 - 5. Track Accessories: Install splices, end caps, connectors, end stops, coupling and joining sleeves, and other accessories as required for a secure and operational installation.
 - a. Provide one locking switch unit for each pair of beds.
 - b. Provide one hinged loading unit for each bed **OR** pair of beds with locking switch unit, **as directed**.
 - 6. IV Hangers: Unless otherwise indicated, install one IV hook on each IV track and hang one IV hanger.
 - 7. Curtain Carriers: Provide curtain carriers adequate for 6-inch (152-mm) spacing along full length of curtain plus an additional carrier.
 - 8. Curtains: Hang curtains on each curtain track. Secure with curtain tieback, **as directed**.
- B. Protection
- 1. Protect installed recessed track openings with nonresidue adhesive tape to prevent construction debris from impeding carrier operation. Remove tape prior to Final Completion.

END OF SECTION 10 21 16 00



Task	Specification	Specification Description
10 21 23 13	10 21 16 00	Cubicle Curtains and Tracks
10 21 23 16	10 21 16 00	Cubicle Curtains and Tracks



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SECTION 10 22 19 13 - DEMOUNTABLE PARTITIONS

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for demountable partitions. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Demountable site-assembled partitions.
 - b. Demountable unitized-panel partitions.

C. Performance Requirements

1. Structural Performance: Provide demountable partitions capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - a. Load-Bearing Capacity of Panel System: Not less than 300-lb (136-kg concentrated) **OR** 2.3-lb/linear inch (0.041-kg/linear mm) distributed, **as directed**, proof load when tested according to BIFMA X 5.6, Section 6, Table 1.
 - b. Transverse-Load Capacity of Panel System: Lateral deflection of not more than 1/120 **OR** 1/240, **as directed**, of the overall span when tested under a uniformly distributed load of 5 lb/sq. ft. (24.4 kg/sq. m) according to ASTM E 72.
 - c. Seismic Performance: Provide demountable partitions capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

D. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For demountable partitions. Include plans, elevations, sections, details, and attachments to other work.
3. Samples: For each type of exposed finish required.
4. Product Test Reports.
5. Maintenance Data.

E. Quality Assurance

1. Sound Transmission Characteristics: Where STC ratings are indicated, provide partitions with STC rating that was determined by testing an identical system according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.
2. Fire-Test-Response Characteristics: Provide demountable partitions complying with the following requirements:
 - a. Where indicated, provide demountable partitions identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1) Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
 - b. Surface-Burning Characteristics: Provide demountable partitions per ASTM E 84:
 - 1) Flame-Spread Index: 25 or less.
 - 2) Smoke-Developed Index: 450 or less.
3. Fire-Rated Door and Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated.
 - a. Test Pressure:



- 1) Test at atmospheric (neutral) pressure according to NFPA 252 or UL 10B.
OR
Test according to NFPA 252 or UL 10C. After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches (1016 mm) or less above the sill.
- b. As scheduled on Drawings.
4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.2 PRODUCTS

A. Demountable Site-Assembled Partitions

1. Face Panels: Manufacturer's standard **OR** Gypsum board, ASTM C 36/C 36M **OR** Wood composite **OR** Fiber composite **OR** Steel-sheet-faced gypsum board, ASTM C 36/C 36M **OR** Stainless-steel-sheet-faced gypsum board, ASTM C 36/C 36M, **as directed**.
 - a. Thickness: Manufacturer's standard **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm) **OR** 3/4 inch (19 mm), **as directed**.
 - b. Width: Manufacturer's standard **OR** 24 inches (610 mm) **OR** 30 inches (762 mm) **OR** As indicated, **as directed**.
 - c. Finish: Unfinished **OR** Manufacturer's standard prime-coat finish ready for field painting **OR** Vinyl wall covering complying with CFFA-W-101-A **OR** Fabric **OR** Factory-applied paint finish **OR** Powder-coat finish **OR** No. 4 satin, **as directed**.
 - d. Colors, Textures, and Patterns: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
2. Accessory Panels: Manufacturer's standard fabric-covered tackable panels **OR** porcelain-enamel chalkboard and markerboard panels, **as directed**.
3. Framing: Studs, top and bottom track, 2-1/2 inches (64 mm) **OR** 4 inches (102 mm) **OR** manufacturer's standard, **as directed**, deep.
 - a. Steel: Metallic-coated, 0.0359-inch (0.912-mm) base metal thickness.
 - b. Aluminum.
 - c. Fiberglass.
4. Panel Joint Closure: Manufacturer's standard **OR** Vinyl **OR** Aluminum **OR** Steel, **as directed**.
5. Trim: Continuous, factory-finished, snap-on type; adjustable for variations in floor level **OR** floor and ceiling levels, **as directed**.
 - a. Outside Corner Trim: Square **OR** Radiused, **as directed**.
 - b. Base: Snap-on vinyl **OR** metal, **as directed**.
 - c. Base Trim Profile: Recessed **OR** Projected **OR** Flush, **as directed**.
 - d. Ceiling Trim Profile: Recessed **OR** Projected, **as directed**.
 - e. Cornice Trim: Continuous over tops of partial-height units for maximum stability.
 - f. Exposed-Metal Trim Finish: Factory-applied paint finish **OR** Clear-anodized aluminum; AAMA 611, AA-M12C22A31, Class II **OR** Color-anodized aluminum; AAMA 611, AA-M12C22A32/A34, Class II **OR** Manufacturer's standard prime-coat finish ready for field painting, **as directed**.
 - g. Trim Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
6. Doors: As specified in Division 12.
7. Door Frames: Manufacturer's standard steel **OR** aluminum, **as directed**, reversible, **as directed**, factory mortised to receive hardware, **as directed**, for 1-3/4-inch (45-mm) doors.
 - a. Frame Finishes: Factory-applied paint finish **OR** Clear-anodized aluminum; AAMA 611, AA-M12C22A31, Class II **OR** Color-anodized aluminum; AAMA 611, AA-M12C22A32/A34, Class II **OR** Manufacturer's standard prime-coat finish ready for field painting, **as directed**.
 - b. Frame Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.



8. Fire-Protection Rating of Rated Door Assemblies: Labeled 20 **OR** 45, **as directed**, minutes.
 9. Hardware: As specified in Division 08 Section "Door Hardware".
 10. Glazing Frames: Manufacturer's standard **OR** Match door frames, **as directed**, for glazing thickness indicated.
 - a. Frame Finishes: Factory-applied paint finish **OR** Clear-anodized aluminum; AAMA 611, AA-M12C22A31, Class II **OR** Color-anodized aluminum; AAMA 611, AA-M12C22A32/A34, Class II **OR** Manufacturer's standard prime-coat finish ready for field painting, **as directed**.
 - b. Frame Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 11. Glazing: Fully tempered clear float glass **OR** Laminated clear float glass **OR** Glass type indicated, **as directed**, complying with Division 08 Section "Glazing".
 12. Acoustical Rating: STC 35, unless directed otherwise.
 13. Fire-Resistance Rating of Partition Assemblies: 1 hour.
 14. Seals: Manufacturer's standard **OR** Open cell, 2 lb/cu. ft. (32 kg/cu. m), **as directed**.
- B. Demountable Unitized-Panel Partitions
1. Panels: Manufacturer's standard **OR** Gypsum board, ASTM C 36/C 36M **OR** Wood composite **OR** Fiber composite **OR** Steel-sheet-faced gypsum board, ASTM C 36/C 36M **OR** Stainless-steel-sheet-faced gypsum board, ASTM C 36/C 36M, **as directed**.
 - a. Type: Unfinished **OR** Factory finished **OR** Metal faced, **as directed**.
 - b. Thickness: Manufacturer's standard **OR** 1-3/4 inches (45 mm) **OR** 2-1/4 inches (57 mm), **as directed**.
 - c. Width: Manufacturer's standard **OR** 24 inches (610 mm) **OR** 30 inches (762 mm) **OR** As indicated, **as directed**.
 - d. Finish: Vinyl wall covering complying with CFFA-W-101-A **OR** Fabric **OR** Factory-applied paint finish **OR** Powder-coat finish **OR** Stainless steel, **as directed**.
 - e. Colors, Textures, and Patterns: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 2. Accessory Panels: Manufacturer's standard fabric-covered tackable panels **OR** porcelain-enamel chalkboard and markerboard panels, **as directed**.
 3. Framing: Manufacturer's standard **OR** Steel **OR** Aluminum, **as directed**.
 - a. Frame Finishes: Factory-applied paint finish **OR** Clear-anodized aluminum; AAMA 611, AA-M12C22A31, Class II **OR** Color-anodized aluminum; AAMA 611, AA-M12C22A32/A34, Class II **OR** Manufacturer's standard prime-coat finish ready for field painting, **as directed**.
 - b. Frame Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 4. Panel Joint Closure: Manufacturer's standard **OR** Flush **OR** Vinyl **OR** Aluminum **OR** Steel, **as directed**.
 5. Trim: Continuous, factory-finished, snap-on type; adjustable for variations in floor level **OR** floor and ceiling levels, **as directed**.
 - a. Base Trim Profile: Recessed **OR** Projected **OR** Flush, **as directed**.
 - b. Ceiling Trim Profile: Recessed **OR** Projected, **as directed**.
 - c. Cornice Trim: Continuous over tops of partial-height units for maximum stability.
 - d. Exposed-Metal Trim Finish: Factory-applied paint finish **OR** Clear-anodized aluminum; AAMA 611, AA-M12C22A31, Class II **OR** Color-anodized aluminum; AAMA 611, AA-M12C22A32/A34, Class II **OR** Manufacturer's standard prime-coat finish ready for field painting, **as directed**.
 - e. Colors: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 6. Doors: Manufacturer's standard solid-core wood **OR** steel **OR** glazed, **as directed**, 1-3/4 inches (45 mm) thick.
 - a. Door Finishes: Factory-applied paint finish **OR** Clear-anodized aluminum; AAMA 611, AA-M12C22A31, Class II **OR** Color-anodized aluminum; AAMA 611, AA-M12C22A32/A34, Class II **OR** Manufacturer's standard prime-coat finish ready for field painting, **as directed**.
 - b. Door Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.



7. Door Frames: Manufacturer's standard steel **OR** aluminum, **as directed**, reversible, **as directed**, factory mortised to receive hardware, **as directed**, for 1-3/4-inch (45-mm) doors.
 - a. Frame Finishes: Factory-applied paint finish **OR** Clear-anodized aluminum; AAMA 611, AA-M12C22A31, Class II **OR** Color-anodized aluminum; AAMA 611, AA-M12C22A32/A34, Class II **OR** Manufacturer's standard prime-coat finish ready for field painting, **as directed**.
 - b. Frame Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
8. Hardware: As specified in Division 08 Section "Door Hardware".
9. Glazing Frames: Manufacturer's standard **OR** Match door frames, **as directed**, for glazing thickness indicated.
 - a. Frame Finishes: Factory-applied paint finish **OR** Clear-anodized aluminum; AAMA 611, AA-M12C22A31, Class II **OR** Color-anodized aluminum; AAMA 611, AA-M12C22A32/A34, Class II **OR** Manufacturer's standard prime-coat finish ready for field painting, **as directed**.
 - b. Frame Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
10. Glazing: Fully tempered clear float glass **OR** Laminated clear float glass **OR** Glass type indicated, **as directed**, complying with Division 08 Section "Glazing".
11. Acoustical Rating: STC 35, unless directed otherwise.
12. Seals: Manufacturer's standard **OR** Open cell, 2 lb/cu. ft. (32 kg/cu. m), **as directed**.

C. Fabrication

1. Demountable Site-Assembled Panels: Fabricate each panel from one sheet **OR** two sheets, **as directed**, of gypsum board.
 - a. Transom Panels: Fabricate in material and finish to match wall panels, unless otherwise indicated.
2. Demountable Unitized Panels: Factory-assembled, flush, hollow unit construction; with faces smooth and free of buckles, oil canning, and seams; and insulated with solidly packed, inorganic, mineral filler. Fabricate panels for installation with concealed fastening devices and pressure-fit components that will not damage ceiling or floor coverings. Fabricate panels with continuous light-and-sound seals at floor, ceiling, and other locations where panels abut fixed construction.
 - a. Factory glaze panels to the greatest extent possible.
3. Components: Fabricate components for installation with concealed fastening devices and pressure-fit members that will not damage ceiling or floor coverings. Fabricate for installation with continuous seals at floor, ceiling, and other locations where partition assemblies abut fixed construction and for installation of sound attenuation insulation in partition cavities.

D. Finishes, General

1. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
2. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

1.3 EXECUTION

A. Installation

1. Install demountable partition systems rigid, level, plumb, and aligned. Install seals to prevent light and sound transmission at connections to floors, ceilings, fixed walls, and abutting surfaces.
 - a. Installation Tolerance: Install each demountable partition so surfaces vary not more than 1/8 inch (3 mm) from the plane formed by the faces of adjacent partitions.
2. Do not alter ceiling suspension system **OR** Make alterations to ceiling suspension system required by partition installation or to gain access to electrical or communication systems without



- affecting the structural integrity of ceiling suspension system. Make alterations so they are not noticeable after panel installation, **as directed**.
3. Install door-and-frame and glazing-and-glazing-frame assemblies securely anchored to partitions and with doors aligned and fitted. Install and adjust door hardware for proper operation.
 - a. Install fire-rated door frames according to NFPA 80.

END OF SECTION 10 22 19 13



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Task	Specification	Specification Description
10 22 19 43	10 22 19 13	Demountable Partitions
10 22 19 53	10 22 19 13	Demountable Partitions
10 22 19 71	10 22 19 13	Demountable Partitions
10 22 23 00	10 22 19 13	Demountable Partitions



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SECTION 10 26 00 00 - CSF WALL AND DOOR PROTECTION

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where wood polymer lumber for wall mounted bumpers is part of the Work. EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items at end of Section. 10 26 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wood Polymer Lumber Bumpers
 - 2. Wood Bumpers
 - 3. FRP Wall Protection
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work apply to the work of this section. Additional requirements and information necessary to complete the work of this section may be found in other documents.
- C. Related Sections:
 - 1. Section 061000, Rough Carpentry.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals:
 - 1. Product Data: Indicate materials, construction, configuration, dimensions, and finishes.
 - 2. Assurance / Control Submittals:
 - a. Certificates: Manufacturer's certificate that products meet or exceed specified requirements.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements:
 - 1. Transport, handle, store, and protect products.



PART 2 - PRODUCTS

2.1 WOOD POLYMER LUMBER

- A. Subject to compliance with project requirements, manufacturers offering wood polymer lumber Products which may be incorporated in the Work include the following:
 - 1. Amazing Recycled Products, Denver, CO (800) 241-2174.
 - 2. Eagle Recycled Products, Anaheim, CA (800) 448-4409.
 - 3. Trex Company, LLC, Winchester, VA (800) 289-8739.
 - 4. Phoenix Recycled Plastics Corporation, Philadelphia, PA (610) 940-1590.
 - 5. Engineered Plastic Systems, Cary, IL (847) 462-9001.
- B. Product Description:
 - 1. Solid reclaimed polyethylene or solid homogenous blend of approximately 50 percent reclaimed polyethylene and 50 percent waste wood (non-virgin).

2.2 FIBERGLASS REINFORCED PLASTIC (FRP) PANELS

- A. Subject to compliance with project requirements, manufacturers offering plastic sheeting or fiberglass reinforced plastic (FRP) panels which may be incorporated in the Work include the following:
 - 1. Crane Composites, Channahon, IL (800) 435-0080
 - 2. Glasteel, _Moscow, TN (800) 238-5546
 - 3. Kalwall, Bow, NH (800) 526-1609
- B. PRODUCT DESCRIPTION
 - 1. Nominal 1/8" thick, white embossed finish, Class A Fire Rated panels.
 - 2. Provide Manufacturer's trim, joining and cap accessories and Install panels in strict accordance with Manufacturer's recommendations.
- C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.3 WOOD LUMBER BUMPERS

- A. Wood lumber bumpers shall be constructed of Douglas fir, southern pine, or western larch. Grade to be select structural. Exterior wood lumber bumpers shall be pressure treated and carry the AWP Standard U1 quality control mark.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.4 FASTENERS FOR WOOD AND WOOD POLYMER WALL BUMPERS

- A. Concrete wall - 5/8 inch diameter x 5-1/2 inch (minimum) hooked bolts with heavy flat washer, lock washer and hex head nut.



- B. Masonry wall - 5/8 inch diameter x 5-1/2 inch (minimum) hooked bolts with heavy flat washer, lock washer and hex head nut - plush fill concrete masonry block cavities with concrete to 48 inch minimum for double bumpers and to 24 inch minimum for single bumper.
- C. Metal stud wall - 1/2 inch diameter (minimum) toggle bolts plus a continuous 14 gauge metal plate backing welded to the metal studs.
- D. Wood stud wall - 5/8 inch diameter x 5-1/2 inch (minimum) lag bolts plus 3 x 4 wood blocking between studs for frame wall anchorage.
- E. Wood stud wall with 4 x 4 spacer - 5/8 inch diameter x 9-1/2 inch (minimum) lag bolts.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Section 017300 - Execution:
 - 1. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive work.
- B. Follow manufacturer's recommended guidelines for cutting, fastening and installing wood polymer lumber. Refer to Report Number A237-06170/MOB, printed 1994.
- C. Provide for 1/8 inch gap at ends of pieces and parts of wood polymer lumber to wood polymer lumber and wood polymer lumber to other materials.
- D. No color is to be applied to the wood polymer lumber. Use standard color (neutral).

3.2 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements - Field Inspection.

USPS CSF Specifications issued: 10/1/2013

Last revised: 4/12/2011

END OF SECTION



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SECTION 10 26 00 00 - MPF WALL AND DOOR PROTECTION

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 – GENERAL

1.1 SUMMARY

- A. Wall Bumpers
- B. Corner guards
- C. Wainscot

1.2. SUBMITTALS

- A. Product Data: Required
- B. Shop Drawings: Required
- C. Samples: Required

1.3. QUALITY ASSURANCE

- A. Regulatory Requirements: Handbook RE-4 requirements for the physically handicapped.

PART 2 - PRODUCTS

2.1 Wall Bumpers: Vestibules, Workroom, Platform, etc.

- A. Configuration: Surface mounted.
- B. Material: Plastic (Fabricate from recyclable non-toxic plastic).
- C. Size: 2 X 10 inch.
- D. Color: Black.

2.2 Corner Guards .

- A. Configuration: Surface mounted.
- B. Material: Stainless steel with No. 4 finish.
- C. Size: 3 ½ inch flanges, 16 gage and 4 feet high.

2.3 Wainscot:



- A. Configuration: Surface mounted.
- B. Material: For New Facilities: 1/8" reinforced fiberglass panel (RFP). For R&A Projects: 1/2 inch B/C plywood treated with fire retardant.
- C. Size: 4'-0" high
- D. Finish:
 - 1. Plywood painted to match the partition top edge trimmed with 1/4 inch x 1/2 inch hardwood edge.
 - 2. RFP with trim on top and bottom in color as selected.

PART 3 – EXECUTION

- 3.1 Install all products in accordance with manufacturer's guidelines and printed instructions.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 03/31/2010

END OF SECTION 10 26 00 00



SECTION 10 26 13 00 - CSF CORNER GUARDS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where corner guards are part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items at end of Section.10 26 13 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Corner guards.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 061000 - Rough Carpentry.
 - 2. Section 092900 - Gypsum Board.
 - 3. Section 099100 - Painting.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Shop Drawings:
 - a. Submit shop drawings indicating dimensions, locations, types, sizes, and finishes for Architect's approval.

NOTE TO SPECIFIER

Edit number and size of samples required.

- 2. Samples: Submit two 12-inch sections of corner guards illustrating component design, configuration, color, and finish.



1.3 SEQUENCING

- A. Coordinate installation with wall construction, including concealed blocking or anchoring devices, installation of wall base, and painting.

1.4 WARRANTY

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. Balco/Metalines, Inc., Wichita, KS (800) 767-0082.
 2. Construction Specialties, Inc. (C/S), Muncy, PA (800) 233-8493.
 3. Pawling Corporation, Wassaic, NY (800) 431-3456.
 4. InPro Corporation, Muskego, WI, (800) 222-5556.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 CORNER GUARDS

- A. Subject to compliance with requirements, provide corner guards by one of the following manufacturers:
 1. Balco: Corner Guards Surface Mounted Type CGS-3, 177P Graphite.
 2. Construction Specialties: Acrovyn - SM-20, 111 Wedgewood Blue.
 3. Pawling: Pro-Tek Corner Guards Surface Mounted CG-10 with TC-10, A265 Windsor Blue.
 4. InPro Corporation: Type 150, 0135 Brittany Blue.
- B. Corner Guards: 4'-0" long snap-on covers of Class 1 fire-rated resilient material, minimum 0.078 inch thick, free-floated over continuous aluminum retainer, 0.063 inch thick, surface mounted and anchored to wall at 20 inches on center maximum; molded end caps color matched to covers.

2.3 ACCESSORIES

- A. Provide attachment accessories as recommended by corner guard manufacturer.

2.4 FABRICATION

- A. Fabricate components with tight joints, corners, and seams.
- B. Pre-drill holes for attachment.



- C. Form end trim closure by capping and finishing smooth.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's published instructions, square and plumb, secured rigidly in position.
- B. Install corner guards with tops at 5'-0" above finished floor.

NOTE TO SPECIFIER

Drawing coordination items are for specifier's reference and not for the contractor's use. Delete before final printing.

DRAWING COORDINATION ITEMS

Drawings should indicate the following information related to this Section.

1. *Location of wall guards (crash rails) and corner guards.*

USPS CSF Specifications issued: 10/1/2013

Last revised: 4/12/2011

END OF SECTION



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SECTION 10 28 13 00 - CSF TOILET ACCESSORIES**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.10 28 13 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Toilet Accessories.
 - 2. Attachment hardware.
- B. Related Documents: The Contract Documents, as defined in the General Conditions, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 061000 - Rough Carpentry: Placement of backing and blocking for attachment of accessories.
 - 2. Section 092216: Placement of backing plate reinforcement for attachment of accessories.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A 123 - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 2. ASTM A 167 - Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - 3. ASTM A 366 - Specification for Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Data for each accessory describing size, finish, details of function, and attachment methods.



1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Conform to United States Postal Service "Standards for Facility Accessibility by the Physically Handicapped" Handbook RE-4 for mounting heights and locations of accessories.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Deliver accessories in original labeled packaging, bearing manufacturer's name and type of accessory.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
1. American Specialties Company, Incorporated, Yonkers, NY (914) 476-9000.
 2. Bobrick Washroom Equipment, Incorporated, North Hollywood, CA (818) 764-1000.
 3. Bradley Corporation, Milwaukee, WI (414) 251-6000.
 4. McKinney Parker, Scranton, PA (570) 969-9770.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

- A. Sheet Steel: ASTM A 366.
- B. Galvanized Sheet Steel: ASTM A 366, ASTM A 123 to 1.25 ounces per square yard.
- C. Stainless Steel Sheet: ASTM A167, Type 304.
- D. Fasteners, Screws, and Bolts: Hot dip galvanized, tamper-proof.
- E. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

NOTE TO SPECIFIER

Coordinate the Accessory Identification Numbers (TA-1, TA-2, etc.) used herein with Numbers used to identify each accessory type on the Drawings.

NOTE TO SPECIFIER

The custodial products used by the accessories covered in this section are available through a national strategic partnership (MLB-CO-01-012; Mandatory National Sources for Custodial Products). As part of the agreement, the suppliers may provide the dispenser along with the custodial product. This arrangement ensures compatibility of custodial products (paper towels, toilet tissue, soap, etc.) with the dispenser. A/E will need to check with the Contracting Officer to determine which accessories, if any, will be provided by the custodial product supplier and edit the following schedule as appropriate.



2.3 MANUFACTURED UNITS

- A. AC-1 - Surface Mounted Liquid Soap Dispenser, (install one dispenser per lavatory):
1. Model Numbers:
 - a. American Specialties: 0342.
 - b. Bobrick: B-2112.
 - c. Bradley: 6542.
 - d. McKinney: 304-H
 2. Description: Horizontal tank type for all-purpose liquid soap. Minimum 20 gage Type 304 stainless steel. Drawn one-piece construction. No. 4 satin finish. Concealed stainless steel wall plate. Clear plastic refill indicator window. Locked hinged stainless steel lid for top filling. Minimum 40 ounce capacity.
- B. AC-2 - Recessed Combination Sanitary Napkin/Tampon Vendor:
1. Model Numbers:
 - a. American Specialties: 04684.
 - b. Bobrick: B-2800, surface mounted.
 - c. Bradley: 401.
 - d. McKinney: 874.

NOTE TO SPECIFIER

Select coin operation denomination.

2. Description: Cabinet of stainless steel, minimum 22 gage, all-welded construction. Door of seamless steel, minimum 18 gage, with returned edges equipped with tumbler lockset. Coin operated; [25] [____] cent denomination. Identification reading "Napkins" and "Tampons" at coin slot. Coin box with separate tumbler lock. No brand name advertising permitted. Capacity minimum 30 sanitary napkins and 27 tampons.
- C. AC-3 - Mirror with Stainless Steel Channel Frame:
1. Model Numbers:
 - a. American Specialties: 0620.
 - b. Bobrick: B-165 series.
 - c. Bradley: 781.
 - d. McKinney: 190.
 2. Description: 20 inches wide x 60 inches high. Minimum 18 gage 1/2 inch x 1/2 inch x 1/2 inch stainless steel frame with 90 degree mitered hairline corners mechanically interlocked. Type 430 bright polished finish. Galvanized steel back with integral horizontal hanging brackets for mounting on concealed wall hanger, secured with concealed wall vandalproof screws in lower frame. Edges and back protected by shock-absorbing water-resistant padding. Ten year warranty against silver spoilage.
- D. AC-4A - Mirror with Stainless Steel Channel Frame:
1. Model Numbers:
 - a. American Specialties: 0600.
 - b. Bobrick: 165 series.
 - c. Bradley: 780.
 - d. McKinney:
 2. Description: 18 inches wide x 36 inches high. Minimum 20 gage stainless steel, all joints mitered, welded and ground smooth. Type 430 bright polished finish. Galvanized steel back with slots for mounting screws and integral screw-head lock. Back protected by shock-absorbing water-resistant padding. Ten year warranty against silver spoilage.
- E. AC-5 - Mop and Broom Holder:
1. Model Numbers:
 - a. American Specialties: 8215B.
 - b. Bobrick: B-223.



- c. Bradley: 9954.
 - d. McKinney: 233.
 - 2. Description: 36 inches long, 3 inch projection, 4 holders. Minimum 22 gage, Type 304 stainless steel hat channel. Spring loaded rubber cam-type mop holders. No. 4 Satin finish.
- F. AC-6 - Surface-Mounted Multi-Roll Tissue Dispenser:
 - 1. Model Numbers:
 - a. American Specialties: 0030.
 - b. Bobrick: B-2888.
 - c. Bradley: 5402.
 - d. McKinney: 615.
 - 2. Description: Minimum 22 gage Type 304 stainless steel cabinet. Minimum 18 gage drawn one-piece Type 304 stainless steel unit front with pivot hinge and tumbler lockset. No. 4 satin finish. Holds 2 standard core 5 inch diameter tissue rolls. Reserve roll drops in-place by automatic release. Theft-resistant spindles.
- G. AC-7 - Recessed Combination Paper Towel Dispenser and Waste Receptacle:
 - 1. Model Numbers:
 - a. American Specialties: 0469.
 - b. Bobrick: B-3944.
 - c. Bradley: 234.
 - d. McKinney: 80294.
 - 2. Description: 4 inch wall depth. Minimum 22 gage Type 304 stainless steel. Drawn and beveled one-piece seamless flange. Full length stainless steel piano hinge and concealed tumbler lock at towel dispenser door. No. 4 satin finish. Capacity minimum 600 C-fold or 800 multi-fold paper towels. Waste receptacle with all edges with hemmed construction. Removable waste receptacle secured to cabinet with tumbler lock. Minimum 12 gallon capacity.
- H. AC-8 - Grab Bar - 36 Inch:
 - 1. Model Numbers:
 - a. American Specialties: 3100 series.
 - b. Bobrick: B-5806x36.
 - c. Bradley: 832 series.
 - d. McKinney: 9602.
 - 2. Description: 1-1/4 inch minimum to 2 inch maximum diameter (1-1/2 inch diameter when required by local code) 36 inch long, horizontal, 1-1/2 inch wall clearance. Type 304 minimum 18 gage stainless steel. Concealed screw attached mounting and anchorage. No. 4 satin finish. Minimum 900 pound supporting capacity.
- I. AC-9 - Grab Bar - 42 Inch:
 - 1. Model Numbers:
 - a. American Specialties: 3100 series.
 - b. Bobrick: B5806x42.
 - c. Bradley: 832 series.
 - d. McKinney: 9602.
 - 2. Description: 1-1/4 inch minimum to 2 inch maximum diameter (1-1/2 inch diameter when required by local code) 42 inch long, horizontal. 1-1/2 inch wall clearance. Type 304 minimum 18 gage stainless steel. Concealed screw attached mounting and anchorage. No. 4 satin finish. Minimum 900 pound supporting capacity.
- J. AC-10 - Recessed Sanitary Napkin Disposal:
 - 1. Model Numbers:
 - a. American Specialties: 0473.
 - b. Bobrick: B-353.
 - c. Bradley: 4731-15.
 - d. McKinney: 827.



2. Description: Minimum 22 gage Type 304 stainless steel. Drawn and beveled one-piece seamless flange. Spring-loaded, self-closing door with full-length stainless steel piano hinge. No. 4 satin finish. Removable leak-proof, rigid molded polyethylene waste receptacle. International graphic symbol on door. Minimum 1.2 gallon capacity.
- K. AC-11 - Partition Mounted Dual-Access Sanitary Napkin Disposal:
1. Model Numbers:
 - a. American Specialties: 0472.
 - b. Bobrick: B-354.
 - c. Bradley: 4721-15.
 - d. McKinney:
 2. Description: Mounted in toilet compartment panel serving both sides of panel. Minimum 22 gage Type 304 stainless steel. Drawn and beveled one-piece seamless flange. Spring-loaded, self-closing door with full-length stainless steel piano hinge. No. 4 satin finish. Removable stainless steel receptacle with tumbler lock. International graphic symbol on door. Minimum 1.2 gallon capacity.
- L. AC-12 - Surface Mounted Shelf:
1. Model Numbers:
 - a. American Specialties: 0692.
 - b. Bobrick: B-296x24.
 - c. Bradley: 756-24.
 - d. McKinney: 224.
 2. Description: 24 inches long, 6 inch depth. Minimum 18 gage Type 304 stainless steel. 3/4 inch return edge with hemmed construction. No. 4 satin finish.

NOTE TO SPECIFIER

This type Grab Bar may be required to meet local handicapped requirements. Verify with local code.

- M. AC-13 - Swing-Up Grab Bar:
1. Model Numbers:
 - a. American Specialties: 3100 Type 53.
 - b. Bobrick: B-4998.
 - c. Bradley: 8370-10.
 - d. McKinney: 9000 Series S/UP.
 2. Description: Minimum 18 gage Type 304 stainless steel; 1-1/4 inch minimum to 2 inch maximum diameter, (1-1/2 inch diameter where required by Local Code) textured grip surface. No. 4 satin finish. Wall plate fabricated from 3/16 inch stainless steel with concealed spring mechanism attached to wall plate holding bar up against wall.
 3. Function: Grab bar is manually lowered to horizontal support position and raised for departure. Bar has counterweight to prevent unintentional lowering to position.
- N. AC-14 – Vertical Grab Bar:
1. Model Numbers:
 - a. American Specialties: 3100 Series
 - b. Bobrick: 5806 x 18
 - c. Bradley: 832 Series
 - d. McKinney: 9602 Series
 2. Description: 1-1/4 inch *minimum to 2 inch maximum* diameter (1-1/2 inch diameter when required by local code) 18 inch long, vertical. 1-1/2 inch wall clearance. Type 304 minimum 18 gage stainless steel. Concealed screw attached mounting and anchorage. No. 4 satin finish. Minimum 900 pound supporting capacity.



2.4 FABRICATION

- A. Weld and grind smooth joints of fabricated components.
- B. Form exposed surfaces from single sheet of stock, free of joints. Form surfaces flat without distortion. Maintain surfaces without scratches or dents.
- C. Fabricate grab bars of tubing, free of visible joints, return to wall with end attachment flanges.
- D. Shop assemble components and package complete with anchors and fittings.
- E. Provide steel anchor plates, adapters, and anchor components for installation.
- F. Back paint components where contact is made with building finishes to prevent electrolysis.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify correct location of opening in wall for recessed accessories.
 - 2. Verify that attachment blocking and backing plates are in place in the correct location for accessory connections.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Deliver inserts and rough-in frames to site for scheduled installation.
- B. Provide and use templates and rough-in measurements as required.

3.3 INSTALLATION

- A. Install fixtures, accessories, and items in accordance with manufacturer's instructions, US Postal Service handicapped requirements, and as indicated on Drawings. Use tamper-proof fasteners.
- B. Install plumb and level, securely and rigidly anchored to substrate.

3.4 ADJUSTING AND CLEANING

- A. Adjust accessories for proper operation and verify mechanisms function smoothly.



- B. Remove temporary labels and protective coatings. Clean and polish exposed surfaces.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



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SECTION 10 28 13 00 - MPF TOILET ACCESSORIES**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 – GENERAL

1.1 SUMMARY

- A. Toilet accessories.
- B. Mop/broom holder with integral shelf
- C. Urns

1.2 SUBMITTALS

- A. Product Data: Required.
- B. Shop Drawings: Required.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements: Conform to applicable code for installing work in conformance with USPS Handbook RE-4.

NOTE TO SPECIFIER

The custodial products used by the accessories covered in this section are available through a national strategic partnership (MLB-CO-01-012; Mandatory National Sources for Custodial Products). As part of the agreement, the suppliers provide the dispenser along with the custodial product. This arrangement ensures compatibility of custodial products (paper towels, toilet tissue, soap, etc.) with the dispenser. Therefore, in lieu of including them in the project solicitation, the dispensers are to be provided by the custodial product supplier. A/E will need to coordinate this with the contracting officer and edit the following schedule as appropriate.

PART 2 – PRODUCTS

2.1 MANUFACTURERS



- A. Identified products must be purchased through the Mandatory National Sources Contract for custodial products, and are subject to a USPS price and requirements purchasing agreement. The following vendor contracts must be used.
1. Cleanwise, Inc., 1-877-778-8007, FAX 1-877-778-9997
 2. W.W. Grainger, Inc., 1-800-GOV-TEAM (1-800-468-8326), FAX 1-877-699-4889
- B. Sources: Bobrick, ASI, or Bradley
- 1.. Stainless Steel: AISI Type 302/304 with polished No. 4 finish.

2.2 SCHEDULE

ITEM	LOCATION
A. Toilet tissue dispenser	One at each water closet. (Available through Mandatory National Sources)
B. Paper towel dispenser	One at each single occupant toilet room and one for every two lavatories. (Available through Mandatory National Sources)
C. Paper towel disposal unit	One for every two lavatories.
D. Napkin dispenser	One at each multi-occupant women's toilet room. (Available through Mandatory National Sources)
E. Napkin disposal	One at each women's water closet.
F. Soap dispenser	One at each lavatory. (Available through Mandatory National Sources)
G. Grab bars	Meet requirements of RE-4.
H. Mirror (24" x 36" minimum)	One at each lavatory.
I. Mirror (18" x 60")	One at each multi-occupant toilet room.
J. Mop/broom holder with integral shelf	One at each mop basin in custodial closets.
K. Large capacity wall mounted urn	Two at each exterior break area.

PART 3 – EXECUTION

- 3.1 Install all products in accordance with manufacturer's guidelines and printed instructions.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 3/31/2010

END OF SECTION 10 28 13 00



Task	Specification	Specification Description
10 28 13 13	01 22 16 00	No Specification Required



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SECTION 10 44 00 00 - CSF FIRE PROTECTION SPECIALTIES

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where fire extinguishers are part of the Work. Verify with Contracting Officer whether USPS provided.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.10 44 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes.
 - 1. Fire extinguishers.
 - 2. Fire extinguisher cabinets.
 - 3. Mounting brackets.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 REFERENCES

- A. National Fire Protection Association (NFPA):
 - 1. NFPA 10 - Portable Fire Extinguishers.
- B. Underwriters Laboratories, Inc. (UL):
 - 1. UL 299 - Dry Chemical Fire Extinguishers.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data:
 - a. Extinguisher type, operational features, color.
 - b. Cabinet type, materials, construction, features, color, finish and attachment method.

1.4 QUALITY ASSURANCE



- A. Regulatory Requirements: Conform to NFPA 10 and local jurisdiction for requirements for extinguisher location and mounting.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products that may be incorporated in the work include the following:
1. J.L. Industries, Bloomington, MN (800) 554-6077.
 2. Larsen's Manufacturing Company, Minneapolis, MN (800) 527-7367.
 3. Potter-Roemer, Incorporated, Cerritos, CA (800) 366-3473.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

- A. Extinguisher: Multipurpose dry chemical type, UL 299; UL-rated 4-A:60:B:C. 10 pound nominal capacity in enameled steel container.

NOTE TO SPECIFIER

Select mounting bracket or cabinet below.

- B. Mounting Bracket: Metal designed to prevent accidentally dislodging extinguisher, of size required for type and capacity of extinguisher specified, screw attached to wall. Brite chrome finish.
- C. Cabinet:
1. Models:
 - a. J.L. Industries: Clear VU Series No. 1515F25.
 - b. Larsen's: Vista Series No. V-2709.
 - c. Potter-Roemer: Buena Series No. 7121-A-16-VR.
 2. Description:
 - a. Metal: Formed sheet steel.
 - b. Mounting: Recessed.
 - c. Trim: Trimless.
 - d. Door: Clear acrylic bubble.
 - e. Finish: Primer.
 - f. Lettering: Vertical red 1-inch letters; "Fire Extinguisher."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
1. Verify rough openings for cabinet are correctly sized and located.



- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install extinguisher and bracket or cabinet in accordance with manufacturer's published instructions in locations required by authority having jurisdiction.
- B. Secure rigidly in place.
- C. Locate extinguishers where indicated on Drawings.
- D. Mount brackets so top of extinguisher is maximum 60 inches above finish floor.
- E. At Workroom locations, paint red background on wall behind fire extinguisher extending 6 inches on both sides of the extinguisher and from floor to ceiling, or to 12 feet above floor, whichever is lower. Color is to be "Safety Red" as specified in Section 099100, Painting.

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END OF SECTION



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SECTION 10 44 00 00 - MPF FIRE PROTECTION SPECIALTIES

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 – GENERAL

1.1 SUMMARY

- A. Fire Extinguishers
- B. Cabinets
- C. Brackets.

1.2 SUBMITTALS

- A. Product Data: Required.
- B. Shop Drawings: Required.

1.3 QUALITY ASSURANCE

- A. Fire Extinguishers shall comply with NFPA 10 "Portable Fire Extinguishers".

PART 2 – PRODUCTS

2.1 MANUFACTURERS/PRODUCTS

- A. Source:
 - 1. Larsen's Manufacturing Company
 - 2. J.L. Industries
 - 3. Potter-Roemer, Inc.
- B. Fire Extinguishers: Multipurpose dry chemical type, cast steel tank, Class ABC, (10 pound minimum capacity). Use of portable halon fire extinguishers containing CFCs is prohibited.
- C. Cabinets: Recessed mounted, prime painted steel with full glass door.
- D. Brackets: Galvanized steel, white enamel finish.

2.2 SCHEDULES

- | Location | Extinguishers Type and Mounting |
|--------------------------|---------------------------------|
| A. Platform and Workroom | Dry Chemical-Bracket |



- | | | |
|----|----------------------------|----------------------|
| B. | Office Areas and Corridors | Dry Chemical-Cabinet |
| C. | Computer Room | Dry Chemical-Bracket |

PART 3 – EXECUTION

- 3.1 Install all products in accordance with manufacturer's guidelines and printed instructions.

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END OF SECTION 10 44 00 00



SECTION 10 44 13 00 - FIRE EXTINGUISHER CABINETS

1.1 GENERAL

- A. Description Of Work:
 - 1. This specification covers the furnishing and installation of materials for fire extinguisher cabinets. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.
- B. Summary
 - 1. Section Includes:
 - a. Fire protection cabinets for the following:
 - 1) Portable fire extinguishers.
 - 2) Fire hose valves.
 - 3) Fire hoses and racks.
- C. Submittals
 - 1. Product Data: For each type of product indicated.
 - 2. Show location of knockouts for hose valves.
 - 3. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
 - 4. Samples: For each type of fire protection cabinet indicated.
 - 5. Maintenance Data.
- D. Quality Assurance
 - 1. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.
 - 2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Coordination
 - 1. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
 - 2. Coordinate size of fire protection cabinets to ensure that type and capacity of fire hoses, hose valves, and hose racks indicated are accommodated.
 - 3. Coordinate sizes and locations of fire protection cabinets with wall depths.
- F. Sequencing
 - 1. Apply decals **OR** vinyl lettering, **as directed**, on field-painted, fire protection cabinets after painting is complete.

1.2 PRODUCTS

- A. Materials
 - 1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
 - 2. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
 - a. Sheet: ASTM B 209 (ASTM B 209M).
 - b. Extruded Shapes: ASTM B 221 (ASTM B 221M).
 - 3. Stainless-Steel Sheet: ASTM A 666, Type 304.
 - 4. Copper-Alloy Brass Sheet: ASTM B 36/B 36M, alloy UNS No. C26000 (cartridge brass, 70 percent copper).



5. Copper-Alloy Bronze Sheet: ASTM B 36/B 36M, alloy UNS No. C28000 (muntz metal, 60 percent copper).
6. Clear Float Glass: ASTM C 1036, Type I, Class 1, Quality q3, 3 **OR** 6, **as directed**, mm thick.
7. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear) **OR** Class 2 (tinted, heat absorbing, and light reducing), bronze tint, **as directed**.
8. Break Glass: Clear annealed float glass, ASTM C 1036, Type I, Class 1, Quality q3, 1.5 mm thick, single strength.
9. Tempered Break Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick.
10. Wire Glass: ASTM C 1036, Type II, Class 1, Form 1, Quality q8, Mesh m1 (diamond), 6 mm thick.
11. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), 1.5 **OR** 3 **OR** 6, **as directed**, mm thick, with Finish 1 (smooth or polished) **OR** Finish 2 (patterned, textured), **as directed**.
12. Acrylic Bubble: One piece.

B. Fire Protection Cabinet

1. Cabinet Type: Suitable for fire extinguisher **OR** extinguisher and hose valve **OR** hose, rack, valve, and extinguisher **OR** hose, rack, and valve **OR** hose valve, **as directed**.
2. Cabinet Construction: Nonrated **OR** 1-hour fire rated **OR** 2-hour fire rated, **as directed**.
 - a. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- (1.1-mm-) thick, cold-rolled steel sheet lined with minimum 5/8-inch- (16-mm-) thick, fire-barrier material. Provide factory-drilled mounting holes.
3. Cabinet Material: Steel **OR** Aluminum **OR** Stainless-steel, **as directed**, sheet.
 - a. Shelf: Same metal and finish as cabinet.
4. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
 - a. Trimless with Concealed Flange: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet. Provide recessed flange, of same material as box, attached to box to act as plaster stop **OR** drywall bead, **as directed**.
 - b. Trimless with Hidden Flange: Flange of same metal and finish as box overlaps surrounding wall finish and is concealed from view by an overlapping door.
 - c. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
5. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.
 - a. Square-Edge Trim: 1-1/4- to 1-1/2-inch (32- to 38-mm) backbend depth.
 - b. Rolled-Edge Trim: 2-1/2-inch (64-mm) **OR** 4-inch (102-mm) **OR** 4-1/2-inch (114-mm), **as directed**, backbend depth.
6. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim. Provide where walls are of insufficient depth for semirecessed cabinet installation.
7. Cabinet Trim Material: Steel sheet **OR** Aluminum sheet **OR** Extruded-aluminum shapes **OR** Stainless-steel sheet **OR** Copper-alloy brass sheet **OR** Copper-alloy bronze sheet **OR** Same material and finish as door, **as directed**.
8. Door Material: Steel sheet **OR** Aluminum sheet **OR** Extruded-aluminum shapes **OR** Stainless-steel sheet **OR** Copper-alloy brass sheet **OR** Copper-alloy bronze sheet, **as directed**.
9. Door Style: Fully glazed, frameless, backless, acrylic panel **OR** Fully glazed panel with frame **OR** Full bubble, frameless **OR** Full bubble with frame **OR** Full bubble with frameless, rotating turntable **OR** Horizontal duo panel with frame **OR** Vertical duo panel with frame **OR** Center glass panel with frame **OR** Solid opaque panel with frame **OR** Flush opaque panel, frameless, with no exposed hinges, **as directed**.



10. Door Glazing: Clear float glass **OR** Tempered float glass (clear) **OR** Tempered float glass (bronze tint) **OR** Break glass **OR** Tempered break glass **OR** Wire glass **OR** Mirror glass **OR** Acrylic sheet **OR** Break acrylic bubble **OR** Molded acrylic bubble, **as directed**.
 - a. Acrylic Sheet Color: Clear **OR** Bronze, **as directed**, transparent acrylic sheet.
 - b. Acrylic Sheet Color: Clear transparent acrylic sheet painted white **OR** red **OR** black, **as directed**, on unexposed side.
 - c. Acrylic Bubble Color: Clear **OR** Bronze **OR** Red, **as directed**, transparent.
11. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - a. Provide projecting lever handle with cam-action latch **OR** projecting door pull and friction latch **OR** recessed door pull and friction latch **OR** manufacturer's standard, **as directed**.
 - b. Provide continuous hinge, of same material and finish as trim, **OR** concealed hinge **OR** pivot hinge **OR** manufacturer's standard hinge, **as directed**, permitting door to open 180 degrees.
12. Accessories:
 - a. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - b. Break-Glass Strike: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.
 - c. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
 - d. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle **OR** Cylinder lock, keyed alike to other cabinets, **as directed**.
 - e. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed.
 - 1) Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
 - a) Location: Applied to cabinet door **OR** cabinet glazing **OR** location indicated on Drawings, **as directed**.
 - b) Application Process: Silk-screened **OR** Engraved **OR** Etched **OR** Decals **OR** Pressure-sensitive vinyl letters, **as directed**.
 - c) Lettering Color: Red **OR** Black **OR** White, **as directed**.
 - d) Orientation: Vertical **OR** Horizontal **OR** As indicated on Drawings, **as directed**.
 - f. Alarm: Manufacturer's standard alarm that actuates when fire protection cabinet door is opened and that is powered by batteries **OR** low voltage, complete with transformer, **as directed**.
13. Finishes:
 - a. Manufacturer's standard baked-enamel paint for the following:
 - 1) Exterior of cabinet door **OR** trim, **OR** door, and trim, **as directed**, except for those surfaces indicated to receive another finish.
 - 2) Interior of cabinet and door, **as directed**.
 - b. Aluminum: Clear anodic **OR** Color anodic **OR** Baked enamel or powder coat, **as directed**.
 - c. Steel: Factory primed for field painting **OR** Baked enamel or powder coat, **as directed**.
 - d. Stainless Steel: No. 2B **OR** No. 4 **OR** No. 6 **OR** No. 7 **OR** No. 8, **as directed**.
 - e. Copper Alloy, Brass: Buffed **OR** Hand rubbed **OR** Hand rubbed, lacquered **OR** Medium satin **OR** Fine matte **OR** Statuary conversion **OR** Patina conversion, **as directed**.
 - f. Copper Alloy, Bronze: Buffed **OR** Hand rubbed **OR** Hand rubbed, lacquered **OR** Medium satin **OR** Fine matte **OR** Statuary conversion **OR** Patina conversion, **as directed**.

C. Security Fire Protection Cabinet

1. Cabinet Type: Suitable for fire extinguisher **OR** extinguisher and hose valve **OR** hose, rack, valve, and extinguisher **OR** hose, rack, and valve **OR** hose valve, **as directed**.
2. Cabinet Construction: Nonrated **OR** 1-hour fire rated **OR** 2-hour fire rated, **as directed**.



- a. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls lined with minimum 5/8-inch- (16-mm-) thick, fire-barrier material.
3. Cabinet Material: 0.0677-inch- (1.7-mm-) thick steel **OR** 0.0966-inch- (2.5-mm-) thick steel **OR** 0.0781-inch- (2.0-mm-) thick, stainless-steel, **as directed**, sheet.
 - a. Shelf: Same metal and finish as cabinet.
4. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
 - a. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
5. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.
 - a. Square-Edge Trim: 1-1/4- to 1-1/2-inch (32- to 38-mm) backbend depth.
 - b. Rolled-Edge Trim: 2-1/2-inch (64-mm) backbend depth.
6. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall; with no trim. Provide where walls are of insufficient depth for semirecessed cabinet installation.
7. Cabinet Trim Material: Steel sheet **OR** Stainless-steel sheet **OR** Same material and finish as door, **as directed**.
8. Door Material: 0.0966-inch- (2.5-mm-) thick steel **OR** 0.0781-inch- (2.0-mm-) thick, stainless-steel **OR** 0.1094-inch- (2.8-mm-) thick, stainless-steel, **as directed**, sheet.
9. Door Style: Solid opaque panel with frame.
10. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated, and as follows:
 - a. Recessed door pull.
 - b. Continuous Hinge: Same material and finish as trim, permitting door to open 180 degrees.
 - c. Mechanical Deadlock: Lockbolt retracted and extended by five-tumbler paracentric **OR** mogul, **as directed**, cylinder; keyed one side.
 - 1) Lockbolt: 1-1/2 inches high by 3/4 inch (38 mm high by 19 mm) thick; 5/8-inch (16-mm) throw.
 - d. Mechanical Deadlock: As specified in Division 08 Section "Detention Door Hardware".
 - e. Mechanical Snaplatch: Automatic snaplatch when closed; latchbolt retracted by five-tumbler paracentric **OR** mogul, **as directed**, cylinder; keyed one side.
 - 1) Lockbolt: 1 inch high by 7/16 inch (25 mm high by 11 mm) thick; 5/16-inch (8-mm) throw.
 - f. Mechanical Snaplatch: As specified in Division 08 Section "Detention Door Hardware".
11. Accessories:
 - a. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to security fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - b. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed.
 - 1) Identify fire extinguisher in security fire protection cabinet with the words "FIRE EXTINGUISHER."
 - a) Location: Applied to cabinet door **OR** location indicated on Drawings, **as directed**.
 - b) Application Process: Silk-screened **OR** Engraved **OR** Etched **OR** Decals **OR** Pressure-sensitive vinyl letters, **as directed**.
 - c) Lettering Color: Red **OR** Black **OR** White, **as directed**.
 - d) Orientation: Vertical **OR** Horizontal **OR** As indicated on Drawings, **as directed**.
 - c. Keys to Door Locks: Three per lock.
12. Finishes:
 - a. Manufacturer's standard baked-enamel paint for the following:



- 1) Exterior of cabinet door **OR** trim, **OR** door, and trim, **as directed**, except for those surfaces indicated to receive another finish.
 - 2) Interior of cabinet and door, **as directed**.
 - b. Steel: Factory primed for field painting **OR** Baked enamel or powder coat, **as directed**.
 - c. Stainless Steel: No. 4 finish.
- D. Fabrication
1. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 - a. Weld joints and grind smooth.
 - b. Provide factory-drilled mounting holes.
 - c. Prepare doors and frames to receive locks.
 - d. Install door locks at factory.
 2. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
 - a. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
 - b. Fabricate door frames of one-piece construction with edges flanged.
 - c. Miter and weld perimeter door frames.
 3. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.
- E. General Finish Requirements
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 2. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
 3. Finish fire protection cabinets after assembly.
 4. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- F. Aluminum Finishes
1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
 2. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
 - a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black, **as directed**.
 - b. Color: As selected from full range of industry colors and color densities, **as directed**.
 3. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
- G. Steel Finishes
1. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" **OR** SSPC-SP 8, "Pickling", **as directed**. After cleaning, apply a conversion coating suited to the organic coating to be applied over it, **as directed**.
 2. Factory Prime Finish: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
 3. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).



- a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

H. Stainless-Steel Finishes

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - c. Directional Satin Finish: No. 4.
 - d. Dull Satin Finish: No. 6.
 - e. Reflective, Directional Polish: No. 7.
 - f. Mirrorlike Reflective, Nondirectional Polish: No. 8.
3. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

I. Copper-Alloy Finishes

1. Buffed Finish, Lacquered: M21-O6x (Mechanical Finish: buffed, smooth specular; Coating: clear organic, air drying, as specified below).
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in 2 coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
2. Hand-Rubbed Finish, Lacquered: M31-M34-O6x (Mechanical Finish: directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed; Coating: clear organic, air drying, as specified below).
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in 2 coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
3. Statuary Conversion Coating over Satin Finish: M31-C55 (Mechanical Finish: directionally textured, fine satin; Chemical Finish: conversion coating, sulfide).
 - a. Color: Match sample.
4. Patina Conversion Coating: CDA-M36-C12-C52 (Mechanical Finish: directionally textured, uniform; Chemical Finish: nonetched cleaned, degreased; Chemical Finish: conversion coating, ammonium sulfate).
 - a. Color: Match sample.

1.3 EXECUTION

A. Preparation

1. Prepare recesses for recessed and semirecessed fire protection cabinets as required by type and size of cabinet and trim style.

B. Installation

1. General: Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights indicated below: or, if not indicated, at heights acceptable to authorities having jurisdiction.
 - a. Fire Protection Cabinets: 54 inches (1372 mm) above finished floor to top of cabinet.
2. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - a. Unless otherwise indicated, provide recessed fire protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire protection cabinets.
 - b. Provide inside latch and lock for break-glass panels.
 - c. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.
 - d. Fire-Rated, Hose and Valve **OR** Hose-Valve, **as directed**, Cabinets:
 - 1) Install cabinet with not more than 1/16-inch (1.6-mm) tolerance between pipe OD and knockout OD. Center pipe within knockout.



- 2) Seal through penetrations with firestopping sealant as specified in Division 07 Section "Penetration Firestopping".
 3. Identification: Apply decals **OR** vinyl lettering, **as directed**, at locations indicated.
- C. Adjusting And Cleaning
1. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
 2. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
 3. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
 4. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.
 5. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 13 00



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SECTION 10 44 16 13 - FIRE EXTINGUISHERS

1.1 GENERAL

- A. Description Of Work:
 - 1. This specification covers the furnishing and installation of materials for fire extinguishers. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.
- B. Summary
 - 1. Section includes portable, hand-carried and wheeled fire extinguishers and mounting brackets for fire extinguishers.
 - 2. Owner-Furnished Material: Hand-carried **OR** Wheeled, **as directed**, fire extinguishers.
- C. Submittals
 - 1. Product Data: For each type of product indicated.
 - 2. Operation and maintenance data.
 - 3. Warranty: Sample of special warranty.
- D. Quality Assurance
 - 1. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
 - 2. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 3. Preinstallation Conference: Conduct conference at Project site.
 - 4. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.
- E. Warranty
 - 1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within six years from date of Final Completion.
 - a. Failures include, but are not limited to, the following:
 - 1) Failure of hydrostatic test according to NFPA 10.
 - 2) Faulty operation of valves or release levers.

1.2 PRODUCTS

- A. Portable, Hand-Carried Fire Extinguishers
 - 1. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet **OR** mounting bracket **OR** fire protection cabinet and mounting bracket, **as directed**, indicated.
 - a. Valves: Manufacturer's standard **OR** Nickel-plated, polished brass body, **as directed**.
 - b. Handles and Levers: Manufacturer's standard **OR** Stainless steel, **as directed**.
 - c. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.
 - 2. Stored-Pressure Water Type: UL-rated 2-A, 2.5-gal. (9.5-L) nominal capacity, with water in stainless-steel container; with pressure-indicating gage.
 - 3. Stored-Pressure Antifreeze Water Type: UL-rated 2-A, 2.5-gal. (9.5-L) nominal capacity, with water and approved antifreeze solution mixed for temperatures as low as minus 40 deg F (minus 40 deg C) in stainless-steel container; with pressure-indicating gage.



4. Stored-Pressure Water-Mist Type: UL-rated 2-A:C, 2.5-gal. (9.5-L) nominal capacity, with water in enameled-steel container; with pressure-indicating gage.
5. Pressurized, AFFF-Foam Type: UL-rated 2-A:10-B, 1.6-gal. (6-L) **OR** 3-A:20-B, 2.5-gal. (9.5-L), **as directed**, nominal capacity, with AFFF foam in stainless-steel container; with pressure-indicating gage.
6. Pressurized, FFFP-Foam Type: UL-rated 3-A:20-B, 2.5-gal. (9.5-L) nominal capacity, with FFFP foam in stainless-steel container; with pressure-indicating gage.
7. Wet-Chemical Type: UL-rated 2-A:1-B:C:K, 1.6-gal. (6-L) **OR** 2.5-gal. (9.5-L), **as directed**, nominal capacity, with potassium acetate-based **OR** citrate-based **OR** carbonate-based, **as directed**, chemical in stainless-steel container; with pressure-indicating gage.
8. Regular Dry-Chemical Type: UL-rated <Insert capacity> nominal capacity, with sodium bicarbonate-based dry chemical in manufacturer's standard enameled container.
9. Regular Dry-Chemical Type in Steel Container: UL-rated 2-B:C, 1-lb (0.4-kg) **OR** 10-B:C, 2.5-lb (1.1-kg) **OR** 10-B:C, 5-lb (2.3-kg) **OR** 40-B:C, 5.5-lb (2.5-kg) **OR** 40-B:C, 6-lb (2.7-kg) **OR** 60-B:C, 10-lb (4.5-kg) **OR** 120-B:C, 20-lb (9.1-kg), **as directed**, nominal capacity, with sodium bicarbonate-based dry chemical in enameled-steel container.
10. Regular Dry-Chemical Type in Aluminum Container: UL-rated 2-B:C, 1-lb (0.4-kg) **OR** 10-B:C, 2.5-lb (1.1-kg) **OR** 10-B:C, 5-lb (2.3-kg) **OR** 40-B:C, 5.5-lb (2.5-kg) **OR** 60-B:C, 10-lb (4.5-kg) **OR** 120-B:C, 20-lb (9.1-kg), **as directed**, nominal capacity, with sodium bicarbonate-based dry chemical in enameled-aluminum container.
11. Regular Dry-Chemical Type in Brass Container: UL-rated 40-B:C, 6-lb (2.7-kg) **OR** 60-B:C, 10-lb (4.5-kg) **OR** 120-B:C, 20-lb (9.1-kg), **as directed**, nominal capacity, with sodium bicarbonate-based dry chemical in chrome-plated brass container.
12. Multipurpose Dry-Chemical Type: UL-rated <Insert capacity> nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.
13. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 1-A:10-B:C, 2.5-lb (1.1-kg) **OR** 2-A:10-B:C, 5-lb (2.3-kg) **OR** 3-A:40-B:C, 5-lb (2.3-kg) **OR** 3-A:40-B:C, 6-lb (2.7-kg) **OR** 4-A:60-B:C, 10-lb (4.5-kg) **OR** 20-A:120-B:C, 20-lb (9.1-kg), **as directed**, nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.
14. Multipurpose Dry-Chemical Type in Aluminum Container: UL-rated 1-A:10-B:C, 2.5-lb (1.1-kg) **OR** 2-A:10-B:C, 5-lb (2.3-kg) **OR** 3-A:40-B:C, 5-lb (2.3-kg) **OR** 3-A:40-B:C, 6-lb (2.7-kg) **OR** 4-A:60-B:C, 10-lb (4.5-kg) **OR** 20-A:120-B:C, 20-lb (9.1-kg), **as directed**, nominal capacity, with monoammonium phosphate-based dry chemical in enameled-aluminum container.
15. Multipurpose Dry-Chemical Type in Brass Container: UL-rated 2-A:10-B:C, 5-lb (2.3-kg) **OR** 3-A:40-B:C, 6-lb (2.7-kg) **OR** 4-A:60-B:C, 10-lb (4.5-kg) **OR** 4-A:80-B:C, 10-lb (4.5-kg) **OR** 20-A:120-B:C, 20-lb (9.1-kg), **as directed**, nominal capacity, with monoammonium phosphate-based dry chemical in chrome-plated brass container.
16. Purple-K Dry-Chemical Type in Aluminum Container: UL-rated 10-B:C, 2.5-lb (1.1-kg) **OR** 30-B:C, 5-lb (2.3-kg) **OR** 120-B:C, 20-lb (9.1-kg), **as directed**, nominal capacity, with potassium bicarbonate-based dry chemical in enameled-aluminum container.
17. Purple-K Dry-Chemical Type in Brass Container: UL-rated 80-B:C, 10-lb (4.5-kg) **OR** 120-B:C, 20-lb (9.1-kg), **as directed**, nominal capacity, with potassium bicarbonate-based dry chemical in chrome-plated brass container.
18. Carbon Dioxide Type: UL-rated 5-B:C, 5-lb (2.3-kg) **OR** 10-B:C, 10-lb (4.5-kg) **OR** 10-B:C, 15-lb (6.8-kg) **OR** 10-B:C, 20-lb (9.1-kg), **as directed**, nominal capacity, with carbon dioxide in manufacturer's standard enameled-metal **OR** enameled-steel **OR** enameled-aluminum, **as directed** container.
19. Dry-Powder Type: FMG-approved, **as directed**, UL-rated Class D, 30-lb (13.6-kg) nominal capacity, with sodium chloride-based **OR** copper-based, **as directed**, powder in enameled-steel container; with pressure-indicating gage.
20. Halon Type: UL-rated 5-B:C, 2.5-lb (1.1-kg) **OR** 10-B:C, 5-lb (2.3-kg), **as directed**, nominal capacity, in enameled-steel container; with pressure-indicating gage.
21. Clean-Agent Type in Aluminum Container: UL-rated 1-B:C, 1.4-lb (0.6-kg) **OR** 2-B:C, 2.5-lb (1.1-kg) **OR** 5-B:C, 5-lb (2.3-kg), **as directed**, nominal capacity, with HCFC Blend B agent and inert material in enameled-aluminum container; with pressure-indicating gage.



22. Clean-Agent Type in Brass Container: UL-rated 1-A:10-B:C, 11-lb (5-kg) **OR** 2-A:10-B:C, 15.5-lb (7-kg), **as directed**, nominal capacity, with HCFC Blend B agent and inert material in chrome-plated brass container; with pressure-indicating gage.
 23. Clean-Agent Type in Steel Container: UL-rated 5-B:C, 4.75-lb (2.2-kg) **OR** 1-A:10-B:C, 10-lb (4.5-kg) **OR** 2-A:10-B:C, 14-lb (6.4-kg), **as directed**, nominal capacity, with HFC blend agent and inert material in enameled-steel container; with pressure-indicating gage.
- B. Mounting Brackets
1. Mounting Brackets: Manufacturer's standard galvanized, **as directed**, steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red **OR** black, **as directed**, baked-enamel finish.
 2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
 - a. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - 1) Orientation: Vertical **OR** Horizontal, **as directed**.
- C. Wheeled Fire Extinguishers
1. Wheeled Fire Extinguishers: Type, size, and capacity for locations indicated, complete with carriage.
 - a. Carriage: Fabricated from enameled-steel pipe, complete with hanger assembly, long-range nozzle, hose, and semipneumatic solid-rubber tires **OR** wide-rim wheels, **as directed**.
 - 1) Hose: 15 feet (4.6 m) **OR** 50 feet (15.2 m) **OR** 100 feet (30.5 m), **as directed**.
 2. Pressurized, FFFP-Foam Type: UL-rated 20-A:160-B, 33-gal. (125-L) nominal capacity, with FFFP foam in stainless-steel container.
 3. Regular Dry-Chemical Type: UL-rated 160-B:C, 50-lb (23-kg) **OR** 240-B:C, 150-lb (68-kg) **OR** 160-B:C, 250-lb (113-kg), **as directed**, nominal capacity, with sodium bicarbonate-based dry chemical in regulated-pressure **OR** stored-pressure **OR** direct-pressure, **as directed**, enameled-steel container.
 4. Multipurpose Dry-Chemical Type: UL-rated 20-A:160-B:C, 30-lb (13.6-kg) **OR** 30-A:160-B:C, 50-lb (23-kg) **OR** 40-A:240-B:C, 125-lb (57-kg) **OR** 40-A:160-B:C, 250-lb (113-kg), **as directed**, nominal capacity, with monoammonium phosphate-based dry chemical in regulated-pressure **OR** stored-pressure **OR** direct-pressure, **as directed**, enameled-steel **OR** enameled-aluminum, **as directed**, container.
 5. Purple-K Dry-Chemical Type: UL-rated 160-B:C, 50-lb (23-kg) **OR** 320-B:C, 125-lb (57-kg) **OR** 160-B:C, 250-lb (113-kg), **as directed**, nominal capacity, with potassium bicarbonate-based dry chemical in regulated-pressure **OR** stored-pressure **OR** direct-pressure, **as directed**, enameled-steel container.
 6. Carbon Dioxide Type: UL-rated 20-B:C, 50-lb (23-kg) **OR** 20-B:C, 100-lb (45-kg), **as directed**, nominal capacity, with carbon dioxide in manufacturer's standard enameled-metal **OR** enameled-steel **OR** enameled-aluminum, **as directed**, container.
 7. Dry-Powder Type: FMG-approved, **as directed**, UL-rated Class D, sodium chloride-based powder, 150-lb (68-kg) **OR** copper-based powder, 250-lb (113-kg), **as directed**, nominal capacity, in regulated-pressure, enameled-steel container; with pressure-indicating gage.
 8. Clean-Agent Type: UL-rated 4-A:40-B:C, 65-lb (29-kg) **OR** 10-A:80-B:C, 150-lb (68-kg), **as directed**, nominal capacity, with HCFC Blend B agent and inert material in stored-pressure, enameled-steel container; with pressure-indicating gage.

1.3 EXECUTION

- A. Installation
1. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.



- a. Mounting Brackets: 54 inches (1372 mm) above finished floor to top of fire extinguisher. If NFPA 10 is the governing code, maximum mounting height for fire extinguishers weighing 40 lb (18 kg) or less shall be 60 inches (1524 mm); for those weighing more, maximum mounting height shall be 42 inches (1067 mm).
2. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 10 44 16 13



Task	Specification	Specification Description
10 44 16 13	01 22 16 00	No Specification Required



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SECTION 10 51 13 00 - WIRE BASKET LOCKERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for wire basket lockers. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Shop Drawings: Submitted shop drawings showing individual locker construction and overall dimensions, including complete installation instructions.

C. Product Handling

1. Store locker components flat until assembly. Protect all finishes from soiling and damage during handling.

D. Warranty

1. Manufacturer shall warranty lockers for a period of 10 years against rust and other types of corrosion, or breakage of any of the baskets and shelves under normal use.

1.2 PRODUCTS

A. Materials

1. Wire Basket Racks:
 - a. Shelving: Shelving units shall consist of minimum 13 ga. steel angle posts punched for bolting shelves.
 - b. Sway Braces: Minimum 12 ga. steel for back and sides of unit.
 - c. Shelves: Minimum 20 ga. formed steel, with down turned flanges at the back to act as backstop and to prevent removal from rear.
 - d. Dividers: Minimum 20 ga., 3-inches in height, with an attaching flange formed at right angles. Dividers shall be bolted to shelves.
 - e. Padlock Attachment: Provide minimum 14 ga. padlock staple attachment at the front edge of each shelf located to match the locking loop formed in the basket rim.
 - f. Casters (Option): 3-inch dia., swivel-type mobility casters bolted to each corner post.
 - g. Number Plates: Aluminum number plates with 3/8" high black letters. Rivet plates to shelf face at each basket opening.
2. Baskets:
 - a. Baskets shall be 12" x 13" x 8" **OR** 9" x 13" x 8", **as directed**, all wire or wire mesh or perforated steel front type. Provide number plates specified above on the front of each basket.
 - b. Pilfer Guards (Option): Provide sheet steel pilfer guard designed for field attachment to the top of the basket to cover the first 3" of depth.
3. Finish:
 - a. Baskets and pilfer guards: electroplating with bright zinc chromate.
 - b. Basket rack posts, shelves, and braces: In color selected from manufacturer's standard colors.

B. Fabrication

1. Locker components shall be fabricated square and rigid with a finish free of scratches and chips. All sides, tops, bottoms, and shelves shall be coated on both sides with a protective masking.



1.3 EXECUTION

A. Installation

1. Install lockers at the location shown in accordance with the manufacturer's instructions for plumb, level, rigid, and flush installations.
2. Anchor the units to wall studs through the locker back and to the floor using #8 pan head wood screws. Furring must be installed between lockers and wall of installations.

END OF SECTION 10 51 13 00



SECTION 10 51 13 00a - MPF METAL LOCKERS**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 – GENERAL

1.1 SUMMARY

- A. Metal lockers.

1.2 SUBMITTALS

- A. Product Data: Required
- B. Shop Drawings: Required
- C. Samples: Required

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Source: Debourgh, List Industries, Lyon Metal Products, and Republic.
- B. Locker Units:

NOTE TO SPECIFIER

The locker sizes depend on the project climate zone. See the Design Criteria and proceed as directed by the Contracting Officer.

- 1. Size, as directed by Contracting Officer :
 - a. 12" Wide x 15" Deep x 36" High (double-tier half-height)
 - b. 7 1/2" Wide x 15" Deep x 72" High (full-height half-width)
 - c. 12" Wide x 15" Deep x 72" High (full-size)
- 2. Configuration: Single tier.
- 3. Mounting: Surface mounted.
- 4. Base: Metal base.
- 5. Top: Sloped metal with closures.
- 6. Locking: Built-in padlock hasps.
- 7. Ventilation method: Door louvers, top and bottom.
- 8. Type: Conventional.
- C. Material and Finish: Steel with shop applied, baked enamel finish.

2.2 ACCESSORIES



- A. For Each Locker: Two double prong wall hooks, hat shelf, metal plate number.

PART 3 – EXECUTION

- 3.1 Install all products in accordance with manufacturer's guidelines and printed instructions.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 5/24/2012

END OF SECTION 10 51 13 00a



SECTION 10 51 13 00a - CSF METAL LOCKERS**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where provision of lockers is part of the Work.

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.10 51 13 00a

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Wardrobe locker units with hinged doors.
 2. Metal bases and filler panels.
 3. Locker room benches.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 1. Product Data: Data on locker types, sizes, and accessories.
 2. Product Data: Data on bench construction, dimensions, configuration, and accessories.
 3. Shop Drawings: Indicate layout, dimensions, details of fabrication and installation. Include plans, elevations, sections, and attachments to other Work.
 4. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Manufacturer's Instructions: Indicate component installation assembly, and installation instructions.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver materials to project site in manufacturer's original unopened protective packaging.



- C. Identify contents, manufacturer, brand name, thermal values, and applicable standards.
- D. Store materials in area protected from weather and construction operations.
- E. Protect Work from damaged during transportation, storage at Project Site, and throughout tenure of work. Protect adjacent Work and materials from damage during progress of specified Work. Damaged Work shall be repaired or replaced at no additional cost to the United States Postal Service. Furnish receipts of all loose or detachable parts.

NOTE TO SPECIFIER

****REQUIRED PART (PRODUCTS) FOLLOWS. DO NOT REVISE THIS PART, EXCEPT AS NOTED BELOW, WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. HSS Industries, Incorporated, Traverse City, MI (800) 330-9701.
 2. Lyon Metal Products, LLC, Aurora, IL (800) 323-0096.
 3. Medart, Incorporated, Greenwood, MS (800) 647-7155.
 4. Penco Products, Incorporated, Oaks, PA (800) 562-1000.
 5. Republic Storage Systems Company, Canton, OH (800) 477-1255.
- B. Subject to compliance with project requirements, manufacturers offering Locker Room Benches which may be incorporated in the Work include the following:
 1. DeBourgh Manufacturing Company, La Junta, CO, (800) 328-8829
 2. Lyon Metal Products, Aurora, IL, (800) 323-0096
 3. [_____].
- C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

NOTE TO SPECIFIER

The locker sizes depend on the project climate zone. See the Design Criteria and proceed as directed by the Contracting Officer.

- A. Type: [Single Tier] [Double Tier] lockers with sloped tops and "Z" type metal base.
- B. Sheet Steel: Commercial grade, mild annealed, cold rolled and stretcher leveled with the following thickness:
 1. Body and shelf: Minimum 24 gauge.



2. Door Frames: Minimum 16 gauge:
 3. Tops and trim: Minimum 18 gauge.
- C. Hinges: Minimum 2 inches high, 0.050 inch thick steel, 4 or 5 knuckle with spun over pin ends.
- D. Fittings:
1. Recessed locking handles with provisions for Contractor furnished padlocks.
 2. One double and three single prong coat hooks.
 3. Door numbers with numbers as directed.
 4. Rubber bumpers.
- E. Locker Unit Size: [12 inches wide by 15 inches deep by 72 inches high] [7.5 inches wide by 15 inches deep by 72 inches high] [12 inches wide by 15 inches deep by 36 inches high].
- F. Bodies: Formed and flanged.
- G. Door Frames: Formed channel shaped, welded and ground flush.
- H. Doors: One piece with vertical edges channel shaped, top and bottom, flanged at 90 degree angle, hinges welded to door and bolted to frame and ventilation louvers and top and bottom.
- I. Sloped tops: Continuous with closed ends where exposed.
- J. Fasteners and Anchors: As recommended by locker manufacturer.
- K. Finish:
1. Preparation: Clean, degrease and neutralize.
 2. Paint Materials and Application: Powder coat or electrostatically sprayed with heavy coat high quality enamel and baked at 300 degrees Fahrenheit, capable of withstanding hammer test without chipping and flaking.

NOTE TO SPECIFIER

Specify finish color to match interior paint finish.

3. Finish Color: [Blue] [Gray] to match specified interior paint finishes.

- L. Padlocks: Combination lock with master-key operation at back of lock.

2.3 LOCKER ROOM BENCHES

- A. Bench Tops: Provide manufacturer's standard one-piece units, of the following material minimum 9-1/2 inches wide by 1-1/4 inches thick, with rounded corners and edges:
1. Laminated maple with one coat of clear sealer on all surfaces and one coat of clear lacquer on top and sides.

NOTE TO SPECIFIER

If the handicap bench is not affixed to a wall (providing back support), then provide a RE4-compliant back support as part of the bench.

- B. Handicap Bench Tops: Provide manufacturer's standard one-piece units, of the following material, 20 to 24 inches deep by 48 inches long by 1-1/4 inches thick, with rounded corners and edges:
1. Laminated maple with one coat of clear sealer on all surfaces and one coat of clear lacquer on top and sides.



- C. Pedestals: Provide manufacturer's standard pedestal supports, with predrilled fastener holes, complete with fasteners and anchors, and as follows:
 - 1. Type: Tubular steel, minimum 1-3/4 inch diameter, threaded on both ends, with standard pipe flange at top and bell shaped cast base; baked-enamel finish; floor anchored with concealed fasteners.
 - 2. Color: Match locker units.
- D. Furnish a minimum of two pedestals for each bench, with pedestal spacing not more than 72 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication of special components, when possible, to ensure proper fitting of work. However, allow for adjustment and fitting of trim and filler panels whenever taking of field measurements before fabrication might delay Work.

3.3 INSTALLATION

- A. Install metal lockers at locations indicated on Drawings in accordance with manufacturer's published instructions.
- B. Install lockers plumb, level, rigid, and flush.
- C. Space fastenings about 48 inches on center, unless otherwise recommended by manufacturer. Install through back-up reinforcing plates where necessary to avoid metal distortion. Conceal fasteners.
- D. Install trim where indicated, use concealed fasteners to provide flush, hairline joints with adjacent surfaces.
- E. Install benches in accordance with manufacturer's published instructions in locations indicated on Drawings.
- F. Bench Quantity: As indicated on Drawings.



3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Inspect installation of lockers, benches, attachments, and alignment with adjacent finishes.
- C. Operate locker doors and locking devices.

3.5 ADJUSTING AND CLEANING

- A. Adjust doors and latches to operate easily without binding. Verify that integral locking devices are operating properly.
- B. Touch-up marred finishes. Use only materials and procedures recommended or furnished by locker and bench manufacturer. Replace units which cannot be restored to factory-finished appearance.

NOTE TO SPECIFIER

Coordinate the following items with drawings and delete from specification.

DRAWING COORDINATION ITEMS

Drawings should indicate the following information related to this Section.

1. *Location and number of required locker units.*
2. *Style and sizes of compartments, compartment arrangement, and size of units.*
3. *Size and location of recessed openings, if any, with details of installation.*

USPS CSF Specifications issued: 10/1/2013

Last revised: 5/24/2012

END OF SECTION



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Task	Specification	Specification Description
10 51 13 00	01 22 16 00	No Specification Required
10 51 53 00	01 22 16 00	No Specification Required



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SECTION 10 55 23 23 - POSTAL SPECIALTIES

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for postal specialties. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:

- a. USPS-approved horizontal mail receptacles.
- b. Private-delivery horizontal mail receptacles.
- c. Private postal-facility horizontal mail receptacles.
- d. Vertical mail receptacles.
- e. USPS-approved cluster box units (CBUs).
- f. Neighborhood delivery and collection box units (NDCBUs).
- g. USPS-approved parcel lockers.
- h. USPS-approved collection boxes.
- i. Private collection boxes.
- j. Data distribution boxes.
- k. Mail chutes.
- l. Accessories:
 - 1) Directory for mail receptacles.
 - 2) Key keeper.
 - 3) Key cabinet.
 - 4) Mail-sorting collection unit.
 - 5) Letter drops.
 - 6) Package depository.

C. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For postal specialties. Include plans, elevations, sections, details, identification sequence for compartments, and attachments to other work.
3. Samples: For each exposed product and for each color and texture specified.
4. Product certificates, including written approval by Postmaster General, as applicable.
5. Maintenance data.
6. Other Informational Submittals: Final USPS local postmaster approval for installed postal specialties to be served by USPS.

D. Quality Assurance

1. Source Limitations for Each Type of Postal Specialty: For USPS-approved products, use only those included on current lists of USPS manufacturers and models.
2. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling

1. Deliver lock keys to Owner by registered mail or overnight package service with a record of each corresponding lock and key number.
2. Deliver combination-lock combinations to Owner by registered mail or overnight package service with a record of each corresponding lock and combination.

F. Warranty



1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of postal specialties that fail in materials or workmanship within five years from date of Final Completion.

1.2 PRODUCTS

A. Materials

1. Aluminum: Manufacturer's standard alloy and temper for type of use and finish indicated, and as follows:
 - a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
 - b. Extruded Shapes: ASTM B 221 (ASTM B 221M).
2. Steel Sheet: Cold rolled, ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, exposed matte finish where exposed.
3. Metallic-Coated Steel Sheet: Galvanized-steel sheet, ASTM A 653/A 653M, G60 (Z180) coating designation, extra smooth where exposed; or electrolytic zinc-coated steel sheet, ASTM A 879/A 879M, Coating Designation 08Z (24G).
4. Stainless-Steel Sheet: ASTM A 666, Type 304.
5. Brass Sheet: ASTM B 36/B 36M, manufacturer's standard copper alloy.
6. Zinc Sheet or Plate: ASTM B 69, manufacturer's standard sheet or plate and zinc alloy.
7. Die-Cast Aluminum: ASTM B 85, manufacturer's standard aluminum alloy.
8. Die-Cast Brass: ASTM B 176, manufacturer's standard copper alloy.
9. Die-Cast Zinc: ASTM B 86, manufacturer's standard zinc alloy.
10. Steel Anchor Bolts, Nuts, and Washers: ASTM F 1554, Grade 36 or 55, hot-dip galvanized.
11. Stainless-Steel Anchor Bolts, Nuts, and Washers: ASTM A 193/A 193M, Grade B8M, Type 316.
12. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

B. USPS-Approved Horizontal Mail Receptacles

1. Front-Loading, USPS-Approved Horizontal Mail Receptacles: Consisting of multiple compartments with fixed, solid compartment backs, enclosed within recessed wall box. Provide access to compartments for distributing incoming mail from front of unit by unlocking master lock and swinging side-hinged master door to provide accessibility to entire group of compartments. Provide access to each compartment for removing mail by swinging compartment door. Comply with USPS-STD-4C **OR** USPS-STD-4B+, **as directed**.
 - a. Mail Delivery: USPS **OR** Private, **as directed**.
 - b. Compartments: Number and size as follows: **OR** As indicated on Drawings, of the following sizes: **OR** As indicated on Drawings, **as directed**.
 - 1) Type I: A group of mail receptacles in single-column configuration with single master door, three – eight mail compartments not less than 3 inches high by 12 inches wide by 15 inches deep (76 mm high by 305 mm wide by 381 mm deep), one outgoing mail collection compartment prepared for master-door lock, and one parcel compartment 15 inches high by 12 inches wide by 15 inches deep (381 mm high by 305 mm wide by 381 mm deep).
 - 2) Type II: A group of mail receptacles in double-column configuration with double master door, three - sixteen mail compartments not less than 3 inches high by 12 inches wide by 15 inches deep (76 mm high by 305 mm wide by 381 mm deep), one outgoing mail collection compartment prepared for master-door lock, and one **OR** two, **as directed**, parcel compartment(s): 15 inches high by 12 inches wide by 15 inches deep (381 mm high by 305 mm wide by 381 mm deep) and 18 inches high by 12 inches wide by 15 inches deep (457 mm high by 305 mm wide by 381 mm deep).
 - 3) Type III: A group of mail receptacles in double-column configuration with single master door, three - sixteen mail compartments not less than 3 inches high by 12 inches wide by 15 inches deep (76 mm high by 305 mm wide by 381 mm deep), one outgoing mail collection compartment prepared for master-door lock, and one **OR** two, **as directed**, parcel compartment(s): 15 inches high by 12 inches wide by 15

-
- 10 55 23 23 - 3



- g. Snap-on Trim: Fabricated from same material and finish as compartment doors.
- h. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.
- i. Exposed Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear **OR** Brass **OR** Dark bronze **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - 2) Baked-Enamel or Powder-Coated Finish: Silver **OR** Black **OR** Medium bronze **OR** Dark bronze **OR** Gold **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.
- 2. Rear-Loading, USPS-Approved Horizontal Mail Receptacles: Consisting of multiple compartments enclosed within recessed wall box. Provide access to compartments for distributing incoming mail from rear of unit with accessibility to entire group of compartments. Provide access to each compartment for removing mail by swinging compartment door. Comply with USPS-STD-4C **OR** USPS-STD-4B+, **as directed**.
 - a. Mail Delivery: USPS **OR** Private, **as directed**.
 - b. Compartments: Number and size as follows: **OR** As indicated on Drawings, of the following sizes: **OR** As indicated on Drawings, **as directed**.
 - 1) Type IV: A group of mail receptacles in single-column configuration with a rear-access cover, three - eight mail compartments not less than 3 inches high by 12 inches wide by 15 inches deep (76 mm high by 305 mm wide by 381 mm deep), one outgoing mail collection compartment, and one parcel compartment 15 inches high by 12 inches wide by 15 inches deep (381 mm high by 305 mm wide by 381 mm deep).
 - 2) Type V: A group of mail receptacles in double-column configuration with a rear-access cover, three - sixteen mail compartments not less than 3 inches high by 12 inches wide by 15 inches deep (76 mm high by **OR** 305 mm wide by 381 mm deep), one outgoing mail collection compartment, and one **OR** two, **as directed**, parcel compartment(s) 15 inches high by 12 inches wide by 15 inches deep (381 mm high by 305 mm wide by 381 mm deep) and 18 inches high by 12 inches wide by 15 inches deep (457 mm high by 305 mm wide by 381 mm deep).
 - 3) Type VII (No Parcel Compartment): A group of mail receptacles in single-column configuration with a rear-access cover, three - nine mail compartments not less than 3 inches high by 12 inches wide by 15 inches deep (76 mm high by 305 mm wide by 381 mm deep), and one outgoing mail collection compartment.
 - 4) Type IX (No Parcel Compartment): A group of mail receptacles in double-column configuration with a rear-access cover, three - nineteen mail compartments not less than 3 inches high by 12 inches wide by 15 inches deep (76 mm high by 305 mm wide by 381 mm deep), and one outgoing mail collection compartment.
 - c. Compartments: Number and size as follows: **OR** Number as indicated on Drawings, of the following sizes: **OR** Number and size as indicated on Drawings, **as directed**.
 - 1) Type A: Provide compartments with inside dimensions not less than 5 inches high by 6 inches wide by 15 inches deep (127 mm high by 152 mm wide by 381 mm deep).
 - 2) Type B: Provide compartments with inside dimensions not less than 5 inches high by 12-1/2 inches wide by 15 inches deep (127 mm high by 318 mm wide by 381 mm deep).
 - 3) Type C: Provide compartments with inside dimensions not less than 10-1/2 inches high by 6 inches wide by 15 inches deep (267 mm high by 152 mm wide by 381 mm deep).
 - 4) Type D: Provide compartments with inside dimensions not less than 10-1/2 inches high by 12-1/2 inches wide by 15 inches deep (267 mm high by 318 mm wide by 381 mm deep).
 - 5) Type E: Provide compartments with inside dimensions not less than 16 inches high by 12-1/2 inches wide by 15 inches deep (406 mm high by 318 mm wide by 381 mm deep).



- d. Rear-Loading Cover: Not required **OR** Lift-off rear cover fabricated from extruded aluminum or aluminum sheet, finished to match front of unit, **as directed**.
OR
Rear-Loading Door: Side hinged, fabricated from extruded aluminum or aluminum sheet, finished to match front of unit; with full-length, stainless-steel piano hinge on one side and positive-latching **OR** locking, **as directed**, mechanism on the other.
 - 1) Rear-Door Lock (for units served by USPS if lock is required): Door prepared to receive lock provided by local postmaster.
OR
Rear-Door Lock: Cylinder lock keyed to building keying system; with two **OR** three, **as directed**, keys. Provide cylinders specified in Division 08 Section "Door Hardware".
 - e. Compartment Doors: Fabricated from extruded aluminum. Equip each with lock and tenant identification as required by cited standard. Provide one compartment with outgoing mail slot, **as directed**.
 - 1) Compartment-Door Locks (for units served by USPS): Comply with USPS-L-1172C, PSIN O910, for locks and keys, or equivalent as approved by USPS; with three keys for each compartment door. Key each compartment differently.
 - 2) Compartment-Door Locks: Five-pin tumbler, cylinder cam **OR** spring-latch-type, **as directed**, locks capable of at least 1000 key changes; with two **OR** three, **as directed**, keys for each compartment door. Key each compartment differently.
 - 3) Compartment-Door Locks: Removable core locks, furnished by Owner and installed as Work of this Section.
 - 4) Compartment-Door Locks: Spring-latch-type lock designed to accommodate cylinders keyed to building keying system; with two **OR** three, **as directed**, keys for each compartment door. Provide cylinders specified in Division 08 Section "Door Hardware".
 - 5) Compartment-Door Locks: Three-digit, single-dial, combination locks with spring latch and automatic throw off. Set each compartment with different combination.
 - f. Frames: Fabricated from extruded aluminum or aluminum sheet; ganged and nested units, with cardholder and blank cards for tenant's identification behind each compartment.
 - g. Snap-on Trim: Fabricated from same material and finish as compartment doors.
 - h. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.
 - i. Exposed Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear **OR** Brass **OR** Dark bronze **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - 2) Baked-Enamel or Powder-Coated Finish: Silver **OR** Black **OR** Medium bronze **OR** Dark bronze **OR** Gold **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.
- C. Private-Delivery Horizontal Mail Receptacles
- 1. Front-Loading, Private-Delivery Horizontal Mail Receptacles: Consisting of multiple compartments with fixed, solid compartment backs, enclosed within recessed wall box. Provide access to compartments for distributing incoming mail from front of unit by unlocking master lock and swinging side-hinged master door to provide accessibility to entire group of compartments. Provide access to each compartment for removing mail by swinging compartment door.
 - a. Front-Loading Master Door: Fabricated from extruded aluminum and braced and framed to hold compartment doors; with master-door lock and concealed, full-length, stainless-steel piano hinge on one side. Fabricate master door to remain open while mail is deposited.
 - 1) Master-Door Lock: Manufacturer's standard five-pin tumbler, cylinder lock; with two **OR** three, **as directed**, keys.
OR



- Master-Door Lock: Cylinder lock keyed to building keying system; with two **OR** three, **as directed**, keys. Provide cylinders specified in Division 08 Section "Door Hardware".
- b. Compartments and Doors: Manufacturer's standard compartments with extruded aluminum doors. Equip each with lock, tenant identification, and concealed, full-length, flush hinge on one side. Provide one compartment prepared for master-door lock and with outgoing mail slot, **as directed**.
- 1) Compartments: Number and size as follows: **OR** As indicated on Drawings, of the following sizes: **OR** As indicated on Drawings, **as directed**.
 - a) Size 1: Provide compartments with inside dimensions not less than 3 inches high by 6 inches wide by 15 inches deep (76 mm high by 152 mm wide by 381 mm deep).
 - b) Size 2: Provide compartments with inside dimensions not less than 5 inches high by 3-1/2 inches wide by 15 inches deep (127 mm high by 89 mm wide by 381 mm deep).
 - c) Size 3: Provide compartments with inside dimensions not less than 5 inches high by 7-1/2 inches wide by 15 inches deep (127 mm high by 191 mm wide by 381 mm deep).
 - d) Size 4: Provide compartments with inside dimensions not less than 10-1/2 inches high by 3-1/2 inches wide by 15 inches deep (267 mm high by 89 mm wide by 381 mm deep).
 - e) Size 5: Provide compartments with inside dimensions not less than 10-1/2 inches high by 7-1/2 inches wide by 15 inches deep (267 mm high by 191 mm wide by 381 mm deep).
 - 2) Tenant Identification: 2-inch-wide by 5/8-inch- (51-mm-wide by 16-mm-) high, clear-plastic cardholder set in recessed slot in face of compartment door. Provide cardboard strip and self-adhesive numbers.

OR

Tenant Identification: Laminated, black plastic tabs, engraved with identification and adhesively applied to face of compartment door.

OR

Tenant Identification: Identification engraved into face of compartment door.
- c. Compartments and Doors: Manufacturer's standard compartments with ornamental doors fabricated from solid, die-cast brass **OR** zinc, **as directed**. Equip each with glass window, **as directed**, lock, nameplate, and two hinges.
- 1) Compartments: Number and size as follows: **OR** As indicated on Drawings, of the following sizes: **OR** As indicated on Drawings, **as directed**.
 - a) Size 1: Provide compartments 15 inches (381 mm) deep with doors 5 inches high by 3-1/2 inches wide (127 mm high by 89 mm wide).
 - b) Size 2: Provide compartments 15 inches (381 mm) deep with doors 6 inches high by 5-1/2 inches wide (152 mm high by 140 mm wide).
 - c) Size 3: Provide compartments 15 inches (381 mm) deep with doors 6 inches high by 11 inches wide (152 mm high by 279 mm wide).
 - 2) Compartment-Door Locks: Five-pin tumbler, cylinder cam **OR** spring-latch-type, **as directed**, locks capable of at least 1000 key changes; with two **OR** three, **as directed**, keys for each compartment door. Key each compartment differently.
 - 3) Compartment-Door Locks: Removable core locks, furnished by Owner and installed as Work of this Section.
 - 4) Compartment-Door Locks: Spring-latch-type lock designed to accommodate cylinders keyed to building keying system; with two **OR** three, **as directed**, keys for each compartment door. Provide cylinders specified in Division 08 Section "Door Hardware".
 - 5) Compartment-Door Locks: Three-digit, single-dial, combination locks with spring latch and automatic throw off. Set each compartment with different combination.



- d. Frames: Fabricated from extruded aluminum or aluminum sheet **OR** brass sheet **OR** zinc sheet or plate, **as directed**; ganged and nested units, with cardholder and blank cards for tenant's identification behind each compartment.
 - e. Snap-on Trim: Fabricated from same material and finish as compartment doors.
 - f. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.
 - g. Exposed Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear, **as directed**.
 - 2) Baked-Enamel or Powder-Coated Finish: Black **OR** Dark bronze **OR** Gold **OR** Medium bronze **OR** Silver **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.
 - h. Brass Finish: Buffed finish, lacquered **OR** Hand-rubbed finish, lacquered **OR** Brushed satin, lacquered, **as directed**.
 - i. Zinc Finish: Manufacturer's standard powder-coated finish, tan, **as directed**.
2. Rear-Loading, Private-Delivery Horizontal Mail Receptacles: Consisting of multiple compartments enclosed within recessed wall box. Provide access to compartments for distributing incoming mail from rear of unit with accessibility to entire group of compartments. Provide access to each compartment for removing mail by swinging compartment door.
- a. Rear-Loading Cover: Not required **OR** Lift-off rear cover fabricated from extruded aluminum or aluminum sheet, finished to match front of unit, **as directed**.
OR
 Rear-Loading Door: Side hinged, fabricated from extruded aluminum or aluminum sheet, finished to match front of unit; with full-length, stainless-steel piano hinge on one side and positive-latching **OR** locking, **as directed**, mechanism on the other. Fabricate rear-loading door to open not less than 90 degrees and to remain open while mail is deposited.
 - 1) Rear-Door Lock: Manufacturer's standard five-pin tumbler, cylinder lock; with two **OR** three, **as directed**, keys.
OR
 Rear-Door Lock: Cylinder lock keyed to building keying system; with two **OR** three, **as directed**, keys. Provide cylinders specified in Division 08 Section "Door Hardware".
 - b. Compartments and Doors: Manufacturer's standard compartments with doors fabricated from extruded aluminum. Equip each with lock, tenant identification, and concealed, full-length, flush hinge on one side. Provide one compartment prepared for master-door lock and with outgoing mail slot, **as directed**.
 - 1) Compartments: Number and size as follows: **OR** As indicated on Drawings, of the following sizes: **OR** As indicated on Drawings, **as directed**.
 - a) Size 1: Provide with inside dimensions not less than 3 inches high by 6 inches wide by 15 inches deep (76 mm high by 152 mm wide by 381 mm deep).
 - b) Size 2: Provide compartments with inside dimensions not less than 5 inches high by 3-1/2 inches wide by 15 inches deep (127 mm high by 89 mm wide by 381 mm deep).
 - c) Size 3: Provide compartments with inside dimensions not less than 5 inches high by 7-1/2 inches wide by 15 inches deep (127 mm high by 191 mm wide by 381 mm deep).
 - d) Size 4: Provide compartments with inside dimensions not less than 10-1/2 inches high by 3-1/2 inches wide by 15 inches deep (267 mm high by 89 mm wide by 381 mm deep).
 - e) Size 5: Provide compartments with inside dimensions not less than 10-1/2 inches high by 7-1/2 inches wide by 15 inches deep (267 mm high by 191 mm wide by 381 mm deep).
 - 2) Tenant Identification: 2-inch-wide by 5/8-inch- (51-mm-wide by 16-mm-) high, clear-plastic cardholder set in recessed slot in face of compartment door. Provide cardboard strip and self-adhesive numbers.
OR



Tenant Identification: Laminated, black plastic tabs, engraved with identification and adhesively applied to face of compartment door.

OR

Tenant Identification: Identification engraved into face of compartment door.

- c. Compartments and Doors: Manufacturer's standard compartments with ornamental doors fabricated from solid, die-cast brass **OR** zinc, **as directed**. Equip each with glass window, **as directed**, lock, nameplate, and two hinges.
 - 1) Compartments: Number and size as follows: **OR** As indicated on Drawings, of the following sizes: **OR** As indicated on Drawings, **as directed**.
 - a) Size 1: Provide compartments 15 inches (381 mm) deep with doors 5 inches high by 3-1/2 inches wide (127 mm high by 89 mm wide).
 - b) Size 2: Provide compartments 15 inches (381 mm) deep with doors 6 inches high by 5-1/2 inches wide (152 mm high by 140 mm wide).
 - c) Size 3: Provide compartments 15 inches (381 mm) deep with doors 6 inches high by 11 inches wide (152 mm high by 279 mm wide).
- d. Compartment-Door Locks: Five-pin tumbler, cylinder cam **OR** spring-latch-type, **as directed**, locks capable of at least 1000 key changes; with two **OR** three, **as directed**, keys for each compartment door. Key each compartment differently.
- e. Compartment-Door Locks: Removable core locks, furnished by Owner and installed as Work of this Section.
- f. Compartment-Door Locks: Spring-latch-type lock designed to accommodate cylinders keyed to building keying system; with two **OR** three, **as directed**, keys for each compartment door. Provide cylinders specified in Division 08 Section "Door Hardware".
- g. Compartment-Door Locks: Three-digit, single-dial, combination locks with spring latch and automatic throw off. Set each compartment with different combination.
- h. Frames: Fabricated from extruded aluminum or aluminum sheet **OR** brass sheet **OR** zinc sheet or plate, **as directed**; ganged and nested units, with cardholder and blank cards for tenant's identification behind each compartment.
- i. Snap-on Trim: Fabricated from same material and finish as compartment doors.
- j. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.
- k. Exposed Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear, **as directed**.
 - 2) Baked-Enamel or Powder-Coated Finish: Black **OR** Dark bronze **OR** Gold **OR** Medium bronze **OR** Silver **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.
- l. Brass Finish: Buffed finish, lacquered **OR** Hand-rubbed finish, lacquered **OR** Brushed satin, lacquered, **as directed**.
- m. Zinc Finish: Manufacturer's standard powder-coated finish, tan, **as directed**.

D. Private Postal-Facility Horizontal Mail Receptacles

- 1. Standard, Rear-Loading Horizontal Mail Receptacles: Consisting of multiple compartments with open backs, enclosed within recessed, modular wall box, with approximate overall module dimensions of 30 inches high by 23-1/2 inches wide by 15-1/2 inches deep (762 mm high by 596 mm wide by 394 mm deep); for installation between studs spaced 24 inches (610 mm) o.c. Provide access to compartments for distributing incoming mail from rear of unit with accessibility to entire group of compartments. Provide access to each compartment for removing mail by swinging compartment door.
 - a. Compartments: Provide 10 **OR** 20 **OR** 30, **as directed**, equal-sized compartments within each module.

OR

Compartments: Provide number and size, and number of modules as indicated on Drawings.
 - b. Compartment Doors: Fabricated from extruded or die-cast aluminum. Equip each with lock, tenant identification, and concealed, full-length, flush hinge on one side.



- 1) Tenant Identification: Identification engraved into face of compartment door **OR** self-adhesive placards, **as directed**.
 - 2) Compartment-Door Locks: Five-pin tumbler, cylinder cam **OR** spring-latch-type, **as directed**, locks capable of at least 1000 key changes; with two **OR** three, **as directed**, keys for each compartment door. Key each compartment differently.
 - c. Frames: Fabricated from aluminum or cold-rolled steel sheet; ganged and nested units, with cardholder and blank cards for tenant's identification behind each compartment.
 - d. Trim: Fabricated from same material as compartment doors.
 - e. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.
 - f. Exposed Aluminum Finish: Finish surfaces exposed to view with silver powder coat on doors, black on trim **OR** gold powder coat on doors and trim **OR** silver powder coat on doors and trim, **as directed**.
2. Rack-Ladder, Rear-Loading Horizontal Mail Receptacles: Consisting of multiple compartments with open backs, enclosed within recessed, modular wall box, with approximate overall module dimensions of 12 inches high by 23-1/2 inches wide by 15-1/2 inches deep (305 mm high by 596 mm wide by 394 mm deep); for installation between rack ladders. Provide access to compartments for distributing incoming mail from rear of unit with accessibility to entire group of compartments. Provide access to each compartment for removing mail by swinging compartment door.
- a. Compartments: Provide one within each module and number of modules as indicated on Drawings.
OR
Compartments: Provide two **OR** four **OR** eight **OR** 12, **as directed**, equal-sized compartments within each module and number of modules as indicated on Drawings.
OR
Compartments: Provide number and size, and number of modules as indicated on Drawings.
 - b. Compartment Doors: Fabricated from extruded aluminum. Equip each with lock, tenant identification, and concealed, full-length, flush hinge on one side.
 - 1) Tenant Identification: Identification engraved into face of compartment door **OR** self-adhesive placards, **as directed**.
 - 2) Compartment-Door Locks: Five-pin tumbler, cylinder cam **OR** spring-latch-type, **as directed**, locks capable of at least 1000 key changes; with two **OR** three, **as directed**, keys for each compartment door. Key each compartment differently.
 - c. Frames: Fabricated from aluminum or cold-rolled steel sheet; ganged and nested units, with cardholder and blank cards for tenant's identification behind each compartment.
 - d. Trim: Fabricated from same material as compartment doors.
 - e. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.
 - f. Rack Ladders: Aluminum or steel with manufacturer's standard finish.
 - 1) Height of Rack Ladders: Two **OR** Three **OR** Four **OR** Five **OR** Six, **as directed**, modules high.
 - 2) Provide two rack ladders for first column of modules and one ladder for each additional, adjacent column of modules.
 - g. Exposed Aluminum Finish: Finish surfaces exposed to view with silver powder coat on doors, black on trim.
- E. Vertical Mail Receptacles
1. USPS-Approved Vertical Mail Receptacles: Consisting of three to seven compartments enclosed within wall box; with inside dimensions of each compartment not less than 15 inches high by 5 inches wide by 6 inches deep (381 mm high by 127 mm wide by 152 mm deep). Provide access to compartments for distributing incoming mail from front of unit by unlocking master lock and tilting inner compartments forward as a group. Provide access to each compartment for removing mail by swinging compartment door. Comply with USPS-STD-4B+.



- a. Mounting: Recessed **OR** Semirecessed with mounting frame **OR** Surface mounted with mounting frame **OR** As indicated on Drawings, **as directed**.
- b. Mail Delivery: USPS **OR** Private, **as directed**.
- c. Compartments: Provide three - seven.
OR
Compartments: Provide number as indicated on Drawings.
- d. Compartment Doors and Frames: Fabricated from striated, extruded aluminum. Equip each compartment door with lock, slot in face of door to receive tenant identification, and concealed, full-length, flush hinge on one side. Provide one double-wide compartment with outgoing mail slot, **as directed**.
 - 1) Tenant Identification: Cardboard name and number tab **OR** Laminated, black plastic tabs, engraved with identification, **as directed**.
 - 2) Compartment-Door Locks (for units served by USPS): Five-pin tumbler, cylinder cam **OR** spring-latch-type, **as directed**, locks capable of at least 1000 key changes; with two **OR** three, **as directed**, keys for each compartment door. Key each compartment differently.
OR
Compartment-Door Locks: Removable core locks, furnished by Owner and installed as Work of this Section.
OR
Compartment-Door Locks: Spring-latch-type lock designed to accommodate cylinders keyed to building keying system; with two **OR** three, **as directed**, keys for each compartment door. Provide cylinders specified in Division 08 Section "Door Hardware".
- e. Frames: Fabricated from aluminum or cold-rolled steel sheet; ganged and nested units, with cardholder and blank cards for tenant's identification within each compartment.
- f. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.
- g. Exposed Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear **OR** Gold **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - 2) Baked-Enamel or Powder-Coated Finish: Aluminum **OR** Black **OR** Brass **OR** Dark bronze **OR** Gold **OR** Green **OR** Ivory **OR** Medium bronze **OR** Silver **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.

F. USPS-Approved Cluster Box Units (CBUs)

- 1. General: Consisting of multiple compartments enclosed within freestanding, pedestal-mounted enclosure. Provide access to compartments for distributing incoming mail from front of unit by unlocking master lock and swinging pair of side-hinged master doors to provide accessibility to entire group of compartments. Provide access to each compartment for removing mail by swinging compartment door. Comply with USPS-B-1118F.
- 2. Compartment Enclosure: Fabricated from aluminum sheet with aluminum mounting pedestal and weather-protection hood, with the following number and size of compartments:
 - a. Type I: Provide eight compartments 12 inches wide by 3 inches high by 15 inches deep (305 mm wide by 76 mm high by 381 mm deep), one outgoing mail compartment 12 inches wide by 3 inches high by 15 inches deep (305 mm wide by 76 mm high by 381 mm deep), one parcel compartment 12 inches wide by 10 inches high by 15 inches deep (305 mm wide by 254 mm high by 381 mm deep), and another parcel compartment 12 inches wide by 13-1/2 inches high by 15 inches deep (305 mm wide by 343 mm high by 381 mm deep).
 - b. Type II: Provide 12 compartments 12 inches wide by 3 inches high by 15 inches deep (305 mm wide by 76 mm high by 381 mm deep), one outgoing mail compartment 12 inches wide by 3 inches high by 15 inches deep (305 mm wide by 76 mm high by 381 mm deep), and one parcel compartment 12 inches wide by 10 inches high by 15 inches deep (305 mm wide by 254 mm high by 381 mm deep).



- c. Type III: Provide 16 compartments 12 inches wide by 3 inches high by 15 inches deep (305 mm wide by 76 mm high by 381 mm deep), one outgoing mail compartment 12 inches wide by 3 inches high by 15 inches deep (305 mm wide by 76 mm high by 381 mm deep), one parcel compartment 12 inches wide by 10 inches high by 15 inches deep (305 mm wide by 254 mm high by 381 mm deep), and another parcel compartment 12 inches wide by 13-1/2 inches high by 15 inches deep (305 mm wide by 343 mm high by 381 mm deep).
 - d. Type IV: Provide 13 compartments 12 inches wide by 4-3/4 inches high by 15 inches deep (305 mm wide by 121 mm high by 381 mm deep), one outgoing mail compartment 12 inches wide by 4-3/4 inches high by 15 inches deep (305 mm wide by 121 mm high by 381 mm deep), and one parcel compartment 12 inches wide by 10 inches high by 15 inches deep (305 mm wide by 254 mm high by 381 mm deep).
 3. Compartment Doors and Frames: Fabricated from one-piece extruded aluminum or aluminum sheet. Equip each compartment door with lock, tenant identification, and concealed, full-length, flush hinge on one side. Provide outgoing mail slot with weather protection flap.
 - a. Tenant Identification: Number engraved into face **OR** applied into recess, **as directed**, of compartment door.
 - b. Compartment-Door Locks: Comply with USPS-L-1172C, PSIN O910, for locks and keys, or equivalent as approved by USPS; with three keys for each compartment door. Key each compartment differently.
 - c. Parcel-Locker-Door Locks: Two-key security system in which control key provides access to parcel-locker key, which opens compartment and is retained once opened.
 4. Pedestal: Aluminum, with same finish as compartment enclosure and attached with theft-resistant fasteners.
 5. Exposed Aluminum Finish: Finish surfaces exposed to view with powder-coated finish in postal gray (light gray) **OR** color as selected from manufacturer's full range of colors, **as directed**.
- G. Neighborhood Delivery And Collection Box Units (NDCBUs)
 1. General: Consisting of multiple compartments, with inside dimensions of each compartment not less than 5 inches high by 6 inches wide by 15 inches deep (127 mm high by 152 mm wide by 381 mm deep), enclosed within freestanding, pedestal-mounted enclosure. Provide access to compartments for distributing incoming mail from rear of unit by side-hinged rear door with accessibility to entire group of compartments. Provide access to each compartment for removing mail by swinging compartment door.
 2. Compartment Enclosure: Fabricated from aluminum sheet with integral weather protection hood, with eight equal-sized compartments (Type I) **OR** 12 equal-sized compartments (Type II) **OR** 16 equal-sized compartments (Type III) **OR** compartments of number and size as indicated on Drawings, **as directed**.
 3. Compartment Doors and Frames: Fabricated from one-piece extruded aluminum or aluminum sheet. Equip each compartment door with lock, tenant identification, and concealed, full-length, flush hinge on one side. Provide top left compartment with outgoing mail slot, **as directed**.
 - a. Tenant Identification: Number engraved into face of compartment door.
 - b. Compartment-Door Locks: Dustproof, five-pin tumbler, cylinder cam locks capable of at least 1000 key changes; with three, **as directed**, keys for each compartment door. Key each compartment differently.
 4. Rear-Loading Door: Fabricated from aluminum sheet, with full-length, stainless-steel piano hinge on one side and three-point latching mechanism on the other. Fabricate rear-loading door to open not less than 90 degrees and to remain open while mail is deposited.
 - a. Rear-Door Lock: Door prepared to receive lock furnished by local postmaster.
OR
Rear-Door Lock: Cylinder lock with two **OR** three, **as directed**, keys. Provide cylinders specified in Division 08 Section "Door Hardware".
 5. Pedestal: Same material and finish as compartment enclosure and attached with theft-resistant fasteners **OR** As indicated on Drawings, **as directed**.
 6. Exposed Aluminum Finish: Finish surfaces exposed to view as follows:
 - a. Anodic Finish: Clear, **as directed**.



- b. Baked-Enamel or Powder-Coated Finish: Black **OR** Dark bronze **OR** Gold **OR** Medium bronze **OR** Color as selected from manufacturer's full range, **as directed**.

H. USPS-Approved Parcel Lockers

1. Front-Loading, USPS-Approved Indoor Parcel Lockers: Consisting of single or multiple compartments enclosed within a larger enclosure of type indicated below. Provide access to compartments for distributing incoming parcels from front of unit. Provide access to each compartment for removing parcels by swinging compartment door. Comply with USPS-STD-4C **OR** USPS-STD-4B+ or USPS-B-1116A construction, adapted for larger-sized, interior, parcel compartments, **as directed**.
 - a. Enclosure Type: Recessed **OR** Freestanding, **as directed**.
 - b. Mail Delivery: USPS **OR** Private, **as directed**.
 - c. Compartments: Number and size as follows: **OR** As indicated on Drawings, of the following sizes: **OR** As indicated on Drawings, **as directed**.
 - 1) Type X, Parcel Only (No Master Door): Single parcel receptacle 15 inches high by 12 inches wide by 15 inches deep (381 mm high by 305 mm wide by 381 mm deep) **OR** 18 inches high by 12 inches wide by 15 inches deep (457 mm high by 305 mm wide by 381 mm deep), **as directed**.
 - 2) Type X, Parcel Only (No Master Door): A group of parcel receptacles in single-column configuration without a master door; one **OR** two, **as directed**, compartment(s) 18 inches high by 12 inches wide by 15 inches deep (457 mm high by 305 mm wide by 381 mm deep) and one compartment 15 inches high by 12 inches wide by 15 inches deep (381 mm high by 305 mm wide by 381 mm deep).
 - 3) Type XI, Parcel Only: A group of parcel receptacles in single-column configuration with single master door prepared for master-door lock; one **OR** two, **as directed**, compartment(s) 15 inches high by 12 inches wide by 15 inches deep (381 mm high by 305 mm wide by 381 mm deep) and one **OR** two, **as directed**, compartment(s) 18 inches high by 12 inches wide by 15 inches deep (457 mm high by 305 mm wide by 381 mm deep).
 - d. Compartments: Fabricated from aluminum sheet with number and size as follows: **OR** as indicated on Drawings, **as directed**.
 - 1) Type I: Provide one box with two compartments, one on top of the other, each compartment with inside dimensions of 12 inches wide by 14 inches high by 15 inches deep (305 mm wide by 356 mm high by 381 mm deep).
 - 2) Type II: Provide one box with four compartments, side by side, two on top and two on bottom, each compartment with inside dimensions of 12 inches wide by 14 inches high by 15 inches deep (305 mm wide by 356 mm high by 381 mm deep).
 - e. Front-Loading Master Door: Fabricated to hold compartment doors; prepared to receive master-door lock provided by local postmaster.
 - f. Compartment Doors and Frames: Fabricated from same material and finish as adjacent mail receptacles **OR** extruded aluminum **OR** aluminum sheet **OR** metallic-coated steel sheet **OR** aluminum or metallic-coated steel sheet, **as directed**. Equip each compartment door with lock, identification, and concealed, full-length, spring-loaded, flush hinge on right side.
 - 1) Compartment Identification: Black, sequential numbers engraved into **OR** stamped onto, **as directed**, recess in face of compartment door.
 - 2) Compartment-Door Locks (for USPS delivery): Dual lock security system in which master lock provides access to customer lock (USPS-L-1172C, PSIN O910) and parcel-locker key opens compartment and is retained once opened.
 - 3) Compartment-Door Locks (for private delivery): Two-key security system in which control key provides access to parcel-locker key, which opens compartment and is retained once opened.
 - g. Exposed Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear **OR** Brass **OR** Dark bronze **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.



- 2) Baked-Enamel or Powder-Coated Finish: Silver **OR** Black **OR** Medium bronze **OR** Dark bronze **OR** Gold **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.
- h. Metallic-Coated Steel Finish: Finish surfaces exposed to view with baked-enamel or powder-coated finish; color as indicated by manufacturer's designations **OR** color as selected from manufacturer's full range, **as directed**.
2. Rear-Loading, USPS-Approved Indoor Parcel Lockers: Consisting of single or multiple compartments enclosed within recessed wall box. Provide access to compartments for distributing incoming parcels from rear of unit with accessibility to entire group of compartments. Provide access to each compartment for removing parcels by swinging compartment door. Comply with USPS-STD-4C **OR** USPS-STD-4B+ or USPS-B-1116A construction, adapted for larger-sized, interior, parcel compartments, **as directed**.
 - a. Mail Delivery: USPS **OR** Private, **as directed**.
 - b. Compartments: Number and size as follows: **OR** As indicated on Drawings, of the following sizes: **OR** As indicated on Drawings, **as directed**.
 - 1) Type XII, Parcel Only: A group of parcel receptacles in single-column configuration with a rear-access cover; one **OR** two, **as directed** compartment(s) 15 inches high by 12 inches wide by 15 inches deep (381 mm high by 305 mm wide by 381 mm deep) and one **OR** two, **as directed**, compartment(s) 18 inches high by 12 inches wide by 15 inches deep (457 mm high by 305 mm wide by 381 mm deep).
 - c. Compartments: Fabricated enclosure with number and size as follows: **OR** as indicated on Drawings, **as directed**.
 - 1) Type I: Provide one box with two compartments, one on top of the other, each compartment with inside dimensions of 12 inches wide by 14 inches high by 15 inches deep (305 mm wide by 356 mm high by 381 mm deep).
 - 2) Type II: Provide one box with four compartments, side by side, two on top and two on bottom, each compartment with inside dimensions of 12 inches wide by 14 inches high by 15 inches deep (305 mm wide by 356 mm high by 381 mm deep).
 - d. Rear-Loading Cover: Not required **OR** Lift-off rear cover fabricated from extruded aluminum or aluminum sheet, finished to match front of unit, **as directed**.
OR
 Rear-Loading Door: Side hinged, fabricated from extruded aluminum or aluminum sheet, finished to match front of unit; with full-length, stainless-steel piano hinge on one side and positive-latching **OR** locking, **as directed**, mechanism on the other.
 - 1) Rear-Door Lock: Door prepared to receive lock provided by local postmaster.
OR
 Rear-Door Lock: Cylinder lock keyed to building keying system; with two **OR** three, **as directed**, keys. Provide cylinders specified in Division 08 Section "Door Hardware".
 - e. Compartment Doors and Frames: Fabricated from same material and finish as adjacent mail receptacles **OR** extruded aluminum **OR** aluminum sheet **OR** metallic-coated steel sheet **OR** aluminum or metallic-coated steel sheet, **as directed**. Equip each compartment door with lock, identification, and concealed, full-length, spring-loaded, flush hinge on one side.
 - 1) Compartment Identification: Black, sequential numbers engraved into **OR** stamped onto, **as directed**, recess in face of compartment door.
 - 2) Compartment-Door Locks (for USPS delivery): Dual-lock security system in which master lock provides access to customer lock (USPS-L-1172C, PSIN O910) and parcel-locker key opens compartment and is retained once opened.
 - 3) Compartment-Door Locks (for private delivery): Two-key security system in which control key provides access to parcel-locker key, which opens compartment and is retained once opened.
 - f. Exposed Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear **OR** Brass **OR** Dark bronze **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.



- 2) Baked-Enamel or Powder-Coated Finish: Silver **OR** Black **OR** Medium bronze **OR** Dark bronze **OR** Gold **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.
- g. Metallic-Coated Steel Finish: Finish surfaces exposed to view with baked-enamel or powder-coated finish; color as indicated by manufacturer's designations **OR** color as selected from manufacturer's full range, **as directed**.
3. USPS-Approved Outdoor Parcel Lockers (OPLs), Pedestal Mounted: Consisting of multiple compartments enclosed within freestanding, pedestal-mounted enclosure. Provide access to compartments for distributing incoming mail from front of unit by unlocking master lock and swinging pair of side-hinged master doors to provide accessibility to entire group of compartments. Provide access to each compartment for removing mail by swinging compartment door. Comply with USPS-B-1116A.
 - a. Compartment Enclosure: Fabricated from aluminum sheet with aluminum mounting pedestal and weather-protection hood, with the following number and size of compartments:
 - 1) Type I: Provide one box with two compartments, one on top of the other, each compartment with inside dimensions of 12 inches wide by 14 inches high by 15 inches deep (305 mm wide by 356 mm high by 381 mm deep).
 - 2) Type II: Provide one box with four compartments, side by side, two on top and two on bottom, each compartment with inside dimensions of 12 inches wide by 14 inches high by 15 inches deep (305 mm wide by 356 mm high by 381 mm deep).
 - b. Compartment Doors and Frames: Fabricated from one-piece extruded aluminum or aluminum sheet. Equip each compartment door with lock, tenant identification, and concealed, full-length, flush hinge on one side. Provide outgoing mail slot with weather protection flap.
 - 1) Locker Identification: Number engraved into face **OR** applied into recess, **as directed**, of compartment door.
 - 2) Door Locks: Two-key security system in which control key provides access to parcel-locker key, which opens compartment and is retained once opened.
 - c. Pedestal: Aluminum, with same finish as compartment enclosure and attached with theft-resistant fasteners.
 - d. Exposed Aluminum Finish: Finish surfaces exposed to view with powder-coated finish in postal gray (light gray) **OR** color as selected from manufacturer's full range of colors, **as directed**.
- I. USPS-Approved Collection Boxes
 1. USPS-Approved, Front-Loading Collection **OR** Receiving, **as directed**, Boxes: Consisting of single compartment with fire-resistant cushion bottom, enclosed within wall box, with mail slot **OR** hopper door, **as directed**, to receive mail. Provide access to compartment for collecting mail from front of unit. Comply with USPS Publication 16.
 - a. Mail Collection: USPS **OR** Private, **as directed**.
 - b. Mounting: Recessed **OR** Semirecessed **OR** Surface mounted, **as directed**.
 - c. Type: Collection box **OR** Receiving box for mail chutes, **as directed**.
 - d. Height: Sized to match height of four **OR** five **OR** six **OR** seven, **as directed**, horizontal mail receptacles.
OR
Height: As indicated on Drawings, **as directed**.
 - e. Compartment Door and Frame: Fabricated from 1/4-inch- (6-mm-) **OR** minimum 1/8-inch- (3-mm-), **as directed**, thick aluminum, with opening not less than 12 by 20 inches (305 by 508 mm) and not more than 18 by 30 inches (457 by 762 mm). Equip door with lock and concealed, full-length, flush hinge on one side.
 - 1) Door Lock (for units served by USPS): Door prepared to receive lock provided by local postmaster.
OR



- Door Lock: Cylinder lock keyed to building keying system; with two **OR** three, **as directed**, keys. Provide cylinders specified in Division 08 Section "Door Hardware".
- 2) Identification: Engrave face of compartment door with 1-inch- (25-mm-) high letters as follows: "U.S. MAIL LETTER BOX" on two lines at top or bottom of unit.
 - 3) Door Style: Set door within face frame **OR** Extend door full width and height of unit, with no exposed frame, **as directed**.
- f. Mail Slot: Fabricated from 1/4-inch- (6-mm-) thick aluminum, with 11-inch-wide by 1-1/4-inch- (279-mm-wide by 32-mm-) high opening, protected by inside hood and hinge flap, and with inside baffle to prevent removal of mail from box.
- OR**
- Hopper Door: Fabricated from 1/4-inch- (6-mm-) thick aluminum, with opening that allows a bundle measuring 6-1/2 inches wide by 11-1/2 inches long by 4 inches high (165 mm wide by 292 mm long by 102 mm high) to be deposited, and with inside baffle to prevent removal of mail from box. Equip door with door pull and concealed, full-length bottom hinge.
- 1) Identification: Engrave face of hopper door with 1-inch- (25-mm-) high letters as follows: "LETTERS AND LETTER MAIL TIED IN BUNDLES."
 - 2) Door Style: Set door within face frame **OR** Extend door full width and height of unit, with no exposed frame, **as directed**.
- g. Exposed Materials: Fabricated from stainless-steel-clad **OR** brass-clad, **as directed**, extruded or sheet aluminum.
- h. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.
- i. Schedule-Card Holder: Provide recessed or surface-mounted holder for pick-up schedule card in center of bottom front portion of unit. Fabricate of same material and finish as front of unit.
- j. Mailbag Hooks: Provide two aluminum or stainless-steel hooks at exterior front edge of bottom of surface-mounted units, spaced 15 to 17-1/2 inches (381 to 445 mm) apart, for supporting mailbags.
- k. Mailbag Rack: Provide internal rack system for supporting mailbags within unit.
2. USPS-Approved, Rear-Loading Collection Boxes: Consisting of single compartment with fire-resistant cushion bottom, enclosed within recessed wall box, with mail slot **OR** hopper door, **as directed**, to receive mail. Provide access to compartment for collecting mail from rear of unit. Comply with USPS Publication 16.
- a. Mail Collection: USPS **OR** Private, **as directed**.
 - b. Height: Sized to match height of four **OR** five **OR** six **OR** seven, **as directed**, horizontal mail receptacles.
- OR**
- Height: As indicated on Drawings, **as directed**.
- c. Compartment Frame and Front Panel: Fabricated from 1/4-inch- (6-mm-) **OR** minimum 1/8-inch- (3-mm-), **as directed**, thick aluminum.
- 1) Identification: Engrave face of front panel with 1-inch- (25-mm-) high letters as follows: "U.S. MAIL LETTER BOX" on two lines at top or bottom of unit.
- d. Mail Slot: Fabricated from 1/4-inch- (6-mm-) thick metal plate, with 11-inch-wide by 1-1/4-inch- (279-mm-wide by 32-mm-) high opening, protected by inside hood and hinge flap, and with inside baffle to prevent removal of mail from box.
- OR**
- Hopper Door: Fabricated from 1/4-inch- (6-mm-) thick metal plate, with opening that allows a bundle measuring 6-1/2 inches wide by 11-1/2 inches long by 4 inches high (165 mm wide by 292 mm long by 102 mm high) to be deposited, and with inside baffle to prevent removal of mail from box. Equip door with door pull and concealed, full-length bottom hinge.
- 1) Identification: Engrave face of hopper door with 1-inch- (25-mm-) high letters as follows: "LETTERS AND LETTER MAIL TIED IN BUNDLES."
 - 2) Door Style: Set door within face frame **OR** Extend door full width and height of unit, with no exposed frame, **as directed**.



- e. Rear-Loading Enclosure: Lift-off rear cover fabricated from same material and finish as front of unit.
OR
 Rear-Loading Door: Side hinged, with opening not less than 12 by 20 inches (305 by 508 mm) and not more than 18 by 30 inches (457 by 762 mm), fabricated from same material and finish as front of unit; with full-length, stainless-steel piano hinge on one side and positive-latching mechanism on the other. Fabricate rear-loading door to remain open while mail is collected.
 - 1) Rear-Door Lock (for units served by USPS): Door prepared to receive lock provided by local postmaster.
OR
 Rear-Door Lock: Cylinder lock keyed to building keying system; with two **OR** three, **as directed**, keys. Provide cylinders specified in Division 08 Section "Door Hardware".
 - f. Exposed Materials: Fabricated from extruded or sheet aluminum.
 - g. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.
 - h. Schedule-Card Holder: Provide recessed or surface-mounted holder for pick-up schedule card in center of bottom front portion of unit. Fabricate of same material and finish as front of unit.
 - i. Mailbag Hooks: Provide two aluminum or stainless-steel hooks at exterior front edge of bottom of surface-mounted units, spaced 15 to 17-1/2 inches (381 to 445 mm) apart, for supporting mailbags.
 - j. Mailbag Rack: Provide internal rack system for supporting mailbags within unit.
 - 3. Finish surfaces exposed to view as follows:
 - a. Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear **OR** Black **OR** Gold **OR** Dark bronze **OR** Light bronze **OR** Medium bronze **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - 2) Baked-Enamel or Powder-Coated Finish: Black **OR** Gold **OR** Dark bronze **OR** Medium bronze **OR** Silver **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.
 - b. Brass Finish: Buffed finish, lacquered **OR** Hand-rubbed finish, lacquered **OR** Brushed satin, lacquered, **as directed**.
 - c. Stainless-Steel Finish: No. 4.
- J. Private Collection Boxes
- 1. Private, Horizontal, Front-Loading Collection Boxes: Consisting of single compartment of same depth as horizontal mail receptacles, enclosed within wall box, with slot in top of front to receive mail. Provide access to compartment for collecting mail from front of unit.
 - a. Height: Sized to match height of four **OR** five **OR** six **OR** seven, **as directed**, horizontal mail receptacles.
 - b. Mounting: Recessed **OR** Semirecessed **OR** Surface mounted, **as directed**.
 - c. Compartment Door and Frame: Fabricated from extruded aluminum or aluminum sheet that is full height of unit including **OR** in portion of unit below, **as directed**, mail slot, and equipped with lock and concealed, continuous side hinge.
 - 1) Door Lock (for units served by USPS): Door prepared to receive lock provided by local postmaster.
OR
 Door Lock: Cylinder lock keyed to building keying system; with two **OR** three, **as directed**, keys. Provide cylinders specified in Division 08 Section "Door Hardware".
 - 2) Identification: Engrave face of compartment door with 1-inch- (25-mm-) high letters as follows: "LETTERS" **OR** "OUTGOING MAIL" **OR** "OFFICE," **as directed**.
 - d. Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear, **as directed**.



- 2) Baked-Enamel or Powder-Coated Finish: Black **OR** Dark bronze **OR** Gold **OR** Medium bronze **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.
2. Private, Horizontal, Rear-Loading Collection Boxes: Consisting of single compartment of same depth as horizontal mail receptacles, enclosed within recessed wall box, with slot in top of front to receive mail. Provide access to compartment for collecting mail from rear of unit.
 - a. Height: Sized to match height of four **OR** five **OR** six **OR** seven, **as directed**, horizontal mail receptacles.
 - b. Rear-Loading Cover: Not required **OR** Lift-off rear cover fabricated from extruded aluminum or aluminum sheet, finished to match front of unit, **as directed**.
OR
Rear-Loading Door: Side hinged, fabricated from extruded aluminum or aluminum sheet, finished to match front of unit; with continuous hinge on one side and positive-latching **OR** locking, **as directed**, mechanism on the other.
 - 1) Rear-Door Lock (for units served by USPS if lock is required): Door prepared to receive lock provided by local postmaster.
OR
Rear-Door Lock: Cylinder lock keyed to building keying system; with two **OR** three, **as directed**, keys. Provide cylinders specified in Division 08 Section "Door Hardware".
 - c. Exposed Materials: Fabricated from extruded or sheet aluminum.
 - d. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.
 - e. Identification: Engrave front of unit below mail slot with 1-inch- (25-mm-) high letters as follows: "LETTERS" **OR** "OUTGOING MAIL" **OR** "OFFICE," **as directed**.
 - f. Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear, **as directed**.
 - 2) Baked-Enamel or Powder-Coated Finish: Black **OR** Dark bronze **OR** Gold **OR** Medium bronze **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.
3. Vertical Collection Boxes: Consisting of single compartment enclosed within wall box, with slot in top of front to receive mail. Provide access to compartment for collecting incoming mail from front of unit.
 - a. Mounting: Recessed **OR** Semirecessed **OR** Surface mounted, **as directed**.
 - b. Size: Same height as adjacent vertical mail receptacles **OR** 8-3/4 inches wide by 19 inches high by 6-1/2 inches deep (222 mm wide by 483 mm high by 165 mm deep) **OR** 15 inches wide by 19 inches high by 6-1/2 inches deep (381 mm wide by 483 mm high by 165 mm deep), **as directed**.
 - c. Compartment Door and Frame: Fabricated from aluminum, with opening for mail. Equip door with lock and concealed, full-length, flush hinge on one side. Set door within face frame.
 - 1) Door Lock (for units served by USPS): Door prepared to receive lock provided by local postmaster.
OR
Door Lock: Cylinder lock keyed to building keying system; with two **OR** three, **as directed**, keys. Provide cylinders specified in Division 08 Section "Door Hardware".
 - 2) Identification: Engrave face of compartment door with 1-inch- (25-mm-) high letters as follows: "LETTERS" **OR** "OUTGOING MAIL" **OR** "OFFICE," **as directed**.
 - d. Exposed Materials: Fabricated from extruded or sheet aluminum.
 - e. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.
 - f. Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear, **as directed**.
 - 2) Baked-Enamel or Powder-Coated Finish: Aluminum **OR** Black **OR** Brass **OR** Dark bronze **OR** Gold **OR** Green **OR** Ivory **OR** Medium bronze **OR** Silver **OR** Color as



indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.

4. Private, Pedestal-Mounted Collection Boxes: Consisting of single compartment enclosed within freestanding, pedestal-mounted enclosure, with slot in top of front of unit to receive mail. Provide access to compartment for collecting mail from front or rear of unit through door equipped with concealed, continuous side hinge and lock.
 - a. Compartment Enclosure: Fabricated from extruded aluminum or aluminum sheet with integral weather-protection hood.
 - b. Pedestal: Same material and finish as parcel locker and attached with theft-resistant fasteners **OR** As indicated on Drawings, **as directed**.
 - c. Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear, **as directed**.
 - 2) Baked-Enamel or Powder-Coated Finish: Blue **OR** Gray **OR** White **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.
5. Private, Curbside Collection Boxes: Consisting of single compartment enclosed within curved-top, freestanding enclosure with four legs and casters, **as directed**. Fabricate enclosure from welded and riveted steel. Provide hopper door with door pull in top of unit to receive packages, with opening size not less than 4-1/2 inches high by 15-1/2 inches wide (114 mm high by 394 mm wide). Provide access to compartment for collecting packages from bottom of front of unit through door equipped with concealed, continuous bottom hinge and lock.
 - a. Door Lock: Five-pin tumbler cylinder **OR** Hasp for padlock, **as directed**.
 - b. Snorkel: Provide rear-mounted, drive-by attachment with opening not less than 12 inches wide by 3 inches high (305 mm wide by 76 mm high).
 - c. Steel Finish: Baked-enamel or powder-coated finish; gray **OR** white **OR** color as indicated by manufacturer's designations **OR** color as selected from manufacturer's full range, **as directed**.

K. Data Distribution Boxes

1. Data Distribution Boxes: Consisting of multiple compartments enclosed within enclosure.
 - a. Enclosure Configuration: Freestanding **OR** Recessed in wall **OR** Recessed in wall and installed between rack ladders, **as directed**.
 - b. Compartment Access: Provide access to compartments as follows:
 - 1) For Distributing Incoming Mail from Front of Unit: Mail slot in each compartment door.
 - 2) For Distributing Incoming Mail from Rear of Unit: Open backs with aluminum cover finished to match front of unit, **as directed**.
 - 3) For Removing Mail: Unlocking and swinging compartment door.
 - c. Compartments: Number and size as follows: **OR** As indicated on Drawings, of the following sizes: **OR** As indicated on Drawings, **as directed**.
 - 1) Size 1: Provide compartments with inside dimensions not less than 5 inches high by 12-1/2 inches wide by 15 inches deep (127 mm high by 318 mm wide by 381 mm deep).
 - d. Compartment Doors: Equip each with lock and concealed, continuous hinge.
 - 1) Door Locks: Five-pin tumbler, cylinder cam **OR** spring-latch-type, **as directed**, locks capable of at least 1000 key changes; with two **OR** three, **as directed**, keys for each compartment door. Key each compartment differently.
OR
Door Locks: Three-digit, single-dial, combination locks with spring latch and automatic throw off. Set each compartment with different combination.
 - e. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.
 - f. Exposed Materials: Fabricated from steel sheet or aluminum with powder-coat finish.
 - g. Rack Ladders: Aluminum or steel with manufacturer's standard finish.



- h. Powder-Coated Finish: Silver **OR** Silver with black trim **OR** Silver with slate trim **OR** Sandalwood with sand trim **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.

L. Mail Chutes

1. General: Factory assembled and fabricated with tight joints, overlaps in direction of mail flow, and free of ledges. Provide transition sections so all sections of chutes are connected and overlap at least 2 inches (51 mm). Fabricate mail chutes so joint sections comply with same dimensions with no reduction in chute size. Provide removable panels for access to concealed portions of chutes that exceed 5 feet (1.5 m) in length. Comply with USPS Publication 16, **as directed**.
 - a. Mail Collection: USPS **OR** Private, **as directed**.
 - b. Inside Dimensions: 8 inches wide by 2 inches deep (203 mm wide by 51 mm deep) (for chutes served by USPS) **OR** 14 inches wide by 3 inches deep (356 mm wide by 76 mm deep) **OR** 14 inches wide by 7 inches deep (356 mm wide by 178 mm deep), **as directed**.
 - c. Mounting: Recessed **OR** Semirecessed **OR** Surface mounted **OR** As detailed, **as directed**.
2. Exposed Front Panels: Continuous, one-piece frames and covers fabricated from 0.125-inch- (3.2-mm-) thick, stainless-steel-clad **OR** brass-clad, **as directed**, extruded aluminum, and retaining removable transparent material as follows, for not less than 3/4 of length of front of chute on each floor:
 - a. Transparent Material: Manufacturer's standard glazing, complying with USPS Publication 16.
3. Concealed Front Panels: Consisting of continuous, one-piece frames retaining 0.0269-inch- (0.7-mm-) thick, metallic-coated steel sheet panels. Extend concealed front panels from top of ceiling fasciae to bottom of floor collar above.
4. Sides and Backs: Continuous, one-piece, 0.125-inch- (3.2-mm-) thick aluminum sheet extending from floor to ceiling on each floor and extending 54 inches (1372 mm) above finish flooring at top story.
5. Floor and Ceiling Fasciae and Lock Band: Manufacturer's standard, matching material and finish of front frames and covers. Provide lock band with locking device and keyed lock that prevents key removal if locking device is not secured.
6. Mail Slots: Same material and finish as chute; not less than 4-3/4 inches wide by 1/2 inch high (121 mm wide by 13 mm high) with device designed to guide mail into inside opening of same size located 2-1/2 inches (64 mm) below mail slot. Provide mail slots on each floor.
 - a. For chutes served by USPS, inscribe the words "U.S. MAIL" on face of mail slots.
7. Finish surfaces exposed to view as follows:
 - a. Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear **OR** Black **OR** Dark bronze **OR** Medium bronze **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - 2) Baked-Enamel or Powder-Coated Finish: Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.
 - b. Brass Finish: Buffed finish, lacquered **OR** Hand-rubbed finish, lacquered **OR** Brushed satin, lacquered, **as directed**.
 - c. Stainless-Steel Finish: No. 4.

M. Accessories

1. Directory for Mail Receptacles: Surface-mounted, front-opening unit, with clear glass or plastic window.
 - a. Framed, Top-Mount Unit for Horizontal Mail Receptacles: Fabricate directory as framed, horizontal unit with modular sections having a 24-name capacity (3 modules) **OR** 32-name capacity (4 modules) **OR** 40-name capacity (5 modules), **as directed**; of same material, size, **as directed**, and finish as adjacent mail receptacles; mounted above mail receptacles as indicated on Drawings, **as directed**.



- b. Framed, Side-Mount Unit for Horizontal Mail Receptacles: Fabricate directory as framed, horizontal unit with 50-name capacity, 28 inches (711 mm) **OR** 60-name capacity, 33-3/8 inches (848 mm) **OR** 70-name capacity, 38-3/4 inches (984 mm), **as directed** high; of same material and finish as adjacent mail receptacles; mounted along side of mail receptacles as indicated on Drawings, **as directed**.
- c. Framed, Side-Mount Unit for Vertical Mail Receptacles: Fabricate directory as framed, vertical unit with modular sections having a 40-name capacity (1 module) **OR** 80-name capacity (2 modules) **OR** 120-name capacity (3 modules) **OR** 160-name capacity (4 modules) **OR** 200-name capacity (5 modules), **as directed**; of same size, material, and finish as adjacent vertical mail compartment doors unless otherwise indicated.
- d. Insert Units for Vertical Mail Receptacles: Fabricate directory as modular inserts having a 40-name capacity (1 module) **OR** 80-name capacity (2 modules) **OR** 120-name capacity (3 modules) **OR** 160-name capacity (4 modules) **OR** 200-name capacity (5 modules), **as directed**; of same size, material, and finish as adjacent vertical mail compartment doors unless otherwise indicated.
- e. Provide name strips made of 1/4-inch- (6-mm-) high label tape.
- 2. Key Keeper: Consisting of single compartment with door; interior compartment size not less than 4-3/4 inches wide by 2-1/4 inches high by 1-1/2 inches deep (121 mm wide by 57 mm high by 38 mm deep), **as directed**. USPS approved, **as directed**.
 - a. Mounting: Recessed **OR** Surface mounted, **as directed**.
 - b. Style: Compartment door set within face frame **OR** extending full width and height of unit, with no exposed frame, **as directed**.
 - c. Type of Operation: Loose key in box **OR** Retractor reel with minimum 20-inch- (508-mm-) long chain **OR** Push button, 24-V switch in box, **as directed**.
 - d. Mail Delivery: USPS **OR** Private, **as directed**.
 - e. Door Lock (for units served by USPS): Door prepared to receive lock furnished by local postmaster.
OR
 Door Lock: Five-pin tumbler, cylinder cam lock capable of at least 1000 key changes; with two **OR** three, **as directed**, keys.
OR
 Door Lock: Cylinder lock keyed to building keying system; with two **OR** three, **as directed**, keys. Provide cylinders specified in Division 08 Section "Door Hardware".
 - f. Exposed Material and Finish: Exposed surfaces fabricated from same material and finish as adjacent mail receptacles.
 - g. Exposed Material and Finish: Steel, aluminum **OR** brass, **as directed**, powder-coated finish.
 - h. Exposed Material and Finish: Stainless steel, brushed finish.
 - i. Exposed Material and Finish: Aluminum, as follows:
 - 1) Anodic Finish: Clear **OR** Brass **OR** Dark bronze **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - 2) Baked-Enamel or Powder-Coated Finish: Black **OR** Dark bronze **OR** Medium bronze **OR** Gold **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.
- 3. Key Cabinet: Wall-mounted, metallic-coated, **as directed**, steel cabinet with pivoting, key-holding panels and side-hinged door equipped with five-pin tumbler, cylinder door lock and concealed, full-length flush hinge. Finish cabinet, panels, and door with baked-enamel or powder-coated finish. Provide key control system consisting of key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers.
 - a. Capacity: Keys for 150 percent of the number of, **as directed**, mail-receptacle locks.
 - b. Cross-Index System: Consisting of index cards for recording key information. Include three receipt forms for each key-holding hook.
 - c. Baked-Enamel or Powder-Coated Finish: Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.



4. Mail-Sorting Collection Unit: Consisting of 1/4-inch- (6-mm-) thick, metal face plate and through-the-wall hopper door(s) allowing receipt and separation of mail.
 - a. Hopper Doors: One **OR** Two **OR** Three, **as directed**, door(s), with door pull for each and with opening size not less than dimensions approved by the Owner.
 - 1) Engrave doors with 1-inch- (25-mm-) high letters as follows: "STAMPED MAIL" **OR** "METERED MAIL," **as directed**.
 - 2) Identification: Engrave unit at top with 2-inch- (51-mm-) high letters as follows: "U.S. MAIL" **OR** "UNITED STATES MAIL," **as directed**.
 - b. Exposed Material and Finish: Exposed surfaces fabricated from same material and finish as adjacent mail receptacles.
 - c. Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear **OR** Black **OR** Dark bronze **OR** Light bronze **OR** Medium bronze **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - 2) Baked-Enamel or Powder-Coated Finish: Black **OR** Dark bronze **OR** Gold **OR** Medium bronze **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.
 - d. Brass Finish: Buffed finish, lacquered **OR** Hand-rubbed finish, lacquered **OR** Brushed satin, lacquered, **as directed**.
 - e. Stainless-Steel Finish: No. 4.
5. Letter Drops (Through Wall): Consisting of 11-inch-wide by 3-1/2-inch- (279-mm-wide by 89-mm-) high, top-hinged, spring-loaded flap that pivots inward, held in place by 1-inch- (25-mm-) wide face frame. Fabricated from 1/4-inch- (6-mm-) thick aluminum or steel, with exposed surfaces finished to match adjacent mail receptacles.
 - a. Sleeve: Provide metallic-coated, **as directed**, steel wall sleeve for full depth of wall.
 - b. Finished Frame: Provide finished face frame on back side of wall opening.
 - c. Identification: Engrave face of swinging flap with 1-inch- (25-mm-) high letters as follows: "U.S. MAIL" **OR** "LETTERS" **OR** "OUTGOING MAIL," **as directed**
 - d. Exposed Material and Finish: Exposed surfaces fabricated from same material and finish as adjacent mail receptacles, **as directed**.
6. Package Depository (Through Wall): Consisting of 1/4-inch- (6-mm-) thick, aluminum or steel face plate and through-the-wall hopper door with hinged baffle, **as directed**, allowing receipt of packages; fabricated from 1/4-inch- (6-mm-) thick aluminum or steel.
 - a. Hopper Door: Equipped with door pull and concealed, full-length bottom hinge; with opening size not less than 15 inches wide by 6-1/2 inches high (381 mm wide by 165 mm high) **OR** as indicated on Drawings, **as directed**.
 - b. Sleeve: Provide metallic-coated, **as directed**, steel wall sleeve for full depth of wall.
 - c. Slowdown: Provide steel slowdown ramp on back side of wall opening.
 - d. Identification: Engrave face of hopper door with 1-inch- (25-mm-) high letters as follows: "BOOK DEPOSITORY," **as directed**
 - e. Finish: Exposed surfaces finished same as mail receptacles.
 - f. Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - 2) Baked-Enamel or Powder-Coated Finish: Dark bronze **OR** Gold **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.
 - g. Steel Finish: Finish surfaces exposed to view with baked-enamel or powder-coated finish; color as indicated by manufacturer's designations **OR** color as selected from manufacturer's full range, **as directed**.

N. Fabrication

1. Form postal specialties to required shapes and sizes, with true lines and angles, square, rigid, and without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges and corners free of sharp edges and burrs and safe to touch. Fabricate doors of postal specialties to preclude binding, warping, or misalignment.



2. Preassemble postal specialties in shop to greatest extent possible to minimize field assembly.
3. Mill joints to a tight, hairline fit. Cope or miter corner joints. Form joints exposed to weather to exclude water penetration.
4. Drill or punch holes required for fasteners and remove burrs. Use security fasteners where fasteners are exposed. If used, seal external rivets before finishing.
5. Weld in concealed locations to greatest extent possible without distorting or discoloring exposed surfaces. Remove weld spatter and welding oxides from exposed surfaces.
6. Fabricate tubular and channel frame assemblies with manufacturer's standard welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support loads.
7. Fabricate rack ladders to support indicated number of units to form a column of units.
8. Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating or by applying other permanent separation as recommended by manufacturers of dissimilar metals.

O. General Finish Requirements

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
3. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

P. Copper-Alloy Finishes

1. Buffed Finish, Lacquered: M21-O6x (Mechanical Finish: buffed, smooth specular; Coating: clear organic coating as specified below).
2. Hand-Rubbed Finish, Lacquered: M31-M34-O6x (Mechanical Finish: directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed; Coating: clear organic coating as specified below).
3. Brushed Satin Finish, Lacquered: M32-O6x (Mechanical Finish: directionally textured, medium satin; Coating: clear organic coating as specified below).
4. Clear Organic Coating: Clear, waterborne, air-drying, acrylic lacquer specially developed for coating copper-alloy products, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm). It consists of a solution of methyl methacrylate copolymer with benzotriazole to prevent breakdown of the film in UV light, and is called "Incralac."

1.3 EXECUTION

A. Installation

1. General: Install postal specialties level and plumb, according to manufacturer's written instructions and roughing-in drawings.
 - a. Where dissimilar metals will be in permanent contact with each other, protect against galvanic action by painting contact surfaces with bituminous coating or by applying other permanent separation as recommended by manufacturer for this purpose.
 - b. Where aluminum will contact grout, concrete, masonry, or wood, protect against corrosion by painting contact surfaces with bituminous coating.
 - c. Final acceptance of postal specialties served by USPS depends on compliance with USPS requirements.
2. Horizontal Mail Receptacles: Install horizontal mail receptacles with center of tenant-door lock cylinders and bottom of compartments at the maximum and minimum heights above finished floor established by USPS and manufacturer's written instructions.



- a. Install removable-core and keyed-in door lock cylinders as required for each type of cylinder lock.
 - b. Install and align two rack ladders for the first column of mail receptacles and one rack ladder for each additional adjacent column of mail receptacles.
 3. Vertical Mail Receptacles: Install vertical mail receptacles with center of master lock cylinder not more than 48 inches (1219 mm) and not less than 30 inches (762 mm) above finished floor.
 4. Pedestal-Mounted Postal Specialties: Anchor units with 1/2-inch- (13-mm-) diameter, galvanized **OR** stainless, **as directed**, -steel anchor bolts with hooked ends, for CBUs, NDCBUs, and some models of parcel lockers and collection boxes.
 5. Collection Boxes: Install collection boxes with centerline of mail slots **OR** handle of hopper doors, **as directed**, not more than 48 inches (1219 mm) above finished floor.
 6. Receiving Boxes: Install receiving boxes with bottom of unloading door not less than 30 inches (762 mm) above finished floor.
 - a. Install receiving boxes with exterior of box bottom not more than 20 inches (508 mm) above finished floor.
 7. Freestanding Data Distribution Boxes: Locate freestanding data distribution boxes at locations indicated or, if not indicated, as directed.
 8. Rack-Ladder Data Distribution Boxes: Install and align two rack ladders for the first column of data distribution boxes and one rack ladder for each additional adjacent column of data distribution boxes.
 9. Mail Chutes: Mount chutes with bottom ends extending 1 inch (25 mm) into receiving boxes. Attach chutes with straps, collars, and sleeves. Do not penetrate chute with fasteners.
 - a. Comply with USPS Publication 16 for installation.
 - b. Install chutes with centerline of mail slots not more than 48 inches (1219 mm) above finished floor.
 10. Key Keeper: Install horizontally **OR** vertically **OR** as indicated on Drawings, **as directed**.
- B. Field Quality Control
1. Arrange for USPS personnel to examine and test postal specialties served by USPS after they have been installed according to USPS regulations.
 2. Obtain written final approval of postal specialties to be served by USPS. Obtain this approval from USPS postmaster that authorizes mail collection for the served installation.
- C. Adjusting, Cleaning, And Protection
1. Remove temporary protective coverings and strippable films, if any, as postal specialties are installed unless otherwise indicated in manufacturer's written installation instructions.
 2. Adjust doors, hardware, and moving parts to function smoothly, and lubricate as recommended by manufacturer. Verify that integral locking devices operate properly.
 3. Touch up marred finishes or replace postal specialties that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by postal specialty manufacturer.
 4. Replace postal specialties that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
 5. On completion of postal specialty installation, clean interior and exterior surfaces as recommended by manufacturer.

END OF SECTION 10 55 23 23



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Task	Specification	Specification Description
10 55 23 26	10 55 23 23	Postal Specialties



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SECTION 10 55 26 00 - CSF PARCEL LOCKERS**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section. 10 55 26 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Parcel lockers.
 - 2. Accessories.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Data on locker types, sizes, and accessories.
 - 2. Shop Drawings: Indicate layout, dimensions, details of fabrication and installation. Include plans, elevations, sections, and attachments to other Work.
 - 3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Manufacturer's Instructions: Indicate component installation assembly, and installation instructions.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Operation and Maintenance Data: Include spare parts data, current unit prices, sources of supply, and maintenance instructions.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.



- B. Deliver materials to project site in manufacturer's original unopened protective packaging.
- C. Identify contents, manufacturer, brand name, and applicable standards.
- D. Store materials in area protected from weather and construction operations.
- E. Protect Work from damage during transportation, storage at Project Site, and throughout tenure of work. Protect adjacent Work and materials from damage during progress of specified Work. Damaged Work shall be repaired or replaced at no additional cost to the United States Postal Service. Furnish receipts of all loose or detachable parts.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project with Contracting Officer.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. HSS Industries, Incorporated, Traverse City, MI (800) 330-9701.
 2. Secura Locker, Chatsworth, CA (800) 709-4933.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Not Permitted.

2.2 PARCEL LOCKERS

- A. Model:
 1. HSS: PL series. PL-1, PL-2, PL-3, PL-DRD, PL-15, PL-SRD.
 2. Secura: Model #1262, #1563, #1564, #1565.

2.3 MATERIALS

- A. Sheet Steel: Zinc-coated steel, nickel bearing, free from buckle, scale, and surface imperfections. Steel to be phosphate-treated, baked-on prime paint with baked enamel finish coat.
- B. Finish: Custom finish and color.
 1. Coating Type: Polyester/Acrylic.
 2. Color of Trim: Black, as delivered.

NOTE TO SPECIFIER

Verify color of faceplate with Contracting Officer (silver is typically provided).

3. Color of Faceplate: [Silver to match finish of P.O. Boxes] [_____].
4. Gloss: 35-Ultrahigh.
5. Edge Coverage: Good.
6. Specific Gravity: 1.20 + 1.80.
7. Average Particle Size: 24-40 Microns (per ASTM-D1921).



8. Chip Resistance: Minimum Rating of 5.

- C. Fasteners: Cadmium, zinc, nickel plated steel; exposed both heads, slotless type; self-locking nuts or locker washers for nuts on moving parts.

2.4 MANUFACTURED UNITS

NOTE TO SPECIFIER

Select USPS or manufacturer to provide box rack ladder system. HSS Industries parcel lockers slide into post office box rack ladder system.

- A. Select model and quantity of parcel lockers as directed by Contracting Officer from the following (based on USPS approved parcel lockers, manufactured by HSS Industries). [Post office box rack ladder system provided by the United States Postal Service.] [Post office box rack ladder system provided by postal parcel locker manufacturer.]
1. Model PL-1 (1 compartment), size: 22.5 inches wide x 15.5 inches deep x 11.75 inches high.
 2. Model PL-2 (2 compartment), size: 22.5 inches wide x 15.5 inches deep x 11.75 inches high.
 3. Model PL-3 (1 compartment), size: 22.5 inches wide x 15.5 inches deep x 23.5 inches high.
 4. Model PL-DRD (rear doors), size: 22" wide x 60 inches high (Required for all installations).
 5. Model PL-15 (1 compartment), size: 14.5 inches wide x 15.5 inches deep x 11.75 inches high.
 6. Model PL-SRD (rear door), size: 13.5 inches wide x 60 inches high (Required for all PL-15 installations).
- B. Select model and quantity of parcel lockers as directed by Contracting Officer from the following (based on Secura Postal Pas-thru lockers, manufactured by Secure):
1. Model #1565 (5 compartments), size: 15 inches wide x 18 inches deep x 60 inches high.
 2. Model #1564 (4 compartments), size: 15 inches wide x 18 inches deep x 60 inches high.
 3. Model #1563 (3 compartments), size: 15 inches wide x 18 inches deep x 60 inches high.
 4. Model #1262 (2 compartments), size: 12 inches wide x 18 inches deep x 60 inches high.

2.5 ACCESSORIES

- A. Locking: Fabricate lockers to receive the following locking devices.
1. Locking Mechanism (Customer Side): Each parcel locker module shall be secured with a U.S. Postal Service furnished 306 lock. (Manufacturers providing an installed lock equal to the 306 lock will be acceptable). Upon opening the compartment with a customer key to remove the contents, the customer key shall remain trapped. Three customer keys shall be provided for each compartment lock. The locks shall be so located to allow for easy replacement if they should be damaged or inoperable. Provide proper holes for USPS supplied and installed "Arrow" lock, above the 306 lock. The Arrow lock enables the Postal Service to unlock the trapped customer key with a master key.
 2. Locking Mechanism (Postal Side): Full length door, minimum 16 GA., locked closed by a 12 gage, plated steel latch/strap that forms a three point latch (top, middle and bottom of door). The latch mechanism and cables shall be covered or enclosed to prevent tampering. The mechanism will be spring loaded to return to the locked position when handle is released or door is slammed shut. The door may be secured by turning the handle and closing the door or slamming the door shut so that the slam lock bolts engage.
- B. Number Plates: Manufacturer's standard stainless steel metal number plates with numerals not less than 3/8 inch (9 mm) high. Number lockers in sequence as directed by Contracting Officer. Attach plates to each locker above keyway with minimum 2 fasteners of same finish as number plate.
- C. Trim: Provide black fillers and/or closure panel trim at jambs and head of recessed lockers, consisting of minimum 18 gage cold-rolled steel, 3 inch (8 cm) and 6 inch (15 cm) wide factory-finish trim where indicated to match lockers. Secure trim to lockers with concealed fastening clips.



2.6 FABRICATION

- A. Construction: Fabricate lockers square, and without warp, with metal faces flat and free of dents or distortion. Make all exposed metal edges safe to touch. Weld frame members together to form rigid, one-piece structure. Weld, bolt, or rivet other joints and connections as standard with manufacturer. Grind exposed welds flush. Do not expose bolts or rivet heads on fronts of locker doors and frames.
- B. Frames: Fabricate of 16 gage channels or 12 gage angles, minimum with continuous stop/strike formed on vertical members.
- C. Interior: Side panels to be flush constructed to inside of frames for easy removal of customer packages. Offset frame-to-side panel or protrusions into the opening are not permitted. From customer side, through compartment - postal floor shall not be visible with postal side door closed and latched. Provisions for attaching lockers together in at least two places front and back.
- D. Body: Fabricate top, bottom and sides of minimum 24 gage steel, with double flanged connections extending full height.
- E. Front Frame and Doors: One piece, minimum 16 gage sheet steel, without louvers, flanged at all edges, constructed to prevent springing when opening or closing. Fabricate to swing minimum 90 degrees.
 - 1. Reinforcing: Provide extra bracing or reinforcing on inside of doors over 15 inches (38 cm) wide.
 - 2. Hinges: Heavy-duty, stainless steel, concealed full loop hinges. Weld to inside of frame and secure to door with minimum 2 factory-installed fasteners which are completely concealed and tamperproof when door is closed. Front door shall have self-closing hinges.
- F. Rear Doors: Provide doors without louvers on back of lockers for access by postal employees from space behind public areas. The rear door shall be supported by a continuous hinge on one side. The rear door must be design and fabricated to preclude access from one compartment to another for the purpose of vandalism or unlawful removal of compartment contents and to prevent access to the workroom floor. Opening the rear door shall expose all compartments within a module for easy access and deposit of parcels.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication of special components, when possible, to ensure proper fitting of work. However, allow for adjustment and



fitting of trim and filler panels whenever taking of field measurements before fabrication might delay Work.

3.3 INSTALLATION

- A. Install metal lockers at locations indicated on Drawings in accordance with manufacturer's published instructions.
- B. Install lockers plumb, level, rigid, and flush.
- C. Space fastenings about 48 inches (1.2 m) on center, unless otherwise recommended by manufacturer. Install through back-up reinforcing plates where necessary to avoid metal distortion. Conceal fasteners.
- D. Install trim where indicated, use concealed fasteners to provide flush, hairline joints with adjacent surfaces.
- E. Provide door with flush fit at cross sill when in closed position to maximize intercompartment security. Gaps not permitted.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Inspect installation of lockers, attachment, and alignment with adjacent finishes.
- C. Operate locker doors and locking devices.

3.5 ADJUSTING AND CLEANING

- A. Adjust doors and latches to operate easily without binding. Verify that integral locking devices are operating properly.
- B. Touch-up marred finishes. Use only materials and procedures recommended or furnished by locker manufacturer. Replace units which cannot be restored to factory-finished appearance.

NOTE TO SPECIFIER

Coordinate the following items with Contract Drawings.

DRAWING COORDINATION ITEMS

Drawings should indicate the following information related to this Section.

1. *Location and number of required locker units.*
2. *Style and sizes of compartments, compartment arrangement, and size of units.*
3. *Size and location of recessed openings, if any, with details of installation.*

USPS CSF Specifications issued: 10/1/2013

Last revised: 3/6/2012



END OF SECTION



Task	Specification	Specification Description
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SECTION 10 56 13 16 - METAL STORAGE SHELVING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for metal storage shelving. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Case-type metal storage shelving.
 - b. Four-post metal storage shelving.
 - c. Post-and-beam metal storage shelving.

C. Performance Requirements

1. Delegated Design: Design metal storage shelving, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Structural Performance for Case-Type and Four-Post Metal Storage Shelving: Capable of withstanding the loads indicated according to MH 28.1.
3. Structural Performance for Post-and-Beam Metal Storage Shelving: Capable of withstanding the loads indicated according to MH 28.2.
4. Seismic Performance: Metal storage shelving shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. Seismic Component Importance Factor: 1.5 **OR** 1.0, **as directed**.

D. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.4: For particleboard, documentation indicating that product contains no urea formaldehyde.
3. Shop Drawings: For customized metal storage shelving. Include plans, elevations, sections, details, and attachments to other work. Include installation details of connectors, lateral bracing, and special bracing.
4. Samples: For each exposed product and for each color and texture specified.
5. Delegated-Design Submittal: For metal storage shelving indicated to comply with performance requirements, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Design Calculations: Calculate requirements for seismic restraints.
6. Seismic Qualification Certificates: For metal storage shelving, accessories, and components, from manufacturer.
7. Product certificates.
8. Maintenance data.

E. Quality Assurance

1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
2. Preinstallation Conference: Conduct conference at Project site.



1.2 PRODUCTS

A. Materials

1. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
2. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
3. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with G60 (Z180) zinc (galvanized) or A60 (ZF180) zinc-iron-alloy (galvannealed) coating.
4. Steel Tubing: ASTM A 513, Type 2.
5. Stainless-Steel Tubing: ASTM A 554, Grade MT-304.
6. Steel Wire: ASTM A 899.
7. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304.
8. Particleboard: ANSI A208.1, made with binder containing no urea formaldehyde.
9. Hardboard: ANSI A135.4.
10. Floor Anchors: Galvanized-steel, post-installed expansion anchors **OR** power-actuated fasteners **OR** threaded concrete screws, **as directed**. Provide number per unit recommended by manufacturer unless additional anchors are indicated in calculations.
11. Wall Anchors: Manufacturer's standard, galvanized-steel anchors designed to secure metal storage shelving to adjacent wall. Provide one per shelving unit for each shelving unit adjacent to a wall unless additional anchors are indicated in calculations.

B. Case-Type Metal Storage Shelving

1. General: Factory-formed, field-assembled, freestanding, case-type metal storage shelving system, designed for shelves to span between and be supported by sheet metal end panels (without posts), with shelves adjustable over the height of shelving unit. Fabricate shelf units with end panel at each end so each unit is independent. Provide fixed top and bottom shelves, adjustable intermediate shelves, and accessories indicated.
2. Load-Carrying Capacity per Shelf: 200 lb (91 kg) **OR** As indicated on Drawings, **as directed**.
3. End Panels: Fabricated from cold-rolled steel sheet, with concealed perforations at front and back edges at manufacturer's standard spacing **OR** 1 inch (25 mm) o.c., **as directed**, for receiving adjustable shelf clips.
 - a. Steel-Sheet Thickness, Nominal: 0.036 inch (0.91 mm) **OR** As required for load-carrying capacity per shelf and number of shelves, **as directed**.
 - b. Adjustable Shelf Clips: Fabricated from 0.036-inch- (0.91-mm-) nominal thickness, cold-rolled steel; with projections designed to engage at least two perforations in end panels.

OR

End Panels: Fabricated from cold-rolled steel sheet; with horizontal slots spaced at manufacturer's standard spacing **OR** 1 inch (25 mm) o.c. **OR** 1-1/2 inches (38 mm) o.c., **as directed**, for supporting shelves.

 - a. Steel-Sheet Thickness, Nominal: 0.036 inch (0.91 mm) **OR** As required for load-carrying capacity per shelf and number of shelves, **as directed**.
4. Back Panel: One piece, fabricated from cold-rolled steel sheet.
 - a. Steel-Sheet Thickness, Nominal: 0.036 inch (0.91 mm) **OR** As required for load-carrying capacity per shelf, **as directed**.
5. Shelves: Fabricated from cold-rolled steel sheet, with slots or holes at 2 inches (51 mm) o.c. for shelf dividers, **as directed**. Fabricate shelves with vertical front that is flanged and returned.
 - a. Steel-Sheet Thickness, Nominal: 0.048 inch (1.21 mm) **OR** As required for load-carrying capacity per shelf and number of shelves, **as directed**.
6. Shelf Quantity: Three **OR** Four **OR** Five **OR** Six, **as directed**, shelves per shelving unit in addition to top and bottom shelf.
7. Base: Closed front, with base strips fabricated from same material and with same finish as end panels.
8. Overall Unit Width: 30 inches (762 mm) **OR** 36 inches (914 mm) **OR** 42 inches (1067 mm) **OR** 48 inches (1219 mm), **as directed**.



9. Overall Unit Depth: 12 inches (305 mm) **OR** 18 inches (457 mm) **OR** 24 inches (610 mm), **as directed**.
 10. Overall Unit Height: 72 inches (1829 mm) **OR** 84 inches (2134 mm) **OR** 96 inches (2438 mm), **as directed**.
 11. Accessories:
 - a. Finished End Panels: Fabricated as solid **OR** perforated, **as directed**, full-height panels from same material and with same finish as end panels, with trim for a finished appearance along edges abutting end panels and top shelf.
 - b. Shelf Dividers: Fabricated from same material and with same finish as shelves; full-height **OR** angle **OR** tapered **OR** sliding, **as directed**, type.
 - c. Bins: Fabricated from same material and with same finish as shelves; size as indicated on Drawings **OR as directed**.
 - d. Shelf-Label Holders: Clear **OR** Colored, **as directed**, plastic, designed to clip onto front edge of shelf.
 12. Finish: Baked enamel **OR** Powder coat, **as directed**.
 - a. Color and Gloss: As selected from manufacturer's full range.
- C. Four-Post Metal Storage Shelving
1. Open **OR** Closed, **as directed**, Four-Post Metal Storage Shelving: Factory-formed, field-assembled, freestanding system, designed for shelves to span between and be supported by corner posts, with shelves adjustable over the height of shelving unit. Fabricate initial shelving unit with a post at each corner. Fabricate additional shelving units similarly, so each unit is independent **OR** as add-on units, designed to share two corner posts with initial shelving unit, **as directed**. Provide fixed top and bottom shelves, adjustable intermediate shelves, and accessories indicated.
 - a. Load-Carrying Capacity per Shelf: 350 lb (159 kg) **OR** 700 lb (318 kg) **OR** 1500 lb (680 kg) **OR** As indicated on Drawings, **as directed**.
 - b. Posts: Fabricated from hot-rolled steel; in angle **OR** offset angle **OR** beaded **OR** T- **OR** tubular T- **OR** V- **OR** box **OR** manufacturer's standard, **as directed**, shape; with perforations at 1-1/2 inches (38 mm) o.c. to receive shelf-to-post connectors.
 - 1) Steel Thickness, Nominal: 0.075 inch (1.90 mm) **OR** As required for load-carrying capacity per shelf and number of shelves, **as directed**.
 - 2) Add-On Shelf Posts: Fabricated from hot-rolled steel, T- **OR** manufacturer's standard, **as directed**, shape; perforated to match main posts and of same thickness.
 - 3) Post Base: Bolt leveler **OR** Adjustable steel floor plate, drilled for floor anchors, **as directed**.
 - c. Bracing: Manufacturer's standard, single **OR** double, **as directed**, diagonal cross bracing at back **OR** ends **OR** back and ends, **as directed**; as required for stability, load-carrying capacity of shelves, and number of shelves.
 - d. Back Panel: One piece **OR** Two half panels, **as directed**, fabricated from cold-rolled steel sheet.
 - 1) Steel-Sheet Thickness, Nominal: 0.024 inch (0.61 mm) **OR** As required for load-carrying capacity per shelf, **as directed**.
 - e. End Panels: Fabricated from cold-rolled steel sheet.
 - 1) Steel-Sheet Thickness, Nominal: 0.024 inch (0.61 mm) **OR** As required for load-carrying capacity per shelf, **as directed**.
 - f. Solid-Type Shelves: Fabricated from steel sheet as follows:
 - 1) Steel-Sheet Thickness, Nominal: 0.030 inch (0.76 mm) **OR** 0.036 inch (0.91 mm) **OR** 0.048 inch (1.21 mm) **OR** As required for load-carrying capacity per shelf, **as directed**.
 - 2) Metallic-Coated Steel-Sheet Thickness, Nominal: 0.034 inch (0.86 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.052 inch (1.32 mm) **OR** As required for load-carrying capacity per shelf, **as directed**.
 - 3) Slots or Holes for Shelf Dividers: 2 inches (51 mm) **OR** 3 inches (76 mm), **as directed**, o.c.



- 4) Fabricate fronts and backs of shelves with box-formed edges, with corners lapped and welded.
OR
Fabricate fronts and backs of shelves with vertical edges that are flanged and returned, with edges reinforced with steel bars, angles, or channels.
- g. Framed-Type Wire Shelves: Steel **OR** Metallic-coated-steel, **as directed**, wire; with shelf frame fabricated from same material and with same finish as posts.
- h. Truss-Type Wire Shelves: Steel **OR** Metallic-coated-steel **OR** Stainless-steel **OR** Manufacturer's standard, chrome-plated, **as directed**, wire-over-wire construction, with downturned wire truss edges.
- i. Shelf Quantity: Three **OR** Four **OR** Five **OR** Six, **as directed**, shelves per shelving unit in addition to top and bottom shelf.
- j. Shelf-to-Post Connectors: Mechanical fasteners (nuts and bolts) **OR** Compression clips **OR** Support clips **OR** Containment clips **OR** Horizontal supports with rivet connectors to post **OR** Manufacturer's standard connectors, **as directed**.
- k. Base: Open, with exposed post legs **OR** Closed, with base strips fabricated from same material and with same finish as shelving, **as directed**.
- l. Overall Unit Width: 30 inches (762 mm) **OR** 36 inches (914 mm) **OR** 42 inches (1067 mm) **OR** 48 inches (1219 mm), **as directed**.
- m. Overall Unit Depth: 12 inches (305 mm) **OR** 18 inches (457 mm) **OR** 24 inches (610 mm), **as directed**.
- n. Overall Unit Height: 72 inches (1829 mm) **OR** 84 inches (2134 mm) **OR** 96 inches (2438 mm), **as directed**.
- o. Accessories:
 - 1) Finished End Panels: Fabricated as solid **OR** perforated, **as directed**, full-height panels from manufacturer's standard thickness cold-rolled steel sheet and with same finish as posts, with trim for a finished appearance along edges abutting posts and top shelf.
 - 2) Shelf Dividers: Fabricated from same material and with same finish as shelves; full-height **OR** angle **OR** tapered **OR** sliding, **as directed**, type.
 - 3) Bins: Fabricated from same material and with same finish as shelves; size as indicated on Drawings **OR as directed**.
 - 4) Shelf-Label Holders: Clear **OR** Colored, **as directed**, plastic, designed to clip onto front edge of shelf.
- p. Finish: Baked enamel **OR** Powder coat, **as directed**.
 - 1) Color and Gloss: As selected from manufacturer's full range.
2. Wire-Type, Four-Post Metal Storage Shelving: Factory-formed, field-assembled, freestanding system without back or end panels, designed for shelves to span between and be supported by corner posts, with shelves adjustable over the entire height of shelving unit. Fabricate initial shelving unit with a post at each corner. Fabricate additional shelving units similarly, so each unit is independent **OR** as add-on units, designed to share two corner posts with initial shelving unit, **as directed**. Provide fixed top and bottom shelves, adjustable intermediate shelves, and accessories indicated.
 - a. Load-Carrying Capacity per Shelf: 200 lb (91 kg) **OR** 600 lb (272 kg) **OR** 1200 lb (544 kg) **OR** As indicated on Drawings, **as directed**.
 - b. Posts: Fabricated from 1-inch- (25-mm-) OD, square **OR** round, **as directed**, tubing of indicated material; with grooves or notches at 1 inch (25 mm) o.c. to receive shelf-to-post connectors. Label posts with numbers at not less than 2 inches (51 mm) o.c. for determining shelf height.
 - 1) Post Material: Steel **OR** Stainless steel, **as directed**.
 - 2) Post Base: Bolt leveler **OR** Adjustable steel floor plate, drilled for floor anchors, **as directed**.
 - 3) Post Cap: Nylon or plastic.
 - c. Framed-Type Wire Shelves: Steel **OR** Metallic-coated-steel **OR** Stainless-steel, **as directed**, wire-over-wire construction, with shelf frame fabricated from same material and



- with same finish as posts; with manufacturer's standard post collar, designed to engage collet (wedge), welded at each corner.
- d. Truss-Type Wire Shelves: Steel **OR** Metallic-coated-steel **OR** Stainless-steel **OR** Manufacturer's standard, chrome-plated, **as directed**, wire-over-wire construction, with downturned wire truss edges; with manufacturer's standard post collar, designed to engage collet (wedge), welded at each corner.
 - e. Waterfall-Type Wire Shelves: Steel **OR** Metallic-coated-steel **OR** Stainless-steel, **as directed**, wire-over-wire waterfall construction; with manufacturer's standard post collar, designed to engage collet (wedge), welded at each corner.
 - f. Solid-Type Shelves: Fabricated from 0.050-inch- (1.27-mm-) thick, stainless-steel sheet metal of indicated material and thickness.
 - g. Shelf Quantity: Three **OR** Four **OR** Five **OR** Six, **as directed**, shelves per shelving unit in addition to top and bottom shelf.
 - h. Shelf-to-Post Connectors: Manufacturer's standard one-piece collet (wedge), designed to engage post collar attached to shelves.
 - i. Bracing: Manufacturer's standard diagonal cross bracing, as required for stability, load-carrying capacity of shelves, and number of shelves.
 - j. Overall Unit Width: 24 inches (610 mm) **OR** 36 inches (914 mm) **OR** 48 inches (1219 mm) **OR** 60 inches (1524 mm), **as directed**.
 - k. Overall Unit Depth: 12 inches (305 mm) **OR** 18 inches (457 mm) **OR** 24 inches (610 mm), **as directed**.
 - l. Overall Unit Height: 60 inches (1524 mm) **OR** 72 inches (1829 mm) **OR** 84 inches (2134 mm), **as directed**.
 - m. Accessories:
 - 1) Shelf Dividers: Fabricated from same material and with same finish as shelves; full-height **OR** angle **OR** tapered **OR** sliding, **as directed**, type.
 - 2) Shelf Inlay: Manufacturer's standard clear plastic **OR** static-dissipative plastic **OR** hardboard, **as directed**, mat.
 - 3) Storage Basket: Edge-of-shelf-mounted wire basket; fabricated from same material and with same finish as shelves.
 - 4) Back Ledges: 1 inch (25 mm) **OR** 4 inches (102 mm), **as directed**, high, fabricated from same material and with same finish as shelves.
 - 5) Side Ledges: 1 inch (25 mm) **OR** 4 inches (102 mm), **as directed**, high, fabricated from same material and with same finish as shelves.
 - 6) Garment Hanger Tube: Width of 21 inches (533 mm) **OR** shelves, **as directed**; with mounting brackets.
 - 7) Shelf-Label Holders: Clear plastic **OR** Colored plastic **OR** Cold-rolled steel sheet, **as directed**, designed to clip onto front edge of shelf.
 - n. Steel Finish: Baked enamel **OR** Powder coat **OR** Manufacturer's standard chrome plated, **as directed**.
 - 1) Color and Gloss: As selected from manufacturer's full range.
 - o. Stainless-Steel Finish: No. 4 directional-satin finish **OR** Manufacturer's standard nondirectional-polish finish, **as directed**.
- D. Post-And-Beam Metal Storage Shelving
1. General: Factory-formed, field-assembled, freestanding, post-and-beam metal storage shelving system, designed for shelves to be supported by beams that span between and are supported by corner posts, with beams adjustable over the entire height of shelving unit. Fabricate initial shelving unit with a post at each corner. Fabricate additional shelving units similarly, so each unit is independent **OR** as add-on units, designed to share two corner posts with initial shelving unit, **as directed**. Provide fixed top and bottom beams, adjustable intermediate beams, and accessories indicated.
 2. Load-Carrying Capacity per Shelf: 400 lb (181 kg) **OR** 1000 lb (454 kg) **OR** 2000 lb (907 kg) **OR** As indicated on Drawings, **as directed**.



3. Posts: Fabricated from cold-rolled steel; in manufacturer's standard **OR** manufacturer's standard angle or open-box **OR** 1-1/2-by-1-1/2-inch (38-by-38-mm) angle **OR** open-box, **as directed**, shape; with perforations at 1-1/2 inches (38 mm) o.c. to receive beam-to-post connectors.
 - a. Steel Thickness, Nominal: 0.075 inch (1.90 mm) **OR** As required for load-carrying capacity per shelf and number of shelves, **as directed**.
 - b. Add-On Shelf Posts: Fabricated from hot-rolled steel, T-shape; perforated to match main posts and of same thickness.
 - c. Post Base: Cold-rolled steel floor plate, drilled for floor anchors.
4. Beams: Fabricated from cold-rolled steel; in channel **OR** flanged **OR** manufacturer's standard, **as directed**, shape; with projecting rivet **OR** tab **OR** manufacturer's standard, **as directed**, beam-to-post connectors at each end designed to engage posts. Provide beam at each side of each shelf, with center supports as required for load-carrying capacity of shelf.
 - a. Steel Thickness, Nominal: 0.075 inch (1.90 mm) **OR** As required for load-carrying capacity per shelf, **as directed**.
 - b. Provide top, bottom, and intermediate shelf beams with single **OR** double, **as directed**, beam-to-post connectors.
OR
Provide top and bottom shelf beams with double beam-to-post connectors and intermediate shelf beams with single beam-to-post connectors.
 - c. Provide beams for the number of shelves required.
OR
Provide beams for shelves per shelving unit in addition to top and bottom shelf beams.
5. Particleboard Shelves: 5/8 inch (16 mm) thick; factory **OR** field, **as directed**, cut.
6. Flat Metal Shelves: Fabricated from steel sheet as follows:
 - a. Steel-Sheet Thickness, Nominal: 0.030 inch (0.76 mm) **OR** 0.036 inch (0.91 mm) **OR** 0.048 inch (1.21 mm) **OR** As required for load-carrying capacity per shelf, **as directed**.
 - b. Metallic-Coated Steel-Sheet Thickness, Nominal: 0.034 inch (0.86 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.052 inch (1.32 mm) **OR** As required for load-carrying capacity per shelf, **as directed**.
 - c. Fabricate fronts and backs **OR** fronts, backs, and sides, **as directed**, of shelves with box-formed edges, with corners lapped and welded.
7. Ribbed-Metal-Decking Shelves: Fabricated from 0.036-inch- (0.91-mm-) nominal thickness steel sheet.
8. Wire Shelves: Welded steel wire; with 2-by-4-inch (51-by-102-mm) **OR** Manufacturer's standard, **as directed**, openings.
9. Shelf Quantity: Three **OR** Four **OR** Five **OR** Six, **as directed**, shelves per shelving unit in addition to top and bottom shelf.
10. Overall Unit Width: 36 inches (914 mm) **OR** 48 inches (1219 mm) **OR** 60 inches (1524 mm) **OR** 69 inches (1753 mm) **OR** 72 inches (1829 mm) **OR** 96 inches (2438 mm), **as directed**.
11. Overall Unit Depth: 18 inches (457 mm) **OR** 24 inches (610 mm) **OR** 30 inches (762 mm) **OR** 36 inches (914 mm) **OR** 48 inches (1219 mm), **as directed**.
12. Overall Unit Height: 60 inches (1524 mm) **OR** 72 inches (1829 mm) **OR** 84 inches (2134 mm) **OR** 96 inches (2438 mm), **as directed**.
13. Accessories:
 - a. Tie Plates: Cold-rolled steel, finished to match posts; designed for joining posts of adjacent shelving units.
 - b. Supports: Back-to-wall **OR** Back-to-back **OR** Back-to-wall and back-to-back, **as directed**, type that bolt to posts; as required for shelving unit stability.
 - c. Record Boxes: Knocked-down, corrugated fiberboard with white finish and contrasting contents legend; with prepunched handles and matching separate lid.
 - 1) Letter/Legal-Size Boxes: 12-1/2 inches wide by 16 inches deep by 10-1/2 inches high (318 mm wide by 406 mm deep by 267 mm high) for letter-size material stored left to right and legal-size material stored front to back.



- 2) Letter-Size Boxes: 12-1/2 inches wide by 24 inches deep by 10-1/2 inches high (318 mm wide by 610 mm deep by 267 mm high) for letter-size material stored left to right.
 - d. Record Box Support Rails: 1-1/2-by-1-1/2-inch (38-by-38-mm) metal angle, with length to match depth of shelving unit; fabricated from same material and with same finish as beams.
14. Finish: Baked enamel **OR** Powder coat, **as directed**.
- a. Color and Gloss: As selected from manufacturer's full range.
- E. Fabrication
1. Shop Fabrication: Prefabricate shelving components in shop to greatest extent possible to minimize field fabrication; temporarily preassemble shelving components where necessary to ensure that field-assembled components fit together properly. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
 2. Fabricate metal storage shelving square and rigid, with posts plumb and true and shelves flat and free of dents or distortion. Fabricate connections to form a rigid structure, free of buckling and warping.
 - a. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
 - b. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.
 - c. Build in straps, plates, brackets, and other reinforcements as needed to support shelf loading.
 - d. Cut, reinforce, drill, and tap metal fabrications to receive hardware, fasteners, and similar items.
 3. Form metal in maximum lengths to minimize joints. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work. Form backs of shelving units up to 48 inches (1219 mm) wide from one piece, **as directed**.
 4. Form edges and corners free of sharp edges or rough areas. Fold back and crimp exposed edges of unsupported sheet metal to form a 1/2-inch- (13-mm-) wide hem on the concealed side; ease edges of metal plate to radius of approximately 1/32 inch (0.8 mm). Shear and punch metals cleanly and accurately. Remove burrs.
 5. Weld corners and seams continuously to develop strength, minimize distortion, and maintain the corrosion resistance of base metals. At exposed locations, finish welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface. Weld before finishing components to greatest extent possible. Remove weld spatter and welding oxides from exposed surfaces before finishing.
- F. General Finish Requirements
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 2. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- G. Metallic-Coated Steel-Sheet Finishes
1. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint, complying with SSPC-Paint 20, to comply with ASTM A 780.
 2. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry thickness.
- H. Steel Finishes



1. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" or SSPC-SP 8, "Pickling."
2. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry thickness.

I. Stainless-Steel Finishes

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - c. Directional Satin Finish: No. 4.

1.3 EXECUTION

A. Preparation

1. Vacuum finished floor and wet mop resilient flooring over which metal storage shelving is to be installed.

B. Installation

1. Install metal storage shelving level, plumb, square, rigid, true, and with shelves flat and free of dents or distortion. Make connections to form a rigid structure, free of buckling and warping.
 - a. Install exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
 - b. Install braces, straps, plates, brackets, and other reinforcements as needed to support shelf loading and as required for stability.
 - c. Adjust post-base bolt leveler to achieve level and plumb installation.
 - d. Anchor shelving units to floor with floor anchors through floor plate. Shim floor plate to achieve level and plumb installation.
 - e. Install seismic restraints.
 - f. Connect side-to-side and back-to-back shelving units together.
 - g. Install shelves in each shelving unit at spacing indicated on Drawings or, if not indicated, at equal spacing.
 - 1) Case-Type Metal Storage Shelving: Install adjustable shelf clips at front and back of each shelf.
 - 2) Four-Post Metal Storage Shelving: Install four clips, one at each post, for support of each shelf; with clips fully engaged in post perforations.
 - 3) Post-and-Beam Metal Storage Shelving: Install beams with beam-to-post connectors fully engaged in post perforations.
2. Accessories:
 - a. Install finished end panels and trim at exposed ends of shelving units.
 - b. Shelf Dividers: Install full-height dividers per shelf **OR** angle dividers per shelf **OR** tapered dividers per shelf **OR** sliding dividers per shelf **OR** dividers of types and locations indicated on Drawings, **as directed**.
 - c. Bins: Install per shelf **OR** at locations indicated on Drawings, **as directed**.
 - d. Shelf-Label Holders: Install one on each shelf, centered **OR** vertically aligned **OR** at locations indicated on Drawings, **as directed**, within each shelving unit.
 - e. Record Box Support Rails: Provide two for each record storage box.
 - f. Shelf Inlays: Install one per shelf **OR** at locations indicated on Drawings, **as directed**.
 - g. Storage Baskets: Install per shelf **OR** at locations indicated on Drawings, **as directed**.
 - h. Back Ledges: Install one per shelf **OR** at locations indicated on Drawings, **as directed**.
 - i. Side Ledges: Install on each side of each shelf **OR** at locations indicated on Drawings, **as directed**.



- j. Garment Hanger Tubes: Install one per shelving unit **OR** more where directed **OR** at locations indicated on Drawings, **as directed**.

C. Erection Tolerances

- 1. Erect case-type and four-post metal storage shelving to a maximum tolerance from vertical of 1/2 inch (13 mm) in up to 10 feet (3 m) of height, not exceeding 1 inch (25 mm) for heights taller than 10 feet (3 m).
- 2. Erect post-and-beam metal storage shelving to a maximum tolerance from vertical of 1/4 inch (6 mm) in 84 inches (2134 mm) of height.

D. Adjusting

- 1. Adjust metal storage shelving so that connectors and other components engage accurately and securely.
- 2. Adjust and lubricate operable components to operate smoothly and easily, without binding or warping. Check and readjust operating hardware.
- 3. Touch up marred finishes or replace metal storage shelving that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal storage shelving manufacturer.
- 4. Replace metal storage shelving that has been damaged or has deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 56 13 16



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Task	Specification	Specification Description
10 56 29 46	10 56 13 16	Metal Storage Shelving
10 71 13 13	01 22 16 00	No Specification Required
10 71 16 13	01 22 16 00	No Specification Required
10 71 16 16	01 22 16 00	No Specification Required



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SECTION 10 73 13 00 - AWNINGS

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for awnings. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Fixed awnings.
 - b. Retractable awnings, manually operated and motorized.

C. Definitions

1. Awning: An architectural projection that provides weather protection, identity, or decoration and is wholly supported by the building to which it is attached. An awning is comprised of a lightweight, rigid skeleton structure over which a rigid covering is attached.
2. Retractable Awning: A cover with a frame that retracts against a building or other structure to which it is entirely supported.

D. Performance Requirements

1. General: Design, fabricate, and install awnings to withstand loads from gravity, wind, snow, ponding, drift, seismic, and structural movement, including thermally induced movement; and to resist, without failure, other conditions of in-service use, including exposure to weather.
2. Structural Performance: Provide awnings capable of withstanding the effects of gravity loads and loads and stresses within limits and under conditions required for the location of the Work.
3. Seismic Performance: Provide awnings capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."
4. Thermal Movements: Provide awnings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, tearing of fabric, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

E. Submittals

1. Product Data: Include styles, material descriptions, construction details, fabrication details, dimensions of individual components and profiles, hardware, fittings, mounting accessories, features, finishes, and operating instructions for awnings.
 - a. Motorized Awning Operators: Include operating instructions.
 - b. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.
2. Shop Drawings: Show location and extent of awnings. Include elevations, sections, and details not shown in Product Data. Show materials, fabrication, dimensions, mounting heights, connections, anchorages, installation details, attachments to other work, operational clearances, and relationship to adjoining work. Show colors and graphic layout and content.
3. Samples: For each of the following products and for the full range of color, texture, and pattern variations required, prepared on Samples of size indicated below. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
 - a. Awning Fabric: 12-inch- (300-mm-) square section of fabric from dye lot to be used for the Work, with specified treatments applied. Mark face of fabric.



- b. Graphics: Not less than 12-inch- (300-mm-) square section showing graphics application method.
- c. Seam, Edge, and Corner Condition: Not less than 12-inch- (300-mm-) long section showing seam, edge, and corner treatment.
- d. Valance: Full-size unit, not less than 12 inches (300 mm) long.
- e. Frame Finish: Not less than 6-inch (150-mm) lengths.
- f. Frame Corner and Three **OR** Four, **as directed**, -Way Truss Intersection: Not less than 12-inch (300-mm) sections showing finished joint construction and fabric and valance attachment to awning frame.
- g. Exposed Hardware Finishes: Manufacturer's standard-size unit, not less than 3 inches (76 mm) square.
- h. Accessories: Manufacturer's full-size unit.
- 4. Welding certificates.
- 5. Maintenance Data: For awnings to include in maintenance manuals.

F. Quality Assurance

- 1. Welding: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code--Steel."
 - b. AWS D1.2, "Structural Welding Code--Aluminum."
- 2. Regulatory Requirements: Provide awnings complying with or exceeding requirements of authorities having jurisdiction>.
- 3. Fire-Test-Response Characteristics: Provide awning fabrics with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - a. Flame-Resistance Ratings: Passes NFPA 701 **OR** California Code of Regulations, Title 19, **as directed**.
 - b. Permanently attach label to each awning fabric indicating whether fabric is inherently and permanently flame resistant, or treated with flame-retardant chemicals, and whether it will require retreatment after designated time period or cleaning.
- 4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

G. Warranty: Manufacturer's standard form in which manufacturer and fabricator agree to repair or replace components of awnings that fail in materials or workmanship within specified warranty period.

- 1. Awning Warranty Period: Five years from date of Final Completion.
- 2. Fabric Warranty Period: Three **OR** Five **OR** Eight **OR** 12, **as directed**, years from date of Final Completion.
- 3. Thread Warranty Period: Five **OR** Eight, **as directed**, years from date of Final Completion.
- 4. Graphics Warranty Period: Outdoor durability not less than five **OR** three, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Awning Fabrics

- 1. Fabric Fiber Content: Vinyl-laminated or -coated polyester mesh **OR** Vinyl-laminated or -coated polyester **OR** Acrylic-coated polyester **OR** Resin-coated polyester **OR** Vinyl-coated polyester/cotton blend **OR** Acrylic-coated polyester/cotton blend **OR** Resin-coated polyester/cotton blend **OR** Solution-dyed acrylic **OR** Solution-dyed modacrylic, **as directed**.
- 2. Style:
 - a. Bottom Hem: Straight **OR** Scalloped, evenly spaced pattern **OR** As indicated by manufacturer's designation **OR** As indicated in an awning schedule, **as directed**.



- b. Trim: As indicated by manufacturer's designation for style and color **OR** As indicated in a window treatment schedule, **as directed**.
 - c. Fringe: As indicated by manufacturer's designation for style and color **OR** As indicated in an awning schedule, **as directed**.
 - d. Color: Match samples **OR** As selected from manufacturer's full range **OR** As indicated in an awning schedule, **as directed**.
 - e. Applied Treatment: Stain resistant **OR** Mildew resistant **OR** Polymer, flame resistant **OR** Water repellent **OR** Lamination, **as directed**.
 - f. Performance Characteristics: As follows:
 - 1) Mildew Resistance: Showing no growth when tested per ASTM G 21.
 - 2) Shrinkage: Not greater than 0.1 **OR** 0.5 **OR** 1, **as directed**, percent per ASTM D 1204.
 - 3) Stretch Factor: Not less than 0.4 **OR** 1 **OR** 4, **as directed**, percent per ASTM D 4851.
 - 3. Graphic Application: Hand painting **OR** Silk-screen printing **OR** Heat color transfer **OR** Vinyl film with pressure-sensitive adhesive backing **OR** PVDF film with pressure-sensitive adhesive backing **OR** PVF film with pressure-sensitive adhesive backing **OR** Radio-frequency, heat-sealed vinyl film **OR** Eradication **OR** Cut-out lettering, **as directed**.
 - a. Text Message: As indicated on Drawings **OR** As indicated in an awning schedule, **as directed**.
 - 1) Text Font: Arial, **unless directed otherwise**.
 - 2) Character Size: Minimum 1-inch- (25.4-mm-) **OR** 1-foot- (0.3048-m-), **as directed**, high characters.
 - b. Vinyl Film: Calendered-vinyl film, not less than 3 mils (0.076 mm) thick, with pressure-sensitive adhesive backing **OR** Cast-vinyl film, not less than 2 mils (0.051 mm) thick, with pressure-sensitive adhesive backing **OR** Cast-vinyl reflective film, not less than 2 mils (0.051 mm) thick, with pressure-sensitive adhesive backing, **as directed**.
 - 4. Inset Fabric: Heat-sealed **OR** Sewn-in, **as directed**, process, and as follows:
 - a. Colors: Match samples **OR** As selected from manufacturer's full range **OR** As indicated in an awning schedule, **as directed**.
 - b. Applied Treatment: Stain resistant **OR** Mildew resistant **OR** Polymer, flame resistant **OR** Water repellent, **as directed**.
- B. Thread: 100 percent expanded PTFE **OR** 100 percent bonded polyester, **as directed**, UV-light, mildew, and rot resistant.
- C. Awning Frames
- 1. Steel Frames:
 - a. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - b. Cold-Formed Steel Tubing: ASTM A 500, grade as required by structural loads.
 - c. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless another weight is indicated or required by structural loads.
 - d. Steel Mechanical Tubing: Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A 513 or steel tubing fabricated from steel complying with ASTM A 1011/A 1011M and complying with dimensional tolerances in ASTM A 500.
 - e. Steel Finish: Manufacturer's standard galvanized and corrosion-resistant mill **OR** Manufacturer's standard decorative **OR** Baked-enamel **OR** Powder-coat, **as directed**, finish complying with finish manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.
 - 2. Aluminum Frames: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated and with not less than the strength and durability properties of alloy and temper required by structural loads.
 - a. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M).
 - b. Aluminum Extrusions: ASTM B 221 (ASTM B 221M).
 - c. Extruded Structural Pipe and Round Tubing: ASTM B 429, standard weight (Schedule 40) unless another weight is indicated or required by structural loads.



- d. Drawn Seamless Tubing: ASTM B 210 (ASTM B 210M).
- e. Aluminum Finish: Mill **OR** Manufacturer's standard decorative **OR** Baked-enamel **OR** Powder-coat, **as directed**, finish complying with finish manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.
- 3. Anchors, Fasteners, Fittings, Hardware, and Installation Accessories: Complying with performance requirements indicated and suitable for exposure conditions, supporting structure, anchoring substrates, and installation methods indicated. Corrosion-resistant or noncorrodible units; weather-resistant, tamperproof, vandal- and theft-resistant, compatible, nonstaining materials. Provide as required for awning assembly, mounting, and secure attachment. Number as needed to comply with performance requirements and to maximize appearance; evenly spaced. Where exposed to view, with finish and color as selected by Architect from manufacturer's full range.
 - a. Wood Screws: ASME B18.6.1.
 - b. Lag Bolts: ASME B18.2.1. (ASME B18.2.3.8M).
 - c. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.
 - d. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1) Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).
 - e. Adhesive-Bonded Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 1512 conducted by a qualified independent testing and inspecting agency.
 - 1) Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).
 - f. Grommets: Zinc-coated brass, No. 2 **OR** Stainless steel, No. 2, **as directed**.
 - 1) Grommet Spacing: 6-inch (150-mm) o.c.
 - g. Lacing: 100 percent polyester, braided No. 4.
- 4. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- 5. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

D. Awning Fabrication

- 1. Fabrics: Reinforce wear points and hardware attachment points with nonwoven **OR** mesh **OR** polypropylene mesh, **as directed**, webbing.
 - a. Fabric Edges and Seams:
 - 1) Fold and stitch selvedge, and cut fabric edges.
 - 2) Hot cut and sealed.
 - 3) Radio-frequency welded.
 - 4) Adhesively bonded.
 - 5) Manufacturer's standard hemming and seaming methods.
- 2. Decorative Trims: Borders **OR** Braid and bindings **OR** Cords **OR** Fringe **OR** Patterned edge; scalloped **OR** Patterned edge; V-shaped **OR** Streamers **OR** Tassels **OR** Welting, **as directed**.
 - a. Colors: As indicated by manufacturer's designations **OR** Match samples **OR** Matching or coordinating with awning fabric color **OR** As selected from manufacturer's full range **OR** As indicated in an awning schedule, **as directed**.



3. Frames: Preassemble awning frames in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
 - a. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
 - b. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
 - c. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Fabricate slip-fit connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
 - d. Weld corners and connections continuously. Obtain fusion without undercut or overlap. Remove welding flux immediately. At exposed corners and connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
 - e. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications in place and to properly transfer loads.
 4. Colors of Metal and Plastic Components Exposed to View: As indicated by manufacturer's designations **OR** Match samples **OR** Matching or coordinating with awning fabric color **OR** As selected from manufacturer's full range **OR** As indicated in an awning schedule, **as directed**.
- E. Retractable Awning Operators
1. Manual Operation: With gear and crank operator.
 - a. Manual Operation Assist Mechanism: Manufacturer's standard spring assist for operating heavy awnings.
 - b. Crank Handle: One **OR** Two, **as directed**, detachable.
 - c. Awning Coupler System: Designed for simultaneously operating two **OR** three, **as directed**, awnings with a single crank. Provide system for each group of awnings **OR** where indicated on Drawings **OR** where indicated in an awning schedule, **as directed**.
 - d. Operating Function: Stop and hold awning at any position in ascending or descending travel **OR** Stop and hold awning at either fully open or fully closed positions only, **as directed**.
 2. Motorized Operation: Provide factory-assembled motorized retractable awning operation systems designed for retracing awnings of type, size, weight, construction, use, and operation frequency indicated. Provide operation systems of size and capacity and with features, characteristics, and accessories suitable for Project conditions and recommended by awning manufacturer, complete with electric motors and factory-prewired motor controls, remote-control stations, remote-control devices, power disconnect switches, enclosures protecting controls and all operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
 3. Comply with NFPA 70.
 4. Control Equipment: Comply with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6 with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.
 5. Electric Motors: UL-approved or -recognized, totally enclosed, insulated motor, complying with NEMA MG 1, with thermal-overload protection and internal limit switches; sized by awning manufacturer to start and operate size and weight of awning considering service factor or considering Project's service conditions without exceeding nameplate ratings.
 - a. Service Factor: According to NEMA MG 1, unless otherwise indicated.
 - b. Motor Characteristics: Single phase, 24 **OR** 110 **OR** 220, **as directed**, V, 60 Hz.
 - c. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.
 - d. Motor Mounting: Within manufacturer's standard roller enclosure.
 6. Remote Controls: Electric controls with NEMA ICS 6, Type 1 **OR** 4, **as directed**, enclosure for surface **OR** recessed or flush, **as directed**, mounting. Provide the following devices for remote-control activation of awnings:
 - a. Control Stations:



- 1) Keyed, maintained **OR** momentary, **as directed**, -contact, three-position, switch-operated control station with open, close, and off functions. Provide two keys per station.
OR
Maintained **OR** Momentary, **as directed**, -contact, three-position, toggle **OR** rocker, **as directed**, -style, wall switch-operated control station with open, close, and center off functions.
- 2) Color: Ivory **OR** White **OR** As indicated in an awning schedule, **as directed**.
- b. Group Control Stations: Maintained **OR** Momentary, **as directed**, -contact, three-position, rocker-style, wall switch-operated control station with open, close, and center-off functions for single-switch group control.
 - 1) Color: Ivory **OR** White **OR** As indicated in an awning schedule, **as directed**.
- c. Individual/Group Control Stations: Maintained **OR** Momentary, **as directed**, -contact, three-position, rocker-style, wall switch-operated control station with open, close, and center-off functions for individual and group control.
 - 1) Color: Ivory **OR** White **OR** As indicated in an awning schedule, **as directed**.
- d. Sun Sensor Controls: Programmable system activated by LEDs detecting daylight intensity and responding by automatically adjusting awnings.
- e. Radio Controls: Digital system consisting of code-compatible universal coaxial receiver, one per awning **OR** where indicated on Drawings, **as directed**, and two portable single-channel transmitters for operating a single motor with a single button to open and close awning.
- f. Radio Controls: Digital system consisting of code-compatible universal coaxial receiver, one per awning **OR** where indicated on Drawings **OR** where indicated in an awning schedule, **as directed**, and two portable multiple-channel transmitters for operating two **OR** four **OR** up to 12, **as directed**, awnings individually, each with a single button to open and close awnings.
- g. Timer Controls: Clock timer, 24-hour **OR** seven-day, **as directed**, programmable for regular events.
- h. Microprocessor Controls: Electronic programmable means for setting, changing, and adjusting control features. Provide unit isolated from voltage spikes and surges.
7. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop awning at fully raised and fully lowered positions.
8. Operating Function: Stop and hold awning at any position **OR** Stop and hold awning at three predetermined positions including open, closed, and one user-programmed position, **as directed**.
9. Operating Features: Include the following:
 - a. Group switching with integrated switch control; single face plate for multiple switch cut-outs.
 - b. Capable of accepting input from building automation control system.
 - c. Override switch.
 - d. Backup gear and crank operator for manual operation during power failures with detachable handle, 6 feet (1.8 m) long **OR** manufacturer's standard length **OR** length required to make operation convenient from ground level **OR** length as indicated on Drawings, **as directed**.
10. Awning Hood: Sheet metal enclosure sized to fit awning roller and operating hardware inside and designed for UV-light, dust, weather, and vandal protection. Finish and color to match awning framing **OR** as indicated on Drawings **OR** as indicated in an awning schedule, **as directed**.

1.3 EXECUTION

A. Installation, General

1. General: Install awnings and motor controls at locations and in position indicated, securely connected to supports, free of rack, and in proper relation to adjacent construction. Use



- mounting methods of types described and in compliance with Shop Drawings and fabricator's written instructions.
2. Install awnings after other finishing operations, including joint sealing and painting, have been completed.
 3. Attach fabric to frames as recommended by fabricator, by stapling into slotted track in frame **OR** using lacing method as required to conceal ends of lacing **OR** using fabric hem pockets, **as directed**, to ensure tight, wrinkle-free fit of fabric to frame.
 4. Slip fit frame connections accurately together to form hairline joints and tighten to secure.
 5. Weld frame connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
 - a. Field Welding: Comply with the following requirements:
 - 1) Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2) Obtain fusion without undercut or overlap.
 - 3) Remove welding flux immediately.
 - 4) At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
 6. Anchoring to In-Place Construction: Use anchors, fasteners, fittings, hardware, and installation accessories where necessary for securing awnings to structural support and for properly transferring load to in-place construction.
 7. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.
 8. Coordinate awning installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed exterior wall and roof assemblies.
 9. Connections: Connect motorized operators to building electrical system.
- B. Adjusting
1. Adjust awnings to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.
- C. Cleaning And Protection
1. Clean awning surfaces after installation, according to manufacturer's written instructions.
 2. Touchup Painting: Immediately after erection, clean field welds, connections, and abraded areas. Paint uncoated and abraded areas with same or compatible material as used for shop-applied finish painting.
 - a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
 3. Galvanized Surfaces: Clean field welds, connections, and abraded areas and repair galvanizing to comply with ASTM A 780.
 4. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that awnings are without damage or deterioration at time of Final Completion.
 5. Replace damaged awnings that cannot be repaired, in a manner approved, before time of Final Completion.

END OF SECTION 10 73 13 00



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SECTION 10 73 16 00 - CSF CANOPIES

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section for Medium Standard Buildings where an Engineered Automobile Shelter at the Carrier Walk is part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section. 10 73 16 00

1.1 SUMMARY

- A. Section Includes:
 - 1. Engineered automobile shelter at Carrier Walk.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A 446 - Specification for Steel Sheet, Zinc Coated by the Hot-Dip Process, Structural Quality.
 - 2. ASTM A-500 - Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - 3. ASTM A-525 - Specification for General Requirements for Steel Sheet, Zinc-Coated by the Hot-Dip Process.

1.3 SYSTEM DESCRIPTION

NOTE TO SPECIFIER

Verify column spacing.

- A. Design Requirements:
 - 1. The engineered system may be substituted for the conventionally structured system detailed in the construction documents, provided that it meets or exceeds the level design and design criteria indicated. The design calculations, product data and shop drawings for the engineered system shall be submitted to the Contracting Officer and Architect for approval.
 - 2. Indicated on the drawings is the location and coverage of the shelter. It is up to the manufacturer to design his optimum shelter based on columns spaced at 20'-0" [_____] on center for parking bay width and manufacturer optimal spacing in the opposite direction.



3. The roof configuration is generally flat with the roof sloped toward the middle of the shelter area and drainage within the column supports.
4. Locate columns away from curb and wheel stop to prevent damage from vehicles.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 1. Product Data: Product data including manufacturer's product specifications, standard details, certified product test results, installation instructions, and general recommendations, as applicable to materials and finishes for each component and for the system.
 2. Shop Drawings: Submit shop drawings showing all erection procedures and accessories required.
 3. Samples: Submit two 2" x 3" color samples for selection of roof deck and trim.
 4. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 1. Project Record Documents: Accurately record the following:
 - a. Submit record drawings bearing the seal and signature of a Professional Engineer registered in the jurisdiction in which the building is being constructed.

1.5 QUALITY ASSURANCE

- A. Qualifications:
 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Store materials on site in a manner so they will not be damaged. Materials shall be placed so water will drain and not accumulate.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS



- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Alcan Building Products, Cleveland, OH (440) 423-6600.
 - 2. Childers Carports and Structures, Incorporated, Houston, TX (713) 460-2181.
 - 3. Texas Aluminum Industries, Incorporated, Houston, TX (800) 231-4009.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

- A. Roof deck and trim shall be prepainted, hot-dip galvanized steel meeting ASTM A446, Grade D, 50,000 psi yield. Galvanizing shall meet ASTM A-525, G-90 Class. Paint shall be factory applied baked polyester with a full coat on color side and a white wash coat on reverse.
- B. Roof beams shall meet ASTM A-446, Grade D, 50,000 psi yield. Galvanizing shall meet ASTM A-525, G-90 Class. A white wash coat factory applied shall be the color required on roof beams.
- C. Columns shall be square tubes meeting ASTM A-500, Grade B. Columns shall be hot-dip galvanized after fabrication with a minimum zinc coating of 2 ounces per square foot. The columns shall be painted to match the full color coat on the top side of the roof deck.
- D. Projections of structural framing creating bird nesting areas shall be framed out with sheet metal closures, with all fluted deck flutes sealed off with and securely attached rubber or metal closure inserts.

2.3 EXTRUDED ALUMINUM

- A. General: Aluminum extruded canopy shall be an all extruded structural system of pre-painted rigid bents and anodized long span deck equal to that manufactured by Alcan Building Products, Division of Alcan Aluminum Corporation, Cleveland, Ohio. All structural sections shall be extruded Aluminum Alloy 6063, heat treated to a T6 Temper. Shop drawings shall be furnished for Contracting Officer's approval. Verify all dimensions, elevations and conditions before fabrication.
- B. Load Requirements: Design the system to meet Live Load requirements and Wind Up-Lift Loads as noted on S1.1 of the drawings plus the Extruded Aluminum Roof Deck shall be able to withstand concentrated loads at any point such as walking on top.
- C. Engineering Properties: All beam, deck, and column extrusions shall be of the dimensions shown and shall have Engineering Properties as shown in current Alcan Catalog for the Sections.
- D. Bent Construction: Beams and columns shall be shop fabricated to be shipped as individual pieces for assembly at the jobsite. All field assembled joints shall be mechanical joints using proper length 3/8 inch diameter aluminum bolts of 6061-T6 alloy or 3/8-inch diameter stainless steel bolts. Extruded beam end caps shall be field installed to the ends of all beams for Type "B", "C", and "D" bents, as shown on the approved shop drawings. Extruded structural beam ties shall be field installed as shown on the drawings to serve as closures between draining deck sections.
- E. Roof Deck Construction: Extruded sections shall be field interlocked into a structurally rigid connection that is self-flashing. Interlocking joints shall be rigidly field fastened 8 inches on center for their entire length. Fastening may be self-riveted by upsetting the metal or by screws or rivets. These fastenings shall have a minimum shear strength of 350 lbs. each, and all such fastenings must be made from the topside of the assembled deck. No exposed interlocking deck joints on the underside of the deck are permissible. Extruded rain caps shall be field installed at all draining breaks in the roof deck as shown on the approved shop drawings.
- F. Drainage: Water shall drain internally from the roof deck as indicated.



- G. Finish: All extrusions shall have factory applied baked enamel finish, color to be selected. The underside of all anodized decks shall be given a clear coat of acrylic lacquer to seal the anodized finish.
- H. Fabrication: Material shall be fabricated from shop drawings, approved by the Contracting Officer. Field verify all dimensions, elevations and conditions before releasing for fabrication.
- I. Erection: Erection shall be performed by manufacturer approved erectors and shall be scheduled after all concrete, masonry and roofing work in the vicinity is complete and cleaned. Column sleeves and/or anchor bolts shall be furnished by the manufacturer and installed to the approved shop drawings. Extreme care shall be taken to prevent damage to the structure and its finish. All extruded canopy systems shall be installed plumb and level as shown on the approved shop drawings. Design and installation of footings to be furnished by others.
- J. Flashing: Any and all flashing to existing construction shall be furnished and installed by others.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install canopy in accordance with manufacturer's drawings and specifications.

3.3 TOLERANCES

- A. Maximum variation from plan or location indicated on drawings: 1/2".
- B. Maximum offset from true alignment between adjacent members butting or in line: none.

3.4 ADJUST AND CLEANING

- A. Clean up site and remove excess material.

USPS CSF Specifications issued: 10/1/2013



Last revised: 4/12/2011

END OF SECTION



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Task	Specification	Specification Description
10 73 26 00	01 22 16 00	No Specification Required



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SECTION 10 75 00 00 - CSF FLAGPOLES

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

*Use this section where Ground Mount Flagpole is part of the Work.
EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.*

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section. 10 75 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Aluminum ground mounted flagpole.
 2. Truck, halyards, and accessories.
 3. Concrete flagpole foundation base.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 1. Section 033000 - Cast-In-Place Concrete: Concrete base.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 1. ASTM B 241 - Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.

1.3 SYSTEM DESCRIPTION

- A. Performance Requirements:

NOTE TO SPECIFIER

Edit wind speed based on local codes, conditions, and requirements.

1. Pole With Flag Flying: Resistant without permanent deformation, [100][____] miles per hour wind velocity, non-resonant, safety design factor of 1.0.
2. Flag Dimension: 4 foot x 6 foot. Coordinate recommended flag size with manufacturer.



1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Data on pole, accessories, and configurations.
 - 2. Shop Drawings: Detailed dimensions, anchor requirements, imposed loads, and foundation system.
 - 3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Design flagpole foundation under direct supervision of a Professional Structural Engineer licensed in the State where Project is located, experienced in the design of flagpole supports.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.
- C. Protect flagpole and accessories on site from damage or moisture.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 - 1. American Flagpole, Division of Kearney-National Incorporated, Abingdon, VA (800) 368-7171.
 - 2. Concord Industries, Incorporated, Addison, TX (800) 527-3902.
 - 3. Eder Flag Manufacturing Company, Incorporated, Oak Creek, WI (800) 558-6044.
 - 4. Pole-Tech Company, Incorporated, East Setauket, NY (800) 633-6733.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

- A. Pole Type: Commercial internal halyard cone tapered aluminum with ground sleeve.
- B. Pole Type: Commercial external halyard cone tapered aluminum with ground sleeve.

NOTE TO SPECIFIER

Dimensions indicated below are for a standard 25 foot pole. Insert appropriate dimensions if a different height is selected for this Project.

- C. Flagpole: ASTM B 241; 6063-T6 wrought alloy aluminum, cone tapered.



1. Outside Butt Diameter: [5-1/2] [____] inches.
2. Outside Tip Diameter: [3-1/2] [____] inches.
3. Nominal Wall Thickness: [0.188] [____] inches.
4. Nominal Height: [25 foot 0 inches] [_____], measured from top of flagpole base.
5. Mounting: Ground mounted to concrete foundation and base.

D. Truck Assembly: Aluminum; revolving; stainless steel ball-bearings, non-fouling.

E. Halyard: Stainless steel aircraft cable with four chrome plated bronze swivel snaphooks, plastic covered counterweight, and beaded sling.

F. Hand Crank: Removable type with automatic brake system to permit locking of flag in any position.

G. Truck Assembly: Aluminum; stationary.

H. Halyard: Nylon halyard with four chrome plated bronze swivel snaphooks.

I. Cleat: 6" minimum, cast aluminum with stainless steel flat head fasteners for flush fit.

J. Collar: Spun aluminum to match pole.

K. Foundation Sleeve: 16 gauge steel, galvanized corrugated tube with 3/16 inch thick steel base plate and support plate, 3/4 inch diameter x 18 inch long ground spike, and steel centering wedges.

L. Concrete: Specified in Section 033000.

M. Flags: Furnished and installed by United States Postal Service.

2.3 FINISHES

A. Metal Surfaces in Contact with Concrete: Asphaltic paint.

NOTE TO SPECIFIER

Select flagpole finish. Clear anodized is standard.

B. Aluminum: [AA M32-C22-A41 Clear anodized.] [AA M32-C12-A42 Bronze Anodized] [AA M32-C12-A42 Black Anodized] [Baked Enamel; Color [_____].

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017300 - Execution: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.



- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.

3.3 INSTALLATION

- A. Install flagpole base assembly, and accessories in accordance with manufacturer's published instructions.
- B. Electrically ground flagpole installation.
- C. Install foundation plate and centering wedges for flagpole base set in concrete base and fasten. Fill foundation tube sleeve with sand and compact.

3.4 CONSTRUCTION

- A. Site Tolerances:
 - 1. Maximum Variation From Plumb: One inch.

3.5 ADJUSTING AND CLEANING

- A. Clean flagpole surfaces immediately prior to installation.
- B. Adjust operating devices for smooth halyard and flag function.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



SECTION 10 75 00 00 - MPF FLAGPOLES

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Aluminum ground mounted flagpole.
 - 2. Truck, halyards, and accessories.
 - 3. Concrete flagpole foundation base.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 033000 - Cast-In-Place Concrete: Concrete base.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM B 241 - Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.

1.3 SYSTEM DESCRIPTION

- A. Performance Requirements:

NOTE TO SPECIFIER

Edit wind speed based on local codes, conditions, and requirements.

- 1. Pole With Flag Flying: Resistant without permanent deformation, 100 miles per hour wind velocity, non-resonant, safety design factor of 1.0.
- 2. Flag Dimension: 4 foot x 6 foot. Coordinate recommended flag size with manufacturer.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Data on pole, accessories, and configurations.
 - 2. Shop Drawings: Detailed dimensions, anchor requirements, imposed loads, and foundation system.



3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Design flagpole foundation under direct supervision of a Professional Structural Engineer licensed in the State where Project is located, experienced in the design of flagpole supports.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.
- C. Protect flagpole and accessories on site from damage or moisture.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 1. American Flagpole, Division of Kearney-National Incorporated, Abingdon, VA (800) 368-7171.
 2. Concord Industries, Incorporated, Addison, TX (800) 527-3902.
 3. Eder Flag Manufacturing Company, Incorporated, Oak Creek, WI (800) 558-6044.
 4. Pole-Tech Company, Incorporated, East Setauket, NY (800) 633-6733.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

- A. Pole Type: Commercial internal halyard cone tapered aluminum with ground sleeve.
- B. Pole Type: Commercial external halyard cone tapered aluminum with ground sleeve.

NOTE TO SPECIFIER

Dimensions indicated below are for a standard 25 foot pole. Insert appropriate dimensions if a different height is selected for this Project.

- C. Flagpole: ASTM B 241; 6063-T6 wrought alloy aluminum, cone tapered.
 1. Outside Butt Diameter: [5-1/2] [____] inches.
 2. Outside Tip Diameter: [3-1/2] [____] inches.
 3. Nominal Wall Thickness: [0.188] [____] inches.
 4. Nominal Height: [25 foot 0 inches] [_____], measured from top of flagpole base.
 5. Mounting: Ground mounted to concrete foundation and base.



- D. Truck Assembly: Aluminum; revolving; stainless steel ball-bearings, non-fouling.
- E. Halyard: Stainless steel aircraft cable with four chrome plated bronze swivel snaphooks, plastic covered counterweight, and beaded sling.
- F. Hand Crank: Removable type with automatic brake system to permit locking of flag in any position.
- G. Truck Assembly: Aluminum; stationary.
- H. Halyard: Nylon halyard with four chrome plated bronze swivel snaphooks.
- I. Cleat: 6" minimum, cast aluminum with stainless steel flat head fasteners for flush fit.
- J. Collar: Spun aluminum to match pole.
- K. Foundation Sleeve: 16 gauge steel, galvanized corrugated tube with 3/16 inch thick steel base plate and support plate, 3/4 inch diameter x 18 inch long ground spike, and steel centering wedges.
- L. Concrete: Specified in Section 033000.
- M. Flags: Furnished and installed by United States Postal Service.

2.3 FINISHES

- A. Metal Surfaces in Contact with Concrete: Asphaltic paint.

NOTE TO SPECIFIER

Select flagpole finish. Clear anodized is standard.

- B. Aluminum: [AA M32-C22-A41 Clear anodized.] [AA M32-C12-A42 Bronze Anodized] [AA M32-C12-A42 Black Anodized] [Baked Enamel; Color [_____].

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION



- A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.

3.3 INSTALLATION

- A. Install flagpole base assembly, and accessories in accordance with manufacturer's published instructions.
- B. Electrically ground flagpole installation.
- C. Install foundation plate and centering wedges for flagpole base set in concrete base and fasten. Fill foundation tube sleeve with sand and compact.

3.4 CONSTRUCTION

- A. Site Tolerances:
 - 1. Maximum Variation From Plumb: One inch.

3.5 ADJUSTING AND CLEANING

- A. Clean flagpole surfaces immediately prior to installation.
- B. Adjust operating devices for smooth halyard and flag function.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 6/29/2010

END OF SECTION 10 75 00 00



SECTION 10 81 13 00 - ORIENTED FLEXIBLE NETTING BIRD BARRIER

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of oriented flexible netting bird barrier. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

1.2 PRODUCTS

A. Material

1. Polyethylene twine netting attached to pre-installed cable system and steel installation hardware.
2. Netting shall be high density polyethylene knitted into sheets with mesh sizes of 3/4" **OR** 1-1/8" **OR 2", as directed.** Polyethylene shall be UV treated, color stable, and flame-retardant.
3. Color shall be selected from manufacturer's standard colors.
4. Installation hardware shall include corner and intermediate attachments, perimeter cable, turnbuckles, ferrules or clamps and net rings.

1.3 EXECUTION

A. Installation

1. Comply with manufacturer's printed instructions.

END OF SECTION 10 81 13 00



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SECTION 10 81 13 00a - MPF BIRD CONTROL DEVICES

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Field constructed roof mounted bird deterrent system.

1.2 SUBMITTALS

- A. Product Data : Required
- B. Shop Drawings : Required
- C. Samples : Required

1.3 QUALITY ASSURANCE

- A. Manufacturer and installer: Company specializing in systems specified with minimum of 5 years documented experience.

PART 2 – PRODUCTS

2.1 MANUFACTURERS/PRODUCTS

- A. Source:
 - 1. Avian Flyway Inc.
 - 2. Pest Management Systems
- B. Materials:
 - 1. Roof perimeter line powered pulse generator system using open wire deterrent lines.
 - 2. Internal Area of Roof – large grid flock deterrents. Grids on 30 feet centers and approximately 7 feet above roof surface. Small diameter wires black color.

PART 3 – EXECUTION

- 3.1 Install all products in accordance with manufacturer's guidelines and printed instructions.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 3/31/2010

END OF SECTION 10 81 13 00a



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SECTION 10 88 00 00 - CSF SCALES**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where a Platform Scale is part of the Work.

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section. 10 88 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Floor mounted platform scale.
 2. Digital indicator.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 REFERENCES

- A. Federal Specifications (FS):
 1. FS AAA-S-79a - Scale, Beam Indicating (and Scales, Dial and Beam Indicating: Motor Truck, Built In and Self contained).
 2. FS AAA-D-121d & Am-1 - Scale, Weighing, General Specifications.
- B. National Institute of Standards and Technology (NIST)
 1. NIST Handbook H-37 - Testing of Weighing Equipment.
 2. NIST Handbook H-44 - Specification, Tolerances, and Regulations - Commercial Weighing and Measuring Devices.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 1. Product Data: Construction, components, operating features, and dimensions.
 2. Shop Drawings: Indicate required opening dimensions, installation details, and connection requirements.
 3. Assurance/Control Submittals:



- a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
- b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 - 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project. Minimum three manufacturers.

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. B-Tek, Incorporated, Canton, OH (800) 266-8900.
 - 2. Cardinal Scales, Webb City, MO (800) 441-4237.
 - 3. General Electric Systems, Cape Coral, FL (800) 237-6284.
 - 4. Mettler-Toledo, Incorporated, Worthington, OH (800) 786-0038.
 - 5. Triner Scale and Manufacturing Company, Incorporated, Memphis, TN (800) 238-0152.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 PLATFORM SCALE

- A. Model:
 - 1. B-Tek: Clydesdale.
 - 2. Cardinal: FH - 555 - I.
 - 3. General: Pro-Weigh 84.
 - 4. Toledo: 2158 Vertex.
 - 5. Triner: TS series.
- B. Platform scales shall be complete with weight plates, two digital indicators, and all accessories, as provided by one manufacturer, as integrated assemblies. Scale shall conform to Class 3 in accordance with National Bureau of Standards Handbook No. 44.



- C. Scale Weight Plate: Scale shall be full load cell floor scale, self-contained, 3,000 pound minimum capacity, with shear beam load cell.
- D. Load Requirements:
1. End Loading: 80 percent of scale capacity.
 2. Safe Overload: 150 percent of scale capacity.
 3. Ultimate Overload: 300 percent of scale capacity.
 4. Maximum Access Speed: 3 miles per hour.
- E. Platform Dimensions: [5 feet 0 inches x 7 feet 0 inches x 3 inches high] [5 feet 0 inches x 5 feet 0 inches, 3 inches high].

NOTE TO SPECIFIER

Galvanized steel is to be selected unless scale will be located at interior of building. Epoxy finish may be selected where scale is located at interior and not exposed to weather.

- F. Platform is to be [galvanized checker plate steel] [checker plate steel with 2 part epoxy finish].
- G. Furnish and install stainless steel recess frame where indicated on Drawings.

2.3 DIGITAL INDICATOR

- A. Model:
1. B-Tek: BT-84.
 2. Cardinal: 708.
 3. General: [_____].
 4. Triner: 1620.
- B. Remote display unit wall mounted. Keyboard indicator located at the scale, remote display indicator shall have read-out only and be located in BMEU office as directed by Contracting Officer. Provide all interconnecting wiring. Indicator shall be self-contained, with front panel controls, to meet the following criteria:
1. Display: Weight 0.50 pound, 5 digits and (-) sign. Displays are seven segment blue-green vacuum fluorescent type.
 2. Decimal Point Location: Adjustable.
 3. Zero Indication: "Zero" Indicator lights when scale is within ± 0.25 increments of the center of the zero increment.
 4. Over Capacity: Display will blank if scale is over 5 increments above maximum capacity.
 5. Under Zero Display: Display will blank with a minus sign if indication falls below gross zero by 5 increments or more.
 6. Initial Range: 0 to 27 millivolts.
 7. Span Range: 3 to 32 millivolts.
 8. Resolution: Up to 1 part in 50,000 displayed; 1 part in 500,000 internal.
 9. Motion Detection: Zero, Tare and Print functions are inhibited while the weight display is changing.
 10. Load Cell Excitation: Provided for up to four 350 ohm or twelve 725 ohm load cells.
 11. Automatic Zero Maintenance: Weight indication within ± 0.1 increments of the center of zero is compensated to zero; total compensation range is 4 percent of full scale.
 12. Power Requirements: 240 VAC, 50-60 Hz. Power consumption is 25 watts.
 13. Radio Frequency Interference: Meets or exceeds Scale Manufacturers Association guidelines.



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Field verify dimensions indicated on Drawings. Be responsible for accurate fit of Specified Products.

3.3 INSTALLATION

- A. Install scale system in accordance with manufacturer's published instructions.
- B. Anchor components, securely, level and plumb.
- C. Make all internal adjustments to components.
- D. Install all digital weight indicators on mounting rack with mounting adapters.
- E. Touch up all scratches and abrasions with finish equal to original.
- F. Deliver scale frame at appropriate time for installation into concrete work.

3.4 CONSTRUCTION

- A. Interface with Other Work: Coordinate recessed installation with platform concrete, plumbing and electrical installations.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Upon completion of installation, put all components through at least two complete operating cycles in presence of the Contracting Officer and verify that all components are properly adjusted and working in accordance with their design intent.



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END OF SECTION



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SECTION 11 11 04 00 - MPF BATTERY CHARGING RACKS**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 – GENERAL

1.1 SUMMARY

- A. Single Stack Battery Charging Rack.

1.2 REFERENCES

- A. Occupational Safety and Health Administration (OSHA):
 - 1. OSHA Regulation 1910-178 (g) Changing and charging storage batteries.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Battery Charging Racks: Indicate materials and finish, installation details, roughing-in measurements, and the configuration of racks.
- B. Shop Drawings:
- C. Certificates:
 - a. Manufacturer's Certificates.
 - 2. Installer's Certification.
 - 3. Qualification.

1.4 QUALITY ASSURANCE

- A. Battery Charging Racks: Conform to requirements of OSHA Regulation 1910-178 (g)
- B. Warranty:
 - 1. Minimum one year warranty.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Battery Handling Systems (BHS), St. Louis, Missouri; 314-423-7091.
 - 1. Models # HBS-30, 42, 60, 72, 84, 96, 108, 120 and 144.
- B. Materials Transportation Company (MTC), Temple, Texas; 800-433-3110.
 - 1. Models #HS-30, 42, 60, 72, 84, 100, 120 and 144.



2.2. MATERIAL

- A. Rack Description:
 - 1. Type: Floor mounted, single, double or triple rack units, dependant upon configuration requirements.
 - 2. Installation: Installed on concrete floor slab.
 - 3. Capacity: Minimum shelf weight - 800 lbs.
 - 4. Maximum base/platform weight – 18,000 lbs.
- B. Rack Construction:
 - 1. Heavy-duty wood, or rigidly welded steel frame.
 - 2. For steel construction, provide non-spark coating for all metal parts
 - 3. Provide base plates at bottom of frame posts for anchoring the rack to the floor.
- C. Platform Surface:
 - 1. Interlayered pressure treated wood or recycled, polyethylene boards.
 - 2. Platform depth - 40".
 - 3. Platform height - Minimum of 12" above floor slab.
- D. Charger Shelf:
 - 1. Depth - Minimum 24" wide
 - 2. Height – 66" above finish floor level.
 - 3. Clear Height – Minimum 50" clear between top of platform and underside of shelf.

PART 3 - EXECUTION

- 3.1 Install all products in accordance with manufacturer's guidelines and printed instructions.

USPS Mail Processing Facility Specification issued: 10/1/2013
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END OF SECTION 11 11 04 00



SECTION 11 12 00 00 - CSF PARKING CONTROL EQUIPMENT

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Parking Control Equipment is part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.11 12 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Parking gate arm and activator units.
 - 2. Devices for card controlled access.
 - 3. Vehicle and motorcycle detection activators.
 - 4. Entry operated by coded card.
 - 5. Exit operation by detection of vehicle or motorcycle.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Data on components, accessories, configurations, and operation.
 - 2. Shop Drawings: Detailed dimensions, electrical requirements, and foundation system.
 - 3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.

1.3 QUALITY ASSURANCE:

- A. UL and NEMA compliance.
- B. Installer: Approved by equipment manufacturer to install specified items.
- C. Conform to applicable code for emergency vehicle access.



1.4 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Protect components and accessories on site from damage or moisture.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 - 1. Magnetic Automation Corporation, Rockledge, FL (321) 6350-8585
 - 2. Aleph America Corporation, Reno, NV (775) 827-8000
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 AUTOMATIC GATE

- A. Basis of Design: Magnetic Automation Corp., Magstop Auto Control

2.3 PHOTOELECTRIC DUAL BEAM DETECTORS

- A. Basis of Design: Aleph America, HA-70D

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install parking control system and components in accordance with manufacturer's instructions and placement drawings.

3.2 TESTING

- A. Test operating functions in accordance with manufacturer's printed checklist.
- B. Correct defects revealed by tests.
- C. Retest corrected areas until functions are operating correctly.

3.3 ACCEPTANCE

- A. At completion of project and as condition of acceptance, parking control equipment and systems shall be operated for a period of 15 consecutive calendar days without breakdown.



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END OF SECTION



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SECTION 11 12 00 00 - MPF PARKING CONTROL EQUIPMENT

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

Use this section where Parking Control Equipment is part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section. 11 12 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Parking gate arm and activator units.
 2. Devices for card controlled access.
 3. Vehicle and motorcycle detection activators.
 4. Entry operated by coded card.
 5. Exit operation by detection of vehicle or motorcycle.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 1. Product Data: Data on components, accessories, configurations, and operation.
 2. Shop Drawings: Detailed dimensions, electrical requirements, and foundation system.
 3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.

1.3 QUALITY ASSURANCE:

- A. UL and NEMA compliance.
- B. Installer: Approved by equipment manufacturer to install specified items.
- C. Conform to applicable code for emergency vehicle access.



1.4 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Protect components and accessories on site from damage or moisture.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 - 1. Magnetic Automation Corporation, Rockledge, FL (321) 6350-8585
 - 2. Aleph America Corporation, Reno, NV (775) 827-8000
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 AUTOMATIC GATE

- A. Basis of Design: Magnetic Automation Corp., Magstop Auto Control

2.3 PHOTOELECTRIC DUAL BEAM DETECTORS

- A. Basis of Design: Aleph America, HA-70D

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install parking control system and components in accordance with manufacturer's instructions and placement drawings.

3.2 TESTING

- A. Test operating functions in accordance with manufacturer's printed checklist.
- B. Correct defects revealed by tests.
- C. Retest corrected areas until functions are operating correctly.

3.3 ACCEPTANCE

- A. At completion of project and as condition of acceptance, parking control equipment and systems shall be operated for a period of 15 consecutive calendar days without breakdown.



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END OF SECTION



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Task	Specification	Specification Description
11 12 36 00	01 22 16 00	No Specification Required



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SECTION 11 13 00 00 - CSF LOADING DOCK EQUIPMENT**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.11 13 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Dock seals.
 - 2. Dock bumpers.
 - 3. Air powered pit type dock levelers.
 - 4. Hydraulic edge-of-dock levelers (Flip Ramp).
 - 5. Dual function, scissors type dock lift/dock leveler.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

NOTE TO SPECIFIER

Keep paragraph below only for powered dock levelers in enclosed platforms.

- C. Related Sections
 - 1. 083613, Sectional Overhead Doors for interlock switch coordination.

1.2 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI MH14.1 - Loading Dock Levelers and Dockboards.
 - 2. ANSI MH29.1 - Safety Requirements for Industrial Scissors Lifts.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data:



- a. Bumpers: Indicate unit dimensions, method of anchorage, and details of construction.
- b. Levelers: Indicate materials and finish, installation details, roughing-in measurements, and operation of unit.
2. Shop Drawings: Indicate required opening dimensions, tolerances of opening dimensions, placement dimensions, and perimeter conditions of construction.
3. Assurance/Control Submittals:

NOTE TO SPECIFIER

Use TEST REPORTS for Dock Levelers for CSF Medium Facilities.

- a. Test Reports: Report from approved Independent Testing Agency indicating compliance of Dock Leveler with requirements of ANSI MH14.1 or ANSI MH29.1.
- b. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
- c. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

- B. Section 017704 – Closeout Procedures and Training: Procedures for closeout submittals.
 1. Operating and Maintenance Data: Operating and maintenance instructions and parts lists.
 2. Submit written special warranty with forms completed in United States Postal Service name and registered with manufacturer as specified in this section.

1.4 QUALITY ASSURANCE

- A. Dock Levelers: Conform to requirements of ANSI MH14.1 or ANSI MH29.1.
- B. Qualifications:
 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

NOTE TO SPECIFIER

Prior to including "Nordock," the design A/E is to confirm with the project contracting officer that the project's total contracted value will meet the limits set for NAFTA – Canada in Clause B. 402.



- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. APS Resource; Mequon, WI; (262) 518-1000
 2. Chalfant Sewing Fabricators, Inc.; Cleveland, OH; (800) 365-0389.
 3. Flexon, Incorporated, Pittsburgh, PA; (800) 365-3667.
 4. Frommelt Industries; Dubuque, IA; (800) 553-4834.
 5. Kelley Dock Systems, Milwaukee, WI; (800) 558-6960
 6. W.B. McGuire Company, Incorporated, Hudson, NY; (800) 624-8473.
 7. Nordock USA, Greenville, SC (866) 885-4276
 8. NOVA Technology, Inc., Menomonee Falls, WI; (800) 236-7325.
 9. Rite Hite Corporation, Milwaukee, WI; (800) 456-0600.
 10. Serco Company, Carrollton, TX; (800) 933-4834
 11. SPX Pock Products, Carrollton, TX (972) 466-0707.

- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

NOTE TO SPECIFIER

"REQUIRED Article (DOCK BUMPERS) follows. Do not revise this Article, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer."

2.2 DOCK BUMPERS

- A. Dock Bumpers at Non-Leveler Locations:
1. Molded rubber, ozone resistant, nylon or polyester reinforced, minimum Shore A Durometer of 80, tensile strength of 950 to 1050 psi.
 2. Thickness from wall, vertical height, width, and profile of bumpers indicated on Drawings.
 3. Pre-drilled, countersunk mounting holes.
- B. Attachment Hardware: 3/4 inch (2 cm) diameter galvanized bolts and "L" shape anchor rods cast into concrete.
- C. Dock Bumpers at Dock Leveler Locations:
1. Laminated rubber, ozone resistant, with two 3/4 inch (2 cm) tie rods and 3/8 inch (1 cm) steel angle at both ends.
 2. Thickness from wall, vertical height, width, and profile of bumpers indicated on Drawings.
 3. Pre-drilled, countersunk mounting holes.

2.3 DOCK SEALS

- A. Models:
1. Chalfant: #160-Black-GP8.
 2. Flexon: [#V-40-WP8 (fixed head pad)] [#F series (no foam head curtain)].
 3. Frommelt: #TPW-901-NPV [TP901 (head pad)] [TP903 (head curtain)]
 4. Kelley: [#DSS-102-WP8-WF(on head pad)] [#DSH-102-WP8-WF (w/head curtain)].
 5. McGuire: #TS111-DP8.
 6. Nordock: #FP (Fixed Head Pad) or FC (Head Curtain)
 7. NOVA: #FP-405-WP8.
 8. Rite-Hite: Genesis Series (Fixed Head Pad or Head Curtain).
 9. Serco: #S-600 WP8-40V or 5700A (Head curtain).
 10. SPX: #W55 (Head Pad), # WSH (Head Curtain)
- B. Components:



1. Side Pads: 12 inch (30 cm) width, length to be clear opening height, with maximum 12 inch (30 cm) projection. Profile of pad shall be square.
2. Head Pad: 24 inch (61 cm) height, length to be 2 feet (61 cm) longer than clear opening width, with maximum 12 inch (30 cm) projection.

2.4 AIR POWERED PIT TYPE DOCK LEVELERS

A. Models:

1. Kelley: aFX Series, with two maintenance struts.
2. Nordock: AD – USPS, with two maintenance struts.
3. Rite Hite: RHA 4002
4. Serco: AB model, with two maintenance struts.

B. Description:

1. Operation: Power activated push button through full working range.
2. Deck Width: 6 feet.
3. Deck Length: [8 feet (2.5 m)] [10 feet (3 m)] (with additional [16 inch (41 cm)] [18 inch (46 cm)] [20 inch (51 cm)]).
4. Operating Range: Minimum 12 inches (30 cm) above to minimum 10 inches (25 cm) below dock level.
5. Capacity: ANSI MH14.1, 1987, Minimum 29,000 pounds.

C. Operation:

1. Leveler is to rise pneumatically through a high volume, low pressure industrial fan motor and PVC lifting bag system when pressure is applied to push button, and fall slowly to truck bed when button is released. Leveler shall have one push button to control both platform and lip operations. Leveler shall have an automatic safety device provided to prevent a drop beyond dock level when leveler is above dock and 2 below dock stops when leveler is below dock level.
2. Leveler is to include lip that is automatically extended as deck section descends onto truck and is yieldable.
3. Leveler shall:
 - a. Have either 1) two outbound maintenance struts secured to the leveler, to support leveler platform with an additional integral maintenance strut for separate lip support; or 2) one central maintenance strut supporting both the leveler and the lip for maintenance purposes.
 - b. Withstand 10,000 pounds fork truck roll-on while maintenance struts are employed.
 - c. Deck strut to be capable of accepting OSHA lockout/tagout pad locks. The lockout/tagout instructions shall be prominently displayed in durable fashion.
4. Dock to truck/trailer cycle time is to be maximum 30 seconds.
5. Leveler electrical requirements: Coordinate wiring requirements and current characteristics with building electrical and emergency power systems.

NOTE TO SPECIFIER

Select paragraph below for optional safety gate.

6. Leveler shall be equipped with safety gate to prevent open dock drop off accidents.

D. Warranty:

1. Leveler shall be rated in capacity to match project application, or a minimum of ANSI MH14.1 , 1987, and provide a minimum of 10-year parts and labor warranty from the manufacturer on all major structural components such as front hinge assembly, front hinge pins, platform assembly, rear hinges, rear hinge pins, sub frame assembly and working range toe guards.
2. Provide minimum 5-year parts and labor warranty from the manufacturer on all major power activated lifting mechanisms such as air hoses, fittings, motors, lifting bag assembly, etc...



2.5 HYDRAULIC EDGE-OF-DOCK DOCK LEVELERS (Flip Ramp)

A. Models:

1. APS Resource: Head Series
2. Chalfant: BL6630.
3. Kelley: #Edge-of-Dock.
4. McGuire: #HEOD 6620.
5. Nordock: Push-Button Series – EH (mechanical lip), EFH – Full Hydraulic (Hydraulic Lift and Lip)
6. Rite-Hite: #EOM 6620.
7. Serco: #AHL6600PO.

B. Description:

1. Operation: Hydraulic.
2. Deck Width: 28 inches.
3. Deck Length: 66 inches.
4. Operating Range: 5 inches above or below dock level.
5. Capacity: 29,000 pounds (minimum).
6. Toe Guards: Full range.

NOTE TO SPECIFIER

Select the following for the dual function scissors type dock lift/dock leveler.

2.6 DUAL FUNCTION SCISSORS TYPE DOCK LIFT/DOCK LEVELER

A. Models:

1. Rite Hite: #DD20126.5.

B. Description:

1. Type: Stationary single-scissor-type hydraulic dock lift/hydraulic dock lever designed for permanent, recessed, installation in preformed concrete pit as indicated on Drawings.
2. Rated Lifting Capacity, scissors lift operation: ANSI MH14.1, 16,000 pounds.
3. Rated Leveling Capacity, leveler operation: ANSI MH14.1, 52,000 pounds.
4. Roll-Over Capacity: 10,000 pounds.
5. Vertical Travel, scissors lift operation: Drive grade to finished floor.
6. Operating Range, leveler operation: 12 inches above to 20 inches below dock level.
7. Travel Speed: 8 feet per minute up or down.
8. Lowered Height: Maximum 8 inches.

NOTE TO SPECIFIER

Edit PLATFORM SIZE below to indicate size required.

9. Platform Size: [6 foot 6 inches wide x 12 feet 0 inches long, excludes 16 inch lip]
10. [Nominal size indicated on Drawings].
11. Travel alarm with bell volume control.

C. Construction: Fabricate from structural steel shapes rigidly welded and reinforced to withstand deformation during operating and stored phases of service. Provide mounting brackets and removable lifting eyes.

D. Operation

1. Self-contained electric hydraulic power unit for raising and lowering of the lift, controlled from a remotely located push-button station.



2. Dual function lift leveler shall have ability to function as a fully automatic scissors lift with capability to lift from grade level (drive approach) to dock height, and stop at any point in-between for loading/unloading processes through control box push button operation.
 3. Lift shall employ automatic style lip to bridge gap between horizontal platform and drive approach, and or extend lip to trailer bed.
 4. Control box mode selection switch shall have ability to switch equipment from lift to leveler modes whereby the rear of the platform is hinged, and front can be raised or lowered to engage trailer beds.
 5. At any time during leveler operation, the lip of the leveler shall be capable of being fully extended or retracted to assist in efficient leveler operation.
 6. Leveler mode operation shall be equipped with automatic return to dock "recycling" to store leveler after trailers depart.
 7. Equipment shall be gated at pit perimeter with two permanent sections of rail approximately 4 feet high spanning the length of the pit, and one section of removable (side swing or vertical rise) gate, approximately 4 feet high, at the front entry to the pit.
 8. Equipment shall have inside and outside communication lights and signs to safely direct trailer drivers to and from the dock position. Equipment shall have a front enclosure for safety and to prevent debris from entering the equipment pit.
- E. Electrical Requirements: Coordinate wiring requirements and current characteristics with building electrical and emergency power systems.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install dock bumpers in accordance with manufacturer's instructions.
- B. Install dock leveler unit in prepared opening in accordance with manufacturer's instructions.
- C. Set square and level.
- D. Anchor unit securely, flush with dock. Weld back of leveling dock to pit frame. Touch-up weld with primer.

3.3 ADJUSTING

- A. Adjust installed unit for smooth and balanced operation.



3.4 OPERATING INSTRUCTION

- A. Provide on-site instruction to review the operation of the system and detail any common troubleshooting or maintenance that is required to ensure normal operation.
- B. Provide one complete set of equipment operating, installation, and programming manuals that will remain at the installed location.

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Last revised: 9/17/2013

END OF SECTION



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SECTION 11 13 00 00 - MPF LOADING DOCK EQUIPMENT**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 – GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Dock seals and Shelters.
 - 2. Dock bumpers.
 - 3. Air powered pit style dock levelers.
 - 4. Hydraulic edge-of-dock levelers (Flip Ramp).
 - 5. Automatic truck restraints.
 - 6. Wheel chocks with automatic light communication

1.2 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI MH14.1 - Industrial Loading Dockboards (Ramps).

1.3 SUBMITTALS

- A. Submittal Procedures: Procedures for submittals.
 - 1. Product Data:
 - a. Bumpers: Indicate unit dimensions, method of anchorage, and details of construction.
 - b. Levelers: Indicate materials and finish, installation details, roughing-in measurements, and operation of unit.
 - 2. Shop Drawings: Indicate required opening dimensions, tolerances of opening dimensions, placement dimensions, and perimeter conditions of construction.
 - 3. Certificate of Assurance:
 - a. Test Reports: Report from approved Independent Testing Agency indicating compliance of Dock Leveler with requirements of ANSI MH14.1.
 - b. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - c. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

1.4 QUALITY ASSURANCE

- A. Dock Levelers: Conform to requirements of ANSI MH14.1.
- B. Qualifications:



1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Product Requirements: Transport, handle, store, and protect Products.

NOTE TO SPECIFIER

Prior to including "Nordock," the design A/E is to confirm with the project contracting officer that the project's total contracted value will meet the limits set for NAFTA – Canada in Clause B. 402.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products, which may be incorporated in the Work, include the following:

1. APS Resource; Mequon, WI; (262) 518-1000
2. Chalfant Sewing Fabricators, Inc.; Cleveland, OH; (800) 365-0389.
3. Flexon, Incorporated, Pittsburgh, PA; (800) 365-3667.
4. Frommelt Industries; Dubuque, IA; (800) 553-4834.
5. Kelley Dock Systems, Milwaukee, WI; (262) 679-6200
6. W.B. McGuire Company, Incorporated, Hudson, NY; (800) 624-8473.
7. Nordock USA, Greenville, SC (866) 885-4276
8. NOVA Technology, Inc., Menomonee Falls, WI; (800) 236-7325.
9. Rite Hite Corporation, Milwaukee, WI; (800) 456-0600.
10. Serco Company, Carrollton, TX; (972) 466-0707

- B. Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 DOCK BUMPERS

- A. Dock Bumpers at Non-Leveler Locations:

1. Molded rubber, ozone resistant, nylon or polyester reinforced, minimum Shore A Durometer of 80, tensile strength of 950 to 1050 psi.
2. Thickness from wall, 6 inch minimum.
3. Pre-drilled, countersunk mounting holes.

- B. Attachment Hardware: 3/4 inch (2 cm) diameter galvanized bolts and "L" shape anchor rods cast into concrete.

- C. Dock Bumpers at Dock Leveler Locations:

1. Laminated rubber fabricated from recycled tires, ozone resistant, with two 3/4 inch (2 cm) tie rods and 3/8 inch (1 cm) steel angle at both ends.
2. Thickness (projection): 6 inches minimum, vertical height, width, and profile of bumpers.

- D. Dock Bumper at Flip Ramp locations:

1. Molded rubber, ozone resistant, nylon or polyester reinforced, minimum Shore A Durometer of 80, tensile strength of 950 to 1050 psi.
2. Manufacturer's standard, replacement dock bumper.



2.3 DOCK SEALS/SHELTERS

A. Models:

1. Chalfant: #160Series.
2. Flexon: [#V Series (fixed head pad)] [#F series (no foam head curtain)].
3. Frommelt: #TPW-901-NPV.
4. Kelley: [#DSS Series (fixed head pad)] [#DSS (Head curtain)].
5. McGuire: #TS111-DP8.
6. Nordock: #FP (Fixed Head Pad) or FC (Head Curtain)
7. NOVA: #FP-Series.
8. Rite-Hite: Genesis Series (Fixed Head Pad or Head Curtain).
9. Serco: #S-600 Series.
10. Weatherall: #WSS

B. Components:

1. Fixed Side Pads: 12 inch (30 cm) width, length to be clear opening height, with maximum 12 inch (30 cm) projection. Profile of pad shall be square.
2. Fixed Head Pad with Curtains: 24 inch (61 cm) height, length to be 2 feet (61 cm) longer than clear opening width, with maximum 12 inch (30 cm) projection.
3. Shelters: Provide soft-sided dock shelter with flexible side supports and curtains able to withstand trailer impact for dock doors wider than 8 feet.
4. Wearpleats: 12 inch wide to comply with tear strength and abrasion resistance of Federal Standard 191.
5. Provide effective seal for trailers ranging from 12'-0" to 13'-6" off pavement. This is based on door size, dock height, and driveway approach.
6. Warranty: Two-year parts and labor.

2.4 AIR POWERED PIT STYLE DOCK LEVELERS

A. Models:

1. Kelley: #AFX Series, with two maintenance struts.
2. Nordock: AD – USPS, with two maintenance struts.
3. Rite Hite: RHA 40002.
4. Serco: AB model, with two maintenance struts.

B. Description:

1. Operation: Power activated push button through full working range.
2. Deck Width: 7 feet.
3. Deck Length: 8 feet (includes 16 inch (41 cm), 18 inch (46 cm) or 20 inch (51 cm) lip).
4. Operating Range: Minimum 12 inches (30 cm) above to minimum 10 inches (25 cm) below dock level.
5. Capacity: ANSI MH14.1, Minimum 40,000 pounds dynamic rated capacity.

C. Operation:

1. Leveler is to rise pneumatically through a high volume, low pressure industrial fan motor and PVC lifting bag system when pressure is applied to push button, and fall slowly to truck bed when button is released. Leveler shall have one push button to control both platform and lip operations. Leveler shall have an automatic safety device provided to prevent a drop beyond dock level when leveler is above dock and to below dock stops when leveler is below dock level.
2. Leveler is to include lip that is automatically extended as deck section descends onto truck and is yieldable.
3. Leveler shall:
 - a. Have either 1) two outbound maintenance struts secured to the leveler, to support leveler platform with an additional integral maintenance strut for separate lip support; or 2) one central maintenance strut supporting both the leveler and the lip for maintenance purposes.
 - b. Withstand 10,000 pounds fork truck roll-on while maintenance struts are employed.



- c. Deck strut to be capable of accepting OSHA lockout/tagout pad locks. The lockout/tagout instructions shall be prominently displayed in durable fashion.
- 4. Dock to truck/trailer cycle time is to be maximum 35 seconds.
- 5. Leveler electrical requirements: Coordinate wiring requirements and current characteristics with building electrical and emergency power systems.

NOTE TO SPECIFIER

Select paragraph below for optional safety gate.

- 6. Leveler shall be equipped with safety gate to prevent open dock drop off accidents.

D. Warranty:

- 1. Leveler shall be rated in capacity to match project application, or a minimum of ANSI MH14.1 40,000 pounds dynamic rated capacity and provide a minimum of 10-year parts and labor warranty from the manufacturer on all major structural components such as front hinge assembly, front hinge pins, platform assembly, rear hinges, rear hinge pins, sub frame assembly and working range toe guards.
- 2. Provide minimum 5-year parts and labor warranty from the manufacturer on all major power activated lifting mechanisms such as air hoses, fittings, motors, lifting bag assembly, etc...

2.5 HYDRAULIC EDGE-OF-DOCK DOCK LEVELERS (Flip Ramp)

A. Models:

- 1. APS Resource: # HEOD 6630
- 2. Chalfant: BL6630.
- 3. Kelley: #Edge-of-Dock.
- 4. McGuire: #HEOD 6620.
- 5. Nordock: Push-Button Series – EH (mechanical lip), EFH – Full Hydraulic (Hydraulic Lift and Lip)
- 6. Rite-Hite: #EOM 6620.

B. Description:

- 1. Operation: Hydraulic.
- 2. Deck Width: 28 inches.
- 3. Deck Length: 66 inches.
- 4. Operating Range: 5 inches above or below dock level.
- 5. Capacity: 20,000 pounds (minimum).

2.6 AUTOMATIC TRUCK RESTRAINTS

A. Models:

- 1. Chalfant: ETRG
- 2. Atlantic: #ATR-600
- 3. Kelley: #STAR4.
- 4. Nordock: #ATL TruckLock
- 5. Poweramp: #PowerStop.
- 6. Rite-Hite: #VBR300.
- 7. Serco: #SL60.
- 8. APS Resource: APS 2000

NOTE TO SPECIFIER

Include the following when a truck restraint is required. Automatic truck restraints are allowed in CSF and MPF facilities only in Climate Zone 6 and 7 of Climate Zone map found in SDC Appendix M1-C.



- B. Description:
1. Positioning: Restraint housing shall be automatically positioned by trailer with no operator input.
 2. For Hook Operation: 110 v, 60 Hz., fractional horsepower electric motor, power activated by push button control. c. Operating Range: 9 inches (23 cm) to 27 inches (69 cm) above grade.
 3. Restraining Capacity Range: 30,000 pounds to 32,000 pounds.
 4. Provide Communication Package: Automatic light communication controlled through position of ICC bar on restraint housing with over-ride to provide audible and visual alarm for non-engagement caution communication.
 5. Over-ride Design: Truck restraint to include removable key over-ride trucks with damaged or missing ICC bars. In over-ride mode, audible alarm is silenced, outside lights remain red, and inside lights show caution.
 6. Approval: Restraint controls including electrical components and wiring completed as a finished system with enclosure, shall be UL listed or recognized.
- C. Operation:
1. Restraint must help to prevent trailer separation accidents by addressing all four types of separation:
 - a. Trailer Premature Departure
 - b. Trailer Creep / Walk-Away
 2. Restraint system must provide LED light communication and signs (straight and mirror image outside), both inside and outside the dock position, to provide instruction to dock workers as to safe entry into trailers, and to trailer drivers as to safe movement to or away from the dock position. Outside lights shall be low profile to prevent damage, and not project off building further than 4.5".
 3. Restraint must have clear text and illustrative instructions on control box adjacent to push buttons, and selector switch to maintain caution mode during non-engagement periods.
 4. Restraint arm, hook or barrier to be activated in up and down positions through push button (switch) operation.
- D. Warranty: Two-year parts and labor warranty, including electrical on all components.

2.7 WHEEL CHOCKS WITH AUTOMATIC LIGHT COMMUNICATION PACKAGE

- A. Wheel Chock
1. Models
 - a. APS Resource: AP0071 Chock / AP0245 sign or approved equal.
 - b. Nordock: #L-88 Chock/USPS 00300 Sign
 2. Description
 - a. Laminated Rubber 8"x8"x8" Well Chock with 15' Chain
 - b. "Trucks Must Be Chocked" Sign at each door.
- B. Automatic Light Communication Package
1. Models
 - a. Serco: ALS Package
 - b. Nordock: DokCom
 2. Description
 - a. Nema 12 rated metal enclosure control panel with red / green led lights and selector switch ("Do Not Enter Truck" / Enter Truck") label – 120V / 1PH / 60 Hz
 - b. Visored exterior led lights – 24VDC
 - c. Exterior communication sign "Back In or Pull Out on green only"
 - d. Light communication package shall be connected to door and leveler through systems such as photo eye limit switch or limit switch on door edge and level interface on the leveler. The light should operate automatically as outlined below with an override switch to close the dock for maintenance, repairs, etc...
 - e. Loading / Unloading Sequence:
 - Outside green / inside red.
 - Place wheel chocks in front of trailer wheels.
 - Open overhead door – outside red / inside red.
 - Position dock leveler on trailer – outside red / inside green.
 - Load / unload truck.



When load / unload completed return dock leveler to stored position – outside red / inside red
Close overhead door – outside green / inside red.
Remove wheel chocks from front of trailer wheels.

- C. A fully automated dock communication and restraint system such as “Smart Chock” by DL Manufacturing is an approved alternate to above component system.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Execution Requirements: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install dock bumpers in accordance with manufacturer's instructions.
- B. Install dock leveler unit in prepared opening in accordance with manufacturer's instructions.
- C. Set square and level.
- D. Anchor unit securely, flush with dock. Weld back of leveling dock to pit frame. Touch-up weld with primer.

3.3 ADJUSTING

- A. Adjust installed unit for smooth and balanced operation.

3.4 OPERATING INSTRUCTION

- A. Provide on-site instruction to review the operation of the system and detail any common troubleshooting or maintenance that is required to ensure normal operation.
- B. Provide one complete set of equipment operating, installation, and programming manuals that will remain at the installed location.

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END OF SECTION 11 13 00 00



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SECTION 11 13 04 00 - CSF DOCK LIFT (SCISSORS TYPE)**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**
THIS SECTION INCLUDES A DIRECT VENDOR ITEM. CONSTRUCTION SUPPLIERS MUST CONTACT THE DIRECT VENDOR AS DIRECTED FOR APPROVED PRICING AND PURCHASING PROCEDURES. Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.11 13 04 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Pit mounted scissors type dock lift.
 2. Surface mounted scissors type dock lift.

NOTE TO SPECIFIER

Portable scissor lifts are offered by Direct Vendor, if not used in the project delete paragraph below.

3. Portable scissor type dock lifts
4. Structure and operating characteristics.

- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

- C. Related Sections:

NOTE TO SPECIFIER

Add paragraph below for surface mounted lift where trucks can potentially impact the unit.

1. Section 055000, Metal Fabrications: for pipe bollards.

NOTE TO SPECIFIER

Delete paragraph below for open platforms.



2. Section 08360, Sectional Overhead Doors: for interlock switch coordination.

1.2 REFERENCES

- A. American National Standards Institute (ANSI):
 1. ANSI MH29.1 - Safety Requirements for Industrial Scissors Lifts.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 1. Product Data: Indicate materials and finish, installation details, roughing-in measurements, and operation of unit.
 2. Shop Drawings: Indicate required opening dimensions, tolerances of opening dimensions, perimeter conditions of construction, and electrical connections.
 3. Assurance/Control Submittals:
 - a. Test Reports: Report from approved Independent Testing Agency indicating compliance of Dock Lift with requirements of ANSI MH29.1.
 - b. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - c. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 1. Operating and Maintenance Data:
 - a. Manufacturer's operating and maintenance instructions.
 - b. Name, address, and telephone number of nearest authorized service representative.
 - c. Complete parts list.
 2. Operation Instruction: Document training by furnishing a sign-in sheet with a description of the training provided, instructors name and organization and those who received training. Refer to 017704 1.3, 1.4 and 1.5 for more specific training requirements.

1.4 QUALITY ASSURANCE

- A. Conform to requirements of ANSI MH29.1.
- B. Qualifications:
 1. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

NOTE TO SPECIFIER

****REQUIRED PART (PRODUCTS) FOLLOWS. DO NOT REVISE THIS PART, EXCEPT AS NOTED BELOW, WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**



PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. This product must be manufactured by a USPS Direct Vendor and is subject to a USPS price and requirements purchasing agreement. The order must be placed using the vendor's web-based ordering system: www.uspslifts.com.
1. Advance Lifts Model #2500K (pit mounted).
 2. Advance Lifts Model #6568 (surface mounted).

NOTE TO SPECIFIER

Delete paragraph below if portable scissor lifts are not used.

3. Advanced Lifts model 1045 & 1055 (portable)

- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Not permitted.

NOTE TO SPECIFIER

Select Pit Mounted or Surface Mounted Scissors Type Dock Lift.

NOTE TO SPECIFIER

For very cold climates specify a lift unit with an oil emerging heater. If in question, verify with Advance Lifts.

2.2 PIT MOUNTED SCISSORS TYPE DOCK LIFT

- A. Description:
1. Type: Stationary single-scissor-type hydraulic dock lift designed for permanent, recessed, installation in preformed concrete pit as indicated on Drawings.
 2. Rated Lifting Capacity: ANSI MH29.1, 5000 pounds.
 3. Roll-Over Capacity: 10,000 pounds.
 4. Vertical Travel: Minimum 58 inches.
 5. Travel Speed: 12 feet per minute up or down.
 6. Lowered Height: Maximum 10 inches.
 7. Platform Size: 6 feet wide x 8 feet long.
 8. Audible travel warning device with adjustable volume control that operates in up and down travel motion.
 9. Flashing travel lights that that operates in up and down travel motion.
 10. Installation Kit to be included with each dock lift. Kit must include 20' of hydraulic hose, 20' of limit switch wire and low-temperature hydraulic oil.
 11. Supply power unit with [wall mounting brackets] [pedestal] appropriate for site.
 12. Quick disconnect: Twist lock removable controls.
- B. Construction: Fabricate from structural steel shapes rigidly welded and reinforced to withstand deformation during operating and stored phases of service.
- C. Platform: Fabricate from heavy steel plate with beveled toe guards on all four sides complying with requirements of ANSI MH29.1. Provide matching hinged throwover bridge where indicated, and removable handrails.
1. Platform Surface: Non-skid safety tread deck plate.



- D. Hinged Bridge: Provide hinged bridge bolted to full length heavy-duty piano type hinge welded to toe guard at end of the platform. Hinge to be minimum 1/4 inch thick steel. Provide bridge complete with heavy-duty lifting chains. Chamfer edge of the bridge to prevent obstruction of material handling vehicle wheels.
1. Bridge Material: Non-skid safety tread steel for bridges under 24" long and non-skid safety tread aluminum for bridges 24 inches long or greater. Bridge material shall be a minimum of 1/4 inch reinforced steel and 3/4 inch minimum thickness for aluminum.
 2. Bridge Size: 66 inches wide x 18 inches long bridge for pit-mounted lifts.

NOTE TO SPECIFIER

Edit handrail configuration if recess scissors lift is being used in an enclosed dock condition. Specify in inches how much the handrail needs to be setback when ordering unit from Advance Lifts.

- E. Handrails: Removable handrails on two sides of platform with single removable link chain across each end. Handrails 42 inches high with midrail and 4 inch high kickplate bottom. If rail sockets are provided with lift, mount flush with platform surface and fit securely in sockets.
- F. Scissor Mechanism: Fabricate leg members from heavy steel formed tube or plate.
- G. Cylinders: Equip with minimum two heavy-duty high pressure hydraulic ram type cylinders. Rams shall be either direct displacement plunger or rod and piston type with positive internal stops as standard with the manufacturer. Cylinder rods shall be chrome plated and polished to prevent rusting. Provide low temperature hydraulic oil.
- H. Bearings: Provide pivot points with permanently lubricated anti-friction bushings or sealed ball bearings for minimum maintenance.
- I. Operation
1. Self-contained electric hydraulic power unit for raising and lowering of the lift, controlled from a remotely located push-button station.
- J. Electrical Requirements: Coordinate wiring requirements and current characteristics with building electrical system.
1. [230 volts/60 Hz/3 phase].
 2. [208 volts/60 Hz/3 phase].
 3. [480 volts/60 Hz/3 phase].
- K. Power Unit: Self-contained, remotely located power unit of proper size, type and operation needed for the capacity of the lift indicated. Power unit shall consist of a 5 HP continuous duty motor, high pressure gear pump, valve manifold, oil line filters, oil reservoir and fluid level sight gauge.
1. Manifold: The manifold shall contain a relief valve, check valve, pressure compensated flow control valve and down solenoid valve and provisions for lowering the lift manually in case of power failure.
 2. Oil Line Filters: Oil line filters shall include one for the oil reservoir, one for the valve manifold and one for the lift itself.
- L. Remote Control Station: Provide lift unit with a weatherproof multiple-button control station of the constant pressure type, complete with "Up" and "Down" push buttons. The controller shall consist of a magnetic motor starter with three pole adjustable overloads and a 24 volt control transformer with a 4 amp fused secondary prewired to terminal strips and mounted in a gasketed NEMA 12 oil and dust tight industrial enclosure. Control shall have a "quick disconnect" feature.
- M. Safety Devices: Provide hinged safety maintenance bars. Provide visible and audible warning when lift is in motion. Provide an automatic safety stop velocity fuse or comparable mechanism.

**NOTE TO SPECIFIER**

Delete the next two paragraph below for open platforms.

- N. Interconnection with overhead door sensor/switch: Provide a connection point for an interlock switch at the door to prevent the lift from operating if the door is not fully open. Coordinate electrical requirements with door manufacturer.
- O. Upper Travel Limit Switch: Equip unit with the manufacturer's standard adjustable upper travel limit switch.
- P. Steel surfaces must be clean and pretreated for optimum paint bond. Prime with a rust inhibitor primer and apply a hard enamel finish. Alternative painting processes must be approved by the USPS contracting officer. Painted toe guards shall have a minimum of 2" yellow with black diagonal stripes to comply with ANSI Z53.1. Unless otherwise indicated, paint other surfaces in the manufacturer's standard color.
- Q. Provide warning labels in accordance with ANSI 2535.4.

2.3 SURFACE MOUNTED SCISSORS TYPE DOCK LIFT

- A. Description:
 - 1. Type: Single-scissors-type hydraulic dock lift designed to be anchored to a concrete apron.
 - 2. Rated Lifting Capacity: ANSI MH29.1, 5500 pounds.
 - 3. Vertical Travel: Minimum 53 inches.
 - 4. Travel Speed: 13 feet per minute Lowered Height:5 inches.
 - 5. Platform Size: 6 feet wide x 8 feet long.
 - 6. Audible travel warning device with adjustable volume control that operates in up and down travel motion.
 - 7. Flashing travel lights that that operates in up and down travel motion.
 - 8. Self contained power unit.
 - 9. Quick disconnect: Twist lock removable controls.
- B. Construction: Fabricate from structural steel shapes rigidly welded and reinforced to withstand deformation during operating and stored phases of service.
- C. Platform: Fabricate from heavy steel plate with beveled toe guards on all four sides complying with requirements of ANSI MH29.1. Provide matching hinged throw-over bridge where indicated, and removable handrails.
 - 1. Platform Surface: Non-skid safety tread deck plate.
- D. Hinged Bridge: Provide hinged bridge bolted to full length heavy-duty piano type hinge welded to toe guard at end of the platform. Hinge to be minimum 1/4 inch thick steel. Provide bridge complete with heavy-duty lifting chains. Chamfer edge of the bridge to prevent obstruction of material handling vehicle wheels.
 - 1. Bridge Material: Non-skid safety tread steel for bridges under 24 inches long and non-skid safety tread aluminum for bridges 24 inches long or greater. Bridge material shall be a minimum of 1/4 inch reinforced steel and 3/4 inch minimum thickness for aluminum.

NOTE TO SPECIFIER

Select BRIDGE SIZE below to indicate actual size required.

- 2. Bridge Size: [60 inches wide x 18 inches long bridge] or [60 inches wide x 24 inches long split bridge].



NOTE TO SPECIFIER

Delete ramp if surface mounted lift is set directly adjacent in front of a raised loading platform.

- E. Ramp: Provide hinged ramp bolted to full length heavy-duty piano type hinge welded to the toe guard at end of the platform. Hinge to be minimum 1/4 inch long.
 - 1. Ramp Material: Bridge material shall be a minimum of 1/4 inch reinforced steel and three quarter inch minimum thickness for aluminum.
 - 2. Ramp Size: 60 inches wide x 30 inches long.

NOTE TO SPECIFIER

Edit handrail configuration if recess scissors lift is being used in an enclosed dock condition. Specify in inches how much the handrails need to be setback when ordering unit from Advance Lifts.

- E. Handrails: Removable handrails on two sides of platform with single removable link chain across each end. Handrails 42 inches high with midrail and 4 inch high kickplate bottom. If rail sockets are provided with lift, mount flush with platform surface and fit securely in sockets.
- F. Scissor Mechanism: Fabricate leg members from heavy steel formed tube or plate.
- G. Cylinders: Equip with minimum two heavy-duty high pressure hydraulic ram type cylinders. Rams shall be either direct displacement plunger or rod and piston type with positive internal stops as standard with the manufacturer. Cylinder rods shall be chrome plated and polished to prevent rusting. Provide low temperature hydraulic oil.
- H. Bearings: Provide pivot points with permanently lubricated anti-friction bushings or sealed ball bearings for minimum maintenance.

NOTE TO SPECIFIER

Select the following Operation paragraph for scissors type dock lift.

- I. Operation
 - 1. Self-contained electric hydraulic power unit for raising and lowering of the lift, controlled from a remotely located push-button station.
- J. Electrical Requirements: Coordinate wiring requirements and current characteristics with building electrical system.
 - 1. [230 volts/60 Hz/1 phase].
 - 2. [208 volts/60 Hz/1 phase].
- K. Power Unit: Self-contained, power unit mounted on the lift and housed in a weatherproof enclosure.. Power unit shall consist of a 2 HP continuous duty motor, high pressure gear pump, valve manifold, oil line filters, oil reservoir and fluid level sight gauge.
- L. Safety Devices: Provide hinged safety maintenance bars. Provide visible and audible warning when lift is in motion. Provide an automatic safety stop velocity fuse or comparable mechanism .

NOTE TO SPECIFIER

Delete the paragraph below for open platforms.

- M. Steel surfaces must be clean and pretreated for optimum paint bond. Prime with a rust inhibitor primer and apply a hard enamel finish. Alternative painting processes must be approved by the USPS contracting officer. Painted toe guards shall have a minimum of 2" yellow with black diagonal stripes to



comply with ANSI Z53.1. Unless otherwise indicated, paint other surfaces in the manufacturer's standard color.

- N. Provide warning labels in accordance with ANSI 2535.4.
- O. The surface mounted scissors type dock lift must be placed on a concrete pad. The minimum size is 6 inches thick x 7 feet wide x 12 feet long.

NOTE TO SPECIFIER

Delete paragraph below if portable scissor lifts are not used.

2.4 PORTABLE SCISSORS TYPE DOCK LIFTS

- A. Description:
 - 1. Type: Portable Single-scissors-type hydraulic dock lift designed for use on to be anchored to a concrete apron.
 - 2. Rated Lifting Capacity: ANSI MH29.1, [4000] [5000].
 - 3. Vertical Travel: 53 inches.
 - 4. Travel Speed: 10 feet per minute down.
 - 5. Lowered Height: 5 1/4 inches.
 - 6. Platform Size: 6 feet x 6 feet.
 - 7. Audible travel warning device with adjustable volume control that operates in up and down travel motion.
 - 8. Flashing travel lights that that operates in up and down travel motion.
 - 9. Self contained power unit.
 - 10. Quick disconnect: Twist lock removable controls.
- B. Construction: Fabricate from structural steel shapes rigidly welded and reinforced to withstand deformation during operating and stored phases of service.
- C. Platform: Fabricate from heavy steel plate with beveled toe guards on all four sides complying with requirements of ANSI MH29.1. Provide matching hinged throw-over bridge where indicated, and removable handrails.
 - 1. Platform Surface: Non-skid safety tread deck plate.
- D. Hinged Bridge: Provide hinged bridge bolted to full length heavy-duty piano type hinge welded to toe guard at end of the platform. Hinge to be minimum 1/4 inch thick steel. Provide bridge complete with heavy-duty lifting chains. Chamfer edge of the bridge to prevent obstruction of material handling vehicle wheels.
 - 1. Bridge Material: Non-skid safety tread steel for bridges under 24 inches long and non-skid safety tread aluminum for bridges 24 inches long or greater. Bridge material shall be a minimum of 1/4 inch reinforced steel and 3/4 inch minimum thickness for aluminum.

NOTE TO SPECIFIER

Select BRIDGE SIZE below to indicate actual size required.

- 2. Bridge Size: [60 inches wide x 18 inches long bridge] or [60 inches wide x 24 inches long split bridge].

NOTE TO SPECIFIER

Delete ramp if surface mounted lift is set directly adjacent in front of a raised loading platform.



- E. Ramp: Provide hinged ramp bolted to full length heavy-duty piano type hinge welded to the toe guard at end of the platform. Hinge to be minimum 1/4 inch long.
1. Ramp Material: Bridge material shall be a minimum of 1/4 inch reinforced steel and three quarter inch minimum thickness for aluminum.
 2. Ramp Size: 60 inches wide x 30 inches long.

NOTE TO SPECIFIER

Edit handrail configuration if recess scissors lift is being used in an enclosed dock condition. Specify in inches how much the handrails need to be setback when ordering unit from Advance Lifts.

- E. Handrails: Removable handrails on two sides of platform with single removable link chain across each end. Handrails 42 inches high with midrail and 4 inch high kickplate bottom. If rail sockets are provided with lift, mount flush with platform surface and fit securely in sockets.
- F. Scissor Mechanism: Fabricate leg members from heavy steel formed tube or plate.
- G. Cylinders: Equip with minimum two heavy-duty high pressure hydraulic ram type cylinders. Rams shall be either direct displacement plunger or rod and piston type with positive internal stops as standard with the manufacturer. Cylinder rods shall be chrome plated and polished to prevent rusting. Provide low temperature hydraulic oil.
- H. Bearings: Provide pivot points with permanently lubricated anti-friction bushings or sealed ball bearings for minimum maintenance.

NOTE TO SPECIFIER

Select the following Operation paragraph for scissors type dock lift.

- I. Operation
1. Self-contained electric hydraulic power unit for raising and lowering of the lift, controlled from a remotely located push-button station.
- J. Electrical Requirements: Coordinate wiring requirements and current characteristics with building electrical system.
1. [120 volts/60 Hz/1 phase].
 2. [_____].
- K. Power Unit: Self-contained, power unit mounted on the lift and housed in a weatherproof enclosure.. Power unit shall consist of a 2 HP continuous duty motor, high pressure gear pump, valve manifold, oil line filters, oil reservoir and fluid level sight gauge.
- L. Safety Devices: Provide hinged safety maintenance bars. Provide visible and audible warning when lift is in motion. Provide an automatic safety stop velocity fuse or comparable mechanism .

NOTE TO SPECIFIER

Delete the paragraph below for open platforms.

- M. Steel surfaces must be clean and pretreated for optimum paint bond. Prime with a rust inhibitor primer and apply a hard enamel finish. Alternative painting processes must be approved by the USPS contracting officer. Painted toe guards shall have a minimum of 2" yellow with black diagonal stripes to comply with ANSI Z53.1. Unless otherwise indicated, paint other surfaces in the manufacturer's standard color.
- N. Provide warning labels in accordance with ANSI 2535.4.



- O. Portable scissors type dock lifts must be used on a concrete pad, minimum 6 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install unit in prepared opening in accordance with manufacturer's published instructions, ANSI MH29.1, and as indicated on Drawings.
- B. Set square and level.
- C. Anchor unit securely.
- D. Make electrical connections as specified in Division 26.

3.3 CONSTRUCTION

- A. Interface with Other Work: Coordinate forming of pit for hydraulic dock lifts to ensure that the pit depth is adequate to accommodate the lift in proper relationship to the loading platform. Attach the lift securely to the pit floor in accordance with the manufacturer's directions.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Inspect unit connection to structure and to electrical service.
- C. Perform operational tests of unit in the presence of the Contracting Officer. Demonstrate each function or operation.
- D. Provide three (3) operator manuals, three (3) maintenance/repair manuals and three (3) parts breakdown diagrams.

E. OPERATING INSTRUCTION



1. Provide on-site instruction to review the operation of the system and detail any common troubleshooting or maintenance that is required to ensure normal operation.
2. Provide one complete set of equipment operating, installation, and programming manuals that will remain at the installed location.

USPS CSF Specifications issued: 10/1/2013
Last revised: 6/14/13

END OF SECTION



SECTION 11 14 14 00 - CSF PORTABLE POSTS AND RAILINGS**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section. 11 14 14 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Retractable, portable, pedestrian traffic guidance device (Tensor Tape).
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - a. Product Data: Data indicating characteristics, dimensions, and function.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 - 1. Lawrence Metal Products, Incorporated, Bay Shore, NY (800) 441-0019.
 - 2. Lavi Industries, Valencia, CA (800) 624-6225.
 - 3. BSI Brass Smith Incorporated, Denver, CO (800) 662-9595.



- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 PEDESTRIAN GUIDANCE BARRIER

- A. Lawrence Metal Products:
 - 1. Model: No. 890-33/33-33-32.
 - 2. Replacement Heads: No. 695-33-33-32, one per post.
 - 3. Replacement Tape Cassettes: No. 70710, one per post.
 - 4. Material, Finish and Color: Plastic, matte black.
- B. Lavi Industries:
 - 1. Model: Beltrac Public Guidance System.
 - 2. Replacement Heads: No. 910T, one per post.
 - 3. Belt Material and Finish: Nylon, black.
 - 4. Material, Finish, and Color: Aluminum, matte black.
- C. Brass Smith Incorporated:
 - 1. Model: Beltway, Enduro
 - 2. Replacement Heads: No. 933, one per post.
 - 3. Belt Material and Finish: Nylon, black.
 - 4. Post Material and Finish: Steel, black.
 - 5. Base Material and Finish: ABS plastic, black.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install pedestrian guidance barriers in accordance with manufacturer's published instructions in locations indicated on Drawings.
- B. Post Spacing: 6 foot 0 inches, maximum.
- C. Quantity of Posts: As indicated on Drawings.



USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



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SECTION 11 14 15 00 - MPF TURNSTILES

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. The products and systems identified in this section provide varying levels of security. Verify the level of security required with the USPS Contracting Officer and Inspection Services. For Design/Build projects, this section is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 – GENERAL

1.1 SUMMARY

- A. Full Height Security Turnstiles.

1.2 SUBMITTALS

- A. Product Data: Required.
- B. Shop Drawings: Required.
- C. Samples: Required.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with USPS Handbook RE-5.
- B. ANSI Life Safety and BOCA Codes.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Turnstile models as manufactured by;
 - 1. Controlled Access, Inc., Hinckley, OH (800)942-0829
 - 2. Alvarado Manufacturing CO, Chino, CA (800)423-4143

2.2 OPERATION; See Section 281304-Physical Access Control System

2.3 MATERIALS

- A. Material and finishes; Polyester enamel: Polyester enamel on Carbon Steel, standard color is black, other colors available upon request.
- B. Passage width; 39" (991mm).
- C. Type; Single.
- D. Arm and barrier tubing sizes; 1-1/2" diameter 14 gauge.
- E. Height: Overall exterior height 91" (2311mm), pedestrian walk through height 84" (2134mm).



- F. Width; 84" (2134mm).

2.4 MATCHING SWING GATE

- A. Material and finishes; Polyester enamel on carbon steel, standard color is black.
- B. Size as pedestrian clearance: 36" (914mm) standard, custom sizes available.
- C. Frame and jamb: 2"x2" (51mmx51mm) 11 gauge box tubing.
- D. Interior tubing sizes; 1-1/2" diameter 14 gauge (38mm).
- E. Exterior height: 91" (2311mm) interior height 88 1/2" (2248mm).
- F. Keylock: Control direction: Control Direction of travel manually by key to lock or unlock, or may be used to override electronic controls.
- G. Swing gate is equipped with outdoor rated electronic strike lock and automatic door closer.

2.5. OPERATION

- A. Interfacing to card readers and computer attendance systems.
- B. See section 281304 – Physical Access Control System.

PART 3 – EXECUTION

- 3.1 Install all products in accordance with manufacturer's guidelines and printed instructions.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 3/31/2010

END OF SECTION 11 14 15 00



SECTION 11 17 04 00 - CSF BULLET RESISTANT SCREENLINE

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Bullet Resistant Screenline is part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section. 11 17 04 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Bullet Resistant Screenline at Full Service Counter comprised of: [Under counter ballistic armor], above counter ballistic security glazing, [above counter ballistic security parcel exchange units], [ballistically reinforced walls adjacent to the counter line], and [ballistic personnel doors].
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 REFERENCES

- A. Underwriters Laboratory (UL)
 - 1. UL Standard 752 - Bullet Resistant Equipment, Level 3 Rating for Super Power Small Arms (SPSA)

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for Submittals.
 - 1. Product Data: Provide for each material or equipment item specified.
 - 2. Shop Drawings: Complete shop drawings shall be submitted for final approval.
 - a. Detailed drawings to show location of parcel passer in relation to existing walls, counters, etc.
 - 3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.



- B. Submit Requests for Information and interpretation of Contract Documents in a timely manner and obtain replies from Contracting Officer in accordance with Section 012600- Contract Modification Procedures.

1.4 QUALITY ASSURANCE

- A. Qualifications:
1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.
- B. Pre-Installation Meetings:
1. Convene a pre-installation meeting one week prior to commencing Work of this Section.
 2. Require attendance of parties directly affecting Work of this Section.
 3. Review conditions of operations, procedures and coordination with related Work.
 4. Agenda:
 - a. Tour, inspect, and discuss conditions of Full Service Counter.
 - b. Review screenline installation requirements.
 - c. Review required submittals, both completed and yet to be completed.
 - d. Approve proposed equipment.
 - e. Review and finalize construction schedule related to screenline installation and verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products

1.6 WARRANTY

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Insulgard Security Products, Brighton, MI 48116, Mr. Scott Morton, 1-800-624-6315.
- B. Section 016000 - Product Requirements: Product options and substitutions: Substitutions: Permitted.

2.2 MATERIALS



- A. Screenlines shall be fabricated out of the UL tested and rated Level 3 laminated polycarbonate in a baffle design. All components shall be factory fabricated and include, but not limited to, surface or recessed deal tray, aluminum channels and all fasteners. All edges of exposed laminated polycarbonate shall be sanded and polished with no rough or sharp edges. Design of screenline shall allow no breach of security from a projectile or object.
- B. Aluminum Extrusions: All aluminum extrusions shall be extruded from prime billet. Alloy and temper to be equivalent to 6061-T6 (Tensile strength - ksi with a minimum ultimate of 38.0 and minimum yield of 35.0.)
- C. Hardware: All hardware shall be as specified and as shown on manufacturer's shop drawings.
- D. Glazing: All glazing materials shall be Ballistic Threat Level 3 with polished edges where required.
 - 1. Glazing shall be 1-5/16 inch laminated polycarbonate with mar resistant coating. Material shall be UL Listed Standard 752 Level 3 and the manufacturer shall have a minimum of 5 years experience manufacturing the above product.
 - a. LEXGARD SP 1250 manufactured by General Electric meets this requirement and its specifications will be the standard of quality.
- E. Fasteners: All assembly fasteners shall be zinc plated. Fasteners where practical shall not be exposed.
- F. Clerk Workstation and other Counters: Must be reinforced with bullet resistant fiberglass.
 - 1. Bullet resistant fiberglass shall be tested and rated by an Independent Testing Laboratory to the above referenced UL Standard(s).
 - 2. Fabrication and installation of these materials shall meet the manufacturers requirements.
 - 3. Under counter fiberglass reinforced panels shall be fabricated by the specialty contractor for field installation.

NOTE TO SPECIFIER

Determine need for accessories listed below and their configuration with Contracting Officer.

2.3 ACCESSORIES

- A. Parcel Pass-Throughs: Intended for transfer of parcels too large to be accommodated by the Workstation deal trays.
 - 1. All Aluminum framing members shall be manufactured with ballistically tested and rated aluminum extrusions and conceal all the necessary operating components to provide smooth operation.
 - 2. All interlocking mechanisms shall be designed to prevent the simultaneous opening of sliding panels and approved by inspection services.
 - 3. Package exchange units shall be situated in an ergonomically correct location so that the clerk has accessibility and adequate space for electronic postal equipment.
- B. Large Parcel Pass-Through: Must be provided in addition to above where space permits to accommodate oversized parcels. Large Parcel Pass-Throughs can be incorporated as stand alone units in the counterline, in a remote location, or on top of a modified Carolina Manufacturing module.
 - 1. All aluminum components and door assemblies shall be tested and rated to meet UL Standard 752 Level 3.
 - 2. Security locking devices shall be used to ensure against the simultaneous opening of both doors and be approved by the local Inspector in Charge.
- C. Personnel Doors: If adjacent to or within 5 feet of the counterline, the personnel door shall be a ballistically rated steel door and frame assembly meeting UL Standard 752 Level 3.
- D. Walls: Walls located within 5 feet of either side of the security counterline must be reinforced with ballistic fiberglass as outlined above and meet UL Standard 752 Level 3.



NOTE TO SPECIFIER

Handicap modules and products are available in the above outlined products which meet ADA requirements. Please refer to ADA guidelines when selecting counter layout.

- E. Handicap Accessible Security Counterline Products
- F. Filler Panels Required: Filler panels required to fill space remaining after the number of workstations has been determined.

NOTE TO SPECIFIER

If space does not allow for a complete Clerk workstation, but because of customer activity an additional workstation is required in the space available, describe and give dimensions for this area. Example would be to eliminate the return unit and provide a 24" work area plus the 24" cash drawer unit.

- G. Custom Clerk Workstation:

2.4 FINISHES

- A. All exposed aluminum shall have architectural Class II clear anodized finish 204-R1.
- B. Finishes for hardware shall be as specified on shop drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. All components and aluminum extrusions shall be factory assembled and pre-fit to assure quality joinery.
- B. Units must be disassembled for shipping.

3.3 INSTALLATION

- A. Contractor shall provide all labor, tools, and equipment for a complete installation.



- B. All work shall be installed by contractor's trained personnel experienced with all the aspects of ballistic scope requirements.
- C. After installation contractor will perform final cleaning of job.

3.4 CONSTRUCTION

- A. All extruded aluminum joints to be fitted true to a hairline joint.
- B. Offset tolerances of aluminum extrusions within end to end or butt joints shall not exceed .031".

USPS CSF Specifications issued: 10/1/2013
Last revised: 6/17/2013

END OF SECTION



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SECTION 11 26 00 00 - CSF UNIT KITCHENS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where a Unit Kitchen is part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section. 11 26 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Self contained unit kitchen.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Indicate materials, finishes, construction, and operating features.
 - 2. Shop Drawings: Wiring diagrams clearly indicating manufacturer installed wiring and Contractor installed wiring.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Operations and Maintenance Data: Manufacturer's recommended maintenance and cleaning instructions.
 - 2. Special Warranty: Submit written special warranty with forms completed in United States Postal Service name and registered with manufacturer as specified in this Section.

1.3 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements: Comply with unit kitchen manufacturer's written requirements for temperature and humidity conditions during storage and installation. Do not install unit kitchens until these conditions have been attained and will be continuously maintained at values near those indicated for final occupancy.



1.4 WARRANTY

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Special Warranty:
 - 1. One year warranty on cabinet and appliances.
 - 2. Five year warranty on refrigeration system.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project. Minimum three manufacturers.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 - 1. Cervitor Kitchens, Incorporated, El Monte, CA (800) 523-2666.
 - 2. Dwyer Products, Incorporated, Michigan City, IN (800) 348-8508.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 UNIT KITCHEN

- A. Model:
 - 1. Cervitor: BF-60
 - 2. Dwyer: 60" W
- B. Counter Height: 34 inch handicapped accessibility.
- C. Cabinet Accessories:
 - 1. Hardware: 3 inch wire pull, polished chrome.
 - 2. Single lever mixing faucet.
 - 3. Standard size sink.
 - 4. Cutlery drawer.
 - 5. Overhead cabinets (optional based on requirements from USPS Contracting Officer).
 - 6. Width modification (as required for limited site conditions).
- D. Appliances:
 - 1. Under-counter refrigerator/freezer, minimum 5.5 cubic feet, compact, single door; designed for recessed installation.
 - 2. Microwave oven, minimum 0.8 cubic feet capacity, 600 watts cooking power.
 - 3. Cooktop not required.

NOTE TO SPECIFIER

Verify finish color with USPS Contracting Officer.

- E. Plastic Laminate: Match interior finish type [PL-4] [____].



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify that unit kitchen can be installed complying with the original design and referenced standards.
 - 2. Examine roughed-in plumbing, mechanical, and electrical services to verify actual locations of piping connections prior to installation.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install unit kitchens level and plumb, according to manufacturer's printed instructions, rough-in drawings, and referenced standards.
- B. Securely anchor components and appliances to supporting cabinets or counter tops with concealed fasteners.
- C. Securely anchor unit kitchens to adjacent walls and floor with concealed devices.
- D. Verify that clearances are adequate to properly and freely operate appliances.
- E. Coordinate with other trades for plumbing, mechanical and electrical service connections.

3.3 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Test, adjust, and verify operation of each appliance, plumbing fixture, and component of unit kitchen. Repair or replace any item found to be defective or operating below rated capacity.

3.4 ADJUSTING, CLEANING, AND PROTECTION

- A. Check that operating parts work freely and fit neatly. Adjust and lubricate hardware and moving parts as necessary.
- B. Remove protective coverings, if any, and clean unit kitchens following installation.
- C. Repair or replace damaged parts, dents, buckles, abrasions, and other defects affecting appearance or serviceability.



USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



Task	Specification	Specification Description
11 28 13 00	01 22 16 00	No Specification Required
11 33 00 00	01 22 16 00	No Specification Required



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SECTION 11 40 00 00 - MPF FOODSERVICE EQUIPMENT**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Commercial Food Service Equipment as per USPS requirements and guidelines:
 - 1. Receiving and handling equipment.
 - 2. Food storage and refrigeration equipment
 - 3. Food preparation equipment and exhaust hoods with integral fire suppression system.
 - 4. Food preparation line.
 - 5. Cafeteria line serving equipment.
 - 6. Vending equipment.
 - 7. Pot washing and dishwashing equipment.
 - 8. Garbage collection and storage equipment.

1.2 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. NSF Seal of Approval.
 - 2. Underwriters' Laboratories Label.
 - 3. NFPA 54, National Fuel Gas Code.
 - 4. NFPA 70, National Electrical Code.
 - 5. NFPA 96, Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment.
 - 6. ASME Boiler Code.
- B. Provide field inspection and testing upon completion of installation.

1.3 SUBMITTALS

- A. Product Data: Required
- B. Shop Drawings: Required

PART 2 – PRODUCTS

2.1 MATERIALS



- A. Stainless Steel: AISI Type 304, No. 4 polished finish.
- B. Tops, Sinks, Dishtables, and Drainboards: 14 gage stainless steel.
- C. Cabinet Bodies and Doors: 20 gage stainless steel.
- D. Drawers: 18 gage stainless steel body with 16 gage stainless steel front.
- E. Shelves: 14 gage stainless steel.
- F. Cold Pans: 14 gage stainless steel.
- G. Exhaust Hoods: NFPA 96 light fixtures, exhaust duct, grease removal and integral fire protection system.
- H. Refrigeration Equipment: Compressors, condensers, piping, and storage areas, capacity as required for projected quantities.

PART 3 – EXECUTION

- 3.1 Install all products in accordance with manufacturer's guidelines and printed instructions.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 3/31/2010

END OF SECTION 11 40 00 00



Task	Specification	Specification Description
11 52 13 13	01 22 16 00	No Specification Required
11 52 16 26	01 22 16 00	No Specification Required



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SECTION 11 53 34 00 - CSF PORTABLE EMERGENCY EYEWASH STATIONS

ONE TIME CAPITAL BUY

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

A. SUMMARY

1. Wall mounted, gravity fed emergency eyewash station for battery charging areas.

B. QUALITY ASSURANCE

1. Codes and standards
 - a) ANSI Z358.1
 - b) Code of Federal Regulations: 29 CFR 1910.151

C. SUBMITTALS

1. Product Data: Required
2. Training, Maintenance Manuals: Required

D. MATERIALS

1. Acceptable Products
 - a. SAS Safety Corp Model SAS 5135.
 - b. Bradley Model 519-921
 - c. Fend-All Model "pure flow"
2. Heads
 - a. Positioned 33-45" from floor.
 - b. Positioned at least 6" from wall or nearest obstruction.
 - c. Flushing fluid at 0.4 gpm for 15 minutes.
3. Valves
 - a. Active in 1 second or less.
 - b. Stay-open valve (leaving hands free).
4. Installation
 - a. Eyewash equipment shall be located in a area that requires no more than 10 seconds to reach.
 - b. The location of the eye wash unit shall be in a well lit area and identified with a sign.
5. Maintenance and Training.
 - a. Units shall be maintained according to the manufacturer's instructions.
 - b. All employees who might be exposed to the chemical splash shall be trained in the use of the equipment.
 - c. All eyewash equipment shall be inspected annually to make sure they meet ANSI Z358.1 requirements.

USPS Capital Equipment Specification issued: 10/1/2013
Last revised: 4/12/2011



END OF SECTION 11 53 34 00



Task	Specification	Specification Description
11 53 43 00	01 22 16 00	No Specification Required
11 66 13 00	01 22 16 00	No Specification Required
11 66 23 13	01 22 16 00	No Specification Required
11 66 43 00	01 22 16 00	No Specification Required



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Task	Specification	Specification Description
12 01 60 00	01 22 16 00	No Specification Required



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SECTION 12 20 00 00 - CSF WINDOW TREATMENTS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section. 12 20 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Horizontal metal slat louver blinds.
 2. Criminal Investigative Office Curtain.
 3. Vertical blinds at Lobby/Self Service.
 4. Mounting system.
 5. Operating hardware.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 1. Product Data: Data indicating physical and dimensional characteristics and operating features.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 1. Operation and Maintenance Data: Manufacturer's recommendations for maintenance and cleaning.

1.3 QUALITY ASSURANCE

- A. Qualifications:
 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.



1.4 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver to site in manufacturer's original packaging.
- C. Store blinds to prevent damage to materials, finishes and operating mechanisms.

1.5 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Existing Conditions: Take field measurements of openings to determine exact sizes required for each opening.

1.6 WARRANTY

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Blinds
 - a. Springs Window Fashions, LP, Montgomery, PA (800) 544-4749
 - b. Hunter Douglas Inc., Upper Saddle River, NJ (800) 727-8953
 - c. Levolor, Rockway, NJ (800) 826-8021
 - 2. Curtain
 - a. Imperial Fastener Co., Pompano Beach, FL (800) 826-8021
- B. Section 016000 - Product Requirements: Product Options and Substitutions. Substitutions: Permitted.

2.2 HORIZONTAL BLINDS

- A. Horizontal Blinds: Horizontal slat louvers hung from full-width headrail with full-width bottom rail; manual control of raising and lowering by cord with full range locking open and closed point locking; blade angle adjustable by control wand.
 - 1. Springs Window Fashions, Bali: Classic 1 inch Mini Blinds, No. 042 "Matte White" color.
 - 2. Hunter Douglas: Contract Flexalum Decor 1 inch Aluminum Blinds Model CD80, No. 127 "Linen Flirt" color.
 - 3. Levolor: Monaco 1 inch Contract Blind, No. 115 "Dover" color.
 - a. Headrail Attachment: Wall brackets.
 - b. Accessory Hardware: Type recommended by blind manufacturer.



2.3 VERTICAL BLINDS

- A. Vertical, 3 ½" PVC Louver Vanes hung from full width headrail, manual wand control for traversing and rotating louvers.
 - 1. Springs Window Fashions: Graber G.85 Dura-View, #3353 "Alabaster".
 - 2. Levelor: Horizon #8091 "Dover".
 - 3. Hunter Douglas: Vertical Solutions, Color to match horizontal blinds.
 - a. Headrail Attachment: Wall Brackets.

2.4 CURTAIN

- A. Model/Color:
 - 1. Imperial: Cubicle Track IFC-98 with Supercote black fabric.

2.5 FABRICATION

- A. Fabricate blinds to cover window frames completely.
- B. At openings requiring multiple blind units, provide separate blind assemblies with space of 1 inch between assemblies, occurring at window mullion centers.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify that structural blocking and supports are correctly placed.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install blinds in accordance with manufacturer's published instructions where indicated on Drawings.
- B. Secure in place with concealed fasteners.
- C. Install curtain on a hospital-type curtain track mounted to the ceiling or to structure above. The curtain must drape from minimum 7 feet above finished floor to the finished floor. The curtain is to be attached with Velcro™ or other mechanical device.

3.3 CONSTRUCTION



- A. Interface with Other Work: Coordinate Work with window installation and placement of concealed blocking to support blinds.
- B. Site Tolerances:
 - 1. Maximum Variation of Gap at Window Opening Perimeter: 1/4 inch.
 - 2. Maximum Offset From Level: 1/8 inch.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Inspect installation, attachment, and operation of blinds.

3.5 ADJUSTING AND CLEANING

- A. Section 017300 - Execution: Requirements for adjusting and cleaning.
- B. Adjust blinds for smooth operation.
- C. Clean blind surfaces prior to Final Acceptance inspection.

NOTE TO SPECIFIER

Coordinate the following items with Contract Drawings:

DRAWING COORDINATION ITEMS

Drawings should indicate the following information related to this Section.

- 1. *Location and size of openings where blinds and curtain will be installed.*
- 2. *Installation details, including bracket location and mounting details*
- 3. *Location of tilt and operational controls.*

USPS CSF Specifications issued: 10/1/2013

Last revised: 4/12/2011

END OF SECTION



SECTION 12 22 13 00 - DRAPERIES AND TRACKS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for draperies and tracks. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes draperies and drapery tracks.

C. Submittals

1. Product Data: For the following:
 - a. Tracks: Include maximum weights of draperies that can be supported.
 - 1) Motorized Tracks: Indicate motor weights, motor-mounting requirements, and electrical requirements.
 - b. Fabrics and textile treatments.
2. Shop Drawings: For tracks. Show installation and anchorage details, locations of components and controls, and field measurements.
 - a. Draperies: Show sizes, locations, and details of installation.
3. Coordination Drawings: For track installation; reflected ceiling plans drawn to scale and coordinating track installation with openings and ceiling-mounted items.
4. Samples: For each drapery and for each fabric color and texture required.
5. Product Schedule: Use same designations indicated on Drawings.
6. Product Certificates: For each fabric treated with flame retardant, signed by fabric supplier.
7. Maintenance data.

D. Quality Assurance

1. Installer Qualifications: For draperies and tracks, fabricator of draperies.
2. Source Limitations: For draperies, obtain each color and pattern of fabric and trim from one dye lot.
3. Fire-Test-Response Characteristics: For fabrics treated with fire retardants, provide products that pass NFPA 701 as determined by testing of fabrics that were treated using treatment-application method intended for use for this Project by a testing and inspecting agency acceptable to authorities having jurisdiction.
4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
5. Corded Window Covering Product Standard: Provide drapery tracks operated by pull cords complying with ANSI A100.1.

1.2 PRODUCTS

A. Drapery Tracks

1. Manually Operated Track:
 - a. Construction: Extruded aluminum, slotted for mounting at interval of not more than 24 inches (610 mm) o.c., and bendable to radii indicated.
 - 1) Lengths and Configurations: As directed.
 - 2) Support Capability: Weight of drapery indicated **OR** 30 lb (14 kg) **OR** 45 lb (20 kg) **OR** 60 lb (27 kg) **OR** 80 lb (36 kg) **OR** 140 lb (64 kg) **OR** 210 lb (95 kg), **as directed**, mounted on track length indicated.



- 3) Finish: Manufacturer's standard **OR** White baked enamel **OR** Clear anodic coating, **as directed**.
 - b. Mounting Brackets: Aluminum, of type suitable for fastening track to surface indicated and designed to support weight of track assembly and drapery plus force applied to operate track.
 - 1) Mounting Surface: As indicated on Drawings **OR** Wall **OR** Ceiling **OR** Drapery pocket, **as directed**.
 - c. Installation Fasteners: Sized to support track assembly and drapery, and fabricated from metal compatible with track, brackets, and supporting construction. Provide two fasteners to fasten each bracket to supporting construction.
 - d. Operation: Baton **OR** Cord **OR** Cord tension pulley, **as directed**.
 - 1) Pulley Mounting Location: Wall **OR** Baseboard **OR** Floor, **as directed**.
 - 2) Draw: One way, stack as indicated on Drawings **OR** One way, stack left **OR** One way, stack right **OR** Two way, center opening, **as directed**.
 - 3) Operating Hardware Location: On stack side **OR** Left **OR** Right **OR** As indicated on Drawings, **as directed**.
 - e. Carriers: Rollers **OR** Rollers with hooks **OR** Rollers with snaps **OR** Coordinate with drapery headings indicated, **as directed**.
 - 1) Master Carriers: Butt **OR** Overlap, **as directed**.
 - f. Accessories: <Insert accessories.>
2. Motorized Track:
- a. Construction: Extruded aluminum, slotted for mounting at interval of not more than 24 inches (610 mm) o.c., and bendable to radii indicated.
 - 1) Lengths and Configurations: As directed.
 - 2) Support Capability: Weight of drapery indicated **OR** 30 lb (14 kg) **OR** 45 lb (20 kg) **OR** 60 lb (27 kg) **OR** 80 lb (36 kg) **OR** 140 lb (64 kg) **OR** 210 lb (95 kg), **as directed**, mounted on track length indicated.
 - 3) Finish: Manufacturer's standard **OR** White baked enamel **OR** Clear anodic coating, **as directed**.
 - b. Mounting Brackets: Suitable for fastening track to surface indicated and designed to support weight of track assembly and drapery plus force applied to operate track.
 - 1) Mounting Surface: As indicated on Drawings **OR** Wall **OR** Ceiling **OR** Drapery pocket, **as directed**.
 - c. Installation Fasteners: Sized to support track assembly and drapery, and fabricated from metal compatible with track, brackets, and supporting construction. Provide two fasteners to fasten each bracket to supporting construction.
 - d. Motor Operation: Low-voltage motor with built-in low-voltage interface for direct access to control systems, with thermal-overload switch; sized for weight of drapery and track length indicated; and equipped with stops to prevent overdrawing.
 - 1) Control: Wall switch **OR** Remote, infrared **OR** Remote, radio controlled **OR** Digital timer, **as directed**.
 - 2) Draw: One way, stack as indicated on Drawings **OR** One way, stack left **OR** One way, stack right **OR** Two way, center opening, **as directed**.
 - 3) Electrical Requirements: 115 V/60 Hz/120 W/1.10 A **OR** 115 V/60 Hz/140 W/1.20 A **OR** 110 V/60 Hz/150 W/1.0 A **OR** 110 V/60 Hz/550 W/5.0 A, **as directed**.
 - 4) Travel Speed: 6 inches (152 mm) **OR** 8 inches (203 mm) **OR** 12 inches (305 mm), **as directed**, per second.
 - e. Carriers: Rollers **OR** Rollers with hooks **OR** Rollers with snaps **OR** Coordinate with drapery headings indicated, **as directed**.
 - 1) Master Carriers: Butt **OR** Overlap, **as directed**.
 - f. Accessories: <Insert accessories.>

B. Draperies

1. Drapery:
 - a. Heading:



- 1) Pinch (French) Pleats: 100 **OR** 150 **OR** 200, **as directed**, percent fullness.
- 2) Stack Pleats: 60 **OR** 80 **OR** 100 **OR** 120, **as directed**, percent fullness.
- 3) Roll Pleats: 60 **OR** 80 **OR** 100 **OR** 120, **as directed**, percent fullness.
- 4) Accordion Pleats: 40 **OR** 80 **OR** 100 **OR** 120, **as directed**, percent fullness.
- 5) Pleat Spacing: **<Insert dimension.>**
- 6) Heading Accessories:
 - a) Nonwoven buckram.
 - b) Woven snap tape, 7/8 inch (22 mm) wide, with nickel-plated snaps at 4 inches (102 mm) o.c.
 - c) Hooks.
- b. Drapery Fabric:
 - 1) Manufacturer, Designation, Pattern, Color, and Fiber Content: **As directed**.
 - 2) Orientation: Run right (up the bolt).
 - 3) Width and Pattern Repeat Distance: **As directed**.
 - 4) Textile Treatments: Stain repellent **OR** Flame retardant, polymer type **OR** Stain repellent; and flame retardant, polymer type, **as directed**.
- c. Lining Fabric:
 - 1) Lining Type: Blackout; light tight **OR** Water resistant, **as directed**.
 - 2) Manufacturer, Manufacturer's Designation, Color, Fiber Content, and Width: **As directed**.
 - 3) Textile Treatments: Stain repellent **OR** Flame retardant, polymer type **OR** Stain repellent; and flame retardant, polymer type, **as directed**.
- d. Interlining: Acoustical.
 - 1) Manufacturer: **As directed**.
- e. Textile Trim and Tiebacks: **As directed**.
- f. Hem Weights: 1-inch- (25-mm-) square lead weights **OR** Tape type (string weights), **as directed**.

C. Drapery Fabrication

1. Fabricate draperies in heading styles and fullnesses indicated. Fabricate headings to stand erect. If less than a full width of fabric is required to produce panel of specified fullness, use equal widths of not less than one-half width of fabric located at ends of panel.
 - a. One-Way-Stacking Draperies: Add 5 inches (127 mm) to overall width for returns.
 - b. Center-Opening Draperies: Add 10 inches (254 mm) to overall width for overlap.
2. Seams: Sew vertical seams with twin-needle sewing machine with selvage trimmed and overlocked. Join widths so that patterns match and vertical seams lay flat and straight without puckering. Horizontal seams are not acceptable.
3. Side Hems: Double-turned, 1-1/2-inch- (38-mm-) wide hems consisting of three layers of fabric, and blindstitched so that stitches are not visible on face of drapery.
4. Bottom Hems: Double-turned, 4-inch- (102-mm-) wide hems consisting of three layers of fabric, and weighted and blindstitched so that weights and stitches are not visible on face of drapery.
 - a. Sew in square lead weights at each seam and at panel corners.
5. Interlinings: Extend from top of drapery to within 1/2 inch (13 mm) of lining's bottom hem and to leading edge of side hems to produce full-shadowed appearance.
6. Linings: Equal to widths of drapery fabric and joined to drapery fabric at top by inside invisible seam, and hand stitched at side hems and shadowed with 1-1/2-inch (38-mm) return of face fabric.
 - a. Bottom Hem: Hem separately from **OR** Blind stitch to, **as directed**, drapery fabric.

1.3 EXECUTION

A. Drapery Track Installation

1. Install track systems according to manufacturer's written instructions, level and plumb, and at height and location in relation to adjoining openings as indicated on Drawings.



2. Isolate metal parts of tracks and brackets from concrete, masonry, and mortar to prevent galvanic action. Use tape or another method recommended in writing by track manufacturer.

B. Drapery Installation

1. Where draperies abut overhead construction, hang draperies so that clearance between headings and overhead construction is 1/4 inch (6.4 mm).
2. Where draperies extend to floor, install so that bottom hems clear finished floor by not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm).
3. Where draperies extend to windowsill, install so that bottom hems hang above sill line and clear sill line by not more than 1/2 inch (13 mm).

C. Adjusting

1. After hanging draperies, test and adjust each track to produce unencumbered, smooth operation.
2. Steam and dress down draperies as required to produce crease- and wrinkle-free installation.
3. Remove and replace draperies that are stained or soiled.

END OF SECTION 12 22 13 00



Task	Specification	Specification Description
12 22 16 00	12 22 13 00	Draperies and Tracks
12 24 13 00	01 22 16 00	No Specification Required



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SECTION 12 31 16 00 - KITCHEN CASEWORK, STAINLESS STEEL CABINETS

1.1 GENERAL

A. Description of Work

1. This specification covers the furnishing and installation of materials for kitchen casework, stainless steel cabinets. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Quality Assurance

1. Comply with all provisions of specifications for the design, quality testing. Manufacturing and installation of metal kitchen cabinets and specified equipment.
2. All kitchen cabinetry and equipment herein specified and shown on the drawings shall meet the standards, quality of materials, construction, workmanship and finish of Innovative Laboratory Systems Co., 1336 Industrial Rd., Omaha Nebraska, (402) 333-0679. Equal manufacturers acceptable.
3. All metal cabinetry and equipment herein shall be the product of one manufacturer and be the one on which this specification is based or approved of substitutes must be obtained in writing from the Owner ten days prior to the bid due date. All manufacturers other than the specified product shall provide evidence of having a minimum of five years experience in the manufacturing and installation of stainless steel kitchen cabinetry.
4. The manufacturer shall, from one year to date of installation, warrant parts or products manufactured and finished against manufacturing defects in material and any such parts which under normal use prove defective within one year form date of installation, shall be repaired or replaced without charge to the Owner.
5. Wood shall not be used in any portion of the casework construction whether exposed or hidden from view.

C. Submittals

1. Shop Drawings
 - a. Identify location of metal cabinetry and related items.
 - b. Detail cabinets, shelving, countertops, etc, in related and dimensional position, with sections. Locations for roughing-in of plumbing, including sinks, faucets, strainers, cocks, etc. shall be included
2. Certificates: All bidders shall provide to the Owner independent test results from a nationally recognized testing laboratory on the finishes required for this project with the bid.

1.2 PRODUCTS

A. Material

1. All metal cabinetry shall be fabricated to Type 304 stainless steel free of scales buckles or other defects.
2. Minimum metal gauge: All minimum thickness of metal referred to herein shall be U.S. standard gauge.
 - a. 20 Gauge: Inner door panels, inner and outer drawer panels, drawer body, and shelves.
 - b. 18 Gauge: Outer door panels, sides, backs, bottoms, and tops.
 - c. 16 Gauge: Top rails, cross rails, drawer slides.
 - d. 14 Gauge: Leveling and corner gussets.

B. Fabrications

1. Cabinet Grade: Premium and complying with the following.
 - a. Align sides, top rails, bottoms and vertical stiles, at intersections, without overlap.



- b. Rounded edges.
 - c. Full welded seams.
 - d. Grind exposed welds flush and smooth.
- 2. Cases: The sides of cabinets shall be formed to make a rabbeted stile 1-1/8" wide. Top of case stiles shall be closed by a mitered 45-degree bend from tip of case side. Stiles shall be closed by welded channel, which contains front shelf adjustment louvers. All case members including intermediate cross rails shall be welded for maximum strength. Use of sheet metal screws to hold intermediate cross rails in place is not acceptable. Sides of all cabinets shall be free from any holes to prevent dust and bacteria from entering the cabinet. Pre-punched holes in the side of any cabinet will not be allowed. All drawer cabinets and cupboard cabinets shall have full backs and bottoms welded into place. Any cabinet without any backs or bottoms will be rejected. All interior bottoms of base and tall cabinets shall be turned down to provide a clean, flush interior free from dust catching ledges and preventing bacterial accumulation. Bottoms of all wall units shall be flushed; recessed bottoms are not acceptable.
- 3. Doors
 - a. Doors shall be double panel reinforced construction 5/8" thick and sound deadened with vertical steel battens. Door fronts and liners shall be welded together for added strength. Door fronts and cases shall be slotted to receive hinges. Hinge wings must be concealed when doors open. Wrap around type hinges are not acceptable. All doors shall have soft rubber bumpers for quiet closing. Rubber bumpers must be securely locked in place. Rubber Bumpers attached by adhesives are not acceptable. All corners of doors shall be welded and ground smooth.
 - b. Sliding doors shall be double panel reinforced construction 5/8" thick and operate on nylon rollers suspended from stainless steel track at top of unit and center guide at bottom. Sliding doors shall have recessed door pulls.
- 4. Drawers
 - a. Drawers front shall be double panel reinforced construction with 5/8" thick fronts and sound deadened with vertical steel battens. Drawers shall be all welded construction. All drawers shall have soft rubber bumpers for quiet closing. Rubber bumpers must be securely locked in place. Rubber bumpers attached by adhesives are not acceptable. All edges of drawer fronts shall be closed.
 - b. Drawer bodies shall be formed from a single sheet of steel including the bottom, two sides, back and inner front. Interior bottoms of drawers shall be fully covered on four sides for ease in cleaning. The top front of the inner drawer shall be offset to interlock with the outer drawer front.
 - c. Flanges on the top of drawer body shall be fully formed channel and bent at a 6-degree angle for maximum strength. Flanges shall be formed to leave the inside of the drawer free form sharp edges. Drawer slide shall be welded to drawer body and be part of a "Z" shaped member in a wrap around design to support drawer body. Drawer slides shall have a 15/16" nylon tired ball bearing roller. Drawer slide shall be roller type, positive in action permitting drawer to be fully opened; yet preventing drawer from accidental removal. Case slides shall be a formed piece of galvanized steel with 15/16" nylon tired ball bearing roller at front of slide. All ball bearing rollers for drawer slide and case slide shall be pre-lubricated to guarantee a smooth, quiet operation. All drawers shall rise upward when opened to prevent engaging of drawers and doors below. Drawers shall have self-closing design during the last 5" of travel.
- 5. Shelves: Shelves shall be formed from a single sheet of stainless steel with 7/8" face turned back and up at a 30-degree angle and edge of flange shall make firm contact with underside of shelf for sound deadening. All shelves in cabinets shall be adjustable on 1-1/2" center and supported by stainless steel clips placed in embossed louvers. All shelves shall be solid.
- 6. Hardware: Door catch shall be positive type latch located at upper inside edge of door. Stainless steel strike bracket shall be installed inside of door with accessible removable screws. Bolt shall be nylon self-closing type tested for 300,000 opening and closing cycles. Complete bolt housing shall be recessed behind cross rail. Roller catches and/or friction catches are not acceptable.



7. Hinges: Hinges shall be institutional type, 2-1/2" long, with a metal thickness of least 0.090", containing 5-knuckles, and centered 3" above bottom and below top of door. Doors 45" high and over shall have an additional hinge in center. Hinges shall be stainless steel with smooth rounded joints for easy cleaning. When door is closed, only the joint shall be exposed. Both hinge wings shall be encased, one within the door, the other within the case. Hinges shall be attached to the door and the case by screws. Hinges welded to door and/or case are not acceptable.
 8. Door and Drawer Pull: Door and drawer pull shall be stainless steel with a brushed satin finish. Shoulder screws shall be used so that when handles are mounted they do not cause the door to buckle or cave. Sliding doors shall have recessed door pulls.
 9. Base Cabinet Legs: All base cabinets and sink units shall be furnished with integral stainless steel legs with adjustable levelers. Bottom of base cabinets shall be approximately 6" above the floor.
 10. Locking Mechanism: All cabinet doors shall be provided with stainless steel angle hasps, with half-inch diameter holes for pad locking, as shown on the drawings. The left door of each door pair shall have a sliding flush bolt on the inside face, as shown on the drawings, to prevent the pair of doors from swinging open when pad locked.
- C. Steel Cabinet Finish
1. Test Procedure: Chemical spot tests shall be made by applying 10 to 15 drops (approximately 0.5 cubic cm) of each reagent listed in Table 1 to the surface to be tested. Each reagent spot shall be open to the atmosphere. Ambient temperature is 68-72 degrees F (20-22 degrees C). After one hour, chemicals shall be flushed away with cold water and the surface, washed with detergent and warm water at 150 degrees F (65 degrees C). Surface shall be examined under 100-foot candles of illumination.
- D. Kitchen Cabinets Performance Requirements
1. Base Cabinets.
 - a. Cabinets Load Test: A 48" wide standing height combination cupboard and drawer cabinet shall be freestanding with installed counter top. Cabinet shall sit 1" off the floor on all four leveling screws and be capable of supporting a uniform distributed load of 2,000 lbs. Door and drawer operation shall not be affected by the load.
 - b. Leveling device for floor mounted cabinets shall be capable of supporting a load of 500 lbs. Without failure and capable of adjustment after load is removed.
 - c. Cabinet Door Test: An open door shall withstand a load of 200 lbs. applied directly at the outer edge. Door shall be moved through a 180 degree arc and weight removed. Operation of the door after test shall be normal without distortion that will adversely affect operation for the door catch.
 - d. Life Cycle Test.
 - 1) Door hinge shall operate for 300,000 opening and closing cycles without a failure.
 - 2) Positive door catch shall operate for 300,000 opening and closing cycles without failure.
 - 3) Drawer shall be tested and operated with a load of 100 lbs. for a minimum of 150,000 opening and closing cycles. After test, drawers shall operate freely without evidence of dragging or scraping.
 2. Wall Cabinets
 - a. A 48" wide, 30" high, 12 3/4" deep hinged wall case shall support a load of 1lbs. on cabinet bottom and 100 lbs. on each adjustable shelf for a total of 300 lbs. Cabinet shall not show any significant permanent defection of cabinet, cabinet bottom or shelves. Doors shall operate smoothly when cabinet is fully loaded.
 - b. An adjustable shelf shall support a uniformly distributed load of 100 lbs. When load is removed, shelf should show no significant permanent distortion.
 - c. Performance of hinge and catch shall be the same as used on base cabinets.
- E. Working Surfaces
1. Stainless Steel: Sink and counter tops shall be fabricated of 16 gauge, Type 304, 18-8 solid stainless steel formed down and back making a 1 1/2" high face on all exposed edges.



Drainboards and cabinet tops shall be rigidly reinforced the full length of the top. Drainboards shall be two-way pitched to the bowl to provide drainage without channeling or grooving. Drainboards, flanges and splashes shall be integral, being formed from one sheet of metal. Raised edge surrounding unit shall be seamless die formed at front and ends of unit. Sink bowls shall be fabricated of 16 gauge, Type 304, 18-8 solid stainless steel seamless electrically welded to drainboard. All joints shall be electrically welded, ground and polished to a satin finish. Entire units shall be thoroughly sound deadened on under surface with sprayed or trowelled undercoating. Wood shall not be used. All tops shall have stainless steel runners to facilitate fastening to cabinets.

1.3 EXECUTION

A. Insulations

1. Install cabinets, shelves, counter tops and other equipment level and square. Install sink units to provide positive drainage of bottom surface of the sinks.
2. Wall cabinets shall be hung from the metal stud framing system wherever possible. If the wall cabinets must be hung from the wall surfacing at any location, proper anchors shall be used. Install wall cabinets level and aligned.
3. Install base cabinets firmly on ground. Level all the surfaces by adjusting the leg levelers. Attached countertops to inslatted base cabinets with stainless steel screws as required. Caulk with silicone all around counter tops where it interfaces with the existing walls. Install the flat back panels to the wall surfaces by the most appropriate method and caulk as required.
4. All work, including installation of new casework, flooring, ceiling, ductwork, etc., as well as the demolition of the existing casework, flooring, etc. shall be completed within three (3) consecutive days of work start. Hours of work shall be between 7:30 a.m. 9:00 p.m. All work, including work noted on Punch List, shall be completed by 9:00 p.m. of the third work day after work starts.

B. Temporary Work Station

1. During the period of demolition and new casework installation (3 days maximum) the contractor shall provide a temporary cabinet assembly for use by the Owner. The temporary assembly shall have a 6-foot section of cabinets with countertop, sink and faucet. The faucet shall be temporary connected to an apparatus hose bib for providing cold water to the sink. The sink shall be temporarily connected to a sewer line or floor drain if possible for the discharge or to another approved system of temporary discharge by means of a suitable container. For the latter method, the Contractor shall be responsible for periodically disposing of the waste container's contents. The temporary cabinet assembly shall be located reasonably close to the existing kitchens and/or dining areas being remodeled. The Owner shall approve the location of the temporary cabinets.

C. Inspection

1. Inspect installed work of other trades and installation conditions for acceptability. Inform Owner of discrepancies that will jeopardize a complete and proper installation
2. Cleaning: Touching up marred and/or abraded finished surfaces, clean components to post construction accepted levels, remove crating and packing material, broom sweep premises.

END OF SECTION 12 31 16 00



Task	Specification	Specification Description
12 31 16 00	01 22 16 00	No Specification Required



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SECTION 12 32 16 00 - CSF MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Non retail/public Casework may be purchased from another source in lieu of Direct Vendor when the casework is not in a designated retail or public area and not in the public's view. Non retail/public Casework shall comply with USPS specification 123216 - MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK **(Excludes all BMEU Casework requirements.)**

THIS SECTION INCLUDES A DIRECT VENDOR ITEM. CONSTRUCTION SUPPLIERS MUST CONTACT THE DIRECT VENDOR AS DIRECTED FOR APPROVED PRICING AND PURCHASING PROCEDURES.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.12 32 16 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fabricated custom cabinets and fixtures.
 - 2. Countertops.
 - 3. Cabinet and fixture hardware.
 - 4. Preparation for installing utilities.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 011000 - Summary of Work: Requirements for Postal Service furnished Products.
 - 2. Section 123504 - Postal Casework: USPS provided casework and equipment.

1.2 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI A135.4 - Basic Hardboard.
 - 2. ANSI A208.1 - Mat Formed Wood Particleboard.
- B. Architectural Woodwork Institute (AWI):
 - 1. AWI AWQS - Architectural Woodwork Quality Standards, 6th Edition Version 1.0.

CSF MANUFACTURED PLASTIC-LAMINATE-CLAD



- C. National Electric Manufacturer's Association (NEMA):
 - 1. NEMA LD3 - High Pressure Decorative Laminates.
- D. United States Department of Commerce Product Standard (PS):
 - 1. PS 1 - Construction and Industrial Plywood.
 - 2. PS 20 - American Softwood Lumber Standard.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Data for hardware and accessories indicating material, type, function, attachment and finish.
 - 2. Shop Drawings:
 - a. Indicate each material used, wood species, component profiles, sections, and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location, and schedule of finishes in conformance with requirements of AWI AWQS.
 - b. Indicate composition of each material and compliance with referenced standards.
 - c. Keying Schedule: Indicate keying system for cabinet and fixture locks.
 - d. Present drawings in related and dimensional positions; section details drawn at minimum 1-1/2 inch scale.
 - 3. Samples: Two 2 inch x 3 inch samples of each plastic laminate finish and color.
 - 4. Assurance/Control Submittals:
 - a. Certificate: Manufacturer certificate indicating that Products meet or exceed specified requirements.
 - b. Qualification Documentation: Custom cabinetwork and fixture manufacturer and installer documentation of experience indicating compliance with specified qualification requirements.

1.4 QUALITY ASSURANCE

- A. Perform work in accordance with AWI AWQS Custom quality.
 - 1. Affix the AWI Quality Grade Stamp to each unit of custom cabinet and fixture work. The AWI Quality Grade Stamp shall display Custom Grade as specified for each section of Work.
- B. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing store fixtures specified in this section with minimum five years documented experience. Member in good standing of the Architectural Woodwork Institute.
 - 2. Installer: Company specializing in performing work of this Section with minimum 5 years documented experience.
- C. Pre-installation Meeting:
 - 1. Convene a pre-installation meeting at Project Site, one week prior to commencing work of this Section.
 - 2. Require attendance of parties directly affecting work of this Section.
 - 3. Review preparation and installation procedures and coordinating and scheduling required with related work.
 - 4. Agenda:
 - a. Tour, inspect, and discuss condition of areas where custom cabinets and fixtures will be installed and other preparatory work performed by other trades.
 - b. Review custom cabinet and fixture requirements (drawings, specifications and other contract documents). Identify requirements for Contractor furnished Products.



- c. Review required submittals, both completed and yet to be completed.
- d. Review and finalize construction schedule related to custom cabinet and fixture work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
- e. Review requirements for inspections, installation certification, and material usage accounting procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Package fixtures in watertight container for transportation to project site to prevent damage and for storage outside building, if required.
- C. Protect fixtures from damage and excessive or inadequate relative humidity.
- D. Maintain relative humidity between 25 percent and 55 percent.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify and coordinate Acceptable Manufacturer listing with U.S. Postal Service Contracting Officer. Insert appropriate address and telephone number.

2.1 MANUFACTURERS

- A. Manufacturers who have previously furnished and installed Products specified in this Section include the following:
- B. [_____]
- C. [_____]
- D. Alternate Manufacturers:
 - 1. Local millwork manufacturers may be approved by Contracting Officer.
 - 2. Submit documentation indicating local millwork manufacturer has produced millwork of a quality acceptable to United States Postal Service for Projects of similar type to Work of this Contract.
 - 3. Obtain approval from Contracting Officer.

2.2 WOOD MATERIALS

- A. Softwood Lumber: PS 20; graded in accordance with AWI Custom; average moisture content of 6 percent.
- B. Hardwood Lumber: NHLA; graded in accordance with AWI Custom; average moisture content of 6 percent.

2.3 PANEL MATERIALS

CSF MANUFACTURED PLASTIC-LAMINATE-CLAD



- A. Softwood Plywood: PS 1; graded in accordance with AWI, core materials of particleboard.
- B. Hardwood Plywood: PS 51; graded in accordance with AWI, core materials of particleboard, type of glue recommended for application.
- C. Wood Particleboard: PS1; AWI standard, composed of wood chips, medium density, made with water resistant adhesive; of grade to suit application; sanded faces.
- D. Hardboard: ANSI A135.4; Pressed wood fiber with resin binder, tempered grade, smooth two sides

NOTE TO SPECIFIER

Specify or modify Plastic Laminate colors, accessories and hardware for the particular facility design.

2.4 PLASTIC LAMINATE MATERIALS

- A. Manufacturers: Subject to compliance with project requirements provide plastic laminates of one of the following:
 - 1. Formica Corporation.
 - 2. Micarta Corporation.
 - 3. Nevamar Corporation.
 - 4. Wilsonart International.
 - 5. Pionite.
- B. High-Pressure Decorative Laminate: NEMA LD3, GP-50 General Purpose .050 inch.
- C. Low Pressure Laminate: Melamine thermo set decorative overlay.

2.5 COLOR SCHEDULE (PLASTIC LAMINATES) - substitutions allowed.

- A. PL-1 White
 - 1. Nevamar, #S-7-27T, Smokey White, textured.
 - 2. Formica, #933, Mission White
 - 3. Micarta, #90M92, Dover White
 - 4. Pionite, #SW806, Carnation White
 - 5. Wilsonart, #1573-60, Frosty White
- B. PL-2 Not Used
- C. PL-3 Blue
 - 1. Formica #85961-58, Express Blue
 - 2.
- D. PL-4 Gray
 - 1. Wilsonart #4142-60, Gray Glace
- E. PL-5 Not Used

2.6 ACCESSORIES

- A. Adhesive: Type recommended by AWI to suit application.



- B. Plastic Edge Trim: Extruded flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
- C. Fasteners: Size and type to suit application.
- D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application.
- E. Concealed Joint Fasteners: Threaded steel.
- F. Grommets: Metal material for cut-outs.

2.7 HARDWARE

- A. [_____]
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- C. Lock Keying: [_____]

2.8 FABRICATION

- A. Fabricate cabinets and fixtures to AWI AWQS, Section 400 - Architectural Cabinets, Custom Grade Standards.
- B. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.
- C. Fit shelves, doors, and exposed edges with matching plastic edging. Use one piece for full length only.
- D. Cap exposed plastic laminate finish edges with material of same finish and pattern.
- E. Door and Drawer Fronts: [_____]
- F. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
- G. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners.
- H. Mechanically fasten back splash to countertops with steel brackets at 16 inches on center.
- I. Provide cutouts for inserts, appliances, outlet boxes, fixtures and fittings. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.



- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify custom cabinet and fixture dimensions by field dimensions.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install custom fabricated cabinets and fixtures in conformance with AWI AWQS, Section 1700 - Installation of Woodwork.
- B. Set and secure fixtures in place; rigid, plumb, and level at locations indicated on Drawings.
 - 1. Attach to floor or walls with fasteners as indicated on Drawings.
- C. Use fixture attachments in concealed locations for wall mounted components.
- D. Carefully scribe fixtures abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- E. Secure fixtures to floor using appropriate angles and anchorages.
- F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.3 CONSTRUCTION

- A. Interface with Other Work:
 - 1. Coordinate installation sequence of fixtures with trades providing data and communication connections to fixtures.
- B. Site Tolerances:
 - 1. Maximum Variation from True Position: 1/16 inch.
 - 2. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Inspection procedures.
- B. Contracting Officer will inspect custom cabinet and fixture installation, alignment, attachment to structure, and connection to data and communication lines.

3.5 ADJUSTING

- A. Adjust moving or operating parts to function smoothly and correctly.



3.6 CLEANING AND PROTECTION

- A. Section 017300 - Execution Cleaning and protection of installed Work.
- B. Clean casework, counters, shelves, hardware, fittings, and fixtures.

USPS CSF Specifications issued: 10/1/2013
Last revised: 3/6/2012

END OF SECTION



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SECTION 12 32 16 00 - MPF MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section. 12 32 16 00 THIS SPECIFICATION MAY NOT BE USED FOR CASEWORK IN PUBLIC AREAS OF RETAIL FACILITIES OR WHERE CASEWORK IS WITHIN VIEW OF THE PUBLIC.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fabricated custom cabinets and fixtures.
 - 2. Countertops.
 - 3. Cabinet and fixture hardware.
 - 4. Preparation for installing utilities.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 011000 - Summary of Work: Requirements for Postal Service furnished Products.
 - 2. Section 123504 - Postal Casework: USPS provided casework

1.2 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI A135.4 - Basic Hardboard.
 - 2. ANSI A208.1 - Mat Formed Wood Particleboard.
- B. Architectural Woodwork Institute (AWI):
 - 1. AWI AWQS - Architectural Woodwork Quality Standards, 6th Edition Version 1.0.
- C. National Electric Manufacturer's Association (NEMA):
 - 1. NEMA LD3 - High Pressure Decorative Laminates.
- D. United States Department of Commerce Product Standard (PS):
 - 1. PS 1 - Construction and Industrial Plywood.
 - 2. PS 20 - American Softwood Lumber Standard.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Data for hardware and accessories indicating material, type, function, attachment and finish.

MPF MANUFACTURED PLASTIC-LAMINATE-CLAD



2. Shop Drawings:
 - a. Indicate each material used, wood species, component profiles, sections, and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location, and schedule of finishes in conformance with requirements of AWI AWQS.
 - b. Indicate composition of each material and compliance with referenced standards.
 - c. Keying Schedule: Indicate keying system for cabinet and fixture locks.
 - d. Present drawings in related and dimensional positions; section details drawn at minimum 1-1/2 inch scale.
3. Samples: Two 2 inch x 3 inch samples of each plastic laminate finish and color.
4. Assurance/Control Submittals:
 - a. Certificate: Manufacturer certificate indicating that Products meet or exceed specified requirements.
 - b. Qualification Documentation: Custom cabinetwork and fixture manufacturer and installer documentation of experience indicating compliance with specified qualification requirements.

1.4 QUALITY ASSURANCE

- A. Perform work in accordance with AWI AWQS Custom quality.
 1. Affix the AWI Quality Grade Stamp to each unit of custom cabinet and fixture work. The AWI Quality Grade Stamp shall display Custom Grade as specified for each section of Work.
- B. Qualifications:
 1. Manufacturer: Company specializing in manufacturing store fixtures specified in this section with minimum five years documented experience. Member in good standing of the Architectural Woodwork Institute.
 2. Installer: Company specializing in performing work of this Section with minimum 5 years documented experience.
- C. Pre-installation Meeting:
 1. Convene a pre-installation meeting at Project Site, one week prior to commencing work of this Section.
 2. Require attendance of parties directly affecting work of this Section.
 3. Review preparation and installation procedures and coordinating and scheduling required with related work.
 4. Agenda:
 - a. Tour, inspect, and discuss condition of areas where custom cabinets and fixtures will be installed and other preparatory work performed by other trades.
 - b. Review custom cabinet and fixture requirements (drawings, specifications and other contract documents). Identify requirements for Contractor furnished Products.
 - c. Review required submittals, both completed and yet to be completed.
 - d. Review and finalize construction schedule related to custom cabinet and fixture work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
 - e. Review requirements for inspections, installation certification, and material usage accounting procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.



- B. Package fixtures in watertight container for transportation to project site to prevent damage and for storage outside building, if required.
- C. Protect fixtures from damage and excessive or inadequate relative humidity.
- D. Maintain relative humidity between 25 percent and 55 percent.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify and coordinate Acceptable Manufacturer listing with U.S. Postal Service Contracting Officer. Insert appropriate address and telephone number.

2.1 MANUFACTURERS

- A. Manufacturers who have previously furnished and installed Products specified in this Section include the following:
- B. [_____]
- C. [_____]
- D. Alternate Manufacturers:
 - 1. Local millwork manufacturers may be approved by Contracting Officer.
 - 2. Submit documentation indicating local millwork manufacturer has produced millwork of a quality acceptable to United States Postal Service for Projects of similar type to Work of this Contract.
 - 3. Obtain approval from Contracting Officer.

2.2 WOOD MATERIALS

- A. Softwood Lumber: PS 20; graded in accordance with AWI Custom; average moisture content of 6 percent.
- B. Hardwood Lumber: NHLA; graded in accordance with AWI Custom; average moisture content of 6 percent.

2.3 PANEL MATERIALS

- A. Softwood Plywood: PS 1; graded in accordance with AWI, core materials of particleboard.
- B. Hardwood Plywood: PS 51; graded in accordance with AWI, core materials of particleboard, type of glue recommended for application.
- C. Wood Particleboard: PS1; AWI standard, composed of wood chips, medium density, made with water resistant adhesive; of grade to suit application; sanded faces.
- D. Hardboard: ANSI A135.4; Pressed wood fiber with resin binder, tempered grade, smooth two sides

NOTE TO SPECIFIER

Specify or modify Plastic Laminate colors, accessories and hardware for the particular facility design.

MPF MANUFACTURED PLASTIC-LAMINATE-CLAD



2.4 PLASTIC LAMINATE MATERIALS

- A. Manufacturers: Subject to compliance with project requirements provide plastic laminates of one of the following:
 - 1. Formica Corporation.
 - 2. Micarta Corporation.
 - 3. Nevamar Corporation.
 - 4. Wilsonart International.
 - 5. Pionite.
- B. High-Pressure Decorative Laminate: NEMA LD3, GP-50 General Purpose .050 inch.
- C. Low Pressure Laminate: Melamine thermo set decorative overlay.

2.5 COLOR SCHEDULE (PLASTIC LAMINATES) - substitutions allowed.

- A. PL-1 White
 - 1. Nevamar, #S-7-27T, Smokey White, textured.
 - 2. Formica, #933, Mission White
 - 3. Micarta, #90M92, Dover White
 - 4. Pionite, #SW806, Carnation White
 - 5. Wilsonart, #1573-60, Frosty White
- B. PL-2 Not Used
- C. PL-3 Blue
 - 1. Formica #85961-58, Express Blue
 - 2.
- D. PL-4 Gray
 - 1. Wilsonart #4142-60, Gray Glace
- E. PL-5 Not Used

2.6 ACCESSORIES

- A. Adhesive: Type recommended by AWI to suit application.
- B. Plastic Edge Trim: Extruded flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
- C. Fasteners: Size and type to suit application.
- D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application.
- E. Concealed Joint Fasteners: Threaded steel.
- F. Grommets: Metal material for cut-outs.



2.7 HARDWARE

- A. [_____]
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- C. Lock Keying: [_____]

2.8 FABRICATION

- A. Fabricate cabinets and fixtures to AWI AWQS, Section 400 - Architectural Cabinets, Custom Grade Standards.
- B. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.
- C. Fit shelves, doors, and exposed edges with matching plastic edging. Use one piece for full length only.
- D. Cap exposed plastic laminate finish edges with material of same finish and pattern.
- E. Door and Drawer Fronts: [_____]
- F. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
- G. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners.
- H. Mechanically fasten back splash to countertops with steel brackets at 16 inches on center.
- I. Provide cutouts for inserts, appliances, outlet boxes, fixtures and fittings. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify custom cabinet and fixture dimensions by field dimensions.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.



3.2 INSTALLATION

- A. Install custom fabricated cabinets and fixtures in conformance with AWI AWQS, Section 1700 - Installation of Woodwork.
- B. Set and secure fixtures in place; rigid, plumb, and level at locations indicated on Drawings.
 - 1. Attach to floor or walls with fasteners as indicated on Drawings.
- C. Use fixture attachments in concealed locations for wall mounted components.
- D. Carefully scribe fixtures abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- E. Secure fixtures to floor using appropriate angles and anchorages.
- F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.3 CONSTRUCTION

- A. Interface with Other Work:
 - 1. Coordinate installation sequence of fixtures with trades providing data and communication connections to fixtures.
- B. Site Tolerances:
 - 1. Maximum Variation from True Position: 1/16 inch.
 - 2. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Inspection procedures.
- B. Contracting Officer will inspect custom cabinet and fixture installation, alignment, attachment to structure, and connection to data and communication lines.

3.5 ADJUSTING

- A. Adjust moving or operating parts to function smoothly and correctly.

3.6 CLEANING AND PROTECTION

- A. Section 017300 - Execution Cleaning and protection of installed Work.
- B. Clean casework, counters, shelves, hardware, fittings, and fixtures.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 4/18/10



END OF SECTION



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SECTION 12 35 04 00 - CSF POSTAL CASEWORK**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT AN APPROVED WRITTEN DEVIATION FROM USPS HEADQUARTERS FIELD OPERATIONS, THROUGH THE NEW SPACE MANAGER OR CONTRACTING OFFICER.**

Non retail/public Casework may be purchased from another source in lieu of Direct Vendor when the casework is not in a designated retail or public area and is not in the public's view. Non retail/public Casework shall comply with USPS specification 123216 - MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK **(Excludes all BMEU Casework requirements.)**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.12 35 04 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fabricated custom cabinets and fixtures.
 - 2. Countertops- including field installed custom solid surface tops on selected fixtures
 - 3. Cabinet and fixture hardware.
 - 4. Preparation for installing utilities.
 - 5. Full Service Workstations.
- B. The USPS Direct Vendor for supplying postal casework listed in this specification through the contractor is Carolina Cabinet Company. No substitutions allowed, for exceptions see Part 2 – Products.
 - 1. In the Offer, include the casework cost from the selected Direct Vendor, including shipping.
 - 2. Unloading and installation are also to be included as part of the Work.
 - 3. The contractor is to order the casework from the USPS Direct Vendor based on the Casework Drawings, in time to meet the schedule.
 - 4. Payment may be required by the USPS Direct Vendor from the contractor prior to shipment of the casework.
- C. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- D. Related Sections:
 - 1. Section 011000 - Summary of Work: Requirements for Postal Service furnished Products.
 - 2. Section 096500 – Resilient Flooring.



1.2 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI A135.4 - Basic Hardboard.
 - 2. ANSI A208.1 - Mat Formed Wood Particleboard.
- B. Architectural Woodwork Institute (AWI):
 - 1. AWI AWQS - Architectural Woodwork Quality Standards, 6th Edition Version 1.0.
- C. National Electric Manufacturer's Association (NEMA):
 - 1. NEMA LD3 - High Pressure Decorative Laminates.
- D. United States Department of Commerce Product Standard (PS):
 - 1. PS 1 - Construction and Industrial Plywood.
 - 2. PS 20 - American Softwood Lumber Standard.
- E. Direct Vendor Detailed Installation Instructions.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Assurance/Control Submittals:
 - a. Qualification Documentation: Custom cabinetwork and fixture installer documentation of experience indicating compliance with specified qualification requirements.

1.4 QUALITY ASSURANCE

- A. Perform work in accordance with AWI AWQS Custom quality.
- B. Qualifications:
 - 1. Installer: Company specializing in performing work of this Section with a minimum of 5 years documented experience
- C. Pre-installation Meeting:
 - 1. Convene a pre-installation meeting at Project Site, one week prior to commencing work of this Section and after casework has been delivered.
 - 2. Require attendance of parties directly affecting work of this Section.
 - 3. Review preparation and installation procedures and coordinating and scheduling required with related work.
 - 4. Agenda:
 - a. Tour, inspect, and discuss condition of areas where custom cabinets and fixtures will be installed and other preparatory work performed by other trades.
 - b. Review custom cabinet and fixture requirements (drawings, specifications and other contract documents). Identify requirements for Postal Service furnished Products and Contractor furnished Products.
 - c. Review and finalize construction schedule related to custom cabinet and fixture work and verify availability of materials, installer's personnel, equipment and facilities needed to complete the Work and avoid delays.
 - d. Review requirements for inspections, installation certification, and material usage accounting procedures.



1.5 STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Receive, handle, store, and protect products.
- B. Protect fixtures from damage and excessive or inadequate relative humidity.
- C. Maintain relative humidity between 25 percent and 55 percent.
- D. Contractor to carefully coordinate delivery scheduling with Direct Vendor to avoid premature delivery and potential damage to casework on project site. Contractor will be responsible for inspection of casework upon receipt and shall report any damage to Direct Vendor, in writing, immediately.
- E. Contractor will be responsible to take an inventory of casework hardware and accessories provided by Direct Vendor and shall report any missing item to Direct Vendor, in writing, immediately.
- F. Contractor shall be responsible to properly store the keys in a safe place and hand them over to Contracting Officer immediately upon completion of installation works and obtain a receipt. KEYS SHALL NOT BE DUPLICATED.
- G. Certain casework items have been manufactured with additional weight installed (for safety reasons) and may require special equipment and handling during unloading. Contractor shall contact Direct Vendor prior to receipt of shipment to insure adequate jobsite facilities for receiving and unloading casework.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The USPS Direct Vendor for supplying postal casework :
 - 1. Carolina Cabinet Company, Wilson, NC, Representative Contact: Chris Dill (252)291-5181, cdill@3c-inc.net.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Not permitted except for the following items, when they are not located in retail areas or otherwise visible to the public: USPS reserves the right to procure items C501; C502H; C503; C504; C505; C506; C507; C508; C510; C511; C512 from other vendors, in accordance with specification 123216 MANUFACTURED LAMINATE-CLAD CASEWORK when approved by the Contracting Officer.
- C. USPS reserves the right to update these products through the Approved Vendor agreements.

2.2 CASEWORK DESCRIPTIONS

NOTE TO SPECIFIER

Enter the required quantities of each casework item in Appendix A.

- A. For casework descriptions and requirements refer to contract drawing. A list of all USPS casework is included in Appendix A of this section.



2.3 CASEWORK HARDWARE AND ACCESSORIES

- A. Direct Vendor will supply all anchoring materials, glass, light fixtures, fluorescent lamps, furring strips, trims, locks, keys (keyed independently) and any other materials and hardware shown on the details in contract drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify casework and fixture dimensions by field dimensions.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install cabinets and fixtures, in conformance with AWI AWQS, Section 1700 - Installation of Woodwork, and Direct Vendor Detailed Installation Instructions, which will be provided with the casework.
- B. Set and secure fixtures in place; rigid, plumb, and level at locations indicated on Drawings.
 - 1. All blocking, screws, bolts, glue and fasteners are to be provided by the Direct Vendor.
 - 2. Attach to floor or walls with fasteners as indicated on Drawings.
 - 3. Firmly secure all freestanding floor units to floor with 2x4 wood blocking and expansion anchor bolts as per the anchoring details in contract drawings.
 - 4. Secure adjoining freestanding casework with four (4) connector bolts as shown on contract drawings
 - 5. Countersink all screws used to adhere slatwall to walls and cabinets.
 - 6. All attachment systems shall be concealed; no screw heads other than the screws covered by cove base shall be visible.
- C. Use fixture attachments in concealed locations for wall and floor mounted components.
- D. Secure fixtures to floor using appropriate angles and anchorages.
- E. Carefully scribe fixtures abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim for this purpose.
- F. Hand the keys over to the Contracting Officer and obtain a receipt.
- G. Cove base will be supplied and installed under Section 096500 – Resilient Flooring.



3.3 CONSTRUCTION

- A. Interface with Other Work:
 - 1. Coordinate installation sequence of fixtures with trades providing electrical, data and communication connections to fixtures.
 - 2. Coordinate the installation of cove base with resilient flooring installer.
- B. Site Tolerances:
 - 1. Maximum Variation from True Position: 1/16 inch (1.58 mm).
 - 2. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.79 mm).

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Inspection procedures.
- B. Contracting Officer will inspect custom cabinet and fixture installation, alignment, attachment to structure, and connection to data and communication lines.

3.5 ADJUSTING

- A. Adjust moving or operating parts to function smoothly and correctly.

3.6 CLEANING AND PROTECTION

- A. Section 017300 - Execution Requirements Cleaning and protection of installed Work.
- B. Clean casework, counters, shelves, hardware, fittings, and fixtures.



APPENDIX A

ITEM #		DESCRIPTION
1	C150	MAIL DROP COUNTER 72"
2	C151	MAIL DROP COUNTER 96"
3	C152	MAIL DROP COUNTER 138"
4	C201	SLATWALL DRAWER UNIT 42"
5	C203	SLATWALL CORNER FILLER UNIT 45 DEGREE
6	C204	SLATWALL CORNER 90 DEGREE 21"
7	C205	SLATWALL END FILLER 21"
8	C206	SLATWALL PANEL 42"
9	C207-L	SLATWALL END FILLER - LEFT HAND
10	C207-R	SLATWALL END FILLER - RIGHT HAND
11	C216	SLATWALL PANEL 48"
12	C250	MERCHANDISING GONDOLA
13	C310	PARCEL SLIDE STORAGE w / RECYCLE
14	C311	45 DEGREE CORNER FILLER
15	C312	FORM STORAGE UNIT
16	C313	RECYCLE UNIT
17	C321	BASE CABINET w / RECYCLE & WRITE
18	C327	BASE CABINET / RECYCLE & WRITE, UNFINISHED BACK
19	C340	HC WRITING DESK / FORMS w / PARCEL SLIDE
20	C342	HC WRITING DESK / FORMS w / PARCEL SLIDE
21	C345	HC COMBO DESK & FORM COUNTER
22	C346	FORMS COUNTER CABINET / RECYCLE
23	C410	TUB STORAGE UNIT
24	C411	LEFT NOTICE CABINET
25	C412	STORAGE CABINET 24"D
26	C413-L	BMC CABINET - LEFT HAND ACCESS
27	C413-R	BMC CABINET - RIGHT HAND ACCESS
28	C414-L	SIDE LOAD HAMPER UNIT - LEFT HAND ACCESS
29	C414-R	SIDE LOAD HAMPER UNIT - RIGHT HAND ACCESS
30	C415	POUCH HAMPER CABINET
31	C417	METER SETTING CABINET w / UPPER
32	C420	WALL CABINET 36"
33	C431	STORAGE CABINET 15"D
34	C432	POUCH HAMPER UNIT
35	C440	FILLER TRIM STRIP KIT
36	C501	BREAK ROOM BASE CABINET 36"



37	C502	BREAK ROOM BASE SINK CABINET 36"
38	C503	BREAK ROOM WALL CABINET 36"
39	C504	BREAK ROOM BASE CABINET 24"
40	C505	BREAK ROOM WALL CABINET 24"
41	C506	BREAK ROOM BASE CABINET TOP 72"
42	C507	BREAK ROOM BASE CABINET TOP 96"
43	C508	BREAK ROOM BASE CABINET TOP 120"
44	C510	BREAK ROOM CABINET CONFIGURATION 72"
45	C511	BREAK ROOM CABINET CONFIGURATION 96"
46	C512	BREAK ROOM CABINET CONFIGURATION 120"
47	C601	4 COMPARTMENT/SAFE SECURITY INSERT
48	C602	8 COMPARTMENT/SAFE SECURITY INSERT
49	C603	12 COMPARTMENT/SAFE SECURITY INSERT
50	C604	4 MODULES COMPARTMENT ADDITION
51	C720	HC ACCESSIBLE COUNTER
52	C721-L	FULL SERVICE COUNTER BASE UNIT
53	C721-R	FULL SERVICE COUNTER BASE UNIT
54	C723	PENCIL TRAY - 16.75" REPLACEMENT PART
55	C724	aisle PANEL
56	C725	GRAPHIC FRAME
57	C726-L	5' HC - ACCESSIBLE COUNTER - OPTION D
58	C726-R	5' HC - ACCESSIBLE COUNTER - OPTION D
59	C727-L	5' NON ACCESSIBLE COUNTER - OPTION D
60	C727-R	5' NON ACCESSIBLE COUNTER - OPTION D
61	C728-L	6'-8" HC - ACCESSIBLE COUNTER - OPTION B
62	C728-R	6'-8" HC - ACCESSIBLE COUNTER - OPTION B
63	C729-L	5'-8" HC - ACCESSIBLE COUNTER - OPTION C
64	C729-R	5'-8" HC - ACCESSIBLE COUNTER - OPTION C
65	C758	4 - DRAWER BASE CABINET

USPS CSF Specifications issued: 10/1/2013
 Last revised: 6/25/2013

END OF SECTION



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SECTION 12 35 04 00 - MPF POSTAL CASEWORK**

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT AN APPROVED WRITTEN DEVIATION FROM USPS HEADQUARTERS FIELD OPERATIONS, THROUGH THE NEW SPACE MANAGER OR CONTRACTING OFFICER.**

Non retail/public Casework may be purchased from another source in lieu of Direct Vendor when the casework is not in a designated retail or public area and is not in the public's view. Non retail/public Casework shall comply with USPS specification 123216 - MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK (**Excludes all BMEU Casework requirements.**)

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section. 12 35 04 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fabricated custom cabinets and fixtures.
 - 2. Countertops- including field installed custom solid surface tops on selected fixtures
 - 3. Cabinet and fixture hardware.
 - 4. Preparation for installing utilities.
 - 5. Full Service Workstations.
- B. The USPS Direct Vendor for supplying postal casework listed in this specification through the contractor is Carolina Cabinet Company. No substitutions allowed, for exceptions see Part 2 – Products.
 - 1. In the Offer, include the casework cost from the selected Direct Vendor, including shipping.
 - 2. Unloading and installation are also to be included as part of the Work.
 - 3. The contractor is to order the casework from the USPS Direct Vendor based on the Casework Drawings, in time to meet the schedule.
 - 4. Payment may be required by the USPS Direct Vendor from the contractor prior to shipment of the casework.
- C. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- D. Related Sections:
 - 1. Section 011000 - Summary of Work: Requirements for Postal Service furnished Products.
 - 2. Section 096500 – Resilient Flooring.

1.2 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI A135.4 - Basic Hardboard.
 - 2. ANSI A208.1 - Mat Formed Wood Particleboard.
- B. Architectural Woodwork Institute (AWI):
 - 1. AWI AWQS - Architectural Woodwork Quality Standards, 6th Edition Version 1.0.
- C. National Electric Manufacturer's Association (NEMA):



1. NEMA LD3 - High Pressure Decorative Laminates.

D. United States Department of Commerce Product Standard (PS):

1. PS 1 - Construction and Industrial Plywood.
2. PS 20 - American Softwood Lumber Standard.

E. Direct Vendor Detailed Installation Instructions.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

1. Assurance/Control Submittals:
 - a. Qualification Documentation: Custom cabinetwork and fixture installer documentation of experience indicating compliance with specified qualification requirements.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with AWI AWQS Custom quality.

B. Qualifications:

1. Installer: Company specializing in performing work of this Section with a minimum of 5 years documented experience

C. Pre-installation Meeting:

1. Convene a pre-installation meeting at Project Site, one week prior to commencing work of this Section and after casework has been delivered.
2. Require attendance of parties directly affecting work of this Section.
3. Review preparation and installation procedures and coordinating and scheduling required with related work.
4. Agenda:
 - a. Tour, inspect, and discuss condition of areas where custom cabinets and fixtures will be installed and other preparatory work performed by other trades.
 - b. Review custom cabinet and fixture requirements (drawings, specifications and other contract documents). Identify requirements for Postal Service furnished Products and Contractor furnished Products.
 - c. Review and finalize construction schedule related to custom cabinet and fixture work and verify availability of materials, installer's personnel, equipment and facilities needed to complete the Work and avoid delays.
 - d. Review requirements for inspections, installation certification, and material usage accounting procedures.

1.5 STORAGE AND HANDLING

A. Section 016000 - Product Requirements: Receive, handle, store, and protect products.

B. Protect fixtures from damage and excessive or inadequate relative humidity.

C. Maintain relative humidity between 25 percent and 55 percent.

D. Contractor to carefully coordinate delivery scheduling with Direct Vendor to avoid premature delivery and potential damage to casework on project site. Contractor will be responsible for inspection of casework upon receipt and shall report any damage to Direct Vendor, in writing, immediately.



- E. Contractor will be responsible to take an inventory of casework hardware and accessories provided by Direct Vendor and shall report any missing item to Direct Vendor, in writing, immediately.
- F. Contractor shall be responsible to properly store the keys in a safe place and hand them over to Contracting Officer immediately upon completion of installation works and obtain a receipt. KEYS SHALL NOT BE DUPLICATED.
- G. Certain casework items have been manufactured with additional weight installed (for safety reasons) and may require special equipment and handling during unloading. Contractor shall contact Direct Vendor prior to receipt of shipment to insure adequate jobsite facilities for receiving and unloading casework.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The USPS Direct Vendor for supplying postal casework :
 - 1. Carolina Cabinet Company, Wilson, NC, 27893 Representative Contact: Chris Dill (252)291-5181,cdill@3c-inc.net.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Not permitted except for the following items, when they are not located in retail areas or otherwise visible to the public: USPS reserves the right to procure items C501; C502H; C503; C504; C505; C506; C507; C508; C510; C511; C512 from other vendors, in accordance with specification 123216 MANUFACTURED LAMINATE-CLAD CASEWORK when approved by the Contracting Officer.
- C. USPS reserves the right to update these products through the Approved Vendor agreements.

2.2 CASEWORK DESCRIPTIONS

NOTE TO SPECIFIER

Enter the required quantities of each casework item in Appendix A.

- A. For casework descriptions and requirements refer to contract drawing. A list of all USPS casework is included in Appendix A of this section.

2.3 CASEWORK HARDWARE AND ACCESSORIES

- A. Direct Vendor will supply all anchoring materials, glass, light fixtures, fluorescent lamps, furring strips, trims, locks, keys (keyed independently) and any other materials and hardware shown on the details in contract drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.



- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify casework and fixture dimensions by field dimensions.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install cabinets and fixtures, in conformance with AWI AWQS, Section 1700 - Installation of Woodwork, and Direct Vendor Detailed Installation Instructions, which will be provided with the casework.
- B. Set and secure fixtures in place; rigid, plumb, and level at locations indicated on Drawings.
 - 1. All blocking, screws, bolts, glue and fasteners are to be provided by the Direct Vendor.
 - 2. Attach to floor or walls with fasteners as indicated on Drawings.
 - 3. Firmly secure all freestanding floor units to floor with 2x4 wood blocking and expansion anchor bolts as per the anchoring details in contract drawings.
 - 4. Secure adjoining freestanding casework with four (4) connector bolts as shown on contract drawings
 - 5. Countersink all screws used to adhere slatwall to walls and cabinets.
 - 6. All attachment systems shall be concealed; no screw heads other than the screws covered by cove base shall be visible.
- C. Use fixture attachments in concealed locations for wall and floor mounted components.
- D. Secure fixtures to floor using appropriate angles and anchorages.
- E. Carefully scribe fixtures abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim for this purpose.
- F. Hand the keys over to the Contracting Officer and obtain a receipt.
- G. Cove base will be supplied and installed under Section 096500 – Resilient Flooring.

3.3 CONSTRUCTION

- A. Interface with Other Work:
 - 1. Coordinate installation sequence of fixtures with trades providing electrical, data and communication connections to fixtures.
 - 2. Coordinate the installation of cove base with resilient flooring installer.
- B. Site Tolerances:
 - 1. Maximum Variation from True Position: 1/16 inch (1.58 mm).
 - 2. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.79 mm).

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Inspection procedures.



- B. Contracting Officer will inspect custom cabinet and fixture installation, alignment, attachment to structure, and connection to data and communication lines.

3.5 ADJUSTING

- A. Adjust moving or operating parts to function smoothly and correctly.

3.6 CLEANING AND PROTECTION

- A. Section 017300 - Execution Requirements Cleaning and protection of installed Work.
- B. Clean casework, counters, shelves, hardware, fittings, and fixtures.

[illegible]

[illegible]

ITEM #		DESCRIPTION
1	BMEU719	SCALE BASE UNIT
2	BMEU720	HC ACCESSIBLE COUNTER
3	BMEU721-L	FULL SERVICE COUNTER
4		FULL SERVICE COUNTER W/BUMPER AND CORNER
5	BMEU721-R	FULL SERVICE COUNTER
6		FULL SERVICE COUNTER W/BUMPER AND CORNER
7	BMEU725	GRAPHICS FRAME
8	BMEU731	SCREENLINE BASE CABINET
9	BMEU732	SCREENLINE WALL CABINET
10	BMEU742	HC ACCESSIBLE REWORK DESK
11	BMEU743	REWORK DESK STORAGE / RECYCLE UNIT
12	BMEU744	REWORK DESK STORAGE UNIT
13	BMEU745-L	REWORK DESK END CAP STORAGE
14	BMEU745-R	REWORK DESK END CAP STORAGE



USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 6/25/2013

END OF SECTION



Task	Specification	Specification Description
12 35 70 13	01 22 16 00	No Specification Required



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SECTION 12 36 23 13 - STONE COUNTERTOPS

1.1 GENERAL

- A. Description Of Work
 - 1. This specification covers the furnishing and installation of materials for stone countertops. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.
- B. Summary
 - 1. This Section includes stone countertops.
- C. Submittals
 - 1. Product Data: For each variety of stone and manufactured products.
 - 2. Shop Drawings: Include plans, sections, details, and attachments to other work.
 - 3. Samples: For each stone type indicated.
 - 4. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.
 - 5. Sealant Compatibility Test Report: From sealant manufacturer, complying with requirements in Division 07 Section "Joint Sealants" and indicating that sealants will not stain or damage stone.
 - 6. Maintenance Data: For stone countertops to include in maintenance manuals. Include Product Data for stone-care products used or recommended by Installer, and names, addresses, and telephone numbers of local sources for products.
- D. Quality Assurance
 - 1. Installer Qualifications: Fabricator of products.
 - 2. Source Limitations for Stone: Obtain each variety of stone from a single quarry with resources to provide materials of consistent quality in appearance and physical properties.
 - a. Make stone slabs available for the Owner to examine for appearance characteristics. the Owner will select aesthetically acceptable slabs.
- E. Delivery, Storage, And Handling
 - 1. Lift stone with wide-belt slings; do not use wire rope or ropes that might cause staining. Move stone, if required, using dollies with cushioned wood supports.
 - 2. Store stone on wood A-frames or pallets with nonstaining separators and nonstaining, waterproof covers. Ventilate under covers to prevent condensation.
- F. Project Conditions
 - 1. Field Measurements: Verify dimensions of construction to receive stone countertops by field measurements before fabrication.

1.2 PRODUCTS

- A. Granite
 - 1. Granite: Comply with ASTM C 615.
 - 2. Cut stone from contiguous, matched slabs in which natural markings occur, **as directed**.
 - 3. Finish: Polished **OR** Honed **OR** Thermal **OR** As indicated **OR** Match the Owner's sample, **as directed**.
- B. Marble
 - 1. Marble: Comply with ASTM C 503.



- a. Stone Abrasion Resistance: Minimum value of 10, based on testing according to ASTM C 241 or ASTM C 1353.
 2. Cut stone from contiguous, matched slabs in which natural markings occur, **as directed**.
 3. Finish: Polished **OR** Honed **OR** As indicated **OR** Match the Owner's sample, **as directed**.
- C. Serpentine
 1. Serpentine: Comply with ASTM C 1526, Classification I Exterior **OR** II Interior, **as directed**.
 - a. Stone Abrasion Resistance: Minimum value of 10, based on testing according to ASTM C 241 or ASTM C 1353.
 2. Cut stone from contiguous, matched slabs in which natural markings occur, **as directed**.
 3. Finish: Polished **OR** Honed **OR** As indicated **OR** Match the Owner's sample, **as directed**.
- D. Slate
 1. Slate: Comply with ASTM C 629, Classification I Exterior **OR** II Interior, **as directed**, with a fine, even grain and unfading color, from clear, sound stock.
 - a. Stone Abrasion Resistance: Minimum value of 8, based on testing according to ASTM C 241 or ASTM C 1353.
 2. Finish: Honed **OR** Sand rubbed **OR** Natural cleft **OR** As indicated **OR** Match the Owner's sample, **as directed**.
- E. Adhesives, Grout, Sealants, And Stone Accessories
 1. General: Use only adhesives formulated for stone and ceramic tile and recommended by their manufacturer for the application indicated.
 2. Water-Cleanable Epoxy Adhesive: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Water-Cleanable Epoxy Grout: ANSI A118.3, chemical-resistant, water-cleanable, tile-setting and -grouting epoxy.
 4. Stone Adhesive: 2-part epoxy or polyester adhesive, formulated specifically for bonding stone to stone, with an initial set time of not more than 2 hours at 70 deg F (21 deg C), and with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - a. Color: Clear **OR** Match stone, **as directed**.
 5. Sealant for Countertops: Manufacturer's standard sealant of characteristics indicated below that comply with applicable requirements in Division 07 Section "Joint Sealants" and will not stain the stone it is applied to.
 - a. Single-component, neutral-curing **OR** acid-curing, **as directed**, silicone sealant.
 - b. Color: Clear **OR** As selected by the Owner from manufacturer's full range, **as directed**.
 - c. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 6. Stone Joint Splines: Stainless-steel or brass washers approximately 1 inch (25 mm) in diameter and of thickness to fit snugly in saw-cut kerf in edge of stone units.
 7. Stone Cleaner: Cleaner specifically formulated for stone types, finishes, and applications indicated, as recommended by stone producer and, if a sealer is specified, by sealer manufacturer. Do not use cleaning compounds containing acids, caustics, harsh fillers, or abrasives.
 8. Stone Sealer: Colorless, stain-resistant sealer that does not affect color or physical properties of stone surfaces, as recommended by stone producer for application indicated.
- F. Stone Fabrication, General
 1. Select stone for intended use to prevent fabricated units from containing cracks, seams, and starts that could impair structural integrity or function.
 - a. Repairs that are characteristic of the varieties specified are acceptable provided they do not impair structural integrity or function and are not aesthetically unpleasing, as judged by the Owner.
 2. Grade and mark stone for final locations to produce assembled countertop units with an overall uniform appearance.



3. Fabricate stone countertops in sizes and shapes required to comply with requirements indicated, including details on Drawings and Shop Drawings.
 - a. For granite, comply with recommendations in NBGQA's "Specifications for Architectural Granite."
 - b. For marble and serpentine, comply with recommendations in MIA's "Dimension Stone-- Design Manual."
 - c. Clean sawed backs of stones to remove rust stains and iron particles.
 - d. Dress joints straight and at right angle to face, unless otherwise indicated.
 - e. Cut and drill sinkages and holes in stone for anchors, supports, and attachments.
 - f. Provide openings, reveals, and similar features as needed to accommodate adjacent work.
 - g. Fabricate molded edges with machines having abrasive shaping wheels made to reverse contour of edge profile to produce uniform shape throughout entire length of edge and with precisely formed arris slightly eased to prevent snipping, and matched at joints between units. Form corners of molded edges as indicated with outside corners slightly eased, unless otherwise indicated.
 - h. Finish exposed faces of stone to comply with requirements indicated for finish of each type of stone required and to match approved Samples and mockups. Provide matching finish on exposed edges of countertops, splashes, and cutouts.
 4. Carefully inspect finished stone units at fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units.
- G. Stone Countertops
1. General: Comply with recommendations in MIA's "Dimension Stone - Design Manual."
 2. Nominal Thickness: Provide thickness indicated, but not less than 3/4 inch (20 mm) **OR** 7/8 inch (22 mm) **OR** 1-1/4 inches (32 mm), **as directed**. Gage backs to provide units of identical thickness.
 3. Edge Detail: Straight, slightly eased at top **OR** 3/8-inch (10-mm) bevel **OR** 3/4-inch (20-mm) full bullnose **OR** 1-1/4-inch (20-mm) full bullnose **OR** 3/8-inch (10-mm) radius with 2-inch (50-mm) apron **OR** 1-1/2-inch (40-mm) laminated bullnose **OR** As indicated, **as directed**.
 4. Splashes: Provide 3/4-inch- (20-mm-) thick backsplashes **OR** end splashes **OR** backsplashes and end splashes, **as directed**, unless otherwise indicated.
 5. Joints: Fabricate countertops without joints.
OR
Fabricate countertops in sections for joining in field, with joints at locations indicated and as follows:
 - a. Bonded Joints: 1/32 inch (0.8 mm) or less in width.
 - b. Grouted Joints: 1/16 inch (1.5 mm) in width.
 - c. Sealant-Filled Joints: 1/16 inch (1.5 mm) in width.
 - d. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints where indicated. Make width of cuts slightly more than thickness of splines to provide snug fit. Provide at least three splines in each joint.
 6. Cutouts and Holes:
 - a. Undercounter Fixtures: Make cutouts for undercounter fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
 - 1) Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch (5 mm) into fixture opening.
 - 2) Provide vertical edges, rounded to 3/8-inch (10-mm) radius at juncture of cutout edges with top surface of countertop, slightly eased at bottom, and projecting 3/16 inch (5 mm) into fixture opening.
 - 3) Provide 3/4-inch (20-mm) full bullnose edges projecting 3/8 inch (10 mm) into fixture opening.
 - b. Counter-Mounted Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
 - c. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

1.3 EXECUTION

A. Preparation

1. Advise installers of other work about specific requirements for placement of inserts and similar items to be used by stone countertop Installer for anchoring stone countertops. Furnish installers of other work with Drawings or templates showing locations of these items.
2. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives. Allow stone to dry before installing.

B. Construction Tolerances

1. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/16 inch in 48 inches (1.5 mm in 1200 mm).
2. Variation from Level: Do not exceed 1/8 inch in 96 inches (3 mm in 2400 mm), 1/4 inch (6 mm) maximum.
3. Variation in Joint Width: Do not vary joint thickness more than 1/4 of nominal joint width.
4. Variation in Plane at Joints (Lipping): Do not exceed 1/64-inch (0.4-mm) difference between planes of adjacent units.
5. Variation in Line of Edge at Joints (Lipping): Do not exceed 1/64-inch (0.4-mm) difference between edges of adjacent units, where edge line continues across joint.

C. Installation Of Countertops

1. General: Install countertops over plywood subtops with full spread of water-cleanable epoxy adhesive.
OR
Install countertops by adhering to supports with water-cleanable epoxy adhesive.
2. Do not cut stone in field, unless otherwise indicated. If stone countertops or splashes require additional fabrication not specified to be performed at Project site, return to fabrication shop for adjustment.
OR
Do necessary field cutting as stone is set. Use power saws with diamond blades to cut stone. Cut lines straight, true, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
3. Set stone to comply with requirements indicated on Drawings and Shop Drawings. Shim and adjust stone to locations indicated, with uniform joints of widths indicated and with edges and faces aligned according to established relationships and indicated tolerances. Install anchors and other attachments indicated or necessary to secure stone countertops in place.
4. Bond joints with stone adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
5. If joints are allowed, space joints with 1/16-inch (1.5-mm) gap for filling with grout **OR** sealant, **as directed**. Use temporary shims to ensure uniform spacing.
 - a. Install metal splines in kerfs in stone edges at joints where indicated. Fill kerfs with stone adhesive **OR** setting adhesive **OR** sealant, **as directed**, before inserting splines and remove excess immediately after adjoining units are drawn into position.
 - b. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
6. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Use power saws with diamond blades to cut stone. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
7. Install backsplash and end splash by adhering to wall with water-cleanable epoxy adhesive and to countertops with stone adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
OR



Install backsplash and end splash by adhering to countertops with stone adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Leave 1/16-inch (1.5-mm) gap between splash and wall for filling with sealant. Use temporary shims to ensure uniform spacing.

OR

Install backsplash and end splash by adhering to wall with water-cleanable epoxy adhesive. Leave 1/16-inch (1.5-mm) gap between countertop and splash for filling with sealant. Use temporary shims to ensure uniform spacing.

8. If grouted joints are acceptable, grout joints to comply with ANSI A108.10. Remove temporary shims before grouting. Tool grout uniformly and smoothly with plastic tool.
9. Apply sealant to joints and gaps specified for filling with sealant; comply with Division 07 Section "Joint Sealants". Remove temporary shims before applying sealant.

D. Adjusting And Cleaning

1. In-Progress Cleaning: Clean countertops as work progresses. Remove adhesive, grout, mortar, and sealant smears immediately.
2. Remove and replace stone countertops of the following description:
 - a. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by the Owner.
 - b. Defective countertops.
 - c. Defective joints, including misaligned joints.
 - d. Interior stone countertops and joints not matching approved Samples and mockups.
 - e. Interior stone countertops not complying with other requirements indicated.
3. Replace in a manner that results in stone countertops matching approved Samples and mockups, complying with other requirements, and showing no evidence of replacement.
4. Clean stone countertops not less than six days after completion of sealant installation **OR** installation, **as directed**, using clean water and soft rags. Do not use wire brushes, acid-type cleaning agents, cleaning compounds with caustic or harsh fillers, or other materials or methods that could damage stone.
5. Sealer Application: Apply stone sealer to comply with stone producer's and sealer manufacturer's written instructions.

END OF SECTION 12 36 23 13



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SECTION 12 41 04 00 - CSF PORTABLE SAFETY LADDERS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where ladders are part of the Work.

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.12 41 04 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Portable 3-step safety ladders.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Data on stair construction, dimensions, configuration, and accessories.
 - 2. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project. Minimum of three manufacturers required.



2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 - 1. Cotterman Company, Croswell, MI(800) 552-3337.
 - 2. [_____].
 - 3. [_____].
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 SAFETY LADDERS

- A. Cotterman:
 - 1. Model: Series 1000, NO. 1003R2630.
 - 2. Type: Three-step with handrails on each side.
 - 3. Dimension: 30 inches x 26 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install safety ladders in accordance with manufacturer's published instructions in locations indicated on Drawings.
- B. Quantity: As indicated on Drawings.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



SECTION 12 48 13 00 - CSF ENTRANCE FLOOR MATS AND FRAMES**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Foot Grilles at Entry Vestibule or other locations is part of the Work.

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.12 48 13 00

PART 1 - GENERAL

1.1 SUMMARY

NOTE TO SPECIFIER

Edit below for Floor Mat option selected. Edit for Recessed or Surface installation.

- A. Section Includes:
 - 1. [Aluminum rail with carpet inserts and metal frame, recessed].
 - 2. [Rubber grid with carpet inserts, recessed].
 - 3. [Ribbed carpet with synthetic rubber backing, recessed] [Ribbed carpet with synthetic rubber backing, surface installed].
 - 4. [Aluminum grating with carpet inserts].
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Data indicating mat characteristics, component dimensions, frame, and dimensions.
 - 2. Shop Drawings: Indicate dimensions and details for recessed installation.
- B. Section 017704 - Closeout Procedures and Trainings: Procedures for closeout submittals.
 - 1. Operation and Maintenance Data: Include cleaning instructions and stain removal procedures.

NOTE TO SPECIFIER



"REQUIRED Part (Products) follows. Do not revise this Part or article, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer."

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Select Mat Option based on site conditions, availability, budget, and input from USPS Contracting Officer. Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

NOTE TO SPECIFIER

OPTION 1: Use for aluminum rails with carpet inserts type mat.

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. C/S Incorporated, Muncy, PA (800) 223-8493.
 2. Pawling, Wassaic, NY (800) 431-3456.
 3. R.C. Musson, Akron, OH (800) 321-2381.
 4. Kadee Industries, Inc, Cleveland OH (800) 321-3827.

NOTE TO SPECIFIER

OPTION 2: Use for rubber with carpet inserts type mat.

- B. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. C/S Incorporated, Muncy, PA (800) 223-8493.
 2. Mats, Incorporated, Braintree, MA (800) 628-7462.
 3. Pawling, Wassaic, NY (800) 431-3456.
 4. R.C. Musson, Akron, OH (800) 321-2381.

NOTE TO SPECIFIER

OPTION 3: Use for ribbed carpet with synthetic rubber backing.

- C. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. AFCO, Rockville, MD (800) 342-0424.
 2. Mats, Incorporated, Braintree, MA (800) 628-7462.
 3. Pawling, Wassaic, NY (800) 431-3456.
 4. Quill-Tuft, Odenton, MD (800) 526-7763.

NOTE TO SPECIFIER

OPTION 4: Use for aluminum grating with carpet inserts type mat.

- D. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:



1. C/S Incorporated, Muncy, PA (800) 223-8493.
2. Pawling, Wassaic, NY (800) 431-3456.
3. Reese, Rosemount, MN (800) 328-0953.
4. Mats Incorporated, Braintree, MA (800) 628-7462.
5. Kadee Industries, Inc, Cleveland OH (800) 321-3827.

E. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

NOTE TO SPECIFIER

OPTION 1: Use for aluminum rails with carpet inserts type mat.

- A. Model/Color:
1. C/S Incorporated: Treadline with "Charcoal carpet insert.
 2. Pawling: Rol-Dek EM-650 with gray insert.
 3. R.C. Musson: EM-650 with charcoal insert.
 4. Kadee: KDCM.
- B. Description:
1. Size Indicated on Drawing: To outside of perimeter frame.
 2. Construction: Aluminum rail treads with thermo plastic rubber hinges.
 3. Tread Inserts: Polypropylene fiber, fusion-bonded to backing and attached to tread rails.
 4. Drain slots provided in vinyl rails.
 5. Fixed recessed metal frame.
 6. Height: 3/8 inch or 1/2 inch.

NOTE TO SPECIFIER

OPTION 2: Use for rubber grid with carpet inserts type mat.

- C. Model/Color:
1. C/S Incorporated: [_____].
 2. Mats, Inc.: Ultra-Entry grid with Berber, charcoal fiber insert.
 3. Pawling: [_____].
 4. R.C. Musson: [_____].
- D. Description:
1. Size Indicated on Drawing: To outside of floor mat.
 2. Construction: Synthetic rubber with carpet inserts.
 3. Tread Inserts: Polypropylene fiber, fusion-bonded to backing.
 4. Height: 3/8 inch or 1/2 inch.

NOTE TO SPECIFIER

OPTION 3: Use for ribbed carpet with synthetic rubber backing.

- E. Model/Color:
1. AFCO: Packard CM 1733, silver gray
 2. Mats, Inc.: Decorib charcoal.
 3. Pawling: Jaguar, "Silver/Gray" color.
 4. Quill-Tuft: Charcoal color.

- F. Description:
1. Size Indicated on Drawing: To outside of floor mat.



2. Construction: Tight needled rib.
3. Pile Fiber: Heavier denier solution dyed polypropylene.
4. Pile Weight: 36 ounces.
5. Backing: Synthetic rubber.
6. Height: 3/8 inch or 1/2 inch.

NOTE TO SPECIFIER

OPTION 4: Use for aluminum grating with carpet inserts type mat.

G. Model/Color:

1. C/S Incorporated: Pedigree II with graphite carpet #9325 HD insert.
2. Pawling: Drainwell III with charcoal #38 carpet insert.
3. Reese: Grate #470 with charcoal #8603 carpet insert.
4. Mats, Inc.: Grate mat with gray insert.
5. Kadee: KDCP.

H. Description:

1. Size Indicated on Drawing: To outside of perimeter frame.
2. Construction: Aluminum rail treads with aluminum hinges.
3. Tread Inserts: Polypropylene fiber, fusion-bonded to backing and attached to tread rails.
4. Drain slots provided in aluminum rails.
5. Fixed recessed metal frame.
6. Height: 1 1/2 inches.

I. Adhesive: Low VOC multipurpose adhesive as recommended by mat manufacturer.

2.3 FABRICATION

- A. Construct mat frames square, tight joints at corners, rigid. Coat surfaces with protective coating where in contact with cementitious materials.
- B. Fabricate mats in single unit sizes; fabricate multiple mats where indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

NOTE TO SPECIFIER

Use Paragraph below for recessed installation.

1. Field verify floor recess before fabricating mats.

- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.



- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Vacuum clean floor where mat will be installed.
- B. Install mats and frames in accordance with manufacturer's published instructions in locations indicated on Drawings.

NOTE TO SPECIFIER

OPTION 1 & 4: Use for vinyl rails with carpet inserts and aluminum grating with carpet inserts type mats.

- C. Install mat frames in floor recess flush with finish floor after cleaning of finish flooring.

NOTE TO SPECIFIER

OPTION 2 & 3: Use Adhesive Attachment below for rubber with carpet inserts and ribbed carpet with synthetic rubber backing type mats.

- D. Adhesive Attachment: Apply adhesive to perimeter of mat, fastening edges and corners securely.

NOTE TO SPECIFIER

Use CONSTRUCTION below for recessed installation.

3.3 CONSTRUCTION

- A. Site Tolerances:
1. Maximum Gap Formed at Recessed Frame From Mat Size: 1/4 inch.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection.
- B. Inspect floor mat installation for proper material, color, placement, and alignment.

3.5 PROTECTION

- A. Section 017300 - Execution: Cleaning of installed Work.
- B. Vacuum clean mat after installation and protect from traffic.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



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SECTION 12 48 13 00 - MPF ENTRANCE FLOOR MATS AND FRAMES**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Aluminum grating with carpet inserts.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Data indicating mat characteristics, component dimensions, frame, and dimensions.
 - 2. Shop Drawings: Indicate dimensions and details for recessed installation.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Operation and Maintenance Data: Include cleaning instructions and stain removal procedures.

NOTE TO SPECIFIER

"REQUIRED Part (Products) follows. Do not revise this Part or article, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. C/S Incorporated, Muncy, PA (800) 223-8493.
 - 2. Pawling, Wassaic, NY (800) 431-3456.



3. Reese, Rosemount, MN (800) 328-0953.
4. Mats Incorporated, Braintree, MA (800) 628-7462.
5. Kadee Industries, Inc, Cleveland OH (800) 321-3827.

- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

A. Model/Color:

1. C/S Incorporated: Pedigree II with graphite carpet #9325 HD insert.
2. Pawling: Drainwell III with charcoal #38 carpet insert.
3. Reese: Grate #470 with charcoal #8603 carpet insert.
4. Mats, Inc.: Grate mat with gray insert.
5. Kadee: KDCP.

B. Description:

1. Size Indicated on Drawing: To outside of perimeter frame.
2. Construction: Aluminum rail treads with aluminum hinges.
3. Tread Inserts: Polypropylene fiber, fusion-bonded to backing and attached to tread rails.
4. Drain slots provided in aluminum rails.
5. Fixed recessed metal frame.
6. Height: 1 1/2 inches.

- C. Adhesive: Low VOC multipurpose adhesive as recommended by mat manufacturer.

2.3 FABRICATION

- A. Construct mat frames square, tight joints at corners, rigid. Coat surfaces with protective coating where in contact with cementitious materials.
- B. Fabricate mats in single unit sizes; fabricate multiple mats where indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
1. Field verify floor recess before fabricating mats.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.



3.2 INSTALLATION

- A. Vacuum clean floor where mat will be installed.
- B. Install mats and frames in accordance with manufacturer's published instructions in locations indicated on Drawings.
- C. Install mat frames in floor recess flush with finish floor after cleaning of finish flooring.

3.3 CONSTRUCTION

- A. Site Tolerances:
 - 1. Maximum Gap Formed at Recessed Frame From Mat Size: 1/4 inch.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection.
- B. Inspect floor mat installation for proper material, color, placement, and alignment.

3.5 PROTECTION

- A. Section 017300 - Execution: Cleaning of installed Work.
- B. Vacuum clean mat after installation and protect from traffic.

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Last revised: 6/29/2010

END OF SECTION 12 48 13 00



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SECTION 12 56 53 00 - LABORATORY CASEWORK**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for laboratory casework. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Metal laboratory casework, with wood doors and drawer fronts.
 - b. Wood laboratory casework.
 - c. Plastic-laminate laboratory casework.
 - d. Utility-space framing at backs of base cabinets and between backs of base cabinets.
 - e. Filler and closure panels.
 - f. Laboratory casework system that includes support and utility-space framing, filler and closure panels, wall panels, undercabinet lighting, and modular countertops.
 - g. Laboratory countertops.
 - h. Tables.
 - i. Shelves.
 - j. Laboratory sinks and troughs.
 - k. Laboratory accessories.
 - l. Water, laboratory gas, and electrical service fittings.

C. Definitions

1. MDF: Medium-density fiberboard.
2. Exposed Surfaces of Casework: Surfaces visible when doors and drawers are closed, including bottoms of cabinets more than 48 inches (1200 mm) above floor, and visible surfaces in open cabinets or behind glass doors.
 - a. Ends of cabinets, including those installed directly against walls or other cabinets, are defined as "exposed."

OR

Ends of cabinets indicated to be installed directly against and completely concealed by walls or other cabinets are defined as "concealed."
3. Semiexposed Surfaces of Casework: Surfaces behind opaque doors, such as cabinet interiors, shelves, and dividers; interiors and sides of drawers; and interior faces of doors. Tops of cabinets 78 inches (1980 mm) or more above floor are defined as "semiexposed."
4. Concealed Surfaces of Casework: Include sleepers, web frames, dust panels, and other surfaces not usually visible after installation.
5. Hardwood Plywood: A panel product composed of layers or plies of veneer, or of veneers in combination with lumber core, hardboard core, MDF core, or particleboard core, joined with adhesive and faced both front and back with hardwood veneers.

D. Performance Requirements

1. System Structural Performance: Laboratory casework and support framing system shall withstand the effects of the following gravity loads and stresses without permanent deformation, excessive deflection, or binding of drawers and doors:
 - a. Support Framing System: 600 lb/ft. (900 kg/m).
 - b. Suspended Base Cabinets (Internal Load): 160 lb/ft. (240 kg/m).
 - c. Work Surfaces (Including Tops of Suspended Base Cabinets): 160 lb/ft. (240 kg/m).
 - d. Wall Cabinets (Upper Cabinets): 160 lb/ft. (240 kg/m).
 - e. Shelves: 40 lb/sq. ft. (200 kg/sq. m).



2. Delegated Design: Design laboratory casework, including comprehensive engineering analysis by a qualified professional engineer, using seismic performance requirements and design criteria indicated.
3. Seismic Performance: Laboratory casework and support framing system, including attachments to other work, shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - a. Component Importance Factor is 1.5 **OR** 1.0, **as directed**.

E. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that cabinets **OR** cabinets, countertops, and shelves, **as directed**, comply with forest certification requirements.
 - 1) Include evidence that casework manufacturer is certified for chain of custody by an FSC-accredited certification body.
 - 2) Include statement indicating costs for each certified wood product.
 - b. Product Data for Credit EQ 4.4: For adhesives and composite wood products, documentation indicating that product contains no urea formaldehyde.
3. Shop Drawings: For laboratory casework. Include plans, elevations, sections, details, and attachments to other work.
4. Samples: For each type of cabinet finish.
5. Delegated-Design Submittal: For laboratory casework indicated to comply with seismic performance requirements, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
6. Product Test Reports for Casework: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating compliance of laboratory casework with requirements of specified product standard and system structural performance specified in "Performance Requirements" Article.
7. Product Test Reports for Countertop Surface Material: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating compliance of laboratory countertop surface materials with requirements specified for chemical and physical resistance.

F. Quality Assurance

1. Manufacturer Qualifications: A qualified manufacturer that produces casework of types indicated for this Project that has been tested for compliance with SEFA 8 and is certified for chain of custody by an FSC-accredited certification body.
2. Source Limitations: Obtain laboratory casework from single source from single manufacturer unless otherwise indicated.
3. Product Designations: Drawings indicate sizes and configurations of laboratory casework by referencing designated manufacturer's catalog numbers. Other manufacturers' laboratory casework of similar sizes and similar door and drawer configurations and complying with the Specifications may be considered.
4. Casework Product Standard: Comply with SEFA 8, "Laboratory Furniture - Casework, Shelving and Tables - Recommended Practices."
5. Flammable Liquid Storage: Where cabinets are indicated for solvent or flammable liquid storage, provide units that are listed and labeled as complying with requirements in NFPA 30 by a testing and inspecting agency acceptable to authorities having jurisdiction **OR** FM Approvals, **as directed**.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
7. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling



1. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

1.2 PRODUCTS

A. Metal Cabinet And Table Materials

1. Metal: Cold-rolled, commercial steel (CS) sheet, complying with ASTM A 1008/A 1008M; matte finish; suitable for exposed applications.
2. Nominal Metal Thickness:
 - a. Sides, Ends, Fixed Backs, Bottoms, Tops, Soffits, and Items Not Otherwise Indicated: 0.048 inch (1.21 mm). Except for flammable liquid storage cabinets, bottoms may be 0.036 inch (0.91 mm) if reinforced.
 - b. Back Panels, Doors, Drawer Fronts and Bodies, and Shelves: 0.036 inch (0.91 mm) except 0.048 inch (1.21 mm) for back panels and doors of flammable liquid storage cabinets and for unreinforced shelves more than 36 inches (900 mm) long.
 - c. Intermediate Horizontal Rails, Table Aprons and Cross Rails, Center Posts, and Top Gussets: 0.060 inch (1.52 mm).
 - d. Drawer Runners, Sink Supports, and Hinge Reinforcements: 0.075 inch (1.90 mm).
 - e. Leveling and Corner Gussets: 0.105 inch (2.66 mm).

3. Wood Door and Drawer Front Materials:

- a. General: Provide materials that are selected and arranged for compatible grain and color. Do not use materials adjacent to one another that are noticeably dissimilar in color, grain, figure, or natural character markings.
- b. Wood Species: Red oak **OR** White birch **OR** Alder **OR** White maple **OR** Hickory **OR** Cherry, **as directed**.
- c. Certified Wood Materials: Provide wood door and drawer fronts obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- d. Adhesives: Do not use adhesives that contain urea formaldehyde.
- e. Hardwood Plywood: HPVA HP-1, either veneer core or particleboard core, unless otherwise indicated, made without urea formaldehyde with face veneer of species indicated, selected for compatible color and grain. Grade A exposed faces at least 1/50 inch (0.5 mm) thick, and Grade J crossbands. Provide backs of same species as faces.
 - 1) Face Veneer Cut: Plain sliced **OR** Quarter sliced **OR** Rift cut **OR** Rotary cut, **as directed**.
 - 2) Particleboard: ANSI A208.1, Grade M-2.
 - 3) Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde **OR** straw-based particleboard complying with ANSI A208.1, Grade M-2, except for density, made with binder containing no urea formaldehyde, **as directed**.
- f. Solid Wood: Clear hardwood lumber of species indicated and selected for grain and color compatible with exposed hardwood plywood, selected for compatible grain and color, with moisture content not more than 7 percent.
- g. Edgebanding for Wood-Veneered Construction: Minimum 1/8-inch- (3-mm-) thick, solid wood of same species as face veneer **OR** Wood veneer of same species as face veneer **OR** Rigid PVC extrusions, through color with satin finish, 3 mm thick, **as directed**.
 - 1) Colors: As selected from manufacturer's full range.

B. Wood Cabinet And Table Materials

1. General:
 - a. Certified Wood Materials: Provide cabinets with not less than 70 percent of wood products **OR** all wood products, **as directed**, obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
 - b. Adhesives: Do not use adhesives that contain urea formaldehyde.



- c. Maximum Moisture Content for Lumber: 7 percent for hardwood and 12 percent for softwood.
 - d. Hardwood Plywood: HPVA HP-1, either veneer core or particleboard core, unless otherwise indicated, made without urea formaldehyde.
 - e. MDF: ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.
 - f. Particleboard: ANSI A208.1, Grade M-2.
 - g. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde **OR** straw-based particleboard complying with ANSI A208.1, Grade M-2, except for density, made with binder containing no urea formaldehyde, **as directed**.
 - h. Hardboard: AHA A135.4, Class 1 Tempered.
 - i. Edgebanding for Wood-Veneered Construction: Minimum 1/8-inch- (3-mm-) thick, solid wood of same species as face veneer **OR** Wood veneer of same species as face veneer **OR** Rigid PVC extrusions, through color with satin finish, 3 mm thick at doors and drawer fronts, 1 mm thick elsewhere, **as directed**.
 - 1) Colors: As selected from manufacturer's full range.
2. Exposed Materials:
- a. General: Provide materials that are selected and arranged for compatible grain and color. Do not use materials adjacent to one another that are noticeably dissimilar in color, grain, figure, or natural character markings.
 - b. Wood Species: Red oak **OR** White birch **OR** Alder **OR** White maple **OR** Hickory **OR** Cherry, **as directed**.
 - c. Plywood: Hardwood plywood with face veneer of species indicated, selected for compatible color and grain. Grade A exposed faces at least 1/50 inch (0.5 mm) thick, and Grade J crossbands. Provide backs of same species as faces.
 - d. Face Veneer Cut: Plain sliced **OR** Quarter sliced **OR** Rift cut **OR** Rotary cut, **as directed**.
 - e. Solid Wood: Clear hardwood lumber of species indicated and selected for grain and color compatible with exposed hardwood plywood, selected for compatible grain and color.
3. Semiexposed Materials:
- a. Solid Wood: Sound hardwood lumber, selected to eliminate appearance defects, of any species similar in color and grain to **OR** same species as, **as directed**, exposed solid wood.
 - b. Plywood: Hardwood plywood of any species similar in color and grain to **OR** same species as, **as directed**, exposed plywood. Grade B **OR** Grade C, **as directed**, faces and Grade J crossbands. Provide backs of same species as faces.
 - c. Provide solid wood or hardwood plywood for semiexposed surfaces unless otherwise indicated.
 - d. Metal for Steel Drawer Pans: Cold-rolled, carbon-steel sheet complying with ASTM A 1008/A 1008M; matte finish; suitable for exposed applications.
4. Concealed Materials:
- a. Solid Wood: Any species, with no defects affecting strength or utility.
 - b. Plywood: Hardwood plywood. Provide backs of same species as faces.
 - c. Particleboard.
 - d. MDF.
 - e. Hardboard.
- C. Plastic-Laminate Cabinet Materials
1. General:
- a. Certified Wood Materials: Provide cabinets with not less than 70 percent of wood products **OR** all wood products, **as directed**, obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
 - b. Adhesives: Do not use adhesives that contain urea formaldehyde.
 - c. Hardwood Plywood: HPVA HP-1, either veneer core or particleboard core, unless otherwise indicated, made without urea formaldehyde.
 - d. MDF: ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.



- e. Particleboard: ANSI A208.1, Grade M-2.
 - f. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde **OR** straw-based particleboard complying with ANSI A208.1, Grade M-2, except for density, made with binder containing no urea formaldehyde, **as directed**.
 - g. Hardboard: AHA A135.4, Class 1 Tempered.
 - h. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.
 - i. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
 - j. Edgebanding for Plastic Laminate: Plastic laminate matching adjacent surfaces **OR** Rigid PVC extrusions, through color with satin finish, 3 mm thick at doors and drawer fronts, 1 mm thick elsewhere, **as directed**.
 - 1) Colors: As selected from manufacturer's full range.
 - k. Edgebanding for Thermoset Decorative Panels: PVC or polyester edge banding complying with LMA EDG-1 and matching thermoset decorative panels.
2. Exposed Materials:
 - a. Plastic Laminate: Grade HGS **OR** Grade HGL **OR** Grade VGS, **as directed**.
 - 1) Colors: As selected from manufacturer's full range.
 3. Semiexposed Materials:
 - a. Plastic Laminate: Grade VGS **OR** Grade CLS, **as directed**.
 - 1) Colors: As selected from manufacturer's full range.
 - 2) Provide plastic laminate for semiexposed surfaces unless otherwise indicated.

OR

Provide plastic laminate for interior faces of doors and drawer fronts and where indicated.
 - b. Thermoset Decorative Panels: Provide thermoset decorative panels for semiexposed surfaces unless otherwise indicated.
 - 1) Colors: As selected from manufacturer's full range.
 - c. Solid Wood: Sound hardwood lumber, selected to eliminate appearance defects.
 - d. Plywood: Hardwood plywood. Grade B **OR** Grade C, **as directed**, faces and Grade J crossbands. Provide backs of same species as faces.
 - e. Metal for Steel Drawer Pans: Cold-rolled, carbon-steel sheet complying with ASTM A 1008/A 1008M; matte finish; suitable for exposed applications.
 4. Concealed Materials:
 - a. Solid Wood: Any species, with no defects affecting strength or utility.
 - b. Plywood: Hardwood plywood.
 - c. Plastic Laminate: Type BKL.
 - d. Particleboard.
 - e. MDF.
 - f. Hardboard.
- D. Auxiliary Cabinet Materials
1. Acid Storage-Cabinet Lining: 1/4-inch- (6-mm-) thick, glass-fiber cement board complying with ASTM C 1186 **OR** polyethylene or polypropylene **OR** polyethylene, polypropylene, epoxy, or phenolic-composite lining material, **as directed**.
 2. Glass for Glazed Doors: Clear float glass complying with ASTM C 1036, Type I, Class 1, Quality-Q3; not less than 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**, thick.
 3. Glass for Glazed Doors: Clear tempered glass complying with ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality-Q3; not less than 5.0 mm thick.

OR

Glass for Glazed Doors: Clear laminated tempered glass complying with ASTM C 1172, Kind LT, Condition A, Type I, Class I, Quality-Q3; with 2 lites not less than 3.0 mm thick and with clear, polyvinyl butyral interlayer.
 4. Frameless Glass Doors: Clear tempered glass complying with ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality-Q3; not less than 5.0 **OR** 6.0, **as directed**, mm thick; with exposed edges seamed before tempering.



- E. Countertop Table Top, Shelf, Trough, And Sink Materials
1. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.
 - a. Colors, Patterns, and Finishes: As selected from casework manufacturer's full range.
 2. Chemical-Resistant Plastic Laminate:
 - a. High-pressure decorative laminate, complying with NEMA LD 3, that has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:
 - 1) No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), amyl acetate, benzene, butyl alcohol, carbon tetrachloride, chloroform, dimethyl formamide, dioxane, ethyl acetate, ethyl alcohol, ethyl ether, formaldehyde (37 percent), gasoline, gentian violet, hydrogen peroxide (3 percent), methyl alcohol, methyl ethyl ketone, methylene chloride, mono chlorobenzene, naphthalene, toluene, trichloroethylene, xylene, and zinc chloride (saturated). Hydrochloric acid (37 percent), methyl red, nitric acid (30 percent), phenol (90 percent), phosphoric acid (75 percent), silver nitrate (saturated), sodium hydroxide (20 percent), and sulfuric acid (77 percent), **as directed**.
 - 2) Slight Effect: Cresol and tincture of iodine, sodium sulfide (15 percent). Phenol (90 percent), sodium hydroxide (20 percent), and methyl red, **as directed**.
 - 3) Moderate Effect: Hydrochloric acid (37 percent), nitric acid (30 percent), phosphoric acid (75 percent), silver nitrate (saturated), and sulfuric acid (77 percent), **as directed**.
 - b. Color: Black **OR** As indicated by manufacturer's designations **OR** As selected from chemical-resistant, plastic-laminate manufacturer's full range, **as directed**.
 3. Core Materials for Plastic Laminate:
 - a. Particleboard: ANSI A208.1, Grade M-2.
 - b. Urea-Formaldehyde-Free Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde.
 - c. Exterior-Glue Particleboard: ANSI A208.1, Grade M-2, Exterior Glue.
 - d. Straw-Based Particleboard: ANSI A208.1, Grade M-2, except for density, made with binder containing no urea formaldehyde.
 - e. Exterior Plywood: DOC PS 1, Exterior A-C **OR** Exterior B-C, **as directed**, with fully sanded face.
 4. Adhesive for Bonding Plastic Laminate: Resorcinol **OR** Urea formaldehyde **OR** Contact adhesive **OR** Manufacturer's standard waterproof adhesive **OR** Manufacturer's standard waterproof, urea-formaldehyde-free adhesive, **as directed**.
 5. Epoxy: Factory-molded, modified epoxy-resin formulation with smooth, nonspecular finish.
 - a. Physical Properties:
 - 1) Flexural Strength: Not less than 10,000 psi (70 MPa).
 - 2) Modulus of Elasticity: Not less than 2,000,000 psi (1400 MPa).
 - 3) Hardness (Rockwell M): Not less than 100.
 - 4) Water Absorption (24 Hours): Not more than 0.02 percent.
 - 5) Heat Distortion Point: Not less than 260 deg F (127 deg C).
 - b. Chemical Resistance: Epoxy-resin material has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:
 - 1) No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, ethyl ether, methyl alcohol, nitric acid (70 percent), phenol, sulfuric acid (60 percent), and toluene.
 - 2) Slight Effect: Chromic acid (60 percent) and sodium hydroxide (50 percent).
 - c. Color: Black **OR** Gray **OR** Beige **OR** As selected from manufacturer's full range, **as directed**.
 6. Phenolic Composite: Solid, high-pressure decorative laminate, complying with NEMA LD 3, Grade CGS.
 - a. Chemical Resistance: Composite countertop material has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:



- 1) No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, formaldehyde (37 percent), furfural, hydrochloric acid (37 percent), hydrofluoric acid (48 percent), nitric acid (30 percent), phosphoric acid (85 percent), sodium hydroxide (20 percent), sulfuric acid (33 percent), toluene, and zinc chloride, **as directed**.
- b. Color: Black **OR** White **OR** Gray **OR** Beige **OR** As selected from manufacturer's full range, **as directed**.
7. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304 **OR** Type 316L, **as directed**.

F. Metal Cabinets And Tables

1. Fabrication: Assemble and finish units at point of manufacture. Use precision dies for interchangeability of like-size drawers, doors, and similar parts. Perform assembly on precision jigs to provide units that are square. Reinforce units with angles, gussets, and channels. Except where otherwise specified, integrally frame and weld cabinet bodies to form dirt and vermin-resistant enclosures. Where applicable, reinforce base cabinets for sink support. Maintain uniform clearance around door and drawer fronts of 1/16 to 3/32 inch (1.5 to 2.4 mm).
2. Flush Doors: Outer and inner pans that nest into box formation, with full-height channel reinforcements at center of door. Fill doors with noncombustible, sound-deadening material.
3. Glazed Doors: Hollow-metal stiles and rails of similar construction as flush doors, with glass held in resilient channels or gasket material.
4. Hinged Doors: Mortise for hinges and reinforce with angles welded inside inner pans at hinge edge.
5. Drawers: Fronts made from outer and inner pans that nest into box formation, with no raw metal edges at top. Sides, back, and bottom fabricated in one piece with rolled or formed top of sides for stiffening and comfortable grasp for drawer removal. Provide drawers with rubber bumpers, polymer roller slides, and positive stops to prevent metal-to-metal contact or accidental removal.
6. Wood Doors: 3/4 inch (19 mm) thick, with particleboard or MDF cores, solid hardwood stiles and rails, and hardwood face veneers and crossbands.
7. Drawers with Wood Fronts: Fronts made from 3/4-inch- (19-mm-) thick, hardwood plywood or solid hardwood. Subfronts, sides, back, and bottom fabricated in one piece with rolled or formed top of sides for stiffening and comfortable grasp for drawer removal. Provide drawers with rubber bumpers, polymer roller slides, and positive stops to prevent metal-to-metal contact or accidental removal.
8. Design of Wood Doors and Drawer Fronts: Lipped overlay with radiused edges **OR** Reveal overlay with square edges **OR** Reveal overlay with radiused edges, **as directed**.
 - a. Provide 1/8-inch (3.2-mm) reveals between adjacent doors and adjacent drawers and between adjacent cabinets.
9. Grain Direction for Wood Doors and Drawer Fronts: Vertical on doors, horizontal on drawer fronts **OR** on both doors and drawer fronts, with continuous vertical matching, **as directed**.
10. Veneer Matching for Wood Doors and Drawer Fronts:
 - a. None required; select and arrange veneers for compatible grain and color.
 - b. Provide veneers for each cabinet from a single flitch, book and running matched **OR** slip and running matched **OR** book or slip and running matched **OR** book and balance matched **OR** slip and balance matched **OR** book or slip and balance matched, **as directed**.
 - 1) Provide continuous matching of adjacent drawer fronts within each cabinet.
 - c. Provide veneers for each elevation from a single flitch, book and running matched **OR** slip and running matched **OR** book or slip and running matched **OR** book and balance matched **OR** slip and balance matched **OR** book or slip and balance matched, **as directed**.
 - 1) Provide continuous matching of adjacent drawer fronts within each cabinet and end matching between drawer fronts of adjacent cabinets.
11. Adjustable Shelves: Front, back, and ends formed down, with edges returned horizontally at front and back to form reinforcing channels.
12. Toe Space: Fully enclosed, 4 inches (100 mm) high by 3 inches (75 mm) deep, with no open gaps or pockets.



13. Tables: Welded tubing legs, not less than 2 inches (50 mm) square with channel stretchers as needed to comply with product standard. Weld or bolt stretchers to legs and cross-stretchers, and bolt legs to table aprons. Provide leveling device welded to bottom of each leg.
 - a. Leg Shoes: Black vinyl or rubber **OR** Satin-finished stainless steel, **as directed**, open-bottom, slip-on type.
14. Utilities: Provide space, cutouts, and holes for pipes, conduits, and fittings in cabinet bodies to accommodate utility services and their support-strut assemblies.
 - a. Provide base cabinets with removable backs for access to utility space.
15. Utility-Space Framing: Laboratory casework manufacturer's standard steel framing units consisting of 2 steel slotted channels complying with MFMA-4, not less than 1-5/8 inches (41 mm) square by 0.105-inch (2.66-mm) nominal thickness, and connected at top and bottom by U-shaped brackets made from 1-1/4-by-1/4-inch (32-by-6-mm) steel flat bars. Framing units may be made by welding specified channel material into rectangular frames instead of using U-shaped brackets.
16. Filler and Closure Panels: Provide where indicated and as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinets and with hemmed or flanged edges unless otherwise indicated.
 - a. Provide utility-space closure panels at spaces between base cabinets where utility space would otherwise be exposed, including spaces below countertops.
 - b. Provide closure panels at ends of utility spaces where utility space would otherwise be exposed.
 - c. Provide knee-space panels (modesty panels) at spaces between base cabinets, where cabinets are not installed against a wall or where space is not otherwise closed **OR** indicated, **as directed**. Fabricate from back-to-back panels or of hollow construction to eliminate exposed hemmed or flanged edges.

G. Wood Cabinets And Tables

1. Design: Lipped overlay with radiused edges **OR** Reveal overlay with square edges **OR** Reveal overlay with radiused edges, **as directed**.
 - a. Provide 1/8-inch (3.2-mm) reveals between doors and drawers that are adjacent.
2. Grain Direction:
 - a. Vertical on both doors and drawer fronts, with continuous vertical matching.
OR
Vertical on doors, horizontal on drawer fronts.
 - b. Lengthwise on face frame members.
 - c. Vertical on end panels.
 - d. Side to side on bottoms and tops of units.
 - e. Vertical on knee-space panels.
 - f. Horizontal on aprons and table frames.
3. Veneer Matching:
 - a. None required; select and arrange veneers for compatible grain and color.
OR
Provide veneers for each cabinet from a single flitch, book and running matched **OR** slip and running matched **OR** book or slip and running matched **OR** book and balance matched **OR** slip and balance matched **OR** book or slip and balance matched, **as directed**.
 - 1) Provide continuous matching of adjacent drawer fronts within each cabinet.
OR
Provide veneers for each elevation from a single flitch, book and running matched **OR** slip and running matched **OR** book or slip and running matched **OR** book and balance matched **OR** slip and balance matched **OR** book or slip and balance matched, **as directed**.
 - 1) Provide continuous matching of adjacent drawer fronts within each cabinet and end matching between drawer fronts of adjacent cabinets.
4. Construction: Provide wood-faced laboratory casework of the following minimum construction:
 - a. Bottoms of Base Cabinets and Tall Cabinets: 3/4-inch- (19-mm-) thick hardwood plywood **OR** veneer-core hardwood plywood, **as directed**.



- b. Tops and Bottoms of Wall Cabinets and Tops of Tall Cabinets: 1-inch- (25-mm-) thick veneer-core hardwood plywood.
- c. Ends of Cabinets: 3/4-inch- (19-mm-) thick hardwood plywood.
- d. Shelves: 1-inch- (25-mm-) thick veneer-core hardwood plywood.
- e. Base Cabinet Top Frames: 3/4-by-2-inch (19-by-50-mm) solid wood with mortise and tenon or doweled connections, glued and pinned or screwed.
- f. Base Cabinet Stretchers: 3/4-by-4-1/2-inch (19-by-114-mm) panel product strips or solid wood boards at front and back of cabinet, glued and pinned or screwed. May be provided as an option to base cabinet top frames.
- g. Base Cabinet Subtops: 3/4-inch- (19-mm-) thick panel product glued and pinned or screwed. May be provided as an option to base cabinet top frames.
- h. Backs of Cabinets: 3/4-inch- (19-mm-) thick, hardwood plywood **OR** particleboard- or MDF-core hardwood plywood, **as directed**, where exposed, 1/4-inch- (6.4-mm-) thick hardboard **OR** 1/4-inch- (6.4-mm-) thick, hardwood plywood **OR** 1/2-inch- (12.7-mm-) thick, hardwood plywood, **as directed**, dadoed into sides, bottoms, and tops where not exposed.
- i. Drawer Fronts: 3/4-inch- (19-mm-) thick, hardwood plywood **OR** particleboard- or MDF-core hardwood plywood, **as directed**, or solid hardwood.
- j. Drawer Sides and Backs: 1/2-inch- (12.7-mm-) thick, solid hardwood or hardwood plywood **OR** veneer-core hardwood plywood, **as directed**, with glued dovetail or multiple-dowel joints.
- k. Drawer Bottoms: 1/4-inch- (6.4-mm-) thick, veneer-core hardwood plywood glued and dadoed into front, back, and sides of drawers. Use 1/2-inch- (12.7-mm-) thick material for drawers more than 24 inches (600 mm) wide.
- l. Drawer Bodies: Steel drawer pans formed from 0.036-inch- (0.91-mm-) thick metal, metallic phosphate treated, and finished with manufacturer's standard 2-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat and 2 mils (0.05 mm) for system.
- m. Doors 48 Inches (1200 mm) High or Less: 3/4 inch (19 mm) thick, with particleboard or MDF cores, solid hardwood stiles and rails, and hardwood face veneers and crossbands.
- n. Doors More Than 48 Inches (1200 mm) High: 1-1/16 inches (27 mm) thick, with honeycomb cores, solid hardwood stiles and rails, and hardwood face veneers and crossbands.
OR
Doors More Than 48 Inches (1200 mm) High: 1-1/8 inches (29 mm) thick, with particleboard cores and hardwood face veneers and crossbands.
- o. Stiles and Rails of Glazed Doors 48 Inches (1200 mm) High or Less: 3/4-inch- (19-mm-) thick, solid hardwood.
OR
Stiles and Rails of Glazed Doors 48 Inches (1200 mm) High or Less: 3/4-inch- (19-mm-) thick particleboard with hardwood face veneers and crossbands.
- p. Stiles and Rails of Glazed Doors More Than 48 Inches (1200 mm) High: 1-1/16-inch- (27-mm-) thick, solid wood with hardwood face veneers.
OR
Stiles and Rails of Glazed Doors More Than 48 Inches (1200 mm) High: 1-1/8 inches (29 mm) thick, with particleboard cores and hardwood face veneers and crossbands.
- 5. Tables: Solid hardwood legs, not less than 2 inches (50 mm) square with solid hardwood stretchers as needed to comply with product standard. Bolt stretchers to legs and cross-stretchers, and bolt legs to table aprons. Provide leveling device at bottom of each leg.
 - a. Leg Shoes: Black vinyl or rubber, open-bottom, slip-on type.
- 6. Utility-Space Framing: Laboratory casework manufacturer's standard steel framing units consisting of 2 steel slotted channels complying with MFMA-4, not less than 1-5/8 inches (41 mm) square by 0.105-inch (2.66-mm) nominal thickness, and connected at top and bottom by U-shaped brackets made from 1-1/4-by-1/4-inch (32-by-6-mm) steel flat bars. Framing units may be made by welding specified channel material into rectangular frames instead of using U-shaped brackets.

7. Filler and Closure Panels: Provide where indicated and as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as adjacent exposed cabinet surfaces unless otherwise indicated.
 - a. Provide utility-space closure panels at spaces between base cabinets where utility space would otherwise be exposed, including spaces below countertops.
 - b. Provide closure panels at ends of utility spaces where utility space would otherwise be exposed.
 - c. Provide knee-space panels (modesty panels) at spaces between base cabinets, where cabinets are not installed against a wall or where space is not otherwise closed **OR** indicated, **as directed**. Fabricate from same material and with same finish as exposed cabinet backs.

H. Plastic-Laminate Cabinets

1. Design: Reveal **OR** Flush, **as directed**, overlay.
2. Construction: Provide plastic-laminate-faced laboratory casework of the following minimum construction:
 - a. Bottoms and Ends of Cabinets, and Tops of Wall Cabinets and Tall Cabinets: 3/4-inch- (19-mm-) thick particleboard, plastic-laminate faced on exposed surfaces, thermoset decorative panels on semiexposed surfaces, **as directed**.
 - b. Shelves: 3/4-inch- (19-mm-) thick thermoset decorative panels.
OR
Shelves: 3/4-inch- (19-mm-) thick particleboard, plastic-laminate faced on exposed surfaces, thermoset decorative panels on semiexposed surfaces, **as directed**.
OR
Shelves: 3/4-inch- (19-mm-) thick plywood, plastic-laminate faced.
 - c. Backs of Cabinets: 1/2-inch- (12.7-mm-) thick particleboard, plastic-laminate faced on exposed surfaces, thermoset decorative panels on semiexposed surfaces, **as directed**.
 - d. Drawer Fronts: 3/4-inch- (19-mm-) thick particleboard, plastic-laminate faced.
 - e. Drawer Sides and Backs: 1/2-inch- (12.7-mm-) thick solid-wood or veneer-core hardwood plywood **OR** thermoset decorative panels, **as directed**, with glued dovetail or multiple-dowel joints.
 - f. Drawer Bottoms: 1/4-inch- (6.4-mm-) thick hardwood plywood **OR** thermoset decorative panels **OR** hardboard, **as directed**, glued and dadoed into front, back, and sides of drawers. Use 1/2-inch- (12.7-mm-) thick material for drawers more than 24 inches (600 mm) wide.
 - g. Drawer Bodies: Steel drawer pans formed from 0.036-inch- (0.91-mm-) thick metal, metallic phosphate treated, and finished with manufacturer's standard 2-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat and 2 mils (0.05 mm) for system.
 - h. Doors 48 Inches (1200 mm) High or Less: 3/4 inch (19 mm) thick, with particleboard or MDF cores and solid-wood stiles and rails, plastic-laminate faced.
 - i. Doors More Than 48 Inches (1200 mm) High: 1-1/16 inches (27 mm) thick, with honeycomb cores and solid hardwood stiles and rails, plastic-laminate faced.
OR
Doors More Than 48 Inches (1200 mm) High: 1-1/8 inches (29 mm) thick, with particleboard cores, plastic-laminate faced.
 - j. Stiles and Rails of Glazed Doors 48 Inches (1200 mm) High or Less: 3/4 inch (19 mm) thick, with particleboard cores, plastic-laminate faced.
 - k. Stiles and Rails of Glazed Doors More Than 48 Inches (1200 mm) High: 1-1/16-inch- (27-mm-) thick, solid wood, plastic-laminate faced.
OR
Stiles and Rails of Glazed Doors More Than 48 Inches (1200 mm) High: 1-1/8 inches (29 mm) thick, with particleboard cores, plastic-laminate faced.
3. Utility-Space Framing: Laboratory casework manufacturer's standard steel framing units consisting of 2 steel slotted channels complying with MFMA-4, not less than 1-5/8 inches (41 mm)



- square by 0.105-inch (2.66-mm) nominal thickness, and connected at top and bottom by U-shaped brackets made from 1-1/4-by-1/4-inch (32-by-6-mm) steel flat bars. Framing units may be made by welding specified channel material into rectangular frames instead of using U-shaped brackets.
4. Filler and Closure Panels: Provide where indicated and as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as adjacent exposed cabinet surfaces unless otherwise indicated.
 - a. Provide utility-space closure panels at spaces between base cabinets where utility space would otherwise be exposed, including spaces below countertops.
 - b. Provide closure panels at ends of utility spaces where utility space would otherwise be exposed.
 - c. Provide knee-space panels (modesty panels) at spaces between base cabinets, where cabinets are not installed against a wall or where space is not otherwise closed **OR** indicated, **as directed**. Fabricate from same material and with same finish as exposed cabinet backs.
- I. Laboratory Casework System
1. Provide casework manufacturer's standard integrated system that includes support framing, suspended modular cabinets, filler and closure panels, wall panels, undercabinet task-lighting fixtures, countertops, and fittings needed to assemble system. System includes hardware and fasteners for securing support framing to permanent construction.
 - a. Cabinet Construction: Metal **OR** Metal with wood doors and drawer fronts **OR** Wood, **as directed**.
 - b. Cabinets can be removed and reinstalled without use of special tools for relocation within system.
 - c. Base cabinets can be removed without providing temporary support for, or removing, countertops.
 - d. Sinks are supported independent of base cabinets.
 - e. Support framing has provision for fastening pipe supports at utility space in not more than 1-inch (25-mm) increments.
 - f. System includes filler and closure panels to close spaces between support framing, cabinets, shelves, countertops, floors, and walls unless otherwise indicated. Fabricate panels from same material and with same finish as metal cabinets and with hemmed or flanged edges.
 2. Support Framing: Casework manufacturer's standard system consisting of vertical supports and connecting braces and rails as follows:
 - a. Cabinets, shelves, and countertops are supported from vertical supports except where floor-supported base cabinets are indicated. Vertical positioning of supported cabinets, shelves, and countertops can be varied in 1-inch (25-mm) increments through full height of supports.
 - b. Vertical supports rest on adjustable leveling bases and are secured to floor with metal clips fastened to floor.
 - c. Vertical supports are installed with braces and rails connecting them to each other and to permanent building walls to create a stable, rigid structure with framed utility spaces where indicated.
 - d. Vertical supports are braced at floor with cantilevered horizontal leg members where indicated.
 3. Undercabinet Task-Light Fixtures: Single-tube fluorescent fixtures with switch and heavy-duty cord and plug.
 - a. Finish: Baked enamel.
 - b. Diffusers: Virgin acrylic with high resistance to yellowing and other changes due to aging, heat, and UV radiation.
 - c. Ballast Sound Rating: A.
 4. Countertops: Provide in modular lengths indicated, without seams.
- J. Metal Cabinet Finish



1. General: Prepare, treat, and finish welded assemblies after assembling. Prepare, treat, and finish components that are to be assembled with mechanical fasteners before assembling. Prepare, treat, and finish concealed surfaces same as exposed surfaces.
2. Preparation: After assembly, clean surfaces of mill scale, rust, oil, and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
3. Chemical-Resistant Finish: Immediately after cleaning and pretreating, apply laboratory casework manufacturer's standard two-coat, chemical-resistant, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).
 - a. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8. Acceptance level for chemical spot test shall be no more than four Level 3 conditions.
 - b. Colors for Metal Laboratory Casework Finish: As selected from manufacturer's full range.

K. Wood Finish

1. Preparation: Sand lumber and plywood before assembling. Sand edges of doors, drawer fronts, and molded shapes with profile-edge sander. Sand after assembling for uniform smoothness at least equivalent to that produced by 220-grit sanding and without machine marks, cross sanding, or other surface blemishes.
2. Staining: Remove fibers and dust and apply stain to exposed and semiexposed surfaces as necessary to match approved Samples. Apply stain in a manner that will produce a consistent appearance. Apply wash-coat sealer before applying stain to closed-grain wood species.
 - a. Stain Color: As selected from manufacturer's full range.
3. Chemical-Resistant Finish: Apply laboratory casework manufacturer's standard two-coat **OR** three-coat, **as directed**, chemical-resistant, transparent finish. Sand and wipe clean between coats. Topcoat(s) may be omitted on concealed surfaces.
 - a. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8. Acceptance level for chemical spot test shall be no more than four Level 3 conditions.

L. Hardware

1. General: Provide laboratory casework manufacturer's standard, commercial-quality, heavy-duty hardware complying with requirements indicated for each type.
2. Hinges: Stainless-steel **OR** Epoxy-coated steel, **as directed**, 5-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide 2 for doors 48 inches (1200 mm) high or less and 3 for doors more than 48 inches (1200 mm) high.
3. Hinges for Wood and Plastic-Laminate Cabinets: Frameless concealed hinges (European type) complying with BHMA A156.9, Type B01602, 100 **OR** 135 **OR** 170, **as directed**, degrees of opening, self-closing, **as directed**.
4. Hinged Door and Drawer Pulls: Solid aluminum, stainless steel, or chrome-plated brass **OR** Epoxy-coated steel, **as directed**, back-mounted pulls. Provide 2 pulls for drawers more than 24 inches (600 mm) wide.
 - a. Design: Wire pulls **OR** Rectangular loop pulls **OR** Rectangular loop pulls with rounded corners **OR** As selected from manufacturer's full range **OR** As indicated, **as directed**.
 - b. Overall Size: 1 by 4-1/2 inches (25 by 114 mm) **OR** 1-1/4 by 4-1/2 inches (32 by 114 mm) **OR** 1-3/8 by 5-1/2 inches (35 by 140 mm) **OR** As selected from manufacturer's full range **OR** As indicated, **as directed**.
5. Sliding Door Pulls: Stainless-steel or chrome-plated **OR** Epoxy-coated steel, **as directed**, recessed flush pulls.
 - a. Design and Size: Round, 3/4-inch (19-mm) diameter by 1/8 inch (3 mm) deep **OR** Round, 3/4-inch (19-mm) diameter by 3/16 inch (5 mm) deep **OR** Oval, 1 by 3 inches (25 by 76 mm), 3/8 inch (10 mm) deep **OR** As selected from manufacturer's full range **OR** As indicated, **as directed**.
6. Pulls: Recessed aluminum **OR** polypropylene, **as directed**, pulls. Provide 2 pulls for drawers more than 24 inches (600 mm) wide.



7. Pulls for Metal Cabinets: Full-width, recessed channel pulls; integrally formed from front pan of doors and drawer fronts.
8. Pulls for Wood Cabinets: Full-width, recessed solid hardwood channels; matching exposed wood of cabinets.
9. Pulls for Plastic-Laminate Cabinets: Full-width, recessed aluminum **OR** solid hardwood, **as directed**, channel pulls.
10. Door Catches: Nylon-roller spring **OR** Dual, self-aligning, permanent magnet, **as directed**, catches. Provide 2 catches on doors more than 48 inches (1200 mm) high.
11. Drawer Slides: Side mounted, epoxy-coated steel, self-closing; designed to prevent rebound when drawers are closed; complying with BHMA A156.9, Type B05091.
 - a. Provide Grade 1 **OR** Grade 1HD-100, **as directed**; for drawers not more than 6 inches (150 mm) high and 24 inches (600 mm) wide.
 - b. Provide Grade 1HD-100 **OR** Grade 1HD-200, **as directed**; for drawers more than 6 inches (150 mm) high or 24 inches (600 mm) wide.
 - c. Standard Duty (Grade 1): Full-extension **OR** Partial-extension, **as directed**, type, with polymer rollers.
 - d. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Full-extension **OR** Full-overtravel-extension, **as directed**, ball-bearing type.
12. Drawer Slides for Wood and Plastic-Laminate Cabinets: Hardwood runners under centers of drawers with polymer guides fastened to backs of drawers.
13. Label Holders: Stainless steel, aluminum, or chrome plated; sized to receive standard label cards approximately 1 by 2 inches (25 by 50 mm), attached with screws or rivets. Provide where indicated **OR** on all drawers, **as directed**.
14. Locks for Metal Cabinets: Cam or half-mortise type with 5-pin tumbler, **as directed**, brass with chrome-plated finish; complying with BHMA A156.11, Type E07281, E07261, E07111, or E07021.
 - a. Provide a minimum of two keys per lock and two master keys.
 - b. Provide where indicated **OR** on all drawers and doors, **as directed**.
 - c. Keying: Key locks alike within each room; key each room separately **OR** each lock separately **OR** locks as directed, **as directed**.
 - d. Master Key System: Key all locks to be operable by master key.
15. Locks for Wood and Plastic-Laminate Cabinets: Cam type with 5-pin tumbler, **as directed**, brass with chrome-plated finish; complying with BHMA A156.11, Type E07281 or E07261.
 - a. Provide a minimum of two keys per lock and two master keys.
 - b. Provide where indicated **OR** on all drawers and doors, **as directed**.
 - c. Keying: Key locks within each room alike, key each room separately **OR** each lock separately **OR** locks as directed, **as directed**.
 - d. Master Key System: Key all locks to be operable by master key.
16. Sliding-Door Hardware Sets: Laboratory casework manufacturer's standard, to suit type and size of sliding-door units.
17. Adjustable Shelf Supports for Wood and Plastic-Laminate Cabinets: Powder-coated steel shelf rests complying with BHMA A156.9, Type B04013.
OR
Adjustable Shelf Supports for Wood and Plastic-Laminate Cabinets: Mortise-type, powder-coated steel standards and shelf rests complying with BHMA A156.9, Types B04071 and B04091.
18. Adjustable Wall Shelf Supports: Surface-type steel standards and steel shelf brackets, with epoxy powder-coated finish, complying with BHMA A156.9, Types B04102 and B04112.

M. Countertops, Table Tops, Shelves, Troughs, And Sinks

1. Countertops, General: Provide units with smooth surfaces in uniform plane free of defects. Make exposed edges and corners straight and uniformly beveled. Provide front and end overhang of 1 inch (25 mm), with continuous drip groove on underside 1/2 inch (13 mm) from edge.
2. Sinks, General: Provide sizes indicated or laboratory casework manufacturer's closest standard size of equal or greater volume, as approved by the Owner.
 - a. Outlets: Provide with strainers and tailpieces, NPS 1-1/2 (DN 40), unless otherwise indicated.



- b. Overflows: For each sink except cup sinks, **OR** Where indicated, **as directed**, provide overflow of standard beehive or open-top design with separate strainer. Height 2 inches (50 mm) less than sink depth. Provide in same material as strainer.
- 3. Plastic-Laminate Countertops, Table Tops and Shelves:
 - a. Countertops: Plastic laminate **OR** Chemical-resistant plastic laminate, **as directed**, shop bonded to top surface and exposed edges of 3/4-inch- (19-mm-) **OR** 1-inch- (25-mm-) **OR** 1-3/16-inch- (30-mm-), **as directed**, thick core with plastic-laminate backing bonded to bottom surface. Sand surfaces to which plastic laminate is to be bonded.
 - 1) Backsplash Core Thickness: 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**.
 - 2) Countertop Core: Particleboard **OR** Urea-formaldehyde-free particleboard **OR** Exterior-glue particleboard **OR** straw-based particleboard **OR** exterior plywood, **as directed**
 - 3) Countertop Core for Counters Containing Sinks: Exterior-glue particleboard **OR** straw-based particleboard **OR** exterior plywood, **as directed**.
 - 4) Countertop Configuration: Flat, with square edges, and flat backsplashes and end splashes. Finish faces and exposed edges of splashes with same plastic laminate as top.
OR
Countertop Configuration: Postformed, with raised, **as directed**, rolled edge and integral coved backsplash with rolled top edge. Construct top and backsplash from one piece of plastic laminate. Where indicated, provide separate end splashes of same material as top and fitted to top.
 - 5) Plastic-Laminate Grade for Flat Countertops: HGS **OR** HGL **OR** HDS, **as directed**.
 - 6) Plastic-Laminate Grade for Postformed Countertops: HGP.
 - 7) Plastic-Laminate Grade for Backing: BKL.
 - b. Table Tops: Plastic laminate **OR** Chemical-resistant plastic laminate, **as directed**, shop bonded to top surface and exposed edges of 3/4-inch- (19-mm-) **OR** 1-inch- (25-mm-) **OR** 1-3/16-inch- (30-mm-), **as directed**, thick core with plastic-laminate backing bonded to bottom surface. Sand surfaces to which plastic laminate is to be bonded.
 - 1) Table-Top Core: Particleboard **OR** Urea-formaldehyde-free particleboard **OR** Exterior-glue particleboard **OR** straw-based particleboard **OR** exterior plywood, **as directed**.
 - 2) Plastic-Laminate Grade for Tables: HGS **OR** HGL **OR** HDS, **as directed**.
 - 3) Plastic-Laminate Grade for Backing: BKL.
 - c. Plastic-Laminate Shelves: Plastic laminate **OR** Chemical-resistant plastic laminate, **as directed**, shop bonded to both faces and all edges of 3/4-inch- (19-mm-) **OR** 1-inch- (25-mm-), **as directed**, thick core. Sand surfaces to which plastic laminate is to be bonded.
 - 1) Shelf Core: Particleboard **OR** Urea-formaldehyde-free particleboard **OR** Exterior-glue particleboard **OR** straw-based particleboard **OR** exterior plywood, **as directed**.
 - 2) Plastic-Laminate Grade for Shelves: HGL.
- 4. Epoxy Countertops, Table Tops, and Sinks:
 - a. Countertop Fabrication: Fabricate with factory cutouts for sinks, holes for service fittings and accessories, and with butt joints assembled with epoxy adhesive and concealed metal splines.
 - 1) Countertop Configuration: Flat, 5/8 inch (16 mm) **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick, with beveled **OR** rounded, **as directed**, edge and corners, and with drip groove and integral coved **OR** applied, **as directed**, backsplash.
OR
Countertop Configuration: Raised (marine) edge, 5/8-inch (16-mm) **OR** 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, minimum thickness, with integral or applied raised edge having beveled **OR** rounded, **as directed**, edge and corners, and with integral coved **OR** applied, **as directed**, backsplash.
OR
Countertop Configuration: As indicated.



- 2) Countertop Construction: Uniform throughout full thickness **OR** Epoxy composition not less than 1/4 inch (6 mm) thick, laminated to backing, **as directed**.
- 3) Product Option: Phenolic-composite countertops may be substituted for epoxy countertops at Contractor's option.
- b. Table-Top Fabrication:
 - 1) Table-Top Configuration: Flat, 5/8 inch (16 mm) **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick, with beveled **OR** rounded, **as directed**, edge and corners, and with drip groove at perimeter.
OR
Table-Top Configuration: Raised (marine) edge, 5/8-inch (16-mm) **OR** 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, minimum thickness, with integral or applied raised edge having beveled **OR** rounded, **as directed**, edge and corners.
 - 2) Table-Top Construction: Uniform throughout full thickness **OR** Epoxy composition not less than 1/4 inch (6 mm) thick, laminated to backing, **as directed**.
 - 3) Product Option: Phenolic-composite table tops may be substituted for epoxy table tops at Contractor's option.
- c. Sink Fabrication: Molded in 1 piece with smooth surfaces, coved corners, and bottom sloped to outlet; 1/2-inch (13-mm) minimum thickness.
 - 1) Provide with polypropylene strainers and tailpieces.
 - 2) Provide sinks for drop-in installation with 1/4-inch- (6-mm-) thick lip around perimeter of sink.
 - 3) Provide integral sinks in epoxy countertops, bonded to countertops with invisible joint line.
 - 4) Provide manufacturer's recommended adjustable support system for table- and cabinet-type installations.
5. Phenolic-Composite Countertops, Table Tops, and Shelves:
 - a. Countertop Fabrication: Fabricate with cutouts for sinks, holes for service fittings and accessories, and with butt joints assembled with epoxy adhesive and concealed metal splines.
 - 1) Countertop Configuration: Flat, 1/2 inch (13 mm) **OR** 5/8 inch (16 mm) **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick, with beveled **OR** rounded, **as directed**, edge and corners, and with drip groove and integral coved backsplash.
OR
Countertop Configuration: Raised (marine) edge, 1/2-inch (13-mm) **OR** 5/8-inch (16-mm) **OR** 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, minimum thickness, with beveled **OR** rounded, **as directed**, edge and corners, and with integral coved backsplash.
OR
Countertop Configuration: As indicated.
 - b. Table-Top Fabrication:
 - 1) Table-Top Configuration: Flat, 1/2 inch (13 mm) **OR** 5/8 inch (16 mm) **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick, with beveled **OR** rounded, **as directed**, edge and corners, and with drip groove at perimeter.
OR
Table-Top Configuration: Raised (marine) edge, 5/8-inch (16-mm) **OR** 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, minimum thickness, with integral or applied raised edge having beveled **OR** rounded, **as directed**, edge and corners.
 - c. Shelf Configuration: Flat, 5/8 inch (16 mm) **OR** 3/4 inch (19 mm), **as directed**, thick, with beveled **OR** rounded, **as directed**, edge and corners.
6. Stainless-Steel Countertops: Made from stainless-steel sheet, not less than 0.062-inch (1.59-mm) nominal thickness, with No. 4 satin finish.
 - a. Extend top down 1 inch (25 mm) at edges with a 1/2-inch (13-mm) return flange under frame. Apply heavy coating of heat-resistant, sound-deadening mastic to undersurface.
 - b. Form backsplash coved to and integral with top surface.
 - c. Provide raised (marine) edge around perimeter of countertops containing sinks; pitch two ways to sink to provide drainage without channeling or grooving.

- d. Provide raised (marine) edge around perimeter of countertops at sinks, where indicated; pitch two ways to sink to provide drainage without channeling or grooving.
 - e. Punch holes for service fittings at factory.
 - f. Reinforce underside of countertop with channels or use thicker metal sheet where necessary to insure rigidity without deflection.
 - g. Weld shop-made joints.
 - h. Where field-made joints are required, provide hairline butt-joints mechanically bolted through continuous channels welded to underside at edges of joined ends. Keep field jointing to a minimum.
 - i. Where stainless-steel sinks or cup sinks occur in stainless-steel countertops, factory weld into one integral unit.
 - j. After fabricating and welding, grind surfaces smooth and polish as needed to produce uniform, directionally textured finish with no evidence of welds and free of cross scratches. Passivate and rinse surfaces; remove embedded foreign matter and leave surfaces clean.
7. **Stainless-Steel Shelves:** Made from stainless-steel sheet, not less than 0.050-inch (1.27-mm) nominal thickness, with No. 4 satin finish. Weld shop-made joints. Fold down **OR** up, **as directed**, front edge 3/4 inch (19 mm); fold up back edge 3 inches (75 mm). Provide integral stiffening brackets, formed by folding up ends 3/4 inch (19 mm) and welding to upturned back edge **OR** front and back edges, **as directed**. After fabricating, grind welds smooth and polish as needed to produce uniform, directionally textured finish with no evidence of welds and free of cross scratches. Passivate and rinse surfaces; remove embedded foreign matter and leave surfaces clean.
8. **Stainless-Steel Sinks:** Made from stainless-steel sheet, not less than 0.050-inch (1.27-mm) nominal thickness. Fabricate with corners rounded and coved to at least 5/8-inch (16-mm) radius. Slope sink bottoms to outlet. Provide double-wall construction for sink partitions with top edge rounded to at least 1/2-inch (13-mm) diameter. Provide continuous butt-welded joints. After fabricating and welding, grind surfaces smooth and polish as needed to produce uniform finish with no evidence of welds and free of cross scratches. Passivate and rinse surfaces; remove embedded foreign matter and leave surfaces clean.
- a. Punch holes for fittings at factory.
 - b. Provide with stainless-steel strainers and tailpieces.
 - c. Provide with integral rims except where located in stainless-steel countertops.
 - d. Apply 1/8-inch- (3-mm-) thick coating of heat-resistant, sound-deadening mastic to undersink surfaces.
9. **Cup Sinks:** Epoxy **OR** Polypropylene **OR** Stainless steel, **as directed**, 3-by-6-inch (75-by-150-mm) oval **OR** 3-by-9-inch (75-by-228-mm) oval **OR** 5-inch (127-mm) diameter, **as directed**.
- a. Provide with polypropylene **OR** stainless-steel, **as directed**, strainers and integral tailpieces.
10. **Cup Sinks:** Material and size as indicated.
- a. Provide epoxy and polypropylene cup sinks with polypropylene strainers and integral tailpieces.
 - b. Provide stainless-steel cup sinks with stainless-steel strainers and integral tailpieces.
11. **Troughs:** Epoxy **OR** Stainless steel, **as directed**. Pitch to drains not less than 1/8 inch/foot (10 mm/m). Except where troughs empty into sinks, provide NPS 1-1/2 (DN 40) outlets with strainers and tailpieces.
- a. **Epoxy Troughs:** Molded in 1 piece with smooth surfaces and coved corners; 1/2-inch (13-mm) **OR** 5/8-inch (16-mm) **OR** 3/4-inch (19-mm), **as directed**, minimum thickness. Provide polypropylene strainers and tailpieces.
 - b. **Stainless-Steel Troughs:** Made from stainless-steel sheet, not less than 0.050-inch (1.27-mm) **OR** 0.062-inch (1.59-mm), **as directed**, nominal thickness. Fabricate with corners rounded and coved to at least 5/8-inch (16-mm) radius. Provide continuous butt-welded joints. After fabricating and welding, grind surfaces smooth and polish as needed to produce uniform finish with no evidence of welds and free of cross scratches. Passivate and rinse surfaces; remove embedded foreign matter and leave surfaces clean. Provide stainless-steel strainers and tailpieces.



N. Laboratory Accessories

1. Reagent Shelves: Provide as indicated, fabricated from same material as adjacent countertop, unless otherwise indicated.
2. Burette Rods: Aluminum or stainless-steel rods, 1/2 inch (13 mm) in diameter and 18 inches (450 mm) long, threaded on 1 end to fit tapered plug adapter for flush socket receptacle. Provide with tapered plug adapter and receptacle.
3. Upright Rod Assembly and Metal Crossbar: Aluminum or stainless steel. Two vertical rods and 1 horizontal crossbar, 3/4 inch (19 mm) in diameter and 36 inches (900 mm) long, unless otherwise indicated; 2 flush socket receptacles and 2 crossbar clamps. Ends of vertical rods are tapered to fit receptacles; all other rod ends are rounded.
4. Greenlaw Arm Assembly: Aluminum or stainless-steel vertical rod, tapered on one end to fit flush socket receptacle. Adjustable crossbar of hardwood with black, acid-resistant finish, secured to upright with adjustable clamp. Provide with receptacle.
5. Lattice Assembly: Aluminum or stainless-steel, vertical and horizontal rod lattice assembly with 3/4-inch- (19-mm-) diameter rods at approximately 12 inches (300 mm) o.c. with 2 flush socket receptacles for mounting.
 - a. Size: 36 inches (900 mm) **OR** 48 inches (1200 mm), **as directed**, wide by 24 inches (600 mm) **OR** 36 inches (900 mm), **as directed**, high.
6. Pegboards: Polypropylene, epoxy, or phenolic-composite pegboards with removable polypropylene pegs and stainless-steel drip troughs with drain outlet.
7. Pegboards: Stainless-steel pegboards with removable polypropylene pegs and stainless-steel drip troughs with drain outlet.

O. Water And Laboratory Gas Service Fittings

1. Service Fittings: Provide units that comply with SEFA 7, "Laboratory and Hospital Fixtures - Recommended Practices." Provide fittings complete with washers, locknuts, nipples, and other installation accessories. Include wall and deck flanges, escutcheons, handle extension rods, and similar items.
 - a. Provide units that comply with "Vandal-Resistant Faucets and Fixtures" recommendations in SEFA 7.
2. Materials: Fabricated from cast or forged red brass unless otherwise indicated.
 - a. Reagent-Grade Water Service Fittings: Polypropylene, PVC, or PVDF for parts in contact with water.
3. Finish: Chromium plated **OR** Chromium plated unless otherwise indicated **OR** Acid- and solvent-resistant powder coating complying with requirements in SEFA 7 for corrosion-resistant finishes, **as directed**.
 - a. Provide chemical-resistant powder coating in laboratory casework manufacturer's standard metallic brown, aluminum, white, or other color as approved by the Owner.
4. Water Valves and Faucets: Provide units complying with ASME A112.18.1, with renewable seats, designed for working pressure up to 80 psig (550 kPa).
 - a. Vacuum Breakers: Provide ASSE 1035 vacuum breakers on water fittings with serrated outlets.
 - b. Aerators: Provide aerators on water fittings that do not have serrated outlets.
 - c. Self-Closing Valves: Provide self-closing valves where indicated.
5. Ground-Key Cocks: Tapered core and handle of one-piece forged brass, ground and lapped, and held in place under constant spring pressure. Provide units designed for working pressure up to 40 psig (280 kPa), with serrated outlets.
6. Ball Valves: Chrome-plated ball and PTFE seals. Handle requires no more than 5 lbf (22 N) to operate. Provide units designed for working pressure up to 75 psig (520 kPa), with serrated outlets.
 - a. Where ball valves are indicated for fuel-gas use, provide locking safety handles that must be pushed in **OR** pulled up, **as directed**, before being turned on unless otherwise indicated.
7. Steam Valves: Stainless-steel seat and PTFE seat disc. Provide units designed for steam working pressure up to 20 psig (140 kPa), with serrated outlets.



8. Needle Valves: Provide units with renewable, self-centering, floating cones and renewable seats of stainless steel or Monel metal, with removable serrated outlets.
 - a. Provide units designed for working pressure up to 60 psig (410 kPa) **OR** 100 psig (690 kPa) **OR** 125 psig (860 kPa), **as directed**.
9. Hand of Fittings: Furnish right-hand fittings unless fitting designation is followed by "L."
10. Remote-Control Valves: Provide needle valves, straight-through or angle type as indicated for fume hoods and where indicated.
11. Handles: Provide three- or four-arm, forged-brass **OR** three- or four-wing, molded plastic or powder-coated metal, **as directed**, handles for valves unless otherwise indicated.
 - a. Provide lever-type handles for ground-key cocks. Lever handle aligns with outlet when valve is closed and is perpendicular to outlet when valve is fully open.
 - b. Provide lever-type handles for ball valves unless otherwise indicated. Lever handle aligns with outlet when valve is closed and is perpendicular to outlet when valve is fully open.
 - c. Provide heat-resistant plastic handles for steam valves.
 - d. Provide knurled, molded plastic handles for needle valves.
12. Service-Outlet Identification: Provide color-coded plastic discs with embossed identification, secured to each service-fitting handle to be tamper resistant. Comply with SEFA 7 for colors and embossed identification.

P. Electrical Service Fittings

1. Service Fittings, General: Provide units complete with metal housings, receptacles, terminals, switches, pilot lights, device plates, accessories, and gaskets required for mounting on laboratory casework.
2. Receptacles: Comply with NEMA WD 1, NEMA WD 6, and UL 498. Duplex type, Configuration 5 20R.
 - a. Receptacle Grade: Hospital **OR** General, **as directed**, grade unless otherwise indicated.
 - b. Color of Receptacles: Brown **OR** Ivory **OR** As selected, **as directed**, unless otherwise indicated or required by NFPA 70.
 - c. GFCI Receptacles: Straight blade, feed-through **OR** non-feed-through, **as directed**, type. Comply with UL 943, Class A, Hospital **OR** General, **as directed**, grade, and include indicator light that is lighted when device is tripped.
 - d. TVSS (Transient Voltage Surge Suppressor) Receptacles: Comply with UL 1449, with integral TVSS in line to ground, line to neutral, and neutral to ground.
 - 1) TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 V and a minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
 - 2) Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."
 - 3) Receptacle Type: Hospital **OR** General, **as directed**, grade, with isolated-ground terminal, **as directed**.
 - 4) Identification: Distinctive marking on face of device to denote TVSS-type unit.
 - 5) Color of TVSS Receptacles: Blue.
3. Switches: Comply with NEMA WD 1 and UL 20. Provide single-pole, double-pole, or 3-way switches as required; rated 120 to 277-V ac; and in amperage capacities to suit units served.
 - a. Color of Switches: Brown **OR** Ivory **OR** As selected, **as directed**, unless otherwise indicated or required by NFPA 70.
 - b. Provide pilot light adjacent to switch or neon-lighted handle, illuminated when switch is "ON," where noted as "PL" next to switch identification.
 - c. Provide key-operated switch where noted as "KEY" next to switch identification.
 - d. Provide thermal-overload switches, single or double pole, as required, with maximum overcurrent trip setting to suit particular motor controlled.
4. Service Fittings, General: Provide units with metal housings and gaskets required for mounting on laboratory casework. Receptacles, terminals, switches, pilot lights, device plates, and accessories are specified in Division 26 Section "Wiring Devices".



5. Pedestal-Type Fittings: Cast-aluminum housings with sloped single face or two faces, as indicated, with neoprene gasket under base and with concealed mounting holes in base for attaching to laboratory casework. Provide holes tapped for conduits.
6. Line-Type Fittings: Provide with cast-metal boxes with threaded holes for mounting on rigid steel conduit. Provide cover plates same size as boxes.
7. Recessed-Type Fittings: Provide with galvanized-steel boxes.
8. Finishes for Service-Fitting Components: Provide housings or boxes for pedestal- and line-type fittings with manufacturer's standard baked-on, chemical-resistant enamel in color as selected from manufacturer's full range.
9. Cover Plates: Provide satin finish, chrome-plated **OR** Type 304, stainless-steel, **as directed**, cover plates with formed, beveled edges.
10. Cover-Plate Identification: Use 1/4-inch- (6-mm-) high letters unless otherwise indicated. For stainless steel or chrome-plated metal, stamp or etch plate and fill in letters with black enamel.
 - a. Provide on all cover plates **OR** at the following locations, **as directed**:
 - 1) Receptacles other than standard 125-V duplex, grounding type.
 - 2) Switches and thermal-overload switches.
 - 3) Pilot lights when located remotely from associated equipment or switch, where function is not obvious.
 - 4) Receptacles, switches, and other locations indicated.
 - b. Provide the following information:
 - 1) Voltage and phase for receptacles other than standard 125-V duplex, grounding type.
 - 2) Indicate equipment being controlled by switches and thermal-overload switches.
 - 3) Indicate equipment being controlled for pilot lights when located remotely from associated equipment or switch, where function is not obvious.
 - 4) Number of breaker in panelboard that controls device.

1.3 EXECUTION

A. Installation Of Cabinets

1. Comply with installation requirements in SEFA 2.3. Install level, plumb, and true; shim as required, using concealed shims. Where laboratory casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical. Do not exceed the following tolerances:
 - a. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet (1.5 mm in 3 m).
 - b. Variation of Bottoms of Upper Cabinets from Level: 1/8 inch in 10 feet (3 mm in 3 m).
 - c. Variation of Faces of Cabinets from a True Plane: 1/8 inch in 10 feet (3 mm in 3 m).
 - d. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch (0.8 mm).
 - e. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch (1.5 mm).
2. Utility-Space Framing: Secure to floor with two fasteners at each frame. Fasten to partition framing, wood blocking, or metal reinforcements in partitions and to base cabinets.
3. Base Cabinets: Fasten cabinets to utility-space framing, partition framing, wood blocking, or reinforcements in partitions with fasteners spaced not more than 24 inches (600 mm) o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform.
 - a. Where base cabinets are installed away from walls, fasten to floor at toe space at not more than 24 inches (600 mm) o.c. and at sides of cabinets with not less than 2 fasteners per side.
4. Wall Cabinets: Fasten to hanging strips, masonry, partition framing, blocking, or reinforcements in partitions. Fasten each cabinet through back, near top, at not less than 24 inches (600 mm) o.c.
5. Install hardware uniformly and precisely. Set hinges snug and flat in mortises.
6. Adjust laboratory casework and hardware so doors and drawers align and operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.

**B. Installation Of Countertops**

1. Comply with installation requirements in SEFA 2.3. Abut top and edge surfaces in one true plane with flush hairline joints and with internal supports placed to prevent deflection. Locate joints only where shown on Shop Drawings.
2. Field Jointing: Where possible, make in same manner as shop-made joints using dowels, splines, fasteners, adhesives, and sealants recommended by manufacturer. Prepare edges in shop for field-made joints.
 - a. Use concealed clamping devices for field-made joints in plastic-laminate countertops. Locate clamping devices within 6 inches (150 mm) of front and back edges and at intervals not exceeding 24 inches (600 mm). Tighten according to manufacturer's written instructions to exert a uniform heavy pressure at joints.
3. Fastening:
 - a. Secure countertops, except for epoxy countertops, to cabinets with Z-type fasteners or equivalent, using two or more fasteners at each cabinet front, end, and back.
 - b. Secure epoxy countertops to cabinets with epoxy cement, applied at each corner and along perimeter edges at not more than 48 inches (1200 mm) o.c.
 - c. Where necessary to penetrate countertops with fasteners, countersink heads approximately 1/8 inch (3 mm) and plug hole flush with material equal to countertop in chemical resistance, hardness, and appearance.
4. Provide required holes and cutouts for service fittings.
5. Seal unfinished edges and cutouts in plastic-laminate countertops with heavy coat of polyurethane varnish.
6. Provide scribe moldings for closures at junctures of countertop, curb, and splash with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent laboratory casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.
7. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Installation Of Sinks

1. Comply with installation requirements in SEFA 2.3.
2. Underside Installation of Epoxy Sinks: Use laboratory casework manufacturer's recommended adjustable support system for table- and cabinet-type installations. Set top edge of sink unit in sink and countertop manufacturers' recommended chemical-resistant sealing compound or adhesive and firmly secure to produce a tight and fully leakproof joint. Adjust sink and securely support to prevent movement. Remove excess sealant or adhesive while still wet and finish joint for neat appearance.
3. Semiflush Installation of Stainless-Steel Sinks: Before setting, apply sink and countertop manufacturers' recommended sealant under rim lip and along top. Remove excess sealant while still wet and finish joint for neat appearance.
4. Drop-in Installation of Epoxy Sinks: Rout groove in countertop to receive sink rim if not prepared in shop. Set sink in adhesive and fill remainder of groove with sealant or adhesive. Use procedures and products recommended by sink and countertop manufacturers. Remove excess adhesive and sealant while still wet and finish joint for neat appearance.
5. Drop-in Installation of Epoxy and Polypropylene Cup Sinks: Rout groove in countertop to receive sink rim if not prepared in shop. Set sink in adhesive and fill remainder of groove with sealant or adhesive. Use procedures and products recommended by sink and countertop manufacturers. Remove excess adhesive and sealant while still wet and finish joint for neat appearance.
6. Surface Installation of Epoxy and Polypropylene Cup Sinks: Set sink in sealant or adhesive. Use procedures and products recommended by sink and countertop manufacturers. Remove excess sealant or adhesive while still wet and finish joint for neat appearance.

D. Installation Of Laboratory Accessories

1. Install accessories according to Shop Drawings, installation requirements in SEFA 2.3, and manufacturer's written instructions.



2. Securely fasten adjustable shelving supports, stainless-steel shelves, and pegboards to partition framing, wood blocking, or reinforcements in partitions.
 3. Install shelf standards plumb and at heights to align shelf brackets for level shelves. Install shelving level and straight, closely fitted to other work where indicated.
 4. Securely fasten pegboards to partition framing, wood blocking, or reinforcements in partitions.
- E. Installation Of Service Fittings
1. Comply with requirements in Division 14 AND Division 22 for installing water and laboratory gas service fittings and electrical devices.
 2. Install fittings according to Shop Drawings, installation requirements in SEFA 2.3, and manufacturer's written instructions. Set bases and flanges of sink- and countertop-mounted fittings in sealant recommended by manufacturer of sink or countertop material. Securely anchor fittings to laboratory casework unless otherwise indicated.
- F. Cleaning And Protecting
1. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by the Owner.
 2. Protect countertop surfaces during construction with 6-mil (0.15-mm) plastic or other suitable water-resistant covering. Tape to underside of countertop at a minimum of 48 inches (1200 mm) o.c.
- G. Service-Fitting Schedule
1. Water Service Fitting:
 - a. Type of Fitting: Swing-spout mixing faucet **OR** Rigid, gooseneck mixing faucet **OR** Rigid, gooseneck, single-service faucet **OR** Remote-control, rigid, gooseneck, single-service faucet **OR** Single-service hose bibb, **as directed**.
 - b. Outlet: Aerator **OR** Vacuum breaker and removable serrated outlet, **as directed**.
 - c. Mounting: Wall **OR** Deck **OR** Line, **as directed**, mounted.
 - d. Additional Requirements: Self-closing valves **OR** For reagent-grade water, **as directed**.
 2. Laboratory Gas Service Fitting:
 - a. Service: Air **OR** Gas (fuel gas) **OR** Vacuum, **as directed**.
 - b. Type of Fitting: Turret **OR** Line mounted **OR** Flange type **OR** Remote-control turret **OR** Remote-control flange type, **as directed**.
 - c. Outlets: One **OR** Two, at 90 degrees **OR** Two, at 180 degrees **OR** Three **OR** Four, **as directed**.
 - d. Outlet Type: Straight **OR** Angled, **as directed**.
 - e. Valve Type: Ground-key cock **OR** Ball valve **OR** Needle valve, **as directed**.
 3. Electrical Service Fitting:
 - a. Type of Fitting: Pedestal, single faced **OR** Pedestal, double faced **OR** Recessed **OR** Line mounted, **as directed**.
 - b. Device: One duplex receptacle **OR** Two duplex receptacles **OR** Four duplex receptacles **OR** One switched receptacle **OR** One duplex receptacle, switch, and pilot light, **as directed**.
 - c. Additional Requirements: GFCI **OR** TVSS, **as directed**, receptacles.

END OF SECTION 12 56 53 00



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Task	Specification	Specification Description
12 56 53 00	01 22 16 00	No Specification Required



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SECTION 12 59 13 00 - SYSTEMS FURNITURE**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for systems furniture. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of component and accessory indicated. Include structural capabilities of load-bearing components.
2. Shop Drawings: Include plans, elevations, sections, details, wire management systems, and attachments to other Work.
3. Samples: For the following products, showing the full range of color, texture, and pattern variations expected. Prepare Samples from the same material to be used for the Work.
 - a. Panel Fabrics: Full-width by 36-inch- (900-mm-) long Sample from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat. Mark top and face of fabric.
 - b. Paint Finishes: 12-inch- (300-mm-) square Sample.
 - c. Wood Finishes: 12-inch- (300-mm-) square Sample.
 - d. Plastic Laminates: 6-inch- (150-mm-) square Sample.
4. Maintenance Data: For systems furniture to include in maintenance manuals.

C. Quality Assurance

1. Fire-Test-Response Characteristics: Provide fabric-covered panels with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - a. Flame Spread: 25 or less.
 - b. Smoke Developed: 450 or less.
2. BIFMA Standard: Comply with BIFMA X 5.6, "Office Furnishings--Panel Systems."
3. Electrical Fixtures, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

1.2 PRODUCTS**A. Systems Furniture**

1. Subject to compliance with requirements, provide the products indicated for each designation in the Systems Furniture Schedule.

B. Panel Fabrics

1. Products: Subject to compliance with requirements, provide the fabrics indicated for each designation in the Systems Furniture Panel Fabric Schedule.
2. C.O.M. Fabric: Provide fabric acceptable to systems furniture manufacturer for application indicated.

1.3 EXECUTION**A. Installation, General**

1. Install panel runs level, plumb, and straight with perpendicular intersections.



2. Install panels level with integral, concealed adjustable devices with not more than 1/4 inch (6 mm) between panel base and finish floor. Do not use shims. Install vertical and horizontal panel joints flush.
3. Distribution Cables and Power Panels: Provide complete electrical, communication, and data distribution.

B. Connections/Data and Communications Cable

1. Install before installing work surfaces. Provide an additional 8-foot (2.4-m) cable length from face of workstation.

1.4 SYSTEMS FURNITURE SCHEDULE

A. Systems Furniture Component **OR** Panel Configuration **OR** Workstation, **as directed**: Where this designation is indicated, provide systems furniture complying with the following:

1. Description: **as directed**.
2. Height: **as directed**.
3. Width: **as directed**.
4. Depth: **as directed**.
5. Finish Designation: **as directed**.

1.5 SYSTEMS FURNITURE PANEL FABRIC SCHEDULE

A. Systems Furniture Panel Fabric: Where this designation is indicated, provide panel fabric complying with the following:

1. Panel Fabric: As selected from systems furniture manufacturer's full range of panel fabrics **OR** C.O.M., as follows, **as directed**:
 - a. Pattern: **as directed**.
 - b. Color: **as directed**.
 - c. Fiber Content: **as directed**.
 - d. Applied Treatments: Stain resistant **OR** Polymer flame resistant, **as directed**.
 - e. Width: **as directed**
 - f. Material Application: Railroad **OR** Up the bolt, **as directed**
 - g. Pattern-Repeat Distance: **as directed**

END OF SECTION 12 59 13 00



Task	Specification	Specification Description
12 59 16 00	01 22 16 00	No Specification Required
12 59 16 00	12 59 13 00	Systems Furniture
12 62 23 00	01 22 16 00	No Specification Required



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SECTION 12 93 13 00 - MISCELLANEOUS SITE AND STREET FURNISHINGS

1.1 GENERAL

- A. Description Of Work
 - 1. This specification covers the furnishing and installation of miscellaneous site and street furnishings. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.
- B. Submittals
 - 1. Shop Drawings: Fabrication and installation drawings for each type of product indicated.
 - 2. Product Data: For each type of product indicated.
- C. Qualification Of Welders
 - 1. Qualify welders in accordance with AWS D1.1 using procedures, materials, and equipment of the type required for the work.
- D. Delivery, Storage, And Protection
 - 1. Protect from corrosion, staining, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

1.2 PRODUCTS

- A. Precast Benches
 - 1. Design precast benches in accordance with manufacturer's standards, size as indicated. Finish and color as indicated selected from manufacturer's standards.
 - 2. Glass Fiber Reinforced Concrete (GFRC) Benches
 - a. Provide glass fiber reinforced concrete (GFRC) benches at locations as directed. Comply with PCI MNL-128 recommended practice for glass fiber reinforced concrete, including Appendix G, Polymer Modified Glass Fiber Reinforced Concrete Panels.
 - b. Design precast benches to sustain a live load of not less than 200 pounds per square foot (10 kPa), constructed of minimum 3000 psi concrete with ASTM C 150 cement, white or grey color consistent with final finish, using alkali resistant (AR) glass fibers produced specifically for use in glass fiber reinforced concrete, minimum three percent glass fiber content. Aggregate shall be clear silica sand aggregate; washed, dried and free from deleterious materials. Provide type with successful history of uses in GFRC fabrication standard with the manufacturer. Provide manufacturer's standard acrylic thermoplastic copolymer admixture.
 - c. Provide factory finished units standard with the manufacturer; texture and color as selected.
 - 3. Precast Concrete/Cast Stone Benches
 - a. Provide reinforced precast concrete benches consisting of a mixture of cement, aggregates and mineral colors suitable for exterior use, located as directed.
 - b. Design benches to sustain a live load of not less than 200 pounds per square foot (10 kPa).
 - 1) Portland cement: ASTM C150 Type I, II, or III.
 - 2) Aggregate: ASTM C33, maximum size 3/4 inch (19 mm).
 - 3) Reinforcing steel: ASTM A615/A615M
 - 4) Galvanized wire mesh: ASTM A185
 - 5) Integral color: ASTM C979, pure mineral oxide, limeproof and non-fading.
 - 6) Provide minimum 5000 psi (35 MPa) 28 day compressive strength concrete, maximum five percent absorption.



- 7) Admixture: ASTM C260 for air-entraining.
- B. Precast Concrete Bicycle Rack
1. Provide one-piece precast concrete bicycle rack base with embedded galvanized metal hitching loops. Design bicycle rack with wheel notches for bike support and wheel locking device.
- C. Precast Concrete Bollards
1. Provide reinforced concrete bollards 12 inch (300 mm) **OR** 18 inch (450 mm), **as directed**, square **OR** round, **as directed**, height as indicated, suitable for ground mount installation. Provide exposed aggregate or sandblast finish as indicated; manufacturer's standard clear acrylic sealer.
 - a. Portland cement: ASTM C150, Type I II or III.
 - b. Aggregate: ASTM C33, maximum size 3/4 inch (19 mm).
 - c. Reinforcing steel: ASTM A615/A615M.
 - d. Integral color: ASTM C979, pure mineral oxide, limeproof and non-fading.
 - e. Concrete strength: 5000 psi (35 MPa), 28 day minimum compressive strength.
 - f. Admixture: ASTM C260 for air-entraining.
- D. Planters, Receptacles, Ash Receptacles
1. Provide for waste receptacles spun aluminum **OR** reinforced fiberglass, **as directed**, flat **OR** domed, **as directed**, tops and removable semi-rigid plastic liner insert. Provide top-mounted ash trays for ash receptacles.
 2. Glass Fiber Reinforced Concrete (GFRC) Precast:
 - a. Provide glass fiber reinforced concrete (GFRC) precast planters/waste receptacles/ash receptacles at locations as directed. Comply with PCI MNL-117 and PCI MNL-128.
 - b. Materials: Provide manufacturer's standard shell thickness of 3/8 to 5/8 inch (9 to 16 mm).
 - 1) Cement: ASTM C150, use only one brand and type of cement throughout the Project.
 - 2) Glass Fibers: Alkali resistant (AR) glass fibers produced specifically for use in glass fiber reinforced concrete. Glass content of GFRC unit to be a minimum of three percent.
 - 3) Aggregates: clear silica sand; washed, dried, and free from deleterious materials; provide type with successful history of use in GFRC and as standard with the manufacturer.
 - 4) Compressive Strength: Minimum 3000 psi (20/25 MPa) 28 day strength.
 - 5) Density: Approximately 120 pcf (1921 kg/cu. m).
 - 6) Polymer Admixture: Manufacturer's standard acrylic thermoplastic copolymer.
 - c. Finishes: Provide factory finished units with manufacturer's standard texture or sandblasted finish as selected.
 - 1) Cement: White or grey as consistent with final finish.
 3. Precast Concrete/Cast Stone Planters
 - a. Provide reinforced precast concrete planters/waste receptacles/ash receptacles consisting of a mixture of cement, aggregates, and mineral colors suitable for exterior use as located on the drawings. Provide manufacturer's standard exposed aggregate or sandblast finish (with clear acrylic coating) as selected.
 - 1) Portland Cement: ASTM C150, gray, Type I.
 - 2) Aggregate: ASTM C33, crushed limestone and sand.
 - 3) Galvanized Steel Mesh: ASTM A185.
 - 4) Integral Color: ASTM C979, pure mineral oxide, limeproof and non-fading.
 - 5) Concrete Strength: 4000 psi (30 MPa) minimum compressive strength at 28 days.
 - 6) Admixture: ASTM C260 for air-entraining.
 4. Wood Planters
 - a. Provide manufacturer's standard wood planter/waste receptacle/ash receptacles fabricated of 3/4 inch (19 mm) thick tongue and grooved wood slats permanently bonded with



- fiberglass interior shell. Provide wood top trim for square planters and fiberglass top trim for round planters.
- 1) Wood Species: As directed.
 - 2) Fiberglass: Molded with multiple laminations of glass fiber impregnated with polyester isophthalic thermosetting resins with a finish of 12-15 mil (0.30-0.38 mm) color impregnated polyester gel coat.
 - 3) Metal Frame: Black color-coated steel frame.
5. Wood Planters with Metal Frames
 - a. Provide manufacturer's standard wood planter/waste receptacle/ash receptacle with galvanized steel welded frames, and nominal 2 inch (50 mm) tongue and grooved, beveled or square cut wood staves. Attach wood staves to metal frame from inside with steel plated screws.
 - 1) Wood species: Kiln dried, maximum 19 percent moisture content, species as directed.
 - 2) Metal frame: Reinforced with steel bars as per manufacture's standard construction, black color factory finish coated.
 - 3) Bottom: 1/4 inch (6.25 mm) exterior grade redwood with drain holes.
 - 4) Liners: Removable galvanized steel or manufacturer's standard.
 - 5) Tops: Hinged top opening, spun aluminum open top with molded rim, ash top.
 6. Fiberglass Planters/Waste Receptacles/Ash Receptacles
 - a. Provide reinforced fiberglass planters/waste receptacles/ash receptacles molded with multiple laminations of glass fiber impregnated with polyester isophthalic thermosetting resins; with 12-15 mil (0.30-0.38 mm) color impregnated polyester gel coat finish; minimum thickness of 1/4 inch (6.25 mm); color as selected.
 - b. Receptacles:
 - 1) Shall be manufactured by Maglin,
 - 2) Color: Malaga Green
- E. Shelters
1. AISC S342L; AISC S335. Provide prefabricated shelter systems to meet design conditions indicated. Shelter design shall conform to all applicable State and Local Building Codes and shall meet manufacturer's standards of construction and materials. Shelter systems shall be preglazed, pre-drilled and pre-cut, shipped with all hardware and accessories necessary for complete field assembly.
 2. Framing Systems: Framing system; columns, rafters, ridge, purlins and other structural framing members shall be aluminum/steel/wood as indicated. Manufacturer shall provide shop drawings and calculations prepared by a structural engineer.
 - a. Extruded aluminum alloy tubing shall conform to ASTM B429 6063-T5 or 3003-H14, anodized or powder coat finish, color as directed. Framing sizes and configurations shall be as required for size of structure indicated meeting manufacturer's standards and applicable building codes.
 - b. Structural steel shall conform to ASTM A36/A36M or ASTM A500, 36,000 psi (248 MPa) yield strength and 58,000 psi (400 MPa) tensile strength, factory finished with rust inhibited primer and powder coat conforming to ASTM D3451. Framing sizes and configurations shall be as required for size of structure indicated meeting manufacturer's standard and applicable building codes.
 - c. Wood framing system shall consist of surfaced four sides (S4S), #2 grade southern yellow pine solid timber columns with eased edges, pressure treated CCA (Copper Chrome Arsinat) 0.6 PCF (9.6 kg/cu.m) against decay, fungi and insect infestation, surfaced four sides (S4S), #1 grade, southern pine, glue-laminated columns manufactured in accordance with ANSI/AITC A190.1 and AITC certified glue-laminated structural grade southern yellow pine beams, rafters and purlins, factory sealed and individually wrapped for protection during shipment. Factory stain all wood members prior to shipment.
 3. Roof Panels/Decking: Provide manufacturer's standard molded acrylic translucent roof panel, OR standing seam metal roof panel, OR wood decking, OR V-beam aluminum roof panels, OR



FRP roof panels, as indicated. Materials shall be factory finished and shipped with all necessary fasteners and accessories as required for complete site assembly.

4. Glazing: Factory installed in separate structural window frames, gasketed and glazed as per manufacturer's standard, interchangeable, glazing system. Provide 1/4 inch (6.25 mm) acrylic sheet, OR tempered glass, OR polycarbonate plastic sheet OR mar-resistant polycarbonate plastic sheet, clear OR color.

F. Tables

1. Precast Concrete Tables: Provide reinforced precast concrete tables with smooth tops; minimum 4500 psi (35 MPa) concrete, 28 day minimum compressive strength, consisting of a mixture of cement, aggregates, and mineral colors suitable for exterior use as located on the drawings. Provide manufacturer's standard exposed aggregate or sandblast finish with clear acrylic coating.
 - a. Portland cement: ASTM C150, gray, Type I.
 - b. Aggregate: ASTM C33, washed limestone and sand.
 - c. Galvanized wire mesh: 14 gage (1.9 mm), 2 by two inch (50 by 50 mm).
 - d. Welded wire fabric: ASTM A185.
 - e. Reinforcing steel: ASTM A615/A615M.
 - f. Integral color: ASTM C979, pure mineral oxide, limeproof and non-fading.
 - g. Admixture: ASTM C260 for air-entraining..
2. Fiberglass Tables: Provide reinforced fiberglass table tops molded with multiple laminations of glass fiber impregnated with polyester isophthalic thermosetting resins, minimum thickness of 1/4 inch (6.25 mm) with 12-15 mil (0.30-0.38 mm) thickness color impregnated polyester gel coat, color as selected.
 - a. Steel pedestal base: ASTM A53 Schedule 40 steel pipe.
 - b. Mounting: Type as indicated.
 - c. Metal finish: Powder coating conforming to ASTM D3451 testing.
3. Perforated Steel Tables: Provide 14 gage (1.9 mm) **OR** 16 gage (1.6 mm), **as directed**, perforated steel sheet table tops with solid metal edges as per manufacturer's standard. Weld tops to base as required for frame support.
 - a. Steel pedestal base: ASTM A53 Schedule 40 steel pipe, 2 3/8 inch (60 mm) O.D.
 - b. Mounting: Type as indicated.
 - c. Hardware: Zinc or cadmium plated nuts, bolts, screws, and lock washers.
 - d. Metal finish: Powder coating conforming to ASTM D3451 testing.
4. Wood Seats and Tables
 - a. Provide manufacturer's standard wood seats and tables, minimum 1-5/8 inches (40 mm) thick with rounded edges, with wood or metal bases as indicated. Provide fasteners and accessories required for on site assembly. Kiln dry and pressure treat wood components to manufacturer's standard, maximum 19 percent moisture content. Pre-treat metal components and provide manufacturer's standard primer and powder coat finish complying with ASTM D3451, color as selected.
 - 1) Design wood tables to sustain a live load of not less than 200 pounds per square foot (10 kPa).
 - 2) Provide kiln dried, surfaced four sides (S4S), clear all sides wood slats of species and sizes indicated.
 - a) Species: As directed.
 - b) Nominal wood slat sizes: As directed.
 - b. Support Base: Provide wood or metal support bases as per manufacturer's standard.
 - 1) Wood: Match in species, grade, grain, color and finish of the wood slats.
 - 2) Steel: ASTM A653/A653M.
 - 3) Cast grey iron: ASTM A 48/A48M, Class 30 or recycled cast grey iron ASTM A48/A48M, Class 25.
 - 4) Cast aluminum: ASTM B26/B26M or ASTM B108 as applicable.
 - 5) Design bases to support the loads imposed in the design of the tables.

G. Grates



1. Provide cast aluminum **OR** cast iron **OR** cast bronze **OR** punched steel **OR** stainless steel, **as directed**, tree grates in round **OR** square, **as directed**, model of sizes indicated on the drawings. Furnish complete with angle steel frames with finish to match tree grates.

H. Fabrication Finishes

1. Galvanizing: Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Galvanizing: ASTM A123/A123M, ASTM A153/A153M or ASTM A653/A653M, as applicable.
2. Galvanize: Anchor bolts, grating fasteners, washers, and parts or devices necessary for proper installation, unless indicated otherwise.
3. Repair of Zinc-Coated Surfaces: Repair damaged surfaces with galvanizing repair method and paint conforming to ASTM A780 or by the application of stick or thick paste material specifically designed for repair of galvanizing, as approved. Clean areas to be repaired and remove the slag from the welds. Heat surfaces to which stick or paste material is applied, with a torch to a temperature sufficient to melt the metallics in stick or paste; spread the molten material uniformly over surfaces to be coated and wipe the excess material off.
4. Pretreatment, Priming and Painting: Apply pretreatment, primer, and paint in accordance with manufacturer's printed instructions. On surfaces concealed in the finished construction or not accessible for finish painting, apply an additional prime coat to a minimum dry film thickness of 1.0 mil (0.03 mm). Tint additional prime coat with a small amount of tinting pigment.
5. Nonferrous Metal Surfaces: Protect by plating, anodic, or organic coatings.
6. Aluminum Surfaces
 - a. Surface Condition: Before finishes are applied, remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and other defects which will affect uniform appearance of finished surfaces.

1.3 EXECUTION

A. Installation

1. Install items at locations indicated, according to manufacturer's instructions. Items listed below require additional procedures.
 - a. Assembly and Erection of Components: Items shall be shipped knocked-down (KD) ready for site assembly. Packaged components shall be complete including all accessories and hardware. Follow manufacturer's instructions for assembly and erection. Provide mounting bolts or hardware for mounting items to substrate.

B. Anchorage, Fastenings, And Connections

1. Provide anchorage where necessary for fastening furniture or furnishings securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion shields, and powder-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.

C. Built-In-Work

1. Form for anchorage metal work built-in with concrete or masonry, or provide with suitable anchoring devices as indicated or as required. Furnish metal work in ample time for securing in place as the work progresses.

D. Welding

1. Perform welding, welding inspection, and corrective welding, in accordance with AWS D1.1. Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation.



E. Finishes: Dissimilar Materials

1. Where dissimilar metals are in contact, protect surfaces with a coat conforming to FS TT-P-664 to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, mortar, masonry, wood, or absorptive materials subject to wetting, protect with ASTM D1187, asphalt-base emulsion.

F. Bollards

1. Install in pipe sleeves embedded in concrete and filled with non-shrink grout or quick setting anchoring cement.

G. Shelters

1. Secure to the adjacent construction with the clip angles attached to the concrete. Secure to concrete with not less than two 1/2 inch (12 mm) diameter expansion bolts.
 - a. Glazing: Factory install windows into separate structural frame. Miter corners and connect internally by extruded aluminum corner keys or screw bosses with tamper-proof stainless steel screws. Provide continuous gasketing around windows set to metal frames. Provide 1/2 to 3/4 inch (13 to 19 mm) deep pocket for polycarbonate glazing. Fully gasket and frame in independent interchangeable factory assembled units. Affix to shelter frame with 3/16 inch (5 mm) shallow head aluminum rivets at approximately 13 1/4 inches (331 mm) on centers for full 360 degrees (6.28 rad), rivet from inside of shelter.
 - b. Roof: Provide manufacturer's standard roof system including fascia **OR** gutter, **as directed**, assembly, ensuring a weather-tight seal and installation.

END OF SECTION 12 93 13 00



Task	Specification	Specification Description
12 93 13 00	01 22 16 00	No Specification Required
12 93 23 00	01 22 16 00	No Specification Required
12 93 23 00	12 93 13 00	Miscellaneous Site and Street Furnishings
12 93 33 00	12 93 13 00	Miscellaneous Site and Street Furnishings
12 93 43 53	12 93 13 00	Miscellaneous Site and Street Furnishings
12 93 53 00	01 22 16 00	No Specification Required



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Task	Specification	Specification Description
13 11 46 00	01 22 16 00	No Specification Required



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SECTION 13 27 00 00 - CSF VAULTS**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where a Modular Security Vault is part of the Work.

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section. 13 27 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Modular vault panel system.
 - 2. Vault door and frame.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections: Section 102213 - Wire Mesh Partitions.

1.2 SYSTEM DESCRIPTION

- A. Specified System: Modular security vault system and vault door.
- B. Contractor Option: Cast-in-place concrete vault in accordance with United States Postal Service Standard Details G2-4-8a, G2-4-8b, G2-4-8c and G2-4-8d with vault door and combination lock as specified in this Section.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data:
 - a. Door and Frame: Indicate construction, materials, configuration, combination locking device, hardware, dimensions, and finish.
 - b. Panels: Indicate construction, panel material and reinforcing, configuration, and dimensions.
 - 2. Shop Drawings:



- a. Door and Frame: Indicate door elevation, dimensions, installation details, attachment details to modular panels, and installation details of sill in floor slab.
- b. Panels: Indicate construction, attachment details to building structure, installation details, and dimensions. Indicate locations and details of panel penetrations for utilities.
- c. Interior wire mesh partition and sliding door or glass partition and sliding door as indicated on Drawings.
- 3. Assurance/Control Submittals:
 - a. Test Reports: Underwriter's Laboratories Incorporated (UL) approval for type 608 Class M vault with General Services Administration (GSA) Security Class 5 vault door with modified lock.
 - b. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - c. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
 - d. Manufacturer's Field Reports: Submit the following reports directly to Contracting Officer from Manufacturer's Field Representative, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
 - 1) Preparatory inspection; inspection of recessed wall panel attachment plate.
 - 2) Inspection during installation; wall panels, ceiling panels, and vault door.
 - 3) Final inspection.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 - 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.
- B. Pre-Installation Meetings:
 - 1. Convene a pre-installation meeting one week prior to commencing Work of this Section.
 - 2. Require attendance of parties directly affecting Work of this Section.
 - 3. Review conditions of operations, procedures and coordination with related Work.
 - 4. Agenda:
 - a. Tour, inspect, and discuss conditions of floor slab, installation of recessed attachment plate, and other preparatory work performed by other trades.
 - b. Review vault panel structural connections, welding requirements, and their requirements.
 - c. Review required submittals, both completed and yet to be completed.
 - d. Review vault panel and vault door installation Drawings.
 - e. Approve proposed equipment to be used for installation. Review manufacturer required clearances for setting of vault panels.
 - f. Review and finalize construction schedule related to vault and verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
 - g. Review required inspections, testing, certifying, and material usage accounting procedures.
 - h. Review safety precautions relating to vault panel and vault door installation operations.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Do not deliver vault door and vault panels until scheduled date of installation.
- C. Unload Products from delivery truck and set in place at locations designated on approved shop drawings.



PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. Custom Vault Corporation, Ridgefield, CT (800) 948-2858.
 2. Diebold Incorporated, Canton, OH (800) 999-3600.
 3. Hamilton Safe, Fairfield, OH (513) 874-3733.
 4. Mosler, Hamilton, OH (800) 667-5371.
 5. Overly Manufacturing Company, Incorporated, Greensburgh, PA (800) 979-7300.
 6. Vault Structures, Incorporated, Fort Myers, FL (800) 226-3990.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 VAULT DOOR AND FRAME

- A. Door and Frame: Conform to United States General Services Administration (GSA) Specification for Security Class 5 meeting one of the following security protection requirements for door and lock.
 1. Approved Vault Door:
 - a. Approval label shall state, in white letters on black background: from
 - 1) General Services Administration Approved Vault Door, Manufacturer's Name will be removed and a letter of certification be provided that the door is the GSA door with the lock replaced.
 - b. The interior label shall state the following:
 - 1) This is a USPS Vault Door and affords the following security protection:
 - 2) 30 man-minutes against surreptitious entry.
 - 3) 10 man-minutes against forced entry.
 - 4) 20 man-hours against manipulation of the lock.
 - c. Electro-mechanical lock supplied with door is to be replaced with combination lock specified at 2.2, C.
 2. Approved Armory Door:
 - a. Approval label shall state, in red letters on silver background:
 - 1) General Services Administration Approved Armory Door, Manufacturer's Name
 - b. The interior label shall state the following:
 - 1) This is a US Government Class-5 Armory Door, which has been tested and approved by the Government. It affords the following security protection:
 - 2) 10 man-minutes against forced entry
 - 3) This door is not intended for the storage of national security information.
- B. Optical device not required.
- C. Combination Lock Assembly:
 1. Lock: Group 1, 3 wheel (tumbler) with brass or equivalent metal wheels.
 2. Lock Combination: Key changeable combination.
 3. R-Locking: Thermal re-locking trigger integral to lock.
 4. Operation:
 - a. Drive cam must present a concentric surface to drop lever at all times except when retracting lock bolt.



- b. Secondary rotary or push-in motion required prior to retracting lock bolt after dialing combination.
- 5. Dial: Dial and ring flange top reading.

2.3 VAULT PANEL SYSTEM

- A. Approval: Tested and approved modular vault panels and vault door combined to provide a complete vault system, meeting UL Standard 608 Class M (15 minutes net working time).
- B. Panels: Modular interlocking vault system consisting of minimum 3-1/2 inch thick lightweight or concrete panels for slab-on-grade installation meeting UL Class-M rating. Modular panels to provide the equivalent of a 9 inch thick cast-in-place concrete wall.
- C. Utility Entrances: Provide three junction boxes with six conduits through top of vault door header panel or location as required by manufacturer. Contractor to provide three junction boxes for access conduit. Manufacturer to verify all penetrations shown on the drawings into any part of vault system prior to fabrication.
- D. Ventilation: Provide ventilating system meeting UL Standard 680.
- E. Panel Connections: Vault wall panels shall be welded together in accordance with manufacturer's requirements for secure welding. Five sided vault systems shall be attached to floor slab with connection angle or recessed steel plate provided and installed by the Contractor.
- F. Grouting: Contractor is to grout perimeter of vault recess with non-shrink grout after vault is installed and accepted by Contracting Officer.
- G. Dimensions: Width, length and height of modular vault as indicated on Drawings.

2.4 WIRE MESH PARTITION

- A. Wire mesh partition and sliding door specified in Section 102213 - Wire Mesh Partitions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.



3.2 INSTALLATION

- A. Install vault wall panels plumb and level on recessed steel plate and weld securely in place.
- B. Install vault ceiling panels on vault wall panels and weld securely in place.
- C. Install vault door and frame in vault wall panels and securely attach. Install door frame trim and bezel after wall finish work is completed. Install vault sill after floor finish work is completed.

3.3 CONSTRUCTION

- A. Interface with Other Work:
 - 1. Coordinate location and installation of vault panel recessed attachment plate in concrete slab.
 - 2. Coordinate routing of conduit through pre-installed wall panel penetrations.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Manufacturer's Field Services: Manufacturer's Representative with Contractor for perimeter trench projects.
 - 1. Attend and conduct Pre-Installation Meeting.
 - 2. Perform preparatory, installation, and final inspections of vault panels and vault door installation.
 - 3. Inspect and approve location of recessed steel attachment plate just prior to pouring of vault foundation slab.
 - 4. Inspect and approve location of steel attachment plate after vault foundation slab has been poured.
 - 5. Provide technical advice to vault panel and vault door installer as required.
 - 6. Prepare and submit inspection reports for each inspection.
- C. Manufacturer's Field Services: Manufacturer's Representative Contractor for five-sided attachment to slab projects.
 - 1. Attend and conduct Pre-Installation Meeting.
 - 2. Perform preparatory, installation, and final inspections of vault panels and vault door installation.
 - 3. Provide technical advice to vault panel and vault door installer as required.

3.5 CLEANING AND PROTECTION

- A. Section 017300 - Execution: Cleaning and protection of installed Work.
- B. Do not remove vault door protective covering until just prior to Substantial Completion Inspection.
- C. Leave panels and flooring surfaces clean of foreign materials to allow installation of finish floor and wallcovering materials.
- D. For poured-in-place concrete vault, operate a dehumidifier inside the vault prior to Substantial Completion.



END OF SECTION

SECTION 13 34 19 00 - MPF METAL BUILDING SYSTEMS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 – GENERAL**1.1 SUMMARY**

- A. Pre-engineered Building including steel framing, interior and exterior metal wall panels, building insulation, metal roof panels, fasteners, gutters, downspouts, trim, flashings, steel doors, roof curbs, equipment supports, hatches and walkways.

1.2 SUBMITTALS

- A. Product Data: Required
- B. Shop Drawings: Required
- C. Structural Calculations: Required
- D. Samples: Required

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements
 - 1. Loads:
 - a) Applicable Building Code
 - b) American Society of Civil Engineers (ASCE)
 - 2. Roof Uplift: UL and FM classification 1-90
- B. Quality Standards
 - 1. Steel Frame: American Iron and Steel Institute (AISI)
 - 2. Flashing, trim, gutters and downspouts: SMACNA – Architectural Steel Metal Manual.
- C. Shop drawings and calculations shall be prepared by a professional engineer licensed in the State the project is being built and shall bear his seal.

PART 2 - PRODUCTS**2.1 MANUFACTURERS/PRODUCTS**

- A. Steel Framing: Multi-span rigid frame, clear span, with standard modules.
- B. Exterior Wall Panels:
 - 1. Type: Manufacturer's standard type installed vertically.
 - 2. Material: 22 gauge, galvanized steel with G90 coating.
 - 3. Finish: Fluoropolymer, Kynar 500, standard color.



- C. Interior (liner) Panels
1. Manufacturers standard type, installed vertically.
 2. Material: 26 gauge galvanized steel with G 90 coating.
 3. Finish: painted.
- D. Roof Panels:
1. Type: Manufacturer's standard standing seam, roll formed panels.
 2. Flat panel between seams.
 3. Material: 22 gauge galvanized steel with 690 coating.
 4. Finish: Fluoropolymer, Kynar 500, standard color.
DOE Energy Star
Solar reflectance per Cool Roof Rating Council (CRRC):
Initial reflectance: 0.65, minimum.
Three years after installation: 0.50, minimum.
- E. Roof and wall insulation:
1. Fiberglass roll insulation with 0.6 lb per cubic foot density, thickness as indicated on drawings.
 2. Where exposed, insulation to be faced with white polymer film and have a flame spread rating of 25 or less in accordance with ASTM E84
- F. Gutters, Downspouts and Trim
1. Material: 22 gauge galvanized steel with G90 coating.
 2. Finish: to match wall panels.
- G. Roof Curbs, Equipment Supports, Hatches and Walkways: Manufacturer's standard construction as applicable to project.
- H. Exterior Steel Doors Type: Hollow metal doors and frames.
1. Material: 14 gauge frame and 16 gauge door.
 2. Finish: Galvanized steel with G90 coating field painted.
 3. Hardware: Ball bearing hinges, mortized lockset, closer, threshold and weatherstripping.

NOTE TO SPECIFIER

Use overhead coiling doors for storage buildings only. See Section 083614 for overhead platform doors for MPFs.

- I. Overhead Coiling Doors
1. Type: Overhead coiling, with counter balance assembly, 18 gauge flat slat curtain, steel guides.
 2. Operation: Motor operated, single key activated wall mounted switch, security lockout capability.
 3. Finish: Shop primed and field painted.
- J. Manufacturer: Butler, Star, or Varco-Pruden, or approved equal.

PART 3 – EXECUTION

- 3.1 Work from approved shop drawings. Install all components in accordance with manufacturer's guidelines, printed instructions and approved shop drawings.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 3/31/2010

END OF SECTION 13 34 19 00



Task	Specification	Specification Description
13 34 19 00	01 22 16 00	No Specification Required
13 48 63 00	01 22 16 00	No Specification Required



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SECTION 13 60 00 00 - MPF MOTOR FUEL UNDERGROUND STORAGE TANKS

NOTE TO SPECIFIER

THIS SPECIFICATION IS INTENDED TO BE A MINIMUM GUIDELINE FOR USE ON USPS PROJECTS NATIONALLY. THE SITE SPECIFIC DESIGN PROFESSIONAL SHALL ADJUST THIS SPECIFICATION, AT A MINIMUM WHERE INDICATED, TO MEET LOCAL REQUIREMENTS AND CONDITIONS FOR EACH SPECIFIC SITE AT WHICH IT IS USED. THIS MODEL DOCUMENT IS NOT AND SHALL NOT BE USED AS A CONSTRUCTION DOCUMENT WITHOUT THE APPROPRIATE MODIFICATION BY THE APPROPRIATE LICENSED DESIGN PROFESSIONAL.

PART 1 - GENERAL**1.1 SUMMARY**

- A. Related Documents: The work of this Section is governed by [Division 1].
- B. Perform work and provide material and equipment as shown on Drawings and as specified or indicated in this Section of the Specifications. Completely coordinate work of this Section with work of other trades and provide a complete and fully functional installation.
- C. Give notices, file plans, obtain permits and licenses, pay fees and back charges, and obtain necessary approvals from authorities that have jurisdiction as required to perform work in accordance with all legal requirements and with the contract documents.
- D. In general, the work of this Section includes furnishing labor, equipment and materials necessary to perform the excavation, de-watering, bedding, backfilling, shoring and installation of underground storage tanks specified or indicated in the Contract Documents.
- E. Related work specified in other Sections includes, but is not necessarily limited to:
 - 1. Section 136010 Underground Motor Fuel Piping and Related Systems
 - 2. Section 136020 Motor Fuel Electrical System
 - 3. Section []

1.2 REFERENCES

- A. American Petroleum Institute:
 - 1. API 12P - Fiberglass Reinforced Plastic Tanks.
 - 2. API 1615 - Installation of Underground Petroleum Storage Systems.
 - 3. API 1632 - Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems.
 - 4. API 2000 -Venting Atmospheric and Low-Pressure Storage Tanks: Non-refrigerated and refrigerated.
- B. ASTM International:
 - 1. ASTM D4021: Glass Fiber Reinforced Polyester Underground Petroleum Storage Tanks.
 - 2. ASTM C136: Standard Test Method for Sieve Analyses of Fine and Coarse Aggregates.
 - 3. ASTM D1557: Standard Test Methods for Laboratory Compaction Characteristics Using Modified Effort
- C. NACE International:



1. NACE RP-02-85 - Corrosion Control of Underground Storage Tank Systems by Cathodic Protection.

D. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
2. NEMA WD 1 - General Requirements for Wiring Devices.
3. NEMA WD 6 - Wiring Devices-Dimensional Requirements.
4. NEMA FG 1 - Nonmetallic Cable Tray Systems.
5. NEMA VE 1 - Metal Cable Tray Systems.
6. NEMA VE 2 - Metal Cable Tray Installation Guidelines.

E. National Fire Protection Association:

1. NFPA 30 - Flammable and Combustible Liquids Code.
2. NFPA 30A – Code for Motor Fuel Dispensing Facilities and Repair Garages.

F. International Code Council

1. International Fire Code

G. Petroleum Equipment Institute:

1. PEI RP100 - Recommended Practices for Installation of Underground Liquid Storage Systems.

H. Underwriters Laboratories Inc.:

1. UL 567 - Pipe Connectors for Flammable Liquids and Combustible Liquids and LP-Gas.
2. UL 913 - Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous Locations.
3. UL 1316 - Glass Fiber Reinforced Plastic Underground Storage Tanks for Petroleum Products.

1.3 DEFINITIONS

- A. Degree of Compaction: Degree of compaction is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D1557, for general soil types, abbreviated as percent laboratory maximum density.

1.4 SUBMITTALS

- A. Comply with [] General Requirements.
- B. Shop Drawings: Submit original copies of product data submittals for materials and equipment in Part 2 of this section including, but not limited to:
1. Tank bedding and backfill material.
 2. Dewatering plan.
 3. Underground Storage Tanks.
 4. Anchors and supports.
 5. Shoring.
- C. Test Reports: Submit written test results for all tests as outlined in this specification.
- D. Manufacturer's Field Reports: Submit report of each visit of manufacturer's representative to provide technical assistance during installation.
- E. State Installer Certification: Certify tank installers employed on the Work, verifying that all workers meet State installer requirements.



- F. Record Drawings: Submit record drawings in accordance with [].
- G. Operation and Maintenance Manuals: Submit copies of the Operation and Maintenance Manual in compliance with Closeout Submittals.
- H. Manufacturer certifications: Submit manufacturer certifications for underground piping and environmental monitoring system installers.

1.5 CLOSEOUT SUBMITTALS

NOTE TO SPECIFIER

CLOSEOUT DOCUMENTS ARE CRITICAL FOR THE SUCCESSFUL FUELING SYSTEM PROJECT, BECAUSE A COMPLETE SET OF CLOSEOUT DOCUMENTS IS NECESSARY FOR THE FACILITY TO MEET LIFE-CYCLE COMPLIANCE REQUIREMENTS. THIS SPECIFICATION SECTION IS INTENDED TO BE HIGHLY DETAILED, AS EXPERIENCE HAS SHOWN THAT CONTRACTORS ARE MUCH BETTER ABLE TO COMPLY WITH A DETAILED LIST INCLUDING SPECIFIC STATE AND OTHER REGULATORY FORMS AND REPORTS, AND MANUFACTURER CHECKLISTS. AS SUCH, THIS SECTION SHOULD BE MADE AS SPECIFIC AS POSSIBLE. THE STATE OR OTHER GOVERNING UST REGULATORY PROGRAM WILL HAVE MOST OF THE INFORMATION NEEDED FOR THE APPROPRIATE LEVEL OF SPECIFICITY. ALSO, CONSULT MANUFACTURERS FOR THEIR INSTALLATION CHECKLISTS AND TEST REPORTS. THE FINAL CLOSEOUT LIST SHOULD BE COORDINATED WITH THE "FIELD QUALITY CONTROL SECTION" SUCH THAT ALL TEST FORMS IDENTIFIED THERE AS REQUIRED, ARE INCLUDED IN THE CLOSEOUT LIST.

COORDINATE THIS SECTION WITH THE CORRESPONDING SECTION IN 136010 AND 136020.

- A. Comply with pertinent provisions of []. In addition, comply with the specifics and additional provisions of this chapter. For the purposes of this section, the terms "Manuals and Instructions" and Closeout Documents" are used interchangeably.
- B. Coordinate closeout submittals with sections 136010 and 136020 to provide a single package for the project.
- C. Format of Closeout Documents, including Operation and Maintenance Manuals and Record Document
 - 1. Provide Electronic (pdf format for documents and jpeg format for photos) of all closeout documents, record documents, drawings, manuals, operating instructions, warranties, and all other documents referenced in this and related sections. Submission shall be on CD-ROM discs readable by Windows operating system. Files should be organized in logical folders and subfolders.
 - 2. In addition, provide bound manuals with all closeout documents, including record documents and drawings. Provide two (2) bound manuals/sets of documents. Bind Manuals in hardcover, three-ring binders, and provide identified dividers with tabs. Use multiple volumes as needed. Do not use three ring binders larger than 3 inches. **Copies of faxed pages are unacceptable.**
 - 3. Obtain at time of purchase of equipment, two (2) copies of operation, lubrication and maintenance manuals for all items. Assemble these manuals in the three ring binders above, and provide electronic versions.
 - 4. Furnish hard copy and electronic manuals for the fuel system to Engineer for approval and distribution to Owner within 30 days of completion of the fuel system. Included shall be 8 hours of training and review at which time the contractor shall review the contents of closeout documents with fuel system operating personnel.
- D. Manuals, Instructions, and Closeout Documents shall include the following items. Items shall be for the new fuel system facility:



1. A minimum of 96 high resolution (no less than 4 mega-pixels) digital (.jpeg format) photographs depicting the installation at each critical construction phase. Particular attention should be paid to underground, buried, and normally inaccessible components.
2. UST installation/warranty checklist with proof of delivery to manufacturer.
3. Environmental Monitoring System final setup printout.
4. Underground sump test records (tank top, and intermediate/transition sumps)
5. Copies of any State/Local approvals, authorizations, permits, and registrations to include:
 - a. [];
 - b. [];
 - c. [].
6. Tank Test Results, and Test Results for all secondary containment structures or annuluses and all containment sumps.
7. Records of all other inspections and tests to include:
 - a. []; and
 - b. [].
8. Tank certificate, licenses, and/or registration to include [].
9. Warranties for all equipment and apparatus. In general, any product / manufacturer documentation that was provided with the equipment shall be provided as part of the closeout documents. Any warranty requiring forms or checklists shall be completed and fully executed.
10. Training certification for instruction seminars signed by the individuals trained on these systems.
11. All instruction bulletins, preventive maintenance schedules, operational instructions, and parts lists provided with the tanks, and all other systems.
12. Waste disposal documentation (if any).
13. Other environmental information or permits (if any).
14. Copies of receipts for any keys, locks, or other equipment turned over to the Owner.
15. Operating and installation manuals and instructions for each piece of equipment that was provided with manuals or instructions, including but not limited to the tank installation instructions.

1.6 QUALITY ASSURANCE

- A. Qualifications: Use adequate numbers of skilled, licensed individuals who are thoroughly trained and experienced in the installation and testing of the specified systems and who are completely familiar with the requirements and the methods needed for proper performance of the work of this Section.
- B. Substitutions: Comply with [].
- C. Materials and Equipment shall be manufactured, installed, and tested as specified in latest editions of applicable publications, standards and ruling of:
 1. Local and State building, plumbing, mechanical, electrical, fire and health department codes.
 2. National Fire Protection Association (NFPA).
 3. Occupational Safety and Health Act (OSHA).
 4. Factory Mutual Association (FM).
 5. Underwriter's Laboratories (UL).
 6. American Petroleum Institute (API).
- D. The most recent editions of applicable specifications and publications of the following organizations form part of the Contract Documents:
 1. American National Standards Institute (ANSI).
 2. American Society of Mechanical Engineers (ASME).
 3. National Electric Manufacturers Association (NEMA).
 4. American Society for Testing of Materials (ASTM).
 5. American Welding Society (AWS).
 6. Manufacturers Standardization Society of the Valve and Fitting Industry (MSS).



- E. Tests of all Contractor secured materials and products being submitted for approval to determine conformance with all requirements of the Contract Documents, including borrow materials proposed for use, shall be performed by an independent testing laboratory retained and compensated by this Contractor.
- F. As materials are incorporated into the project, on-site and off-site quality control tests shall be performed during construction to determine conformance with the Contract Documents by an independent testing laboratory retained and compensated by this Contractor.
- G. Quality assurance testing to validate results of quality control tests performed by the Contractor's testing laboratory shall be performed by an independent testing laboratory retained and compensated by the Owner.
- H. All fuel system equipment shall be compatible with oxygenated fuel blends including up to 15% Ethanol and 20% biodiesel blend.
- I. Complete the gasoline system installation in accordance with the requirements of the State of [].
- J. Comply with the testing and field quality control requirements elsewhere in this section.

1.7 PERMITS AND SUBMISSIONS

- A. The Contractor shall be responsible for all permits and notifications required by State and Local codes and regulations.
- B. Specifically at a minimum, the Contractor shall make the following submissions to the State of [] Department of []:
 - 1. [].
 - 2. [].
 - 3. [].
 - 4. [].
- C. The Contractor shall also be responsible for the making the following submission to the [] Weights and Measures:
 - 1. [].
- D. Copies of all submissions and permits/registrations received shall be provided as part of the closeout documentation.

1.8 QUALIFICATIONS

- A. Manufacturer: Utilize companies specializing in manufacturing products specified in this section with minimum five years documented experience.
- B. Tank Installer: Company specializing in performing Work of this section with minimum ten years documented experience. The Contractor installing the Gasoline System shall be a State certified installed when required.

1.9 GENERAL CONDITIONS

- A. Lines and grades shall be as indicated. Establish and maintain temporary benchmarks on the site for reference. All vertical dimensions shall be verified from these benchmarks.



- B. All permanent benchmarks shall be protected from disturbance or destruction. Any point disturbed or destructed shall be immediately replaced by a qualified surveyor at this Contractor's expense. Documentation of any such relocation or replacement shall be given to the Engineer.
- C. Disposition of Utilities
 - 1. Adequately protect from damage all active utilities and remove or relocate only as indicated, specified or directed.
 - 2. Report inactive and abandoned utilities encountered in excavating and grading operations to the Engineer. Remove, plug or cap as directed by the Engineer.
 - 3. Provide a minimum of a 48 hour notice to the Engineer and receive written notice to proceed before interrupting any utility.
- D. Stockpiling of topsoil and other excavated materials will be permitted on-site within the project limits on a case by case basis provided the stockpiles are constructed and maintained in a manner that does not create a foreign object damage risk or adversely affect any other ongoing construction or operation at the site.
- E. During windy or wet conditions and at the conclusion of each day's work period, cover all excavated material to prevent it from becoming saturated or being displaced by wind or rain. Anchor all sides of covering as required to hold the covering firmly in place. In all cases, provide additional measures as necessary to prevent erosion, sedimentation and wind-borne displacement of excavated materials from their stockpiled location.
- F. Before beginning any work specified in this Section, the Contractor shall make certain that all applicable soil erosion and sediment control requirements are compiled with and the proper authorities have been informed of the construction schedule.
- G. Provide the services of a registered land surveyor to lay out all fuel related work perform under this Contract.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Comply with [].
- B. Protect equipment, materials and specialties from elements and other damages caused during shipment, storage and erection until final acceptance from the Owner.

1.11 ENVIRONMENTAL REQUIREMENTS

- A. Comply with [].
- B. Do not install underground piping when bedding is wet or frozen.

1.12 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.13 COORDINATION

- A. Comply with [].



1.14 WARRANTY

- A. All tanks shall carry a 30 year warranty.

PART 2 - PRODUCTS

2.1 EARTHWORK MATERIALS

- A. Underground Storage Tank Bedding and Backfill Material
 - 1. Provide UST bedding and backfill material in strict accordance with the tank manufacturer's installation instructions.
 - 2. Provide a laboratory Certificate of Sieve Analysis (ASTM Method C136) to the Owner for approval prior to backfilling.

NOTE TO SPECIFIER

ADJUST GENERAL SITE FILL MATERIALS (CRUSHED STONE AND CRUSHED GRAVEL) TO MEET SITE SPECIFIC CONDITIONS OR TO MEET THE RECOMMENDATIONS OF A GEOTECHNICAL REPORT. DO NOT VARY TANK BACKFILL MATERIALS FROM THAT REQUIRED BY THAT TANK MANUFACTURER.

- B. Granular Fill
 - 1. Crushed stone and similar base materials shall be material that will compact and adequately bond under watering and rolling. Base course materials are to be placed in one or more layers, rolled thoroughly, and compacted until the material does not creep or wave ahead of the roller. All coarse aggregates shall be removed and the finish surface of the base must be firm and free of loose material.
 - 2. Crushed gravel or crushed rock shall be 1-1/2" minus, free from dirt, clay balls, and organic material, well graded from coarse to fine, containing sufficient finer material for proper compaction, and less than 8% by weight passing the No. 200 sieve.]
- C. Geotextile Fabric
 - 1. Provide geotextile fabric for all underground storage tank installations.
 - 2. Geotextile fabric shall be "ProPex 4545" manufactured by the Amoco Corporation. approved equal, or as specified by the tank manufacturer.

2.2 CONCRETE

- A. Concrete for tank cover pad and fuel dispensing apron shall have a minimum 28-day compressive strength of 3000 psi, with a maximum slump of 4 inches. Concrete shall be broom finished.
- B. Reinforcing bar shall comply with ASTM A-615.

2.3 UNDERGROUND GASOLINE STORAGE TANKS

- A. Manufacturer:
 - 1. Containment Solutions, Inc.
 - 2. Xerxes
 - 3. ZCL
- B. All underground storage tanks shall be constructed of fiberglass reinforced plastic (FRP) and carry a UL-1316 listing.



- C. The contractor shall provide UL labeled model fiberglass underground storage tank in sizes and with fittings shown on the contract drawings.
- D. Tanks shall be tested and installed with pea gravel or approved alternate backfill material according to the current installation instructions provided with the tank.
- E. Loading Condition
 - 1. Tank shall be designed to meet the following design criteria:
 - a. External hydrostatic pressure: Buried in ground with seven (7) feet of cover over the tank, the hole fully flooded and a safety factor of 5:1 against general buckling.
 - b. Surface loads: When installed according to manufacturer's installation instructions, tanks will withstand surface H-20 axle loads (32,000 lbs./axle).
 - c. Internal load: Primary and secondary tanks shall withstand five (5) PSI air pressure test with 5:1 safety factor.
 - d. Tanks shall be designed to support accessory equipment such as heating coils, ladders, drop tubes, etc. when installed according to manufacturer's recommendations.
- F. Product Storage Requirements
 - 1. All primary tanks must be vented. Tanks are designed for operation at atmospheric pressure only.
 - 2. Tanks shall be capable of storing liquids with specific gravity up to 1.1.
- G. Dimensional Requirements
 - 1. Nominal capacity and dimensions of the tank shall be as shown on the Contract Documents.
- H. Monitoring Capabilities
 - 1. Tanks shall have a space between the primary and secondary shell walls to allow the free flow of containment of all leaked product from the primary tank.
 - 2. The following continuous monitoring conditions shall be compatible with the cavity between the inner and outer tanks:
 - a. Vented to atmosphere.
 - b. Vacuum -5 PSI maximum.
 - c. Positive air pressure: 5 PSI maximum.
 - d. External hydrostatic pressure: 7 feet maximum groundwater head pressure over top of tank.
 - 3. Tanks shall have an integrally mounted reservoir installed on the tank for hydrostatic monitoring. The reservoir shall be constructed of fiberglass reinforced plastic materials and warranted for 30 years against failure due to internal/external corrosion and when properly installed, against structural failure.
 - 4. Tank shall be designed with one (1) four (4) inch fitting that will access the tank bottom between the primary and secondary walls (annular space).
 - 5. The double wall tank monitor shall be capable of detecting a breach in the inner and/or outer tank under the following installed conditions:
 - a. When the inner tank is empty.
 - b. When the inner tank is partially or completely full and the groundwater is below the tank bottom.
 - c. When the inner tank is partially or completely full and the tank is partially or completely submerged in ground water.
 - 6. The leak detection performance of the hydrostatic monitoring system shall be tested and verified by a qualified independent consultant to detect leaks as small as 0.10 gallons per hour within a one month period.
 - 7. All monitoring equipment, including FRP reservoirs and electronic controls, shall be UL listed or accepted.



8. The solution used in the tank annular space shall have UL approval for compatibility with the tank and be contrasting color to the tank surface to facilitate visual inspection of the tank for leak prior to burial.

I. Accessories

1. Anchor Accessories
 - a. Anchor Straps: Provide glass fiber reinforced plastic anchor straps for each tank. Number and location of straps shall be as specified by manufacturer. Each strap shall be capable of withstanding a maximum load of each tank diameter as shown.

Tank Diameter (feet)	Max. Load (lbs.)
4'-0"	4,200
6'-0"	18,000
8'-0"	25,000
10'-0"	25,000
 - b. Straps shall be standard as supplied by the tank manufacturer. Hardware shall be mastic coated and wrapped in geotextile fabric.
2. Deadmen: Tank hold down deadmen shall be factory fabricated and supplied by the tank manufacturer.
3. Certification Plate
 - a. Underwriters Laboratories label shall be permanently affixed to each tank.
4. Flanged Manways
 - a. Flanged manways shall be provided as specified in the contract drawings.
 - b. All manways will be furnished complete with UL listed gaskets, bolts and covers.
 - c. Location: Refer to details on Contract Documents.
5. Fill Tubes
 - a. Fill tubes of shall be provided by the contractor as specified on the Contract Documents.
6. Hydrostatic Monitor Accessories
 - a. Brine Antifreeze
 - 1) **Brine Solution Designation:** BAS-30Chemical Composition: 30%+ calcium chloride, 1% to 3% potassium chloride, 1% to 2% sodium chloride, Balance water
Visual Appearance: Green in color, Odorless fluid, Specific Gravity @ 60°F: 1.272-1.317 Factory installed.
 - i. **Reservoir Sensor** – A reservoir sensor manufactured by the environmental monitoring system manufacturer shall be provided.
 - 2) **Tank Gauge Probe** – A tank level probe as specified in Section 136.020 Motor Fuel Electrical Systems Part 2.15 Environmental Monitoring System shall be installed
 - b. Watertight Turbine Enclosures – Watertight FRP turbine enclosures, manufactured by the tank manufacturer, shall be furnished by the Contractor, in accordance with the Contract Documents.

- 2.4 TANK TOP EQUIPMENT: All tank top equipment shall meet the Phase I EVR standard as defined by the California Air Resources Board.

PART 3 - EXECUTION

3.1 GENERAL

- A. The installation of underground storage tanks and all fuel system equipment shall be conducted in strict accordance with the manufacturer's installation instructions. Nothing in this specification is intended to supersede or contradict those instructions.
- B. Install underground tanks and all fuel system equipment in accordance with the requirements of all State and Local codes and regulations including, but not limited to, the State [], the State of []



] Fire Code as adopted and amended by the State of [], and The International Fire Code and NFPA 30A.

3.2 DRAINAGE AND DEWATERING

- A. The Contractor is responsible for the collection and disposal of all surface and subsurface water encountered during construction.
- B. Drainage
 - 1. So that construction operations progress successfully, completely drain the construction site during periods of construction to keep soil materials sufficiently dry. The Contractor shall establish/construct storm drainage features (ponds/basins) at the earliest stages of site development, and throughout construction grade the construction area to provide surface water runoff away from the construction activity and/or provide temporary ditches, dikes, swales and other drainage features and equipment as required to maintain dry soils and prevent erosion. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed. Excavated slopes and backfill surfaces shall be protected to prevent erosion. Excavation shall be performed so that the site, the area immediately surrounding the site, and the area affecting operations at the site shall be continually and effectively drained.
- C. Dewatering
 - 1. The Contractor shall not allow water to accumulate in excavations. Surface water must be prevented from flowing into excavations and from flooding the Project site. The Contractor shall be responsible for all equipment and labor necessary for the removal of all surface water that enters the excavation. Remove water from excavations to prevent softening of foundation bottoms, undercutting of footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain portable holding tanks, pumps, well points, sumps, suction and discharge water lines, and other dewatering system components to convey water away from excavations. Maintain erosion control measures to prevent sediment from leaving the work area.
 - 2. Groundwater flowing toward or into the excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in excavation and to eliminate interference with orderly progress of construction.
 - 3. [A geotechnical report is available.] The Contractor shall be responsible for all dewatering of the tank excavation necessary to complete the installation in accordance with manufacturer requirements. The Contractor is responsible for securing all State and Federal permits for the discharge of groundwater.
 - 4. All dewatering shall be accomplished in strict accordance with all Federal, state, and local requirements, and in strict accordance with all applicable general or site specific dewatering permits.
 - 5. Unless authorized by the Owner, bulk transportation and disposal of excavation water at an off-site facility will not be allowed.

NOTE TO SPECIFIER

PAY PARTICULAR ATTENTION TO THIS SECTION ON DEWATERING. PERMITTING GROUNDWATER DISCHARGES, ESPECIALLY IF TO SURFACE WATER, ESPECIALLY FROM A SITE THAT HAS AN EXISTING UST USE, CAN BE INVOLVED, AND MAY REQUIRE A GROUNDWATER DISCHARGE PERMIT OR NOTIFICATION OF INTENT UNDER THE REMEDIATION GENERAL PERMIT. UNDERSTANDING THAT THE DIRECTION HERE IS FOR THIS TO BE THE CONTRACTOR'S RESPONSIBILITY, IF A DIFFICULT DEWATERING SITUATION IS PREDICTED AS PART OF THE DESIGN PROCESS, MORE DETAIL TO THE



CONTRACTOR, OR THE DEVELOPMENT OF A DEWATERING PLAN PRIOR TO BIDDING, MAY BE DESIRED.

6. The Contractor shall be responsible for filing all permits to allow groundwater discharges to surface or groundwater.

3.3 SUBGRADE GEOTEXTILE FABRIC

- A. The installation of geotextile fabric is required under all tank backfill and bed materials in accordance with tank manufacturer instructions. Place synthetic filter fabric as indicated directly on prepared subgrade free of vegetation, stumps, rocks and other debris which may puncture or otherwise damage the fabric. Repair damaged fabric by placing an additional layer of fabric to cover the damaged area a minimum of three (3) feet overlap in all directions. Overlap fabric at joints a minimum of three (3) feet. Obtain approval of filter fabric installation before placing fill or backfill. Place fill or backfill on fabric in the direction of overlaps and compact as specified herein. Follow manufacturer's recommended installation procedures.

3.4 BACKFILL AND FILL MATERIAL PLACEMENT – OTHER THAN TANK EXCAVATIONS

- A. Backfilling shall not begin until construction below finish grade has been approved, underground utilities or fuel and related piping installations have been inspected, tested and approved.
- B. Excavation
 1. The area under new concrete slabs and/or footings, concrete and/or asphalted paving, and concrete walkways shall be excavated to the depth indicated on the Contract documents. Unless otherwise directed, all excavated native soil must be replaced with approved backfill material. Allowance must be made for the required base and sand or gravel cushion-leveling course. The area of the foundations and footings shall be proof rolled to detect any soft zones. All soft zones must be removed and replaced with select material compacted to 95% maximum dry density (ASTM D 1557), as tested by the Contractor.
 2. Structures and utilities located within the excavated area shall not be disturbed without prior approval by the Owner. The Contractor shall protect all structures and utilities to remain so as to prevent disruption of facility operations.
 3. The Contractor shall provide the necessary shoring, sheeting or bracing as required by OSHA and other applicable regulatory agencies for any trenching or similar excavation. All shoring materials used shall be in good, serviceable condition, and carried down as the excavation progresses.

NOTE TO SPECIFIER

THE A/E SHALL DETERMINE IF SHORING WILL BE REQUIRED, OR IF GENERAL DIRECTION TO MAINTAIN SAFE SLOPES WILL BE GIVEN TO THE CONTRACTOR. EXPERIENCE HAS SHOWN THAT IF THE CONTRACTOR IS NOT REQUIRED TO SHORE IN THE SPECIFICATION, IT WILL GENERALLY NOT BE INCLUDED IN THE BID PRICE. IN THE ALTERNATIVE, IF THE A/E DETERMINES FROM THE GEOTECHNICAL OR SITE CONDITIONS THAT SHORING WILL BE BENEFICIAL TO THE PROJECT, IT SHOULD BE SPECIFIC AS MANDATORY HERE. ADJUST THIS LANGUAGE AS NECESSARY FOR THE SITE SPECIFIC APPROACH. IF SHORING WILL NOT BE REQUIRED, USE ALTERNATE LANGUAGE TO DIRECT THE CONTRACTOR TO MAINTAIN SAFE EXCAVATIONS.

- C. Sheeting and Shoring
 1. Engineered excavation support shall be required for all underground storage tank excavations. Or [The Contractor is responsible for maintaining safe excavations through the project, including safe slopes and/or engineered excavation support.]



2. The Contractor shall furnish all labor, materials, equipment, tools and appurtenances required to complete the work of sheeting, shoring and bracing as necessary to complete the installation and/or removal of underground storage tanks, and as required by OSHA and other applicable regulatory agencies for any trenching or similar excavation. The required construction shall meet all applicable federal, state, and local regulations. All shoring materials used shall be in good, serviceable condition, and carried down as the excavation progresses. Shoring shall be removed after tank is backfilled.
3. All material shall conform to the minimum requirements of applicable federal, state, and local codes and/or regulations.
4. Pressures on sheeting and the stability of the sheeting and bottom of the excavation are dependent not only on soil conditions but on many procedures and options available to the Contractor, such as dewatering, staging of excavation, installation of bracing, flexibility of sheeting, construction equipment used, and time of completing the work. All such factors shall be considered in the design of the sheeting and bracing.

NOTE TO SPECIFIER

ADJUST THIS LANGUAGE BASED ON THE AVAILABILITY OF GEOTECHNICAL INFORMATION. GENERALLY, IT IS BENEFICIAL TO KNOW SOIL CONDITIONS, GROUNDWATER DEPTH AND DEPTH TO BEDROCK BEFORE UNDERTAKING A UST INSTALLATION.

5. Shoring shall be designed and provided by the Contractor.
6. The Contractor shall submit drawings, computations and substantiating data prepared, signed, and sealed by a professional engineer licensed in the State of [], and shall be submitted to the Owner in accordance with project submittal requirements. The plans shall show the proposed sheeting design and method of construction. Any review or comments by the Owner shall not relieve the Contractor of his responsibility for proper sheeting and bracing.
7. The contractor shall design the shoring system having consulted the project geotechnical report. THE CONTRACTOR SHALL REVIEW THE GEOTECHNICAL REPORT AND DESIGN THE SHORING SYSTEM ACCORDINGLY. NO ADDITIONAL COMPENSATION WILL BE PROVIDED FOR CONDITIONS THAT WERE IDENTIFIED IN THE REPORT.
8. During the installation of the shoring and bracing and as long as the excavation is open, the Contractor shall monitor the work to insure that it is carried out in accordance with the design and procedures.
9. Before commencing work the Contractor shall check and verify all dimensions and elevations. The Contractor shall be solely responsible for the proper alignment and fit of the proposed tank installation.
10. Dewatering and groundwater treatment may occur in conjunction with the sheeting and shoring operation. It is the Contractor's responsibility to ensure that such dewatering activities do not adversely impact upon the sheeting and shoring. Any movement in the sheeting and shoring shall be corrected immediately, and corrective measures enacted to ensure no further movement.
11. The Contractor shall make every effort to reduce noise, vibration, and other adverse conditions which may result from the installation of the sheeting and shoring.
12. If the excavation is to be left unattended, the Contractor shall erect and maintain solidly constructed fencing to restrict unauthorized access. The use of orange construction fence, flashing barriers, or similar measures will not be allowed.

D. Material Disposal

1. The Contractor shall dispose of all excess and/or unsuitable excavated material. IN THE EVENT THAT CONTAMINATED SOIL, WATER OR HAZARDOUS WASTE MATERIAL IS ENCOUNTERED IN ANY EXCAVATION, THE CONTRACTOR SHALL SECURE THE EXCAVATION AND NOTIFY OWNER IMMEDIATELY. UNDER NO CIRCUMSTANCES SHALL ANY CONTAMINATED SOIL, WATER OR HAZARDOUS MATERIALS BE REMOVED WITHOUT AUTHORIZATION BY OWNER. Refer to and comply with Section 013543 –

Environmental Procedures, and Section 017419 – Construction Waste Management and Disposal.

E. Subgrade Preparation

1. The Contractor shall finely grade all improvement areas indicated on the contract documents to the finish elevation indicated less the depth of the slab, footing, paving, and/or walkways and their base. Any required fill must conform to specifications set forth in Paragraph F.4.a. All subgrades shall be compacted to 95% Maximum Dry Density (ASTM D 1557) as tested by the Contractor.

F. Fill, Backfill, and Base

1. The Contractor shall not commence placement of fill, backfill, or base materials until the subgrade has been inspected and approved by the Owner. Excavations resulting from underground storage tank (UST) or above ground storage tank (AST) removals shall not be backfilled until the Owner has reviewed the results of post-excavation soil sample analysis and advised Contractor to proceed.
2. The Contractor shall provide a minimum of [8-inch] compacted gravel cushion below all new concrete slabs, (including replacement), footings, paving, and walkways. Backfill around concrete shall be of materials not subject to expansion or contraction (non-cohesive), and shall be sloped away from the concrete work. Sand shall not be placed above any gravel used as backfill in an area undergoing installation of concrete slabs, footings, paving, and walkways.
3. Trench or excavation backfill shall be compacted to 95% maximum dry density, as tested by the Contractor, with a mechanical tamper in lifts not to exceed 6 inches. Surface material and finish must be replaced to match that of adjacent grade surface, including any base material required.
4. All new fill shall be compacted to at least 95% Maximum Dry Density at Optimum Moisture Content according to ASTM D-1557, as tested by the Contractor.
 - a. Granular Fill.
 - 1) Crushed stone and similar base materials shall be material that will compact and adequately bond under watering and rolling. Base course materials are to be placed in one or more layers, rolled thoroughly, and compacted until the material does not creep or wave ahead of the roller. All coarse aggregates shall be removed and the finish surface of the base must be firm and free of loose material.
 - b. Backfilling
 - 1) Ballasting the underground storage tanks with water shall be required immediately upon installation of the tanks at a point specified by the tank manufacturer.
 - 2) Backfill using the same material as used for bedding. Place first 12" lift evenly around tanks. From the bank or adjacent tank top, backfill must be pushed completely beneath the tank bottom, between ribs and under end caps to provide necessary support. A long handled probe can be used to penetrate backfill and push it between all ribs and at 3 to 5 points under endcaps. The backfill may be shoveled beneath the tank. Place another 12" lift evenly around the tanks. Repeat the probing of backfill from the bank or adjacent tank top.
 - c. Installation Procedure - Wet Hole
 - 1) Wet hole installation shall only be allowed with specific approval by the Owner and in cases where dry hole installations are not practical. Follow tank manufacturer instructions for wet hole installation procedures.

3.5 EXAMINATION

- A. Verify excavations are to required grade, dry, and not over-excavated.

3.6 INSTALLATION - UNDERGROUND TANKS



- A. The installation of underground storage tanks shall be conducted in strict accordance with the tank manufacturer's installation instructions. Nothing in this specification is intended to supersede or contradict those instructions.
- B. Install underground tanks and all fuel system equipment in accordance with the requirements of all State and Local codes and regulations including, but not limited to, the State of [].
- C. Check factory installed equipment and accessories for loosening during transit.
- D. Install underground tanks with anchoring as specified in the Contract Documents. Secure with hold-down straps and turnbuckles.
- E. Install piping connections to tanks with unions and swing joints. Provide venting in accordance with API 2000.
- F. Seal unused tank openings using threaded steel pipe plugs, flanges, or caps.
- G. Extend fill line and cover to grade and provide concrete pad as specified in the Contract Documents.
- H. Tank Accessories:
 - 1. Install tank accessories shipped loose with tank.
 - 2. Install tank accessories as indicated on Drawings.
- I. Install underground tanks with cover as specified on the Contract Documents. The Contractor shall not exceed the specified cover by more than twelve (12) inches, the tank manufacturer's requirements notwithstanding. The elevation of the tank relative to the aboveground piping system is critical for successful operation of the fuel dispensers.
- J. Backfill tanks with backfill approved by the tank manufacturer. Refer to Section 2.1.
- K. Ballast tanks with clean water upon tank installation at the time specified by the tank manufacturer.
- L. Only after completion of entire installation, including all concrete surface pads, remove all water ballast prior to the tanks being filled with gasoline. The contractor shall be present during the first fuel or fluid delivery to each tank.

3.7 FIELD QUALITY CONTROL

- A. Coordinate with Sections 136010 and 136020.
- B. Test all tanks, sumps, and interstitial spaces in accordance with State of [] requirements, manufacturer requirements and guidelines, and PEI-RP100. All test results shall be submitted to the engineer within 24 hours of completion. The primary and secondary chambers of all product carrying vessels (pipes and tanks) shall be tested prior to and after final backfill. The test pressure on the interstitial piping space shall be maintained through the final backfill process and verified after backfill is complete.
- C. After completion of the gasoline system installation, and after backfilling and setting concrete, Test all underground tanks with a precision method capable of detecting leaks of 0.005 gph. The precision test shall be performed by a third party independent testing company, and shall provide a certified report of tightness to the Owner with 5 days of completion.
- D. Notify the Engineer at least ten (10) working days prior to setting the tanks into the excavation and ten (10) working days prior to final backfill of the tank top and underground piping. The Engineer may be



present during tank setting and for a final-pre-backfill inspection of all underground components, and neither of these evolutions shall be conducted until the Engineer has had the opportunity to observe.

- E. In addition to the requirements outlined above, hydrostatically test all tanks sumps and turbine enclosures by filling each sump with water to within six (6) inches of the top and monitoring the water level of two (2) hours. This test shall be conducted by a testing agency and the results reported to the Engineer within 24 hours of completion.
- F. Provide documentation of all tests signed by certified personnel to the Owner prior to the operation of the facility and in the closeout documents including a copy of the State of [].
- G. Complete the Suction Stub Verification Form, Overfill Verification Form, Tank Tilt Verification Form, and Brine Level Verification Form, as provided on the construction documents.

3.8 INITIAL FUEL DELIVERY

- A. The Contractor shall be responsible for supplying sufficient gasoline for startup and calibration activities.



TANK AND SYSTEM REGISTRATION

- B. The Contractor shall submit to the Owner, prior to the operation of the facility, a completed and executed State of []. Include the completed form, with owner signature, in the closeout documents with evidence of submission to the State agency.
- C. Submit all other forms, notifications, and reports as required by the State, and provide copies to the Owner prior to operation of the system, and in the closeout documents including the State of [], [], [].

3.9 COMMISSIONING

- A. Coordinate commissioning activities with the commissioning activities required in sections 136010 and 136020. A single commission program, combining the requirements of the three sections shall be coordinated.
- B. The Contractor shall commission the motor fuel systems. Commissioning shall include all testing, start-up, calibration, programming, and documentation. At the conclusion of the commissioning, the facility shall be ready for the Owner and tenants to conduct unrestricted operations and use all systems to their full intended and designed capacity.
- C. The Contractor shall submit a system commissioning plan to the Owner and engineer for approval at least 30 days prior to commissioning the system. The plan, at a minimum shall include health and safety, testing, calibration, startup, and operational testing procedures for all operation and safety equipment. The plan shall also include all testing and commissioning procedures specifically outlined in this section. The contractor shall be responsible for supplying all fluids and commodities required to startup and calibrate systems. The plan may be combined with commission plans for other vehicle service equipment systems.
- D. Commissioning of the fuel system shall commence no less than 21 days prior to date of beneficial occupancy, and be completed prior to beneficial occupancy.
- E. Fuel or flammable liquids shall not be introduced into the underground tanks until the environmental monitoring and leak detection system is fully programmed, operational, and tested. Fuel shall not be introduced into the dispensing system until all safety (including emergency stop, crash valves, etc.) and leak detection devices have been tested and fire extinguishers are installed.
- F. Notify the engineer no less than 14 days prior to the completion of Commissioning. When Commissioning is completed, the Contractor shall facilitate a final inspection by the engineer. The Contractor shall have all necessary trade personnel on-site to operate equipment, open containment areas, and open electrical enclosures and equipment during the engineer's final Commissioning inspection. That final inspection shall include, but not be limited to:
 - 1. Operational test of all systems.
 - 2. Operational test of all safety devices (e-stop switches, crash valves, overfill alarms);
 - 3. General review of the installation against plans, specs, and manufacturer requirements;
 - 4. Review of all test reports and manufacturer start-up reports;
 - 5. Test of all leak detection sensors;
 - 6. Closeout document requirements review;
 - 7. Tank registration form review, to include all outstanding regulatory reports;
 - 8. Inspection of all tank level probes to verify 90% setting;
 - 9. Inspect of mechanical overfill protection devices to verify/measure 95% setting;
 - 10. Inspect of all sumps and containment areas;
 - 11. Review and validation of monitoring system programming;



12. Operational test of the fuel management system and verification that the system is recording transactions and that the operator is able to generate fuel invoices.
13. Confirmation that system training has been completed; and
14. Verification that remote monitoring for the Environmental Monitoring System is programmed and functioning properly.

3.10 MANUFACTURER'S FIELD SERVICES

- A. The Contractor's field superintendent supervising the installation of all underground petroleum carrying components shall be factory or manufacturer certified to perform such installation. Additionally, the field supervisor shall carry any State or Local certifications to install underground tanks and petroleum components.
- B. Furnish factory training representatives to provide up to 8 hours of training on each major piece of equipment or system.

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END OF SECTION 13 60 00 00



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SECTION 13 60 05 00 - R&A REMOVAL OF UNDERGROUND STORAGE TANKS

NOTE TO SPECIFIER

THIS SPECIFICATION IS INTENDED TO BE A MINIMUM GUIDELINE FOR USE ON USPS PROJECTS NATIONALLY. THE SITE SPECIFIC DESIGN PROFESSIONAL SHALL ADJUST THIS SPECIFICATION, AT A MINIMUM WHERE INDICATED, TO MEET LOCAL REQUIREMENTS AND CONDITIONS FOR EACH SPECIFIC SITE AT WHICH IT IS USED. THIS MODEL DOCUMENT IS NOT AND SHALL NOT BE USED AS A CONSTRUCTION DOCUMENT WITHOUT THE APPROPRIATE MODIFICATION BY THE APPROPRIATE LICENSED DESIGN PROFESSIONAL.

PART 1 - GENERAL

1.1 SUMMARY

- A. Perform work and provide material and equipment as shown on Drawings and as specified or indicated in this Section of the Specifications. Completely coordinate work of this Section with work of other trades.
- B. Give notices, file plans, obtain permits and licenses, pay fees and back charges, and obtain necessary approvals from authorities that have jurisdiction as required to perform work in accordance with all legal requirements and with the contract documents.
- C. In general, the work of this Section includes furnishing labor, equipment and materials necessary to perform the excavation, trenching, and ancillary work associated with the removal of fuel piping, underground storage tanks, transition sump pits, fuel related electrical conduit, related communications and security equipment, canopies, and all other related utilities specified or indicated in the Contract Documents.

NOTE TO SPECIFIER

IT MAY BE NECESSARY TO INCLUDE SOME ADDITIONAL USPS STANDARD SPECIFICATIONS (LISTED BELOW) FOR CONSISTENCY OF SITE RESTORATION MATERIALS

- D. Related work specified in other Sections includes, but is not necessarily limited to:
 - 1. Section [017704 Closeout Procedures & Training]
 - 2. Section [260500 Common Work Results for Electrical]
 - 3. Section [312000, Earth Moving]
 - 4. Section [312300, Excavation and Fill]
 - 5. Section [321216, Asphalt Pavement]
 - 6. Section [321313, Concrete Pavement]
 - 7. Section [329200, Turfs and Grasses]
 - 8. Section [329300, Plants]
 - 9. Section []

1.2 REFERENCES

- A. American Petroleum Institute:
 - 1. API RP 1604 - Closure of Underground Petroleum Storage Tanks
 - 2. API STD 2015 – Safe Entry and Cleaning of Petroleum Storage Tanks
 - 3. API RP 2016 - Guidelines and Procedures for Entering and Cleaning Petroleum Storage Tanks



4. API RP 2003 - Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents

B. National Fire Protection Association:

1. NFPA 30 - Flammable and Combustible Liquids Code
2. NFPA 30A - Code for Motor Fuel Dispensing Facilities and Repair Garages
3. NFPA 70 – National Electric Code
4. NFPA 70E - Standard for Electrical Safety in the Workplace
5. NFPA 329, Recommended Practice for Handling Releases of Flammable and Combustible Liquids and Gases

C. Underwriters Laboratories Inc.:

1. UL 913 - Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous Locations.

D. United States (US) Environmental Protection Agency

1. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Publication SW-846
2. 40 CFR 280 – Technical Standard and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST)

E. United States Occupational Health and Safety Administration (OSHA)

1. 29 CFR 1910 – Occupational Safety and Health Standards
2. 29 CFR 1926 – Safety and Health Regulations for Construction

1.3 DEFINITIONS

A. CO: USPS Contracting Officer

B. COR: USPS Contracting Officer's Representative

C. Designer: Consulting Architecture and Engineering entity responsible for project design or environmental professional.

1.4 SUBMITTALS

A. Comply with [].

B. Prior to beginning work, submit to the COR submittal the Pre-Removal Checklist and all associated attachments as outlined in Module 4E- Storage Tank Standards of the USPS Standard Design Criteria, Handbook AS-503.

C. A UST Closure Assessment Report or necessary compliance driven closure documents, in its required format, shall be submitted to the appropriate authority having jurisdiction by the Contractor, with concurrent copies provided to the COR.

1.5 CLOSEOUT SUBMITTALS

A. Comply with pertinent provisions of Section 017704 Closeout Procedures & Training and [].

B. Submit the following documents to the COR at the conclusion of the project:



1. A written receipt or disposal documentation for each removed UST. The receipt should include the name (printed/signed), facility, phone/address, and list all materials disposed of. Photographs documenting the destruction of all removed tanks shall be included.
2. All other UST documents required by State and Local codes and regulations.
3. The Pre-Removal Checklist.
4. All Regulatory Notification Documentation.
5. All Permits and Authorizations Issued by Regulatory Authority.
6. The Updated Tank Registration, Including Proof of Delivery.
7. The Closure Assessment Report.
8. All Updated and Modified Environmental Plans and Permits Resulting from the UST Removals.
9. All Waste Disposal Documentation.
10. Final Site Inspection Documentation.
11. As-Built Drawings depicting all new conditions and all underground utilities, tanks, and structures abandoned in place.
12. Close-Out Checklist.

1.6 QUALITY ASSURANCE

- A. Qualifications: Use adequate numbers of skilled, licensed individuals who are thoroughly trained and experienced in the installation and testing of the specified systems and who are completely familiar with the requirements and the methods needed for proper performance of the work of this Section.
- B. Materials and Equipment shall be manufactured, installed, and tested as specified in latest editions of applicable publications, standards and ruling of:
 1. Local and State building, plumbing, mechanical, electrical, fire and health department codes, [as applicable.]
 2. National Fire Protection Association (NFPA).
 3. Occupational Safety and Health Act (OSHA).
 4. Factory Mutual Association (FM).
 5. Underwriter's Laboratories (UL).
 6. American Petroleum Institute (API).
- C. The most recent editions of applicable specifications and publications of the following organizations form part of the Contract Documents:
 1. American National Standards Institute (ANSI).
 2. American Society of Mechanical Engineers (ASME).
 3. National Electric Manufacturers Association (NEMA).
 4. American Society for Testing of Materials (ASTM).
 5. American Welding Society (AWS).
 6. Manufacturers Standardization Society of the Valve and Fitting Industry (MSS).

1.7 PERMITS AND SUBMISSIONS

- A. The Contractor shall be responsible for all permits and notifications required by Federal, State and local codes and regulations.
- B. Specifically at a minimum, the Contractor shall make the following submissions to the State of [] Department of []:
 1. [].
 2. [].
 3. [].
 4. [].



- C. Copies of all submissions and permits/registrations received shall be provided as part of the closeout documentation.

1.8 QUALIFICATIONS

- A. UST Removal: Company specializing in performing Work of this section with minimum five years documented experience.
- B. The Contractor's on-site supervisor shall be a certified [].
- C. The Contractor shall employ the services of a [] environmental professional as required by [] in the event that contaminated materials are discovered.
- D. Comply with the requirements for health and safety personnel training and certification outlined in Section 1.15, HEALTH AND SAFETY.

1.9 GENERAL CONDITIONS

- A. All permanent benchmarks shall be protected from disturbance or destruction. Any point disturbed or destructed shall be immediately replaced by a qualified surveyor at this Contractor's expense. Documentation of any such relocation or replacement shall be given to the COR.
- B. Disposition of Utilities
 - 1. Adequately protect from damage all active utilities and remove or relocate only as indicated, specified or directed.
 - 2. Report inactive and abandoned utilities encountered in excavating and grading operations to the COR. Remove, plug or cap as directed by the COR.
 - 3. Provide a minimum of a 48 hour notice to the COR and receive written notice to proceed before interrupting any utility.
- C. Stockpiling of topsoil and other excavated materials will be permitted on-site within the project limits on a case by case basis provided the stockpiles are constructed and maintained in a manner that does not create a foreign object damage risk or adversely affect any other ongoing construction or operation at the site.
- D. During windy or wet conditions and at the conclusion of each day's work period, cover all excavated material to prevent it from becoming saturated or being displaced by wind or rain. Anchor all sides of covering as required to hold the covering firmly in place. In all cases, provide additional measures as necessary to prevent erosion, sedimentation and wind-borne displacement of excavated materials from their stockpiled location.
- E. Before beginning any work specified in this Section, the Contractor shall make certain that all applicable soil erosion and sediment control requirements are compiled with and the proper authorities have been informed of the construction schedule.
- F. The Contractor is responsible for providing means for temporary power during tank removal activities.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Comply with [].



- B. Work shall comply with all applicable environmental regulations and those of other governing agencies in their most recent version are applicable. It is the Contractor's responsibility to know, understand, and abide by all such regulations and requirements.

1.11 FIELD MEASUREMENTS

- A. Verify field measurements prior to removal.
- B. Conduct a thorough survey of interferences associated with the work scope prior to removal. Report interference issues to the COR prior to beginning removal activities.

1.12 COORDINATION

- A. Comply with [].
- B. The Contractor shall coordinate UST removal with the appropriate authority or authorities having jurisdiction and the tank removal oversight (environmental) consultant as required by State or Local codes and regulations.

1.13 WARRANTY

- A. Comply with [].
- B. The Contractor shall be responsible, at the Contractor's expense, for addressing all comments or rejected incomplete reports from the governing environmental authority related to the UST closure report, including resubmissions as required.
- C. The Contractor shall warranty all restoration work for a period of one year from project completion.

1.14 HEALTH AND SAFETY

- A. All on-site Contractor and Sub-Contractor personnel shall have completed OSHA 40-Hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training, including required annual re-certifications.
- B. All on-site Contractor and Sub-Contractor personnel shall have completed OSHA 10-Hour General Construction Safety Training.
- C. The contractor shall have an OSHA and state compliant company-wide health and safety program that shall be submitted to the COR for approval prior to beginning work.
- D. An OSHA and state compliant site-specific Health and Safety Plan (HASP) shall be prepared and available on-site for each tank removal project.
- E. Conduct and document daily, on-site "Tail-Gate" Meetings or Last Minute Risk Assessments before beginning work each day.
- F. Comply with 29 CFR 1910, 29 CFR 1926 at all times during the project. API Recommended Practices 1604 and 2016 and API Publication 2015 shall be strictly followed during all removal activities.



PART 2 - PRODUCTS

2.1 EARTHWORK AND RESTORATION

A. Backfill Materials

1. Clean, uncontaminated soils removed from the existing tank excavation during the tank removal can be reused to fill the excavation during restoration. Reused fill may be used up to four (4) feet below finished grade. The contractor shall take steps to keep the removed fill identified for reuse dry while awaiting replacement into the open excavation, such that fill materials shall not be wet, frozen, or otherwise saturated.
2. Material between the reused fill and the base course for pavement or concrete shall be imported fill complying with Section 312000.
3. Base course materials for concrete or asphaltic pavement shall comply with Sections 321216 and 321313 as appropriate for the restoration surface. Soils for use in landscaped areas shall comply with Sections 329200 and 329300.

PART 3 - EXECUTION

3.1 PROTECTION

NOTE TO SPECIFIER

SHORING IS NOT NORMALLY REQUIRED FOR MOST UST REMOVALS. THE NEED FOR SHORING SHOULD BE ASSESSED DURING THE PRE-REMOVAL SURVEY.

THE A/E SHALL DETERMINE IF SHORING WILL BE REQUIRED, OR IF GENERAL DIRECTION TO MAINTAIN SAFE SLOPES WILL BE GIVEN TO THE CONTRACTOR. EXPERIENCE HAS SHOWN THAT IF THE CONTRACTOR IS NOT REQUIRED TO SHORE IN THE SPECIFICATION, IT WILL GENERALLY NOT BE INCLUDED IN THE BID PRICE. IN THE ALTERNATIVE, IF THE A/E DETERMINES FROM THE GEOTECHNICAL OR SITE CONDITIONS THAT SHORING WILL BE BENEFICIAL TO THE PROJECT, IT SHOULD BE SPECIFIC AS MANDATORY HERE. ADJUST THIS LANGUAGE AS NECESSARY FOR THE SITE SPECIFIC APPROACH. IF SHORING WILL NOT BE REQUIRED, USE ALTERNATE LANGUAGE TO DIRECT THE CONTRACTOR TO MAINTAIN SAFE EXCAVATIONS.

A. Shoring and Sheeting

1. The Contractor shall furnish all labor, materials, equipment, tools and appurtenances required to complete the work of sheeting, shoring and bracing as necessary to complete the removal of underground storage tanks, and as required by OSHA and other applicable regulatory agencies for any trenching or similar excavation. Include provisions in the shoring and sheeting plan that will accomplish the following:
 - a. Prevent undermining of pavements, foundations and slabs.
 - b. Prevent slippage or movement in banks or slopes adjacent to the excavation.
 - c. Sloping the faces of the excavation in lieu of shoring will be allowed. In such cases, the following criteria shall be met:
 - 1) The excavation is less than 20 feet in depth.
 - 2) There are no adjacent structures, roads or pavements that will affect the excavation.
 - 3) No equipment, stored material, or overlying material will affect the excavation.
 - 4) Vibration from equipment, traffic, or blasting will not affect the excavation.
 - 5) There will be no ground water issues.
 - 6) Surcharges will not affect the excavation.



2. All shoring materials used shall be in good, serviceable condition, and carried down as the excavation progresses.
3. All material shall conform to the minimum requirements of applicable Federal, state, and local codes and/or regulations.
4. The Contractor shall submit drawings, computations and substantiating data prepared, signed, and sealed by a professional engineer licensed in the State of [], and shall be submitted to the [] a minimum of twenty-one (21) days prior to work taking place. The plans shall show the proposed sheeting design and method of construction. Any review or comments by the [] shall not relieve the Contractor of his responsibility for proper sheeting and bracing.
5. During the installation of the shoring and bracing and as long as the excavation is open, the Contractor shall monitor the work to insure that it is carried out in accordance with the design and procedures.
6. Before commencing work the Contractor shall check and verify all dimensions and elevations.
7. Dewatering and groundwater treatment may occur in conjunction with the sheeting and shoring operation. It is the Contractor's responsibility to ensure that such dewatering activities do not adversely impact upon the sheeting and shoring. Any movement in the sheeting and shoring shall be corrected immediately, and corrective measures enacted to ensure no further movement.
8. The Contractor shall make every effort to reduce noise, vibration, and other adverse conditions which may result from the installation of the sheeting and shoring.
9. If the excavation is to be left unattended, the Contractor shall erect and maintain solidly constructed fencing to restrict unauthorized access. The use of orange construction fence, flashing barriers, or similar measures will not be allowed.

3.2 DRAINAGE AND DEWATERING

- A. The Contractor is responsible for the collection and disposal of all surface and subsurface water encountered during construction.
- B. Drainage
 1. So that construction operations progress successfully, completely drain the construction site during periods of construction to keep soil materials sufficiently dry. The Contractor shall establish/construct storm drainage features (ponds/basins) at the earliest stages of site development, and throughout construction grade the construction area to provide surface water runoff away from the construction activity and/or provide temporary ditches, dikes, swales and other drainage features and equipment as required to maintain dry soils and prevent erosion. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed. Excavated slopes and backfill surfaces shall be protected to prevent erosion. Excavation shall be performed so that the site, the area immediately surrounding the site, and the area affecting operations at the site shall be continually and effectively drained.
- C. Dewatering
 1. Groundwater flowing toward or into the excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in excavation and to eliminate interference with orderly progress of construction.
 2. The Contractor shall be responsible for all dewatering of the tank excavation necessary to complete tank removal. All dewatering and removal of water shall be accomplished in accordance with all applicable Federal, State and Local requirements.

NOTE TO SPECIFIER



PAY PARTICULAR ATTENTION TO THIS SECTION ON DEWATERING. PERMITTING GROUNDWATER DISCHARGES, ESPECIALLY IF TO SURFACE WATER, ESPECIALLY FROM A SITE THAT HAS AN EXISTING UST USE, CAN BE INVOLVED, AND MAY REQUIRE A GROUNDWATER DISCHARGE PERMIT OR NOTIFICATION OF INTENT UNDER THE REMEDIATION GENERAL PERMIT. UNDERSTANDING THAT THE DIRECTION HERE IS FOR THIS TO BE THE CONTRACTOR'S RESPONSIBILITY. IF A DIFFICULT DEWATERING SITUATION IS PREDICTED AS PART OF THE DESIGN PROCESS, MORE DETAIL TO THE CONTRACTOR, OR THE DEVELOPMENT OF A DEWATERING PLAN PRIOR TO BIDDING, MAY BE DESIRED.

3. The Contractor shall be responsible for filing all permits to allow groundwater discharges to surface or groundwater.
4. The area under new concrete slabs and/or footings, concrete and/or asphalted paving, and concrete walkways shall be excavated to the depth indicated on the Contract documents. Unless otherwise directed, all excavated native soil must be replaced with approved backfill material. Allowance must be made for the required base and sand or gravel cushion-leveling course. The area of the foundations and footings shall be proof rolled to detect any soft zones. All soft zones must be removed and replaced with select material compacted to 95% maximum dry density (ASTM D 1557), as tested by the Contractor.
5. Structures and utilities located within the excavated area shall not be disturbed without prior approval by the []. The Contractor shall protect all structures and utilities to remain so as to prevent disruption of facility operations.

D. Dewatering

1. The Contractor shall not allow water to accumulate in excavations. Surface water must be prevented from flowing into excavations and from flooding the Project site. The Contractor shall be responsible for all equipment and labor necessary for the removal of all surface water that enters the excavation. Remove water from excavations to prevent softening of foundation bottoms, undercutting of footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain portable holding tanks, pumps, well points, sumps, suction and discharge water lines, and other dewatering system components to convey water away from excavations. Maintain erosion control measures to prevent sediment from leaving the work area.
2. Unless authorized by the COR, bulk transportation and disposal of excavation water at an off-site facility will not be allowed.
3. The Contractor shall be responsible for the proper permitting of all surface and groundwater discharges, and for the disposal of all groundwater removed from the tank holes in accordance with all Federal, State and Local requirements.

3.3 EXAMINATION

- A. Comply with [].
- B. Verify excavations are to required grade, dry, and not over-excavated.
- C. Collect environmental (soil and groundwater) samples, including screening or 'headspace' samples, as required by the governing environmental authority for the preparation of the closure report.

3.4 REMOVAL AND TEMPORARY STORAGE OF FUELS AND WASTE DISPOSAL

- A. The Contractor shall provide fuel removal, transfer, and storage services, during UST removal. All fuel transfers shall be discussed with the [] prior to executing any work. The Contractor shall report the quantity of fuel before and after any transfer activities. Fuel removal services shall be conducted in accordance with National Fire Protection Association (NFPA) codes, Occupational Safety



and Health Administration (OSHA) regulations, and all applicable Federal, State, and local regulations. If fuel storage is required during the construction period, the Contractor shall provide a secondarily contained UL-listed container that is compatible with the type of fuel being stored. Any permits required for temporary fuel storage shall be obtained by the Contractor at his/her expense.

- B. The Contractor shall contact the [] to discuss waste disposal options for any waste fuels and/or sludge generated during this project. No waste fuel shall be disposed of until a determination has been made regarding the appropriate disposal method. All efforts shall be made to dispose of fuel for recycle or reuse rather than disposal as waste. In all cases, the Contractor is responsible for compliance with all applicable Federal, State, and local regulations.
- C. The Contractor is responsible, at the contractor's expense, for the removal of all residual/waste fuels and sludges remaining in the tanks in accordance with all applicable Federal, State and local requirements.

3.5 EXCAVATION MATERIALS DISPOSAL

- A. The Contractor shall dispose of all excess and/or unsuitable excavated material.
- B. IN THE EVENT THAT CONTAMINATED SOIL, WATER OR HAZARDOUS WASTE MATERIAL IS ENCOUNTERED IN ANY EXCAVATION, THE CONTRACTOR SHALL SECURE THE EXCAVATION AND NOTIFY THE COR IMMEDIATELY. UNDER NO CIRCUMSTANCES SHALL ANY CONTAMINATED SOIL, WATER OR HAZARDOUS MATERIALS BE REMOVED WITHOUT AUTHORIZATION BY THE COR.
- C. The Contractor shall be prepared to over-excavate and store soil on-site up to 100 cubic yards of contaminated soil.
- D. The Contractor is responsible for the proper storage and disposal of all unused fuels and sludge remaining in the tanks in accordance with all Federal, State and Local requirements. Provide the COR with a waste disposal plan prior to beginning work.
- E. The contractor shall coordinate with the qualified environmental professional or other USPS designated persons the collection of soil, groundwater and tank coupon samples as required.

3.6 REMOVAL SCOPE - UNDERGROUND TANKS

- A. The contractor is responsible for the removal of UST system equipment, including but not limited to:
 - 1. Tanks;
 - 2. Piping;
 - 3. Cover pad/drive pad;
 - 4. Rigid metal canopies;
 - 5. Bottom pad or deadmen;
 - 6. Liner surrounding the tank;
 - 7. Electrical wiring (to breaker);
 - 8. Communications/Fuel management systems;
 - 9. Security system equipment, including cameras;
 - 10. Environmental monitoring equipment; and
 - 11. Pumps/dispensers.
- B. If the existing tanks or piping systems are monitored by an environmental monitoring system that is currently monitoring tanks or piping systems not identified for removal, the Contractor shall remove all sensor and probe inputs related to the removed equipment and re-program the system for the remaining equipment, using a manufacturer certified technician. If there are no other users on the existing



monitoring system, the contractor shall be responsible for removing the monitoring system and any associated alarm annunciators and acknowledgement switches.

- C. All electrical service to the tank system shall be turned off and locked out. All wiring, between the circuit breaker and UST system, and all monitoring system wire from the console to the UST system shall be removed. All aboveground conduits shall be removed. Underground conduit may be abandoned in place, but shall be end-marked with red paint and removed so as not to create trip hazards or unsightly exposure.
- D. All product, liquid, and wastes shall be removed from the UST system (including piping and dispensers) and disposed of in accordance with all applicable Federal, State, and local regulations.
- E. All piping shall be disconnected and removed. If site conditions dictate the need to abandon piping in-place, do so only under the approval of the governing environmental authority and in accordance with their abandon in place guidelines.

NOTE TO SPECIFIER

GENERALLY, THE ENVIRONMENTAL AUTHORITIES THAT REGULATE UST REMOVALS REQUIRE THAT ALL UNDERGROUND PRODUCT AND VENT PIPING BE REMOVED, UNLESS THERE IS A SIGNIFICANT STRUCTURAL INTERFERENCE NECESSITATING ABANDONMENT IN PLACE. THEREFORE, UNDERGROUND FUEL AND VENT PIPING SHALL BE REMOVED, EXCEPT IN SUCH CASES, AND ABANDONMENT IN PLACE SHALL ONLY BE ACCOMPLISHED WITH THE APPROVAL OF THE COR AND ENVIRONMENTAL AUTHORITY REGULATING THE REMOVAL, AND ONLY IN ACCORDANCE WITH THEIR ABANDON IN PLACE GUIDELINES.

- F. The UST system shall be tested by the Contractor for hazardous and explosive vapors and rendered vapor free or inerted of such vapors. The UST system shall be tested periodically during removal and handling to ensure safe conditions are maintained at all times. See additional requirements later in this Specification.
- G. Tank closure documentation (i.e. updated tank registration forms, tank closure report) must be submitted to the appropriate regulatory agency as required by State and/or local regulations.

3.7 FLAMMABILITY AND COMBUSTIBILITY

- A. IT IS CRITICAL THAT THE CONTRACTOR STRICTLY FOLLOW SAFETY PROCEDURES ASSOCIATED WITH MAINTAINING A NON HAZARDOUS ATMOSPHERE IN THE TANK THROUGHOUT THE PROCEDURE. STRICT ADHERENCE TO API RECOMMENDED PRACTICE/PUBLICATIONS 1604, 2015, 2016 IS REQUIRED.
- B. Document that all underground utilities have been clearly marked. The Contractor is responsible for maintaining the utility mark-out with the appropriate utility location service for the duration of the project. Additionally, locate all underground fuel piping prior to beginning work.
- C. Eliminate all potential sources of ignition from the project limits (i.e., smoking materials, non-explosion proof electrical and internal combustion equipment).
- D. Prevent discharge of static electricity during venting of flammable vapors by minimizing agitation and static producing movement, if possible, by providing a conductive path for the continuous, "safe" discharge of electricity by either bonding or grounding equipment and vehicles.



- E. Secure the work area from all pedestrians and vehicular traffic using construction fencing and cones. Do not leave open excavations without completely securing the perimeter with a locked, secure fence.
- F. Prevent the accumulation of vapors at ground level and in the excavations.
- G. Refer to API Recommended Practice 2003 for required precautionary measures to ensure vapor-free working conditions.
- H. The Contractor shall use a combustible gas indicator (CGI) to periodically check for hazardous vapor concentrations in the work area. All CGI readings shall be recorded and provided to the on-site health and safety supervisor. Open flame and spark-generating equipment shall NOT be used in the vapor hazard area. Electrical equipment used in this area must be explosion-proof and approved for use in potentially explosive atmospheres. **SMOKING WILL STRICTLY BE PROHIBITED AT ALL TIMES.**

3.8 PIPE TRENCHES

- A. Saw cut existing pavement to facilitate removal of underground piping, cable, and conduit. Concrete, asphalt and backfill materials above the underground piping, cable, and conduit shall be carefully removed prior to underground utility removal. The Contractor shall excavate with extreme caution and avoid puncturing the piping. If necessary, the Contractor shall remove fill materials by hand using spark-free tools.

3.9 TANK PREPARATION

- A. Concrete, asphalt and backfill materials above the tank top shall be carefully removed prior to tank cleaning and removal. THE CONTRACTOR SHALL EXCAVATE WITH EXTREME CAUTION AND AVOID PUNCTURING THE TANK, ITS ASSOCIATED PIPING, AND ANY TANK HOLD-DOWN STAYS. If necessary, the Contractor shall remove fill materials directly above the tank top by hand using spark-free tools.
- B. Prior to tank removal, all piping and wiring shall be disconnected from the tank. The Contractor shall avoid spillage when disconnecting and draining product piping. All exposed piping ends shall be capped after draining. Any soil impacted by spillage shall be excavated immediately and properly disposed at a certified disposal facility at the Contractor's expense.
- C. The Contractor shall remove all liquids and solids encountered in the tank and its interstitial space prior to handling the tank. Explosion-proof or air driven pumps shall be used when removing product and residues from the UST. If a vacuum truck is used, the truck should be located outside the vapor hazard area and shall be properly grounded. Plastic (PVC) pick-up tubes shall NOT be used on the stripping lines of vacuum trucks, as they are prone to accumulating static charges. Use a hand pump to remove the bottom few inches of liquid, if necessary, while observing appropriate grounding and bonding procedures. Tank bottoms, sludges, and materials used to clean the UST shall be disposed of at the Contractor's expense, in accordance with all applicable State, Federal and Local requirements.
- D. If the purging method is used to eliminate vapors in the tank, the Contractor shall continuously test the tank with a CGI to measure the reduction in the concentration of flammable vapors. Readings shall be collected from the bottom, middle, and top of the tank at each end and the middle (i.e., a minimum of 9 testing locations per tank). Prior to tank handling, CGI readings shall remain between 10-20% of the lower explosive limit (LEL) for gasoline and diesel. If CGI readings are above 10-20% LEL, the Contractor shall continue purging and testing the system.
- E. If the inerting method is used to eliminate oxygen in the tank, the Contractor shall continuously monitor the tank with an oxygen indicator. Readings shall be collected from the bottom, middle, and top of the tank at each end and the middle (i.e., a minimum of 9 testing locations per tank). Prior to tank handling,



oxygen indicator readings shall be maintained at 50% of the lowest level of oxygen necessary to support combustion, or 6-7%. The tank shall NOT be entered after inerting.

3.10 TANK AND MATERIAL DISPOSAL

- A. All USTs shall be properly disposed. Sufficient holes shall be made in the tanks to render them unfit for future use. Reuse of the tanks, or the sale of the tanks for reuse, is prohibited. The Contractor shall provide the COR with a minimum of six (6) photographs of each tank, in the disposal condition, for verification as part of the closeout documents.
- B. The Contractor is responsible for disposing all tank appurtenances (unless otherwise directed by the COR) including:
 - 1. Tanks;
 - 2. Piping;
 - 3. Cover pad/drive pad;
 - 4. Rigid metal canopies;
 - 5. Lighting;
 - 6. Bottom pad or deadmen;
 - 7. Liner surrounding the tank;
 - 8. Electrical wiring (to breaker);
 - 9. Communications/Fuel management systems;
 - 10. Security system equipment, including cameras;
 - 11. Environmental monitoring equipment; and
 - 12. Pumps/dispensers.
- C. The USPS reserves the right to retain any equipment and materials for their exclusive use.
- D. The Contractor shall not reuse, sell or barter for reuse, or give away for reuse, any of the equipment or materials removed from the site.
- E. [The Contractor shall recycle all metals, [], []]. [All lighting materials shall be disposed of in accordance with Federal, State, and Local regulations.]
- F. If required, rigid metal canopies and other structures identified for removal shall be assessed for the presence of hazardous materials, including lead paint and asbestos, prior to the removal. Secure all permits as required, and dispose of any hazardous materials in accordance with all applicable Federal, State, and local regulation.
- G. The Contractor is responsible for checking current Federal, State, and local regulations and applicable consensus codes for special procedures or preparations that are required before the transport and disposal of any tank or appurtenances.
- H. A written receipt or disposal documentation shall be submitted in the Closeout Documents. The receipt should include the name (printed/signed), facility, phone/address, and list all materials disposed.

3.11 RESTORATION

NOTE TO SPECIFIER

THE FOLLOWING BACKFILL GUIDANCE IS GENERAL IN NATURE AND SHOULD BE ADJUSTED FOR SITE SPECIFIC CONDITIONS. FILLS, PAVEMENTS, AND OTHER RESOTRATION FINISHED SHALL COMPLY WITH THE APPROPRIATE USPS STANDARD SPECIFICATION.



A. Tank Excavation

1. The contractor shall backfill the tank excavation and piping trenches after the UST has been removed and field screening samples indicate that no contamination is present.
2. Clean soils removed from the excavation may be placed back into the excavation up to a level four (4) feet below finished grade.
3. Place in [8] [____] inch maximum lifts compacted minimum [95] [____] percent optimum density in accordance with ASTM D1557 (Modified Proctor) at minimum moisture content of [1] [____] percent below and maximum moisture content [3] [____] percent above optimum moisture content.
4. Backfill the area between four (4) feet below finished grade to the bottom of the subgrade preparation with approved imported clean fill.
5. Place in [8] [____] inch maximum lifts compacted minimum [95] [____] percent optimum density in accordance with ASTM D1557 (Modified Proctor) at minimum moisture content of [1] [____] percent below and maximum moisture content [3] [____] percent above optimum moisture content.
6. The Contractor shall provide a minimum of a 12-inch compacted gravel cushion below all new concrete slabs or pavement, paving, and walkways. Backfill around concrete shall be of materials not subject to expansion or contraction (non-cohesive), and shall be sloped away from the concrete work. Sand shall not be placed above any gravel used as backfill in an area undergoing installation of concrete slabs, footings, paving, and walkways.
7. Trench or excavation backfill shall be compacted to 95% maximum dry density, as tested by the Contractor, with a mechanical tamper in lifts not to exceed 6 inches. Surface material and finish must be replaced to match that of adjacent grade surface, including any base material required.
8. All new fill shall be compacted to at least 95% Maximum Dry Density at Optimum Moisture Content according to ASTM D-1557, as tested by the Contractor.
 - a. Granular Fill.
 - 1) Crushed stone and similar base materials shall be material that will compact and adequately bond under watering and rolling. Base course materials are to be placed in one or more layers, rolled thoroughly, and compacted until the material does not creep or wave ahead of the roller. All coarse aggregates shall be removed and the finish surface of the base must be firm and free of loose material.
 - 2) Crushed gravel or crushed rock shall be 1-1/2" minus, free from dirt, clay balls, and organic material, well graded from coarse to fine, containing sufficient finer material for proper compaction, and less than 8% by weight passing the No. 200 sieve.
9. Fill materials shall comply with Section 312000.

B. Restoration Finishes

1. General: Restore the site to the pre-existing conditions, e.g. areas that were paved (or where tank slabs were surrounded by pavement) shall be repaved, areas that were concrete pavement shall be restored with concrete to match, areas that were landscaped should be restored to the original landscaped conditions, and disturbed walkways, striping, signage or any other site feature that was disturbed shall be replaced. Match existing grades and fine grade to avoid puddles and other drainage issues.
2. Comply with Section 321216 pavement restoration.
3. Comply with Section 321313 for concrete pavement restoration.
4. Comply with Sections 329200 and 329300 for landscaping restoration.
5. Comply with Section 312000 and 312300 for general excavation and compaction.

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END OF SECTION 13 60 05 00

SECTION 13 60 10 00 - MPF UNDERGROUND MOTOR FUEL PIPING AND RELATED SYSTEMS

NOTE TO SPECIFIER

THIS SPECIFICATION IS INTENDED TO BE A MINIMUM GUIDELINE FOR USE ON USPS PROJECTS NATIONALLY. THE SITE SPECIFIC DESIGN PROFESSIONAL SHALL ADJUST THIS SPECIFICATION, AT A MINIMUM WHERE INDICATED, TO MEET LOCAL REQUIREMENTS AND CONDITIONS FOR EACH SPECIFIC SITE AT WHICH IT IS USED. THIS MODEL DOCUMENT IS NOT AND SHALL NOT BE USED AS A CONSTRUCTION DOCUMENT WITHOUT THE APPROPRIATE MODIFICATION BY THE APPROPRIATE LICENSED DESIGN PROFESSIONAL.

PART 1 - GENERAL**1.1 SUMMARY**

- A. Related Documents: The work of this Section is governed by [Division 1].
- B. Perform work and provide material and equipment as shown on Drawings and as specified or indicated in this Section of the Specifications. Completely coordinate work of this Section with work of other trades and provide a complete and fully functional installation.
- C. Give notices, file plans, obtain permits and licenses, pay fees and back charges, and obtain necessary approvals from authorities that have jurisdiction as required to perform work in accordance with all legal requirements and with the contract documents.
- D. In general, the work of this Section includes furnishing labor, equipment and materials necessary to perform the excavation, trenching, de-watering, bedding, backfilling, compaction, shoring and off-site disposal of excess and unsuitable materials during installation of fuel piping, underground storage tanks, transition sump pits, fuel related electrical conduit, and all other related utilities specified or indicated in the Contract Documents.
- E. Related work specified in other Sections includes, but is not necessarily limited to:
 - 1. Section 136000 Motor Fuel Underground Storage Tanks
 - 2. Section 136020 Motor Fuel Electrical System
 - 3. Section []

1.2 REFERENCES

- A. American Petroleum Institute:
 - 1. API 12P - Fiberglass Reinforced Plastic Tanks.
 - 2. API 1615 - Installation of Underground Petroleum Storage Systems.
 - 3. API 1632 - Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems.
 - 4. API 2000 - Venting Atmospheric and Low-Pressure Storage Tanks: Non-refrigerated and Refrigerated.
- B. ASTM International:
 - 1. ASTM D4021: Glass Fiber Reinforced Polyester Underground Petroleum Storage Tanks.
 - 2. ASTM C136: Standard Test Method for Sieve Analyses of Fine and Coarse Aggregates.
 - 3. ASTM D1557: Standard Test Methods for Laboratory Compaction Characteristics Using Modified Effort



- C. NACE International:
 - 1. NACE RP-02-85 - Corrosion Control of Underground Storage Tank Systems by Cathodic Protection.
- D. National Electrical Manufacturers Association:
 - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 2. NEMA WD 1 - General Requirements for Wiring Devices.
 - 3. NEMA WD 6 - Wiring Devices-Dimensional Requirements.
 - 4. NEMA FG 1 - Nonmetallic Cable Tray Systems.
 - 5. NEMA VE 1 - Metal Cable Tray Systems.
 - 6. NEMA VE 2 - Metal Cable Tray Installation Guidelines.
- E. National Fire Protection Association:
 - 1. NFPA 30 - Flammable and Combustible Liquids Code.
 - 2. NFPA 30A – Code for Motor Fuel Dispensing Facilities and Repair Garages.
- F. International Code Council
 - 1. International Fire Code
- G. Petroleum Equipment Institute:
 - 1. PEI RP100 - Recommended Practices for Installation of Underground Liquid Storage Systems.
- H. Underwriters Laboratories Inc.:
 - 1. UL 567 - Pipe Connectors for Flammable Liquids and Combustible Liquids and LP-Gas.
 - 2. UL 913 - Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous Locations.
 - 3. UL 971 - Nonmetallic Underground Piping for Flammable Liquids.

1.3 DEFINITIONS

- A. Degree of Compaction: Degree of compaction is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D1557, for general soil types, abbreviated as percent laboratory maximum density.

1.4 SUBMITTALS

- A. Comply with [] General Requirements.
- B. Shop Drawings: Submit original copies of product data submittals for materials and equipment in Part 2 of this section including, but not limited to:
 - 1. Pipe bedding and backfill material.
 - 2. Leak detection and monitoring equipment.
 - 3. Piping.
 - 4. Valves.
 - 5. Containment Sumps.
 - 6. Spill Containment Manholes.
 - 7. Mechanical Overfill Device
 - 8. Audible/Visual Overfill Alarm
 - 9. Dispensers.
 - 10. Submersible Turbine Pumps.



- C. Test Reports: Submit written test results for all tests as outlined in this specification.
- D. Manufacturer's Field Reports: Submit report of each visit of manufacturer's representative to provide technical assistance during installation.
- E. State Installer Certification: Certify tank installers employed on the Work, verifying that all workers meet State installer requirements.
- F. Record Drawings: Submit record drawings in accordance with [].
- G. Operation and Maintenance Manuals: Submit copies of the Operation and Maintenance Manual in compliance with Closeout Submittals.
- H. Manufacturer certifications: Submit manufacturer certifications for underground piping, dispensers and environmental monitoring system installers.

1.5 CLOSEOUT SUBMITTALS

NOTE TO SPECIFIER

CLOSEOUT DOCUMENTS ARE CRITICAL FOR THE SUCCESSFUL FUELING SYSTEM PROJECT, BECAUSE A COMPLETE SET OF CLOSEOUT DOCUMENTS IS NECESSARY FOR THE FACILITY TO MEET LIFE-CYCLE COMPLIANCE REQUIREMENTS. THIS SPECIFICATION SECTION IS INTENDED TO BE HIGHLY DETAILED, AS EXPERIENCE HAS SHOWN THAT CONTRACTORS ARE MUCH BETTER ABLE TO COMPLY WITH A DETAILED LIST INCLUDING SPECIFIC STATE AND OTHER REGULATORY FORMS AND REPORTS, AND MANUFACTURER CHECKLISTS. AS SUCH, THIS SECTION SHOULD BE MADE AS SPECIFIC AS POSSIBLE. THE STATE OR OTHER GOVERNING UST REGULATORY PROGRAM WILL HAVE MOST OF THE INFORMATION NEEDED FOR THE APPROPRIATE LEVEL OF SPECIFICITY. ALSO, CONSULT MANUFACTURERS FOR THEIR INSTALLATION CHECKLISTS AND TEST REPORTS. THE FINAL CLOSEOUT LIST SHOULD BE COORDINATED WITH THE "FIELD QUALITY CONTROL SECTION" SUCH THAT ALL TEST FORMS IDENTIFIED THERE AS REQUIRED, ARE INCLUDED IN THE CLOSEOUT LIST.

COORDINATE THIS SECTION WITH THE CORRESPONDING SECTION IN 136000 AND 136020.

- A. Comply with pertinent provisions of []. In addition, comply with the specifics and additional provisions of this chapter. For the purposes of this section, the terms "Manuals and Instructions" and Closeout Documents" are used interchangeably.
- B. Coordinate closeout submittals with sections 136000 and 136020 to provide a single package for the project.
- C. Format of Closeout Documents, including Operation and Maintenance Manuals and Record Document
 - 1. Provide Electronic (pdf format for documents and jpeg format for photos) of all closeout documents, record documents, drawings, manuals, operating instructions, warranties, and all other documents referenced in this and related sections. Submission shall be on CD-ROM discs readable by Windows operating system. Files should be organized in logical folders and subfolders.
 - 2. In addition, provide bound manuals with all closeout documents, including record documents and drawings. Provide two (2) bound manuals/sets of documents. Bind Manuals in hardcover, three-ring binders, and provide identified dividers with tabs. Use multiple volumes as needed. Do not use three ring binders larger than 3 inches. **Copies of faxed pages are unacceptable.**



3. Obtain at time of purchase of equipment, two (2) copies of operation, lubrication and maintenance manuals for all items. Assemble these manuals in the three ring binders above, and provide electronic versions.
4. Furnish hard copy and electronic manuals for the fuel system to Engineer for approval and distribution to Owner within 30 days of completion of the fuel system. Included shall be 8 hours of training and review at which time the contractor shall review the contents of closeout documents with fuel system operating personnel.

D. Manuals, Instructions, and Closeout Documents shall include the following items. Items shall be for the new fuel system facility:

1. A minimum of 96 high resolution (no less than 4 mega-pixels) digital (.jpeg format) photographs depicting the installation at each critical construction phase. Particular attention should be paid to underground, buried, and normally inaccessible components.
2. Underground piping manufacturers' installation checklists with proof of delivery to manufacturer.
3. Environmental Monitoring System final setup printout.
4. Underground sump test records (dispenser, and intermediate/transition sumps)
5. Dispenser registration documentation and proof of transmittal to manufacturer.
6. Dispenser calibration documentation.
7. A copy of the Weights and Measures jurisdiction calibration report.
8. Copies of any State/Local approvals, authorizations, permits, and registrations to include:
 - a. [];
 - b. [];
 - c. [].
9. Piping Test Results, Vapor Recovery Test Results, and Test Results for all secondary containment structures or annuluses and all containment sumps.
10. Records of all other inspections and tests to include:
 - a. []; and
 - b. [].
11. Automatic line leak detector test results and electronic release detection equipment (sensors and probes) test results on state regulatory agency forms.
12. Warranties for all equipment and apparatus. In general, any product / manufacturer documentation that was provided with the equipment shall be provided as part of the closeout documents. Any warranty requiring forms or checklists shall be completed and fully executed.
13. Training certification for instruction seminars signed by the individuals trained on these systems.
14. All instruction bulletins, preventive maintenance schedules, operational instructions, and parts lists provided with the tanks, dispensers, monitoring system, and all other systems.
15. Waste disposal documentation (if any).
16. Other environmental information or permits (if any).
17. Copies of receipts for any keys, locks, or other equipment turned over to the Owner.
18. Operating and installation manuals and instructions for each piece of equipment that was provided with manuals or instructions, including but not limited to the tank installation instructions.

1.6 QUALITY ASSURANCE

- A. Qualifications: Use adequate numbers of skilled, licensed individuals who are thoroughly trained and experienced in the installation and testing of the specified systems and who are completely familiar with the requirements and the methods needed for proper performance of the work of this Section.
- B. Substitutions: Comply with the Instructions to Bidders and Division I.
- C. Materials and Equipment shall be manufactured, installed, and tested as specified in latest editions of applicable publications, standards and ruling of:
 1. Local and State building, plumbing, mechanical, electrical, fire and health department codes.



2. National Fire Protection Association (NFPA).
 3. Occupational Safety and Health Act (OSHA).
 4. Factory Mutual Association (FM).
 5. Underwriter's Laboratories (UL).
 6. American Petroleum Institute (API).
- D. The most recent editions of applicable specifications and publications of the following organizations form part of the Contract Documents:
1. American National Standards Institute (ANSI).
 2. American Society of Mechanical Engineers (ASME).
 3. National Electric Manufacturers Association (NEMA).
 4. American Society for Testing of Materials (ASTM).
 5. American Welding Society (AWS).
 6. Manufacturers Standardization Society of the Valve and Fitting Industry (MSS).
- E. Tests of all Contractor secured materials and products being submitted for approval to determine conformance with all requirements of the Contract Documents, including borrow materials proposed for use, shall be performed by an independent testing laboratory retained and compensated by this Contractor.
- F. As materials are incorporated into the project, on-site and off-site quality control tests shall be performed during construction to determine conformance with the Contract Documents by an independent testing laboratory retained and compensated by this Contractor.
- G. Quality assurance testing to validate results of quality control tests performed by the Contractor's testing laboratory shall be performed by an independent testing laboratory retained and compensated by the Owner.
- H. All fuel system equipment shall be compatible with oxygenated fuel blends including up to 15% Ethanol and 20% biodiesel blends.
- I. Complete the gasoline system installation in accordance with the requirements of the State of [].
- J. Comply with the testing and field quality control requirements elsewhere in this section.

1.7 PERMITS AND SUBMISSIONS

- A. The Contractor shall be responsible for all permits and notifications required by State and Local codes and regulations.
- B. Specifically at a minimum, the Contractor shall make the following submissions to the State of [] Department of []:
1. [].
 2. [].
 3. [].
 4. [].
- C. The Contractor shall also be responsible for the making the following submission to the [] Weights and Measures:
1. [].
- D. Copies of all submissions and permits/registrations received shall be provided as part of the closeout documentation.



1.8 QUALIFICATIONS

- A. Manufacturer: Utilize companies specializing in manufacturing products specified in this section with minimum five years documented experience.
- B. Leak Detection Systems: The installing contractor of the Environmental Monitoring System shall the highest level manufacturer installer certification.
- C. Tank Installer: Company specializing in performing Work of this section with minimum ten years documented experience. The Contractor installing the Gasoline System shall be a State certified installed when required.
- D. Provide a manufacturer certified installer to supervise the installation of the underground UL-971 piping systems (both semi-rigid and fiberglass reinforced plastic). Provide installers of the aboveground pre-manufactured piping system that have a resume of significant experience installing the system, including at least 10 years of demonstrated experience.

1.9 GENERAL CONDITIONS

- A. Lines and grades shall be as indicated. Establish and maintain temporary benchmarks on the site for reference. All vertical dimensions shall be verified from these benchmarks.
- B. All permanent benchmarks shall be protected from disturbance or destruction. Any point disturbed or destructed shall be immediately replaced by a qualified surveyor at this Contractor's expense. Documentation of any such relocation or replacement shall be given to the Engineer.
- C. Disposition of Utilities
 - 1. Adequately protect from damage all active utilities and remove or relocate only as indicated, specified or directed.
 - 2. Report inactive and abandoned utilities encountered in excavating and grading operations to the Engineer. Remove, plug or cap as directed by the Engineer.
 - 3. Provide a minimum of a 48 hour notice to the Engineer and receive written notice to proceed before interrupting any utility.
- D. Stockpiling of topsoil and other excavated materials will be permitted on-site within the project limits on a case by case basis provided the stockpiles are constructed and maintained in a manner that does not create a foreign object damage risk or adversely affect any other ongoing construction or operation at the site.
- E. During windy or wet conditions and at the conclusion of each day's work period, cover all excavated material to prevent it from becoming saturated or being displaced by wind or rain. Anchor all sides of covering as required to hold the covering firmly in place. In all cases, provide additional measures as necessary to prevent erosion, sedimentation and wind-borne displacement of excavated materials from their stockpiled location.
- F. Before beginning any work specified in this Section, the Contractor shall make certain that all applicable soil erosion and sediment control requirements are compiled with and the proper authorities have been informed of the construction schedule.
- G. Provide the services of a registered land surveyor to lay out all fuel related work perform under this Contract.



1.10 DELIVERY, STORAGE, AND HANDLING

- A. Comply with [].
- B. Protect equipment, materials and specialties from elements and other damages caused during shipment, storage and erection until final acceptance from the Owner.

1.11 ENVIRONMENTAL REQUIREMENTS

- A. Comply with [].
- B. Do not install underground piping when bedding is wet or frozen.

1.12 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.13 COORDINATION

- A. Comply with [].

PART 2 - PRODUCTS

2.1 EARTHWORK MATERIALS

- A. Underground Pipe Bedding and Backfill Material
 - 1. Provide underground pipe bedding and backfill material in strict accordance with the UL-971 piping manufacturer's installation instructions.
 - 2. Provide a laboratory Certificate of Sieve Analysis (ASTM Method C136) to the Owner for approval prior to backfilling.

NOTE TO SPECIFIER

ADJUST GENERAL SITE FILL MATERIALS (CRUSHED STONE AND CRUSHED GRAVEL) TO MEET SITE SPECIFIC CONDITIONS OR TO MEET THE RECOMMENDATIONS OF A GEOTECHNICAL REPORT. DO NOT VARY TANK BACKFILL MATERIALS FROM THAT REQUIRED BY THAT TANK MANUFACTURER.

- B. Granular Fill
 - 1. Crushed stone and similar base materials shall be material that will compact and adequately bond under watering and rolling. Base course materials are to be placed in one or more layers, rolled thoroughly, and compacted until the material does not creep or wave ahead of the roller. All coarse aggregates shall be removed and the finish surface of the base must be firm and free of loose material.
 - 2. Crushed gravel or crushed rock shall be 1-1/2" minus, free from dirt, clay balls, and organic material, well graded from coarse to fine, containing sufficient finer material for proper compaction, and less than 8% by weight passing the No. 200 sieve.]
- C. Geotextile Fabric
 - 1. Provide geotextile fabric for all underground storage tank installations.

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2. Geotextile fabric shall be "ProPex 4545" manufactured by the Amoco Corporation. approved equal, or as specified by the tank manufacturer.

2.2 TANK TOP EQUIPMENT: All tank top equipment shall meet the Phase I EVR standard as defined by the California Air Resources Board.

2.3 GASOLINE PIPING

A. UNDERGROUND FIBERGLASS REINFORCED PLASTIC

1. Manufacturer:
 - a. Ameron
 - b. Smith Fibercast
 - c. Approved Equal
2. FRP: ASTM D2310 and ASTM D2996, UL-971 listed double walled, coaxial, filament wound glass fiber reinforced epoxy pipe with integral epoxy liner and exterior coating. Piping materials shall be as follows:
 - a. Pipe: All primary filament wound pipe shall contain a resin-rich liner with a minimum thickness of 0.015 inches. The liner resin system shall be chemically resistant epoxy resin that has been demonstrated to be satisfactory for the intended service. Pipe shall be coaxial and a pre-manufactured double-walled system.
 - b. Structural Wall: The resins, reinforcements, colorants and other materials when combined as a composite laminate structure shall meet the performance requirements of this specification. Glass fiber reinforcement shall be type E glass with an epoxy-compatible finish. Glass fiber content shall not be less than 60% by weight of the reinforced structural wall.
 - c. Interstitial Layer: The layer between the primary and interstitial pipe layers shall be of uniform thickness with the ability to allow fluid flow throughout, meeting UL criteria. This layer shall also prevent relative movement of the primary and secondary pipes.
 - d. Containment Pipe: Construction of the containment pipe and materials used shall be identical to the reinforced portion of the primary pipe, exhibiting similar physical properties.
 - e. Pipe Dimensions: Primary pipe shall be manufactured to steel pipe outside diameters for all sized. Pipe outside diameter tolerances shall not exceed +/-1%. Secondary piping shall properly fit into fittings supplied by manufacturer.
 - f. Wall Thickness: The total wall thickness of pipe furnished under this Specification shall not at any point be greater than 120% nor less than 87-½% of the nominal thickness.
 - g. Fitting Dimensions: All fittings supplied under this Specification shall have face-to-face dimensions and laying lengths as specified in the manufacturer's literature.
 - h. Joining Methods:
 - 1) Primary Pipe: Primary pipe and fittings shall be joined by means of a matching taper adhesive joint. Adhesives used for joining components shall be compatible with all intended fluids. The adhesive systems shall be used in accordance with the manufacturer's recommendations.
 - 2) Containment Pipe: Containment pipe joints shall be made with bolted clamshell halved bonded together with adhesive.
 - 3) Flanges: Flanges shall be two-piece (van Stone) type with raised grooves on the sealing face. Fiberglass-reinforced stub ends are to be adhesive bonded to pipe or fitting.

B. GASOLINE PIPING – UNDERGROUND FLEXIBLE

1. Manufacturer:
 - a. UPP
 - b. APT



- c. NUPI
 - d. Approved Equal
- 2. Flexible below grade piping shall meet the UL-971 standard, and shall not have underground joints outside of sumps or containment areas.

2.4 GASOLINE SYSTEM VALVES

- A. Ball Valves
 - 1. Manufacturer
 - a. Morrison Brothers Model 691
 - b. Crane Valve, North America.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO, Inc.
 - f. Approved equal
 - 2. MSS SP 110, Class 125, two piece, threaded ends, bronze body, chrome plated bronze ball, reinforced teflon seats, blow-out proof stem, lever handle, UL 842 listed for flammable liquids, full port.
- B. Vertical Dispenser Check Valves
 - 1. Manufacturer
 - a. OPW 10BUP-5926
 - b. OPW 10SBUP-5926
 - c. Approved equal
 - 2. Vertical, double poppet, check valve with protective shear groove, coated cast iron, Viton disc, thermal relief valve, compatible with E85 and M85.

2.5 GASOLINE FILL SPILL CONTAINMENT MANHOLE

- A. Manufacturer
 - 1. OPW
 - 2. Emco Wheaton
 - 3. Fairfield
 - 4. Approved Equal
- B. Requirements: The remote fill spill containment manhole shall:
 - 1. Be UL Listed
 - 2. Be double walled
 - 3. Be completely testable and without any manhole excavation
 - 4. Be capable of a primary bucket replacement without any excavation
 - 5. Provided with manufacturer installed mechanical leak detection indicator.

2.6 MECHANICAL OVERFILL PROTECTION DEVICE

- A. Manufacturers:
 - 1. OPW (71-SO).
 - 2. Morrison Brothers.
 - 3. Approved Equal.
- B. Requirements: The remote fill spill containment manhole shall be Phase I EVR listed by the California Air Resources Board.



2.7 AUDIBLE/VISUAL OVERFILL ALARM

- A. Manufacturers: The Audible/Visual Overfill Alarm System shall be manufactured by the selected Environmental Monitoring and Fuel Control System manufacturer. Coordinate with other sections.
- B. One strobe/horn combination shall be provided for every UST individually. Strobe/horn combinations shall not share tanks.

2.8 GASOLINE SYSTEM SUBMERSIBLE TURBINE PUMP

- A. Manufacturer
 - 1. FE Petro
 - 2. Red Jacket
 - 3. Approved Equal

NOTE TO SPECIFIER

ADJUST SUBMERSIBLE PUMP SIZE AND TYPE. WHILE A 2 HP FIXED SPEED PUMP IS APPROPRIATE FOR MOST USPS FACILITIES, LARGER OR UNIQUE SYSTEMS MAY WARRANT A LARGER OR FIXED SPEED PUMP.

- B. General Requirements
 - 1. 2 hp, fixed speed
 - 2. Provide with manufacturer supplied pump controller.
 - 3. Provide with the appropriate shaft length

NOTE TO SPECIFIER

ADJUST LANGUAGE FOR DIESEL DISPENSERS BASED ON SITE SPECIFIC FLEET CONDITIONS AS SHOWN, FOR SINGLE PRODUCT DIESEL DISPENSERS

FOR SINGLE PRODUCT DIESEL DISPENSERS ONLY, BASED ON THE FLEET MIX, ULTRA HIGH CAPACITY DIEPSNERS MAY BE APPROPRIATE. ALSO, IF THERE IS A MIX OF VEHICLES, SINGLE PRODUCT DIESEL DISPENSERS SHOULD BE PROVIDED WITH A ONE ¾" HOSE AND NOZZLE, AND ONE 1" HOSE AND NOZZLE. THIS WILL ALLOW FOR THE ACCOMODATION OF LARGER AND SMALLER DIESEL VEHICLES.

2.9 GASOLINE SYSTEM DISPENSERS

- A. Manufacturer:
 - 1. Wayne
 - 2. Gasboy
 - 3. Bennett
- B. Self-contained, two hose single product electronic dispensers with island oriented nozzle boots, solenoid valves and 100:1 electronic pulse output per nozzle.
- C. Label all dispensers by fueling position. Do not affix labels to removable dispenser doors.
- D. Provide one (1) dispenser key per dispenser to the Owner at project conclusion.



- E. [For single product diesel dispensers, provide high capacity/ultra high capacity models.] [Provide one ¾" hose and nozzle and one 1" hose and nozzle on single product diesel dispensers.]
- F. Provide primary and spare dispenser filters for dispenser startup described later in this section. All dispenser filters provided shall be designed for compatibility with ethanol blends.
- G. Provide all required stickers and labels, including 87 Octane, ULSD, product labels, anti-static, and all required safety labels.

2.10 DISPENSER CONTAINMENT

- A. Below ground – provide FRP piping sumps as shown on the construction drawings and compatible with dispenser footprint.
- B. Manufacturers:
 - 1. Franklin Fueling.
 - 2. S. Bravo.
 - 3. Approved equal.

2.11 DISPENSER EQUIPMENT

NOTE TO SPECIFIER

ADJUST LANGUAGE FOR DIESEL DISPENSERS BASED ON SITE SPECIFIC FLEET CONDITIONS AS SHOWN, FOR SINGLE PRODUCT DIESEL DISPENSERS

FOR SINGLE PRODUCT DIESEL DISPENSERS ONLY, BASED ON THE FLEET MIX, ULTRA HIGH CAPACITY DIEPSNERS MAY BE APPROPRIATE. ALSO, IF THERE IS A MIX OF VEHICLES, SINGLE PRODUCT DIESEL DISPENSERS SHOULD BE PROVIDED WITH A ONE ¾" HOSE AND NOZZLE, AND ONE 1" HOSE AND NOZZLE. THIS WILL ALLOW FOR THE ACCOMODATION OF LARGER AND SMALLER DIESEL VEHICLES.

COORDINATE WITH DIESEL DISPENSER SECTION

- A. Hose Retractors
 - 1. Manufacturers/Models:
 - a. POMECO: Model 6100-7000.
 - b. Morrison Bros: Model 610 0100AR.
 - c. Approved Equal.
- B. Nozzles
 - 1. Manufacturers/Models:
 - a. OPW: Model 11B.
 - b. Approved Equal.
- C. Hoses
 - 1. Manufacturers/Models:
 - a. Goodyear: ¾" flexsteel hardwall.
 - b. Approved Equal.
- D. Breakaways
 - 1. Manufacturers/Models:
 - a. Catlow: Model CTM 75.



- b. Approved Equal.

E. Hose Swivels

- 1. Manufacturers/Models:
 - a. OPW: Model 45-5060.
 - b. Approved Equal.

F. Emergency Shutoff/Crash Valves

- 1. Manufacturers/Models:
 - a. OPW.
 - b. Morrison Brothers.
 - c. Approved Equal.
- 2. Specifications:
 - a. Normally closed valve.
 - b. Shear point.
 - c. 2 inch NPT threaded end connections.
 - d. Fire protection fusible link trips the valve closed at 165 degrees F.
 - e. Test port.
- 3. Materials
 - a. Ductile iron valve top and body.
 - b. Disc and seal material compatible with gasoline.
 - c. Stainless steel poppet spring.
 - d. Provide with stabilizer bar to hold valve rigidly in place and allow for proper shearing action.

2.12 FIRE EXTINGUISHERS

- A. Provide 4-A:80-B:C fire extinguishers, metal cabinets, and signage at locations shown on the construction drawings.

2.13 GASOLINE SYSTEM IDENTIFICATION

A. Nameplates

- 1. Manufacturers:
 - a. Craftmark Identification Systems
 - b. Safety Sign Co.
 - c. Seton Identification Products

B. Valve Tags

- 1. Manufacturers:
 - a. Craftmark Identification Systems
 - b. Safety Sign Co.
 - c. Seton Identification Products

C. Underground Pipe Markers

- 1. Manufacturer:
 - a. Tek ID
 - b. Approved equal

PART 3 - EXECUTION**3.1 GENERAL**

- A. The installation of underground piping and all fuel system equipment shall be conducted in strict accordance with the manufacturer's installation instructions. Nothing in this specification is intended to supersede or contradict those instructions.
- B. Install underground piping and all fuel system equipment in accordance with the requirements of all State and Local codes and regulations including, but not limited to, the State [], the State of [] Fire Code as adopted and amended by the State of [], and The International Fire Code and NFPA 30A.

3.2 EARTHWORK

- A. **Excavation**
 - 1. The area under new concrete slabs and/or footings, concrete and/or asphalted paving, and concrete walkways shall be excavated to the depth indicated on the Contract documents. Unless otherwise directed, all excavated native soil must be replaced with approved backfill material. Allowance must be made for the required base and sand or gravel cushion-leveling course. The area of the foundations and footings shall be proof rolled to detect any soft zones. All soft zones must be removed and replaced with select material compacted to 95% maximum dry density (ASTM D 1557), as tested by the Contractor.
 - 2. Structures and utilities located within the excavated area shall not be disturbed without prior approval by the Owner. The Contractor shall protect all structures and utilities to remain so as to prevent disruption of facility operations.
 - 3. The Contractor shall provide the necessary shoring, sheeting or bracing as required by OSHA and other applicable regulatory agencies for any trenching or similar excavation. All shoring materials used shall be in good, serviceable condition, and carried down as the excavation progresses.
- B. **Dewatering**
 - 1. The Contractor shall not allow water to accumulate in excavations. Surface water must be prevented from flowing into excavations and from flooding the Project site. The Contractor shall establish/construct storm drainage features (ponds/basins) at the earliest stages of site development, and throughout construction grade the construction area to provide surface water runoff away from the construction activity and/or provide temporary ditches, dikes, swales and other drainage features and equipment as required to maintain dry soils and prevent erosion. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. [It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed.] Excavated slopes and backfill surfaces shall be protected to prevent erosion. Excavation shall be performed so that the site, the area immediately surrounding the site, and the area affecting operations at the site shall be continually and effectively drained.
 - 2. The Contractor shall be responsible for all equipment and labor necessary for the removal of all surface and ground water that enters the excavation. Remove water from excavations to prevent softening of foundation bottoms, undercutting of footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain portable holding tanks, pumps, well points, sumps, suction and discharge water lines, and other dewatering system components to convey water away from excavations. Maintain erosion control measures to prevent sediment from leaving the work area.



3. [A geotechnical report is available.] The Contractor shall be responsible for all dewatering of the excavations necessary to complete the installation in accordance with manufacturer requirements. The Contractor is responsible for securing all State and Federal permits for the discharge of groundwater.

C. Material Disposal

1. The Contractor shall dispose of all excess and/or unsuitable excavated material. IN THE EVENT THAT CONTAMINATED SOIL, WATER OR HAZARDOUS WASTE MATERIAL IS ENCOUNTERED IN ANY EXCAVATION, THE CONTRACTOR SHALL SECURE THE EXCAVATION AND NOTIFY OWNER IMMEDIATELY. UNDER NO CIRCUMSTANCES SHALL ANY CONTAMINATED SOIL, WATER OR HAZARDOUS MATERIALS BE REMOVED WITHOUT AUTHORIZATION BY OWNER. Refer to and comply with Section 013543 – Environmental Procedures, and Section 017419 – Construction Waste Management and Disposal.

NOTE TO SPECIFIER

ADJUST GENERAL SUBGRADE PREPARATION REQUIREMENTS TO MEET SITE SPECIFIC CONDITIONS OR TO MEET THE RECOMMENDATIONS OF A GEOTECHNICAL REPORT. DO NOT VARY PIPING BED OR BACKFILL MATERIALS FROM THAT REQUIRED BY THE UNDERGROUND PIPING MANUFACTURER.

D. Subgrade Preparation

1. The Contractor shall finely grade all improvement areas indicated on the contract documents to the finish elevation indicated less the depth of the slab, footing, paving, and/or walkways and their base. Any required fill must conform to specifications set forth in Paragraph F.4.a. All subgrades shall be compacted to 95% Maximum Dry Density (ASTM D 1557) as tested by the Contractor.

E. Fill, Backfill, and Base

1. The Contractor shall not commence placement of fill, backfill, or base materials until the subgrade has been inspected and approved by the Owner. Excavations resulting from underground storage tank (UST) or above ground storage tank (AST) removals shall not be backfilled until the Owner has reviewed the results of post-excavation soil sample analysis and advised Contractor to proceed.
2. The Contractor shall provide a minimum of [8-inch compacted gravel] cushion below all new concrete slabs, (including replacement), footings, paving, and walkways. Backfill around concrete shall be of materials not subject to expansion or contraction (non-cohesive), and shall be sloped away from the concrete work. Sand shall not be placed above any gravel used as backfill in an area undergoing installation of concrete slabs, footings, paving, and walkways.
3. Trench or excavation backfill shall be compacted to 95% maximum dry density, as tested by the Contractor, with a mechanical tamper in lifts not to exceed [6 inches]. Surface material and finish must be replaced to match that of adjacent grade surface, including any base material required.

3.3 PIPE TRENCHES

- A. Excavate to the dimensions indicated in the Contract Drawings. Grade bottom of trenches to provide uniform support for each section of pipe after pipe bedding placement. Tamp if necessary to provide a firm pipe bed. Recesses shall be excavated to accommodate bells and joints so that pipe will be uniformly supported for the entire length. Rock, where encountered, shall be excavated to a depth of at least six (6) inches below the bottom of the pipe.



3.4 BACKFILL AND FILL MATERIAL PLACEMENT OVER PIPES

- A. Backfilling shall not begin until construction below finish grade has been approved, underground utilities or fuel and related piping installations have been inspected, tested and approved.

3.5 EXAMINATION

- A. Verify excavations are to required grade, dry, and not over-excavated.

3.6 INSTALLATION - BURIED PIPING SYSTEMS

- A. All piping to be installed by manufacturer certified personnel in strict accordance with manufacturer installation instructions.
- B. Verify connection size, location, and inverts are as indicated on Drawings.
- C. Establish elevations of buried piping with not less than 18 inches of cover unless otherwise specified.
- D. Remove scale and dirt on inside of piping before assembly.
- E. Install pipe to elevation as indicated on Drawings.
- F. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted depth; compact to 95 percent maximum density.
- G. Install pipe on prepared bedding.
- H. ***All underground product piping and vent piping shall have a continuous 1% slope down to the tank piping sump. The piping shall be installed such that there are no traps or liquid collection points. At the conclusion of final testing, back off all test boots and remove all Schrader valves and test fittings such that any product entering the secondary containment space in the piping system will drain to the monitored tank sump.***
- I. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- J. Install shutoff and drain valves at locations indicated on Drawings.
- K. Install magnetic utility warning tape continuous over top of pipe buried 6 inches below finish grade.
- L. Pipe Testing Requirements:
 - 1. Test piping per manufacturer's and State of [] requirements and specifications.
 - 2. Maintain the required pressure for a minimum of 2 hours after the backfill process has been completed.
- M. Pipe Cover and Backfilling:
 - 1. Backfill trench in accordance with the.
 - 2. Maintain optimum moisture content of fill material to attain required compaction density.
 - 3. After pneumatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 4 inches compacted layers to 12 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
 - 4. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
 - 5. Do not use wheeled or tracked vehicles for tamping.



3.7 SPILL AND OVERFILL EQUIPMENT

- A. Install spill and overfill equipment in accordance with manufacturer requirements and the construction drawings.
- B. Submit mechanical overfill prevention valve calculations to the Engineer for approval.
- C. Demonstrate operability/measure all overfill prevention devices in the presence of the Engineer.
- D. Submit written test results.

3.8 INSTALLATION – DISPENSERS

- A. Dispensers shall be installed in strict accordance with manufacturer instructions.
- B. The Contractor shall furnish and install filters for each gasoline dispenser/pump. Activate each dispenser and inspect filter for leaks. Allow approximately 100 gallons of product to flow through the filter, then remove and replace filter.
- C. The Contractor shall perform the following electrical circuit test for the dispensers:
 - 1. Turn off all circuit breakers controlling the pumps and check to assure that all pumps are not running.
 - 2. Confirm that all nozzles are in the dispenser boot with the boot electrical switch off.
 - 3. Turn on circuit breaker controlling one pump and on each dispensing pump:
 - 4. Remove nozzle, turn operating handle on, and dispense product to confirm hose is pressurized.
 - 5. If circuit disconnection or other problems are detected using the above procedure, make correction and repeat entire system checkout.
- D. The Contractor shall add 87 Octane, and ethanol (10%) stickers to the appropriate dispensers, as and if applicable.
- E. Dispensers must be properly anchored.

3.9 INSTALLATION – FIRE EXTINGUISHERS

- A. Install fire extinguishers, cabinets and signage in accordance with NFPA and State Fire Code Requirements, in locations shown on the construction drawings.
- B. Coordinate location of extinguisher mounts so as not to conflict with other fuel island equipment.

3.10 FIELD QUALITY CONTROL

NOTE TO SPECIFIER

IT IS IMPORTANT TO BE AS SPECIFIC AS POSSIBLE WHEN IDENTIFYING THE FORMS THAT THE CONTRACTOR IS REQUIRED TO FILL OUT. EACH PIPING AND TANK MANUFACTURER HAS A CHECKLIST AND TESTING FORMS. MANY STATES DO AS WELL. MOST STATES ALSO HAVE TEST FORMS FOR LEAK DETECTION EQUIPMENT, OVERFILL DEVICES, AND TANK GAUGING DEVICES, THAT ARE REQUIRED TO BE SUBMITTED ANUALLY ONCE THE FACILITY IS IN OPERATION. THE COMPLETION OF THESE FORMS SHOULD ALL BE INCLUDED IN THESE SPECIFICATION SO THAT THE OWNER HAS PROPER, STATE APPROVED, DOCUMENTATION OF THESE TESTS FOR THE FIRST YEAR OF



OPERATION. MOST STATE REGULATORY PROGRAMS HAVE ALL OF THEIR REPORTING AND TESTING FORMS ONLINE AND EASILY ACCESSIBLE FOR INCLUSION AS APPROPRIATE HERE.

COORDINATE THIS SECTION WITH THE CORRESPONDING SECTION IN 136000 AND 136020.

- A. Coordinate with Sections 136000 and 136020.
- B. Test all piping systems, sumps, interstitial spaces in accordance with State of [] requirements, manufacturer requirements and guidelines, and PEI-RP100. All test results shall be submitted to the engineer within 24 hours of completion. The primary and secondary chambers of all product carrying vessels shall be tested prior to and after final backfill. The test pressure on the interstitial piping space shall be maintained through the final backfill process and verified after backfill is complete.
- C. After completion of the gasoline system installation, and after backfilling and setting concrete, Test all underground piping with a precision method capable of detecting leaks of 0.005 gph. The precision test shall be performed by a third party independent testing company, and shall provide a certified report of tightness to the Owner with 5 days of completion.
- D. After completion of the gasoline system installation, test the Stage I Vapor Recovery System. The following tests shall be conducted. Provide test results to the Owner within 5 days of completion, and in the closeout documents:
 - 1. Pressure Decay Test (Bay Area Air Pollution Control District Source Test Procedure ST-30 (2/6/91)); and
 - 2. P/V Vent Cap Test (Leak Rate and Cracking Pressure of Pressure/Vacuum Valves CARB TP-201.1E).
- E. Where installed, test the Stage II Vapor Recovery System in accordance with [].
- F. Notify the Engineer at least ten (10) working days prior to setting the tanks into the excavation and ten (10) working days prior to final backfill of the tank top and underground piping. The Engineer may be present during tank setting and for a final-pre-backfill inspection of all underground components, and neither of these evolutions shall be conducted until the Engineer has had the opportunity to observe.
- G. In addition to the requirements outlined above, hydrostatically test all tanks sumps and turbine enclosures by filling each sump with water to within six (6) inches of the top and monitoring the water level of two (2) hours. This test shall be conducted by a testing agency and the results reported to the Engineer within 24 hours of completion.
- H. Provide documentation of all tests signed by certified personnel to the Owner prior to the operation of the facility and in the closeout documents including a copy of the State of [].
- I. Complete an operational test of all leak detection and level monitoring systems. Test in accordance with State and Manufacturer requirements. Submit completed state leak detection and sensor test forms to the Owner prior to the operation of the facility, and in the closeout documents.
- J. Test all safety devices, including but not limited to crash valves, emergency stop devices, and leak detection devices, in the presence of the engineer. Provide a written report of all tests including completion of the State of [] Report.
- K. Commission and calibrate the fuel dispensers using the services of a manufacturer certified service organization. Provide a report of startup and calibration from that agency.



- L. Complete the Suction Stub Verification Form, Overfill Verification Form, Tank Tilt Verification Form, and Brine Level Verification Form, as provided on the construction documents.
- M. Complete the [] Department of [] of Weights and Measures [], and affix the weights and measures seal on each dispenser face, one per nozzle and meter. Provide a copy of Weights and Measures Report in the closeout documents.
- N. Adjust/calibrate/commission the submersible pump controllers, adjusting output pressures as required to achieve the desired flowrate performance.
- O. Test the flowrate of fuel at each dispenser in the presence of the engineer, owner, and tenant. Flowrate shall be 9-10 gallons per minute for gasoline dispensers, with all nozzles pumping. [Flowrate shall be greater than 20 gallons per minute for ultra-high capacity diesel dispensers.]

3.11 INITIAL FUEL DELIVERY

- A. The Contractor shall be responsible for supplying sufficient gasoline for startup and calibration activities.

3.12 TANK AND SYSTEM REGISTRATION

- A. The Contractor shall submit to the Owner, prior to the operation of the facility, a completed and executed State of []. Include the completed form, with owner signature, in the closeout documents with evidence of submission to the State agency.
- B. Submit all other forms, notifications, and reports as required by the State, and provide copies to the Owner prior to operation of the system, and in the closeout documents including the State of [], [], [].

3.13 COMMISSIONING

- A. Coordinate commissioning activities with the commissioning activities required in sections 136010 and 136020. A single commission program, combining the requirements of the three sections shall be coordinated.
- B. The Contractor shall commission the motor fuel systems. Commissioning shall include all testing, start-up, calibration, programming, and documentation. At the conclusion of the commissioning, the facility shall be ready for the Owner and tenants to conduct unrestricted operations and use all systems to their full intended and designed capacity.
- C. The Contractor shall submit a system commissioning plan to the Owner and engineer for approval at least 30 days prior to commissioning the system. The plan, at a minimum shall include health and safety, testing, calibration, startup, and operational testing procedures for all operation and safety equipment. The plan shall also include all testing and commissioning procedures specifically outlined in this section. The contractor shall be responsible for supplying all fluids and commodities required to startup and calibrate systems. The plan may be combined with commission plans for other vehicle service equipment systems.
- D. Commissioning of the fuel system shall commence no less than 21 days prior to date of beneficial occupancy, and be completed prior to beneficial occupancy.



- E. Fuel or flammable liquids shall not be introduced into the underground tanks until the environmental monitoring and leak detection system is fully programmed, operational, and tested. Fuel shall not be introduced into the dispensing system until all safety (including emergency stop, crash valves, etc.) and leak detection devices have been tested and fire extinguishers are installed.
- F. Back off all test boots and remove all test fittings from piping systems at the conclusion of testing, to allow for the free flow of product from the piping secondary into the monitored containment sump in the case of primary pipe failure.
- G. Notify the engineer no less than 14 days prior to the completion of Commissioning. When Commissioning is completed, the contractor shall facilitate a final inspection by the engineer. The contractor shall have all necessary trade personnel on-site to operate equipment, open containment areas, and open electrical enclosures and equipment during the engineer's final Commissioning inspection. That final inspection shall include, but not be limited to:
 - 1. Operational test of all systems.
 - 2. Operational test of all safety devices (e-stop switches, crash valves, overfill alarms);
 - 3. General review of the installation against plans, specs, and manufacturer requirements;
 - 4. Review of all test reports and manufacturer start-up reports;
 - 5. Test of all leak detection sensors;
 - 6. Closeout document requirements review;
 - 7. Tank registration form review, to include all outstanding regulatory reports;
 - 8. Inspection of all tank level probes to verify 90% setting;
 - 9. Inspect of mechanical overfill protection devices to verify/measure 95% setting;
 - 10. Inspect of all sumps and containment areas;
 - 11. Review and validation of monitoring system programming;
 - 12. Operational test of the fuel management system and verification that the system is recording transactions and that the operator is able to generate fuel invoices.
 - 13. Confirmation that system training has been completed; and
 - 14. Verification that remote monitoring for the Environmental Monitoring System is programmed and functioning properly.

3.14 MANUFACTURER'S FIELD SERVICES

- A. The Contractor's field superintendent supervising the installation of all underground petroleum carrying components shall be factory or manufacturer certified to perform such installation. Additionally, the field supervisor shall carry any State or Local certifications to install underground tanks and petroleum components.
- B. Furnish factory training representatives to provide up to 8 hours of training on each major piece of equipment or system.

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END OF SECTION 13 60 10 00



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SECTION 13 60 20 00 - MPF MOTOR FUEL ELECTRICAL SYSTEM

NOTE TO SPECIFIER

THIS SPECIFICATION IS INTENDED TO BE A MINIMUM GUIDELINE FOR USE ON USPS PROJECTS NATIONALLY. THE SITE SPECIFIC DESIGN PROFESSIONAL SHALL ADJUST THIS SPECIFICATION, AT A MINIMUM WHERE INDICATED, TO MEET LOCAL REQUIREMENTS AND CONDITIONS FOR EACH SPECIFIC SITE AT WHICH IT IS USED. THIS MODEL DOCUMENT IS NOT AND SHALL NOT BE USED AS A CONSTRUCTION DOCUMENT WITHOUT THE APPROPRIATE MODIFICATION BY THE APPROPRIATE LICENSED DESIGN PROFESSIONAL.

PART 1 - GENERAL**1.1 SUMMARY**

- A. Related Documents: The work of this Section is governed by [Division 1].
- B. Perform work and provide material and equipment as shown on Drawings and as specified or indicated in this Section of the Specifications. Completely coordinate work of this Section with work of other trades and provide a complete and fully functional installation.
- C. Give notices, file plans, obtain permits and licenses, pay fees and back charges, and obtain necessary approvals from authorities that have jurisdiction as required to perform work in accordance with all legal requirements and with the contract documents.
- D. In general, the work of this Section includes furnishing labor, equipment and materials necessary to perform the excavation, trenching, de-watering, bedding, backfilling, compaction, shoring and off-site disposal of excess and unsuitable materials during installation of fuel piping, underground storage tanks, transition sump pits, fuel related electrical conduit, and all other related utilities specified or indicated in the Contract Documents.
- E. Related work specified in other Sections includes, but is not necessarily limited to:
 - 1. Section 136000 Motor Fuel Underground Storage Tanks
 - 2. Section 136010 Underground Motor Fuel Piping and Related Systems
 - 3. Section []

1.2 REFERENCES

- A. American Petroleum Institute:
 - 1. API 1615 - Installation of Underground Petroleum Storage Systems.
- B. ASTM International:
 - 1. ASTM D4021: Glass Fiber Reinforced Polyester Underground Petroleum Storage Tanks.
 - 2. ASTM C136: Standard Test Method for Sieve Analyses of Fine and Coarse Aggregates.
 - 3. ASTM D1557: Standard Test Methods for Laboratory Compaction Characteristics Using Modified Effort
- C. NACE International:
 - 1. NACE RP-02-85 - Corrosion Control of Underground Storage Tank Systems by Cathodic Protection.



- D. National Electrical Manufacturers Association:
 - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 2. NEMA WD 1 - General Requirements for Wiring Devices.
 - 3. NEMA WD 6 - Wiring Devices-Dimensional Requirements.
 - 4. NEMA FG 1 - Nonmetallic Cable Tray Systems.
 - 5. NEMA VE 1 - Metal Cable Tray Systems.
 - 6. NEMA VE 2 - Metal Cable Tray Installation Guidelines.
- E. National Fire Protection Association:
 - 1. NFPA 30 - Flammable and Combustible Liquids Code.
 - 2. NFPA 30A – Code for Motor Fuel Dispensing Facilities and Repair Garages.
 - 3. NFPA 70 – National Electric Code
- F. International Code Council
 - 1. International Fire Code
- G. Petroleum Equipment Institute:
 - 1. PEI RP100 - Recommended Practices for Installation of Underground Liquid Storage Systems.
- H. Underwriters Laboratories Inc.:
 - 1. UL 913 - Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous Locations.

1.3 SUBMITTALS

- A. Comply with [] General Requirements.
- B. Shop Drawings: Submit original copies of product data submittals for materials and equipment in Part 2 of this section including, but not limited to:
 - 1. Conduits.
 - 2. Conductors.
 - 3. Cable.
 - 4. Circuit Boards.
 - 5. Panels.
 - 6. Monitoring Consoles.
 - 7. Fuel Management Systems.
 - 8. Sensors.
 - 9. Probes.
 - 10. Underground Warning Tape.
 - 11. Emergency Stop Actuators.
 - 12. Emergency Stop Disconnects.
 - 13. Dispenser Hook Isolation Devices.
- C. Test Reports: Submit written test results for all tests as outlined in this specification.
- D. Manufacturer's Field Reports: Submit report of each visit of manufacturer's representative to provide technical assistance during installation.
- E. State Installer Certification: Certify tank installers employed on the Work, verifying that all workers meet State installer requirements.
- F. Record Drawings: Submit record drawings in accordance with [].



- G. Operation and Maintenance Manuals: Submit copies of the Operation and Maintenance Manual in compliance with Closeout Submittals.
- H. Manufacturer certifications: Submit manufacturer certifications for underground piping and environmental monitoring system installers.

1.4 CLOSEOUT SUBMITTALS

NOTE TO SPECIFIER

CLOSEOUT DOCUMENTS ARE CRITICAL FOR THE SUCCESSFUL FUELING SYSTEM PROJECT, BECAUSE A COMPLETE SET OF CLOSEOUT DOCUMENTS IS NECESSARY FOR THE FACILITY TO MEET LIFE-CYCLE COMPLIANCE REQUIREMENTS. THIS SPECIFICATION SECTION IS INTENDED TO BE HIGHLY DETAILED, AS EXPERIENCE HAS SHOWN THAT CONTRACTORS ARE MUCH BETTER ABLE TO COMPLY WITH A DETAILED LIST INCLUDING SPECIFIC STATE AND OTHER REGULATORY FORMS AND REPORTS, AND MANUFACTURER CHECKLISTS. AS SUCH, THIS SECTION SHOULD BE MADE AS SPECIFIC AS POSSIBLE. THE STATE OR OTHER GOVERNING UST REGULATORY PROGRAM WILL HAVE MOST OF THE INFORMATION NEEDED FOR THE APPROPRIATE LEVEL OF SPECIFICITY. ALSO, CONSULT MANUFACTURERS FOR THEIR INSTALLATION CHECKLISTS AND TEST REPORTS. THE FINAL CLOSEOUT LIST SHOULD BE COORDINATED WITH THE "FIELD QUALITY CONTROL SECTION" SUCH THAT ALL TEST FORMS IDENTIFIED THERE AS REQUIRED, ARE INCLUDED IN THE CLOSEOUT LIST.

COORDINATE THIS SECTION WITH THE CORRESPONDING SECTION IN 136000 AND 136010.

- A. Comply with pertinent provisions of the appropriate Division I regarding - Contract Closeout. In addition, comply with the specifics and additional provisions of this chapter. For the purposes of this section, the terms "Manuals and Instructions" and Closeout Documents" are used interchangeably.
- B. Coordinate closeout submittals with sections 136000 and 136010 to provide a single package for the project.
- C. Format of Closeout Documents, including Operation and Maintenance Manuals and Record Document
 - 1. Provide Electronic (pdf format for documents and jpeg format for photos) of all closeout documents, record documents, drawings, manuals, operating instructions, warranties, and all other documents referenced in this and related sections. Submission shall be on CD-ROM discs readable by Windows operating system. Files should be organized in logical folders and subfolders.
 - 2. In addition, provide bound manuals with all closeout documents, including record documents and drawings. Provide two (2) bound manuals/sets of documents. Bind Manuals in hardcover, three-ring binders, and provide identified dividers with tabs. Use multiple volumes as needed. Do not use three ring binders larger than 3 inches. **Copies of faxed pages are unacceptable.**
 - 3. Obtain at time of purchase of equipment, two (2) copies of operation, lubrication and maintenance manuals for all items. Assemble these manuals in the three ring binders above, and provide electronic versions.
 - 4. Furnish hard copy and electronic manuals for the fuel system to Engineer for approval and distribution to Owner within 30 days of completion of the fuel system. Included shall be 8 hours of training and review at which time the contractor shall review the contents of closeout documents with fuel system operating personnel.
- D. Manuals, Instructions, and Closeout Documents shall include the following items. Items shall be for the new fuel system facility:
 - 1. A minimum of 96 high resolution (no less than 4 mega-pixels) digital (.jpeg format) photographs depicting the installation at each critical construction phase. Particular attention should be paid to underground, buried, and normally inaccessible components.



2. Environmental monitoring system warranty registration and checkout form/Intrinsic Safety Checklist with proof of delivery to manufacturer.
3. Laminated 11" x 17" diagram showing all sensor, probe locations throughout system with corresponding labels to match environmental monitoring system.
4. Environmental Monitoring System final setup printout.
5. Records of all other inspections and tests to include:
 - a. []; and
 - b. [].
6. Warranties for all equipment and apparatus. In general, any product / manufacturer documentation that was provided with the equipment shall be provided as part of the closeout documents. Any warranty requiring forms or checklists shall be completed and fully executed.
7. Training certification for instruction seminars signed by the individuals trained on these systems.
8. All instruction bulletins, preventive maintenance schedules, operational instructions, and parts lists provided with the tanks, dispensers, monitoring system, and all other systems.
9. Copies of receipts for any keys, locks, or other equipment turned over to the Owner.
10. Operating and installation manuals and instructions for each piece of equipment that was provided with manuals or instructions, including but not limited to the tank installation instructions.

1.5 QUALITY ASSURANCE

- A. Qualifications: Use adequate numbers of skilled, licensed individuals who are thoroughly trained and experienced in the installation and testing of the specified systems and who are completely familiar with the requirements and the methods needed for proper performance of the work of this Section.
- B. Substitutions: Comply with the Instructions to Bidders and Division I.
- C. Materials and Equipment shall be manufactured, installed, and tested as specified in latest editions of applicable publications, standards and ruling of:
 1. Local and State building, plumbing, mechanical, electrical, fire and health department codes.
 2. National Fire Protection Association (NFPA).
 3. Occupational Safety and Health Act (OSHA).
 4. Factory Mutual Association (FM).
 5. Underwriter's Laboratories (UL).
 6. American Petroleum Institute (API).
- D. The most recent editions of applicable specifications and publications of the following organizations form part of the Contract Documents:
 1. American National Standards Institute (ANSI).
 2. American Society of Mechanical Engineers (ASME).
 3. National Electric Manufacturers Association (NEMA).
 4. American Society for Testing of Materials (ASTM).
 5. American Welding Society (AWS).
 6. Manufacturers Standardization Society of the Valve and Fitting Industry (MSS).
- E. Tests of all Contractor secured materials and products being submitted for approval to determine conformance with all requirements of the Contract Documents, including borrow materials proposed for use, shall be performed by an independent testing laboratory retained and compensated by this Contractor.
- F. As materials are incorporated into the project, on-site and off-site quality control tests shall be performed during construction to determine conformance with the Contract Documents by an independent testing laboratory retained and compensated by this Contractor.



- G. Quality assurance testing to validate results of quality control tests performed by the Contractor's testing laboratory shall be performed by an independent testing laboratory retained and compensated by the Owner.
- H. All fuel system equipment shall be compatible with oxygenated fuel blends including up to 15% Ethanol and 20% biodiesel blends.
- I. Complete the system installation in accordance with the requirements of the State of [] electrical code and the National Electrical Code.
- J. Comply with the testing and field quality control requirements elsewhere in this section.

1.6 PERMITS AND SUBMISSIONS

- A. The Contractor shall be responsible for all permits and notifications required by State and Local codes and regulations.
- B. Specifically at a minimum, the Contractor shall make the following submissions to the State of [] Department of []:
 - 1. [].
 - 2. [].
 - 3. [].
 - 4. [].
- C. Copies of all submissions and permits/registrations received shall be provided as part of the closeout documentation.

1.7 QUALIFICATIONS

- A. Manufacturer: Utilize companies specializing in manufacturing products specified in this section with minimum five years documented experience.
- B. Leak Detection Systems: The installing contractor of the Environmental Monitoring System shall the highest level manufacturer installer certification.
- C. The motor fuel electrical system shall be installed by a State of [] Licensed Master Electrician with at least 5 years of demonstrated experience with petroleum fuel systems.

1.8 GENERAL CONDITIONS

- A. Lines and grades shall be as indicated. Establish and maintain temporary benchmarks on the site for reference. All vertical dimensions shall be verified from these benchmarks.
- B. All permanent benchmarks shall be protected from disturbance or destruction. Any point disturbed or destructed shall be immediately replaced by a qualified surveyor at this Contractor's expense. Documentation of any such relocation or replacement shall be given to the Engineer.
- C. Disposition of Utilities
 - 1. Adequately protect from damage all active utilities and remove or relocate only as indicated, specified or directed.
 - 2. Report inactive and abandoned utilities encountered in excavating and grading operations to the Engineer. Remove, plug or cap as directed by the Engineer.



3. Provide a minimum of a 48 hour notice to the Engineer and receive written notice to proceed before interrupting any utility.

- D. Stockpiling of topsoil and other excavated materials will be permitted on-site within the project limits on a case by case basis provided the stockpiles are constructed and maintained in a manner that does not create a foreign object damage risk or adversely affect any other ongoing construction or operation at the site.
- E. During windy or wet conditions and at the conclusion of each day's work period, cover all excavated material to prevent it from becoming saturated or being displaced by wind or rain. Anchor all sides of covering as required to hold the covering firmly in place. In all cases, provide additional measures as necessary to prevent erosion, sedimentation and wind-borne displacement of excavated materials from their stockpiled location.
- F. Before beginning any work specified in this Section, the Contractor shall make certain that all applicable soil erosion and sediment control requirements are complied with and the proper authorities have been informed of the construction schedule.
- G. Provide the services of a registered land surveyor to lay out all fuel related work perform under this Contract.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Comply with [].
- B. Protect equipment, materials and specialties from elements and other damages caused during shipment, storage and erection until final acceptance from the Owner.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Comply with [].
- B. Do not install underground piping when bedding is wet or frozen.

1.11 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.



1.12 COORDINATION

- A. Comply with [].

PART 2 - PRODUCTS

- 2.1 TANK TOP EQUIPMENT: All tank top equipment shall meet the Phase I EVR standard as defined by the California Air Resources Board.

2.2 ELECTRICAL SYSTEM CONDUITS

- A. Electrical conduits shall comply with the following:
1. Rigid Conduit: Conduits shall be new rigid galvanized steel sized in accordance with NFPA 70, but no smaller than 3/4" diameter. Rigid non-metallic conduit shall be allowed in accordance with the requirements of Article 514 of the NEC.
 2. Flexible Conduit: Flexible conduit in NEC, Class I, Division 1 Classified Areas shall be Crouse-Hinds, flexible couplings type "ED" series or equal. Flexible conduit in NEC, Class I, Division 2 or Non-Classified Areas shall be liquid-tight metallic-core galvanized steel, grounding type with extruded PVC cover. Adapters and connectors shall be liquid-tight Crouse-Hinds "LT" type connectors or equal.
 3. Magnetic safety tape shall be used above all underground conduit.

2.3 ELECTRICAL SYSTEM GROUNDING

- A. Grounding Conductors
1. All grounding conductors shall be 2/0 AWG, stranded copper.
 2. Grounding ring conductors shall be 2/0.
- B. Grounding Rods
1. All Grounding Rods shall copper clad and 8 feet minimum in length.
 2. All electrical wire and cable for circuits shall be properly sized to conform to NFPA 70.
 3. Ground wires and bonds shall be #2 AWG stranded copper cable with approved type solderless connectors and lugs.
- C. Connectors
1. Make connections in accordance with NFPA 70.

2.4 ELECTRICAL SYSTEM CONDUCTORS WIRE AND CABLE

- A. General
1. Provide wire with a minimum insulating rating of 600 volts, except for wire, used in 50 volts or below applications for control of signal systems use 300 volt minimum or 600 volt where permitted to be incorporated with other wiring systems.
 2. All wire and cable installed within conduits that exit, enter, or go through a hazardous area must conform to NEC, Article 501-13 for conductor insulation.
- B. Conductor
1. Electrical grade annealed copper, tinned if rubber insulated, and fabricated in accordance with ASTM standards. Minimum size AWG # 12 for branch circuits.



2. The conductors illustrated on the drawings are copper except as otherwise noted.
 3. All conductors shall be THHN or THWN except as noted.
 4. All conductors shall be petroleum resistant and nylon jacketed.
- C. Stranding.
1. All connectors shall be stranded in accordance with ASTM Class B stranding designations.
 2. Control wires stranded in accordance with ASTM Class B stranding designations.
- D. Insulated Single Conductors
1. Type THHN/THWN - Flame retardant: Heat-resistant thermoplastic insulation, nylon jacket rated for 90 C dry/75C wet operation. Use for branch circuit wiring.
 2. Use type THHN/THWN or RHW or XHHW, rated for 90 C, for feeder circuits.
- E. Multi-Conductor Data Cable
1. Supply data cable as required and appropriate by dispenser, fuel management, and environmental monitoring system manufacturers.
- F. Multi-Conductor Power Cable
1. Not authorized on this project.
- G. Color Coding
1. Provide consistent color coding of all circuits as follows:
 - a. 120/208 volts code
 - 1) Phase A - Black.
 - 2) Phase B - Red.
 - 3) Phase C - Blue.
 - 4) Neutral - White.
 - 5) Ground - Green.
 - b. 277/480 Volt Code
 - 1) Phase A - Brown.
 - 2) Phase B - Orange.
 - 3) Phase C - Yellow.
 - 4) Neutral - Gray.
 - 5) Ground - Green.
 2. Color-code wiring for control systems installed in conjunction with mechanical and/or miscellaneous equipment in accordance with the wiring diagrams furnished with the equipment. Factory color code wire number 6 and smaller. Wire number 4 and larger may be color coded by color taping of the entire length of the exposed ends.
 3. Multi-Conductor Control, Signal, and Communication (100 conductors or fewer per cable): In accordance with Table 5-1, Part 5 of ICEA Pub. S-61-402 (NEMA WC 5).
 4. Substitutions for Color-Coded Wire: with approval of Owner's Representative and where color coding cannot be readily provided because of limited quantities involved, either of the following:
 - a. Plastic tape applied spirally and half-lapped over exposed portions of conductors within manholes, boxes, and similar enclosures.
 - b. Colored tubing cut and inserted over ends of wire prior to installing terminals.
 5. Substitutions for Color Coding for Multi-Conductor Control Cable: Printed conductor identification instead of color-coding is acceptable.

2.5 ELECTRICAL SYSTEM CONNECTORS

- A. Make connections, splices, and taps and joints with solderless devices, mechanically and electrically secure. Protect exposed wires and connecting devices with electrical tape or insulation to provide protection not less than that of the conductor.



2.6 OUTLET, JUNCTION, AND PULL BOXES

All exterior, sump, and fuel component outlet boxes not in a designated electrical room, shall carry a NEMA 4 or NEMA 4X rating unless otherwise indicated elsewhere in these specifications or construction drawings. All outlet boxes in the Hazard areas shall be rated in accordance with Chapter 5 of NFPA 70.

- A. Cast Type Conduit Boxes, Outlet Bodies and Fittings
 1. Provide surface mounted outlet and junction boxes, in indoor locations, where exposed to moisture and in outdoor locations.
 2. Use Ferrous Alloy boxes and conduit bodies with Rigid Steel or IMC.
 3. Use Ferrous Alloy or cast aluminum boxes and conduit bodies with Electrical Metallic Tubing.
 4. Covers: Cast or sheet metal unless otherwise required.
 5. Tapered threads for hubs.
- B. Galvanized Pressed Steel Outlet Boxes
 1. General
 - a. Pressed steel, galvanized or cadmium-plated, minimum of four (4") inches, octagonal or square, with galvanized cover or extension ring as required.
 2. Concrete Box
 - a. Four (4") inch octagon with a removable backplate and 3/8" fixture stud, if required. Depth of box shall allow for a minimum of one (1") inch of concrete to be poured above the backplate.
 3. Plug any open knockouts not utilized.
- C. Sheet Steel Boxes Indoors
 1. No. 12 USS gauge sheet steel for boxes with maximum side less than forty (40") inches, and maximum area not exceeding 1,000 square inches; riveted or welded 3/4 inch flanges at exterior corners.
 2. No. 10 USS gauge sheet steel for boxes with maximum side forty (40") to sixty (60") inches, and maximum area 1,000 to 1,500 square inches; riveted or welded 3/4 inch flanges at exterior corners.
 3. No. 10 USS gauge sheet steel riveted or welded to 1-1/2 by 1-1/2 by 1/4" welded angle iron framework for boxes with a maximum side exceeding sixty (60") inches and more than 1,500 square inches in area.
 4. Covers
 - a. Same gauge steel as box.
 - b. Subdivided single covers so no section of cover exceeds fifty (50) pounds.
 - c. Machine bolts, machine screws threaded into tapped holes, or sheet metal screws as required; maximum spacing twelve (12") inches.
 5. Paint
 - a. Rust inhibiting primer; ANSI No. 61 light gray finish coat.
 6. Where size of box is not indicated, size to permit pulling, racking and splicing of cables.
 7. For Boxes over 600 Volts
 - a. Provide insulated cable supports and removable steel barriers to isolate each feeder. Stencil cable voltage class in red letters on the front cover of the box.
 - b. Braze a ground connector suitable for copper cables to the inside of the box.
- D. Pull and Splice Boxes, Outdoors
 1. Aluminum reinforced, with removable covers secured by brass machine screws.
 2. Where size of box is not indicated, size to permit pulling, racking, and splicing of the cables.
 3. Braze a ground connector suitable for copper cables to the inside of the box.
- E. Junction Box, Sidewalk Type
 1. Cast iron, hot-dipped galvanized with threaded conduit entrance hubs, flanged, reinforced checkered cover, gasketed with pry bar slots and countersunk stainless steel screws.



F. Floor Boxes

1. General
 - a. Class I, water-tight, normal depth cast iron construction Type I, fully adjustable, for use in concrete.
 - b. Single Gang Round type.
 - c. Multiple Gang or Combination.
 - 1) Rectangular type partitions for separating power from communication sections.
2. Floor Box Covers
 - a. Rugged construction, impervious to cleaning detergents.
 - b. Compatible with floor covering.
 - c. Brass or bronze for flush mounting.
 - d. Providing continuous ground path to box.
 - e. Provide carpet flange in carpeted areas.

2.7 ELECTRICAL SYSTEM FIRESTOPPING

A. Manufacturers:

1. Dow Corning Corp.
2. Fire Trak Corp.
3. Hilti Corp.
4. International Protective Coating Corp.
5. 3M fire Protection Products.
6. Specified Technology, Inc.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

1. Silicone Firestopping Elastomeric Firestopping: Multiple component silicone elastomeric compound and compatible silicone sealant.
2. Foam Firestopping Compounds: Multiple component foam compound.
3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
4. Fiber Stuffing and Sealant Firestopping: Composite of fiber stuffing insulation with silicone elastomer for smoke stopping.
5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

2.8 ELECTRICAL SYSTEM NAMEPLATES

- A. Unless otherwise noted, nameplates shall be black lamacoid plates with white engraved upper case letters enclosed by white border on beveled edge.
- B. Nameplates for equipment, supplied by the emergency system (if installed) shall be red lamacoid with white lettering.
- C. All nameplates shall be engraved and must be secured with rivets, brass or cadmium plate screws. The use of Dymo tape or the like is unacceptable.



- D. Nameplate inscriptions shall bear the name and number of equipment to which they are attached as indicated on the Drawings. The engineer reserves the right to make modifications in the inscriptions as necessary.

2.9 ELECTRICAL SYSTEM CABLE TAGS AND WIRE IDENTIFICATION LABELS

- A. Cable tags shall be flameproof secured with nylon ties.
- B. Wire markers shall be preprinted cloth tape type or approved equivalent.

2.10 ELECTRICAL SYSTEM IDENTIFICATION LABELS

- A. Acceptable Manufacturers
 - 1. W.H. Brady Company (Style A)
 - 2. Thomas & Betts Company (T&B), Style A.
 - 3. Approved Equal
- B. Plasticized Cloth
 - 1. Non-conductive.
 - 2. Waterproof.
 - 3. Capable of withstanding continuous temperatures of 235 degrees F and intermittent temperatures to 300 degrees F.
 - 4. Overcoating for protection against oil, solvents, chemicals, moisture, abrasion and dirt.
- C. Heavy, thermo-resistant industrial grade adhesive, for adhesion of label to any surface without curling, peeling or falling off.
- D. Label Designations, Nominal System Voltages Applied to the covers of all medium and low voltage pull, splice and junction boxes.
- E. Machine printed.

2.11 ELECTRICAL SYSTEM UNDERGROUND WARNING TAPE

- A. Manufacturers:
 - 1. TEK ID
 - 2. PRESCO
 - 3. Approved equal.
- B. Description: 3 inch wide plastic tape, detectable type, colored red with suitable warning legend describing buried electrical lines. The warning tape shall list the utility covered, e.g., "CAUTION BURIED ELECTRIC LINE BELOW", TEK ID MODEL # DULT-1-3.

2.12 SEAL-OFF FITTINGS

- A. Cable seals shall be listed for Class I Division 1 and 2 areas, and shall be installed in accordance with the NEC.

2.13 EMERGENCY STOP ACTUATOR

- A. The emergency stop actuator shall be a flush momentary switch.



- B. Provide manufacturer/OEM cover for push button to prevent inadvertent actuation.

2.14 DISPENSER ISOLATION DEVICES

- A. Provide dispenser isolation devices as shown on the construction drawings to provide disconnecting means for all power and data inputs/outputs to/from the dispensers.
- B. In addition, provide Dispenser Hook Isolation (DHI) boxes in the electrical panel to provide optical isolation of the dispenser circuits.

2.15 ENVIRONMENTAL MONITORING SYSTEM

NOTE TO SPECIFIER

UPDATE MONITORING SYSTEM SPECIFICATIONS TO BE CONSISTENT WITH THE USPS TECHNICAL REQUIREMENTS OF THE NATIONAL CENTRALIZED BULK STORAGE TANK AND NOTIFICATION SYSTEM.

- A. Manufacturers:
1. Veeder Root
 2. [Approved Equal. Note – All monitoring systems shall be compatible with the USPS Technical Requirements of the National Centralized Bulk Storage Tank and Notification System]
- B. The Contractor shall connect new sensors, probes, and alarms to the monitoring consoles.
- C. The monitoring equipment must be compatible with the tank installed, and include all wiring, sensors and components for a complete operational system.
- D. The interstitial space sensor shall be capable of detecting a change of liquid level in the tank interstitial space.
- E. The internal tank sensor shall be capable of measuring water level, fuel level, phase separation, and product high and low levels.
- F. The leak monitor shall be capable of sensing any liquid that has entered the piping containment sump. The sensor is to be connected to the same unit used for the tank monitor.
- G. The overfill alarm visible indicators and horn shall be the same manufacturer as the tank monitor.
- H. The overfill alarm horn sign shall be constructed in accordance with the construction drawings with the words "OVERFILL ALARM WHEN ALARM SOUNDS TANK IS FULL" and with other language as specified on the construction drawings. Size the sign and lettering in accordance with the construction drawings for easy reading from ground level.
- I. The monitoring system shall be capable of remote monitoring through an IP addressable direct internet connection and telephone modem.

2.16 FUEL MANAGEMENT SYSTEM

NOTE TO SPECIFIER



THE FUEL MANAGEMENT SYSTEM MAY OR MAY NOT BE DESIRED BASED ON THE INDIVIDUAL SITE NEEDS. IF A FUEL MANAGEMENT SYSTEM IS NOT INSTALLED WITH THE PROJECT, THEN A SURFACE MOUNTED, WATERTIGHT MANHOLE SHOULD BE INSTALLED IN THE DISPENSING AREA, SUCH THAT A FUEL MANAGEMENT SYSTEM CAN BE INSTALLED IN THE FUTURE. THE SYSTEM CAPABILITIES MAY NEED TO BE ADJUSTED FOR SITE SPECIFIC CONDITIONS. COORDINATE WITH SITE SPECIFIC NEEDS AND INFRASTRUCTURE TO SPECIFY A NETWORK IF DESIRED OR REQUIRED.

- A. Manufacturers:
 - 1. Gasboy/Orpak
 - 2. Petrovend
 - 3. Fuelmaster
 - 4. Approved Equal

- B. Provide a pedestal based fuel management system to authorize and record fuel transactions.

- C. The system shall have the following capabilities:
 - 1. Authorizing a fuel dispensing transaction after an authorized card is read by the HID proximity card reader or entered into a keypad.
 - 2. Associating each issued HID card with a person and department.
 - 3. Be capable of having at least [1000] persons in the system working for up to [25] departments, in any combination thereof.
 - 4. Be capable of specifically authorizing certain cards. For example, only authorizing cards that have been issued to persons. Additionally, the capability of de-authorizing cards at any time by the manager, for example, in the case of employee termination.
 - 5. Be capable of recording and reporting each transaction, including person, company, time, date, fueling position number, and gallons dispensed, accurate to 0.1 gallon.
 - 6. Setting a pre-authorized, system-wide dispensing limit (per authorization) if required by the Fire Department.
 - 7. Generating individual invoices on a periodic basis (weekly, monthly, etc.) for each customer/tenant company. Each invoice shall have the ability to list total gallons dispensed, price per gallon, total invoice value, and a listing of each transaction in detail (time/date/person/amount dispensed).
 - 8. The ability to centrally control fueling at the entire facility, collectively or on an individual dispenser basis. That is, the manager, from the control computer, shall be able to "turn-on" or "turn-off" any fueling position at the facility at any time by allowing or dis-allowing the system to authorize any particular position.
 - 9. Be managed from a remote computer at the facility (within the facility LAN) or be managed remotely from a computer over the internet.

- D. Provide remote desktop computer with sufficient system resources to operate the fuel management system.

- E. Supply all network equipment and software, including but not limited to routers, switches, cables, fiber optic cables, fiber converters, connectors, software, and power supplies sufficient to create an internal virtual private network to which all fuel system control equipment (including Fuel Management and Environmental Monitoring, System consoles) will be connected. The network shall have the capability for the fuel control desktop computers to see and control all fuel system equipment, and have the ability for an outside user, monitoring company, or manufacturer service person to access each system software or web-based interfaces.]



PART 3 - EXECUTION**3.1 GENERAL**

- A. The installation of underground storage tanks and all fuel system equipment electrical and monitoring components shall be conducted in strict accordance with the manufacturer's installation instructions. Nothing in this specification is intended to supersede or contradict those instructions.
- B. Install underground tanks and all fuel system equipment in accordance with the requirements of all State and Local codes and regulations including, but not limited to, the State [], the State/City of [] Electrical Code as adopted and amended by the State of [], The International Fire Code and NFPA 30A, and the NFPA 70

3.2 ELECTRICAL SYSTEM – EXAMINATION

- A. Prior to device installation, verify outlet boxes are installed at proper height.
- B. Prior to device installation, verify wall openings are neatly cut and completely covered by wall plates.
- C. Prior to device installation, verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- D. Prior to making equipment connections, verify equipment is ready for electrical connection, for wiring, and to be energized.

3.3 ELECTRICAL SYSTEM INSTALLATION – CONDUIT

- A. All exposed canopy area conduits shall be finished to match the canopy structure.

3.4 ELECTRICAL SYSTEM INSTALLATION – EQUIPMENT CONNECTIONS

- A. Make electrical connections.
- B. Make conduit connections to equipment using flexible conduit. Use liquid-tight flexible conduit with watertight connectors in damp or wet locations, including in all sumps and fueling equipment areas.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- E. Install terminal block jumpers to complete equipment wiring requirements.
- F. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

3.5 HAZARDOUS LOCATIONS



- A. Install electrical wiring and components in strict accordance with Chapter 5 and Articles 514 and 515 of the NEC.

3.6 ELECTRICAL SYSTEM - WIRE AND CABLE

- A. Provide a complete system of conductors in raceway system. All conductors of all systems shall be installed in a raceway system.
- B. Use No. 12 AWG, minimum.
- C. Do not install wire in incomplete conduit runs or until after the concrete work and plastering is completed and moisture is swabbed from conduits. Eliminate splices wherever possible. Where necessary, splice in readily accessible pull, junction, or outlet box.
- D. Flashover or insulation value of joints shall be equal to that of the conductor. Provide Underwriters' Laboratories listed connectors rated to 600 volts for general use and 1,000 volts for use between ballasts and lamps or gaseous discharge fixtures.
- E. Use terminating fittings, connectors, etc., of a type suitable for the specified cable furnished. Make bends in cable at termination prior to installing compression device. Make fittings tight.
- F. Extend wire sizing for the entire length of a circuit, feeder, etc. unless specifically noted otherwise.

3.7 ELECTRICAL SYSTEM WIRE INSTALLATION

- A. General
 - 1. Provide tools, equipment, and materials to pull all wire and cable into place and to make required splices and termination.
- B. Wire and Cable in Conduit, Duct or Wireway
 - 1. Utilize roller bearing swivel to prevent twisting of cable entering conduit or duct.
 - 2. Take precautions to avoid entrance of dirt and water into conduit and ducts.
 - 3. Clean existing conduits and ducts to remove any pulling compound prior to pulling new cables.
 - 4. Do not damage conductor insulation, braid jacket or sheath.
 - 5. Do not bend conductors to less than manufacturer's recommended radius.
 - 6. Make splices only in pull boxes, junction boxes and outlet boxes.
 - 7. Utilize cable reels on jacks for pulling through pull boxes, ducts and conduits so bends will not be excessive and conductors will not touch sharp edges; use feeding tube where required.
 - 8. For large diameter cables, utilize properly sized pulling grips (endless woven basket two to four feet long of ductile steel).
 - 9. Do not exceed maximum recommended pulling tension of wire and cable.
- C. Splices, Terminations, and Connections
 - 1. General: Except where lugs are furnished with equipment, provide terminals and connectors suitable for quantity, conductor size and direction of entry (top or bottom).
 - 2. Insulated Flanged Terminals: Install for connection of conductors No. 12 AWG and smaller to device terminals; do not exceed three terminals at single connections.
 - 3. Circumferential Compression Type Connectors: Install for splices and connections No. 4 AWG and larger.
 - a. Use for incoming and outgoing cable connections at enclosures and for ground connections.
 - b. Use manufacturer's approved tool and correct hex head that embosses die number on connector lug.
 - c. Make crimped indentations parallel with conductor.



- d. Fill voids and irregularities with insulation putty.
- e. Cover neatly with four (4) layers of vinyl plastic tape except where insulated covers are permitted; half-lap tape in two directions.
- f. Use spring-held bakelite covers over splices or taps only with approval of Owner's Representative.
- 4. Conductor Arcproofing
 - a. Cover two or more power feeder cables occurring in the same switchboard section, junction box or pull box (including pull boxes over switchboards) with arcproof and flameproof tape.
 - b. Provide tape "Scotch" Irvington Tape No. 7700 or Plymouth Rubber Co. Slipknot No. 30 to provide an insulation capable of withstanding a 200-amp arc for not less than 30 seconds.
 - c. Apply tape in a single layer, half lapped, or as recommended by the manufacturer to conform to the above requirements. Apply with a random wrap of 1/2 inch (15mm) wide pressure-sensitive, plastic film tape color coded as specified in the "conductor identification" paragraph.

3.8 FIELD QUALITY CONTROL – WIRE

- A. Testing
 - 1. Test system wiring for continuity, grounds and short circuits prior to connection of any equipment.
 - 2. Test final equipment connections for continuity of grounds and short circuits.
 - 3. Insulation Resistance of Feeders and Subfeeders
 - a. Test with megger for insulation resistance.
 - b. Correct faults and replace sections with faulty insulation.
 - c. Demonstrate installation is free of grounds and short circuits and that insulation resistance complies with ICEA values.
 - 4. Test direct burial cables after completion of backfilling.

3.9 ELECTRICAL SYSTEM INSTALLATION – DEVICES

- A. Locations
 - 1. Comply with layout drawings for general location; contact Owner's Representative for questions about locations and mounting methods.
 - 2. Relocate outlets obviously placed in a location or manner not suitable to the room finish.
 - 3. Avoid placing outlets behind open doors.
- B. Align devices vertically and horizontally. Device plates shall be aligned vertically with a tolerance of 1/16". All four edges of device plates shall be in contact with the wall surface.
- C. Mounting Heights as indicated on the Drawings and according to ADA requirements.
- D. Fastening - securely fasten devices into boxes and attach appropriate cover plates.
- E. Install device plates on all outlet boxes. Provide blank plates for all empty, spare and boxes for future devices.
- F. Caulk around edges of outdoor device plates and boxes when rough wall surfaces prevent a rain tight seal. Use caulking material as approved by the Architect/Engineer.

3.10 ELECTRICAL SYSTEM FIELD QUALITY CONTROL – DEVICES

- A. Inspect each wiring device for defects.



- B. Operate and test each device.
- C. Make electrical connections.
- D. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- E. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- F. Install terminal block jumpers to complete equipment wiring requirements.
- G. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.
- H. Install all connections within the Classified Areas in accordance with Chapter 5 of the NEC.

3.11 EMERGENCY STOP SYSTEM TESTING

- A. The emergency stop system shall be tested in the presence of the Engineer.
- B. A report of emergency stop system testing shall be provided in closeout documents.

3.12 DISCONNECT

- A. The Contractor shall install disconnecting means for each individual dispenser. Install dispenser area disconnecting devices as shown on the construction drawings, which provide both power and data disconnects.
- B. In addition, install DHI boxes in the electrical room to provide optical isolation of the dispensing circuits, as shown on the construction drawings.

3.13 DISPENSER TESTING

- A. The Contractor shall perform the following electrical circuit test for the [] (#) facility dispensers:
 1. Turn off all circuit breakers controlling the pumps and check to assure that all pumps are not running.
 2. Confirm that all nozzles are in the dispenser boot with the boot electrical switch off.
 3. Turn on circuit breaker controlling one pump and on each dispensing pump:
 - a. Remove nozzle, turn operating handle on, and dispense product to confirm hose is pressurized.
 - b. Assure that only the correct pump turns on.
 4. If circuit disconnection or other problems are detected using the above procedure, more correction and repeat entire system checkout.

3.14 INSTALLATION - ENVIRONMENTAL MONITORING SYSTEM

- A. The Contractor's monitoring system installer shall be a certified environmental monitoring system technician and installer.



- B. The environmental monitoring system shall be configured in strict accordance with the construction drawings.
- C. The Contractor shall install all monitoring equipment, including monitor console and communications module, magnetostrictive probes, leak sensors, and hydrostatic sensors, in strict accordance with the environmental monitoring system installation instructions.
- D. The Contractor shall verify the overall accuracy of the Automatic Tank Gauging (ATG) system in accordance with API's Manual of Petroleum Measurement Standards, Chapter 3, Section 1B.
- E. The Contractor shall supply, install, and program a red warning light and sign outside of the maintenance building at 84 inches AFF, at the location shown on the construction drawing. The light shall be actuated by an output signal from the monitoring system, and shall be programed to actuate upon any UST or AST leak sensor alarm (sump or interstitial). The light shall not actuate due to any level probe conditions, i.e., the light should not actuate on high or low level alarms.
- F. The environmental monitoring system must be programmed with, at a minimum, the following parameters:
 - 1. Proper tank size, product, and gallonage.
 - 2. Water level warning at 1.5".
 - 3. High water level limit at 2.0".
 - 4. High product level – 90%.
 - 5. Delivery limit – 30%.
 - 6. Low Product level – 25%.
 - 7. Leak test - Annually for double-wall tanks (4-hour test).
 - 8. The audible timer shutoff on the monitoring system overfill alarms shall be set at 60 seconds.
 - 9. The system shall be programmed for single shift with a start time at midnight.
 - 10. All liquid sensors shall be identified as to their location. If multiple sensors are used, Contractor will post a laminated drawing adjacent to the monitor to indicate the location of the sensors by name and number. In addition, the Contractor shall fabricate and mount a sign stating "Tank Monitoring System" adjacent to the monitoring system panel.
 - 11. The Contractor shall be responsible for confirming the above parameters with each system operator and programming the environmental monitoring system to meet each operator's specific needs.
- G. The Contractor shall provide, as part of the closeout documentation, the monitoring system final setup print-out.
- H. The Contractor shall locate all monitoring equipment, including the monitoring system console and all sensors, in accordance with the construction drawings for each location.
- I. The Contractor shall complete and submit to the manufacturer the environmental monitoring system Warranty Registration and Checkout form as well as the Intrinsic Safety Checklist. A copy of the completed checklist as well as confirmation of delivery of the checklist to the manufacturer shall be submitted as part of the closeout documentation.
 - 1. MANUFACTURER'S WRITTEN CERTIFICATION OF A COMPLETE AND FUNCTIONAL INSTALLATION FOR THE LEAK DETECTION AND INVENTORY CONTROL SYSTEM SHALL BE PROVIDED BY THE CONTRACTOR.
- J. The Contractor shall connect the monitoring system to the internet and the fuel management system. The Contractor shall configure the monitoring system to send automatic e-mails and/or text messages based on owner direction.



- K. The Contractor shall supply, as part of the closeout documentation, any instruction bulletins, preventative maintenance schedules, operational instructions and parts lists associated with the environmental monitoring system.

3.15 INSTALLATION – FUEL MANAGEMENT SYSTEM

NOTE TO SPECIFIER

THE FUEL MANAGEMENT SYSTEM MAY OR MAY NOT BE DESIRED BASED ON THE INDIVIDUAL SITE NEEDS. IF A FUEL MANAGEMENT SYSTEM IS NOT INSTALLED WITH THE PROJECT, THEN A SURFACE MOUNTED, WATERTIGHT MANHOLE SHOULD BE INSTALLED IN THE DISPENSING AREA, SUCH THAT A FUEL MANAGEMENT SYSTEM CAN BE INSTALLED IN THE FUTURE. THE SYSTEM CAPABILITIES MAY NEED TO BE ADJUSTED FOR SITE SPECIFIC CONDITIONS. COORDINATE WITH SITE SPECIFIC NEEDS AND INFRASTRUCTURE TO SEPCIFY A NETWORK IF DESIRED OR REQUIRED.

- A. Install Fuel Management System in accordance with manufacturer requirements and instructions, and in accordance with NFPA 30A and 70.
- B. Run wires, cables, conduits, and raceways as necessary to complete all system connections, including fiber optic pathways and converters where necessary.
- C. Make all connections to system to function as described above.
- D. Engage the services of a manufacturer field representative to program, start up, calibrate, and test the system and provide training to fuel management personnel on all system functionality. Complete sample transactions and generate sample invoices from those transactions, prior to turn-over to the Owner.
- E. Install all required network equipment required to provide a fully functioning system.

3.16 SENSOR AND LEVEL PROBE TESTING

- A. Complete functionality of the environmental monitoring system shall be tested. In the presence of the engineer, put each sensor into an alarm condition and manually raise the probe float to simulate an overfill condition.
- B. All sensors and probes shall be tested in the presence of the Engineer.
- C. Provide the monitoring system printout of each alarm from the test sequence (depicting each sensor alarming) to the Owner prior to operating the system.
- D. Complete State electronic release detection form reporting test results to the Owner. Coordinate testing with other Gasoline System sections.

3.17 COMMISSIONING

- A. Coordinate commissioning activities with the commissioning activities required in sections 136000 and 136010. A single commission program, combining the requirements of the three sections shall be coordinated.
- B. The Contractor shall commission the motor fuel systems. Commissioning shall include all testing, start-up, calibration, programming, and documentation. At the conclusion of the commissioning, the facility



shall be ready for the Owner and tenants to conduct unrestricted operations and use all systems to their full intended and designed capacity.

- C. The Contractor shall submit a system commissioning plan to the Owner and engineer for approval at least 30 days prior to commissioning the system. The plan, at a minimum shall include health and safety, testing, calibration, startup, and operational testing procedures for all operation and safety equipment. The plan shall also include all testing and commissioning procedures specifically outlined in this section. The Contractor shall be responsible for supplying all fluids and commodities required to startup and calibrate systems. The plan may be combined with commission plans for other vehicle service equipment systems.
- D. Commissioning of the fuel system shall commence no less than 21 days prior to date of beneficial occupancy, and be completed prior to beneficial occupancy.
- E. Fuel or flammable liquids shall not be introduced into the underground tanks until the environmental monitoring and leak detection system is fully programmed, operational, and tested. Fuel shall not be introduced into the dispensing system until all safety (including emergency stop, crash valves, etc.) and leak detection devices have been tested and fire extinguishers are installed.
- F. Notify the engineer no less than 14 days prior to the completion of Commissioning. When Commissioning is completed, the Contractor shall facilitate a final inspection by the engineer. The Contractor shall have all necessary trade personnel on-site to operate equipment, open containment areas, and open electrical enclosures and equipment during the engineer's final Commissioning inspection. That final inspection shall include, but not be limited to:
 - 1. Operational test of all systems.
 - 2. Operational test of all safety devices (e-stop switches, crash valves, overfill alarms);
 - 3. General review of the installation against plans, specs, and manufacturer requirements;
 - 4. Review of all test reports and manufacturer start-up reports;
 - 5. Test of all leak detection sensors;
 - 6. Closeout document requirements review;
 - 7. Tank registration form review, to include all outstanding regulatory reports;
 - 8. Inspection of all tank level probes to verify 90% setting;
 - 9. Inspect of mechanical overfill protection devices to verify/measure 95% setting;
 - 10. Inspect of all sumps and containment areas;
 - 11. Review and validation of monitoring system programming;
 - 12. Operational test of the fuel management system and verification that the system is recording transactions and that the operator is able to generate fuel invoices.
 - 13. Confirmation that system training has been completed; and
 - 14. Verification that remote monitoring for the Environmental Monitoring System is programmed and functioning properly.

3.18 MANUFACTURER'S FIELD SERVICES

- A. The Contractor's field superintendent supervising the installation of all underground petroleum carrying components shall be factory or manufacturer certified to perform such installation. Additionally, the field supervisor shall carry any State or Local certifications to install underground tanks and petroleum components.
- B. Furnish factory training representatives to provide up to 8 hours of training on each major piece of equipment or system.

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SECTION 14 21 00 00 - MPF ELECTRIC TRACTION ELEVATORS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 – GENERAL

1.1 SUMMARY

- A. Electric traction passenger elevator including driving machines, car hoistway entrances, guide rails, signals, controls, electrical wiring, roping, buffers and counterweights (if any); and devices for operating, dispatching, safety security, leveling and alarm.
- B. Oversize freight elevator(if required for two-story facilities) shall be sized to accommodate the largest piece of mechanization, automation, utility or other equipment to be installed in the building.

1.2 SUBMITTALS

- A. Product Data: Required
- B. Shop Drawings: Required
- C. Operational and Maintenance Manuals: Required

1.3 QUALITY ASSURANCE

- A. Comply with ASME ANSI A17.1 "American Standard Safety Code for Elevators, Dumbwaiters, Escalators and Moving Walks" except where more stringent requirements are imposed by local regulations,
- B. Comply with HANDBOOK RE-4 for handicapped accessibility.
- C. Elevator installation is to be inspected, approved and certified by USPS elevator inspector.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Provide elevator systems as manufactured by ThyssenKrupp Elevator Systems, Inc., Otis Elevator Co. or Schindler Elevator Co.

2.2 SCHEDULE OF EQUIPMENT (PASSENGER ELEVATOR ONLY)

- A. Elevator operation: Electric traction.
- B. Capacity: 2500 pounds.
- C. Speed: 200 FPM.



- D. Operation control system: Duplex automatic, programmable solid state.
- E. Hoistway doors: Single speed; stainless steel; extruded aluminum sills.
- F. Door operation: Motorized.
- G. Car enclosure:
 - 1. Walls: High pressure plastic laminate over steel shell.
 - 2. Front (including doors): Stainless steel.
 - 3. Ceiling: Plastic eggcrate design with fluorescent lighting.
 - 4. Sill: Extruded aluminum.
 - 5. Handrails: Stainless steel, cylindrical design; on rear and side walls.
 - 6. Flooring: Vinyl tile.
 - 7. Accessories: Telephone box, emergency light, 2-speed exhaust fan, and inspection certificate frame.
- H. Signals: Impulse hall and car operating stations; hall lanterns; car riding lanterns and gongs; dual beam photo eye; car position indicator.
- I. Special features: Multi-leveling; fireman's feature; battery lowering emergency power.

PART 3 – EXECUTION

- 3.1 Install all products in accordance with manufacturer's guidelines and printed instructions.

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END OF SECTION 14 21 00 00



SECTION 14 24 00 00 - MPF HYDRAULIC ELEVATORS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 – GENERAL

1.1 SUMMARY

- A. Hydraulic passenger elevator including driving machines (pumping units), car hoistway entrances, guide rails, signals, controls, electrical wiring, roping, plungers, buffers and counterweights (if any); and devices for operating, dispatching, safety security, leveling and alarm.
- B. Oversize freight elevator(if required for two-story facilities) shall be sized to accommodate the largest piece of mechanization, automation, utility or other equipment to be installed in the building.

1.2 SUBMITTALS

- A. Product Data: Required
- B. Shop Drawings: Required
- C. Operational and Maintenance Manuals: Required

1.3 QUALITY ASSURANCE

- A. Comply with ASME ANSI A17.1 "American Standard Safety Code for Elevators, Dumbwaiters, Escalators and Moving Walks" except where more stringent requirements are imposed by local regulations,
- B. Comply with HANDBOOK RE-4 for handicapped accessibility.
- C. Elevator installation is to be inspected, approved and certified by USPS elevator inspector.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Provide elevator systems as manufactured by Thyssen Krup Elevator Systems, Inc., Otis Elevator Co. or Schindler Elevator Co.

2.2 SCHEDULE OF EQUIPMENT (PASSENGER ELEVATOR ONLY)

- A. Elevator control: Oil hydraulic
- B. Capacity: 2500 pounds.
- C. Speed: 125FPM.



- D. Operation control system: Duplex automatic, programmable solid state.
- E. Hoistway doors: Single speed; stainless steel; extruded aluminum sills.
- F. Door operation: Motorized.
- G. Car enclosure:
 - 1. Walls: High pressure plastic laminate over steel shell.
 - 2. Front (including doors): Stainless steel.
 - 3. Ceiling: Plastic eggcrate design with fluorescent lighting.
 - 4. Sill: Extruded aluminum.
 - 5. Handrails: Stainless steel, cylindrical design,; on rear and side walls.
 - 6. Flooring: Vinyl tile.
 - 7. Accessories: Telephone box, emergency light, 2-speed exhaust fan, and inspection certificate frame.
- H. Signals: Impulse hall and car operating stations; hall lanterns; car riding lanterns and gongs; dual beam photo eye; car position indicator.
- I. Special features: Multi-leveling; fireman's feature; battery lowering emergency power.

PART 3 – EXECUTION

- 3.1 Install all products in accordance with manufacturer's guidelines and printed instructions.

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Last revised: 3/31/2010

END OF SECTION 14 24 00 00

SECTION 14 26 00 00 - LIMITED-USE/LIMITED-APPLICATION ELEVATORS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for limited-use/limited-application elevators. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes limited-use/limited-application (LU/LA) elevators.

C. Definitions

1. Definitions in ASME A17.1 apply to Work of this Section.
2. Defective Elevator Work: Operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

D. Performance Requirements

1. Rated Load: 1400 lb (635 kg).
2. Rated Speed: 25 to 30 fpm (0.13 to 0.15 m/s).

E. Submittals

1. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information.
2. Shop Drawings: Show plans, elevations, sections, and large-scale details indicating coordination with building structure, relationships with other construction, and locations of equipment and signals.
3. Samples: For exposed finishes.
4. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator being provided.
5. Qualification Data: For Installer.
6. Operation and maintenance data.
7. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction, for normal, unrestricted elevator use.
8. Warranty: Special warranty specified in this Section.

F. Quality Assurance

1. Installer Qualifications: Elevator manufacturer or manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
2. Regulatory Requirements: Comply with ASME A17.1 and elevator design requirements for earthquake loads in ASCE 7.
 - a. Affected peak velocity acceleration (A_v) for Project's location is less than 0.10 (Seismic Risk Zones 0 and 1) **OR** greater than or equal to 0.10, but less than 0.20 (Seismic Risk Zone 2) **OR** greater than or equal to 0.20 (Seismic Risk Zones 3 and 4), **as directed**.
 - b. Project's Seismic Design Category is A **OR** B **OR** C **OR** D, **as directed**.
 - c. Elevator's Importance Factor is 1.5 **OR** 1.0, **as directed**.
3. Accessibility Requirements: Comply with Sections 407.4.1 through 407.4.10 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" **OR** ICC A117.1, **as directed**.



4. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 **OR** UBC Standard 7-2 **OR** UL 10B, **as directed**.

G. Delivery, Storage, And Handling

1. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging.
2. Store materials, components, and equipment off of ground, under cover, and in a dry location. Handle according to manufacturer's written recommendations to prevent damage, deterioration, or soiling.

H. Warranty

1. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair, restore, or replace defective elevator work within one year from date of Final Completion.

1.2 PRODUCTS

A. Components

1. General: Provide manufacturer's standard LU/LA elevator. Where components are not otherwise indicated, provide standard components, published by manufacturer as included in standard LU/LA elevators and as required for complete system.
2. Machine Type: Hydraulic, holeless, beside the car; either roped hydraulic or direct-acting hydraulic.
3. Pump Units: Positive-displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations. Provide the following:
 - a. Submersible pump, with submersible squirrel-cage induction motor, **as directed**, suspended inside oil tank from vibration isolation mounts.
 - b. Pump motor with solid-state starting **OR** variable-voltage, variable-frequency motor control, **as directed**.
 - c. Hydraulic silencer and flexible piping connectors at pump unit.
4. Hydraulic Fluid: Fire-resistant fluid with antioxidant, anticorrosive, antifoaming, and metal-passivating additives. Hydraulic fluid is approved by elevator manufacturer for use with elevator equipment.
5. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work where installation of devices is specified in another Section.

B. Operation Systems

1. General: Provide manufacturer's standard microprocessor, **as directed**, operation system for single automatic operation **OR** selective collective automatic operation, **as directed**.
2. Standby Power Operation: On activation of standby power, car is returned to a designated floor and parked with doors open. Car can be manually put into service on standby power, either for return operation or for regular operation, by switches in control panel located at main lobby, **as directed**. Manual operation causes automatic operation to cease.
3. Battery-Powered Lowering: Provide system that, when power fails, lowers car to the lowest floor, opens car and hoistway door, and shuts down. System includes rechargeable battery and automatic recharging system.
4. Emergency Operation: None required **OR** Phase I emergency recall operation **OR** Phase I emergency recall operation and Phase II emergency in-car operation, **as directed**.

C. Door Reopening Devices



1. Photoelectric Device: Provide photoelectric device that projects light beam across car entrance. Device is capable of sensing objects at 5 and 29 inches (125 and 735 mm) above the floor, **as directed**. Interruption of light beam shall cause doors to stop and reopen.
 2. Infrared Array: Provide door-reopening devices with a uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more of the light beams shall cause doors to stop and reopen.
- D. Finish Materials
1. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated.
 2. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.
 3. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.
 4. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.
 5. Stainless-Steel Bars: ASTM A 276, Type 304.
 6. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.
 7. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063.
 8. Plastic Laminate: High-pressure type complying with NEMA LD 3, Type HGS for flat applications **OR** Type HGL for flat applications, **as directed**, and Type BKV for panel backing.
- E. Elevator Car Enclosures
1. General: Provide steel-framed car enclosures with wall panels, car roof, access doors, power door operators, and ventilation. Provide finished car including materials and finishes specified below.
 2. Clear Inside Dimensions:
 - a. Inside Width: 36 inches (915 mm) **OR** 42 inches (1065 mm) **OR** 48 inches (1219 mm), **as directed**, from sidewall to sidewall.
 - b. Inside Depth: 48 inches (1219 mm) **OR** 54 inches (1370 mm) **OR** 60 inches (1524 mm), **as directed**, from back wall to front wall (return panels).
 - c. Inside Height: 84 inches (2134 mm) to underside of ceiling.
 3. Materials and Finishes: Provide manufacturer's standards, but not less than the following:
 - a. Floor Finish: Specified in a Division 07 **OR** Elevator manufacturer's standard level-loop nylon carpet; color as selected from manufacturer's full range, **as directed**.
 - b. Enameled-Steel Wall Panels: Flush construction; fabricated from cold-rolled steel sheet. Provide with factory-applied enamel or powder-coat finish; colors as selected from manufacturer's full range.
 - c. Stainless-Steel Wall Panels: Flush, hollow-metal construction; fabricated from stainless-steel sheet; polished, No. 8 **OR** satin, No. 4, **as directed**, finish.
 - d. Plastic-Laminate Wall Panels: Plastic laminate adhesively applied to manufacturer's standard core with plastic-laminate panel backing and manufacturer's standard protective edge trim. Plastic-laminate color, texture, and pattern as selected from plastic-laminate **OR** elevator, **as directed**, manufacturer's full range.
 - e. Sills: Extruded aluminum, with grooved surface, 1/4 inch (6.4 mm) thick.
 - f. Metal Ceiling: Flush panels, fabricated from cold-rolled steel sheet. Provide panels with factory-applied enamel or powder-coat finish; colors as selected from manufacturer's full range.
 - g. Lighting: Not less than two incandescent downlights. Provide battery backup power source with automatic charging, **as directed**.
 - h. Handrail: 1-1/2 inches (38 mm) round **OR** 1/2 by 2 inches (13 by 50 mm) rectangular **OR** Manufacturer's standard, **as directed**, polished stainless steel, No. 8 finish **OR** satin stainless steel, No. 4 finish, **as directed**, on one side **OR** on both sides **OR** at rear, **as directed**, of car.
 4. Car Doors: Manufacturer's standard units complete with track systems, hardware, sills, and accessories.
 - a. Operation: Manual **OR** Automatic, **as directed**.
 - b. Type: Horizontal sliding **OR** Folding, **as directed**.



- c. Clear Opening Width: 32 inches (815 mm) **OR** 36 inches (914 mm), **as directed**.
- d. Door Height: 80 inches (2032 mm) **OR** 84 inches (2134 mm), **as directed**.
- e. Enameled-Steel Doors: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied enamel or powder-coat finish; colors as selected from manufacturer's full range.
- f. Primed-Steel Doors: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied, corrosion-resistant primer for field painting.
- g. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet or by laminating stainless-steel sheet to exposed faces and edges of enameled cold-rolled steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning. Polished, No. 8 **OR** Satin, No. 4, **as directed**, finish.
- h. Plastic-Laminate Doors: Flush, hollow-metal construction; fabricated by laminating plastic laminate to exposed faces of enameled cold-rolled steel doors and covering edges with protective edge trim. Plastic-laminate color, texture, and pattern as selected from plastic-laminate **OR** elevator, **as directed**, manufacturer's full range.
- i. Aluminum Folding Doors: Aluminum extrusions with edges forming full-height hinges connected by stainless-steel rod.

F. Hoistway Entrances

- 1. General: Provide manufacturer's standard door-and-frame hoistway entrances, same size as car doors, complete with track systems, hardware, sills, and accessories.
 - a. Operation: Manual **OR** Automatic, **as directed**.
 - b. Type: Horizontal sliding **OR** Side hinged, **as directed**.
- 2. Provide frame size and profile to coordinate with hoistway wall construction.
 - a. Where gypsum board wall construction is indicated, provide self-supporting frames with reinforced head sections.
- 3. Materials and Fabrication: Provide manufacturer's standards, but not less than the following:
 - a. Enameled-Steel Frames: Formed from cold-rolled or hot-rolled steel sheet. Provide with factory-applied enamel finish; colors as selected from manufacturer's full range.
 - b. Primed-Steel Frames: Formed from cold-rolled or hot-rolled steel sheet. Provide with factory-applied, corrosion-resistant primer for field painting.
 - c. Stainless-Steel Frames: Formed from stainless-steel sheet; polished, No. 8 **OR** satin, No. 4, **as directed**, finish.
 - d. Enameled-Steel Doors: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied enamel finish; colors as selected from manufacturer's full range.
 - e. Primed-Steel Doors: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied, corrosion-resistant primer for field painting.
 - f. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet or by laminating stainless-steel sheet to exposed faces and edges of enameled cold-rolled steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning. Polished, No. 8 **OR** Satin, No. 4, **as directed**, finish.
 - g. Plastic-Laminate Doors: Flush, hollow-metal construction; fabricated by laminating plastic laminate to exposed faces of enameled cold-rolled steel doors and covering edges with protective edge trim. Plastic-laminate color, texture, and pattern as selected from plastic-laminate **OR** elevator, **as directed**, manufacturer's full range.
 - h. Sills: Extruded aluminum, with grooved surface, 1/4 inch (6.4 mm) thick.
 - i. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.
- 4. Fire-Protection Rating: 1 hour **OR** 1-1/2 hours, **as directed**, with 30-minute temperature rise of 450 deg F (250 deg C).

G. Signal Equipment

1. General: Provide buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements with long-life incandescent lamps and acrylic or other permanent, nonyellowing translucent plastic diffusers **OR** LEDs, **as directed**.
 - a. Finish: Polished stainless steel, No. 8 finish **OR** Satin stainless steel, No. 4 finish, **as directed**.
2. Car Control Stations: Provide manufacturer's standard car control stations. Mount in side panel adjacent to car door, unless otherwise indicated.
 - a. Mark buttons and switches with standard identification for required use or function that complies with ASME A17.1. Use both tactile symbols and Braille.
 - b. Provide "No Smoking" sign matching car control station, either integral with car control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.
3. Emergency Communication System: Provide system that complies with ASME A17.1 and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" **OR** ICC A117.1, **as directed**. On activation, system dials preprogrammed number of monitoring station and identifies elevator location to monitoring station. System indicates when it has been activated and when monitoring station has responded. System provides for two-way communication, by both voice and visual display, together with push buttons. System is contained in cabinet, with identification, instructions for use, and battery backup power supply.
OR
Emergency Telephone: Provide telephone cabinet with emergency telephone. On activation, telephone dials preprogrammed number of monitoring station **OR** 911, **as directed**, and identifies elevator location. Telephone provides two-way voice communication.
4. Car Position Indicator: Provide digital-type position indicator in elevator car. Also provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car control station.
5. Hall Push-Button Stations: Manufacturer's standard wall-mounted units, equipped with buttons for calling elevator and for indicating desired direction of travel where applicable.
6. Hall Lanterns: Manufacturer's standard units with illuminated arrows, but provide single arrow at terminal landings.
7. Hall Annunciator: Provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.
8. Emergency Signs: Provide signs matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire the elevators are out of service and exit stairs should be used instead. Provide one sign at each hall push-button station, unless otherwise indicated.

1.3 EXECUTION

A. Installation

1. Install cylinder plumb and accurately located for elevator car position and travel. Anchor securely in place, supported at pit floor and braced at intervals as needed to maintain alignment. Anchor cylinder guides at spacing needed to maintain alignment and avoid overstressing guides.
2. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts designed to effectively prevent transmission of vibrations to structure and thereby eliminate sources of structure-borne noise from elevator system.
3. Lubricate operating parts of systems as recommended by manufacturers.
4. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Reduce clearances to minimum safe workable dimension at each landing.
5. Leveling Tolerance: 1/4 inch (6 mm), up or down, regardless of load and direction of travel.
6. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.



7. Locate hall lanterns either above or beside hoistway entrance at a minimum of 72 inches (1829 mm) above finished floor unless hall lanterns are built into entrance frames.

B. Field Quality Control

1. Acceptance Testing: On completion of elevator installation and before permitting use of elevator, perform acceptance tests as required and recommended by ASME A17.1 and by authorities having jurisdiction.
2. Advise Owner and authorities having jurisdiction in advance of dates and times tests are to be performed.

C. Demonstration

1. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevator.
2. Check operation of elevator with Owner's personnel present and before date of Final Completion. Determine that operation systems and devices are functioning properly.
3. Check operation of elevator with Owner's personnel present not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

END OF SECTION 14 26 00 00



SECTION 14 45 00 00 - MPF VEHICLE LIFTS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Furnishing and complete installation of new vehicle lifts. The lifts shall be provided with all necessary devices for satisfactory operation.

1.2 ACCEPTABLE MANUFACTURERS: Required characteristics and performance of vehicle lifts are based on products of the following manufacturers:

- A. Rotary Lift (two-post lifts).
- B. Hunter Engineering Co. (scissors lift).

Requests for substitutions will be considered in accordance with the provisions of Section 016000.

1.3 WORK INCLUDED

- A. Supply all labor and materials required to deliver and install the vehicle lift systems and make them full operational.

1.4 QUALITY ASSURANCE

- A. Manufacturer's and Installer's Qualifications:
 1. Materials and products shall be manufactured by a company continuously and regularly employed in the manufacture of similar materials, for a period of at least 5 consecutive years; and which can show evidence of these materials being satisfactorily used on at least six projects of similar size, scope, and type within such a period. At least three of the projects shall have been in successful use for three years or longer.
 2. Installation shall be by an installer which has been in the business of installing similar systems for at least three consecutive years and is approved as an installer by the equipment manufacturer.

1.5 SUBMITTALS

- A. Submit shop drawings showing lay-out, details of construction, anchorages, and accessories specific to this project.



1.6 WARRANTY

- A. Provide manufacturer's 2-year parts and labor warranty.

PART 2 - PRODUCTS

2.1 VEHICLE LIFTS

- A. Two-Post Lift: (Symmetrical) floor-mounted and rigidly anchored: Design requirements are based on Model SP-0S series, by Rotary Lift, Inc.
 - 1. Floor-mounted and rigidly anchored.
- B. Two-Post Lift: (Asymmetrical) floor-mounted rigidly anchored: Design requirements are based on Model SP0A, by Rotary Lift, Inc.
- C. Alignment Rack with two swing air jacks: Design requirements are based on Model RX--43 by Hunter Engineering Co.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lifts shall be floor mounted and rigidly anchored and installed in strict accordance with manufacturer's recommendations, with all required appurtenances and connections to provide fully operational functionality.

3.2 FIELD TESTING

- A. Upon completion and before final inspection of the work, each vehicle lift shall be operated under full rated capacity load and shall be tested as in-service to demonstrate compliance with the contract requirements. Piping shall be thoroughly flushed and cleaned before being placed into operation.

3.3 INSTRUCTING OPERATING PERSONNEL

- A. The services of a manufacturer's technical representative to instruct Owner's personnel in operation and maintenance of the lifts shall be provided. Schedule with Owner at least 7 days in advance.

USPS Mail Processing Facility Specifications issued: 10/1/2013
Last revised: 6/29/2010

END OF SECTION 14 45 00 00



SECTION 14 45 00 00 - CSF VEHICLE LIFTS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Furnishing and complete installation of new vehicle lifts. The lifts shall be provided with all necessary devices for satisfactory operation.

1.2 ACCEPTABLE MANUFACTURERS: Required characteristics and performance of vehicle lifts are based on products of the following manufacturers:

- A. Rotary Lift (two-post lifts).
- B. Hunter Engineering Co. (scissors lift).

Requests for substitutions will be considered in accordance with the provisions of Section 016000.

1.3 WORK INCLUDED

- A. Supply all labor and materials required to deliver and install the vehicle lift systems and make them full operational.

1.4 QUALITY ASSURANCE

- A. Manufacturer's and Installer's Qualifications:
 1. Materials and products shall be manufactured by a company continuously and regularly employed in the manufacture of similar materials, for a period of at least 5 consecutive years; and which can show evidence of these materials being satisfactorily used on at least six projects of similar size, scope, and type within such a period. At least three of the projects shall have been in successful use for three years or longer.
 2. Installation shall be by an installer which has been in the business of installing similar systems for at least three consecutive years and is approved as an installer by the equipment manufacturer.



1.5 SUBMITTALS

- A. Submit shop drawings showing lay-out, details of construction, anchorages, and accessories specific to this project.

1.6 WARRANTY

- A. Provide manufacturer's 2-year parts and labor warranty.

PART 2 - PRODUCTS

2.1 VEHICLE LIFTS

- A. Two-Post Lift: (Symmetrical) floor-mounted and rigidly anchored: Design requirements are based on Model SP-0S series, by Rotary Lift, Inc.
 - 1. Floor-mounted and rigidly anchored.
- B. Two-Post Lift: (Asymmetrical) floor-mounted rigidly anchored: Design requirements are based on Model SP0A, by Rotary Lift, Inc.
- C. Alignment Rack with two swing air jacks: Design requirements are based on Model RX--43 by Hunter Engineering Co.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lifts shall be floor mounted and rigidly anchored and installed in strict accordance with manufacturer's recommendations, with all required appurtenances and connections to provide fully operational functionality.

3.2 FIELD TESTING

- A. Upon completion and before final inspection of the work, each vehicle lift shall be operated under full rated capacity load and shall be tested as in-service to demonstrate compliance with the contract requirements. Piping shall be thoroughly flushed and cleaned before being placed into operation.

3.3 INSTRUCTING OPERATING PERSONNEL

- A. The services of a manufacturer's technical representative to instruct Owner's personnel in operation and maintenance of the lifts shall be provided. Schedule with Owner at least 7 days in advance.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011



END OF SECTION 14 45 00 00



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SECTION 21 00 00 00 - CSF FIRE SUPPRESSION

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this where Fire Suppression System is part of the Work. THIS SECTION IS A "PERFORMANCE" SPECIFICATION. The Section describes the design requirements for the Fire Suppression System. The Fire Sprinkler Contractor will design the system and prepare detailed Fire Sprinkler Drawings to be used for the installation of the Fire Suppression System.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.21 00 00 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire Protection Basic Materials and Methods:
 - a. Hangers and Supports.
 - b. Pipe and Fittings.
 - c. Piping Specialties.
 - d. Valves.
2. Wet-Pipe Fire Suppression Sprinklers:
 - a. System design, installation, and certification.
 - b. Fire department connections.

NOTE TO SPECIFIER

Include if Dry Pipe System Required.

3. Dry-Pipe Fire Suppression Sprinklers:
 - a. System design, installation, and certification.
 - b. Fire department connections.

NOTE TO SPECIFIER

Include if Fire Pump Required. Edit Type of Driver (Motor or Engine). Use electric drive pump when the facility is equipped with emergency power generator.

4. Fire Pumps:
 - a. Fire pump package.
 - b. Fire pump [motor.] [engine.]
 - c. Electric jockey pump.
 - d. Controllers.



B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

C. Related Sections:

1. Section 312300 - Excavation and Fill: Earthwork for utilities.
2. Section 331100 - Water Utility Distribution Piping: Fire protection water system.
3. Section 283100 - Fire Detection and Alarm: Interconnection of systems.

1.2 REFERENCES

A. American National Standards Institute (ANSI):

1. ANSI B 16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, and 250.
2. ANSI B 16.3 - Malleable-Iron Threaded Fittings, Class 150 and 300.
3. ANSI B 16.4 - Gray Iron Threaded Fittings.
4. ANSI A 21.10 - Ductile Iron and Gray Iron Fittings, 2 in. through 48 in., for Water and Other Liquids.
5. ANSI A 21.51 - Ductile-Iron Pipe, Centrifugally Cast.

B. American Society of Mechanical Engineers (ASME):

1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
2. ASME B16.3 - Malleable Iron Threaded Fittings.
3. ASME B16.4 - Gray Iron Threaded Fittings.
4. ASME B16.5 - Pipe Flanges and Flanged Fittings.
5. ASME B16.9 - Factory-made Wrought Steel Buttwelding Fittings.
6. ASME B16.25 - Buttwelding Ends.
7. ASME Sec 9 - Welding and Brazing Qualifications.

NOTE TO SPECIFIER

Use ASSE when backflow preventers are required.

C. American Society of Sanitary Engineering (ASSE):

1. ASSE 1047 - Reduced Pressure Detector Assembly Backflow Preventer.
2. ASSE 1048 - Double Check Detector Assembly Backflow Preventer.
- 3.

D. American Society for Testing and Materials (ASTM):

1. ASTM A 53 - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
2. ASTM A 47 - Specification for Malleable Iron Castings.
3. ASTM A 135 - Specification for Electric-Resistance-Welded Steel Pipe.
4. ASTM A 234 - Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
5. ASTM A 795 - Specification for Black and Hot-dipped Zinc-coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.

E. Factory Mutual (FM):

NOTE TO SPECIFIER

Edit editions— FM Data Sheet 2-8N will be replaced by Data Sheet 2-0 later in 2009, edit accordingly.

1. FM - Approval Guide, [2002] [] Edition.
2. FM Data Sheet 2-8N, [2002] [] Edition.

F. National Fire Protection Association (NFPA):

**NOTE TO SPECIFIER***Edit editions*

1. NFPA 13, [2007] [] Edition - Installation of Sprinkler Systems.

NOTE TO SPECIFIER*Use if Fire Pump Required*

2. NFPA 20, [2007] [] Edition - Standard for the Installation of Stationary Pumps for Fire Protection.
3. NFPA 24, [2007] [] Edition – Standard for the Installation of Private Fire Service Mains and Their Appurtenances
4. NFPA 70, [2008] [] Edition - National Electrical Code.
5. NFPA 72, [2007] [] Edition - National Fire Alarm Code
6. NFPA 291, [2007] [] Edition – Recommended Practice for Fire Flow Testing and Marking of Hydrants.

- G. Underwriters Laboratories, Inc.(UL):

NOTE TO SPECIFIER*Edit Edition*

1. UL Fire Directory B, Product Directory - Fire Protection Equipment Directory, [2009] [] Edition.
2. UL 193 - Alarm Valves for Fire Protection Service.
3. UL 199 - Automatic Sprinklers for Fire Protection Service.
4. UL 346 - Water Flow Indicators for Fire Protective Signaling Systems.
5. UL 405 - Standard for Fire Department Connections.
6. UL 753 - Alarm Accessories for Automatic Water Supply Control Valves for Fire Protection Service.

NOTE TO SPECIFIER*Use if hose cabinets or racks are required*

7. UL 668 - Hose Valves for Fire Protection Services.

NOTE TO SPECIFIER*Use if Fire Pump Required*

8. UL 448 - Pumps for Fire Protection Service.

NOTE TO SPECIFIER

Use if Diesel Engine Fire Pump Required. Do not use if the facility is equipped with emergency power generator and electric motor is used in instead of diesel engine.

9. UL 1247 - Diesel Engines for Driving Centrifugal Fire Pumps.
10. UL 1468 - Direct-Acting Pressure Reducing and Pressure-Control Valves for Fire Protection Service.
11. UL 1478 - Fire Pump Relief Valves.

1.3 DEFINITIONS

- A. Authority Having Jurisdiction: See Public Authorities.
- B. Delegated Engineer: A Professional Engineer Registered in the State where the project is located who undertakes final design of the fire protection system.



- C. Owner: Any designated representative of the Owner.
- D. Professional of Record: Architect or Engineer of Record indicated on the Contract Documents.
- E. Public Authorities: Local, State or Federal government body having jurisdiction over any portion of the project. This includes, but is not limited to: building departments, Fire Departments, Fire Marshals Offices, Water Departments, Insurance Regulatory Boards, Utility Companies or Districts, Cross Connection Control Departments, Transportation Departments, etc.

1.4 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. System to provide coverage for entire building.

NOTE TO SPECIFIER

Use for Ordinary Hazard Group 2 Locations

- 2. Retail Areas, Canopies, Workroom and General Storage areas.
 - a. Density: 0.20 gpm/ft² for most hydraulically remote 1500 ft², with 250 gpm hose stream allowance. If Area is less than 1500 ft², calculate at 0.20 gpm/ft² for entire area with 250 gpm hose stream allowance.
 - b. Sprinkler Temperature Rating: Ordinary. High in combustible concealed spaces or near heat producing equipment.
 - c. Spacing: 130 ft² per sprinkler maximum, 15 feet spacing maximum.
 - d. Occupancy: Mercantile, Ordinary Hazard Group 2 per NFPA 13.

NOTE TO SPECIFIER

Use for Light Hazard Locations

- 3. Office Areas and Restrooms
 - a. Density: 0.10 gpm/ft² for most hydraulically remote 1500 ft², with 100 gpm hose stream allowance. If area is less than 1500 ft², calculate at 0.10 gpm/ft² for entire area with 100 gpm hose stream allowance.
 - b. Sprinkler Temperature Rating: Ordinary. High near heat producing equipment.
 - c. Spacing: 225 ft² per sprinkler maximum, 15 feet spacing maximum.
 - d. Occupancy: Light Hazard per NFPA 13.

NOTE TO SPECIFIER

Use for Locations with Combustible Concealed Spaces

- 4. Combustible Concealed Spaces
 - a. Density: 0.10 gpm/ft² for most hydraulically remote 1500 ft², with 100 gpm hose stream allowance. If area is less than 1500 ft², calculate at 0.10 gpm/ft² for entire area with 100 gpm hose stream allowance.
 - b. Sprinkler Temperature rating: Intermediate. High near heat producing equipment.
 - c. Spacing: 130 ft² per sprinkler maximum, 15 feet spacing maximum.
 - d. Occupancy: Light Hazard per NFPA 13.

NOTE TO SPECIFIER

Use if water flow test data is known, verified and is to be the "Design Basis Fact".



5. Design sprinkler systems using the following [water] [fire pump] supply: [____] psi [static] [churn], [____] psi residual flowing [____] gpm [, and [____] psi residual flowing [____] gpm]. This test effective at [hydrant located] [____] and provided by [____]

NOTE TO SPECIFIER

Use if Delegated Engineer is required to perform water flow.

6. The Delegated Engineer shall perform a water flow test to determine the available water supply for fire protection system design. The following parameters shall be followed in conducting the water flow test:
- Conduct flow test in accordance with NFPA 291. Coordinate flow tests validity with Public Authorities and Contracting Officer.
 - Contact the Public Authorities before conducting the flow test. Public Authority appointed representative must be present during the flow test.
 - Conduct a water flow pressure test as close to the proposed location as practical. The water flow pressure test shall consist of three separate pressure tests conducted at the same location. The first water flow pressure test shall be conducted at zero flow (initial static condition). The second water flow pressure test shall be conducted flowing at or more than [] [700] gpm (residual condition). The final water flow pressure test (final static condition) shall be conducted immediately following the second at zero flow, to determine if pumps or other pressure/flow modifying devices may have been engaged. Conduct test during peak hour demand conditions. If test can not be conducted during peak hour, adjust results to peak hour demand.

NOTE TO SPECIFIER

Edit Safety Factor Values Based on project/Public Authority Requirements

- Safety Factor: 10 percent of static and residual PSI.
- Hydraulic calculation areas of application shall be based on actual floor area protected by sprinklers. Use 1.2 multiplied by the square root of the area for design criteria.

NOTE TO SPECIFIER

Use if Dry Pipe System Required

9. Hydraulic calculations for all dry pipe system piping shall be based on a C Value of 100.

NOTE TO SPECIFIER

Use if Hose Cabinets or Racks are Required

- Install 1-1/2 inch Fire Department hose valves and racks with 100 feet of hose. Locate as [indicated on Drawings and as] required by Public Authorities. Final location and quantity subject to approval of Contracting Officer and Public Authorities.
- System control valve shall be a post indicating valve located a minimum of 40 feet from building.

NOTE TO SPECIFIER

Use if Fire Pump is NOT Required

12. Entire hose allowance (gpm) shall be included in hydraulic calculations at the connection to the city water main or a yard hydrant, whichever is closer to the system riser. [If inside hose cabinets, racks, or connections are required then include 100 gpm of the total hose allowance at point of connection of hose system piping to automatic fire sprinkler system piping.]

NOTE TO SPECIFIER

Use if Fire Pump IS Required



13. Entire hose allowance (gpm) required in schedule shall be included in hydraulic calculations at pump discharge flange. [If inside hose cabinets, racks, or connections are required then include 100 gpm of the total hose allowance at point of connection of hose system piping to automatic fire sprinkler system piping.]

B. Scope of Work: Design, fabrication and installation of Fire Protection System Including the Following:

1. Complete fire protection system as outlined in these Contract Documents, including all labor, materials, shop drawings and hydraulic needed to furnish and install a complete and functional fire protection system. System shall comply with NFPA 13, Public Authorities, Contracting Officer and Contract Documents.
2. Visit site to determine conditions and extent of work.
3. Coordination of work with Contract Documents and all trades, including building design loads.
4. The work under this section shall yield to all other trades.
5. Warranty on new materials and labor.
6. Provide all necessary permits, taxes and fees, including Public Authorities inspection and testing fees necessary to complete the specified work.
7. Provide any required core drilling of walls, and required UL listed, non-combustible firestopping materials at all new sprinkler piping penetrations. Patch as required. New piping penetrations shall be adequately firestopped to maintain the fire resistance rating required.
8. Access panels for service and access to valves in enclosed ceiling and walls.
9. Provide coordination and interface of alarm initiating and supervisory devices with the fire alarm system.
10. The fire protection piping and sprinkler layout shall function in such a manner so as not to interfere with lighting fixtures, air distribution devices, equipment, piping, beams, and ductwork. The work under this section shall yield to all other trades.
11. Furnish, install and adjust as necessary all waterflow and valve supervisory switches.
12. Fire protection systems complete with supervised control valves, inspector's test and main drain assemblies, vane type waterflow alarm switches, pressure gauge, main drain, auxiliary drains, and local alarm devices.
13. Provide required signs at all new control valves, main drains, auxiliary drains and inspector's test connections, hydraulic placards, etc.
14. System testing.
15. Underground pipe modifications, including all necessary fittings, clamps, thrust blocking, backflow preventers, excavating and backfilling, etc.
16. Fire department connection with check valve and ball drip, including interconnecting supply piping to sprinkler riser.
17. If sprinkler system in any area is subject to freezing, then use non-freeze system (dry or anti-freeze).
18. Drawings must indicate specific method of freeze protection for all areas.

NOTE TO SPECIFIER

Use if Fire Pump IS Required. Use electric drive pump when the facility is equipped with emergency power generator.

19. If necessary, Contractor shall furnish and install one UL Listed and [or] FM Approved [electric motor] [diesel engine] driven horizontal split case fire pump. Each unit shall include a pump, base, coupling, coupling guard, necessary fittings and an automatic controller.

NOTE TO SPECIFIER

Use if Fire Pump IS Required. Edit Values. Use electric drive pump when the facility is equipped with emergency power generator.

20. The fire pump shall be rated at:
- a. Pump Capacity: [1000] [] gpm at [219] [] feet head, [95] [] psi.
 - b. The net pump shutoff (churn) pressure plus the maximum static suction pressure, adjusted for elevation, shall not exceed the pressure for which the system components are rated



- c. Maximum permissible pump speed shall not exceed [2100] [] rpm.
- d. Maximum permissible [engine] [motor] speed shall not exceed [2100] [] rpm.
- e. Maximum permissible [engine] [motor] horse power shall not exceed [75] [] hp.
- f. Static suction pressure available: [] psi maximum and [] psi minimum.
- g. Suction pressure at rated gpm: [] psi maximum and [] psi minimum.
- h. Suction pressure at 150 percent rated gpm: [] psi maximum and [] psi minimum.
- i. Maximum permissible static pressure on discharge flange of pump (including maximum static suction and maximum churn pressure: [150] [] psi.
- j. Unit shall be designed to deliver not less than 150 percent of rated capacity at 65 percent of rated capacity.
- k. Ambient temperature range: [125] [] degrees F maximum to [40] [] degrees F minimum.
- l. The unit will be installed at approximately [20] [] feet elevation above sea level.
- m. Pump start: At a minimum operating design pressure of [130] [] psi
- n. Maximum demand: Shall not exceed 120 percent of pump's rated capacity.
- o. Pump: Supplied from [public water main] [suction tank].

NOTE TO SPECIFIER

Use if Fire Pump IS Required. Edit Values

- 21. Performance of Jockey Pump on Fire Pump System:
 - a. Pump Capacity: [5] [] gpm , at [231] [] feet head, [100] [] psi.
 - b. Maximum permissible pump churn pressure shall not exceed [120] [] percent of rated pressure ([120] [] psi maximum)
 - c. Motor: [1.5] [] hp.

NOTE TO SPECIFIER

Use if Fire Pump IS Required

- 22. If fire pump is necessary, all equipment furnished and the complete installation of the fire pump shall be in accordance with NFPA 20. Pumps and controllers shall be UL Listed and [or] FM Approved.
 - a. Assembled pump configuration must be installed per manufacturer's recommendations.
 - b. Purchase pumps, driver, controllers, and accessories under unit contract.

NOTE TO SPECIFIER

Use if Fire Pump and Pump Suction Control Valve is Required.

- c. Provide pump suction control valve.

1.5 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for Submittals.

- 1. Product Data:
 - a. Sprinkler heads, valves, and specialties.
 - b. Performance ratings rough-in details, weights, support requirements, and piping connections.
- 2. Preliminary Shop Drawings: Prior to detailed submission, submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
- 3. Shop Drawings: Indicate hydraulic calculations, detailed pipe layout, hangers and supports, components and accessories. Indicate system controls. Prior to commencement of installation, submit licensed Professional Engineer's sprinkler system drawings (signed and sealed by Delegated Engineer) specified in "Quality Assurance" Article to Designated Reviewers. Include system hydraulic calculations and equipment data. Submittals shall be complete and in bound sets. Sprinkler system drawings, prepared according to NFPA 13 and FM 2-8N and Contract Documents. Submittals shall be made to Designated reviewers. Designated Reviewers are:



- a. Additional Submittal: Submit shop drawings, product data, and hydraulic calculations to Public Authorities for approval. Submit proof of approval to Contracting Officer.
- b. Submittals to Contracting Officer:

NOTE TO SPECIFIER

Use the following for Florida, South Carolina, Kentucky, and Louisiana, and as required by the project

- c. Submittals to [Fire Protection Engineer] [Professional] of Record:
- 4. Assurance/Control Submittals:
 - a. Design Data:
 - b. Test Reports: Submit the following reports directly to Contracting Officer from Testing Laboratory, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements.
 - 1) Pre-test.
 - 2) Acceptance test.
 - c. Certificates: Manufacturer's certificate certifying that components and Products meet or exceed specified requirements.
 - d. Qualification Documentation:
 - 1) Submit documentation of manufacturer and installer experience indicating compliance with specified qualification requirements. Include lists of completed projects with project names and addresses, and names of Engineers and Contracting Officers.
 - 2) Fire protection contractor license issued by State or local authority having jurisdiction.
 - e. Manufacturer's Field Reports: Submit the following reports directly to Contracting Officer from Manufacturer's Quality Control Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements.
 - 1) Preparatory inspection.
 - 2) Initial inspection.
 - 3) Follow-up inspection.
 - 4) Final inspection.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Project Record Documents: Accurately record the following.
 - a. Sprinklers and deviations of piping from Drawings.
 - b. Drain and test locations.
 - 2. Operation and Maintenance Data:
 - a. Components of system, servicing requirements, inspection data, replacement part numbers and availability, and location and numbers of service depot.

1.6 QUALITY ASSURANCE

A. Qualifications:

- 1. Manufacturer: Company specializing in manufacturing the Products specified in this Section, whose equipment, specialties, and accessories are listed by product name and manufacturer in UL Fire Protection Equipment Directory and FM Approval Guide and that conform to other requirements indicated.
- 2. Installer: Company specializing in performing the Work of this Section with minimum of 3 years documented experience and approved by Public Authorities in the State and Jurisdiction where the project is located. Company qualified to install and alter fire protection piping, equipment, specialties, and accessories, and repair and service equipment. Company familiar with, and in compliance with, requirements of authorities having jurisdiction.
- 3. Delegated Engineer: Design fire protection system, develop working plans and shop drawings, and perform shop and site work under direct supervision of a Delegated Engineer experienced in design of this work and licensed in the State where the Project is located.



NOTE TO SPECIFIER

Use if Fire Pump IS Required

- B. If a fire pump is required, the manufacturer shall provide the services of a qualified Field Engineer to assist in the proper installation of equipment, make necessary mechanical adjustments, and align fire pump flexible coupling. Arrange, conduct and provide all required test equipment for Field Acceptance Test. Test shall be witnessed by the Public Authorities and Contracting Officer.

NOTE TO SPECIFIER

Edit standards

- C. Regulatory Requirements:
1. Perform Work in accordance with NFPA [13 , 20, 24, 70, 72, and 291].
 2. Equipment and Components: UL listed and FM approved with appropriate label or marking.
 3. Hydraulic Calculations, Product Data, Shop Drawings: Bear stamp of approval of Public Authorities.
 4. Welding Materials and Procedures: Conform to AWS D10.9.
 5. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.
 6. Comply with requirements of Public Authorities for submittals, approvals, materials, hose threads, installation, inspections, and testing.
 7. Comply with requirements of Contracting Officer and Owner's insurance underwriter for submittals, approvals, materials, installation, inspections, and testing.
 8. Provide certificate of compliance from Public Authorities indicating approval of field acceptance tests.
 9. Conform to applicable code for submission of design and calculations, reviewed shop and erection drawings and as required for acquiring permits.
 10. Cooperate with regulatory agency or authority and provide data as requested.
- D. Pre-Installation Meetings:
1. Convene a pre-installation meeting one week prior to commencing Work of this Section.
 2. Require attendance of parties directly affecting Work of this Section.
 3. Review conditions of operations, procedures and coordination with related Work.
 4. Agenda:
 - a. Tour, inspect, and discuss conditions of building and building structure.
 - b. Review fire sprinkler system design and requirements.
 - c. Review required submittals, both completed and yet to be completed.
 - d. Review fire protection system Drawings and data.
 - e. Review and finalize construction schedule related to fire sprinkler system and verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
 - f. Review required inspections, testing, certifying, and material usage accounting procedures.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.
- C. Deliver and store valves in shipping containers, with labeling in place.
- D. Provide temporary protective coating on cast iron and steel valves.



- E. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

1.8 MAINTENANCE

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Extra Products: At completion of installation, deliver to Contracting Officer.
 - 1. Provide extra sprinklers under provision of NFPA 13.
 - 2. Provide suitable wrenches for each head type.
 - 3. Provide metal storage cabinet in location designated. Cabinet to be of sufficient size to store sprinklers, wrenches, and copy of all fire protection submittal documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Ames Company, Incorporated, Woodland, CA (530) 666-2493.
 - 2. Cla-Val Company, Costa Mesa, CA, (800) 942-6326.
 - 3. Febco, Fresno, CA, (209) 252-0791.
 - 4. The Viking Corporation, Hastings, MI (800) 968-9501.
 - 5. Watts Industries, North Andover, MA (978) 688-1811.
 - 6. Wilkins Regulator Division, Zurn Industries, Incorporated, Erie, PA (814) 455-0921.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 FIRE PROTECTION PIPING - BELOW GROUND

- A. Cast Iron Pipe: Class 200, with flanged joints, ASA 21.2 or bell and spigot ASA 21.6. Cement-mortar lined, ASA 21.4.
 - 1. Fittings: Cast Iron Flanged, ASA B16.1 Class 125; bell and spigot ASA 21.10; fittings to be cement mortar lined ASA21.4.
- B. Polyvinyl Chloride (PVC) Pipe: ASTM D1784-60T, ASTM D2241-64AT. Commercial Standard CS 256-63. Designed for Maximum working pressure of 160 psi at 73 degrees F.
 - 1. Rubber ring joints: Ring Tite PVC Pipe, by Manville.
 - 2. Substitutions: Under provisions of Section 016000.
- C. Ductile Iron Pipe: Class 50
- D. Indicator Posts:
 - 1. No. A-20805, with tamper switch (double contact), by Mueller.
 - 2. Substitutions: Under provisions of Section 016000.
- E. Gate Valves: AWWA C500-59T.

2.3 FIRE PROTECTION PIPING - ABOVE GROUND



- A. Black Steel Pipe: ANSI/ASTM A53; ASTM A795; ASTM A135; ANSI B36.10M; Schedule 10 or 40 (Schedule 30 for 8 inch pipe and larger).
 - 1. Steel Fittings: ANSI/ASME B16.9, wrought steel, butt welded; ANSI/ASME B16.25, battled ends; ASTM A234, wrought carbon steel and alloy steel; ANSI/ASME B16.5, steel flanges and fittings; ANSI/ASME B16.11, forged steel socket welded and threaded.
 - 2. Cast Iron Fittings: ANSI/ASME B16.1, flanges and fittings; ANSI/ASME B16.4, screwed fittings.
 - 3. Malleable Iron Fittings: ANSI/ASME B16.3, screwed type. ANSI/ASTM A47.
 - 4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped composition sealing gasket, steel bolts, nuts, and washers; [Victaulic FlushSeal gasket required for drypipe, preaction and double interlock dry systems.]
 - 5. Fitting type to match pipe. Galvanized required for Drypipe Systems.
- B. Alternate Products: Acceptable alternatives to Schedule 10 and Schedule 40 pipe.
 - 1. "Superflow" Non-threadable Lightwall, by Allied.
 - 2. "Dyna-Flow" Non-threadable Lightwall, by American Tube.
 - 3. Schedule 5 pipe used with Victaulic "Pressfit" system.
 - 4. "Eddylite," by Bullmoose.
- C. Pipe must meet the following conditions:
 - 1. Threads: Shop cut according to applicable ANSI standards.
 - 2. Pipe Fittings: Specifically rated for use with pipe.

NOTE TO SPECIFIER

Use BACKFLOW PREVENTERS where required by local authority having jurisdiction.

2.4 BACKFLOW PREVENTER

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Ames Company, Incorporated, Woodland, CA (530) 666-2493.
 - 2. Cla-Val Company, Costa Mesa, CA, (800) 942-6326.
 - 3. Febco, Fresno, CA, (209) 252-0791.
 - 4. The Viking Corporation, Hastings, MI (800) 968-9501.
 - 5. Watts Industries, North Andover, MA (978) 688-1811.
 - 6. Wilkins Regulator Division, Zurn Industries, Incorporated, Erie, PA (814) 455-0921.
 - 7. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. ASSE standard type, size, maximum flow rate, and maximum pressure loss as indicated on Drawings. Bronze, cast-iron, steel, or stainless-steel body, corrosion-resistant interior components, FDA-approved epoxy coating for cast-iron or steel body, 150 psig working pressure.

NOTE TO SPECIFIER

OPTION 1: Use REDUCED PRESSURE BACKFLOW type when required by authority having jurisdiction

- C. Reduced-Pressure Backflow Preventer: ASSE 1013, consisting of OS&Y gate valves on inlet and outlet and strainer on inlet with test cocks and pressure-differential relief valve with ASME A 112.1.2 air gap fitting located between two positive-seating check valves.

NOTE TO SPECIFIER

OPTION 2: Use DOUBLE-CHECK BACKFLOW type when required by authority having jurisdiction.



- D. Double-Check Backflow Prevention Assemblies: ASSE 1015, consisting of shutoff valves on inlet and outlet and strainer on inlet with test cocks and two positive-seating check valves.

NOTE TO SPECIFIER

OPTION 3: Use REDUCED PRESSURE DETECTOR type when required by authority having jurisdiction.

- E. Reduced-Pressure Detector Assembly Backflow Preventer: UL 312 and ASSE 1047, consisting of OS&Y gate valves on inlet and outlet, and strainer on inlet, with pressure-differential relief valve with ASME A112.1.2 air-gap fitting between two positive-seating check valves and test cocks, and bypass with displacement-type water meter, valves, and reduced-pressure backflow preventer.

NOTE TO SPECIFIER

OPTION 4: Use DOUBLE CHECK DETECTOR type when required by authority having jurisdiction.

- F. Double-Check Detector Assembly Backflow Preventer: UL 312 and ASSE 1048, consisting of OS&Y gate valves on inlet and outlet and strainer on inlet with two positive-seating check valves and test cocks, and bypass with displacement-type water meter, valves, and double-check backflow preventer.

2.5 GATE VALVES

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Grinnell Supply Sales, Company, Grinnell Corporation.
 2. Nibco, Incorporated.
 3. Stockham Valves and Fittings, Incorporated.
 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Gate Valves (Up to and including 2 inches): Bronze body, bronze trim, rising stem, handwheel, inside screw, single wedge or disc, solder or threaded ends.
- C. Gate Valves(Over 2 inches): Iron body, bronze trim, rising stem, handwheel, OS&Y, single wedge, flanged ends.

2.6 GLOBE OR ANGLE VALVES

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Grinnell Supply Sales, Company, Grinnell Corporation, Exeter, NH (603) 778-9200.
 2. Nibco, Incorporated, Elkhart, IN (800) 642-5463.
 3. Stockham Valves and Fittings, Incorporated, Cullman, AL (800) 786-2542.
 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Up to 2 inches: Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable composition disc, solder or screwed ends, with backseating capacity.
- C. Over 2 inches: Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.



2.7 BUTTERFLY VALVES

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. Grinnell Supply Sales, Company, Grinnell Corporation, Exeter, NH (603) 778-9200.
 2. Nibco, Incorporated, Elkhart, IN (800) 642-5463.
 3. Stockham Valves and Fittings, Incorporated, Cullman, AL (800) 786-2542.
 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Cast or ductile iron body; chrome plated ductile iron disc, resilient replaceable EPDM seat; wafer, lug, or grooved ends; extended neck; handwheel and gear drive and integral indicating device; built-in tamper proof switch.

2.8 CHECK VALVES

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. Grinnell Supply Sales, Company, Grinnell Corporation, Exeter, NH (603) 778-9200.
 2. Nibco, Incorporated, Elkhart, IN (800) 642-5463.
 3. Stockham Valves and Fittings, Incorporated, Cullman, AL (800) 786-2542.
 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Up to and including 2 inches: Bronze swing disc, solder or screwed ends.
- C. Over 2 inches: Iron body, bronze trim, stainless steel spring, renewable composition disc, screwed, wafer, flanged, or grooved ends.

2.9 DRAIN VALVES

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. Grinnell Supply Sales, Company, Grinnell Corporation, Exeter, NH (603) 778-9200.
 2. Nibco, Incorporated, Elkhart, IN (800) 642-5463.
 3. Stockham Valves and Fittings, Incorporated, Cullman, AL (800) 786-2542.
 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Bronze compression stop with hose thread, nipple and cap. Use hose thread, nipple and cap only where piping to outside or other approved drainage facility is not readily available.
- C. Brass ball valve with cap and chain, 3/4 inch hose thread.
- D. Use hose thread, nipple and cap.

2.10 ALARM CHECK VALVES

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. Grinnell Supply Sales, Company, Grinnell Corporation, Exeter, NH (603) 778-9200.
 2. Viking Corporation, Hastings, MI (800) 968-9501.



3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.11 DRYPIPE VALVES

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. Grinnell Supply Sales, Company, Grinnell Corporation, Exeter, NH (603) 778-9200.
 2. The Viking Corporation, Hastings, MI (800) 968-9501.
 3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.12 MAINTENANCE AIR COMPRESSOR

- A. If applicable, Subject to compliance with requirements, provide maintenance air compressor of one of the following manufacturers:
 1. Reliable Fire Equipment Co, Mt. Vernon, NY (914) 668-3470.
 2. The Viking Corporation, Hastings, MI (800) 968-9501.
 3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. If applicable, provide electric, air cooled, tank mounted, inlet filter silencer, fly wheel, belt guard, automatic start-stop control, tank, air dryer, motor with a thermal overload protection rated for continuous operation at the rated capacity, motor control with adjustable pressure switch set to start compressor at 75 percent of the normal pressure to prevent short cycling. Provide desiccator (air dryer) between compressor and dry pipe single stage oilless compressor, equip with check valve, centrifugal pressure and moisture unloader, and pressure switch. Exact location to be approved by Public Authorities, and Contracting Officer.

2.13 SPRINKLERS

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. Gem Sprinkler Company, Division of Grinnell Corporation, Exeter, NH (603) 778-9200.
 2. Reliable Automatic Sprinkler Company, Incorporated, Mt. Vernon, NY (914) 668-3470.
 3. The Viking Corporation Hastings, MI (800) 968-9501.
 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

NOTE TO SPECIFIER

Edit Finish as Appropriate.

- B. Subject to compliance with requirements, provide automatic sprinklers, with 1/2 inch, 17/32 inch orifice; or 0.64 inch (extra large) orifice, unless noted otherwise. Sidewall sprinklers are not acceptable, unless noted otherwise.
 1. Areas With Exposed Structure Above:
 - a. Standard Sprinklers: Upright sprinkler, [____] [bronze].
 - b. Extra Large Orifice Sprinklers: [____] [bronze].
 2. Areas With Finished Ceilings, Not Visible To The Public: Pendent sprinkler, [____] [chrome], with two-piece [____] [chrome] escutcheon plate.



3. Areas With Finished Ceilings 10 Feet Above Finish Floor or Higher, Visible to the Public: Pendent sprinkler, [____] [chrome], with two-piece [____] [chrome] escutcheon plate.
4. Areas With Finished Ceilings Below 10 Feet Above Finish Floor, Visible to the Public: Pendent sprinkler, [____] [chrome], with two-piece 1/2 inch recessed [____] [chrome] escutcheon plate.

2.14 SLEEVES AND ESCUTCHEONS

- A. Sleeves through structural concrete members and sleeves for walls below grade and floors on grade shall be standard weight galvanized Schedule 40 steel pipe. Sleeves through other than structural components of the building shall be 20 gage galvanized sheet metal with lock seam joints. Sleeve shall extend two inches past finished surface. USG Thermafiber safing insulation shall be installed between sleeve and pipe.
- B. Pipe escutcheon plates to be installed where exposed piping passes through walls, ceilings, and floors of building shall be minimum 20 gage steel, [____] [chrome].

2.15 ACCESSORIES

- A. Hangers and Supports: Provide hangers and supports as required by NFPA 13 and Public Authorities. Provide seismic bracing in accordance with NFPA 13, as required by state and local codes, and Public Authorities.
- B. Flushing Connections: Provide threaded, capped nipple or mechanical groove end cap on ends of cross mains. If nipple provided, diameter shall be same as pipe, but not larger than 2 inches.
- C. Auxiliary Drains:
 1. 5 gallons or greater: provide minimum 1 inch globe valve with hose adapter and cap.
 2. Less than 5 gallons: provide minimum 1 inch nipple and cap.
 3. All auxiliary drain facilities shall be placed to allow easy access.
- D. If piping or components of Inspector's test connection are modified as a result of this Work, then provide as required by Contractor.
- E. If inspector test valve and auxiliary drain valve are piped together then test drain assembly shall be an approved manufactured assembled unit. Subject to compliance with requirements, provide valves of one of the following manufacturers:
 1. "Test Master", by Victaulic, Easton, PA (610) 559-3300.
 2. Central Sprinkler Corp., Lansdale, PA (800) 523-6512.
 3. Globe Fire Sprinkler Corp., Standish, MI (800) 248-0278.
 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

NOTE TO SPECIFIER

Option 1 - Use if Local Alarm is Water Motor Alarm Gong.

- F. Water Motor Alarm Gong: Provide water-operated alarm gong on exterior of building adjacent to sprinkler system riser. Electric alarm bell (gong) not permitted.

NOTE TO SPECIFIER

Option 2 - Use if Local Alarm is Electric Bell. Edit Location.



- G. Electric Bell: Provide 10 inch diameter electric bell on exterior of building [adjacent to sprinkler system riser] [locate as indicated on drawings] [locate as required by Public Authorities].

NOTE TO SPECIFIER

Option 3 - Use if Local Alarm is Horn. Edit Location.

- H. Horn and Strobe: Provide horn and strobe on exterior of building [adjacent to sprinkler system riser] [locate as indicated on drawings] [locate as required by Public Authorities].
- I. Wet Sprinkler System Water Flow Detectors: Equip sprinkler system risers with double pole vane type flow detector, Model No. VSR-F, by Potter Electric Signal of St. Louis, Missouri, (800) 325-3936. Set adjustable delayed signal at 30 seconds. Connect to alarm system.
1. Substitutions: Under provisions of Section 016000.

NOTE TO SPECIFIER

Use if Dry Pipe System Required

- J. Dry Sprinkler System Water Flow Detector: Equip Dry System risers with pressure activated flow detector by Potter Electric Signal of St. Louis, Missouri, (800) 325-3936. Connect to alarm system.
1. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- K. Control Valve Supervisory Switches:
1. Equip post indicator valves with tamper switches, Model No. PCVS, as manufactured by Potter Electric Signal of St. Louis, Missouri. Connect to alarm system.
2. Equip outside screw and yoke valves with tamper switches, Model No. OSYSU-A2 as manufactured by Potter Electric Signal of St. Louis, Missouri. Connect to alarm system.
3. All valves capable of controlling water supply shall have tamper switches. Connect to alarm system.
4. If control valve is located remote from store building, provide 3/4 inch conduit, with pull string, from remote location to nearest electrical room.
5. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- L. Fire Department Connections: Fire Department connections in accordance with NFPA 13 and Public Authorities. Equip with threads/connections compatible with hoses utilized by the local fire department.
1. Drain: 3/4 inch automatic drip, piped to approved drainage location.
2. Label: "Auto Sprinkler".
3. Finish: Red enamel.

NOTE TO SPECIFIER

Edit Thread Type Based on Project/Public Authority Requirements.

4. Thread/Connection: [NST] [Storz] [____], verify with Public Authorities.
- M. Wire Cage Sprinkler Guards: Fig. 6160, by Potter-Roemer or acceptable substitute.
1. Provide sprinkler guards on sprinkler pendants that are located below 8 feet above finished floor, except at semi-recessed sprinklers.
- N. Relief Valves: For gridded sprinkler systems, provide a relief valve not less than 1/4 inch size and set to operate at 175 psi or 10 psi in excess of the maximum system pressure, whichever is greater. Location of relief valves to be in accordance with NFPA 13.

NOTE TO SPECIFIER



Use if Fire Hose Cabinets or Racks are Required

O. Fire Hose Connection:

1. Provide [1 1/2] [2 1/2] [____] inch hose stations throughout [Building] as indicated [Contract Documents].
2. Provide each hose station with:
 - a. Valve: UL 668, 300 psig (2070 kpa) rated, brass, non-adjustable type, 90 degree angle pattern, female NPS inlet and male hose outlet. Size [1 1/2] [2 1/2] [____] inches. Hose valve threads in accordance with NFPA 1963 and match local fire department threads.
 - b. Hose: 300 lb. test, 100 percent polyester jacket and synthetic rubber lining. Size [1 1/2] [2 1/2] [____] inch. Length [75] [100] [____] feet. [____] [2 1/2 inch by 1 1/2 inch reducer.]
 - c. Nozzle: UL 401, [brass] [polycarbonate plastic] adjustable from shutoff to fog spray to straight stream.

NOTE TO SPECIFIER

Use if PSI exceeds 175.

- d. Valve: UL 1468, 400 psig (2760 kpa) rated, brass, pressure-regulating type, 90 degree angle pattern, female NPS inlet and male hose outlet. Design in accordance with NFPA 1963 and match local fire department threads.

NOTE TO SPECIFIER

Use if Fire Pump required.

2.16 FIRE PUMP MANUFACTURERS

- A. Subject to compliance with requirements, provide pumps of one of the following manufacturers:
1. Aurora Pump, North Aurora, IL (800) 316-7720.
 2. Fairbanks Morse Pumps, Kansas City, KS (913) 371-5000.
 3. ITT A-C Pump, Cincinnati, OH.
 4. Peerless Pump, Indianapolis, IN (317) 925-9661.
 5. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

NOTE TO SPECIFIER

Use if Fire Pump required.

2.17 HORIZONTAL BASE MOUNTED PUMPS

- A. Type: UL listed and [or] FM approved. Conform to UL 448, horizontal shaft, double suction, direct connected, horizontally split case, for 250 psig maximum working pressure, labeled specifically "FOR FIRE SERVICE".
- B. Casing: Cast iron, with suction and discharge gage ports, renewable bronze casing wearing rings, seal flush connection, drain plug, suction and discharge flange machined to ASME B16-1 dimensions, 250 psi pressure rating.
- C. Impeller: Bronze double suction fully enclosed, statically and dynamically balanced and keyed directly to motorshaft.
- D. Bearings: Grease lubricated ball bearings.



- E. Shaft: Alloy steel with replaceable bronze shaft sleeve.
- F. Seals: Packing gland with minimum four rings graphite impregnated packing and Teflon antern rings, 230 degrees F (110 degrees C) maximum continuous operating temperature.
- G. Drive: Flexible coupling with metal coupling guard.
- H. Base plate: Cast iron or fabricated steel with integral drain rim, provide 3/4 inch threaded outlet for drain
- I. Pump manufacturer shall have unit responsibility for proper operation of the complete unit, and provide services of a factory trained technician to supervise installation, and to attend final field acceptance tests.
- J. Each pump shall be hydrostatically and run tested at the factory before shipment.

NOTE TO SPECIFIER

Use if Fire Pump required.

2.18 FIRE PUMP ACCESSORIES

- A. Eccentric suction reducer and OS&Y valve on suction side of pump.
- B. Concentric increaser and check valve in pump discharge and butterfly valve on system side of check valve.
- C. Suction pressure gage (compound type), with snubber, valve cock and lever handle.
- D. Discharge pressure gage, with snubber, valve cock and lever handle.
- E. Casing 3/4 inch relief valve minimum.
- F. Float operated 1 inch automatic air release valve.
- G. Hose valve manifold with 2 1/2 inch hose gate valves with caps and chains. Size per NFPA 20.

NOTE TO SPECIFIER

Use if the facility is equipped with emergency power generator and fire Pump Bypass is required for electric drive engine.

- H. Fire pump bypass on electric pump fitted with butterfly valves and check valve.

NOTE TO SPECIFIER

Use if Fire Pump IS Required and the facility is equipped with emergency power generator and electric drive pump is used.

2.19 ELECTRIC MOTOR DRIVER

- A. Motor: Squirrel cage induction type; in open drip proof NEMA MG-1 enclosure.



B. Power: 480 volt, three phase, 60 Hz.

NOTE TO SPECIFIER

Use if Fire Pump required.

2.20 FIRE PUMP CONTROLLER

A. Subject to compliance with requirements, provide fire pump controller of one of the following manufacturers:

1. Firetrol, Inc., Cary, NC (919) 460-5200.
2. Master Control, Lake Bluff, IL (847) 295-1010.
3. Metron, Inc., Denver, CO (303) 592-1903.
4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

NOTE TO SPECIFIER

Use if Fire Pump required. Edit Values

B. Controller: UL listed and [or] FM approved for fire pump service with across-the-line starter, in NEMA 4 enclosure, including the following:

1. Disconnect Switch: Externally operable, quick break type.
2. Circuit Breaker: Trips in each phase calibrated at least to 300 percent of the motor full-load current, interrupting capacity shall be equal to or exceed maximum fault current at site, but shall in no case be less than [____] [150,000] amps RMS symmetrical at 480 VAC.
3. Motor Starter: Energized automatically through pressure switch or manually by externally operable handle.
4. Pressure Switch: Bourdon Tube Type with adjustable independent high and low set points and a range of 10 psi to 300 psi.
5. Running Period Timer: Keeps motor in operation when started automatically, for a minimum of 10 minutes.
6. Ammeter test link and voltmeter test studs.
7. Remote start switch relay.
8. Manual Selector Station: On enclosure marked "Automatic" and "Non-Automatic."
9. Normally open dry contacts for remote indication of all tamper switches (common), circuit breaker open, low pump house temperature (below 45° F), power available, low pressure, local start, remote start, phase failure, phase reversal, pump running, run timer on, and all signals required by NFPA 20.
10. Weekly Test Start: Provide ability to set day of week, time of day and running timer for the test period (0 to 30 minutes).
11. Supervised control circuit which automatically starts pump upon failure of control power transformer or control relays.
12. Externally mounted visible indicators for power available, low pump house temperature, low pressure, local start, remote start, phase failure, phase reversal, pump running and run timer on.
13. Automatic shut-off timer set for 10 minutes, to operate only after starting causes return to normal.
14. Front mounted, front wired, and front accessible controller components, including circuit breaker and contactors.
15. Grounding lug and bonding provisions.

**NOTE TO SPECIFIER***Use if Fire Pump required.*

2.21 PRESSURE BOOSTER (JOCKEY) PUMPS

- A. Subject to compliance with requirements, provide pressure booster (jockey) pump of one of the following manufacturers:
1. Aurora Pump, North Aurora, IL (800) 316-7720.
 2. Grundfos Pump, Clovis, CA (209) 292-8000.
 3. Peerless Pump, Indianapolis, IN (317) 925-9661.
 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

NOTE TO SPECIFIER*Use if Fire Pump required. Edit Values*

- B. Power: [480] [208] volt, three phase, 60 Hz.
- C. Type: Electrically operated, vertical multi-stage type with standard open drip-proof motor, factory assembled and factory tested.
- D. Casing: Cast iron, with suction and discharge connections of size indicated. threaded, or flanged and machined to ASME B16.1 dimensions, and 250 psig minimum pressure rating.
- E. Impeller: Bronze or stainless steel.
- F. Shaft: Stainless steel.
- G. Seals: Mechanical.
- H. Controller: Enclosed in floor mounted NEMA 4 steel housing, UL listed and labeled. Factory assembled, wired, and tested, with full voltage starter. Provide separate controller for jockey pump, with magnetic contactor, fusible disconnect switch, pressure switch and minimum run period timer.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
1. Examine areas in which Work of this Section is to be performed.
 2. Verify that surfaces and site conditions are ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.



3.2 PREPARATION

- A. Coordinate work of this Section with other affected work [and construction schedule].
- B. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- C. Remove scale and foreign material, from inside and outside, before assembly.
- D. Prepare piping connections to equipment with flanges or unions.
- E. Install system and equipment in accordance with manufacturers instructions, and NFPA Standards.

3.3 INSTALLATION - BELOW GROUND PIPING

- A. Install piping and system components in accordance with NFPA 24. Verify that main feed from water supply source to building is as specified.
- B. Support barrel of pipe for entire length on compacted pipe bedding. Excavate for couplings, fittings and valves.
- C. Lay pipe to lines and grades as required.
- D. Keep interior of pipe free from dirt and other foreign material as installation progresses. Plug open ends when work is stopped. Join lengths with couplings in accordance with pipe manufacturer's instructions. Join to fittings and valves that have rubber ring bells with same groove dimensions and tolerance as pipe.
- E. Provide valves and fittings as necessary.
- F. Install concrete thrust blocks as required. Place concrete between undisturbed soil with fittings anchored. Do not cover coupling flanges or other joints with concrete.

3.4 INSTALLATION - ABOVE GROUND PIPING

- A. Install piping in accordance with NFPA 13. Install sprinkler piping products in accordance with recognized industry practices to ensure that fire protection sprinkler piping complies with requirements and serves intended purposes.
- B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient. Use eccentric reducers to maintain top of pipe level. Slope piping and arrange systems to drain. Size drain piping as required to drain sprinkler system properly. Provide drain valves at main shut-off valves and low points of piping.

NOTE TO SPECIFIER

Use if Subject to Freezing

- 1. Pitch piping as required in Drypipe systems. If applicable:
 - a. Drypipe Branchlines: Slope 1/2 inch for every 10 feet.
 - b. Drypipe Mains: Slope 1/4 inch for every 10 feet.
- C. Install piping to conserve building space. Do not interfere with use of building space and other work.
- D. Group piping whenever practical at common elevations.



- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. All system components shall be concealed above ceilings where ceilings exist.
- G. Replace sprinklers having paint other than factory finish with new sprinklers. Cleaning and reuse of painted sprinklers is prohibited.
- H. Do not penetrate building structural members. Examine other work indicated on the Contract Documents and conditions at job site. Coordinate routing of work with other construction trades to avoid interference with other installations. Do not cut building structural members, beams, joists, etc. for routing of sprinkler piping. In the event of conflicts, consult Contracting Officer, and their decision shall govern.
- I. Provide sleeves when penetrating floors and walls. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required. Provide wall plates at all penetrations.
- J. Die cut screw joints with full cut standard taper pipe threads with non-toxic joint compound applied to male threads only. Recoat threads on galvanized pipe with galvanized coating.
- K. Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.
- L. Route piping and locate sprinklers as required to avoid building structure equipment, plumbing piping, heating and air conditioning piping, ductwork, lighting fixtures, electrical conduits and bus ducts, and similar work.
 - 1. Final location of lighting will have priority over final sprinkler locations.
- M. Provide pipe offsets as required to complete installation. Modify shop prefabricated piping, pipe hangers, and other components as required to fit the job site conditions.
- N. Shop drill and weld weld-o-lets on piping.
- O. Conceal piping in chases, walls, furred spaces and above ceiling in areas with dropped ceilings.
- P. If piping or components of Inspector's Test Connection are modified as a result of this Work, then:
 - 1. Provide one inspector's test valve for each system at the most remote point of the system along the exterior wall, piped to non-public areas.
 - 2. Install inspector's test valves at five feet (minimum) to seven feet (maximum) above finish floor to facilitate bi-monthly tests.
 - 3. Coordinate test valve locations with Contracting Officer.
 - 4. Test connection shall discharge at location approved by Contracting Officer.
 - 5. Outlet shall have same orifice as sprinklers.
- Q. Piping shall maintain clearance from electrical equipment as required by NEC and Public Authorities. Drains and Inspector's test connection shall not be piped into or through electrical rooms/areas.
- R. Sprinkler piping that passes through unheated spaces in or under structures and are exposed to freezing shall be protected from freezing as indicated or in accordance with applicable methods in NFPA 13.
- S. Provide valves as required to comply with NFPA Standards and requirements of Public Authorities. Provide backflow prevention devices, check valves, and drains where required by Public Authorities.
- T. Make reductions in pipe sizes with one-piece reducing fittings. Bushings are not acceptable. Use flanged fittings at base of risers.



- U. Contractor shall notify Contracting Officer one week prior to any sprinkler system shutdown or work performed.

NOTE TO SPECIFIER

Use if System components are to be painted

- V. All system components (i.e. pipe, fittings, supports, and accessories), except sprinklers, not concealed shall be prepared for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding. Apply masking tape or paper cover to ensure sprinkler do not receive field paint finish. Remove tape or paper after painting.

NOTE TO SPECIFIER

Use if Subject to Freezing

- W. Locate sprinklers in suspended ceiling tiles along the centerline of the two foot dimension, and at one foot increments from the edge in the four foot dimension direction. Provide piping offsets as necessary to locate sprinklers.
- X. Dry Pendent Sprinklers: Install concealed above ceilings where ceilings are used.
- Y. Anti-freeze Systems (where required): Install "Loop", concealed, above ceilings where ceilings are used, or as required by Public Authorities, and Contracting Officer.
- Z. If applicable, install maintenance air compressor adjacent to dry pipe riser. Connect 1/4 inch compressor outlet with the 1/4 inch pipe through a shutoff valve to the system side of drypipe valve. Adjust pressure switch to the required setting.
- AA. Locate wet pipe (and dry pipe if required) inspector test valves and associated sight glasses at remote ends of system, in accessible locations. Provide drain pipes as required by Contracting Officer.

NOTE TO SPECIFIER

Use if Fire Pump required.

3.5 FIRE PUMP

- A. Provide direct feed power supply to fire pump controller from power source with no fuses or breakers in the circuit. See Section 260500 – Common Work Results for Electrical for electrical diagram submittal requirements.
- B. Provide access space around pumps for service. Provide no less than minimum as recommended by manufacturer.
- C. Support piping adjacent to pump such that no weight is carried on pump casings. For base mounted pumps, provide supports under elbows on pump suction and discharge.
- D. Provide drains for bases and seals, piped to and discharging into floor drains.
- E. Mount unit on vibration isolators.



- F. Provide for connection to electrical service.
- G. Lubricate pumps before start-up.
- H. Check, align, and certify base mounted pumps by qualified millwright prior to start-up.

NOTE TO SPECIFIER

Use if the facility is equipped with emergency power generator and electric drive pump is used.

- I. Electric Fire Pump System:
 - 1. Suction pipe, valve, and fittings.
 - 2. Discharge pipe, valve and fittings.
 - 3. Bypass pipe, valves and fitting.
 - 4. Jockey pump suction and discharge pipe, valves and fittings.
 - 5. Controllers mounted, pipe and wired.
 - 6. Gland drip pockets piped to common drain for skid.
 - 7. Gauges and air release valve installed.
 - 8. Structural steel skid with checkered steel floor plate.
 - 9. Piping, equipment and structural skid painted red.
 - 10. Provide testing and operation instructions on laminated/weather protected wall mounted sign. Submit example to of Record for approval prior to installation.
- J. Locate Fire Department connection on discharge side of pump.
- K. Locate controller as close to motor as practical and within sight. Provide controller with suitable protection as necessary to protect against water escaping from pump or connections. Elevate controller minimum of 12 inches above finished floor.

3.6 PROTECTION OF WORK

- A. Protect work from danger of freezing, breakage, dirt, foreign materials, etc., and replace work so damaged. Use every precaution to protect work of others.

3.7 IDENTIFICATION

- A. Apply signs to control, drain, test and alarm valves, etc., to identify their purposes and functions. Provide lettering sizes and styles selected by Contracting Officer from NFPA's suggested styles.
- B. Stencil riser/zone numbers on risers.
- C. Provide hydraulic placard for each sprinkler system in accordance with NFPA 13.

3.8 CLEANING AND FLUSHING

- A. Prior to connecting overhead system piping to underground supply system piping, flush underground supply system piping per NFPA 13 and 24.

3.9 FIELD QUALITY CONTROL



- A. Section 014000 - Quality Requirements: Procedures for field inspection and testing of installation.
- B. Site Tests - Leaks from System:
1. Contractor shall identify to Contracting Officer any leaks or damage that occur within the system as a result of testing. Contractor shall take necessary precautions to limit any potential damage. Corrective action shall be performed at Contractors expense.
- C. Site Tests - Above Ground Fire Protection Piping:
1. Test system pressure piping for leakage as required by and in presence of Public Authorities, and Contracting Officer Test to consist of holding the test pressure at the high end for a period of two hours. Test pressure: 200 psi or 50 psi over normal operating pressure, whichever is greater. Conduct test in accordance with NFPA 13. Send completed copy of the material and test certificate to Contracting Officer.
 2. All required tests shall be witnessed by Public Authorities, and Contracting Officer.
 3. Inspection of welds, and/or verification of welder's qualifications may be required by Public Authorities. Contractor shall comply with all requirements of Public Authorities, including but not limited to :
 - a. Provide written documentation of welders qualifications and certification.
 - b. Stamp imprint of welders identification adjacent to all welds.
 - c. Provide provisions for, schedule and conduct inspection of all welds . Inspection shall be scheduled at project site, with pipe at grade level, prior to installation.
- D. Site Tests - Under Ground Fire Protection Piping:
1. Test pressure piping for leakage in presence of Public Authorities and Contracting Officer. Test to consist of holding the test pressure in each section of line tested for a period of two hours. Test pressure at the high end of each test section shall be 200 psi or 50 psi over normal operating pressure whichever is greater. Conduct test in accordance with NFPA 24.
 2. Flush underground mains and lead-in connections thoroughly before connection is made to above ground system piping to remove foreign material. Minimum flow rate shall not be less than the maximum water flow demand rate of the system and not less than necessary to provide a velocity of 10 feet per second. Continue flushing for sufficient time to ensure thorough cleaning. Provide proper disposal of water from flushing operation.
 3. All required tests shall be witnessed by Public Authorities, and Contracting Officer.
 4. Contractor shall identify to Contracting Officer any leaks or damage that occur within the system as a result of testing. Contractor shall take necessary precautions to limit any potential damage. Corrective action shall be performed at Contractors expense

NOTE TO SPECIFIER

Use if Fire Pump required.

- E. Site Tests - Fire Pump:
1. Test pump in accordance with NFPA 20. Send completed copy of the material and test certificate to Public Authorities, and Contracting Officer.
 2. Contractor shall be responsible for providing all personnel and equipment necessary for complete start up and acceptance testing purposes. Minimum equipment required:
 - a. Three (3) 50 feet sections of 2 1/2 inch 300 pound test rubber lined with 100 percent polyester jacket, equivalent to Potter Roemer Fig. 2902. Provide with Double Lug Couplings, equivalent to Potter Roemer Fig. 2936.
 - b. Three (3) Underwriters Play Pipes with swivel handle and marlin wound brass pipe. Provide each with 1 3/4 inch tip orifice, equivalent to Potter Roemer Fig. 2949
 - c. One (1) Pitot tube equipped with calibrated bourdon tube gauge, with storage case. Provide each with flow rate computation table, equivalent to Potter Roemer.
 3. Notify Public Authorities, and Contracting Officer two weeks prior to any fire pump acceptance test so a representative may witness testing.



4. Factory Test: All equipment will be factory tested in accordance with the requirements of NFPA, U.L. and FM.
5. Start-Up Service: The service of a factory trained representative for the controllers, and pumps shall be available on the job site to check installation, conduct field acceptance testing, conduct start-up, and instruct personnel.
- F. All required tests shall be witnessed by Public Authorities, and Contracting Officer.

USPS CSF Specifications issued: 10/1/2013
Last revised: 5/11/11

END OF SECTION



SECTION 21 00 00 00 - MPF FIRE SUPPRESSION

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. THIS SECTION IS A "PERFORMANCE" SPECIFICATION. The Section describes the design requirements for the Fire Alarm System. The Fire Alarm Contractor will design the system and prepare detailed Fire Alarm Drawings to be used for the installation of the Fire Alarm System.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.21 00 00 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire Protection Basic Materials and Methods:
 - a. Hangers and Supports.
 - b. Pipe and Fittings.
 - c. Piping Specialties.
 - d. Valves.
2. Wet-Pipe Fire Suppression Sprinklers:
 - a. System design, installation, and certification.
 - b. Fire department connections.

NOTE TO SPECIFIER

Include if Dry Pipe System Required.

3. Dry-Pipe Fire Suppression Sprinklers:
 - a. System design, installation, and certification.
 - b. Fire department connections.

NOTE TO SPECIFIER

Include if Fire Pump Required. Edit Type of Driver (Motor or Engine). Use electric drive pump when the facility is equipped with emergency power generator.

4. Fire Pumps:
 - a. Fire pump package.
 - b. Fire pump [motor.] [engine.]
 - c. Electric jockey pump.
 - d. Controllers.

- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

C. Related Sections:

1. Section 312300 - Excavation and Fill: Earthwork for utilities.
2. Section 331100 - Water Utility Distribution Piping: Fire protection water system.
3. Section 283100 - Fire Detection and Alarm: Interconnection of systems.



1.2 REFERENCES

- A. American National Standards Institute (ANSI):
1. ANSI B 16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, and 250.
 2. ANSI B 16.3 - Malleable-Iron Threaded Fittings, Class 150 and 300.
 3. ANSI B 16.4 - Gray Iron Threaded Fittings.
 4. ANSI A 21.10 - Ductile Iron and Gray Iron Fittings, 2 in. through 48 in., for Water and Other Liquids.
 5. ANSI A 21.51 - Ductile-Iron Pipe, Centrifugally Cast.
- B. American Society of Mechanical Engineers (ASME):
1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
 2. ASME B16.3 - Malleable Iron Threaded Fittings.
 3. ASME B16.4 - Gray Iron Threaded Fittings.
 4. ASME B16.5 - Pipe Flanges and Flanged Fittings.
 5. ASME B16.9 - Factory-made Wrought Steel Butt welding Fittings.
 6. ASME B16.25 - Butt welding Ends.
 7. ASME Sec 9 - Welding and Brazing Qualifications.

NOTE TO SPECIFIER

Use ASSE when backflow preventers are required.

- C. American Society of Sanitary Engineering (ASSE);
1. ASSE 1047 - Reduced Pressure Detector Assembly Backflow Preventer.
 2. ASSE 1048 - Double Check Detector Assembly Backflow Preventer.
 - 3.
- D. American Society for Testing and Materials (ASTM):
1. ASTM A 53 - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 2. ASTM A 47 - Specification for Malleable Iron Castings.
 3. ASTM A 135 - Specification for Electric-Resistance-Welded Steel Pipe.
 4. ASTM A 234 - Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
 5. ASTM A 795 - Specification for Black and Hot-dipped Zinc-coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.

- E. Factory Mutual (FM):

NOTE TO SPECIFIER

Edit editions— FM Data Sheet 2-8N will be replaced by Data Sheet 2-0 later in 2009, edit accordingly.

1. FM - Approval Guide, [2002] [] Edition.
2. FM Data Sheet 2-8N, [2002] [] Edition.

- F. National Fire Protection Association (NFPA):

NOTE TO SPECIFIER

Edit editions

1. NFPA 13, [2007] [] Edition - Installation of Sprinkler Systems.

NOTE TO SPECIFIER

Use if Fire Pump Required

2. NFPA 20, [2007] [] Edition - Standard for the Installation of Stationary Pumps for Fire Protection.



3. NFPA 24, [2007] [____] Edition – Standard for the Installation of Private Fire Service Mains and Their Appurtenances
4. NFPA 70, [2008] [____] Edition - National Electrical Code.
5. NFPA 72, [2007] [____] Edition - National Fire Alarm Code.
6. NFPA 291, [2007] [____] Edition – Recommended Practice for Fire Flow Testing and Marking of Hydrants.

G. Underwriters Laboratories, Inc.(UL):

NOTE TO SPECIFIER

Edit Edition

1. UL Fire Directory B, Product Directory - Fire Protection Equipment Directory, [2009] [____] Edition.
2. UL 193 - Alarm Valves for Fire Protection Service.
3. UL 199 - Automatic Sprinklers for Fire Protection Service.
4. UL 346 - Water Flow Indicators for Fire Protective Signaling Systems.
5. UL 405 - Standard for Fire Department Connections.
6. UL 753 - Alarm Accessories for Automatic Water Supply Control Valves for Fire Protection Service.

NOTE TO SPECIFIER

Use if hose cabinets or racks are required

7. UL 668 - Hose Valves for Fire Protection Services.

NOTE TO SPECIFIER

Use if Fire Pump Required

8. UL 448 - Pumps for Fire Protection Service.

NOTE TO SPECIFIER

Use if Fire Pump Required. Do not use if the facility is equipped with emergency power generator and electric motor is used in instead of diesel engine.

9. UL 1247 - Diesel Engines for Driving Centrifugal Fire Pumps.
10. UL 1468 - Direct-Acting Pressure Reducing and Pressure-Control Valves for Fire Protection Service.
11. UL 1478 - Fire Pump Relief Valves.

1.3 DEFINITIONS

- A. Authority Having Jurisdiction: See Public Authorities.
- B. Delegated Engineer: A Professional Engineer Registered in the State where the project is located who undertakes final design of the fire protection system.
- C. Owner: Any designated representative of the Owner.
- D. Professional of Record: Architect or Engineer of Record indicated on the Contract Documents.
- E. Public Authorities: Local, State or Federal government body having jurisdiction over any portion of the project. This includes, but is not limited to: building departments, Fire Departments, Fire Marshals Offices, Water Departments, Insurance Regulatory Boards, Utility Companies or Districts, Cross Connection Control Departments, Transportation Departments, etc.



1.4 SYSTEM DESCRIPTION

A. Design Requirements:

1. System to provide coverage for entire building.

NOTE TO SPECIFIER

Use for Ordinary Hazard Group 2 Locations

2. Retail Areas, Canopies, Workroom and General Storage areas.
 - a. Density: 0.20 gpm/ft² for most hydraulically remote 1500 ft², with 250 gpm hose stream allowance. If Area is less than 1500 ft², calculate at 0.20 gpm/ft² for entire area with 250 gpm hose stream allowance.
 - b. Sprinkler Temperature Rating: Ordinary. High in combustible concealed spaces or near heat producing equipment.
 - c. Spacing: 130 ft² per sprinkler maximum.
 - d. Occupancy: Mercantile, Ordinary Hazard Group 2 per NFPA 13.

NOTE TO SPECIFIER

Use for Light Hazard Locations

3. Office Areas and Restrooms
 - a. Density: 0.10 gpm/ft² for most hydraulically remote 1500 ft², with 100 gpm hose stream allowance. If area is less than 1500 ft², calculate at 0.10 gpm/ft² for entire area with 100 gpm hose stream allowance.
 - b. Sprinkler Temperature Rating: Ordinary. High near heat producing equipment.
 - c. Spacing: 225 ft² per sprinkler maximum, 15 feet spacing maximum.
 - d. Occupancy: Light Hazard per NFPA 13.

NOTE TO SPECIFIER

Use for Locations with Combustible Concealed Spaces

4. Combustible Concealed Spaces
 - a. Density: 0.10 gpm/ft² for most hydraulically remote 1500 ft², with 100 gpm hose stream allowance. If area is less than 1500 ft², calculate at 0.10 gpm/ft² for entire area with 100 gpm hose stream allowance.
 - b. Sprinkler Temperature rating: Intermediate. High near heat producing equipment.
 - c. Spacing: 130 ft² per sprinkler maximum, 15 feet spacing maximum.
 - d. Occupancy: Light Hazard per NFPA 13.

NOTE TO SPECIFIER

Use if water flow test data is known, verified and is to be the "Design Basis Fact".

5. Design sprinkler systems using the following [water] [fire pump] supply: [____] psi [static] [churn], [____] psi residual flowing [____] gpm [, and [____] psi residual flowing [____] gpm]. This test effective at [hydrant located] [____] and provided by [____].

NOTE TO SPECIFIER

Use if Delegated Engineer is required to perform water flow.

6. The Delegated Engineer shall perform a water flow test to determine the available water supply for fire protection system design. The following parameters shall be followed in conducting the water flow test:
 - a. Conduct flow test in accordance with NFPA 291. Coordinate flow tests validity with Public Authorities and Contracting Officer.



- b. Contact the Public Authorities before conducting the flow test. Public Authority appointed representative must be present during the flow test.
- c. Conduct a water flow pressure test as close to the proposed location as practical. The water flow pressure test shall consist of three separate pressure tests conducted at the same location. The first water flow pressure test shall be conducted at zero flow (initial static condition). The second water flow pressure test shall be conducted flowing at or more than [] [700] gpm (residual condition). The final water flow pressure test (final static condition) shall be conducted immediately following the second at zero flow, to determine if pumps or other pressure/flow modifying devices may have been engaged. Conduct test during peak hour demand conditions. If test can not be conducted during peak hour, adjust results to peak hour demand.

NOTE TO SPECIFIER

Edit Safety Factor Values Based on project/Public Authority Requirements

7. Safety Factor: 10 percent of static and residual PSI.
8. Hydraulic calculation areas of application shall be based on actual floor area protected by sprinklers. Use 1.2 multiplied by the square root of the area for design criteria.

NOTE TO SPECIFIER

Use if Dry Pipe System Required

9. Hydraulic calculations for all dry pipe system piping shall be based on a C Value of 100.

NOTE TO SPECIFIER

Use if Hose Cabinets or Racks are Required

10. Install 1-1/2 inch Fire Department hose valves and racks with 100 feet of hose. Locate as [indicated on Drawings and as] required by Public Authorities. Final location and quantity subject to approval of Contracting Officer and Public Authorities.
11. System control valve shall be a post indicating valve located a minimum of 40 feet from building.

NOTE TO SPECIFIER

Use if Fire Pump is NOT Required

12. Entire hose allowance (gpm) shall be included in hydraulic calculations at the connection to the city water main or a yard hydrant, whichever is closer to the system riser. [If inside hose cabinets, racks, or connections are required then include 100 gpm of the total hose allowance at point of connection of hose system piping to automatic fire sprinkler system piping.]

NOTE TO SPECIFIER

Use if Fire Pump IS Required

13. Entire hose allowance (gpm) required in schedule shall be included in hydraulic calculations at pump discharge flange. [If inside hose cabinets, racks, or connections are required then include 100 gpm of the total hose allowance at point of connection of hose system piping to automatic fire sprinkler system piping.]

- B. Scope of Work: Design, fabrication and installation of Fire Protection System Including the Following:
 1. Complete fire protection system as outlined in these Contract Documents, including all labor, materials, shop drawings and hydraulic needed to furnish and install a complete and functional fire protection system. System shall comply with NFPA 13, Public Authorities, Contracting Officer and Contract Documents.
 2. Visit site to determine conditions and extent of work.
 3. Coordination of work with Contract Documents and all trades, including building design loads.
 4. The work under this section shall yield to all other trades.
 5. Warranty on new materials and labor.



6. Provide all necessary permits, taxes and fees, including Public Authorities inspection and testing fees necessary to complete the specified work.
7. Provide any required core drilling of walls, and required UL listed, non-combustible firestopping materials at all new sprinkler piping penetrations. Patch as required. New piping penetrations shall be adequately firestopped to maintain the fire resistance rating required.
8. Access panels for service and access to valves in enclosed ceiling and walls.
9. Provide coordination and interface of alarm initiating and supervisory devices with the fire alarm system.
10. The fire protection piping and sprinkler layout shall function in such a manner so as not to interfere with lighting fixtures, air distribution devices, equipment, piping, beams, and ductwork. The work under this section shall yield to all other trades.
11. Furnish, install and adjust as necessary all waterflow and valve supervisory switches.
12. Fire protection systems complete with supervised control valves, inspector's test and main drain assemblies, vane type waterflow alarm switches, pressure gauge, main drain, auxiliary drains, and local alarm devices.
13. Provide required signs at all new control valves, main drains, auxiliary drains and inspector's test connections, hydraulic placards, etc.
14. System testing.
15. Underground pipe modifications, including all necessary fittings, clamps, thrust blocking, backflow preventers, excavating and backfilling, etc.
16. Fire department connection with check valve and ball drip, including interconnecting supply piping to sprinkler riser.
17. If sprinkler system in any area is subject to freezing, then use non-freeze system (dry or anti-freeze).
18. Drawings must indicate specific method of freeze protection for all areas.

NOTE TO SPECIFIER

Use if Fire Pump IS Required. Use electric drive pump when the facility is equipped with emergency power generator.

19. If necessary, Contractor shall furnish and install one UL Listed and [or] FM Approved [electric motor] [diesel engine] driven horizontal split case fire pump. Each unit shall include a pump, base, coupling, coupling guard, necessary fittings and an automatic controller.

NOTE TO SPECIFIER

Use if Fire Pump IS Required. Edit Values. Use electric drive pump when the facility is equipped with emergency power generator.

20. The fire pump shall be rated at:
 - a. Pump Capacity: [1000] [] gpm at [219] [] feet head, [95] [] psi.
 - b. The net pump shutoff (churn) pressure plus the maximum static suction pressure, adjusted for elevation, shall not exceed the pressure for which the system components are rated.
 - c. Maximum permissible pump speed shall not exceed [2100] [] rpm.
 - d. Maximum permissible [engine] [motor] speed shall not exceed [2100] [] rpm.
 - e. Maximum permissible [engine] [motor] horse power shall not exceed [75] [] hp.
 - f. Static suction pressure available: [] psi maximum and [] psi minimum.
 - g. Suction pressure at rated gpm: [] psi maximum and [] psi minimum.
 - h. Suction pressure at 150 percent rated gpm: [] psi maximum and [] psi minimum.
 - i. Maximum permissible static pressure on discharge flange of pump (including maximum static suction and maximum churn pressure: [150] [] psi.
 - j. Unit shall be designed to deliver not less than 150 percent of rated capacity at 65 percent of rated capacity.
 - k. Ambient temperature range: [125] [] degrees F maximum to [40] [] degrees F minimum.
 - l. The unit will be installed at approximately [20] [] feet elevation above sea level.
 - m. Pump start: At a minimum operating design pressure of [130] [] psi



- n. Maximum demand: Shall not exceed 120 percent of pump's rated capacity.
- o. Pump: Supplied from [public water main] [suction tank].

NOTE TO SPECIFIER

Use if Fire Pump IS Required. Edit Values

- 21. Performance of Jockey Pump on Fire Pump System:
 - a. Pump Capacity: [5] [] gpm , at [231] [] feet head, [100] [] psi.
 - b. Maximum permissible pump churn pressure shall not exceed [120] [] percent of rated pressure ([120] [] psi maximum)
 - c. Motor: [1.5] [] hp.

NOTE TO SPECIFIER

Use if Fire Pump IS Required

- 22. If fire pump is necessary, all equipment furnished and the complete installation of the fire pump shall be in accordance with NFPA 20. Pumps and controllers shall be UL Listed and [or] FM Approved.
 - a. Assembled pump configuration must be installed per manufacturer's recommendations.
 - b. Purchase pumps, driver, controllers, and accessories under unit contract.

NOTE TO SPECIFIER

Use if Fire Pump and Pump Suction Control Valve is Required.

- c. Provide pump suction control valve.

1.5 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for Submittals.

- 1. Product Data:
 - a. Sprinkler heads, valves, and specialties.
 - b. Performance ratings rough-in details, weights, support requirements, and piping connections.
- 2. Preliminary Shop Drawings: Prior to detailed submission, submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
- 3. Shop Drawings: Indicate hydraulic calculations, detailed pipe layout, hangers and supports, components and accessories. Indicate system controls. Prior to commencement of installation, submit licensed Professional Engineer's sprinkler system drawings (signed and sealed by Delegated Engineer) specified in "Quality Assurance" Article to Designated Reviewers. Include system hydraulic calculations and equipment data. Submittals shall be complete and in bound sets. Sprinkler system drawings, prepared according to NFPA 13 and FM 2-8N and Contract Documents. Submittals shall be made to Designated reviewers. Designated Reviewers are:
 - a. Additional Submittal: Submit shop drawings, product data, and hydraulic calculations to Public Authorities for approval. Submit proof of approval to Contracting Officer.
 - b. Submittals to Contracting Officer:

NOTE TO SPECIFIER

Use the following for Florida, South Carolina, Kentucky, and Louisiana, and as required by the project

- c. Submittals to [Fire Protection Engineer] [Professional] of Record:
- 4. Assurance/Control Submittals:
 - a. Design Data:
 - b. Test Reports: Submit the following reports directly to Contracting Officer from Testing Laboratory, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements.



- 1) Pre-test.
 - 2) Acceptance test.
 - c. Certificates: Manufacturer's certificate certifying that components and Products meet or exceed specified requirements.
 - d. Qualification Documentation:
 - 1) Submit documentation of manufacturer and installer experience indicating compliance with specified qualification requirements. Include lists of completed projects with project names and addresses, and names of Engineers and Contracting Officers.
 - 2) Fire protection contractor license issued by State or local authority having jurisdiction.
 - e. Manufacturer's Field Reports: Submit the following reports directly to Contracting Officer from Manufacturer's Quality Control Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements.
 - 1) Preparatory inspection.
 - 2) Initial inspection.
 - 3) Follow-up inspection.
 - 4) Final inspection.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
1. Project Record Documents: Accurately record the following.
 - a. Sprinklers and deviations of piping from Drawings.
 - b. Drain and test locations.
 2. Operation and Maintenance Data:
 - a. Components of system, servicing requirements, inspection data, replacement part numbers and availability, and location and numbers of service depot.

1.6 QUALITY ASSURANCE

- A. Qualifications:
1. Manufacturer: Company specializing in manufacturing the Products specified in this Section, whose equipment, specialties, and accessories are listed by product name and manufacturer in UL Fire Protection Equipment Directory and FM Approval Guide and that conform to other requirements indicated.
 2. Installer: Company specializing in performing the Work of this Section with minimum of 3 years documented experience and approved by Public Authorities in the State and Jurisdiction where the project is located. Company qualified to install and alter fire protection piping, equipment, specialties, and accessories, and repair and service equipment. Company familiar with, and in compliance with, requirements of authorities having jurisdiction.
 3. Delegated Engineer: Design fire protection system, develop working plans and shop drawings, and perform shop and site work under direct supervision of a Delegated Engineer experienced in design of this work and licensed in the State where the Project is located.

NOTE TO SPECIFIER

Use if Fire Pump IS Required

- B. If a fire pump is required, the manufacturer shall provide the services of a qualified Field Engineer to assist in the proper installation of equipment, make necessary mechanical adjustments, and align fire pump flexible coupling. Arrange, conduct and provide all required test equipment for Field Acceptance Test. Test shall be witnessed by the Public Authorities and Contracting Officer.
- *****

NOTE TO SPECIFIER

Edit standards



C. Regulatory Requirements:

1. Perform Work in accordance with NFPA [13, 20, 24, 70, 72 and 291].
2. Equipment and Components: UL listed and FM approved with appropriate label or marking.
3. Hydraulic Calculations, Product Data, Shop Drawings: Bear stamp of approval of Public Authorities.
4. Welding Materials and Procedures: Conform to AWS D10.9.
5. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.
6. Comply with requirements of Public Authorities for submittals, approvals, materials, hose threads, installation, inspections, and testing.
7. Comply with requirements of Contracting Officer and Owner's insurance underwriter for submittals, approvals, materials, installation, inspections, and testing.
8. Provide certificate of compliance from Public Authorities indicating approval of field acceptance tests.
9. Conform to applicable code for submission of design and calculations, reviewed shop and erection drawings and as required for acquiring permits.
10. Cooperate with regulatory agency or authority and provide data as requested.

D. Pre-Installation Meetings:

1. Convene a pre-installation meeting one week prior to commencing Work of this Section.
2. Require attendance of parties directly affecting Work of this Section.
3. Review conditions of operations, procedures and coordination with related Work.
4. Agenda:
 - a. Tour, inspect, and discuss conditions of building and building structure.
 - b. Review fire sprinkler system design and requirements.
 - c. Review required submittals, both completed and yet to be completed.
 - d. Review fire protection system Drawings and data.
 - e. Review and finalize construction schedule related to fire sprinkler system and verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
 - f. Review required inspections, testing, certifying, and material usage accounting procedures.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.
- C. Deliver and store valves in shipping containers, with labeling in place.
- D. Provide temporary protective coating on cast iron and steel valves.
- E. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

1.8 MAINTENANCE

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Extra Products: At completion of installation, deliver to Contracting Officer.
 1. Provide extra sprinklers under provision of NFPA 13.
 2. Provide suitable wrenches for each head type.
 3. Provide metal storage cabinet in location designated. Cabinet to be of sufficient size to store sprinklers, wrenches, and copy of all fire protection submittal documents.



PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Ames Company, Incorporated, Woodland, CA (530) 666-2493.
 - 2. Cla-Val Company, Costa Mesa, CA, (800) 942-6326.
 - 3. Febco, Fresno, CA, (209) 252-0791.
 - 4. The Viking Corporation, Hastings, MI (800) 968-9501.
 - 5. Watts Industries, North Andover, MA (978) 688-1811.
 - 6. Wilkins Regulator Division, Zurn Industries, Incorporated, Erie, PA (814) 455-0921.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 FIRE PROTECTION PIPING - BELOW GROUND

- A. Cast Iron Pipe: Class 200, with flanged joints, ASA 21.2 or bell and spigot ASA 21.6. Cement-mortar lined, ASA 21.4.
 - 1. Fittings: Cast Iron Flanged, ASA B16.1 Class 125; bell and spigot ASA 21.10; fittings to be cement mortar lined ASA21.4.
- B. Polyvinyl Chloride (PVC) Pipe: ASTM D1784-60T, ASTM D2241-64AT. Commercial Standard CS 256-63. Designed for Maximum working pressure of 160 psi at 73 degrees F.
 - 1. Rubber ring joints: Ring Tite PVC Pipe, by Manville.
 - 2. Substitutions: Under provisions of Section 016000.
- C. Ductile Iron Pipe: Class 50
- D. Indicator Posts:
 - 1. No. A-20805, with tamper switch (double contact), by Mueller.
 - 2. Substitutions: Under provisions of Section 016000.
- E. Gate Valves: AWWA C500-59T.

2.3 FIRE PROTECTION PIPING - ABOVE GROUND

- A. Black Steel Pipe: ANSI/ASTM A53; ASTM A795; ASTM A135; ANSI B36.10M; Schedule 10 or 40 (Schedule 30 for 8 inch pipe and larger).
 - 1. Steel Fittings: ANSI/ASME B16.9, wrought steel, butt welded; ANSI/ASME B16.25, battled ends; ASTM A234, wrought carbon steel and alloy steel; ANSI/ASME B16.5, steel flanges and fittings; ANSI/ASME B16.11, forged steel socket welded and threaded.
 - 2. Cast Iron Fittings: ANSI/ASME B16.1, flanges and fittings; ANSI/ASME B16.4, screwed fittings.
 - 3. Malleable Iron Fittings: ANSI/ASME B16.3, screwed type. ANSI/ASTM A47.
 - 4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped composition sealing gasket, steel bolts, nuts, and washers; [Victaulic FlushSeal gasket required for drypipe, preaction and double interlock dry systems.]
 - 5. Fitting type to match pipe. Galvanized required for Drypipe Systems.
- B. Alternate Products: Acceptable alternatives to Schedule 10 and Schedule 40 pipe.
 - 1. "Superflow" Non-threadable Lightwall, by Allied.
 - 2. "Dyna-Flow" Non-threadable Lightwall, by American Tube.
 - 3. Schedule 5 pipe used with Victaulic "Pressfit" system.



4. "Eddylite," by Bullmoose.

C. Pipe must meet the following conditions:

1. Threads: Shop cut according to applicable ANSI standards.
2. Pipe Fittings: Specifically rated for use with pipe.

NOTE TO SPECIFIER

Use BACKFLOW PREVENTERS where required by local authority having jurisdiction.

2.4 BACKFLOW PREVENTER

A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:

1. Ames Company, Incorporated, Woodland, CA (530) 666-2493.
2. Cla-Val Company, Costa Mesa, CA, (800) 942-6326.
3. Febco, Fresno, CA, (209) 252-0791.
4. The Viking Corporation, Hastings, MI (800) 968-9501.
5. Watts Industries, North Andover, MA (978) 688-1811.
6. Wilkins Regulator Division, Zurn Industries, Incorporated, Erie, PA (814) 455-0921.
7. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

- B. ASSE standard type, size, maximum flow rate, and maximum pressure loss as indicated on Drawings. Bronze, cast-iron, steel, or stainless-steel body, corrosion-resistant interior components, FDA-approved epoxy coating for cast-iron or steel body, 150 psig working pressure.

NOTE TO SPECIFIER

OPTION 1: Use REDUCED PRESSURE BACKFLOW type when required by authority having jurisdiction

- C. Reduced-Pressure Backflow Preventer: ASSE 1013, consisting of OS&Y gate valves on inlet and outlet and strainer on inlet with test cocks and pressure-differential relief valve with ASME A 112.1.2 air gap fitting located between two positive-seating check valves.

NOTE TO SPECIFIER

OPTION 2: Use DOUBLE-CHECK BACKFLOW type when required by authority having jurisdiction.

- D. Double-Check Backflow Prevention Assemblies: ASSE 1015, consisting of shutoff valves on inlet and outlet and strainer on inlet with test cocks and two positive-seating check valves.

NOTE TO SPECIFIER

OPTION 3: Use REDUCED PRESSURE DETECTOR type when required by authority having jurisdiction.

- E. Reduced-Pressure Detector Assembly Backflow Preventer: UL 312 and ASSE 1047, consisting of OS&Y gate valves on inlet and outlet, and strainer on inlet, with pressure-differential relief valve with ASME A112.1.2 air-gap fitting between two positive-seating check valves and test cocks, and bypass with displacement-type water meter, valves, and reduced-pressure backflow preventer.

NOTE TO SPECIFIER

OPTION 4: Use DOUBLE CHECK DETECTOR type when required by authority having jurisdiction.



- F. Double-Check Detector Assembly Backflow Preventer: UL 312 and ASSE 1048, consisting of OS&Y gate valves on inlet and outlet and strainer on inlet with two positive-seating check valves and test cocks, and bypass with displacement-type water meter, valves, and double-check backflow preventer.

2.5 GATE VALVES

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Grinnell Supply Sales, Company, Grinnell Corporation.
 2. Nibco, Incorporated.
 3. Stockham Valves and Fittings, Incorporated.
 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Gate Valves (Up to and including 2 inches): Bronze body, bronze trim, rising stem, handwheel, inside screw, single wedge or disc, solder or threaded ends.
- C. Gate Valves(Over 2 inches): Iron body, bronze trim, rising stem, handwheel, OS&Y, single wedge, flanged ends.

2.6 GLOBE OR ANGLE VALVES

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Grinnell Supply Sales, Company, Grinnell Corporation, Exeter, NH (603) 778-9200.
 2. Nibco, Incorporated, Elkhart, IN (800) 642-5463.
 3. Stockham Valves and Fittings, Incorporated, Cullman, AL (800) 786-2542.
 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Up to 2 inches: Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable composition disc, solder or screwed ends, with backseating capacity.
- C. Over 2 inches: Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

2.7 BUTTERFLY VALVES

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Grinnell Supply Sales, Company, Grinnell Corporation, Exeter, NH (603) 778-9200.
 2. Nibco, Incorporated, Elkhart, IN (800) 642-5463.
 3. Stockham Valves and Fittings, Incorporated, Cullman, AL (800) 786-2542.
 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Cast or ductile iron body; chrome plated ductile iron disc, resilient replaceable EPDM seat; wafer, lug, or grooved ends; extended neck; handwheel and gear drive and integral indicating device; built-in tamper proof switch.



2.8 CHECK VALVES

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Grinnell Supply Sales, Company, Grinnell Corporation, Exeter, NH (603) 778-9200.
 - 2. Nibco, Incorporated, Elkhart, IN (800) 642-5463.
 - 3. Stockham Valves and Fittings, Incorporated, Cullman, AL (800) 786-2542.
 - 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Up to and including 2 inches: Bronze swing disc, solder or screwed ends.
- C. Over 2 inches: Iron body, bronze trim, stainless steel spring, renewable composition disc, screwed, wafer, flanged, or grooved ends.

2.9 DRAIN VALVES

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Grinnell Supply Sales, Company, Grinnell Corporation, Exeter, NH (603) 778-9200.
 - 2. Nibco, Incorporated, Elkhart, IN (800) 642-5463.
 - 3. Stockham Valves and Fittings, Incorporated, Cullman, AL (800) 786-2542.
 - 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Bronze compression stop with hose thread, nipple and cap. Use hose thread, nipple and cap only where piping to outside or other approved drainage facility is not readily available.
- C. Brass ball valve with cap and chain, 3/4 inch hose thread.
- D. Use hose thread, nipple and cap.

2.10 ALARM CHECK VALVES

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Grinnell Supply Sales, Company, Grinnell Corporation, Exeter, NH (603) 778-9200.
 - 2. Viking Corporation, Hastings, MI (800) 968-9501.
 - 3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.11 DRYPIPE VALVES

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Grinnell Supply Sales, Company, Grinnell Corporation, Exeter, NH (603) 778-9200.
 - 2. The Viking Corporation, Hastings, MI (800) 968-9501.
 - 3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.12 MAINTENANCE AIR COMPRESSOR



- A. If applicable, Subject to compliance with requirements, provide maintenance air compressor of one of the following manufacturers:
1. Reliable Fire Equipment Co, Mt. Vernon, NY (914) 668-3470.
 2. The Viking Corporation, Hastings, MI (800) 968-9501.
 3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. If applicable, provide electric, air cooled, tank mounted, inlet filter silencer, fly wheel, belt guard, automatic start-stop control, tank, air dryer, motor with a thermal overload protection rated for continuous operation at the rated capacity, motor control with adjustable pressure switch set to start compressor at 75 percent of the normal pressure to prevent short cycling. Provide desiccator (air dryer) between compressor and dry pipe single stage oilless compressor, equip with check valve, centrifugal pressure and moisture unloader, and pressure switch. Exact location to be approved by Public Authorities, and Contracting Officer.

2.13 SPRINKLERS

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Gem Sprinkler Company, Division of Grinnell Corporation, Exeter, NH (603) 778-9200.
 2. Reliable Automatic Sprinkler Company, Incorporated, Mt. Vernon, NY (914) 668-3470.
 3. The Viking Corporation Hastings, MI (800) 968-9501.
 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

NOTE TO SPECIFIER

Edit Finish as Appropriate.

- B. Subject to compliance with requirements, provide automatic sprinklers, with 1/2 inch, 17/32 inch orifice; or 0.64 inch (extra large) orifice, unless noted otherwise. Sidewall sprinklers are not acceptable, unless noted otherwise.
1. Areas With Exposed Structure Above:
 - a. Standard Sprinklers: Upright sprinkler, [____] [bronze].
 - b. Extra Large Orifice Sprinklers: [____] [bronze].
 2. Areas With Finished Ceilings, Not Visible To The Public: Pendent sprinkler, [____] [chrome], with two-piece [____] [chrome] escutcheon plate.
 3. Areas With Finished Ceilings 10 Feet Above Finish Floor or Higher, Visible to the Public: Pendent sprinkler, [____] [chrome], with two-piece [____] [chrome] escutcheon plate.
 4. Areas With Finished Ceilings Below 10 Feet Above Finish Floor, Visible to the Public: Pendent sprinkler, [____] [chrome], with two-piece 1/2 inch recessed [____] [chrome] escutcheon plate.

2.14 SLEEVES AND ESCUTCHEONS

- A. Sleeves through structural concrete members and sleeves for walls below grade and floors on grade shall be standard weight galvanized Schedule 40 steel pipe. Sleeves through other than structural components of the building shall be 20 gage galvanized sheet metal with lock seam joints. Sleeve shall extend two inches past finished surface. USG Thermafiber safing insulation shall be installed between sleeve and pipe.
- B. Pipe escutcheon plates to be installed where exposed piping passes through walls, ceilings, and floors of building shall be minimum 20 gage steel, [____] [chrome].



2.15 ACCESSORIES

- A. Hangers and Supports: Provide hangers and supports as required by NFPA 13 and Public Authorities. Provide seismic bracing in accordance with NFPA 13, as required by state and local codes, and Public Authorities.
- B. Flushing Connections: Provide threaded, capped nipple or mechanical groove end cap on ends of cross mains. If nipple provided, diameter shall be same as pipe, but not larger than 2 inches.
- C. Auxiliary Drains:
 - 1. 5 gallons or greater: provide minimum 1 inch globe valve with hose adapter and cap.
 - 2. Less than 5 gallons: provide minimum 1 inch nipple and cap.
 - 3. All auxiliary drain facilities shall be placed to allow easy access.
- D. If piping or components of Inspector's test connection are modified as a result of this Work, then provide as required by Contractor.
- E. If inspector test valve and auxiliary drain valve are piped together then test drain assembly shall be an approved manufactured assembled unit. Subject to compliance with requirements, provide valves of one of the following manufacturers:
 - 1. "Test Master", by Victaulic, Easton, PA (610) 559-3300.
 - 2. Central Sprinkler Corp., Lansdale, PA (800) 523-6512.
 - 3. Globe Fire Sprinkler Corp., Standish, MI (800) 248-0278.
 - 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

NOTE TO SPECIFIER

Option 1 - Use if Local Alarm is Water Motor Alarm Gong.

- F. Water Motor Alarm Gong: Provide water-operated alarm gong on exterior of building adjacent to sprinkler system riser. Electric alarm bell (gong) not permitted.

NOTE TO SPECIFIER

Option 2 - Use if Local Alarm is Electric Bell. Edit Location.

- G. Electric Bell: Provide 10 inch diameter electric bell on exterior of building [adjacent to sprinkler system riser] [locate as indicated on drawings] [locate as required by Public Authorities].

NOTE TO SPECIFIER

Option 3 - Use if Local Alarm is Horn. Edit Location.

- H. Horn and Strobe: Provide horn and strobe on exterior of building [adjacent to sprinkler system riser] [locate as indicated on drawings] [locate as required by Public Authorities].
- I. Wet Sprinkler System Water Flow Detectors: Equip sprinkler system risers with double pole vane type flow detector, Model No. VSR-F, by Potter Electric Signal of St. Louis, Missouri, (800) 325-3936. Set adjustable delayed signal at 30 seconds. Connect to alarm system.
 - 1. Substitutions: Under provisions of Section 016000.

NOTE TO SPECIFIER

Use if Dry Pipe System Required



- J. Dry Sprinkler System Water Flow Detector: Equip Dry System risers with pressure activated flow detector by Potter Electric Signal of St. Louis, Missouri, (800) 325-3936. Connect to alarm system.
1. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- K. Control Valve Supervisory Switches:
1. Equip post indicator valves with tamper switches, Model No. PCVS, as manufactured by Potter Electric Signal of St. Louis, Missouri. Connect to alarm system.
 2. Equip outside screw and yoke valves with tamper switches, Model No. OSYSU-A2 as manufactured by Potter Electric Signal of St. Louis, Missouri. Connect to alarm system.
 3. All valves capable of controlling water supply shall have tamper switches. Connect to alarm system.
 4. If control valve is located remote from store building, provide 3/4 inch conduit, with pull string, from remote location to nearest electrical room.
 5. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- L. Fire Department Connections: Fire Department connections in accordance with NFPA 13 and Public Authorities. Equip with threads/connections compatible with hoses utilized by the local fire department.
1. Drain: 3/4 inch automatic drip, piped to approved drainage location.
 2. Label: "Auto Sprinkler".
 3. Finish: Red enamel.

NOTE TO SPECIFIER

Edit Thread Type Based on Project/Public Authority Requirements.

4. Thread/Connection: [NST] [Storz] [____], verify with Public Authorities.

- M. Wire Cage Sprinkler Guards: Fig. 6160, by Potter-Roemer or acceptable substitute.
1. Provide sprinkler guards on sprinkler pendants that are located below 8 feet above finished floor, except at semi-recessed sprinklers.
- N. Relief Valves: For gridded sprinkler systems, provide a relief valve not less than 1/4 inch size and set to operate at 175 psi or 10 psi in excess of the maximum system pressure, whichever is greater. Location of relief valves to be in accordance with NFPA 13.

NOTE TO SPECIFIER

Use if Fire Hose Cabinets or Racks are Required

- O. Fire Hose Connection:
1. Provide [1 1/2] [2 1/2] [____] inch hose stations throughout [Building] as indicated [Contract Documents].
 2. Provide each hose station with:
 - a. Valve: UL 668, 300 psig (2070 kpa) rated, brass, non-adjustable type, 90 degree angle pattern, female NPS inlet and male hose outlet. Size [1 1/2] [2 1/2] [____] inches. Hose value threads in accordance with NFPA 1963 and match local fire department threads.
 - b. Hose: 300 lb. test, 100 percent polyester jacket and synthetic rubber lining. Size [1 1/2] [2 1/2] [____] inch. Length [75] [100] [____] feet. [____] [2 1/2 inch by 1 1/2 inch reducer.]
 - c. Nozzle: UL 401, [brass] [polycarbonate plastic] adjustable from shutoff to fog spray to straight stream.

NOTE TO SPECIFIER

Use if PSI exceeds 175.



- d. Valve: UL 1468, 400 psig (2760 kpa) rated, brass, pressure-regulating type, 90 degree angle pattern, female NPS inlet and male hose outlet. Design in accordance with NFPA 1963 and match local fire department threads.

NOTE TO SPECIFIER

Use if Fire Pump required.

2.16 FIRE PUMP MANUFACTURERS

- A. Subject to compliance with requirements, provide pumps of one of the following manufacturers:
1. Aurora Pump, North Aurora, IL (800) 316-7720.
 2. Fairbanks Morse Pumps, Kansas City, KS (913) 371-5000.
 3. ITT A-C Pump, Cincinnati, OH.
 4. Peerless Pump, Indianapolis, IN (317) 925-9661.
 5. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

NOTE TO SPECIFIER

Use if Fire Pump required.

2.17 HORIZONTAL BASE MOUNTED PUMPS

- A. Type: UL listed and [or] FM approved. Conform to UL 448, horizontal shaft, double suction, direct connected, horizontally split case, for 250 psig maximum working pressure, labeled specifically "FOR FIRE SERVICE".
- B. Casing: Cast iron, with suction and discharge gage ports, renewable bronze casing wearing rings, seal flush connection, drain plug, suction and discharge flange machined to ASME B16-1 dimensions, 250 psi pressure rating.
- C. Impeller: Bronze double suction fully enclosed, statically and dynamically balanced and keyed directly to motorshaft.
- D. Bearings: Grease lubricated ball bearings.
- E. Shaft: Alloy steel with replaceable bronze shaft sleeve.
- F. Seals: Packing gland with minimum four rings graphite impregnated packing and Teflon antern rings, 230 degrees F (110 degrees C) maximum continuous operating temperature.
- G. Drive: Flexible coupling with metal coupling guard.
- H. Base plate: Cast iron or fabricated steel with integral drain rim, provide 3/4 inch threaded outlet for drain
- I. Pump manufacturer shall have unit responsibility for proper operation of the complete unit, and provide services of a factory trained technician to supervise installation, and to attend final field acceptance tests.
- J. Each pump shall be hydrostatically and run tested at the factory before shipment.

NOTE TO SPECIFIER

Use if Fire Pump required.



2.18 FIRE PUMP ACCESSORIES

- A. Eccentric suction reducer and OS&Y valve on suction side of pump.
- B. Concentric increaser and check valve in pump discharge and butterfly valve on system side of check valve.
- C. Suction pressure gage (compound type), with snubber, valve cock and lever handle.
- D. Discharge pressure gage, with snubber, valve cock and lever handle.
- E. Casing 3/4 inch relief valve minimum.
- F. Float operated 1 inch automatic air release valve.
- G. Hose valve manifold with 2 1/2 inch hose gate valves with caps and chains. Size per NFPA 20.

NOTE TO SPECIFIER

Use if the facility is equipped with emergency power generator and fire Pump Bypass is required for electric drive engine.

- H. Fire pump bypass on electric pump fitted with butterfly valves and check valve.

NOTE TO SPECIFIER

Use if Fire Pump IS Required and the facility is equipped with emergency power generator and electric drive pump is used.

2.19 ELECTRIC MOTOR DRIVER

- A. Motor: Squirrel cage induction type; in open drip proof NEMA MG-1 enclosure.
- B. Power: 480 volt, three phase, 60 Hz.

NOTE TO SPECIFIER

Use if Fire Pump required.

2.20 FIRE PUMP CONTROLLER

- A. Subject to compliance with requirements, provide fire pump controller of one of the following manufacturers:
 - 1. Firetrol, Inc., Cary, NC (919) 460-5200.
 - 2. Master Control, Lake Bluff, IL (847) 295-1010.
 - 3. Metron, Inc., Denver, CO (303) 592-1903.



4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

NOTE TO SPECIFIER

Use if Fire Pump required. Edit Values

- B. Controller: UL listed and [or] FM approved for fire pump service with across-the-line starter, in NEMA 4 enclosure, including the following:
1. Disconnect Switch: Externally operable, quick break type.
 2. Circuit Breaker: Trips in each phase calibrated at least to 300 percent of the motor full-load current, interrupting capacity shall be equal to or exceed maximum fault current at site, but shall in no case be less than [] [150,000] amps RMS symmetrical at 480 VAC.
 3. Motor Starter: Energized automatically through pressure switch or manually by externally operable handle.
 4. Pressure Switch: Bourdon Tube Type with adjustable independent high and low set points and a range of 10 psi to 300 psi.
 5. Running Period Timer: Keeps motor in operation when started automatically, for a minimum of 10 minutes.
 6. Ammeter test link and voltmeter test studs.
 7. Remote start switch relay.
 8. Manual Selector Station: On enclosure marked "Automatic" and "Non-Automatic."
 9. Normally open dry contacts for remote indication of all tamper switches (common), circuit breaker open, low pump house temperature (below 45° F), power available, low pressure, local start, remote start, phase failure, phase reversal, pump running, run timer on, and all signals required by NFPA 20.
 10. Weekly Test Start: Provide ability to set day of week, time of day and running timer for the test period (0 to 30 minutes).
 11. Supervised control circuit which automatically starts pump upon failure of control power transformer or control relays.
 12. Externally mounted visible indicators for power available, low pump house temperature, low pressure, local start, remote start, phase failure, phase reversal, pump running and run timer on.
 13. Automatic shut-off timer set for 10 minutes, to operate only after starting causes return to normal.
 14. Front mounted, front wired, and front accessible controller components, including circuit breaker and contactors.
 15. Grounding lug and bonding provisions.

NOTE TO SPECIFIER

Use if Fire Pump required.

2.21 PRESSURE BOOSTER (JOCKEY) PUMPS

- A. Subject to compliance with requirements, provide pressure booster (jockey) pump of one of the following manufacturers:
1. Aurora Pump, North Aurora, IL (800) 316-7720.
 2. Grundfos Pump, Clovis, CA (209) 292-8000.
 3. Peerless Pump, Indianapolis, IN (317) 925-9661.
 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

NOTE TO SPECIFIER

Use if Fire Pump required. Edit Values



- B. Power: [480] [208] volt, three phase, 60 Hz.
- C. Type: Electrically operated, vertical multi-stage type with standard open drip-proof motor, factory assembled and factory tested.
- D. Casing: Cast iron, with suction and discharge connections of size indicated. threaded, or flanged and machined to ASME B16.1 dimensions, and 250 psig minimum pressure rating.
- E. Impeller: Bronze or stainless steel.
- F. Shaft: Stainless steel.
- G. Seals: Mechanical.
- H. Controller: Enclosed in floor mounted NEMA 4 steel housing, UL listed and labeled. Factory assembled, wired, and tested, with full voltage starter. Provide separate controller for jockey pump, with magnetic contactor, fusible disconnect switch, pressure switch and minimum run period timer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Examine areas in which Work of this Section is to be performed.
 - 2. Verify that surfaces and site conditions are ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Coordinate work of this Section with other affected work [and construction schedule].
- B. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- C. Remove scale and foreign material, from inside and outside, before assembly.
- D. Prepare piping connections to equipment with flanges or unions.
- E. Install system and equipment in accordance with manufacturers instructions, and NFPA Standards.

3.3 INSTALLATION - BELOW GROUND PIPING



- A. Install piping and system components in accordance with NFPA 24. Verify that main feed from water supply source to building is as specified.
- B. Support barrel of pipe for entire length on compacted pipe bedding. Excavate for couplings, fittings and valves.
- C. Lay pipe to lines and grades as required.
- D. Keep interior of pipe free from dirt and other foreign material as installation progresses. Plug open ends when work is stopped. Join lengths with couplings in accordance with pipe manufacturer's instructions. Join to fittings and valves that have rubber ring bells with same groove dimensions and tolerance as pipe.
- E. Provide valves and fittings as necessary.
- F. Install concrete thrust blocks as required. Place concrete between undisturbed soil with fittings anchored. Do not cover coupling flanges or other joints with concrete.

3.4 INSTALLATION - ABOVE GROUND PIPING

- A. Install piping in accordance with NFPA 13. Install sprinkler piping products in accordance with recognized industry practices to ensure that fire protection sprinkler piping complies with requirements and serves intended purposes.
- B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient. Use eccentric reducers to maintain top of pipe level. Slope piping and arrange systems to drain. Size drain piping as required to drain sprinkler system properly. Provide drain valves at main shut-off valves and low points of piping.

NOTE TO SPECIFIER

Use if Subject to Freezing

- 1. Pitch piping as required in Drypipe systems. If applicable:
 - a. Drypipe Branchlines: Slope 1/2 inch for every 10 feet.
 - b. Drypipe Mains: Slope 1/4 inch for every 10 feet.
- C. Install piping to conserve building space. Do not interfere with use of building space and other work.
- D. Group piping whenever practical at common elevations.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. All system components shall be concealed above ceilings where ceilings exist.
- G. Replace sprinklers having paint other than factory finish with new sprinklers. Cleaning and reuse of painted sprinklers is prohibited.
- H. Do not penetrate building structural members. Examine other work indicated on the Contract Documents and conditions at job site. Coordinate routing of work with other construction trades to avoid interference with other installations. Do not cut building structural members, beams, joists, etc. for routing of sprinkler piping. In the event of conflicts, consult Contracting Officer, and their decision shall govern.



- I. Provide sleeves when penetrating floors and walls. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required. Provide wall plates at all penetrations.
- J. Die cut screw joints with full cut standard taper pipe threads with non-toxic joint compound applied to male threads only. Recoat threads on galvanized pipe with galvanized coating.
- K. Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.
- L. Route piping and locate sprinklers as required to avoid building structure equipment, plumbing piping, heating and air conditioning piping, ductwork, lighting fixtures, electrical conduits and bus ducts, and similar work.
 - 1. Final location of lighting will have priority over final sprinkler locations.
- M. Provide pipe offsets as required to complete installation. Modify shop prefabricated piping, pipe hangers, and other components as required to fit the job site conditions.
- N. Shop drill and weld weld-o-lets on piping.
- O. Conceal piping in chases, walls, furred spaces and above ceiling in areas with dropped ceilings.
- P. If piping or components of Inspector's Test Connection are modified as a result of this Work, then:
 - 1. Provide one inspector's test valve for each system at the most remote point of the system along the exterior wall, piped to non-public areas.
 - 2. Install inspector's test valves at five feet (minimum) to seven feet (maximum) above finish floor to facilitate bi-monthly tests.
 - 3. Coordinate test valve locations with Contracting Officer.
 - 4. Test connection shall discharge at location approved by Contracting Officer.
 - 5. Outlet shall have same orifice as sprinklers.
- Q. Piping shall maintain clearance from electrical equipment as required by NEC and Public Authorities. Drains and Inspector's test connection shall not be piped into or through electrical rooms/areas.
- R. Sprinkler piping that passes through unheated spaces in or under structures and are exposed to freezing shall be protected from freezing as indicated or in accordance with applicable methods in NFPA 13.
- S. Provide valves as required to comply with NFPA Standards and requirements of Public Authorities. Provide backflow prevention devices, check valves, and drains where required by Public Authorities.
- T. Make reductions in pipe sizes with one-piece reducing fittings. Bushings are not acceptable. Use flanged fittings at base of risers.
- U. Contractor shall notify Contracting Officer one week prior to any sprinkler system shutdown or work performed.

NOTE TO SPECIFIER

Use if System components are to be painted

- V. All system components (i.e. pipe, fittings, supports, and accessories), except sprinklers, not concealed shall be prepared for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding. Apply masking tape or paper cover to ensure sprinkler do not receive field paint finish. Remove tape or paper after painting.

**NOTE TO SPECIFIER***Use if Subject to Freezing*

- W. Locate sprinklers in suspended ceiling tiles along the centerline of the two foot dimension, and at one foot increments from the edge in the four foot dimension direction. Provide piping offsets as necessary to locate sprinklers.
- X. Dry Pendent Sprinklers: Install concealed above ceilings where ceilings are used.
- Y. Anti-freeze Systems (where required): Install "Loop", concealed, above ceilings where ceilings are used, or as required by Public Authorities, and Contracting Officer.
- Z. If applicable, install maintenance air compressor adjacent to dry pipe riser. Connect 1/4 inch compressor outlet with the 1/4 inch pipe through a shutoff valve to the system side of drypipe valve. Adjust pressure switch to the required setting.
- AA. Locate wet pipe (and dry pipe if required) inspector test valves and associated sight glasses at remote ends of system, in accessible locations. Provide drain pipes as required by Contracting Officer.

NOTE TO SPECIFIER*Use if Fire Pump required.*

3.5 FIRE PUMP

- A. Provide direct feed power supply to fire pump controller from power source with no fuses or breakers in the circuit. See Section 013300 for electrical diagram submittal requirements.
- B. Provide access space around pumps for service. Provide no less than minimum as recommended by manufacturer.
- C. Support piping adjacent to pump such that no weight is carried on pump casings. For base mounted pumps, provide supports under elbows on pump suction and discharge.
- D. Provide drains for bases and seals, piped to and discharging into floor drains.
- E. Mount unit on vibration isolators.
- F. Provide for connection to electrical service.
- G. Lubricate pumps before start-up.
- H. Check, align, and certify base mounted pumps by qualified millwright prior to start-up.

NOTE TO SPECIFIER*Use if the facility is equipped with emergency power generator and electric drive pump is used.*

- I. Electric Fire Pump System:
 - 1. Suction pipe, valve, and fittings.
 - 2. Discharge pipe, valve and fittings.
 - 3. Bypass pipe, valves and fitting.
 - 4. Jockey pump suction and discharge pipe, valves and fittings.
 - 5. Controllers mounted, pipe and wired.
 - 6. Gland drip pockets piped to common drain for skid.



7. Gauges and air release valve installed.
8. Structural steel skid with checkered steel floor plate.
9. Piping, equipment and structural skid painted red.
10. Provide testing and operation instructions on laminated/weather protected wall mounted sign. Submit example to of Record for approval prior to installation.

J. Locate Fire Department connection on discharge side of pump.

K. Locate controller as close to motor as practical and within sight. Provide controller with suitable protection as necessary to protect against water escaping from pump or connections. Elevate controller minimum of 12 inches above finished floor.

3.6 PROTECTION OF WORK

A. Protect work from danger of freezing, breakage, dirt, foreign materials, etc., and replace work so damaged. Use every precaution to protect work of others.

3.7 IDENTIFICATION

A. Apply signs to control, drain, test and alarm valves, etc., to identify their purposes and functions. Provide lettering sizes and styles selected by Contracting Officer from NFPA's suggested styles.

B. Stencil riser/zone numbers on risers.

C. Provide hydraulic placard for each sprinkler system in accordance with NFPA 13.

3.8 CLEANING AND FLUSHING

A. Prior to connecting overhead system piping to underground supply system piping, flush underground supply system piping per NFPA 13 and 24.

3.9 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Procedures for field inspection and testing of installation.

B. Site Tests - Leaks from System:

1. Contractor shall identify to Contracting Officer any leaks or damage that occur within the system as a result of testing. Contractor shall take necessary precautions to limit any potential damage. Corrective action shall be performed at Contractors expense.

C. Site Tests - Above Ground Fire Protection Piping:

1. Test system pressure piping for leakage as required by and in presence of Public Authorities, and Contracting Officer Test to consist of holding the test pressure at the high end for a period of two hours. Test pressure: 200 psi or 50 psi over normal operating pressure, whichever is greater. Conduct test in accordance with NFPA 13. Send completed copy of the material and test certificate to Contracting Officer.
2. All required tests shall be witnessed by Public Authorities, and Contracting Officer.
3. Inspection of welds, and/or verification of welder's qualifications may be required by Public Authorities. Contractor shall comply with all requirements of Public Authorities, including but not limited to :
 - a. Provide written documentation of welders qualifications and certification.



- b. Stamp imprint of welders identification adjacent to all welds.
 - c. Provide provisions for, schedule and conduct inspection of all welds . Inspection shall be scheduled at project site, with pipe at grade level, prior to installation.
- D. Site Tests - Under Ground Fire Protection Piping:
- 1. Test pressure piping for leakage in presence of Public Authorities and Contracting Officer. Test to consist of holding the test pressure in each section of line tested for a period of two hours. Test pressure at the high end of each test section shall be 200 psi or 50 psi over normal operating pressure whichever is greater. Conduct test in accordance with NFPA 24.
 - 2. Flush underground mains and lead-in connections thoroughly before connection is made to above ground system piping to remove foreign material. Minimum flow rate shall not be less than the maximum water flow demand rate of the system and not less than necessary to provide a velocity of 10 feet per second. Continue flushing for sufficient time to ensure thorough cleaning. Provide proper disposal of water from flushing operation.
 - 3. All required tests shall be witnessed by Public Authorities, and Contracting Officer.
 - 4. Contractor shall identify to Contracting Officer any leaks or damage that occur within the system as a result of testing. Contractor shall take necessary precautions to limit any potential damage. Corrective action shall be performed at Contractors expense

NOTE TO SPECIFIER

Use if Fire Pump required.

- E. Site Tests - Fire Pump:
- 1. Test pump in accordance with NFPA 20. Send completed copy of the material and test certificate to Public Authorities, and Contracting Officer.
 - 2. Contractor shall be responsible for providing all personnel and equipment necessary for complete start up and acceptance testing purposes. Minimum equipment required:
 - a. Three (3) 50 feet sections of 2 1/2 inch 300 pound test rubber lined with 100 percent polyester jacket, equivalent to Potter Roemer Fig. 2902. Provide with Double Lug Couplings, equivalent to Potter Roemer Fig. 2936.
 - b. Three (3) Underwriters Play Pipes with swivel handle and marlin wound brass pipe. Provide each with 1 3/4 inch tip orifice, equivalent to Potter Roemer Fig. 2949
 - c. One (1) Pitot tube equipped with calibrated bourdon tube gauge, with storage case. Provide each with flow rate computation table, equivalent to Potter Roemer.
 - 3. Notify Public Authorities, and Contracting Officer two weeks prior to any fire pump acceptance test so a representative may witness testing.
 - 4. Factory Test: All equipment will be factory tested in accordance with the requirements of NFPA, U.L. and FM.
 - 5. Start-Up Service: The service of a factory trained representative for the controllers, and pumps shall be available on the job site to check installation, conduct field acceptance testing, conduct start-up, and instruct personnel.
- F. All required tests shall be witnessed by Public Authorities, and Contracting Officer.

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END OF SECTION



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SECTION 21 05 00 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for common work results for fire suppression. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Piping materials and installation instructions common to most piping systems.
 - b. Mechanical sleeve seals.
 - c. Sleeves.
 - d. Escutcheons.
 - e. Grout.
 - f. Fire-suppression equipment and piping demolition.
 - g. Equipment installation requirements common to equipment sections.
 - h. Painting and finishing.
 - i. Concrete bases.
 - j. Supports and anchorages.

C. Definitions

1. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
2. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
3. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
4. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
5. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
6. The following are industry abbreviations for plastic materials:
 - a. CPVC: Chlorinated polyvinyl chloride plastic.
7. The following are industry abbreviations for rubber materials:
 - a. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - b. NBR: Acrylonitrile-butadiene rubber.

D. Submittals

1. Welding certificates.

E. Quality Assurance

1. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
2. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - a. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - b. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.



3. Electrical Characteristics for Fire-Suppression Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

F. Delivery, Storage, And Handling

1. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
2. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.2 PRODUCTS

A. Pipe, Tube, And Fittings

1. Refer to individual Division 28 for pipe, tube, and fitting materials and joining methods.
2. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

B. Joining Materials

1. Refer to individual Division 28 for special joining materials not listed below.
2. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - a. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
 - 1) Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - 2) Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - b. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
3. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
4. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
5. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
6. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
7. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
8. Solvent Cements for Joining CPVC Plastic Piping: ASTM F 493.

C. Mechanical Sleeve Seals

1. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - a. Sealing Elements: EPDM **OR** NBR, **as directed**, interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - b. Pressure Plates: Plastic **OR** Carbon steel **OR** Stainless steel, **as directed**. Include two for each sealing element.
 - c. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating **OR** Stainless steel, **as directed**, of length required to secure pressure plates to sealing elements. Include one for each sealing element.

D. Sleeves

1. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
2. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.



3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with set screws.
5. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
6. PVC Pipe: ASTM D 1785, Schedule 40.
7. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

E. Escutcheons

1. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
2. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
3. One-Piece, Cast-Brass Type: With set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass **OR** Polished chrome-plated and rough brass, **as directed**.
4. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass **OR** Polished chrome-plated and rough brass, **as directed**.
5. One-Piece, Stamped-Steel Type: With set screw **OR** spring clips, **as directed**, and chrome-plated finish.
6. Split-Plate, Stamped-Steel Type: With concealed **OR** exposed-rivet, **as directed**, hinge, set screw **OR** spring clips, **as directed**, and chrome-plated finish.
7. One-Piece, Floor-Plate Type: Cast-iron floor plate.
8. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

F. Grout

1. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - a. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - c. Packaging: Premixed and factory packaged.

1.3 EXECUTION

A. Fire-Suppression Demolition

1. Refer to Division 01 Section(s) "Cutting And Patching" AND Division 02 Section(s) "Selective Structure Demolition" for general demolition requirements and procedures.
2. Disconnect, demolish, and remove fire-suppression systems, equipment, and components indicated to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
3. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.



B. Piping Systems - Common Requirements

1. Install piping according to the following requirements and Division 28 specifying piping systems.
2. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
3. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
4. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
5. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
6. Install piping to permit valve servicing.
7. Install piping at indicated slopes.
8. Install piping free of sags and bends.
9. Install fittings for changes in direction and branch connections.
10. Install piping to allow application of insulation.
11. Select system components with pressure rating equal to or greater than system operating pressure.
12. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - a. New Piping:
 - 1) Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - 2) Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - 3) Insulated Piping: One-piece, stamped-steel type with spring clips.
 - 4) Bare Piping at Wall and Floor Penetrations in Finished Spaces:
 - a) One-piece, cast-brass type with polished chrome-plated finish.

OR

One-piece, stamped-steel type.
 - 5) Bare Piping at Ceiling Penetrations in Finished Spaces:
 - a) One-piece **OR** Split-casting, **as directed**, cast-brass type with polished chrome-plated finish.

OR

One-piece, stamped-steel type **OR** Split-plate, stamped-steel type with concealed hinge, **as directed**, and set screw.
 - 6) Bare Piping in Unfinished Service Spaces:
 - a) One-piece, cast-brass type with polished chrome-plated **OR** rough-brass, **as directed**, finish.

OR

One-piece, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and set screw **OR** spring clips, **as directed**.
 - 7) Bare Piping in Equipment Rooms:
 - a) One-piece, cast-brass type.

One-piece, stamped-steel type with set screw **OR** spring clips, **as directed**.
 - 8) Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
 - b. Existing Piping: Use the following:
 - c. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
 - d. Insulated Piping: Split-plate, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and spring clips.
 - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces:
 - 1) Split-casting, cast-brass type with chrome-plated finish.

OR

Split-plate, stamped-steel type with concealed hinge and spring clips.



- f. Bare Piping at Ceiling Penetrations in Finished Spaces:
 - 1) Split-casting, cast-brass type with chrome-plated finish.
OR
Split-plate, stamped-steel type with concealed hinge and set screw.
- g. Bare Piping in Unfinished Service Spaces:
 - 1) Split-casting, cast-brass type with polished chrome-plated **OR** rough-brass, **as directed**, finish.
OR
Split-plate, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and set screw or spring clips.
- h. Bare Piping in Equipment Rooms:
 - 1) Split-casting, cast-brass type.
OR
Split-plate, stamped-steel type with set screw or spring clips.
- i. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
- 13. Sleeves are not required for core-drilled holes.
- 14. Permanent sleeves are not required for holes formed by removable PE sleeves.
- 15. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- 16. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
 - a. Cut sleeves to length for mounting flush with both surfaces.
 - 1) Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - b. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - c. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - 1) PVC **OR** Steel, **as directed**, Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
 - 2) Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
 - 3) Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing And Trim" for flashing.
 - a) Seal space outside of sleeve fittings with grout.
 - d. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- 17. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - a. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
 - b. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
 - c. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- 18. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - a. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.



19. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
20. Verify final equipment locations for roughing-in.
21. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

C. Piping Joint Construction

1. Join pipe and fittings according to the following requirements and Division 28 specifying piping systems.
2. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
3. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
4. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
5. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
6. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
7. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Para. 1.1 "Quality Assurance" Article.
8. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
9. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
10. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

D. Painting

1. Painting of fire-suppression systems, equipment, and components is specified in Division 09 Section(s) "Exterior Painting" AND "Interior Painting".
2. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

E. Concrete Bases

1. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - a. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
 - c. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - f. Install anchor bolts according to anchor-bolt manufacturer's written instructions.



- g. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-place Concrete".
- F. Erection Of Metal Supports And Anchorages
 - 1. Refer to Division 05 Section "Metal Fabrications" for structural steel.
 - 2. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.
 - 3. Field Welding: Comply with AWS D1.1.
- G. Erection Of Wood Supports And Anchorages
 - 1. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor fire-suppression materials and equipment.
 - 2. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
 - 3. Attach to substrates as required to support applied loads.
- H. Grouting
 - 1. Mix and install grout for fire-suppression equipment base bearing surfaces, pump and other equipment base plates, and anchors.
 - 2. Clean surfaces that will come into contact with grout.
 - 3. Provide forms as required for placement of grout.
 - 4. Avoid air entrapment during placement of grout.
 - 5. Place grout, completely filling equipment bases.
 - 6. Place grout on concrete bases and provide smooth bearing surface for equipment.
 - 7. Place grout around anchors.
 - 8. Cure placed grout.

END OF SECTION 21 05 00 00



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Task	Specification	Specification Description
21 05 13 00	21 05 00 00	Common Work Results for Fire Suppression
21 05 16 00	21 05 00 00	Common Work Results for Fire Suppression



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SECTION 21 05 19 00 - METERS AND GAGES FOR PLUMBING PIPING**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for meters and gages for plumbing piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Bimetallic-actuated thermometers.
 - b. Filled-system thermometers.
 - c. Liquid-in-glass thermometers.
 - d. Light-activated thermometers.
 - e. Thermowells.
 - f. Dial-type pressure gages.
 - g. Gage attachments.
 - h. Test plugs.
 - i. Test-plug kits.
 - j. Sight flow indicators.

C. Submittals

1. Product Data: For each type of product indicated.
2. Product Certificates: For each type of meter and gage, from manufacturer.
3. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

1.2 PRODUCTS**A. Bimetallic-Actuated Thermometers**

1. Standard: ASME B40.200.
2. Case: Liquid-filled and sealed type(s); stainless steel with 3-inch (76-mm) **OR** 5-inch (127-mm), **as directed**, nominal diameter.
3. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F (deg C) **OR** deg F and deg C, **as directed**.
4. Connector Type(s): Union joint, adjustable angle **OR** rigid, back **OR** rigid, bottom, **as directed**, with unified-inch screw threads.
5. Connector Size: 1/2 inch (13 mm), with ASME B1.1 screw threads.
6. Stem: 0.25 or 0.375 inch (6.4 or 9.4 mm) in diameter; stainless steel.
7. Window: Plain glass or plastic.
8. Ring: Stainless steel.
9. Element: Bimetal coil.
10. Pointer: Dark-colored metal.
11. Accuracy: Plus or minus 1 **OR** 1.5, **as directed**, percent of scale range.

B. Filled-System Thermometers

1. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch (114-mm) **OR** 5-inch (127-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter.
 - c. Element: Bourdon tube or other type of pressure element.



- d. Movement: Mechanical, dampening type, **as directed**, with link to pressure element and connection to pointer.
- e. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
- f. Pointer: Dark-colored metal.
- g. Window: Glass or plastic.
- h. Ring: Metal **OR** Stainless steel, **as directed**.
- i. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device **OR** rigid, back **OR** rigid, bottom, **as directed**; with ASME B1.1 screw threads.
- j. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
 - 1) Design for Thermowell Installation: Bare stem.
- k. Accuracy: Plus or minus 1 percent of scale range.
- 2. Direct-Mounted, Plastic-Case, Vapor-Actuated Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Sealed type, plastic; 4-1/2-inch (114-mm) **OR** 5-inch (127-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter.
 - c. Element: Bourdon tube or other type of pressure element.
 - d. Movement: Mechanical, with link to pressure element and connection to pointer.
 - e. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
 - f. Pointer: Dark-colored metal.
 - g. Window: Glass or plastic.
 - h. Ring: Metal or plastic.
 - i. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device **OR** rigid, back **OR** rigid, bottom, **as directed**; with ASME B1.1 screw threads.
 - j. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
 - 1) Design for Thermowell Installation: Bare stem.
 - k. Accuracy: Plus or minus 1 percent of scale range.
- 3. Remote-Mounted, Metal-Case, Vapor-Actuated Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch (114-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter with back **OR** front, **as directed**, flange and holes for panel mounting.
 - c. Element: Bourdon tube or other type of pressure element.
 - d. Movement: Mechanical, with link to pressure element and connection to pointer.
 - e. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
 - f. Pointer: Dark-colored metal.
 - g. Window: Glass or plastic.
 - h. Ring: Metal **OR** Stainless steel, **as directed**.
 - i. Connector Type(s): Union joint, back **OR** bottom, **as directed**; with ASME B1.1 screw threads.
 - j. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
 - 1) Design for Thermowell Installation: Bare stem.
 - k. Accuracy: Plus or minus 1 percent of scale range.
- 4. Remote-Mounted, Plastic-Case, Vapor-Actuated Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Sealed type, plastic; 4-1/2-inch (114-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter with back **OR** front, **as directed**, flange and holes for panel mounting.
 - c. Element: Bourdon tube or other type of pressure element.



- d. Movement: Mechanical, with link to pressure element and connection to pointer.
- e. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
- f. Pointer: Dark-colored metal.
- g. Window: Glass or plastic.
- h. Ring: Metal or plastic.
- i. Connector Type(s): Union joint, threaded, back **OR** bottom, **as directed**; with ASME B1.1 screw threads.
- j. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
 - 1) Design for Thermowell Installation: Bare stem.
- k. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

C. Liquid-In-Glass Thermometers

1. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Cast aluminum; 6-inch (152-mm) nominal size.
 - c. Case Form: Back angle **OR** Straight, **as directed**, unless otherwise indicated.
 - d. Tube: Glass with magnifying lens and blue or red organic liquid.
 - e. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
 - f. Window: Glass or plastic.
 - g. Stem: Aluminum or brass and of length to suit installation.
 - 1) Design for Thermowell Installation: Bare stem.
 - h. Connector: 3/4 inch (19 mm), with ASME B1.1 screw threads.
 - i. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
2. Plastic-Case, Compact-Style, Liquid-in-Glass Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Plastic; 6-inch (152-mm) nominal size.
 - c. Case Form: Back angle **OR** Straight, **as directed**, unless otherwise indicated.
 - d. Tube: Glass with magnifying lens and blue or red organic liquid.
 - e. Tube Background: Nonreflective with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
 - f. Window: Glass or plastic.
 - g. Stem: Aluminum or brass and of length to suit installation.
 - 1) Design for Thermowell Installation: Bare stem.
 - h. Connector: 3/4 inch (19 mm), with ASME B1.1 screw threads.
 - i. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
3. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Cast aluminum; 7-inch (178-mm) **OR** 9-inch (229-mm), **as directed**, nominal size unless otherwise indicated.
 - c. Case Form: Adjustable angle **OR** Back angle **OR** Straight, **as directed**, unless otherwise indicated.
 - d. Tube: Glass with magnifying lens and blue or red organic liquid.
 - e. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
 - f. Window: Glass or plastic.
 - g. Stem: Aluminum and of length to suit installation.
 - 1) Design for Thermowell Installation: Bare stem.
 - h. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
 - i. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.



4. Plastic-Case, Industrial-Style, Liquid-in-Glass Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Plastic; 7-inch (178-mm) **OR** 9-inch (229-mm), **as directed**, nominal size unless otherwise indicated.
 - c. Case Form: Adjustable angle **OR** Back angle **OR** Straight, **as directed**, unless otherwise indicated.
 - d. Tube: Glass with magnifying lens and blue or red organic liquid.
 - e. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
 - f. Window: Glass or plastic.
 - g. Stem: Aluminum **OR** Brass **OR** Stainless steel **OR** Aluminum, brass, or stainless steel, **as directed**, and of length to suit installation.
 - 1) Design for Thermowell Installation: Bare stem.
 - h. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
 - i. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
- D. Light-Activated Thermometers
 1. Direct-Mounted, Light-Activated Thermometers:
 - a. Case: Plastic **OR** Metal, **as directed**; 7-inch (178-mm) **OR** 9-inch (229-mm), **as directed**, nominal size unless otherwise indicated.
 - b. Scale(s): Deg F (Deg C) **OR** Deg F and deg C, **as directed**.
 - c. Case Form: Adjustable angle.
 - d. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
 - e. Stem: Aluminum and of length to suit installation.
 - 1) Design for Thermowell Installation: Bare stem.
 - f. Display: Digital.
 - g. Accuracy: Plus or minus 2 deg F (1 deg C).
 2. Remote-Mounted, Light-Activated Thermometers:
 - a. Case: Plastic, for wall mounting.
 - b. Scale(s): Deg F (Deg C) **OR** Deg F and deg C, **as directed**.
 - c. Sensor: Bulb and thermister wire.
 - 1) Design for Thermowell Installation: Bare stem.
 - d. Display: Digital.
 - e. Accuracy: Plus or minus 2 deg F (1 deg C).
- E. Thermowells
 1. Thermowells:
 - a. Standard: ASME B40.200.
 - b. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
 - c. Material for Use with Copper Tubing: CNR or CUNI.
 - d. Material for Use with Steel Piping: CRES **OR** CSA, **as directed**.
 - e. Type: Stepped shank unless straight or tapered shank is indicated.
 - f. External Threads: NPS 1/2, NPS 3/4, or NPS 1, (DN 15, DN 20, or NPS 25,) ASME B1.20.1 pipe threads.
 - g. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.
 - h. Bore: Diameter required to match thermometer bulb or stem.
 - i. Insertion Length: Length required to match thermometer bulb or stem.
 - j. Lagging Extension: Include on thermowells for insulated piping and tubing.
 - k. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
 2. Heat-Transfer Medium: Mixture of graphite and glycerin.
- F. Pressure Gages



1. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
 - a. Standard: ASME B40.100.
 - b. Case: Liquid-filled **OR** Sealed **OR** Open-front, pressure relief **OR** Solid-front, pressure relief, **as directed**, type(s); cast aluminum or drawn steel; 4-1/2-inch (114-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter.
 - c. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 - d. Pressure Connection: Brass, with NPS 1/4 (DN 8) **OR** NPS 1/4 or NPS 1/2 (DN 8 or DN 15) **OR** NPS 1/2 (DN 15), **as directed**, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 - e. Movement: Mechanical, with link to pressure element and connection to pointer.
 - f. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa) **OR** psi and kPa, **as directed**.
 - g. Pointer: Dark-colored metal.
 - h. Window: Glass or plastic.
 - i. Ring: Metal **OR** Brass **OR** Stainless steel, **as directed**.
 - j. Accuracy: Grade A, plus or minus 1 percent of middle half of **OR** Grade B, plus or minus 2 percent of middle half of **OR** Grade C, plus or minus 3 percent of middle half of **OR** Grade D, plus or minus 5 percent of whole, **as directed**, scale range.
2. Direct-Mounted, Plastic-Case, Dial-Type Pressure Gages:
 - a. Standard: ASME B40.100.
 - b. Case: Sealed type; plastic; 4-1/2-inch (114-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter.
 - c. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 - d. Pressure Connection: Brass, with NPS 1/4 (DN 8) **OR** NPS 1/4 or NPS 1/2 (DN 8 or DN 15) **OR** NPS 1/2 (DN 15), **as directed**, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 - e. Movement: Mechanical, with link to pressure element and connection to pointer.
 - f. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa) **OR** psi and kPa, **as directed**.
 - g. Pointer: Dark-colored metal.
 - h. Window: Glass or plastic.
 - i. Accuracy: Grade A, plus or minus 1 percent of middle half of **OR** Grade B, plus or minus 2 percent of middle half of **OR** Grade C, plus or minus 3 percent of middle half of **OR** Grade D, plus or minus 5 percent of whole, **as directed**, scale range.
3. Remote-Mounted, Metal-Case, Dial-Type Pressure Gages:
 - a. Standard: ASME B40.100.
 - b. Case: Liquid-filled **OR** Sealed, **as directed**, type; cast aluminum or drawn steel **OR** metal, **as directed**; 4-1/2-inch (114-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter with back **OR** front, **as directed**, flange and holes for panel mounting.
 - c. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 - d. Pressure Connection: Brass, with NPS 1/4 (DN 8) **OR** NPS 1/4 or NPS 1/2 (DN 8 or DN 15) **OR** NPS 1/2 (DN 15), **as directed**, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 - e. Movement: Mechanical, with link to pressure element and connection to pointer.
 - f. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa) **OR** psi and kPa, **as directed**.
 - g. Pointer: Dark-colored metal.
 - h. Window: Glass or plastic.
 - i. Ring: Metal **OR** Stainless steel, **as directed**.
 - j. Accuracy: Grade A, plus or minus 1 percent of middle half of **OR** Grade B, plus or minus 2 percent of middle half of **OR** Grade C, plus or minus 3 percent of middle half of **OR** Grade D, plus or minus 5 percent of whole, **as directed**, scale range.
4. Remote-Mounted, Plastic-Case, Dial-Type Pressure Gages:
 - a. Standard: ASME B40.100.
 - b. Case: Sealed type; plastic; 4-1/2-inch (114-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter with back **OR** front, **as directed**, flange and holes for panel mounting.



- c. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
- d. Pressure Connection: Brass, with NPS 1/4 (DN 8) **OR** NPS 1/4 or NPS 1/2 (DN 8 or DN 15) **OR** NPS 1/2 (DN 15), **as directed**, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
- e. Movement: Mechanical, with link to pressure element and connection to pointer.
- f. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa) **OR** psi and kPa, **as directed**.
- g. Pointer: Dark-colored metal.
- h. Window: Glass or plastic.
- i. Accuracy: Grade A, plus or minus 1 percent of middle half of **OR** Grade B, plus or minus 2 percent of middle half of **OR** Grade C, plus or minus 3 percent of middle half of **OR** Grade D, plus or minus 5 percent of whole, **as directed**, scale range.

G. Gage Attachments

- 1. Snubbers: ASME B40.100, brass; with NPS 1/4 (DN 8) **OR** NPS 1/4 or NPS 1/2 (DN 8 or DN 15) **OR** NPS 1/2 (DN 15), **as directed**, ASME B1.20.1 pipe threads and piston **OR** porous-metal, **as directed**, -type surge-dampening device. Include extension for use on insulated piping.
- 2. Valves: Brass ball **OR** Brass or stainless-steel needle, **as directed**, with NPS 1/4 (DN 8) **OR** NPS 1/4 or NPS 1/2 (DN 8 or DN 15) **OR** NPS 1/2 (DN 15), **as directed**, ASME B1.20.1 pipe threads.

H. Test Plugs

- 1. Description: Test-station fitting made for insertion into piping tee fitting.
- 2. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- 3. Thread Size: NPS 1/4 (DN 8) or NPS 1/2 (DN 15), ASME B1.20.1 pipe thread.
- 4. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F (3450 kPa at 93 deg C).
- 5. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

I. Test-Plug Kits

- 1. Furnish one test-plug kit(s) containing one **OR** two, **as directed**, thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.
- 2. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F (minus 4 to plus 52 deg C).
- 3. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F (minus 18 to plus 104 deg C).
- 4. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- (51- to 76-mm-) diameter dial and probe. Dial range shall be at least 0 to 200 psig (0 to 1380 kPa).
- 5. Carrying Case: Metal or plastic, with formed instrument padding.

J. Sight Flow Indicators

- 1. Description: Piping inline-installation device for visual verification of flow.
- 2. Construction: Bronze or stainless-steel body, with sight glass and ball, flapper, or paddle wheel indicator, and threaded or flanged ends.
- 3. Minimum Pressure Rating: 125 psig (860 kPa) **OR** 150 psig (1034 kPa), **as directed**.
- 4. Minimum Temperature Rating: 200 deg F (93 deg C).
- 5. End Connections for NPS 2 (DN 50) and Smaller: Threaded.
- 6. End Connections for NPS 2-1/2 (DN 65) and Larger: Flanged.



1.3 EXECUTION

A. Installation

1. Install thermowells with socket extending a minimum of 2 inches (51 mm) into fluid **OR** one-third of pipe diameter **OR** to center of pipe, **as directed**, and in vertical position in piping tees.
2. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
3. Install thermowells with extension on insulated piping.
4. Fill thermowells with heat-transfer medium.
5. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
6. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
7. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
8. Install remote-mounted pressure gages on panel.
9. Install valve and snubber in piping for each pressure gage for fluids.
10. Install test plugs in piping tees.
11. Install thermometers in the following locations:
 - a. Inlet and outlet of each water heater.
 - b. Inlets and outlets of each domestic water heat exchanger.
 - c. Inlet and outlet of each domestic hot-water storage tank.
 - d. Inlet and outlet of each remote domestic water chiller.
12. Install pressure gages in the following locations:
 - a. Building water service entrance into building.
 - b. Inlet and outlet of each pressure-reducing valve.
 - c. Suction and discharge of each domestic water pump.

B. Connections

1. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

C. Adjusting

1. Adjust faces of meters and gages to proper angle for best visibility.

D. Thermometer Schedule

1. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:
 - a. Liquid-filled **OR** Sealed, **as directed**, bimetallic-actuated type.
 - b. Direct **OR** Remote, **as directed**, -mounted, metal **OR** plastic, **as directed**, -case, vapor-actuated type.
 - c. Compact **OR** Industrial, **as directed**, -style, liquid-in-glass type.
 - d. Direct **OR** Remote, **as directed**, -mounted, light-activated type.
 - e. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
2. Thermometers at inlets and outlets of each domestic water heat exchanger shall be one of the following:
 - a. Liquid-filled **OR** Sealed, **as directed**, bimetallic-actuated type.
 - b. Direct **OR** Remote, **as directed**, -mounted, metal **OR** plastic, **as directed**, -case, vapor-actuated type.
 - c. Compact **OR** Industrial, **as directed**, -style, liquid-in-glass type.
 - d. Direct **OR** Remote, **as directed**, -mounted, light-activated type.
 - e. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
3. Thermometers at inlet and outlet of each domestic hot-water storage tank shall be one of the following:
 - a. Liquid-filled **OR** Sealed, **as directed**, bimetallic-actuated type.



- b. Direct **OR** Remote, **as directed**, -mounted, metal **OR** plastic, **as directed**, -case, vapor-actuated type.
 - c. Compact **OR** Industrial, **as directed**, -style, liquid-in-glass type.
 - d. Direct **OR** Remote, **as directed**, -mounted, light-activated type.
 - e. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
 - 4. Thermometers at inlet and outlet of each remote domestic water chiller shall be one of the following:
 - a. Liquid-filled **OR** Sealed, **as directed**, bimetallic-actuated type.
 - b. Direct **OR** Remote, **as directed**, -mounted, metal **OR** plastic, **as directed**, -case, vapor-actuated type.
 - c. Compact **OR** Industrial, **as directed**, -style, liquid-in-glass type.
 - d. Direct **OR** Remote, **as directed**, -mounted, light-activated type.
 - e. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
 - 5. Thermometer stems shall be of length to match thermowell insertion length.
- E. Thermometer Scale-Range Schedule
- 1. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F (Minus 20 to plus 50 deg C) **OR** 0 to 100 deg F and minus 20 to plus 50 deg C, **as directed**.
 - 2. Scale Range for Domestic Cold-Water Piping: 0 to 150 deg F (Minus 20 to plus 70 deg C) **OR** 0 to 150 deg F and minus 20 to plus 70 deg C, **as directed**.
 - 3. Scale Range for Domestic Cold-Water Piping: 30 to 240 deg F (0 to plus 115 deg C) **OR** 30 to 240 deg F and 0 to plus 115 deg C, **as directed**.
 - 4. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F (0 to 150 deg C) **OR** 0 to 250 deg F and 0 to 150 deg C, **as directed**.
 - 5. Scale Range for Domestic Hot-Water Piping: 20 to 240 deg F (0 to 150 deg C) **OR** 20 to 240 deg F and 0 to 150 deg C, **as directed**.
 - 6. Scale Range for Domestic Hot-Water Piping: 30 to 240 deg F (0 to plus 115 deg C) **OR** 30 to 240 deg F and 0 to plus 115 deg C, **as directed**.
 - 7. Scale Range for Domestic Cooled-Water Piping: 0 to 100 deg F (Minus 20 to plus 50 deg C) **OR** 0 to 100 deg F and minus 20 to plus 50 deg C, **as directed**.
 - 8. Scale Range for Domestic Cooled-Water Piping: 0 to 150 deg F (Minus 20 to plus 70 deg C) **OR** 0 to 150 deg F and minus 20 to plus 70 deg C, **as directed**.
- F. Pressure-Gage Schedule
- 1. Pressure gages at discharge of each water service into building shall be one of the following:
 - a. Liquid-filled **OR** Sealed **OR** Open-front, pressure-relief **OR** Solid-front, pressure-relief, **as directed**, direct **OR** remote, **as directed**, -mounted, metal case.
 - b. Sealed, direct **OR** remote, **as directed**, -mounted, plastic case.
 - c. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
 - 2. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be one of the following:
 - a. Liquid-filled **OR** Sealed **OR** Open-front, pressure-relief **OR** Solid-front, pressure-relief, **as directed**, direct **OR** remote, **as directed**, -mounted, metal case.
 - b. Sealed, direct **OR** remote, **as directed**, -mounted, plastic case.
 - c. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
 - 3. Pressure gages at suction and discharge of each domestic water pump shall be one of the following:
 - a. Liquid-filled **OR** Sealed **OR** Open-front, pressure-relief **OR** Solid-front, pressure-relief, **as directed**, direct **OR** remote, **as directed**, -mounted, metal case.
 - b. Sealed, direct **OR** remote, **as directed**, -mounted, plastic case.



- c. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
- G. Pressure-Gage Scale-Range Schedule
- 1. Scale Range for Water Service Piping: 0 to 100 psi (0 to 600 kPa) **OR** 0 to 100 psi and 0 to 600 kPa, **as directed**.
 - 2. Scale Range for Water Service Piping: 0 to 160 psi (0 to 1100 kPa) **OR** 0 to 160 psi and 0 to 1100 kPa, **as directed**.
 - 3. Scale Range for Water Service Piping: 0 to 200 psi (0 to 1400 kPa) **OR** 0 to 200 psi and 0 to 1400 kPa, **as directed**.
 - 4. Scale Range for Domestic Water Piping: 0 to 100 psi (0 to 600 kPa) **OR** 0 to 100 psi and 0 to 600 kPa, **as directed**.
 - 5. Scale Range for Domestic Water Piping: 0 to 160 psi (0 to 1100 kPa) **OR** 0 to 160 psi and 0 to 1100 kPa, **as directed**.
 - 6. Scale Range for Domestic Water Piping: 0 to 200 psi (0 to 1400 kPa) **OR** 0 to 200 psi and 0 to 1400 kPa, **as directed**.
 - 7. Scale Range for Domestic Water Piping: 0 to 300 psi (0 to 2500 kPa) **OR** 0 to 300 psi and 0 to 2500 kPa, **as directed**.

END OF SECTION 21 05 19 00



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SECTION 21 05 19 00a - METERS AND GAGES FOR HVAC PIPING**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for meters and gages for HVAC piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Bimetallic-actuated thermometers.
 - b. Filled-system thermometers.
 - c. Liquid-in-glass thermometers.
 - d. Light-activated thermometers.
 - e. Thermowells.
 - f. Dial-type pressure gages.
 - g. Gage attachments.
 - h. Test plugs.
 - i. Test-plug kits.
 - j. Sight flow indicators.
 - k. Orifice flowmeters.
 - l. Pitot-tube flowmeters.
 - m. Turbine flowmeters.
 - n. Venturi flowmeters.
 - o. Vortex-shedding flowmeters.
 - p. Impeller-turbine, thermal-energy meters.
 - q. Ultrasonic, thermal-energy meters.

C. Submittals

1. Product Data: For each type of product indicated.
2. Wiring Diagrams: For power, signal, and control wiring.
3. Product Certificates: For each type of meter and gage, from manufacturer.
4. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

1.2 PRODUCTS**A. Bimetallic-Actuated Thermometers**

1. Standard: ASME B40.200.
2. Case: Liquid-filled and sealed type(s); stainless steel with 3-inch (76-mm) **OR** 5-inch (127-mm), **as directed**, nominal diameter.
3. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F (deg C) **OR** deg F and deg C, **as directed**.
4. Connector Type(s): Union joint, adjustable angle **OR** rigid, back **OR** rigid, bottom, **as directed**, with unified-inch screw threads.
5. Connector Size: 1/2 inch (13 mm), with ASME B1.1 screw threads.
6. Stem: 0.25 or 0.375 inch (6.4 or 9.4 mm) in diameter; stainless steel.
7. Window: Plain glass or plastic.
8. Ring: Stainless steel.
9. Element: Bimetal coil.
10. Pointer: Dark-colored metal.



11. Accuracy: Plus or minus 1 **OR** 1.5, **as directed**, percent of scale range.

B. Filled-System Thermometers

1. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch (114-mm) **OR** 5-inch (127-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter.
 - c. Element: Bourdon tube or other type of pressure element.
 - d. Movement: Mechanical, dampening type, **as directed**, with link to pressure element and connection to pointer.
 - e. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
 - f. Pointer: Dark-colored metal.
 - g. Window: Glass or plastic.
 - h. Ring: Metal **OR** Stainless steel.
 - i. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device **OR** rigid, back **OR** rigid, bottom, **as directed**; with ASME B1.1 screw threads.
 - j. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
 - 1) Design for Air-Duct Installation: With ventilated shroud.
 - 2) Design for Thermowell Installation: Bare stem.
 - k. Accuracy: Plus or minus 1 percent of scale range.
2. Direct-Mounted, Plastic-Case, Vapor-Actuated Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Sealed type, plastic; 4-1/2-inch (114-mm) **OR** 5-inch (127-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter.
 - c. Element: Bourdon tube or other type of pressure element.
 - d. Movement: Mechanical, with link to pressure element and connection to pointer.
 - e. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
 - f. Pointer: Dark-colored metal.
 - g. Window: Glass or plastic.
 - h. Ring: Metal or plastic.
 - i. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device **OR** rigid, back **OR** rigid, bottom, **as directed**; with ASME B1.1 screw threads.
 - j. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
 - 1) Design for Air-Duct Installation: With ventilated shroud.
 - 2) Design for Thermowell Installation: Bare stem.
 - k. Accuracy: Plus or minus 1 percent of scale range.
3. Remote-Mounted, Metal-Case, Vapor-Actuated Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch (114-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter with back **OR** front, **as directed**, flange and holes for panel mounting.
 - c. Element: Bourdon tube or other type of pressure element.
 - d. Movement: Mechanical, with link to pressure element and connection to pointer.
 - e. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
 - f. Pointer: Dark-colored metal.
 - g. Window: Glass or plastic.
 - h. Ring: Metal **OR** Stainless steel, **as directed**.



- i. Connector Type(s): Union joint, back **OR** bottom, **as directed**; with ASME B1.1 screw threads.
- j. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
 - 1) Design for Air-Duct Installation: With ventilated shroud.
 - 2) Design for Thermowell Installation: Bare stem.
- k. Accuracy: Plus or minus 1 percent of scale range.
- 4. Remote-Mounted, Plastic-Case, Vapor-Actuated Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Sealed type, plastic; 4-1/2-inch (114-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter with back **OR** front, **as directed**, flange and holes for panel mounting.
 - c. Element: Bourdon tube or other type of pressure element.
 - d. Movement: Mechanical, with link to pressure element and connection to pointer.
 - e. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
 - f. Pointer: Dark-colored metal.
 - g. Window: Glass or plastic.
 - h. Ring: Metal or plastic.
 - i. Connector Type(s): Union joint, threaded, back **OR** bottom, **as directed**; with ASME B1.1 screw threads.
 - j. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
 - 1) Design for Air-Duct Installation: With ventilated shroud.
 - 2) Design for Thermowell Installation: Bare stem.
 - k. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
- C. Liquid-In-Glass Thermometers
 - 1. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Cast aluminum; 6-inch (152-mm) nominal size.
 - c. Case Form: Back angle **OR** Straight, **as directed**, unless otherwise indicated.
 - d. Tube: Glass with magnifying lens and blue or red, **as directed**, organic liquid.
 - e. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
 - f. Window: Glass or plastic.
 - g. Stem: Aluminum or brass and of length to suit installation.
 - 1) Design for Air-Duct Installation: With ventilated shroud.
 - 2) Design for Thermowell Installation: Bare stem.
 - h. Connector: 3/4 inch (19 mm), with ASME B1.1 screw threads.
 - i. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
 - 2. Plastic-Case, Compact-Style, Liquid-in-Glass Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Plastic; 6-inch (152-mm) nominal size.
 - c. Case Form: Back angle **OR** Straight, **as directed**, unless otherwise indicated.
 - d. Tube: Glass with magnifying lens and blue or red, **as directed**, organic liquid.
 - e. Tube Background: Nonreflective with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
 - f. Window: Glass or plastic.
 - g. Stem: Aluminum or brass and of length to suit installation.
 - 1) Design for Air-Duct Installation: With ventilated shroud.
 - 2) Design for Thermowell Installation: Bare stem.
 - h. Connector: 3/4 inch (19 mm), with ASME B1.1 screw threads.
 - i. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.



3. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Cast aluminum; 7-inch (178-mm) **OR** 9-inch (229-mm), **as directed**, nominal size unless otherwise indicated.
 - c. Case Form: Adjustable angle **OR** Back angle **OR** Straight, **as directed**, unless otherwise indicated.
 - d. Tube: Glass with magnifying lens and blue or red, **as directed**, organic liquid.
 - e. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
 - f. Window: Glass or plastic.
 - g. Stem: Aluminum and of length to suit installation.
 - 1) Design for Air-Duct Installation: With ventilated shroud.
 - 2) Design for Thermowell Installation: Bare stem.
 - h. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
 - i. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
 4. Plastic-Case, Industrial-Style, Liquid-in-Glass Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Plastic; 7-inch (178-mm) **OR** 9-inch (229-mm), **as directed**, nominal size unless otherwise indicated.
 - c. Case Form: Adjustable angle **OR** Back angle **OR** Straight, **as directed**, unless otherwise indicated.
 - d. Tube: Glass with magnifying lens and blue or red, **as directed**, organic liquid.
 - e. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
 - f. Window: Glass or plastic.
 - g. Stem: Aluminum **OR** Brass **OR** Stainless steel, **as directed**, and of length to suit installation.
 - 1) Design for Air-Duct Installation: With ventilated shroud.
 - 2) Design for Thermowell Installation: Bare stem.
 - h. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
 - i. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
- D. Light-Activated Thermometers
1. Direct-Mounted, Light-Activated Thermometers:
 - a. Case: Plastic **OR** Metal, **as directed**; 7-inch (178-mm) **OR** 9-inch (229-mm), **as directed**, nominal size unless otherwise indicated.
 - b. Scale(s): Deg F (Deg C) **OR** Deg F and deg C, **as directed**.
 - c. Case Form: Adjustable angle.
 - d. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
 - e. Stem: Aluminum and of length to suit installation.
 - 1) Design for Air-Duct Installation: With ventilated shroud.
 - 2) Design for Thermowell Installation: Bare stem.
 - f. Display: Digital.
 - g. Accuracy: Plus or minus 2 deg F (1 deg C).
 2. Remote-Mounted, Light-Activated Thermometers:
 - a. Case: Plastic, for wall mounting.
 - b. Scale(s): Deg F (Deg C) **OR** Deg F and deg C, **as directed**.
 - c. Sensor: Bulb and thermister wire.
 - 1) Design for Air-Duct Installation: With ventilated shroud.
 - 2) Design for Thermowell Installation: Bare stem.
 - d. Display: Digital.
 - e. Accuracy: Plus or minus 2 deg F (1 deg C).



- E. Duct-Thermometer Mounting Brackets
1. Description: Flanged bracket with screw holes, for attachment to air duct and made to hold thermometer stem.
- F. Thermowells
1. Thermowells:
 - a. Standard: ASME B40.200.
 - b. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
 - c. Material for Use with Copper Tubing: CNR **OR** CUNI, **as directed**.
 - d. Material for Use with Steel Piping: CRES **OR** CSA, **as directed**.
 - e. Type: Stepped shank unless straight or tapered shank is indicated.
 - f. External Threads: NPS 1/2, NPS 3/4, or NPS 1, (DN 15, DN 20, or NPS 25,) ASME B1.20.1 pipe threads.
 - g. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.
 - h. Bore: Diameter required to match thermometer bulb or stem.
 - i. Insertion Length: Length required to match thermometer bulb or stem.
 - j. Lagging Extension: Include on thermowells for insulated piping and tubing.
 - k. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
 2. Heat-Transfer Medium: Mixture of graphite and glycerin.
- G. Pressure Gages
1. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
 - 1) Standard: ASME B40.100.
 - 2) Case: Liquid-filled **OR** Sealed **OR** Open-front, pressure relief **OR** Solid-front, pressure relief, **as directed**, type(s); cast aluminum or drawn steel; 4-1/2-inch (114-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter.
 - 3) Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 - 4) Pressure Connection: Brass, with NPS 1/4 (DN 8) **OR** NPS 1/2 (DN 15), **as directed**, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 - 5) Movement: Mechanical, with link to pressure element and connection to pointer.
 - 6) Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa) **OR** psi and kPa, **as directed**.
 - 7) Pointer: Dark-colored metal.
 - 8) Window: Glass or plastic.
 - 9) Ring: Metal **OR** Brass **OR** Stainless steel, **as directed**.
 - 10) Accuracy: Grade A, plus or minus 1 percent of middle half of **OR** Grade B, plus or minus 2 percent of middle half of **OR** Grade C, plus or minus 3 percent of middle half of **OR** Grade D, plus or minus 5 percent of whole, **as directed**, scale range.
 2. Direct-Mounted, Plastic-Case, Dial-Type Pressure Gages:
 - a. Standard: ASME B40.100.
 - b. Case: Sealed type; plastic; 4-1/2-inch (114-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter.
 - c. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 - d. Pressure Connection: Brass, with NPS 1/4 (DN 8) **OR** NPS 1/2 (DN 15), **as directed**, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 - e. Movement: Mechanical, with link to pressure element and connection to pointer.
 - f. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa) **OR** psi and kPa, **as directed**.
 - g. Pointer: Dark-colored metal.
 - h. Window: Glass or plastic.
 - i. Accuracy: Grade A, plus or minus 1 percent of middle half of **OR** Grade B, plus or minus 2 percent of middle half of **OR** Grade C, plus or minus 3 percent of middle half of **OR** Grade D, plus or minus 5 percent of whole, **as directed**, scale range.



3. Remote-Mounted, Metal-Case, Dial-Type Pressure Gages:
 - a. Standard: ASME B40.100.
 - b. Case: Liquid-filled **OR** Sealed, **as directed**, type; cast aluminum or drawn steel **OR** metal, **as directed**; 4-1/2-inch (114-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter with back **OR** front, **as directed**, flange and holes for panel mounting.
 - c. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 - d. Pressure Connection: Brass, with NPS 1/4 (DN 8) **OR** NPS 1/2 (DN 15), **as directed**, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 - e. Movement: Mechanical, with link to pressure element and connection to pointer.
 - f. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa) **OR** psi and kPa, **as directed**.
 - g. Pointer: Dark-colored metal.
 - h. Window: Glass or plastic.
 - i. Ring: Metal **OR** Stainless steel, **as directed**.
 - j. Accuracy: Grade A, plus or minus 1 percent of middle half of **OR** Grade B, plus or minus 2 percent of middle half of **OR** Grade C, plus or minus 3 percent of middle half of **OR** Grade D, plus or minus 5 percent of whole, **as directed**, scale range.
 4. Remote-Mounted, Plastic-Case, Dial-Type Pressure Gages:
 - a. Standard: ASME B40.100.
 - b. Case: Sealed type; plastic; 4-1/2-inch (114-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter with back **OR** front, **as directed**, flange and holes for panel mounting.
 - c. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 - d. Pressure Connection: Brass, with NPS 1/4 (DN 8) **OR** NPS 1/2 (DN 15), **as directed**, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 - e. Movement: Mechanical, with link to pressure element and connection to pointer.
 - f. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa) **OR** psi and kPa, **as directed**.
 - g. Pointer: Dark-colored metal.
 - h. Window: Glass or plastic.
 - i. Accuracy: Grade A, plus or minus 1 percent of middle half of **OR** Grade B, plus or minus 2 percent of middle half of **OR** Grade C, plus or minus 3 percent of middle half of **OR** Grade D, plus or minus 5 percent of whole, **as directed**, scale range.
- H. Gage Attachments
1. Snubbers: ASME B40.100, brass; with NPS 1/4 (DN 8) **OR** NPS 1/2 (DN 15), **as directed**, ASME B1.20.1 pipe threads and piston-type **OR** porous-metal-type, **as directed**, surge-dampening device. Include extension for use on insulated piping.
 2. Siphons: Loop-shaped section of brass **OR** stainless-steel **OR** steel, **as directed**, pipe with NPS 1/4 (DN 8) **OR** NPS 1/2 (DN 15), **as directed**, pipe threads.
 3. Valves: Brass ball **OR** Brass or stainless-steel needle, **as directed**, with NPS 1/4 (DN 8) **OR** NPS 1/2 (DN 15), **as directed**, ASME B1.20.1 pipe threads.
- I. Test Plugs
1. Description: Test-station fitting made for insertion into piping tee fitting.
 2. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
 3. Thread Size: NPS 1/4 (DN 8) **OR** NPS 1/2 (DN 15), **as directed**, ASME B1.20.1 pipe thread.
 4. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F (3450 kPa at 93 deg C).
 5. Core Inserts: Chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber.
- J. Test-Plug Kits
1. Furnish one test-plug kit(s) containing one **OR** two, **as directed**, thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.



2. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F (minus 4 to plus 52 deg C).
 3. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F (minus 18 to plus 104 deg C).
 4. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- (51- to 76-mm-) diameter dial and probe. Dial range shall be at least 0 to 200 psig (0 to 1380 kPa).
 5. Carrying Case: Metal or plastic, with formed instrument padding.
- K. Sight Flow Indicators
1. Description: Piping inline-installation device for visual verification of flow.
 2. Construction: Bronze or stainless-steel body, with sight glass and ball, flapper, or paddle wheel indicator, and threaded or flanged ends.
 3. Minimum Pressure Rating: 125 psig (860 kPa) **OR** 150 psig (1034 kPa), **as directed**.
 4. Minimum Temperature Rating: 200 deg F (93 deg C).
 5. End Connections for NPS 2 (DN 50) and Smaller: Threaded.
 6. End Connections for NPS 2-1/2 (DN 65) and Larger: Flanged.
- L. Flowmeters
1. Orifice Flowmeters:
 - a. Description: Flowmeter with sensor, hoses or tubing, fittings, valves, indicator, and conversion chart.
 - b. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
 - c. Sensor: Wafer-orifice-type, calibrated, flow-measuring element; for installation between pipe flanges.
 - 1) Design: Differential-pressure-type measurement for gas **OR** oil **OR** steam **OR** water, **as directed**.
 - 2) Construction: Cast-iron body, brass valves with integral check valves and caps, and calibrated nameplate.
 - 3) Minimum Pressure Rating: 300 psig (2070 kPa).
 - 4) Minimum Temperature Rating: 250 deg F (121 deg C).
 - d. Permanent Indicators: Meter suitable for wall or bracket mounting, calibrated for connected sensor and having 6-inch- (152-mm-) diameter, or equivalent, dial with fittings and copper tubing for connecting to sensor.
 - 1) Scale: Gallons per minute (Liters per second).
 - 2) Accuracy: Plus or minus 1 percent between 20 and 80 percent of scale range.
 - e. Portable Indicators: Hand-held, differential-pressure type, calibrated for connected sensor and having two 12-foot (3.7-m) hoses, with carrying case.
 - 1) Scale: Gallons per minute (Liters per second).
 - 2) Accuracy: Plus or minus 2 percent between 20 and 80 percent of scale range.
 - f. Display: Shows rate of flow, with register to indicate total volume in gallons (liters).
 - g. Conversion Chart: Flow rate data compatible with sensor and indicator.
 - h. Operating Instructions: Include complete instructions with each flowmeter.
 2. Pitot-Tube Flowmeters:
 - a. Description: Flowmeter with sensor and indicator.
 - b. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
 - c. Sensor: Insertion type; for inserting probe into piping and measuring flow directly in gallons per minute (liters per second).
 - 1) Design: Differential-pressure-type measurement for oil **OR** water, **as directed**.
 - 2) Construction: Stainless-steel probe of length to span inside of pipe, with integral transmitter and direct-reading scale.
 - 3) Minimum Pressure Rating: 150 psig (1035 kPa).
 - 4) Minimum Temperature Rating: 250 deg F (121 deg C).

- d. Indicator: Hand-held meter; either an integral part of sensor or a separate meter.
 - e. Integral Transformer: For low-voltage power connection.
 - f. Accuracy: Plus or minus 3 percent.
 - g. Display: Shows rate of flow, with register to indicate total volume in gallons (liters).
 - h. Operating Instructions: Include complete instructions with each flowmeter.
3. Turbine Flowmeters:
- a. Description: Flowmeter with sensor and indicator.
 - b. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
 - c. Sensor: Impeller turbine; for inserting into pipe fitting or for installing in piping and measuring flow directly in gallons per minute (liters per second).
 - 1) Design: Device or pipe fitting with inline turbine and integral direct-reading scale for gas **OR** oil **OR** steam **OR** water, **as directed**.
 - 2) Construction: Bronze or stainless-steel body, with plastic turbine or impeller.
 - 3) Minimum Pressure Rating: 150 psig (1035 kPa).
 - 4) Minimum Temperature Rating: 180 deg F (82 deg C).
 - d. Indicator: Hand-held meter; either an integral part of sensor or a separate meter.
 - e. Accuracy: Plus or minus 1-1/2 percent.
 - f. Display: Shows rate of flow, with register to indicate total volume in gallons (liters).
 - g. Operating Instructions: Include complete instructions with each flowmeter.
4. Venturi Flowmeters:
- a. Description: Flowmeter with calibrated flow-measuring element, hoses or tubing, fittings, valves, indicator, and conversion chart.
 - b. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
 - c. Sensor: Venturi-type, calibrated, flow-measuring element; for installation in piping.
 - 1) Design: Differential-pressure-type measurement for gas **OR** oil **OR** steam **OR** water, **as directed**.
 - 2) Construction: Bronze, brass, or factory-primed steel, with brass fittings and attached tag with flow conversion data.
 - 3) Minimum Pressure Rating: 250 psig (1725 kPa).
 - 4) Minimum Temperature Rating: 250 deg F (121 deg C).
 - 5) End Connections for NPS 2 (DN 50) and Smaller: Threaded.
 - 6) End Connections for NPS 2-1/2 (DN 65) and Larger: Flanged or welded.
 - 7) Flow Range: Flow-measuring element and flowmeter shall cover operating range of equipment or system served.
 - d. Permanent Indicators: Meter suitable for wall or bracket mounting, calibrated for connected flowmeter element, and having 6-inch- (152-mm-) diameter, or equivalent, dial with fittings and copper tubing for connecting to flowmeter element.
 - 1) Scale: Gallons per minute (Liters per second).
 - 2) Accuracy: Plus or minus 1 percent between 20 and 80 percent of scale range.
 - e. Portable Indicators: Hand-held, differential-pressure type, calibrated for connected flowmeter element and having two 12-foot (3.7-m) hoses, with carrying case.
 - 1) Scale: Gallons per minute (Liters per second).
 - 2) Accuracy: Plus or minus 2 percent between 20 and 80 percent of scale range.
 - f. Display: Shows rate of flow, with register to indicate total volume in gallons (liters).
 - g. Conversion Chart: Flow rate data compatible with sensor.
 - h. Operating Instructions: Include complete instructions with each flowmeter.
5. Vortex-Shedding Flowmeters:
- a. Description: Flowmeter with sensor and indicator.
 - b. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
 - c. Sensor: Inline type; for installing between pipe flanges and measuring flow directly in gallons per minute (liters per second).



- 1) Design: Flow obstruction device, vortex-measurement type for gas **OR** steam **OR** liquids, **as directed**.
 - 2) Construction: Stainless-steel body, with integral transmitter and direct-reading scale.
 - 3) Minimum Pressure Rating: 1000 psig (6900 kPa).
 - 4) Minimum Temperature Rating: 500 deg F (260 deg C).
 - 5) Integral Transformer: For low-voltage power operation.
 - d. Indicator: Hand-held meter; either an integral part of sensor or a separate meter.
 - e. Accuracy: Plus or minus 0.25 percent for liquids and 0.75 percent for gases.
 - f. Display: Shows rate of flow, with register to indicate total volume in gallons (liters).
 - g. Operating Instructions: Include complete instructions with each flowmeter.
- M. Thermal-Energy Meters
1. Impeller-Turbine, Thermal-Energy Meters:
 - a. Description: System with strainer, **as directed**, flow sensor, temperature sensors, transmitter, indicator, and connecting wiring.
 - b. Flow Sensor: Impeller turbine with corrosion-resistant-metal body and transmitter; for installing in piping.
 - 1) Design: Total thermal-energy measurement.
 - 2) Minimum Pressure Rating: 150 psig (1035 kPa).
 - 3) Minimum Temperature Range: 40 to 250 deg F (5 to 121 deg C).
 - c. Temperature Sensors: Insertion-type transducer.
 - d. Indicator: Solid-state, integrating-type meter with integral battery pack, **as directed**; for wall mounting.
 - 1) Data Output: Six-digit electromechanical counter with readout in kilowatts per hour or British thermal units (joules).
 - 2) Battery Pack: Five-year lithium battery.
 - e. Accuracy: Plus or minus 1 percent.
 - f. Display: Visually indicates total fluid volume in gallons (liters) and thermal-energy flow in kilowatts per hour or British thermal units (joules).
 - g. Strainer: Full size of main line piping.
 - h. Operating Instructions: Include complete instructions with each thermal-energy meter system.
 2. Ultrasonic, Thermal-Energy Meters:
 - a. Description: Meter with flow sensor, temperature sensors, transmitter, indicator, and connecting wiring.
 - b. Flow Sensor: Transit-time ultrasonic type with transmitter.
 - c. Temperature Sensors: Insertion-type or strap-on transducer.
 - d. Indicator: Solid-state, integrating-type meter with integral battery pack, **as directed**.
 - 1) Data Output: Six-digit electromechanical counter with readout in kilowatts per hour or British thermal units (joules).
 - 2) Battery Pack: Five-year lithium battery.
 - e. Accuracy: Plus or minus 1 percent.
 - f. Display: Visually indicates total fluid volume in gallons (liters) and thermal-energy flow in kilowatts per hour or British thermal units (joules).
 - g. Operating Instructions: Include complete instructions with each thermal-energy meter system.

1.3 EXECUTION

A. Installation

1. Install thermowells with socket extending a minimum of 2 inches (51 mm) into fluid **OR** one-third of pipe diameter **OR** to center of pipe, **as directed**, and in vertical position in piping tees.
2. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.



3. Install thermowells with extension on insulated piping.
4. Fill thermowells with heat-transfer medium.
5. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
6. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
7. Install duct-thermometer mounting brackets in walls of ducts. Attach to duct with screws.
8. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
9. Install remote-mounted pressure gages on panel.
10. Install valve and snubber in piping for each pressure gage for fluids (except steam).
11. Install valve and syphon fitting in piping for each pressure gage for steam.
12. Install test plugs in piping tees.
13. Install flow indicators in piping systems in accessible positions for easy viewing.
14. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters according to manufacturer's written instructions.
15. Install flowmeter elements in accessible positions in piping systems.
16. Install wafer-orifice flowmeter elements between pipe flanges.
17. Install differential-pressure-type flowmeter elements, with at least minimum straight lengths of pipe, upstream and downstream from element according to manufacturer's written instructions.
18. Install permanent indicators on walls or brackets in accessible and readable positions.
19. Install connection fittings in accessible locations for attachment to portable indicators.
20. Mount thermal-energy meters on wall if accessible; if not, provide brackets to support meters.
21. Install thermometers in the following locations:
 - a. Inlet and outlet of each hydronic zone.
 - b. Inlet and outlet of each hydronic boiler.
 - c. Two inlets and two outlets of each chiller.
 - d. Inlet and outlet of each hydronic coil in air-handling units.
 - e. Two inlets and two outlets of each hydronic heat exchanger.
 - f. Inlet and outlet of each thermal-storage tank.
 - g. Outside-, return-, supply-, and mixed-air ducts.
22. Install pressure gages in the following locations:
 - a. Discharge of each pressure-reducing valve.
 - b. Inlet and outlet of each chiller chilled-water and condenser-water connection.
 - c. Suction and discharge of each pump.

B. Connections

1. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.
2. Connect flowmeter-system elements to meters.
3. Connect flowmeter transmitters to meters.
4. Connect thermal-energy meter transmitters to meters.

C. Adjusting

1. After installation, calibrate meters according to manufacturer's written instructions.
2. Adjust faces of meters and gages to proper angle for best visibility.

D. Thermometer Schedule

1. Thermometers at inlet and outlet of each hydronic zone shall be one of the following:
 - a. Liquid-filled **OR** Sealed, **as directed**, bimetallic-actuated type.
 - b. Direct-mounted **OR** Remote-mounted, **as directed**, metal-case **OR** plastic-case, **as directed**, vapor-actuated type.
 - c. Compact-style **OR** Industrial-style, **as directed**, liquid-in-glass type.
 - d. Direct-mounted **OR** Remote-mounted, **as directed**, light-activated type.
 - e. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.



2. Thermometers at inlet and outlet of each hydronic boiler shall be one of the following:
 - a. Liquid-filled **OR** Sealed, **as directed**, bimetallic-actuated type.
 - b. Direct-mounted **OR** Remote-mounted, **as directed**, metal-case **OR** plastic-case, **as directed**, vapor-actuated type.
 - c. Compact-style **OR** Industrial-style, **as directed**, liquid-in-glass type.
 - d. Direct-mounted **OR** Remote-mounted, **as directed**, light-activated type.
 - e. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
3. Thermometers at inlets and outlets of each chiller shall be one of the following:
 - a. Liquid-filled **OR** Sealed, **as directed**, bimetallic-actuated type.
 - b. Direct-mounted **OR** Remote-mounted, **as directed**, metal-case **OR** plastic-case, **as directed**, vapor-actuated type.
 - c. Compact-style **OR** Industrial-style, **as directed**, liquid-in-glass type.
 - d. Direct-mounted **OR** Remote-mounted, **as directed**, light-activated type.
 - e. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
4. Thermometers at inlet and outlet of each hydronic coil in air-handling units and built-up central systems shall be one of the following:
 - a. Liquid-filled **OR** Sealed, **as directed**, bimetallic-actuated type.
 - b. Direct-mounted **OR** Remote-mounted, **as directed**, metal-case **OR** plastic-case, **as directed**, vapor-actuated type.
 - c. Compact-style **OR** Industrial-style, **as directed**, liquid-in-glass type.
 - d. Direct-mounted **OR** Remote-mounted, **as directed**, light-activated type.
 - e. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
5. Thermometers at inlets and outlets of each hydronic heat exchanger shall be one of the following:
 - a. Liquid-filled **OR** Sealed, **as directed**, bimetallic-actuated type.
 - b. Direct-mounted **OR** Remote-mounted, **as directed**, metal-case **OR** plastic-case, **as directed**, vapor-actuated type.
 - c. Compact-style **OR** Industrial-style, **as directed**, liquid-in-glass type.
 - d. Direct-mounted **OR** Remote-mounted, **as directed**, light-activated type.
 - e. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
6. Thermometers at inlet and outlet of each hydronic heat-recovery unit shall be one of the following:
 - a. Liquid-filled **OR** Sealed, **as directed**, bimetallic-actuated type.
 - b. Direct-mounted **OR** Remote-mounted, **as directed**, metal-case **OR** plastic-case, **as directed**, vapor-actuated type.
 - c. Compact-style **OR** Industrial-style, **as directed**, liquid-in-glass type.
 - d. Direct-mounted **OR** Remote-mounted, **as directed**, light-activated type.
 - e. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
7. Thermometers at inlet and outlet of each thermal-storage tank shall be one of the following:
 - a. Liquid-filled **OR** Sealed, **as directed**, bimetallic-actuated type.
 - b. Direct-mounted **OR** Remote-mounted, **as directed**, metal-case **OR** plastic-case, **as directed**, vapor-actuated type.
 - c. Compact-style **OR** Industrial-style, **as directed**, liquid-in-glass type.
 - d. Direct-mounted **OR** Remote-mounted, **as directed**, light-activated type.
 - e. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
8. Thermometers at outside-, return-, supply-, and mixed-air ducts shall be one of the following:
 - a. Liquid-filled **OR** Sealed, **as directed**, bimetallic-actuated type.
 - b. Direct-mounted **OR** Remote-mounted, **as directed**, metal-case **OR** plastic-case, **as directed**, vapor-actuated type.
 - c. Compact-style **OR** Industrial-style, **as directed**, liquid-in-glass type.
 - d. Direct-mounted **OR** Remote-mounted, **as directed**, light-activated type.
9. Thermometer stems shall be of length to match thermowell insertion length.



E. Thermometer Scale-Range Schedule

1. Scale Range for Chilled-Water Piping: Minus 40 to plus 160 deg F (Minus 40 to plus 100 deg C) **OR** Minus 40 to plus 160 deg F and minus 40 to plus 100 deg C, **as directed**.
2. Scale Range for Chilled-Water Piping: 0 to 100 deg F (Minus 20 to plus 50 deg C) **OR** 0 to 100 deg F and minus 20 to plus 50 deg C, **as directed**.
3. Scale Range for Chilled-Water Piping: 0 to 150 deg F (Minus 20 to plus 70 deg C) **OR** 0 to 150 deg F and minus 20 to plus 70 deg C, **as directed**.
4. Scale Range for Chilled-Water Piping: 0 to 250 deg F (0 to 150 deg C) **OR** 0 to 250 deg F and 0 to 150 deg C, **as directed**.
5. Scale Range for Condenser-Water Piping: 0 to 100 deg F (Minus 20 to plus 50 deg C) **OR** 0 to 100 deg F and minus 20 to plus 50 deg C, **as directed**.
6. Scale Range for Condenser-Water Piping: 0 to 150 deg F (Minus 20 to plus 70 deg C) **OR** 0 to 150 deg F and minus 20 to plus 70 deg C, **as directed**.
7. Scale Range for Condenser-Water Piping: 0 to 250 deg F (0 to 150 deg C) **OR** 0 to 250 deg F and 0 to 150 deg C, **as directed**.
8. Scale Range for Condenser-Water Piping: 20 to 240 deg F (0 to 150 deg C) **OR** 20 to 240 deg F and 0 to 150 deg C, **as directed**.
9. Scale Range for Condenser-Water Piping: 30 to 240 deg F (0 to plus 115 deg C) **OR** 30 to 240 deg F and 0 to plus 115 deg C, **as directed**.
10. Scale Range for Heating, Hot-Water Piping: 0 to 250 deg F (0 to 150 deg C) **OR** 0 to 250 deg F and 0 to 150 deg C, **as directed**.
11. Scale Range for Heating, Hot-Water Piping: 20 to 240 deg F (0 to 150 deg C) **OR** 20 to 240 deg F and 0 to 150 deg C, **as directed**.
12. Scale Range for Heating, Hot-Water Piping: 30 to 240 deg F (0 to plus 115 deg C) **OR** 30 to 240 deg F and 0 to plus 115 deg C, **as directed**.
13. Scale Range for Heating, Hot-Water Piping: 50 to 400 deg F (0 to 200 deg C) **OR** 50 to 400 deg F and 0 to 200 deg C, **as directed**.
14. Scale Range for Heating, Hot-Water Piping: 50 to 550 deg F (10 to 300 deg C) **OR** 50 to 550 deg F and 10 to 300 deg C, **as directed**.
15. Scale Range for Steam and Steam-Condensate Piping: 0 to 250 deg F (0 to 150 deg C) **OR** 0 to 250 deg F and 0 to 150 deg C, **as directed**.
16. Scale Range for Steam and Steam-Condensate Piping: 20 to 240 deg F (0 to 150 deg C) **OR** 20 to 240 deg F and 0 to 150 deg C, **as directed**.
17. Scale Range for Steam and Steam-Condensate Piping: 30 to 240 deg F (0 to plus 115 deg C) **OR** 30 to 240 deg F and 0 to plus 115 deg C, **as directed**.
18. Scale Range for Steam and Steam-Condensate Piping: 50 to 400 deg F (0 to 200 deg C) **OR** 50 to 400 deg F and 0 to 200 deg C, **as directed**.
19. Scale Range for Air Ducts: Minus 40 to plus 110 deg F (Minus 40 to plus 45 deg C) **OR** Minus 40 to plus 110 deg F and minus 40 to plus 45 deg C, **as directed**.
20. Scale Range for Air Ducts: Minus 40 to plus 160 deg F (Minus 40 to plus 100 deg C) **OR** Minus 40 to plus 160 deg F and minus 40 to plus 100 deg C, **as directed**.
21. Scale Range for Air Ducts: 0 to 100 deg F (Minus 20 to plus 50 deg C) **OR** 0 to 100 deg F and minus 20 to plus 50 deg C, **as directed**.
22. Scale Range for Air Ducts: 0 to 150 deg F (Minus 20 to plus 70 deg C) **OR** 0 to 150 deg F and minus 20 to plus 70 deg C, **as directed**.
23. Scale Range for Air Ducts: 0 to 250 deg F (0 to 150 deg C) **OR** 0 to 250 deg F and 0 to 150 deg C, **as directed**.
24. Scale Range for Air Ducts: 20 to 240 deg F (0 to 150 deg C) **OR** 20 to 240 deg F and 0 to 150 deg C, **as directed**.
25. Scale Range for Air Ducts: 30 to 240 deg F (0 to plus 115 deg C) **OR** 30 to 240 deg F and 0 to plus 115 deg C, **as directed**.
26. Scale Range for Air Ducts: 50 to 400 deg F (0 to 200 deg C) **OR** 50 to 400 deg F and 0 to 200 deg C, **as directed**.

F. Pressure-Gage Schedule



1. Pressure gages at discharge of each pressure-reducing valve shall be one of the following:
 - a. Liquid-filled **OR** Sealed **OR** Open-front, pressure-relief **OR** Solid-front, pressure-relief, **as directed**, direct-mounted **OR** remote-mounted, **as directed**, metal case.
 - b. Sealed, direct-mounted **OR** remote-mounted, **as directed**, plastic case.
 - c. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
 2. Pressure gages at inlet and outlet of each chiller chilled-water and condenser-water connection shall be one of the following:
 - a. Liquid-filled **OR** Sealed **OR** Open-front, pressure-relief **OR** Solid-front, pressure-relief, **as directed**, direct-mounted **OR** remote-mounted, **as directed**, metal case.
 - b. Sealed, direct-mounted **OR** remote-mounted, **as directed**, plastic case.
 - c. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
 3. Pressure gages at suction and discharge of each pump shall be one of the following:
 - a. Liquid-filled **OR** Sealed **OR** Open-front, pressure-relief **OR** Solid-front, pressure-relief, **as directed**, direct-mounted **OR** remote-mounted, **as directed**, metal case.
 - b. Sealed, direct-mounted **OR** remote-mounted, **as directed**, plastic case.
 - c. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
- G. Pressure-Gage Scale-Range Schedule
1. Scale Range for Chilled-Water Piping: 30 in. Hg to 15 psi (minus 100 to 0 kPa) **OR** 30 in. Hg to 15 psi and minus 100 to 0 kPa, **as directed**.
 2. Scale Range for Chilled-Water Piping: 0 to 30 psi (0 to 240 kPa) **OR** 0 to 30 psi and 0 to 240 kPa, **as directed**.
 3. Scale Range for Chilled-Water Piping: 0 to 100 psi (0 to 600 kPa) **OR** 0 to 100 psi and 0 to 600 kPa, **as directed**.
 4. Scale Range for Chilled-Water Piping: 0 to 160 psi (0 to 1100 kPa) **OR** 0 to 160 psi and 0 to 1100 kPa, **as directed**.
 5. Scale Range for Chilled-Water Piping: 0 to 200 psi (0 to 1400 kPa) **OR** 0 to 200 psi and 0 to 1400 kPa, **as directed**.
 6. Scale Range for Chilled-Water Piping: 0 to 300 psi (0 to 2500 kPa) **OR** 0 to 300 psi and 0 to 2500 kPa, **as directed**.
 7. Scale Range for Chilled-Water Piping: 0 to 600 psi (0 to 4000 kPa) **OR** 0 to 600 psi and 0 to 4000 kPa, **as directed**.
 8. Scale Range for Condenser-Water Piping: 30 in. Hg to 15 psi (minus 100 to 0 kPa) **OR** 30 in. Hg to 15 psi and minus 100 to 0 kPa, **as directed**.
 9. Scale Range for Condenser-Water Piping: 0 to 30 psi (0 to 240 kPa) **OR** 0 to 30 psi and 0 to 240 kPa, **as directed**.
 10. Scale Range for Condenser-Water Piping: 0 to 100 psi (0 to 600 kPa) **OR** 0 to 100 psi and 0 to 600 kPa, **as directed**.
 11. Scale Range for Condenser-Water Piping: 0 to 160 psi (0 to 1100 kPa) **OR** 0 to 160 psi and 0 to 1100 kPa, **as directed**.
 12. Scale Range for Condenser-Water Piping: 0 to 200 psi (0 to 1400 kPa) **OR** 0 to 200 psi and 0 to 1400 kPa, **as directed**.
 13. Scale Range for Condenser-Water Piping: 0 to 300 psi (0 to 2500 kPa) **OR** 0 to 300 psi and 0 to 2500 kPa, **as directed**.
 14. Scale Range for Condenser-Water Piping: 0 to 600 psi (0 to 4000 kPa) **OR** 0 to 600 psi and 0 to 4000 kPa, **as directed**.
 15. Scale Range for Heating, Hot-Water Piping: 30 in. Hg to 15 psi (minus 100 to 0 kPa) **OR** 30 in. Hg to 15 psi and minus 100 to 0 kPa, **as directed**.
 16. Scale Range for Heating, Hot-Water Piping: 0 to 30 psi (0 to 240 kPa) **OR** 0 to 30 psi and 0 to 240 kPa, **as directed**.
 17. Scale Range for Heating, Hot-Water Piping: 0 to 100 psi (0 to 600 kPa) **OR** 0 to 100 psi and 0 to 600 kPa, **as directed**.



18. Scale Range for Heating, Hot-Water Piping: 0 to 160 psi (0 to 1100 kPa) **OR** 0 to 160 psi and 0 to 1100 kPa, **as directed**.
19. Scale Range for Heating, Hot-Water Piping: 0 to 200 psi (0 to 1400 kPa) **OR** 0 to 200 psi and 0 to 1400 kPa, **as directed**.
20. Scale Range for Heating, Hot-Water Piping: 0 to 300 psi (0 to 2500 kPa) **OR** 0 to 300 psi and 0 to 2500 kPa, **as directed**.
21. Scale Range for Heating, Hot-Water Piping: 0 to 600 psi (0 to 4000 kPa) **OR** 0 to 600 psi and 0 to 4000 kPa, **as directed**.
22. Scale Range for Steam Piping: 30 in. Hg to 15 psi (minus 100 to 0 kPa) **OR** 30 in. Hg to 15 psi and minus 100 to 0 kPa, **as directed**.
23. Scale Range for Steam Piping: 0 to 30 psi (0 to 240 kPa) **OR** 0 to 30 psi and 0 to 240 kPa, **as directed**.
24. Scale Range for Steam Piping: 0 to 100 psi (0 to 600 kPa) **OR** 0 to 100 psi and 0 to 600 kPa, **as directed**.
25. Scale Range for Steam Piping: 0 to 160 psi (0 to 1100 kPa) **OR** 0 to 160 psi and 0 to 1100 kPa, **as directed**.
26. Scale Range for Steam Piping: 0 to 200 psi (0 to 1400 kPa) **OR** 0 to 200 psi and 0 to 1400 kPa, **as directed**.
27. Scale Range for Steam Piping: 0 to 300 psi (0 to 2500 kPa) **OR** 0 to 300 psi and 0 to 2500 kPa, **as directed**.
28. Scale Range for Steam Piping: 0 to 600 psi (0 to 4000 kPa) **OR** 0 to 600 psi and 0 to 4000 kPa, **as directed**.

H. Flowmeter Schedule

1. Flowmeters for Chilled-Water Piping: Orifice **OR** Pitot-tube **OR** Turbine **OR** Venturi **OR** Vortex-shedding, **as directed**, type.
2. Flowmeters for Condenser-Water Piping: Orifice **OR** Pitot-tube **OR** Turbine **OR** Venturi **OR** Vortex-shedding, **as directed**, type.
3. Flowmeters for Heating, Hot-Water Piping: Orifice **OR** Pitot-tube **OR** Turbine **OR** Venturi **OR** Vortex-shedding, **as directed**, type.
4. Flowmeters for Steam and Steam-Condensate Piping: Orifice **OR** Turbine **OR** Venturi **OR** Vortex-shedding, **as directed**, type.

I. Thermal-Energy Meter Schedule

1. Thermal-Energy Meters for Chilled-Water Piping: Impeller-turbine **OR** Ultrasonic, **as directed**, type.
2. Thermal-Energy Meters for Condenser-Water Piping: Impeller-turbine **OR** Ultrasonic, **as directed**, type.
3. Thermal-Energy Meters for Heating, Hot-Water Piping: Impeller-turbine **OR** Ultrasonic, **as directed**, type.
4. Thermal-Energy Meters for Steam and Steam-Condensate Piping: Impeller-turbine **OR** Ultrasonic, **as directed**, type.

END OF SECTION 21 05 19 00a



Task	Specification	Specification Description
21 05 19 00	01 22 16 00	No Specification Required
21 05 19 00	21 05 00 00	Common Work Results for Fire Suppression
21 05 23 00	21 05 00 00	Common Work Results for Fire Suppression
21 05 29 00	21 05 00 00	Common Work Results for Fire Suppression
21 05 48 00	21 05 00 00	Common Work Results for Fire Suppression
21 05 53 00	21 05 00 00	Common Work Results for Fire Suppression



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SECTION 21 11 19 00 - FIRE-SUPPRESSION STANDPIPES**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for fire-suppression standpipes. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Pipes, fittings, and specialties.
 - b. Fire-protection valves.
 - c. Hose connections.
 - d. Hose stations.
 - e. Monitors.
 - f. Fire-department connections.
 - g. Alarm devices.
 - h. Manual control stations.
 - i. Control panels.
 - j. Pressure gages.

C. Definitions

1. High-Pressure Standpipe Piping: Fire-suppression standpipe piping designed to operate at working pressure higher than standard 175 psig (1200 kPa), but not higher than 250 psig (1725 kPa) **OR** 300 psig (2070 kPa), **as directed**.
2. Standard-Pressure Standpipe Piping: Fire-suppression standpipe piping designed to operate at working pressure 175 psig (1200 kPa) maximum.

D. System Descriptions

1. Automatic Wet-Type, Class I Standpipe System: Includes NPS 2-1/2 (DN 65) hose connections. Has open water-supply valve with pressure maintained and is capable of supplying water demand.
2. Automatic Wet-Type, Class II Standpipe System: Includes NPS 1-1/2 (DN 40) hose stations. Has open water-supply valve with pressure maintained and is capable of supplying water demand.
3. Automatic Wet-Type, Class III Standpipe System: Includes NPS 1-1/2 (DN 40) hose stations and NPS 2-1/2 (DN 65) hose connections. Has open water-supply valve with pressure maintained and is capable of supplying water demand.
4. Automatic Dry-Type, Class I Standpipe System: Includes NPS 2-1/2 (DN 65) hose connections. Has open water-supply valve and dry-pipe valve with standpipes containing compressed air. Opening fire-hose valve releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into standpipes.
5. Automatic Dry-Type, Class II Standpipe System: Includes NPS 1-1/2 (DN 40) hose stations. Has open water-supply valve and dry-pipe valve with standpipes containing compressed air. Opening fire-hose valve releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into standpipes.
6. Automatic Dry-Type, Class III Standpipe System: Includes NPS 1-1/2 (DN 40) hose stations and NPS 2-1/2 (DN 65) hose connections. Has open water-supply valve and dry-pipe valve with standpipes containing compressed air. Opening fire-hose valve releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into standpipes.
7. Semiautomatic Dry-Type, Class I Standpipe System: Includes NPS 2-1/2 (DN 65) hose connections. Has open water-supply valve and deluge valve with standpipes containing air.



Actuation of detection device permits water pressure to open deluge valve. Water then flows into standpipes.

8. Semiautomatic Dry-Type, Class II Standpipe System: Includes NPS 1-1/2 (DN 40) hose stations. Has open water-supply valve and deluge valve with standpipes containing air. Actuation of detection device permits water pressure to open deluge valve. Water then flows into standpipes.
9. Semiautomatic Dry-Type, Class III Standpipe System: Includes NPS 1-1/2 (DN 40) hose stations and NPS 2-1/2 (DN 65) hose connections. Has open water-supply valve and deluge valve with standpipes containing air. Actuation of detection device permits water pressure to open deluge valve. Water then flows into standpipes.
10. Manual Wet-Type, Class I Standpipe System: Includes NPS 2-1/2 (DN 65) hose connections. Has small water supply to maintain water in standpipes. Piping is wet, but water must be pumped into standpipes to satisfy demand.
11. Manual Dry-Type, Class I Standpipe System: Includes NPS 2-1/2 (DN 65) hose connections. Does not have permanent water supply. Piping is dry. Water must be pumped into standpipes to satisfy demand.

E. Performance Requirements

1. Standard-Pressure, Fire-Suppression Standpipe System Component: Listed for 175-psig (1200-kPa) minimum working pressure.
2. High-Pressure, Fire-Suppression Standpipe System Component: Listed for 250-psig (1725-kPa) minimum **OR** 300-psig (2070-kPa), **as directed**, working pressure.
3. Delegated Design: Design fire-suppression standpipes, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
4. Fire-suppression standpipe design shall be approved by authorities having jurisdiction.
 - a. Minimum residual pressure at each hose-connection outlet is as follows:
 - 1) NPS 1-1/2 (DN 40) Hose Connections: 65 psig (450 kPa).
 - 2) NPS 2-1/2 (DN 65) Hose Connections: 100 psig (690 kPa).
 - b. Maximum residual pressure at required flow at each hose-connection outlet is as follows unless otherwise indicated:
 - 1) NPS 1-1/2 (DN 40) Hose Connections: 100 psig (690 kPa).
 - 2) NPS 2-1/2 (DN 65) Hose Connections: 175 psig (1200 kPa).
5. Seismic Performance: Fire-suppression standpipes shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

F. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For fire-suppression standpipes. Include plans, elevations, sections, details, and attachments to other work.
 - a. Wiring Diagrams: For power, signal, and control wiring.
3. Delegated-Design Submittal: For standpipe systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
4. Qualification Data: For qualified Installer and professional engineer.
5. Approved Standpipe Drawings: Working plans, prepared according to NFPA 14, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
6. Welding certificates.
7. Fire-hydrant flow test report.
8. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."
9. Field quality-control reports.
10. Operation and Maintenance Data: For fire-suppression standpipes specialties to include in emergency, operation, and maintenance manuals.



G. Quality Assurance

1. Installer Qualifications:
 - a. Installer's responsibilities include designing, fabricating, and installing fire-suppression standpipes and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 - 1) Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
2. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. NFPA Standards: Fire-suppression standpipe equipment, specialties, accessories, installation, and testing shall comply with NFPA 14, "Installation of Standpipe and Hose Systems."

H. Project Conditions

1. Interruption of Existing Fire-Suppression Standpipe Service: Do not interrupt fire-suppression standpipe service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary fire-suppression standpipe service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of fire-suppression standpipe service.
 - b. Do not proceed with interruption of fire-suppression standpipe service without the Owner's written permission.

1.2 PRODUCTS

A. Piping Materials

1. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

B. Steel Pipe And Fittings

1. Standard Weight, Galvanized- and Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.
2. Schedule 30, Galvanized- and Black-Steel Pipe: ASTM A 135; ASTM A 795/A 795M, Type E; or ASME B36.10M, wrought steel; with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.
3. Thinwall Galvanized- and Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.
4. Schedule 10, Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, Schedule 10 in NPS 5 (DN 125) and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10 (DN 150 to DN 250), plain end.
5. Nonstandard OD, Thinwall Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, thinwall, with plain ends and wall thickness less than Schedule 10.
6. Hybrid Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, lightwall, with wall thickness less than Schedule 10 and greater than Schedule 5.
7. Standard-Weight, Galvanized- and Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, seamless steel pipe with threaded ends.
8. Galvanized and Uncoated, Steel Couplings: ASTM A 865, threaded.
9. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
10. Malleable- or Ductile-Iron Unions: UL 860.
11. Cast-Iron Flanges: ASME B16.1, Class 125.
12. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
13. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.



14. Grooved-Joint, Steel-Pipe Appurtenances:
 - a. Pressure Rating: 175 psig (1200 kPa) **OR** 250 psig (1725 kPa) **OR** 300 psig (2070 kPa), **as directed**, minimum.
 - b. Galvanized and Uncoated, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
 - c. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.
- C. Copper Tube And Fittings
 1. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) and ASTM B 88, Type M (ASTM B 88M, Type C) water tube, drawn temper.
 2. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
 3. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings.
 4. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
 5. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
 6. Grooved-Joint, Copper-Tube Appurtenances:
 - a. Grooved-End, Copper Fittings: ASTM B 75 (ASTM B 75M), copper tube or ASTM B 584, bronze castings.
 - b. Grooved-End-Tube Couplings: To fit copper tube dimensions, with design similar to AWWA C606. Include ferrous housing sections, EPDM-rubber gasket suitable for hot and cold water, and bolts and nuts.
- D. Piping Joining Materials
 1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free.
 - a. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
 - b. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.
 2. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
 3. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
 4. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- E. Listed Fire-Protection Valves
 1. General Requirements:
 - a. Valves shall be UL listed or FM approved.
 - b. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig (1200 kPa).
 - c. Minimum Pressure Rating for High-Pressure Piping: 250 psig (1725 kPa) **OR** 300 psig (2070 kPa), **as directed**.
 2. Ball Valves:
 - a. Standard: UL 1091 except with ball instead of disc.
 - b. Valves NPS 1-1/2 (DN 40) and Smaller: Bronze body with threaded ends.
 - c. Valves NPS 2 and NPS 2-1/2 (DN 50 and DN 65): Bronze body with threaded ends or ductile-iron body with grooved ends.
 - d. Valves NPS 3 (DN 80): Ductile-iron body with grooved ends.
 3. Bronze Butterfly Valves:
 - a. Standard: UL 1091.
 - b. Pressure Rating: 175 psig (1200 kPa).
 - c. Body Material: Bronze.
 - d. End Connections: Threaded.



4. Iron Butterfly Valves:
 - a. Standard: UL 1091.
 - b. Pressure Rating: 175 psig (1200 kPa).
 - c. Body Material: Cast or ductile iron.
 - d. Style: Lug or wafer.

OR

End Connections: Grooved.
 5. Check Valves:
 - a. Standard: UL 312.
 - b. Pressure Rating: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Type: Swing check.
 - d. Body Material: Cast iron.
 - e. End Connections: Flanged or grooved.
 6. Bronze OS&Y Gate Valves:
 - a. Standard: UL 262.
 - b. Pressure Rating: 175 psig (1200 kPa).
 - c. Body Material: Bronze.
 - d. End Connections: Threaded.
 7. Iron OS&Y Gate Valves:
 - a. Standard: UL 262.
 - b. Pressure Rating: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Cast or ductile iron.
 - d. End Connections: Flanged or grooved.
 8. Indicating-Type Butterfly Valves:
 - a. Standard: UL 1091.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum.
 - c. Valves NPS 2 (DN 50) and Smaller:
 - 1) Valve Type: Ball or butterfly.
 - 2) Body Material: Bronze.
 - 3) End Connections: Threaded.
 - d. Valves NPS 2-1/2 (DN 65) and Larger:
 - 1) Valve Type: Butterfly.
 - 2) Body Material: Cast or ductile iron.
 - 3) End Connections: Flanged, grooved, or wafer.
 - e. Valve Operation: Integral electrical, 115-V ac, prewired, single-circuit, supervisory switch **OR** electrical, 115-V ac, prewired, two-circuit, supervisory switch **OR** visual, **as directed**, indicating device.
 9. NRS Gate Valves:
 - a. Standard: UL 262.
 - b. Pressure Rating: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Cast iron with indicator post flange.
 - d. Stem: Nonrising.
 - e. End Connections: Flanged or grooved.
 10. Indicator Posts:
 - a. Standard: UL 789.
 - b. Type: Horizontal for wall mounting.
 - c. Body Material: Cast iron with extension rod and locking device.
 - d. Operation: Wrench **OR** Hand wheel, **as directed**.
- F. Trim And Drain Valves
1. General Requirements:
 - a. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum.
 2. Angle Valves.
 3. Ball Valves.



4. Globe Valves.
5. Plug Valves.

G. Specialty Valves

1. General Requirements:
 - a. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - b. Pressure Rating:
 - 1) Standard-Pressure Piping Specialty Valves: 175 psig (1200 kPa) minimum.
 - 2) High-Pressure Piping Specialty Valves: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Cast or ductile iron.
 - d. Size: Same as connected piping.
 - e. End Connections: Flanged or grooved.
2. Alarm Valves:
 - a. Standard: UL 193.
 - b. Design: For horizontal or vertical installation.
 - c. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, **as directed**, and fill-line attachment with strainer.
 - d. Drip Cup Assembly (if retarding chamber is required): Pipe drain without valves and separate from main drain piping.
 - e. Drip Cup Assembly (if retarding chamber is not required): Pipe drain with check valve to main drain piping.
3. Dry-Pipe Valves:
 - a. Standard: UL 260.
 - b. Design: Differential-pressure type.
 - c. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
 - d. Air-Pressure Maintenance Device:
 - 1) Standard: UL 260.
 - 2) Type: Automatic device to maintain minimum air pressure in piping.
 - 3) Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig (95- to 410-kPa) adjustable range, and 175-psig (1200-kPa) **OR** 300-psig (2070-kPa), **as directed**, outlet pressure.
 - e. Air Compressor:
 - 1) Standard: UL's "Fire Protection Equipment Directory" listing.
 - 2) Motor Horsepower: Fractional.
 - 3) Power: 120-V ac, 60 Hz, single phase.
4. Deluge Valves:
 - a. Standard: UL 260.
 - b. Design: Hydraulically operated, differential-pressure type.
 - c. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, drip cup assembly piped without valves and separate from main drain line, fill-line attachment with strainer, and push-rod chamber supply connection.
 - d. Wet, Pilot-Line Trim Set: Include gage to read push-rod chamber pressure, globe valve for manual operation of deluge valve, and connection for actuation device.
 - e. Dry, Pilot-Line Trim Set: Include dry, pilot-line actuator; air- and water-pressure gages; low-air-pressure warning switch; air relief valve; and actuation device. Dry, pilot-line actuator includes cast-iron, operated, diaphragm-type valve with resilient facing plate, resilient diaphragm, and replaceable bronze seat. Valve includes threaded water and air inlets and water outlet. Loss of air pressure on dry, pilot-line side allows pilot-line actuator to open and causes deluge valve to open immediately.
 - f. Air-Pressure Maintenance Device:



- 1) Standard: UL 260.
 - 2) Type: Automatic device to maintain minimum air pressure in piping.
 - 3) Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator, or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig (95- to 410-kPa) adjustable range, and 175-psig (1200-kPa) **OR** 300-psig (2070-kPa), **as directed**, outlet pressure.
 - g. Air Compressor:
 - 1) Standard: UL's "Fire Protection Equipment Directory" listing.
 - 2) Motor Horsepower: Fractional.
 - 3) Power: 120-V ac, 60 Hz, single phase.
 5. Pressure-Reducing Valves:
 - a. UL 668 hose valve, with integral UL 1468 reducing device.
 - b. Pressure Rating: 300 psig (2070 kPa) minimum.
 - c. Material: Brass or bronze.
 - d. Inlet: Female pipe threads.
 - e. Outlet: Threaded with or without adapter having male hose threads.
 - f. Pattern: Angle or gate.
 - g. Finish: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
 6. Automatic (Ball Drip) Drain Valves:
 - a. Standard: UL 1726.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum.
 - c. Type: Automatic draining, ball check.
 - d. Size: NPS 3/4 (DN 20).
 - e. End Connections: Threaded.
- H. Hose Connections
1. Adjustable-Valve Hose Connections:
 - a. Standard: UL 668 hose valve, with integral UL 1468 reducing or restricting pressure-control device, for connecting fire hose.
 - b. Pressure Rating: 300 psig (2070 kPa) minimum.
 - c. Material: Brass or bronze.
 - d. Size: NPS 1-1/2 or NPS 2-1/2 (DN 40 or DN 65), as indicated.
 - e. Inlet: Female pipe threads.
 - f. Outlet: Male hose threads with lugged cap, gasket, and chain. Include hose valve threads according to NFPA 1963 and matching local fire-department threads.
 - g. Pattern: Angle or gate.
 - h. Pressure-Control Device Type: Pressure reducing **OR** restricting, **as directed**.
 - i. Design Outlet Pressure Setting: as directed by the Owner.
 - j. Finish: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
 2. Nonadjustable-Valve Hose Connections:
 - a. Standard: UL 668 hose valve for connecting fire hose.
 - b. Pressure Rating: 300 psig (2070 kPa) minimum.
 - c. Material: Brass or bronze.
 - d. Size: NPS 1-1/2 or NPS 2-1/2 (DN 40 or DN 65), as indicated.
 - e. Inlet: Female pipe threads.
 - f. Outlet: Male hose threads with lugged cap, gasket, and chain. Include hose valve threads according to NFPA 1963 and matching local fire-department threads.
 - g. Pattern: Angle or gate.
 - h. Finish: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
- I. NPS 1-1/2 (DN 40) Rack-Type Hose Stations
1. Hose Rack:
 - a. Standard: UL 47.



- b. Material: Brass or bronze with polished chrome-plated **OR** Steel with red-enamel, **as directed**, finish.
 - c. Type: Hose-rack assembly. Include hose valve, hose rack, water-retention device, hose pins, and hose.
 - d. Operation: Semiautomatic.
 - e. Sized to hold fire hose.
 - 2. Hose Valve:
 - a. Standard: UL 668 NPS 1-1/2 (DN 40), for connecting fire hose.
 - b. Type: Adjustable **OR** Nonadjustable, **as directed**.
 - c. Pressure-Control Device: Not required **OR** Pressure reducing **OR** Pressure restricting, **as directed**.
 - d. Design Outlet Pressure Setting: Not applicable **OR as directed**.
 - e. Hose Valve and Trim Finish: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
 - f. Pressure Rating: 300 psig (2070 kPa) minimum.
 - g. Pattern: Angle.
 - h. Material: Brass or bronze.
 - i. Pressure-Control Device: UL 1468 integral or for field installation if indicated.
 - j. Size: NPS 1-1/2 (DN 40).
 - k. Inlet: Female pipe threads.
 - l. Outlet: Male hose threads according to NFPA 1963 and matching local fire-department threads.
 - 3. Hose:
 - a. Standards: NFPA 1961 and UL 219 lined fire hose with swivel inlet, coupling, gaskets, and nozzle.
 - b. Size: NPS 1-1/2 (DN 40).
 - c. Length: 50 feet (15 m) **OR** 75 feet (23 m) **OR** 100 feet (30 m), **as directed**.
 - d. Jacket: Combination of natural and synthetic threads **OR** Natural thread **OR** Synthetic thread, **as directed**.
 - e. Lining: Combination of rubber and plastic compounds **OR** Rubber compound **OR** Plastic compound, **as directed**.
 - f. Cover: Rubber, plastic, or combination of rubber and plastic compounds.
 - g. Nozzle: UL 401.
 - 1) Material: Brass **OR** Polished brass **OR** Rough chrome-plated brass **OR** Polished chrome-plated brass **OR** Polycarbonate plastic, **as directed**.
 - 2) Type: Plain, for nonadjustable water stream **OR** Spray, adjustable from shutoff to fog spray or straight stream **OR** Spray, adjustable from shutoff to full fog; for use on electrical fires, **as directed**.
- J. NPS 1-1/2 BY NPS 2-1/2 (DN 40 BY DN 65) Rack-Type Hose Stations
- 1. Hose Rack:
 - a. Standard: UL 47.
 - b. Material: Brass or bronze with polished chrome-plated **OR** Steel with red-enamel, **as directed**, finish.
 - c. Type: Hose-rack assembly. Include hose valve, reducer adapter, hose rack, water-retention device, hose pins, and hose.
 - d. Operation: Semiautomatic.
 - e. Sized to hold fire hose.
 - 2. Hose Valve:
 - a. Standard: UL 668, NPS 2-1/2 (DN 65), for connecting fire hose.
 - b. Type: Adjustable **OR** Nonadjustable, **as directed**.
 - c. Pressure-Control Device: Not required **OR** Pressure reducing **OR** Pressure restricting, **as directed**.
 - d. Design Outlet Pressure Setting: Not applicable **OR as directed**.



- e. Hose Valve and Trim Finish: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
 - f. Pressure Rating: 300 psig (2070 kPa) minimum.
 - g. Pattern: Angle.
 - h. Material: Brass or bronze.
 - i. Pressure-Control Device: UL 1468, integral or for field installation if indicated.
 - j. Size: NPS 2-1/2 (DN 65).
 - k. Inlet: Female pipe threads.
 - l. Outlet: Male hose threads according to NFPA 1963 and matching local fire-department threads.
 - m. Reducer Adapter: NPS 2-1/2 by NPS 1-1/2 (DN 65 by DN 40).
3. Hose:
- a. Standards: NFPA 1961 and UL 219, lined fire hose with swivel inlet, coupling, gaskets, and nozzle.
 - b. Size: NPS 1-1/2 (DN 40).
 - c. Length: 50 feet (15 m) **OR** 75 feet (23 m) **OR** 100 feet (30 m), **as directed**.
 - d. Jacket: Combination of natural and synthetic threads **OR** Natural thread **OR** Synthetic thread, **as directed**.
 - e. Lining: Combination of rubber and plastic compounds **OR** Rubber compound **OR** Plastic compound, **as directed**.
 - f. Cover: Rubber, plastic, or combination of rubber and plastic compounds.
 - g. Nozzle: UL 401 spray nozzle unless plain nozzle is indicated.
 - 1) Material: Brass **OR** Polished brass **OR** Rough chrome-plated brass **OR** Polished chrome-plated brass **OR** Polycarbonate plastic, **as directed**.
 - 2) Type: Plain, for nonadjustable water stream **OR** Spray, adjustable from shutoff to fog spray or straight stream **OR** Spray, adjustable from shutoff to full fog; for use on electrical fires, **as directed**.
- K. NPS 1-1/2 (DN 40) Reel-Type Hose Stations
- 1. Hose Reel:
 - a. Standard: UL 47.
 - b. Hose Reel and Bracket Material: Steel.
 - c. Type: Hose-reel assembly. Include hose valve, wall bracket, hose reel, water-retention device, hose pins, and hose.
 - d. Operation: Semiautomatic.
 - e. Sized to hold fire hose.
 - f. Finish: Red enamel.
 - 2. Hose Valve:
 - a. Standard: UL 668, NPS 1-1/2 (DN 40), for connecting fire hose.
 - b. Type: Adjustable **OR** Nonadjustable, **as directed**.
 - c. Pressure-Control Device: Not required **OR** Pressure reducing **OR** Pressure restricting, **as directed**.
 - d. Design Outlet Pressure Setting: Not applicable **OR as directed**.
 - e. Hose Valve and Trim Finish: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
 - f. Pressure Rating: 300 psig (2070 kPa) minimum.
 - g. Pattern: Angle.
 - h. Material: Brass or bronze.
 - i. Pressure-Control Device: UL 1468, integral or for field installation if indicated.
 - j. Size: NPS 1-1/2 (DN 40).
 - k. Inlet: Female pipe threads.
 - l. Outlet: Male hose threads according to NFPA 1963 and matching local fire-department threads.
 - 3. Hose:
 - a. Standards: NFPA 1961 and UL 219 lined fire hose with swivel inlet, coupling, gaskets, and nozzle.



- b. Size: NPS 1-1/2 (DN 40).
- c. Length: 50 feet (15 m) **OR** 75 feet (23 m) **OR** 100 feet (30 m), **as directed**.
- d. Jacket: Combination of natural and synthetic threads **OR** Natural thread **OR** Synthetic thread, **as directed**.
- e. Lining: Combination of rubber and plastic compounds **OR** Rubber compound **OR** Plastic compound, **as directed**.
- f. Cover: Rubber, plastic, or combination of rubber and plastic compounds.
- g. Nozzle: UL 401.
 - 1) Material: Brass **OR** Polished brass **OR** Rough chrome-plated brass **OR** Polished chrome-plated brass **OR** Polycarbonate plastic, **as directed**.
 - 2) Type: Spray, adjustable from shutoff to fog spray or straight stream **OR** full fog; for use on electrical fires, **as directed**.

L. Monitors

- 1. Type: Stationary.
- 2. Nozzle: UL 401, NPS 2-1/2 (DN 65), brass, adjustable from fog spray to straight stream to shutoff.
- 3. Horizontal Rotation: 360 degrees with locking device.
- 4. Vertical Rotation: 80-degree elevation and 60-degree depression with locking device.
- 5. Waterway: Double **OR** Single, **as directed**, brass or stainless-steel tube.
- 6. Waterway Size: NPS 2-1/2 (DN 65) minimum.
- 7. Water Stream Flow: 500 gpm (31.5 L/s) **OR** 750 gpm (47.3 L/s) **OR** 1000 gpm (63 L/s), **as directed**.
- 8. Operation: Lever **OR** Wheel, **as directed**.
- 9. Base Inlet Size: NPS 2-1/2 (DN 65) **OR** NPS 3 (DN 80) **OR** NPS 4 (DN 100), **as directed**.
- 10. Finish: Red-painted body with brass trim.

M. Fire-Department Connections

- 1. Exposed-Type, Fire-Department Connection:
 - a. Standard: UL 405.
 - b. Type: Exposed, projecting, for wall mounting.
 - c. Pressure Rating: 175 psig (1200 kPa) minimum.
 - d. Body Material: Corrosion-resistant metal.
 - e. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
 - f. Caps: Brass, lugged type, with gasket and chain.
 - g. Escutcheon Plate: Round, brass, wall type.
 - h. Outlet: Back, with pipe threads.
 - i. Number of Inlets: Two **OR** Three, **as directed**.
 - j. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE" **OR** "STANDPIPE", **as directed**.
 - k. Finish: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
 - l. Outlet Size: NPS 4 (DN 100) **OR** NPS 5 (DN 125) **OR** NPS 6 (DN 150), **as directed**.
- 2. Flush-Type, Fire-Department Connection:
 - a. Standard: UL 405.
 - b. Type: Flush, for wall mounting.
 - c. Pressure Rating: 175 psig (1200 kPa) minimum.
 - d. Body Material: Corrosion-resistant metal.
 - e. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
 - f. Caps: Brass, lugged type, with gasket and chain.
 - g. Escutcheon Plate: Rectangular, brass, wall type.



- h. Outlet: With pipe threads.
 - i. Body Style: Horizontal **OR** Square **OR** Vertical, **as directed**.
 - j. Number of Inlets: Two **OR** Three **OR** Four **OR** Six, **as directed**.
 - k. Outlet Location: Back **OR** Bottom **OR** Left side **OR** Right side **OR** Top, **as directed**.
 - l. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE" **OR** "STANDPIPE", **as directed**.
 - m. Finish: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
 - n. Outlet Size: NPS 4 (DN 100) **OR** NPS 5 (DN 125) **OR** NPS 6 (DN 150) **OR** NPS 8 (DN 200), **as directed**.
3. Yard-Type, Fire-Department Connection:
- a. Standard: UL 405.
 - b. Type: Exposed, freestanding.
 - c. Pressure Rating: 175 psig (1200 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - d. Body Material: Corrosion-resistant metal.
 - e. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
 - f. Caps: Brass, lugged type, with gasket and chain.
 - g. Escutcheon Plate: Round, brass, floor type.
 - h. Outlet: Bottom, with pipe threads.
 - i. Number of Inlets: Two **OR** Three **OR** Four, **as directed**.
 - j. Sleeve: Brass **OR** Not required, **as directed**.
 - k. Sleeve Height: 18 inches (460 mm).
 - l. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE" **OR** "STANDPIPE", **as directed**.
 - m. Finish, Including Sleeve: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
 - n. Outlet Size: NPS 4 (DN 100) **OR** NPS 5 (DN 125) **OR** NPS 6 (DN 150), **as directed**.
- N. Alarm Devices
- 1. Alarm-device types shall match piping and equipment connections.
 - 2. Water-Motor-Operated Alarm:
 - a. Standard: UL 753.
 - b. Type: Mechanically operated, with Pelton wheel.
 - c. Alarm Gong: Cast aluminum with red-enamel factory finish.
 - d. Size: 10-inch (250-mm) diameter.
 - e. Components: Shaft length, bearings, and sleeve to suit wall construction.
 - f. Inlet: NPS 3/4 (DN 20).
 - g. Outlet: NPS 1 (DN 25) drain connection.
 - 3. Electrically Operated Alarm Bell:
 - a. Standard: UL 464.
 - b. Type: Vibrating, metal alarm bell.
 - c. Size: 6-inch (150-mm) minimum **OR** 8-inch (200-mm) minimum **OR** 10-inch (250-mm), **as directed**, diameter.
 - d. Finish: Red-enamel factory finish, suitable for outdoor use.
 - 4. Water-Flow Indicators:
 - a. Standard: UL 346.
 - b. Water-Flow Detector: Electrically supervised.
 - c. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
 - d. Type: Paddle operated.
 - e. Pressure Rating: 250 psig (1725 kPa).
 - f. Design Installation: Horizontal or vertical.

5. Pressure Switches:
 - a. Standard: UL 346.
 - b. Type: Electrically supervised water-flow switch with retard feature.
 - c. Components: Single-pole, double-throw switch with normally closed contacts.
 - d. Design Operation: Rising pressure signals water flow.
 6. Valve Supervisory Switches:
 - a. Standard: UL 346.
 - b. Type: Electrically supervised.
 - c. Components: Single-pole, double-throw switch with normally closed contacts.
 - d. Design: Signals that controlled valve is in other than fully open position.
 7. Indicator-Post Supervisory Switches:
 - a. Standard: UL 346.
 - b. Type: Electrically supervised.
 - c. Components: Single-pole, double-throw switch with normally closed contacts.
 - d. Design: Signals that controlled indicator-post valve is in other than fully open position.
- O. Manual Control Stations
1. Description: UL listed or FM approved, hydraulic operation, with union, NPS 1/2 (DN 15) pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.
- P. Control Panels
1. Description: Single-area, two-area, or single-area cross-zoned control panel as indicated, including NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves. Panels contain power supply; battery charger; standby batteries; field-wiring terminal strip; electrically supervised solenoid valves and polarized fire-alarm bell; lamp test facility; single-pole, double-throw auxiliary alarm contacts; and rectifier.
 - a. Panels: UL listed and FM approved when used with thermal detectors and Class A detector circuit wiring. Electrical characteristics are 120-V ac, 60 Hz, with 24-V dc rechargeable batteries.
 - b. Manual Control Stations: Electric operation, metal enclosure, labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.
OR
 Manual Control Stations: Hydraulic operation, with union, NPS 1/2 (DN 15) pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.
- Q. Pressure Gages
1. Standard: UL 393.
 2. Dial Size: 3-1/2- to 4-1/2-inch (90- to 115-mm) diameter.
 3. Pressure Gage Range: 0 to 250 psig (0 to 1725 kPa) minimum **OR** 0 to 300 psig (0 to 2070 kPa), **as directed**.
 4. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.
 5. Air System Piping Gage: Include retard feature, **as directed**, and "AIR" or "AIR/WATER" label on dial face.
- R. Escutcheons
1. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
 2. One-Piece, Cast-Brass Escutcheons: Polished chrome-plated or rough-brass finish with set-screws.
 3. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with chrome-plated finish.



4. One-Piece, Stamped-Steel Escutcheons: Chrome-plated finish with set-screw or spring clips.
5. Split-Casting, Cast-Brass Escutcheons: Polished chrome-plated or rough-brass finish with concealed hinge and set-screw.
6. Split-Plate, Stamped-Steel Escutcheons: Chrome-plated finish with concealed **OR** exposed-rivet, **as directed**, hinge, set-screw or spring clips.
7. One-Piece Floor Plates: Cast-iron flange with holes for fasteners, **as directed**.
8. Split-Casting Floor Plates: Cast brass with concealed hinge.

S. Sleeves

1. Cast-Iron Wall-Pipe Sleeves: Cast or fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
2. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
3. Molded-PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
4. Molded-PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.
5. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
6. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, standard weight, zinc coated, plain ends.
7. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with set-screws.

T. Sleeve Seals

1. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - a. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - b. Pressure Plates: Carbon steel **OR** Plastic **OR** Stainless steel, **as directed**.
 - c. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating **OR** Stainless steel, **as directed**, of length required to secure pressure plates to sealing elements.

U. Grout

1. Standard: ASTM C 1107, Grade B, posthardening and volume adjusting, dry, hydraulic-cement grout.
2. Characteristics: Nonshrink, and recommended for interior and exterior applications.
3. Design Mix: 5000-psi (34-MPa), 28-day compressive strength.
4. Packaging: Premixed and factory packaged.

1.3 EXECUTION

A. Preparation

1. Perform fire-hydrant flow test according to NFPA 14 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
2. Report test results promptly and in writing.

B. Service-Entrance Piping

1. Connect fire-suppression standpipe piping to water-service piping at service entrance into building. Comply with requirements for exterior piping in Division 21 Section "Facility Fire-suppression Water-service Piping".
2. Install shutoff valve, backflow preventer, **as directed**, pressure gage, drain, and other accessories at connection to fire-suppression water-service piping. Comply with requirements for backflow preventers in Division 21 Section "Facility Fire-suppression Water-service Piping", **as directed**.
3. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

C. Water-Supply Connections

1. Connect fire-suppression standpipe piping to building's interior water-distribution piping. Comply with requirements for interior piping in Division 22 Section "Domestic Water Piping".
2. Install shutoff valve, backflow preventer, **as directed**, pressure gage, drain, and other accessories at connection to water-distribution piping. Comply with requirements for backflow preventers in Division 22 Section "Domestic Water Piping Specialties", **as directed**.
OR
Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

D. Piping Installation

1. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - a. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with the Owner before deviating from approved working plans.
2. Piping Standard: Comply with requirements in NFPA 14 for installation of fire-suppression standpipe piping.
3. Install seismic restraints on piping. Comply with requirements in NFPA 13 for seismic-restraint device materials and installation.
4. Install listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
5. Install drain valves on standpipes. Extend drain piping to outside of building.
6. Install automatic (ball drip) drain valves to drain piping between fire-department connections and check valves. Drain to floor drain or outside building.
7. Install alarm devices in piping systems.
8. Install hangers and supports for standpipe system piping according to NFPA 14. Comply with requirements in NFPA 13 for hanger materials.
9. Install pressure gages on riser or feed main and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 (DN 8) and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
10. Drain dry-type standpipe system piping.
11. Pressurize and check dry-type standpipe system piping and air-pressure maintenance devices **OR** air compressors, **as directed**.
12. Fill wet-type standpipe system piping with water.
13. Install electric heating cables and pipe insulation on wet-type, fire-suppression standpipe piping in areas subject to freezing. Comply with requirements for heating cables in Division 21 Section "Heat Tracing For Fire-suppression Piping" and for piping insulation in Division 21 Section "Fire-suppression Systems Insulation".
14. Connect compressed-air supply to dry-pipe sprinkler piping.
OR
Connect air compressor to the following piping and wiring:
 - a. Pressure gages and controls.
 - b. Electrical power system.
 - c. Fire-alarm devices, including low-pressure alarm.

E. Joint Construction

1. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
2. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.
3. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.
4. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.



5. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
 6. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
 7. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
 8. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
 9. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
 10. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
 - a. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
 11. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.
 12. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
 13. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.
- F. Valve And Specialties Installation
1. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 14 and authorities having jurisdiction.
 2. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
 3. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
 4. Specialty Valves:
 - a. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
 - b. Alarm Valves: Install bypass check valve and retarding chamber drain-line connection.
 - c. Dry-Pipe and Deluge Valves: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
 - 1) Install air compressor and compressed-air supply piping.
 - OR**
 - Air-Pressure Maintenance Device: Install shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14- to 60-psig (95- to 410-kPa) adjustable range; and 175-psig (1200-kPa) maximum inlet pressure.
 - 2) Install compressed-air supply piping from building's compressed-air piping system.
- G. Hose-Connection Installation
1. Install hose connections adjacent to standpipes.
 2. Install freestanding hose connections for access and minimum passage restriction.
 3. Install NPS 1-1/2 (DN 40) hose-connection valves with flow-restricting device.



4. Install NPS 2-1/2 (DN 65) hose connections with quick-disconnect NPS 2-1/2 by NPS 1-1/2 (DN 65 by DN 40) reducer adapter and flow-restricting device.
 5. Install wall-mounted-type hose connections in cabinets. Include pipe escutcheons, with finish matching valves, inside cabinet where water-supply piping penetrates cabinet. Install valves at angle required for connection of fire hose. Comply with requirements for cabinets in Division 10 Section "Fire Extinguisher Cabinets".
- H. Hose-Station Installation
1. Install freestanding hose stations for access and minimum passage restriction.
 2. Install NPS 1-1/2 (DN 40) hose-station valves with flow-restricting device unless otherwise indicated.
 3. Install NPS 2-1/2 (DN 65) hose connections with quick-disconnect NPS 2-1/2 by NPS 1-1/2 (DN 65 by DN 40) reducer adapter and flow-restricting device unless otherwise indicated.
 4. Install freestanding hose stations with support or bracket attached to standpipe.
 5. Install wall-mounted, rack hose stations in cabinets. Include pipe escutcheons, with finish matching valves, inside cabinet where water-supply piping penetrates cabinet. Install valves at angle required for connection of fire hose. Comply with requirements for cabinets in Division 10 Section "Fire Extinguisher Cabinets".
 6. Install hose-reel hose stations on wall with bracket.
- I. Monitor Installation
1. Install monitors on standpipe piping.
- J. Fire-Department Connection Installation
1. Install wall-type, fire-department connections.
 2. Install yard-type, fire-department connections in concrete slab support. Comply with requirements for concrete in Division 03 Section "Cast-in-place Concrete".
 - a. Install two **OR** three, **as directed**, protective pipe bollards around **OR** on sides of, **as directed**, each fire-department connection. Comply with requirements for bollards in Division 05 Section "Metal Fabrications".
 3. Install automatic (ball drip) drain valve at each check valve for fire-department connection.
- K. Escutcheon Installation
1. Install escutcheons for penetrations of walls, ceilings, and floors.
 2. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 - b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish **OR** stamped steel with set-screw **OR** stamped steel with set-screw or spring clips **OR** stamped steel with spring clips, **as directed**.
 - c. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish **OR** One piece or split casting, cast brass with polished chrome-plated finish **OR** One piece, stamped steel with set-screw **OR** One piece or split plate, stamped steel with set-screw **OR** Split plate, stamped steel with set-screw, **as directed**.
 - d. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish **OR** cast brass with rough-brass finish **OR** stamped steel with set-screw **OR** stamped steel with spring clips **OR** stamped steel with set-screw or spring clips, **as directed**.
 - e. Bare Piping in Equipment Rooms: One piece, cast brass **OR** stamped steel with set-screw **OR** stamped steel with spring clips **OR** stamped steel with set-screw or spring clips, **as directed**.
 - f. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.
 3. Escutcheons for Existing Piping:
 - a. Chrome-Plated Piping: Split casting, cast brass with chrome-plated finish.



- b. Insulated Piping: Split plate, stamped steel with concealed or exposed-rivet hinge and spring clips.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish **OR** plate, stamped steel with concealed hinge and spring clips, **as directed**.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish **OR** plate, stamped steel with concealed hinge and set-screw, **as directed**.
 - e. Bare Piping in Unfinished Service Spaces: Split casting, cast brass with polished chrome-plated finish **OR** casting, cast brass with rough-brass finish **OR** plate, stamped steel with concealed hinge and set-screw or spring clips **OR** plate, stamped steel with concealed or exposed-rivet hinge and set-screw or spring clips **OR** plate, stamped steel with exposed-rivet hinge and set-screw or spring clips, **as directed**.
 - f. Bare Piping in Equipment Rooms: Split casting, cast brass **OR** plate, stamped steel with set-screw or spring clips, **as directed**.
 - g. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting floor plate.
- L. Sleeve Installation
- 1. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
 - 2. Sleeves are not required for core-drilled holes.
 - 3. Permanent sleeves are not required for holes formed by removable PE sleeves.
 - 4. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
 - 5. Install sleeves in new partitions, slabs, and walls as they are built.
 - 6. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants".
 - 7. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants".
 - 8. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals.
 - 9. Seal space outside of sleeves in concrete slabs and walls with grout.
 - 10. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.
 - 11. Install sleeve materials according to the following applications:
 - a. Sleeves for Piping Passing through Concrete Floor Slabs: Molded PE **OR** Molded PVC **OR** Galvanized-steel pipe, **as directed**.
 - b. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Galvanized-steel pipe **OR** Stack sleeve fittings, **as directed**.
 - 1) Extend sleeves 2 inches (50 mm) above finished floor level.
 - 2) For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Comply with requirements for flashing in Division 07 Section "Sheet Metal Flashing And Trim".
 - c. Sleeves for Piping Passing through Gypsum-Board Partitions:
 - 1) PVC-pipe **OR** Galvanized-steel-pipe, **as directed**, sleeves for pipes smaller than NPS 6 (DN 150).
 - 2) Galvanized-steel-sheet sleeves for pipes NPS 6 (DN 150) and larger.
 - 3) Exception: Sleeves are not required for water-supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
 - d. Sleeves for Piping Passing through Concrete Roof Slabs: Molded PE **OR** Molded PVC **OR** Galvanized-steel pipe, **as directed**.
 - e. Sleeves for Piping Passing through Exterior Concrete Walls:
 - 1) Galvanized-steel-pipe sleeves for pipes smaller than NPS 6 (DN 150).



- 2) Cast-iron wall pipe sleeves for pipes NPS 6 (DN 150) and larger.
 - 3) Install sleeves that are large enough to provide 1-inch (25-mm) annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.
 - f. Sleeves for Piping Passing through Interior Concrete Walls:
 - 1) PVC-pipe **OR** Galvanized-steel-pipe, **as directed**, sleeves for pipes smaller than NPS 6 (DN 150).
 - 2) Galvanized-steel-sheet sleeves for pipes NPS 6 (DN 150) and larger.
 12. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestop materials and installations in Division 07 Section "Penetration Firestopping".
- M. Sleeve Seal Installation
1. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.
 2. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- N. Identification
1. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 14.
 2. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".
- O. Field Quality Control
1. Perform tests and inspections.
 2. Tests and Inspections:
 - a. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - c. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
 - d. Energize circuits to electrical equipment and devices.
 - e. Start and run air compressors.
 - f. Coordinate with fire-alarm tests. Operate as required.
 - g. Coordinate with fire-pump tests. Operate as required.
 - h. Verify that equipment hose threads are same as local fire-department equipment.
 3. Fire-suppression standpipe system will be considered defective if it does not pass tests and inspections.
 4. Prepare test and inspection reports.
- P. Demonstration
1. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.
- Q. Piping Schedule
1. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends; cast-iron threaded fittings; and threaded **OR** grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved, **as directed**, joints.
 2. Standard-pressure, wet-type, fire-suppression standpipe piping, NPS 4 (DN 100) and smaller, shall be one of the following:
 - a. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 - b. Standard-weight **OR** Schedule 30 or thinwall, **as directed**, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.



- c. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - d. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - e. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 - f. Thinwall **OR** Schedule 10, **as directed**, **OR** nonstandard OD, thinwall or hybrid, **as directed**, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - g. Thinwall **OR** Schedule 10, **as directed**, **OR** nonstandard OD, thinwall or hybrid, **as directed**, black-steel pipe with plain ends; welding fittings; and welded joints.
 - h. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with plain ends; cast- or wrought-copper solder-joint fittings; and brazed joints.
 - i. Type L (Type B) **OR** Type M (Type B), **as directed**, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.
3. Standard-pressure, wet-type, fire-suppression standpipe piping, NPS 5 to NPS 8 (DN 125 to DN 200), shall be one of the following:
- a. Standard-weight **OR** Schedule 30, **as directed**, or thinwall, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 - b. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - c. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - d. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - e. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 - f. Thinwall **OR** Schedule 10, **as directed**, or hybrid black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - g. Thinwall **OR** Schedule 10, **as directed**, or hybrid black-steel pipe with plain ends; welding fittings; and welded joints.
 - h. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with plain ends; cast- or wrought-copper solder-joint fittings; and brazed joints.
 - i. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.
4. Standard-pressure, wet-type, fire-suppression standpipe piping, NPS 10 and NPS 12 (DN 250 and DN 300), shall be one of the following:
- a. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 - b. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - c. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - d. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - e. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 - f. Thinwall **OR** Schedule 10, **as directed**, **OR** nonstandard OD, thinwall or hybrid, **as directed**, black-steel pipe with plain ends; welding fittings; and welded joints.



5. High-pressure, wet-type, fire-suppression standpipe piping, NPS 4 (DN 100) and smaller, shall be one of the following:
 - a. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 - b. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - c. Standard-weight or Schedule 30, black-steel pipe with cut-grooved **OR** roll-grooved, **as directed**, ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - d. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - e. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 - f. Thinwall **OR** Schedule 10, **as directed**, **OR** nonstandard OD, thinwall or hybrid, **as directed**, black-steel pipe with plain ends; welding fittings; and welded joints.
6. High-pressure, wet-type, fire-suppression standpipe piping, NPS 5 (DN 125) and larger, shall be one of the following:
 - a. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 - b. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - c. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - d. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - e. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 - f. Thinwall **OR** Schedule 10, **as directed**, **OR** nonstandard OD, thinwall or hybrid, **as directed**, black-steel pipe with plain ends; welding fittings; and welded joints.
7. Standard-pressure, dry-type, fire-suppression standpipe piping, NPS 4 (DN 100) and smaller, shall be one of the following:
 - a. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - b. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - c. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with plain ends; cast- or wrought-copper solder-joint fittings; and brazed joints.
 - d. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.
8. Standard-pressure, dry-type, fire-suppression standpipe piping, NPS 5 and NPS 6 (DN 125 and DN 150), shall be one of the following:
 - a. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - b. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - c. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with plain ends; cast- or wrought-copper solder-joint fittings; and brazed joints.
 - d. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.



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Task	Specification	Specification Description
21 12 13 00	21 11 19 00	Fire-Suppression Standpipes
21 12 23 00	21 11 19 00	Fire-Suppression Standpipes
21 12 29 00	01 22 16 00	No Specification Required
21 12 29 00	21 11 19 00	Fire-Suppression Standpipes



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SECTION 21 13 13 00 - WET-PIPE FIRE-SUPPRESSION SPRINKLERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for wet-pipe fire-suppression sprinklers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Pipes, fittings, and specialties.
 - b. Fire-protection valves.
 - c. Fire-department connections.
 - d. Sprinklers.
 - e. Excess-pressure pumps.
 - f. Alarm devices.
 - g. Manual control stations.
 - h. Control panels.
 - i. Pressure gages.

C. Definitions

1. High-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175 psig (1200 kPa), but not higher than 250 psig (1725 kPa) **OR** 300 psig (2070 kPa), **as directed**.
2. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175 psig (1200 kPa) maximum.

D. System Descriptions

1. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.
2. Deluge Sprinkler System: Open sprinklers are attached to piping connected to water supply through deluge valve. Fire-detection system, in same area as sprinklers, opens valve. Water flows into piping system and discharges from attached sprinklers when valve opens.

E. Performance Requirements

1. Standard-Pressure Piping System Component: Listed for 175-psig (1200-kPa) minimum working pressure.
2. High-Pressure Piping System Component: Listed for 250-psig (1725-kPa) minimum **OR** 300-psig (2070-kPa), **as directed**, working pressure.
3. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
4. Sprinkler system design shall be approved by authorities having jurisdiction.
 - a. Margin of Safety for Available Water Flow and Pressure: 10 **OR** 20, **as directed**, percent, including losses through water-service piping, valves, and backflow preventers.
 - b. Sprinkler Occupancy Hazard Classifications:
 - 1) Automobile Parking Areas: Ordinary Hazard, Group 1.
 - 2) Building Service Areas: Ordinary Hazard, Group 1.
 - 3) Churches: Light Hazard.
 - 4) Electrical Equipment Rooms: Ordinary Hazard, Group 1.
 - 5) Dry Cleaners: Ordinary Hazard, Group 2.



- 6) General Storage Areas: Ordinary Hazard, Group 1.
 - 7) Laundries: Ordinary Hazard, Group 1.
 - 8) Libraries except Stack Areas: Light Hazard.
 - 9) Library Stack Areas: Ordinary Hazard, Group 2.
 - 10) Machine Shops: Ordinary Hazard, Group 2.
 - 11) Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
 - 12) Office and Public Areas: Light Hazard.
 - 13) Plastics Processing Areas: Extra Hazard, Group 2.
 - 14) Printing Plants: Extra Hazard, Group 1.
 - 15) Repair Garages: Ordinary Hazard, Group 2.
 - 16) Residential Living Areas: Light Hazard.
 - 17) Restaurant Service Areas: Ordinary Hazard, Group 1.
 - 18) Solvent Cleaning Areas: Extra Hazard, Group 2.
 - 19) Upholstering Plants: Extra Hazard, Group 1.
 - c. Minimum Density for Automatic-Sprinkler Piping Design:
 - 1) Residential (Dwelling) Occupancy: 0.05 gpm over 400-sq. ft. (2.04 mm/min. over 37.2-sq. m) area.
 - 2) Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. (4.1 mm/min. over 139-sq. m) area.
 - 3) Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. (6.1 mm/min. over 139-sq. m) area.
 - 4) Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. (8.1 mm/min. over 139-sq. m) area.
 - 5) Extra-Hazard, Group 1 Occupancy: 0.30 gpm over 2500-sq. ft. (12.2 mm/min. over 232-sq. m) area.
 - 6) Extra-Hazard, Group 2 Occupancy: 0.40 gpm over 2500-sq. ft. (16.3 mm/min. over 232-sq. m) area.
 - 7) Special Occupancy Hazard: As determined by authorities having jurisdiction.
 - d. Minimum Density for Deluge-Sprinkler Piping Design:
 - 1) Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm (6.1 mm/min.) over entire area.
 - 2) Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm (8.1 mm/min.) over entire area.
 - 3) Extra-Hazard, Group 1 Occupancy: 0.30 gpm (12.2 mm/min.) over entire area.
 - 4) Extra-Hazard, Group 2 Occupancy: 0.40 gpm (16.3 mm/min.) over entire area.
 - 5) Special Occupancy Hazard: As determined by authorities having jurisdiction.
 - e. Maximum Protection Area per Sprinkler: Per UL listing.
OR
 Maximum Protection Area per Sprinkler:
 - 1) Residential Areas: 400 sq. ft. (37 sq. m).
 - 2) Office Spaces: 120 sq. ft. (11.1 sq. m) **OR** 225 sq. ft. (20.9 sq. m), **as directed**.
 - 3) Storage Areas: 130 sq. ft. (12.1 sq. m).
 - 4) Mechanical Equipment Rooms: 130 sq. ft. (12.1 sq. m).
 - 5) Electrical Equipment Rooms: 130 sq. ft. (12.1 sq. m).
 - 6) Other Areas: According to NFPA 13 recommendations unless otherwise indicated.
 - f. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:
 - 1) Light-Hazard Occupancies: 100 gpm (6.3 L/s) for 30 minutes.
 - 2) Ordinary-Hazard Occupancies: 250 gpm (15.75 L/s) for 60 to 90 minutes.
 - 3) Extra-Hazard Occupancies: 500 gpm (31.5 L/s) for 90 to 120 minutes.
 5. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.
- F. Submittals
1. Product Data: For each type of product indicated.
 2. LEED Submittal:



- a. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content and chemical components.
 3. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.
 - a. Wiring Diagrams: For power, signal, and control wiring.
 4. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 5. Qualification Data: For qualified Installer and professional engineer, **as directed**.
 6. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
 7. Welding certificates.
 8. Fire-hydrant flow test report.
 9. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
 10. Field quality-control reports.
 11. Operation and maintenance data.
 - G. Quality Assurance
 1. Installer Qualifications:
 - a. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 - 1) Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
 2. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
 3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 4. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
 - a. NFPA 13, "Installation of Sprinkler Systems."
 - b. NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height."
 - c. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."
 - H. Project Conditions
 1. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of sprinkler service.
 - b. Do not proceed with interruption of sprinkler service without the Owner's written permission.
- 1.2 PRODUCTS
- A. Piping Materials
 1. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.
 - B. Steel Pipe And Fittings
 1. Standard Weight, Galvanized- and Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.



2. Schedule 30, Galvanized- and Black-Steel Pipe: ASTM A 135; ASTM A 795/A 795M, Type E; or ASME B36.10M, wrought steel; with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.
3. Thinwall Galvanized- and Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.
4. Schedule 10, Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, Schedule 10 in NPS 5 (DN 125) and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10 (DN 150 to DN 250), plain end.
5. Nonstandard OD, Thinwall Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, thinwall, with plain ends and wall thickness less than Schedule 10.
6. Hybrid Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, lightwall, with wall thickness less than Schedule 10 and greater than Schedule 5.
7. Schedule 5 Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, lightwall, with plain ends.
8. Galvanized- and Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
9. Galvanized and Uncoated, Steel Couplings: ASTM A 865, threaded.
10. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
11. Malleable- or Ductile-Iron Unions: UL 860.
12. Cast-Iron Flanges: ASME 16.1, Class 125.
13. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
14. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.
15. Grooved-Joint, Steel-Pipe Appurtenances:
 - a. Pressure Rating: 175 psig (1200 kPa) **OR** 250 psig (1725 kPa) **OR** 300 psig (2070 kPa), **as directed**, minimum.
 - b. Galvanized and Uncoated, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
 - c. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.
16. Steel Pressure-Seal Fittings: UL 213, FM-approved, 175-psig (1200-kPa) pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.

C. Copper Tube And Fittings

1. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) and ASTM B 88, Type M (ASTM B 88M, Type C) water tube, drawn temper.
2. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
3. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings.
4. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
5. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
6. Copper Pressure-Seal Fittings:
 - a. Standard: UL 213.
 - b. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
 - c. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Cast-bronze fitting with EPDM-rubber O-ring seal in each end.
7. Grooved-Joint, Copper-Tube Appurtenances:
 - a. Grooved-End, Copper Fittings: ASTM B 75 (ASTM B 75M), copper tube or ASTM B 584, bronze castings.



- b. Grooved-End-Tube Couplings: To fit copper-tube dimensions, with design similar to AWWA C606. Include ferrous housing sections, EPDM-rubber gasket suitable for hot and cold water, and bolts and nuts.
 - 8. Copper-Tube, Extruded-Tee Connections:
 - a. Description: Tee formed in copper tube according to ASTM F 2104.
 - D. CPVC Pipe And Fittings
 - 1. CPVC Pipe: ASTM F 442/F 442M and UL 1821, SDR 13.5, for 175-psig (1200-kPa) rated pressure at 150 deg F (62 deg C), with plain ends. Include "LISTED" and "CPVC SPRINKLER PIPE" markings.
 - 2. CPVC Fittings: UL listed or FM approved, for 175-psig (1200-kPa) rated pressure at 150 deg F (62 deg C), socket type. Include "LISTED" and "CPVC SPRINKLER FITTING" markings.
 - a. NPS 3/4 to NPS 1-1/2 (DN 20 to DN 40): ASTM F 438 and UL 1821, Schedule 40, socket type.
 - b. NPS 2 to NPS 3 (DN 50 to DN 80): ASTM F 439 and UL 1821, Schedule 80, socket type.
 - c. CPVC-to-Metal Transition Fittings: CPVC, one piece, with dimensions equivalent to pipe; one end with threaded brass insert, and one socket end.
 - d. CPVC-to-Metal Transition Unions: CPVC, with dimensions equivalent to pipe; one end with threaded brass insert, and one socket end.
 - e. Flanges: CPVC, one or two pieces.
 - E. Piping Joining Materials
 - 1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free.
 - a. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
 - b. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.
 - 2. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
 - 3. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
 - 4. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
 - 5. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493, solvent cement recommended by pipe and fitting manufacturer, and made for joining CPVC sprinkler pipe and fittings. Include cleaner or primer recommended by pipe and fitting manufacturer.
 - a. Use solvent cement that has a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Use adhesive primer that has a VOC content of 650 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 6. Plastic, Pipe-Flange Gasket, and Bolts and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.
 - F. Cover System For Sprinkler Piping
 - 1. Description: System of support brackets and covers made to protect sprinkler piping.
 - 2. Brackets: Glass-reinforced nylon.
 - 3. Covers: Extruded PVC sections of length, shape, and size required for size and routing of CPVC piping.
 - G. Listed Fire-Protection Valves
 - 1. General Requirements:
 - a. Valves shall be UL listed or FM approved.
 - b. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig (1200 kPa).
 - c. Minimum Pressure Rating for High-Pressure Piping: 250 psig (1725 kPa) **OR** 300 psig (2070 kPa), **as directed**.
 - 2. Ball Valves:



- a. Standard: UL 1091 except with ball instead of disc.
 - b. Valves NPS 1-1/2 (DN 40) and Smaller: Bronze body with threaded ends.
 - c. Valves NPS 2 and NPS 2-1/2 (DN 50 and DN 65): Bronze body with threaded ends or ductile-iron body with grooved ends.
 - d. Valves NPS 3 (DN 80): Ductile-iron body with grooved ends.
- 3. Bronze Butterfly Valves:
 - a. Standard: UL 1091.
 - b. Pressure Rating: 175 psig (1200 kPa).
 - c. Body Material: Bronze.
 - d. End Connections: Threaded.
- 4. Iron Butterfly Valves:
 - a. Standard: UL 1091.
 - b. Pressure Rating: 175 psig (1200 kPa).
 - c. Body Material: Cast or ductile iron.
 - d. Style: Lug or wafer.

OR

End Connections: Grooved.
- 5. Check Valves:
 - a. Standard: UL 312.
 - b. Pressure Rating: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Type: Swing check.
 - d. Body Material: Cast iron.
 - e. End Connections: Flanged or grooved.
- 6. Bronze OS&Y Gate Valves:
 - a. Standard: UL 262.
 - b. Pressure Rating: 175 psig (1200 kPa).
 - c. Body Material: Bronze.
 - d. End Connections: Threaded.
- 7. Iron OS&Y Gate Valves:
 - a. Standard: UL 262.
 - b. Pressure Rating: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Cast or ductile iron.
 - d. End Connections: Flanged or grooved.
- 8. Indicating-Type Butterfly Valves:
 - a. Standard: UL 1091.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum.
 - c. Valves NPS 2 (DN 50) and Smaller:
 - 1) Valve Type: Ball or butterfly.
 - 2) Body Material: Bronze.
 - 3) End Connections: Threaded.
 - d. Valves NPS 2-1/2 (DN 65) and Larger:
 - 1) Valve Type: Butterfly.
 - 2) Body Material: Cast or ductile iron.
 - 3) End Connections: Flanged, grooved, or wafer.
 - e. Valve Operation: Integral electrical, 115-V ac, prewired, single-circuit, supervisory switch **OR** electrical, 115-V ac, prewired, two-circuit, supervisory switch **OR** visual, **as directed**, indicating device.
- 9. NRS Gate Valves:
 - a. Standard: UL 262.
 - b. Pressure Rating: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Cast iron with indicator post flange.
 - d. Stem: Nonrising.
 - e. End Connections: Flanged or grooved.
- 10. Indicator Posts:
 - a. Standard: UL 789.



- b. Type: Horizontal for wall mounting.
- c. Body Material: Cast iron with extension rod and locking device.
- d. Operation: Wrench **OR** Hand wheel, **as directed**.

H. Trim And Drain Valves

1. General Requirements:
 - a. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum.
2. Angle Valves.
3. Ball Valves.
4. Globe Valves.
5. Plug Valves.

I. Specialty Valves

1. General Requirements:
 - a. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - b. Pressure Rating:
 - 1) Standard-Pressure Piping Specialty Valves: 175 psig (1200 kPa) minimum.
 - 2) High-Pressure Piping Specialty Valves: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Cast or ductile iron.
 - d. Size: Same as connected piping.
 - e. End Connections: Flanged or grooved.
2. Alarm Valves:
 - a. Standard: UL 193.
 - b. Design: For horizontal or vertical installation.
 - c. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, **as directed**, and fill-line attachment with strainer.
 - d. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
OR
Drip Cup Assembly: Pipe drain with check valve to main drain piping.
3. Deluge Valves:
 - a. Standard: UL 260.
 - b. Design: Hydraulically operated, differential-pressure type.
 - c. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, drip cup assembly piped without valves and separate from main drain line, fill-line attachment with strainer, and push-rod chamber supply connection.
 - d. Wet, Pilot-Line Trim Set: Include gage to read push-rod chamber pressure, globe valve for manual operation of deluge valve, and connection for actuation device.
4. Automatic (Ball Drip) Drain Valves:
 - a. Standard: UL 1726.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum.
 - c. Type: Automatic draining, ball check.
 - d. Size: NPS 3/4 (DN 20).
 - e. End Connections: Threaded.

J. Fire-Department Connections

1. Exposed-Type, Fire-Department Connection:
 - a. Standard: UL 405.
 - b. Type: Exposed, projecting, for wall mounting.
 - c. Pressure Rating: 175 psig (1200 kPa) minimum.
 - d. Body Material: Corrosion-resistant metal.



- e. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
- f. Caps: Brass, lugged type, with gasket and chain.
- g. Escutcheon Plate: Round, brass, wall type.
- h. Outlet: Back, with pipe threads.
- i. Number of Inlets: Two **OR** Three, **as directed**.
- j. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE" **OR** "AUTO SPKR", **as directed**.
- k. Finish: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
- l. Outlet Size: NPS 4 (DN 100) **OR** NPS 5 (DN 125) **OR** NPS 6 (DN 150), **as directed**.
- 2. Flush-Type, Fire-Department Connection:
 - a. Standard: UL 405.
 - b. Type: Flush, for wall mounting.
 - c. Pressure Rating: 175 psig (1200 kPa) minimum.
 - d. Body Material: Corrosion-resistant metal.
 - e. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
 - f. Caps: Brass, lugged type, with gasket and chain.
 - g. Escutcheon Plate: Rectangular, brass, wall type.
 - h. Outlet: With pipe threads.
 - i. Body Style: Horizontal **OR** Square **OR** Vertical, **as directed**.
 - j. Number of Inlets: Two **OR** Three **OR** Four **OR** Six, **as directed**.
 - k. Outlet Location: Back **OR** Bottom **OR** Left side **OR** Right side **OR** Top, **as directed**.
 - l. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE" **OR** "AUTO SPKR", **as directed**.
 - m. Finish: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
 - n. Outlet Size: NPS 4 (DN 100) **OR** NPS 5 (DN 125) **OR** NPS 6 (DN 150) **OR** NPS 8 (DN 200), **as directed**.
- 3. Yard-Type, Fire-Department Connection:
 - a. Standard: UL 405.
 - b. Type: Exposed, freestanding.
 - c. Pressure Rating: 175 psig (1200 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - d. Body Material: Corrosion-resistant metal.
 - e. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
 - f. Caps: Brass, lugged type, with gasket and chain.
 - g. Escutcheon Plate: Round, brass, floor type.
 - h. Outlet: Bottom, with pipe threads.
 - i. Number of Inlets: Two **OR** Three **OR** Four, **as directed**.
 - j. Sleeve: Brass **OR** Not required, **as directed**.
 - k. Sleeve Height: 18 inches (460 mm).
 - l. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE" **OR** "AUTO SPKR", **as directed**.
 - m. Finish, Including Sleeve: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
 - n. Outlet Size: NPS 4 (DN 100) **OR** NPS 5 (DN 125) **OR** NPS 6 (DN 150), **as directed**.
- K. Sprinkler Specialty Pipe Fittings
 - 1. Branch Outlet Fittings:
 - a. Standard: UL 213.



- b. Pressure Rating: 175 psig (1200 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
 - d. Type: Mechanical-T and -cross fittings.
 - e. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
 - f. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
 - g. Branch Outlets: Grooved, plain-end pipe, or threaded.
 - 2. Flow Detection and Test Assemblies:
 - a. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
 - d. Size: Same as connected piping.
 - e. Inlet and Outlet: Threaded.
 - 3. Branch Line Testers:
 - a. Standard: UL 199.
 - b. Pressure Rating: 175 psig (1200 kPa).
 - c. Body Material: Brass.
 - d. Size: Same as connected piping.
 - e. Inlet: Threaded.
 - f. Drain Outlet: Threaded and capped.
 - g. Branch Outlet: Threaded, for sprinkler.
 - 4. Sprinkler Inspector's Test Fittings:
 - a. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Cast- or ductile-iron housing with sight glass.
 - d. Size: Same as connected piping.
 - e. Inlet and Outlet: Threaded.
 - 5. Adjustable Drop Nipples:
 - a. Standard: UL 1474.
 - b. Pressure Rating: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Steel pipe with EPDM-rubber O-ring seals.
 - d. Size: Same as connected piping.
 - e. Length: Adjustable.
 - f. Inlet and Outlet: Threaded.
 - 6. Flexible, Sprinkler Hose Fittings:
 - a. Standard: UL 1474.
 - b. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
 - c. Pressure Rating: 175 psig (1200 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - d. Size: Same as connected piping, for sprinkler.
- L. Sprinklers
- 1. General Requirements:
 - a. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - b. Pressure Rating for Residential Sprinklers: 175 psig (1200 kPa) maximum.
 - c. Pressure Rating for Automatic Sprinklers: 175 psig (1200 kPa) minimum.
 - d. Pressure Rating for High-Pressure Automatic Sprinklers: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - 2. Automatic Sprinklers with Heat-Responsive Element:
 - a. Early-Suppression, Fast-Response Applications: UL 1767.
 - b. Nonresidential Applications: UL 199.
 - c. Residential Applications: UL 1626.



- d. Characteristics: Nominal 1/2-inch (12.7-mm) orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
 - 3. Open Sprinklers with Heat-Responsive Element Removed: UL 199.
 - a. Characteristics:
 - 1) Nominal 1/2-inch (12.7-mm) Orifice: With Discharge Coefficient K between 5.3 and 5.8.
 - 2) Nominal 17/32-inch (13.5-mm) Orifice: With Discharge Coefficient K between 7.4 and 8.2.
 - 4. Sprinkler Finishes:
 - a. Chrome plated.
 - b. Bronze.
 - c. Painted.
 - 5. Special Coatings:
 - a. Wax.
 - b. Lead.
 - c. Corrosion-resistant paint.
 - 6. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
 - a. Ceiling Mounting: Chrome-plated steel, one piece, flat **OR** Chrome-plated steel, two piece, with 1-inch (25-mm) vertical adjustment **OR** Plastic, white finish, one piece, flat, **as directed**.
 - b. Sidewall Mounting: Chrome-plated steel **OR** Plastic, white finish, **as directed**, one piece, flat.
 - 7. Sprinkler Guards:
 - a. Standard: UL 199.
 - b. Type: Wire cage with fastening device for attaching to sprinkler.
- M. Excess-Pressure Pumps
- 1. Pump: Factory-fabricated, positive-displacement, gear type.
 - a. Pump and Motor: Directly connected.
 - b. Motor: Comply with requirements in Division 21 Section "Common Work Results For Fire Suppression".
 - 2. Miscellaneous Components: Wet-pipe kit of switches, fittings, valves, mounting brackets, and connections for power, hydraulic piping, and wiring from alarm devices.
 - 3. Motor Control: Differential-pressure switch.
 - 4. Lights: To indicate sprinkler system's operating condition.
 - a. White Light: Pressure is normal.
 - b. Red Light: Pressure is low.
 - 5. Capacity: 2.0 gpm at 75-psig (0.13 L/s at 520-kPa) differential pressure and 1/3 hp **OR** 1.85 gpm at 100-psig (0.12 L/s at 690-kPa) differential pressure and 1/2 hp **OR** 3.5 gpm at 100-psig (0.22 L/s at 690-kPa) differential pressure and 1/2 hp, **as directed**.
- N. Alarm Devices
- 1. Alarm-device types shall match piping and equipment connections.
 - 2. Water-Motor-Operated Alarm:
 - a. Standard: UL 753.
 - b. Type: Mechanically operated, with Pelton wheel.
 - c. Alarm Gong: Cast aluminum with red-enamel factory finish.
 - d. Size: 10-inch (250-mm) diameter.
 - e. Components: Shaft length, bearings, and sleeve to suit wall construction.
 - f. Inlet: NPS 3/4 (DN 20).
 - g. Outlet: NPS 1 (DN 25) drain connection.
 - 3. Electrically Operated Alarm Bell:



- a. Standard: UL 464.
 - b. Type: Vibrating, metal alarm bell.
 - c. Size: 6-inch (150-mm) minimum-diameter **OR** 8-inch (200-mm) minimum-diameter **OR** 10-inch (250-mm) diameter, **as directed**.
 - d. Finish: Red-enamel factory finish, suitable for outdoor use.
- 4. Water-Flow Indicators:
 - a. Standard: UL 346.
 - b. Water-Flow Detector: Electrically supervised.
 - c. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
 - d. Type: Paddle operated.
 - e. Pressure Rating: 250 psig (1725 kPa).
 - f. Design Installation: Horizontal or vertical.
- 5. Pressure Switches:
 - a. Standard: UL 346.
 - b. Type: Electrically supervised water-flow switch with retard feature.
 - c. Components: Single-pole, double-throw switch with normally closed contacts.
 - d. Design Operation: Rising pressure signals water flow.
- 6. Valve Supervisory Switches:
 - a. Standard: UL 346.
 - b. Type: Electrically supervised.
 - c. Components: Single-pole, double-throw switch with normally closed contacts.
 - d. Design: Signals that controlled valve is in other than fully open position.
- 7. Indicator-Post Supervisory Switches:
 - a. Standard: UL 346.
 - b. Type: Electrically supervised.
 - c. Components: Single-pole, double-throw switch with normally closed contacts.
 - d. Design: Signals that controlled indicator-post valve is in other than fully open position.
- O. Manual Control Stations
 - 1. Description: UL listed or FM approved, hydraulic operation, with union, NPS 1/2 (DN 15) pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.
- P. Control Panels
 - 1. Description: Single-area, two-area, or single-area cross-zoned control panel as indicated, including NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves. Panels contain power supply; battery charger; standby batteries; field-wiring terminal strip; electrically supervised solenoid valves and polarized fire-alarm bell; lamp test facility; single-pole, double-throw auxiliary alarm contacts; and rectifier.
 - a. Panels: UL listed and FM approved when used with thermal detectors and Class A detector circuit wiring. Electrical characteristics are 120-V ac, 60 Hz, with 24-V dc rechargeable batteries.
 - b. Manual Control Stations: Electric operation, metal enclosure, labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.

OR

Manual Control Stations: Hydraulic operation, with union, NPS 1/2 (DN 15) pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.
- Q. Pressure Gages



1. Standard: UL 393.
2. Dial Size: 3-1/2- to 4-1/2-inch (90- to 115-mm) diameter.
3. Pressure Gage Range: 0 to 250 psig (0 to 1725 kPa) minimum **OR** 0 to 300 psig (0 to 2070 kPa), **as directed**.
4. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.
5. Air System Piping Gage: Include retard feature, **directed**, and "AIR" or "AIR/WATER" label on dial face.

R. Escutcheons

1. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
2. One-Piece, Cast-Brass Escutcheons: Polished chrome-plated **OR** rough-brass, **as directed**, finish with set-screws.
3. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with chrome-plated finish.
4. One-Piece, Stamped-Steel Escutcheons: Chrome-plated finish with set-screw **OR** spring clips, **as directed**.
5. Split-Casting, Cast-Brass Escutcheons: Polished chrome-plated **OR** rough-brass, **as directed**, finish with concealed hinge and set-screw.
6. Split-Plate, Stamped-Steel Escutcheons: Chrome-plated finish with concealed **OR** exposed-rivet, **as directed**, hinge, set-screw **OR** spring clips, **as directed**.
7. One-Piece Floor Plates: Cast-iron flange with holes for fasteners, **as directed**.
8. Split-Casting Floor Plates: Cast brass with concealed hinge.

S. Sleeves

1. Cast-Iron Wall Pipe Sleeves: Cast or fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
2. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
3. Molded-PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
4. Molded-PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.
5. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
6. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, standard weight, zinc coated, plain ends.
7. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with set-screws.

T. Sleeve Seals

1. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - a. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - b. Pressure Plates: Carbon steel **OR** Plastic **OR** Stainless steel, **as directed**.
 - c. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating **OR** Stainless steel, **as directed**, of length required to secure pressure plates to sealing elements.

U. Grout

1. Standard: ASTM C 1107, Grade B, posthardening and volume adjusting, dry, hydraulic-cement grout.
2. Characteristics: Nonshrink, and recommended for interior and exterior applications.
3. Design Mix: 5000-psi (34-MPa), 28-day compressive strength.
4. Packaging: Premixed and factory packaged.



1.3 EXECUTION

- A. Preparation
 - 1. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
 - 2. Report test results promptly and in writing.
- B. Service-Entrance Piping
 - 1. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Division 21 Section "Facility Fire-suppression Water-service Piping".
 - 2. Install shutoff valve, backflow preventer, **as directed**, pressure gage, drain, and other accessories indicated at connection to water-service piping. Comply with requirements for backflow preventers in Division 21 Section "Facility Fire-suppression Water-service Piping", **as directed**.
OR
Install shutoff valve, check valve, pressure gage, and drain at connection to water service.
- C. Water-Supply Connections
 - 1. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Division 22 Section "Domestic Water Piping".
 - 2. Install shutoff valve, backflow preventer, **as directed**, pressure gage, drain, and other accessories indicated at connection to water-distribution piping. Comply with requirements for backflow preventers in Division 22 Section "Domestic Water Piping Specialties", **as directed**.
OR
Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.
- D. Piping Installation
 - 1. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - a. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with the Owner before deviating from approved working plans.
 - 2. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.
 - 3. Install seismic restraints on piping. Comply with requirements for seismic-restraint device materials and installation in NFPA 13.
 - 4. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
 - 5. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.
 - 6. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.
 - 7. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
 - 8. Install sprinkler piping with drains for complete system drainage.
 - 9. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
 - 10. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.
 - 11. Install alarm devices in piping systems.
 - 12. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
 - 13. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 (DN 8) and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.



14. Pressurize and check preaction sprinkler system piping and air-pressure maintenance devices **OR** air compressors, **as directed**.
15. Fill sprinkler system piping with water.
16. Install electric heating cables and pipe insulation on sprinkler piping in areas subject to freezing. Comply with requirements for heating cables in Division 21 Section "Heat Tracing For Fire-suppression Piping" and for piping insulation in Division 21 Section "Fire-suppression Systems Insulation".

E. Joint Construction

1. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
2. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.
3. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.
4. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
5. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
6. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
7. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
8. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.
9. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
10. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
 - a. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
11. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
12. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
13. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
14. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.
15. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
16. Copper-Tubing, Pressure-Sealed Joints: Join copper tube and copper pressure-seal fittings with tools recommended by fitting manufacturer.
17. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
18. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.



19. Plastic-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
 - b. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
- F. Installation Of Cover System For Sprinkler Piping
 1. Install cover system, brackets, and cover components for sprinkler piping according to manufacturer's "Installation Manual" and with NFPA 13 or NFPA 13R for supports.
- G. Valve And Specialties Installation
 1. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
 2. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
 3. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
 4. Specialty Valves:
 - a. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
 - b. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.
 - c. Deluge Valves: Install in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
- H. Excess-Pressure Pump Installation
 1. Assemble components and mount on wood backing. Comply with requirements in Division 06 Section "Rough Carpentry" for wood backing material and installation.
 2. Install excess-pressure pumps, controls, devices, and supports for sprinkler piping application.
 - a. Mounting: Install on wall, where indicated **OR** attached to water-supply pipe, **as directed**.
- I. Sprinkler Installation
 1. Install sprinklers in suspended ceilings in center of narrow dimension of, **as directed**, acoustical ceiling panels.
 2. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
 3. Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.
- J. Fire-Department Connection Installation
 1. Install wall-type, fire-department connections.
 2. Install yard-type, fire-department connections in concrete slab support. Comply with requirements for concrete in Division 03 Section "Cast-in-place Concrete".
 - a. Install two **OR** three, **as directed**, protective pipe bollards around **OR** on sides of, **as directed**, each fire-department connection. Comply with requirements for bollards in Division 05 Section "Metal Fabrications".
 3. Install automatic (ball drip) drain valve at each check valve for fire-department connection.
- K. Escutcheon Installation
 1. Install escutcheons for penetrations of walls, ceilings, and floors.
 2. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 - b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish **OR** stamped steel with set-screw **OR** stamped steel with set-screw or spring clips **OR** stamped steel with spring clips, **as directed**.



- c. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish **OR** One piece or split casting, cast brass with polished chrome-plated finish **OR** Split casting, cast brass with polished chrome-plated finish **OR** One piece, stamped steel with set-screw **OR** One piece or split plate, stamped steel with set-screw **OR** Split plate, stamped steel with set-screw, **as directed**.
 - d. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish **OR** cast brass with rough-brass finish **OR** stamped steel with set-screw **OR** stamped steel with spring clips **OR** stamped steel with set-screw or spring clips, **as directed**.
 - e. Bare Piping in Equipment Rooms: One piece, cast brass **OR** stamped steel with set-screw **OR** stamped steel with spring clips **OR** stamped steel with set-screw or spring clips, **as directed**.
 - f. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.
3. Escutcheons for Existing Piping:
- a. Chrome-Plated Piping: Split casting, cast brass with chrome-plated finish.
 - b. Insulated Piping: Split plate, stamped steel with concealed or exposed-rivet hinge and spring clips.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish **OR** plate, stamped steel with concealed hinge and spring clips, **as directed**.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish **OR** plate, stamped steel with concealed hinge and set-screw, **as directed**.
 - e. Bare Piping in Unfinished Service Spaces: Split casting, cast brass with polished chrome-plated finish **OR** casting, cast brass with rough-brass finish **OR** plate, stamped steel with concealed hinge and set-screw or spring clips **OR** plate, stamped steel with concealed or exposed-rivet hinge and set-screw or spring clips **OR** plate, stamped steel with exposed-rivet hinge and set-screw or spring clips, **as directed**.
 - f. Bare Piping in Equipment Rooms: Split casting, cast brass **OR** plate, stamped steel with set-screw or spring clips, **as directed**.
 - g. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting floor plate.

L. Sleeve Installation

- 1. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
- 2. Sleeves are not required for core-drilled holes.
- 3. Permanent sleeves are not required for holes formed by removable PE sleeves.
- 4. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- 5. Install sleeves in new partitions, slabs, and walls as they are built.
- 6. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants".
- 7. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants".
- 8. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals.
- 9. Seal space outside of sleeves in concrete slabs and walls with grout.
- 10. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.
- 11. Install sleeve materials according to the following applications:
 - a. Sleeves for Piping Passing through Concrete Floor Slabs: Molded PE **OR** Molded PVC **OR** Galvanized-steel pipe, **as directed**.
 - b. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Galvanized-steel pipe **OR** Stack sleeve fittings, **as directed**.



- 1) Extend sleeves 2 inches (50 mm) above finished floor level.
- 2) For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Comply with requirements for flashing in Division 07 Section "Sheet Metal Flashing And Trim".
- c. Sleeves for Piping Passing through Gypsum-Board Partitions:
 - 1) PVC-pipe **OR** Galvanized-steel-pipe, **as directed**, sleeves for pipes smaller than NPS 6 (DN 150).
 - 2) Galvanized-steel-sheet sleeves for pipes NPS 6 (DN 150) and larger.
 - 3) Exception: Sleeves are not required for water-supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
- d. Sleeves for Piping Passing through Concrete Roof Slabs: Molded PE **OR** Molded PVC **OR** Galvanized-steel pipe, **as directed**.
- e. Sleeves for Piping Passing through Exterior Concrete Walls:
 - 1) Galvanized-steel-pipe sleeves for pipes smaller than NPS 6 (DN 150).
 - 2) Cast-iron wall-pipe sleeves for pipes NPS 6 (DN 150) and larger.
 - 3) Install sleeves that are large enough to provide 1-inch (25-mm) annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.
- f. Sleeves for Piping Passing through Interior Concrete Walls:
 - 1) PVC-pipe **OR** Galvanized-steel-pipe, **as directed**, sleeves for pipes smaller than NPS 6 (DN 150).
 - 2) Galvanized-steel-sheet sleeves for pipes NPS 6 (DN 150) and larger.
12. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestop materials and installations in Division 07 Section "Penetration Firestopping".
- M. Sleeve Seal Installation
 1. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.
 2. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- N. Identification
 1. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
 2. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".
- O. Field Quality Control
 1. Perform tests and inspections.
 2. Tests and Inspections:
 - a. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - c. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - d. Energize circuits to electrical equipment and devices.
 - e. Start and run excess-pressure pumps.
 - f. Coordinate with fire-alarm tests. Operate as required.
 - g. Coordinate with fire-pump tests. Operate as required.
 - h. Verify that equipment hose threads are same as local fire-department equipment.
 3. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
 4. Prepare test and inspection reports.



P. Cleaning

1. Clean dirt and debris from sprinklers.
2. Remove and replace sprinklers with paint other than factory finish.

Q. Piping Schedule

1. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends; cast-iron threaded fittings; and threaded **OR** grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved, **as directed**, joints.
2. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
3. Copper-tube, extruded-tee connections may be used for tee branches in copper tubing instead of specified copper fittings. Branch-connection joints must be brazed.
4. CPVC pipe; Schedule 40 **OR** Schedule 80, **as directed**, CPVC fittings; and solvent-cemented joints may be used for light-hazard and residential occupancies.
5. Standard-pressure, wet-pipe sprinkler system, NPS 2 (DN 50) and smaller, shall be one of the following:
 - a. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 - b. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - c. Standard-weight or Schedule 30, black-steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.
 - d. Standard-weight or Schedule 30, galvanized-steel pipe with plain ends; galvanized, plain-end-pipe fittings; and twist-locked joints.
 - e. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - f. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - g. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 - h. Thinwall **OR** Schedule 10, **as directed**, nonstandard OD, thinwall or hybrid black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - i. Thinwall **OR** Schedule 10, **as directed**, or hybrid black-steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.
 - j. Thinwall **OR** Schedule 10, **as directed**, nonstandard OD, thinwall or hybrid black-steel pipe with plain ends; welding fittings; and welded joints.
 - k. Schedule 5 steel pipe; steel pressure-seal fittings; and pressure-sealed joints.
 - l. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with plain ends; cast- or wrought-copper solder-joint fittings; and brazed joints.
 - m. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with plain ends; copper pressure-seal fittings; and pressure-sealed joints.
 - n. NPS 2 (DN 50), Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.
6. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 4 (DN 65 to DN 100), shall be one of the following:
 - a. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 - b. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - c. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.



- d. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - e. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 - f. Thinwall **OR** Schedule 10, **as directed**, nonstandard OD, thinwall or hybrid black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - g. Thinwall **OR** Schedule 10, **as directed**, nonstandard OD, thinwall or hybrid black-steel pipe with plain ends; welding fittings; and welded joints.
 - h. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with plain ends; cast- or wrought-copper solder-joint fittings; and brazed joints.
 - i. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with plain ends; copper pressure-seal fittings; and pressure-sealed joints.
 - j. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.
7. Standard-pressure, wet-pipe sprinkler system, NPS 5 (DN 125) and larger, shall be one of the following:
- a. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 - b. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - c. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - d. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - e. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 - f. Thinwall **OR** Schedule 10, **as directed**, or hybrid black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - g. Thinwall **OR** Schedule 10, **as directed**, or hybrid black-steel pipe with plain ends; welding fittings; and welded joints.
 - h. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with plain ends; cast- or wrought-copper solder-joint fittings; and brazed joints.
 - i. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.
8. High-pressure, wet-pipe sprinkler system, NPS 4 (DN 100) and smaller, shall be one of the following:
- a. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - b. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - c. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 - d. Thinwall **OR** Schedule 10, **as directed**, or hybrid black-steel pipe with plain ends; welding fittings; and welded joints.
9. High-pressure, wet-pipe sprinkler system, NPS 5 (DN 125) and larger, shall be one of the following:
- a. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.



- b. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
- c. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
- d. Thinwall **OR** Schedule 10, **as directed**, or hybrid black-steel pipe with plain ends; welding fittings; and welded joints.

R. Sprinkler Schedule

- 1. Use sprinkler types in subparagraphs below for the following applications:
 - a. Rooms without Ceilings: Upright sprinklers.
 - b. Rooms with Suspended Ceilings: Pendent sprinklers **OR** Recessed sprinklers **OR** Flush sprinklers **OR** Concealed sprinklers, **as directed**.
 - c. Wall Mounting: Sidewall sprinklers.
 - d. Spaces Subject to Freezing: Upright sprinklers **OR** Pendent, dry sprinklers **OR** Sidewall, dry sprinklers, **as directed**.
 - e. Deluge-Sprinkler Systems: Upright and pendent, open sprinklers.
 - f. Special Applications: Extended-coverage, flow-control, and quick-response sprinklers where indicated.
- 2. Provide sprinkler types in subparagraphs below with finishes indicated.
 - a. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
 - b. Flush Sprinklers: Bright chrome, with painted white escutcheon.
 - c. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
 - d. Residential Sprinklers: Dull chrome.
 - e. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 21 13 13 00

SECTION 21 13 16 00 - DRY-PIPE FIRE-SUPPRESSION SPRINKLERS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for dry-pipe fire-suppression sprinklers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Pipes, fittings, and specialties.
 - b. Fire-protection valves.
 - c. Fire-department connections.
 - d. Sprinkler specialty pipe fittings.
 - e. Sprinklers.
 - f. Alarm devices.
 - g. Manual control stations.
 - h. Control panels.
 - i. Pressure gages.

C. Definitions

1. Standard-Pressure Sprinkler Piping: Dry-pipe sprinkler system piping designed to operate at working pressure 175 psig (1200 kPa) maximum.

D. System Descriptions

1. Dry-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing compressed air. Opening of sprinklers releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into piping and discharges from sprinklers that are open.
2. Combined Dry-Pipe and Preaction Sprinkler System: Automatic sprinklers are attached to piping containing compressed air. Fire-detection system in same area as sprinklers actuates tripping devices that open dry-pipe valve without loss of air pressure and actuates fire alarm. Water discharges from sprinklers that have opened.
3. Single-Interlock Preaction Sprinkler System: Automatic sprinklers are attached to piping containing low-pressure air. Actuation of fire-detection system in same area as sprinklers opens deluge valve, permitting water to flow into piping and to discharge from sprinklers that have opened.
4. Double-Interlock Preaction Sprinkler System: Automatic sprinklers are attached to piping containing low-pressure air. Actuation of a fire-detection system in the same area as sprinklers opens the deluge valve permitting water to flow into the sprinkler piping; a closed solenoid valve in the sprinkler piping is opened by another fire-detection device; then water will discharge from sprinklers that have opened.

E. Performance Requirements

1. Standard-Pressure Piping System Component: Listed for 175-psig (1200-kPa) minimum working pressure.
2. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
3. Sprinkler system design shall be approved by authorities having jurisdiction.
 - a. Margin of Safety for Available Water Flow and Pressure: 10 **OR** 20, **as directed**, percent, including losses through water-service piping, valves, and backflow preventers.
 - b. Sprinkler Occupancy Hazard Classifications:
 - 1) Automobile Parking Areas: Ordinary Hazard, Group 1.



- 2) Building Service Areas: Ordinary Hazard, Group 1.
- 3) Churches: Light Hazard.
- 4) Electrical Equipment Rooms: Ordinary Hazard, Group 1.
- 5) Dry Cleaners: Ordinary Hazard, Group 2.
- 6) General Storage Areas: Ordinary Hazard, Group 1.
- 7) Laundries: Ordinary Hazard, Group 1.
- 8) Libraries Except Stack Areas: Light Hazard.
- 9) Library Stack Areas: Ordinary Hazard, Group 2.
- 10) Machine Shops: Ordinary Hazard, Group 2.
- 11) Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
- 12) Office and Public Areas: Light Hazard.
- 13) Plastics Processing Areas: Extra Hazard, Group 2.
- 14) Printing Plants: Extra Hazard, Group 1.
- 15) Repair Garages: Ordinary Hazard, Group 2.
- 16) Restaurant Service Areas: Ordinary Hazard, Group 1.
- 17) Solvent Cleaning Areas: Extra Hazard, Group 2.
- 18) Upholstering Plants: Extra Hazard, Group 1.
- c. Minimum Density for Automatic-Sprinkler Piping Design:
 - 1) Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. (4.1 mm/min. over 139-sq. m) area.
 - 2) Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. (6.1 mm/min. over 139-sq. m) area.
 - 3) Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. (8.1 mm/min. over 139-sq. m) area.
 - 4) Extra-Hazard, Group 1 Occupancy: 0.30 gpm over 2500-sq. ft. (12.2 mm/min. over 232-sq. m) area.
 - 5) Extra-Hazard, Group 2 Occupancy: 0.40 gpm over 2500-sq. ft. (16.3 mm/min. over 232-sq. m) area.
 - 6) Special Occupancy Hazard: As determined by authorities having jurisdiction.
- d. Maximum Protection Area per Sprinkler: Per UL listing.
OR
 Maximum Protection Area per Sprinkler:
 - 1) Office Spaces: 120 sq. ft. (11.1 sq. m) **OR** 225 sq. ft. (20.9 sq. m), **as directed**.
 - 2) Storage Areas: 130 sq. ft. (12.1 sq. m).
 - 3) Mechanical Equipment Rooms: 130 sq. ft. (12.1 sq. m).
 - 4) Electrical Equipment Rooms: 130 sq. ft. (12.1 sq. m).
 - 5) Other Areas: According to NFPA 13 recommendations unless otherwise indicated.
- e. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:
 - 1) Light-Hazard Occupancies: 100 gpm (6.3 L/s) for 30 minutes.
 - 2) Ordinary-Hazard Occupancies: 250 gpm (15.75 L/s) for 60 to 90 minutes.
 - 3) Extra-Hazard Occupancies: 500 gpm (31.5 L/s) for 90 to 120 minutes.
4. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

F. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For dry-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.
 - a. Wiring Diagrams: For power, signal, and control wiring.
3. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
4. Qualification Data: For qualified Installer and professional engineer, **as directed**.



5. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
6. Fire-hydrant flow test report.
7. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
8. Field quality-control reports.
9. Operation and maintenance data.

G. Quality Assurance

1. Installer Qualifications:
 - a. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 - 1) Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
 - a. NFPA 13, "Installation of Sprinkler Systems."
 - b. NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height."
 - c. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

H. Project Conditions

1. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of sprinkler service.
 - b. Do not proceed with interruption of sprinkler service without the Owner's written permission.

1.2 PRODUCTS

A. Piping Materials

1. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Steel Pipe And Fittings

1. Standard Weight, Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.
2. Schedule 30, Galvanized-Steel Pipe: ASTM A 135; ASTM A 795/A 795M, Type E; or ASME B36.10M, wrought steel; with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.
3. Thinwall Galvanized-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.
4. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
5. Galvanized, Steel Couplings: ASTM A 865, threaded.
6. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
7. Malleable- or Ductile-Iron Unions: UL 860.
8. Cast-Iron Flanges: ASME B16.1, Class 125.



9. Plain-End-Pipe Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn or screwed retainer pin to secure pipe in fitting.
 10. Grooved-Joint, Steel-Pipe Appurtenances:
 - a. Pressure Rating: 175 psig (1200 kPa) **OR** 250 psig (1725 kPa) **OR** 300 psig (2070 kPa), **as directed**, minimum.
 - b. Galvanized, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
 - c. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.
- C. Copper Tube And Fittings
1. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) and ASTM B 88, Type M (ASTM B 88M, Type C) water tube, drawn temper.
 2. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
 3. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings.
 4. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
 5. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
 6. Copper Pressure-Seal Fittings:
 - a. Standard: UL 213.
 - b. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
 - c. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Cast-bronze fitting with EPDM-rubber O-ring seal in each end.
 7. Grooved-Joint, Copper-Tube Appurtenances:
 - a. Grooved-End, Copper Fittings: ASTM B 75 (ASTM B 75M), copper tube or ASTM B 584, bronze castings.
 - b. Grooved-End-Tube Couplings: To fit copper tube, with dimensions and design similar to AWWA C606. Include ferrous housing sections, EPDM-rubber gasket suitable for hot and cold water, and bolts and nuts.
 8. Copper-Tube, Extruded-Tee Connections:
 - a. Description: Tee formed in copper tube according to ASTM F 2014.
- D. Piping Joining Materials
1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free.
 - a. Class 125, Cast-Iron and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
 - b. Class 250, Cast-Iron and Class 300, Raised-Face Flanges: Ring-type gaskets.
 2. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
 3. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
- E. Listed Fire-Protection Valves
1. General Requirements:
 - a. Valves shall be UL listed or FM approved.
 - b. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig (1200 kPa).
 2. Ball Valves:
 - a. Standard: UL 1091 except with ball instead of disc.
 - b. Valves NPS 1-1/2 (DN 40) and Smaller: Bronze body with threaded ends.
 - c. Valves NPS 2 and NPS 2-1/2 (DN 50 and DN 65): Bronze body with threaded ends or ductile-iron body with grooved ends.
 - d. Valves NPS 3 (DN 80): Ductile-iron body with grooved ends.
- F. Bronze Butterfly Valves:



- a. Standard: UL 1091.
 - b. Pressure Rating: 175 psig (1200 kPa).
 - c. Body Material: Bronze.
 - d. End Connections: Threaded.

- G. Iron Butterfly Valves:
 - a. Standard: UL 1091.
 - b. Pressure Rating: 175 psig (1200 kPa).
 - c. Body Material: Cast or ductile iron.
 - d. Style: Lug or wafer.
 - OR**
 - End Connections: Grooved.

- H. Check Valves:
 - a. Standard: UL 312
 - b. Pressure Rating: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Type: Swing check.
 - d. Body Material: Cast iron.
 - e. End Connections: Flanged or grooved.
- 2. Bronze OS&Y Gate Valves:
 - a. Standard: UL 262.
 - b. Pressure Rating: 175 psig (1200 kPa).
 - c. Body Material: Bronze.
 - d. End Connections: Threaded.
- 3. Iron OS&Y Gate Valves:
 - a. Standard: UL 262.
 - b. Pressure Rating: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Cast or ductile iron.
 - d. End Connections: Flanged or grooved.
- 4. Indicating-Type Butterfly Valves:
 - a. Standard: UL 1091.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum.
 - c. Valves NPS 2 (DN 50) and Smaller:
 - 1) Valve Type: Ball or butterfly.
 - 2) Body Material: Bronze.
 - 3) End Connections: Threaded.
 - d. Valves NPS 2-1/2 (DN 65) and Larger:
 - 1) Valve Type: Butterfly.
 - 2) Body Material: Cast or ductile iron.
 - 3) End Connections: Flanged, grooved, or wafer.
 - e. Valve Operation: Integral electrical, 115-V ac, prewired, single-circuit, supervisory switch **OR** electrical, 115-V ac, prewired, two-circuit, supervisory switch **OR** visual, **as directed**, indicating device.
- 5. NRS Gate Valves:
 - a. Standard: UL 262.
 - b. Pressure Rating: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Cast iron with indicator post flange.
 - d. Stem: Nonrising.
 - e. End Connections: Flanged or grooved.
- 6. Indicator Posts:
 - a. Standard: UL 789.
 - b. Type: Horizontal for wall mounting.
 - c. Body Material: Cast iron with extension rod and locking device.
 - d. Operation: Wrench **OR** Hand wheel, **as directed**.

- I. Trim And Drain Valves



1. General Requirements:
 - a. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum.
2. Angle Valves.
3. Ball Valves.
4. Globe Valves.
5. Plug Valves.

J. Specialty Valves

1. General Requirements:
 - a. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - b. Pressure Rating:
 - 1) Standard-Pressure Piping Specialty Valves: 175 psig (1200 kPa) minimum.
 - 2) High-Pressure Piping Specialty Valves: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Cast or ductile iron.
 - d. Size: Same as connected piping.
 - e. End Connections: Flanged or grooved.
2. Dry-Pipe Valves:
 - a. Standard: UL 260
 - b. Design: Differential-pressure type.
 - c. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
 - d. Air-Pressure Maintenance Device:
 - 1) Standard: UL 260.
 - 2) Type: Automatic device to maintain minimum air pressure in piping.
 - 3) Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig (95- to 410-kPa) adjustable range, and 175-psig (1200-kPa) **OR** 300-psig (2070-kPa), **as directed**, outlet pressure.
 - e. Air Compressor:
 - 1) Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - 2) Motor Horsepower: Fractional.
 - 3) Power: 120-V ac, 60 Hz, single phase.
3. Deluge Valves:
 - a. Standard: UL 260.
 - b. Design: Hydraulically operated, differential-pressure type.
 - c. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, drip cup assembly piped without valves and separate from main drain line, fill-line attachment with strainer, and push-rod chamber supply connection.
 - d. Dry, Pilot-Line Trim Set: Include dry, pilot-line actuator; air- and water-pressure gages; low-air-pressure warning switch; air relief valve; and actuation device. Dry, pilot-line actuator includes cast-iron, operated, diaphragm-type valve with resilient facing plate, resilient diaphragm, and replaceable bronze seat. Valve includes threaded water and air inlets and water outlet. Loss of air pressure on dry, pilot-line side allows pilot-line actuator to open and causes deluge valve to open immediately.
 - e. Air-Pressure Maintenance Device:
 - 1) Standard: UL 260.
 - 2) Type: Automatic device to maintain minimum air pressure in piping.
 - 3) Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure,



- strainer, pressure ratings with 14- to 60-psig (95- to 410-kPa) adjustable range, and 175-psig (1200-kPa) **OR** 300-psig (2070-kPa), **as directed**, outlet pressure.
- f. Air Compressor:
 - 1) Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - 2) Motor Horsepower: Fractional.
 - 3) Power: 120-V ac, 60 Hz, single phase.
 - 4. Automatic (Ball Drip) Drain Valves:
 - a. Standard: UL 1726.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum.
 - c. Type: Automatic draining, ball check.
 - d. Size: NPS 3/4 (DN 20).
 - e. End Connections: Threaded.
- K. Fire-Department Connections
- 1. Exposed-Type, Fire-Department Connection:
 - a. Standard: UL 405.
 - b. Type: Exposed, projecting, for wall mounting.
 - c. Pressure Rating: 175 psig (1200 kPa) minimum.
 - d. Body Material: Corrosion-resistant metal.
 - e. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
 - f. Caps: Brass, lugged type, with gasket and chain.
 - g. Escutcheon Plate: Round, brass, wall type.
 - h. Outlet: Back, with pipe threads.
 - i. Number of Inlets: Two **OR** Three, **as directed**.
 - j. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE" **OR** "AUTO SPKR", **as directed**.
 - k. Finish: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
 - l. Outlet Size: NPS 4 (DN 100) **OR** NPS 5 (DN 125) **OR** NPS 6 (DN 150), **as directed**.
 - 2. Flush-Type, Fire-Department Connection:
 - a. Standard: UL 405.
 - b. Type: Flush, for wall mounting.
 - c. Pressure Rating: 175 psig (1200 kPa) minimum.
 - d. Body Material: Corrosion-resistant metal.
 - e. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
 - f. Caps: Brass, lugged type, with gasket and chain.
 - g. Escutcheon Plate: Rectangular, brass, wall type.
 - h. Outlet: With pipe threads.
 - i. Body Style: Horizontal **OR** Square **OR** Vertical, **as directed**.
 - j. Number of Inlets: Two **OR** Three **OR** Four **OR** Six, **as directed**.
 - k. Outlet Location: Back **OR** Bottom **OR** Left side **OR** Right side **OR** Top, **as directed**.
 - l. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE" **OR** "AUTO SPKR", **as directed**.
 - m. Finish: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
 - n. Outlet Size: NPS 4 (DN 100) **OR** NPS 5 (DN 125) **OR** NPS 6 (DN 150) **OR** NPS 8 (DN 200), **as directed**.
 - 3. Yard-Type, Fire-Department Connection:
 - a. Standard: UL 405.
 - b. Type: Exposed, freestanding.
 - c. Pressure Rating: 175 psig (1200 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.



- d. Body Material: Corrosion-resistant metal.
 - e. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
 - f. Caps: Brass, lugged type, with gasket and chain.
 - g. Escutcheon Plate: Round, brass, floor type.
 - h. Outlet: Bottom, with pipe threads.
 - i. Number of Inlets: Two **OR** Three **OR** Four, **as directed**.
 - j. Sleeve: Brass **OR** Not required, **as directed**.
 - k. Sleeve Height: 18 inches (460 mm).
 - l. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE" **OR** "AUTO SPKR", **as directed**.
 - m. Finish, Including Sleeve: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
 - n. Outlet Size: NPS 4 (DN 100) **OR** NPS 5 (DN 125) **OR** NPS 6 (DN 150), **as directed**.
- L. Sprinkler Specialty Pipe Fittings
- 1. General Requirements for Dry-Pipe-System Fittings: UL listed for dry-pipe service.
 - 2. Branch Outlet Fittings:
 - a. Standard: UL 213.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
 - d. Type: Mechanical-T and -cross fittings.
 - e. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
 - f. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
 - g. Branch Outlets: Grooved, plain-end pipe, or threaded.
 - 3. Flow Detection and Test Assemblies:
 - a. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
 - d. Size: Same as connected piping.
 - e. Inlet and Outlet: Threaded.
 - 4. Branch Line Testers:
 - a. Standard: UL 199.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum.
 - c. Body Material: Brass.
 - d. Size: Same as connected piping.
 - e. Inlet: Threaded.
 - f. Drain Outlet: Threaded and capped.
 - g. Branch Outlet: Threaded, for sprinkler.
 - 5. Sprinkler Inspector's Test Fittings:
 - a. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Cast- or ductile-iron housing with sight glass.
 - d. Size: Same as connected piping.
 - e. Inlet and Outlet: Threaded.
 - 6. Adjustable Drop Nipples:
 - a. Standard: UL 1474.
 - b. Pressure Rating: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Steel pipe with EPDM O-ring seals.
 - d. Size: Same as connected piping.
 - e. Length: Adjustable.



- f. Inlet and Outlet: Threaded.
- 7. Flexible, Sprinkler Hose Fittings:
 - a. Standard: UL 1474.
 - b. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
 - c. Pressure Rating: 175 psig (1200 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - d. Size: Same as connected piping, for sprinkler.
- M. Sprinklers
 - 1. General Requirements:
 - a. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - b. Pressure Rating for Residential Sprinklers: 175 psig (1200 kPa) maximum.
 - c. Pressure Rating for Automatic Sprinklers: 175 psig (1200 kPa) minimum.
 - d. Pressure Rating for High-Pressure Automatic Sprinklers: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - 2. Automatic Sprinklers with Heat-Responsive Element:
 - a. Nonresidential Applications: UL 199.
 - b. Residential Applications: UL 1626.
 - c. Characteristics: Nominal 1/2-inch (12.7-mm) orifice with discharge coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
 - 3. Sprinkler Finishes:
 - a. Chrome plated.
 - b. Bronze.
 - c. Painted.
 - 4. Special Coatings:
 - a. Wax.
 - b. Lead.
 - c. Corrosion-resistant paint.
 - 5. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
 - a. Ceiling Mounting: Chrome-plated steel, one piece, flat **OR** Chrome-plated steel, two piece, with 1-inch (25-mm) vertical adjustment **OR** Plastic, white finish, one piece, flat, **as directed**.
 - b. Sidewall Mounting: Chrome-plated steel **OR** Plastic, white finish, **as directed**, one piece, flat.
 - 6. Sprinkler Guards:
 - a. Standard: UL 199.
 - b. Type: Wire cage with fastening device for attaching to sprinkler.
- N. Alarm Devices
 - 1. Alarm-device types shall match piping and equipment connections.
 - 2. Water-Motor-Operated Alarm:
 - a. Standard: UL 753.
 - b. Type: Mechanically operated, with Pelton wheel.
 - c. Alarm Gong: Cast aluminum with red-enamel factory finish.
 - d. Size: 10-inch (250-mm) diameter.
 - e. Components: Shaft length, bearings, and sleeve to suit wall construction.
 - f. Inlet: NPS 3/4 (DN 20).
 - g. Outlet: NPS 1 (DN 25) drain connection.
 - 3. Electrically Operated Alarm Bell:
 - a. Standard: UL 464.
 - b. Type: Vibrating, metal alarm bell.



- c. Size: 6-inch (150-mm) minimum **OR** 8-inch (200-mm) minimum **OR** 10-inch (250-mm), **as directed**, diameter.
 - d. Finish: Red-enamel factory finish, suitable for outdoor use.
 - 4. Pressure Switches:
 - a. Standard: UL 346.
 - b. Type: Electrically supervised water-flow switch with retard feature.
 - c. Components: Single-pole, double-throw switch with normally closed contacts.
 - d. Design Operation: Rising pressure signals water flow.
 - 5. Valve Supervisory Switches:
 - a. Standard: UL 346.
 - b. Type: Electrically supervised.
 - c. Components: Single-pole, double-throw switch with normally closed contacts.
 - d. Design: Signals that controlled valve is in other than fully open position.
 - 6. Indicator-Post Supervisory Switches:
 - a. Standard: UL 346.
 - b. Type: Electrically supervised.
 - c. Components: Single-pole, double-throw switch with normally closed contacts.
 - d. Design: Signals that controlled indicator-post valve is in other than fully open position.
- O. Manual Control Stations
 - 1. Description: UL listed or FM Global approved, hydraulic operation, with union, NPS 1/2 (DN 15) pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.
- P. Control Panels
 - 1. Description: Single-area, two-area, or single-area cross-zoned type control panel as indicated, including NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves. Panels contain power supply; battery charger; standby batteries; field-wiring terminal strip; electrically supervised solenoid valves and polarized fire-alarm bell; lamp test facility; single-pole, double-throw auxiliary alarm contacts; and rectifier.
 - 2. Panels: UL listed and FM Global approved when used with thermal detectors and Class A detector circuit wiring. Electrical characteristics are 120-V ac, 60 Hz, with 24-V dc rechargeable batteries.
 - a. Manual Control Stations: Electric operation, metal enclosure, labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.
OR
Manual Control Stations: Hydraulic operation, with union, NPS 1/2 (DN 15) pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.
- Q. Pressure Gages
 - 1. Standard: UL 393.
 - 2. Dial Size: 3-1/2- to 4-1/2-inch (90- to 115-mm) diameter.
 - 3. Pressure Gage Range: 0 to 250 psig (0 to 1725 kPa) minimum **OR** 0 to 300 psig (0 to 2070 kPa), **as directed**.
 - 4. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.
 - 5. Air System Piping Gage: Include retard feature, **as directed**, and "AIR" or "AIR/WATER" label on dial face.
- R. Escutcheons
 - 1. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.



2. One-Piece, Cast-Brass Escutcheons: Polished chrome-plated or rough-brass finish with set-screws.
3. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with chrome-plated finish.
4. One-Piece, Stamped-Steel Escutcheons: Chrome-plated finish with set-screw or spring clips.
5. Split-Casting, Cast-Brass Escutcheons: Polished chrome-plated or rough-brass finish with concealed hinge and set-screw.
6. Split-Plate, Stamped-Steel Escutcheons: Chrome-plated finish with concealed **OR** exposed-rivet, **as directed**, hinge, set-screw or spring clips.
7. One-Piece Floor Plates: Cast-iron flange with holes for fasteners, **as directed**.
8. Split-Casting Floor Plates: Cast brass with concealed hinge.

S. Sleeves

1. Cast-Iron Wall Pipe Sleeves: Cast or fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
2. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
3. Molded-PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
4. Molded-PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.
5. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
6. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, standard weight, zinc coated, plain ends.
7. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with set-screws.

T. Sleeve Seals

1. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - a. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - b. Pressure Plates: Carbon steel **OR** Plastic **OR** Stainless steel, **as directed**.
 - c. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating **OR** Stainless steel, **as directed**, of length required to secure pressure plates to sealing elements.

U. Grout

1. Standard: ASTM C 1107, Grade B, posthardening and volume adjusting, dry, hydraulic-cement grout.
2. Characteristics: Nonshrink, and recommended for interior and exterior applications.
3. Design Mix: 5000-psi (34-MPa), 28-day compressive strength.
4. Packaging: Premixed and factory packaged.

1.3 EXECUTION

A. Preparation

1. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
2. Report test results promptly and in writing.

B. Service-Entrance Piping

1. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements in Division 21 Section "Facility Fire-suppression Water-service Piping" for exterior piping.



2. Install shutoff valve, backflow preventer, **as directed**, pressure gage, drain, and other accessories indicated at connection to water-service piping. Comply with requirements in Division 21 Section "Facility Fire-suppression Water-service Piping" for backflow preventers, **as directed**.
3. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

C. Water-Supply Connections

1. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements in Division 22 Section "Domestic Water Piping" for interior piping.
2. Install shutoff valve, backflow preventer, **as directed**, pressure gage, drain, and other accessories indicated at connection to water-distribution piping. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for backflow preventers, **as directed**.
3. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

D. Piping Installation

1. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - a. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with the Owner before deviating from approved working plans.
2. Piping Standard: Comply with requirements in NFPA 13 for installation of sprinkler piping.
3. Install seismic restraints on piping. Comply with requirements in NFPA 13 for seismic-restraint device materials and installation.
4. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
5. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.
6. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.
7. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
8. Install sprinkler piping with drains for complete system drainage.
9. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
10. Install automatic (ball drip) drain valves to drain piping between fire-department connections and check valves. Drain to floor drain or to outside building.
11. Connect compressed-air supply to dry-pipe sprinkler piping.

OR

Connect air compressor to the following piping and wiring:

 - a. Pressure gages and controls.
 - b. Electrical power system.
 - c. Fire-alarm devices, including low-pressure alarm.
12. Install alarm devices in piping systems.
13. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements in NFPA 13 for hanger materials.
14. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 (DN 8) and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
15. Drain dry-pipe sprinkler piping.
16. Pressurize and check dry-pipe sprinkler system piping and air-pressure maintenance devices **OR** air compressors, **as directed**.

E. Joint Construction



1. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
 2. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.
 3. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.
 4. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 5. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
 6. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
 7. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
 8. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.
 9. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
 10. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.
 11. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
 12. Copper-Tubing, Pressure-Sealed Joints: Join copper tube and copper pressure-seal fittings with tools recommended by fitting manufacturer.
 13. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2104. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
 14. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.
- F. Valve And Specialties Installation
1. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
 2. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
 3. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
 4. Specialty Valves:
 - a. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
 - b. Dry-Pipe and Deluge Valves: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
 - 1) Install air compressor and compressed-air supply piping.
 - 2) Air-Pressure Maintenance Device: Install shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14- to 60-psig (95- to 410-kPa) adjustable range; and 175-psig (1200-kPa) maximum inlet pressure.
 - 3) Install compressed-air supply piping from building's compressed-air piping system.



- G. Sprinkler Installation
1. Install sprinklers in suspended ceilings in center of narrow dimension of, **as directed**, acoustical ceiling panels.
 2. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
 3. Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.
- H. Fire-Department Connection Installation
1. Install wall-type, fire-department connections.
 2. Install yard-type, fire-department connections in concrete slab support. Comply with requirements for concrete in Division 03 Section "Cast-in-place Concrete".
 - a. Install two **OR** three, **as directed**, protective pipe bollards around **OR** on sides of, **as directed**, each fire-department connection. Comply with requirements for bollards in Division 05 Section "Metal Fabrications".
 3. Install automatic (ball drip) drain valve at each check valve for fire-department connection.
- I. Escutcheon Installation
1. Install escutcheons for penetrations of walls, ceilings, and floors.
 2. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 - b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish **OR** stamped steel with set-screw **OR** stamped steel with set-screw or spring clips **OR** stamped steel with spring clips, **as directed**.
 - c. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish **OR** One piece or split casting, cast brass with polished chrome-plated finish **OR** Split casting, cast brass with polished chrome-plated finish **OR** One piece, stamped steel with set-screw **OR** One piece or split plate, stamped steel with set-screw **OR** Split plate, stamped steel with set-screw, **as directed**.
 - d. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish **OR** cast brass with rough-brass finish **OR** stamped steel with set-screw **OR** stamped steel with spring clips **OR** stamped steel with set-screw or spring clips, **as directed**.
 - e. Bare Piping in Equipment Rooms: One piece, cast brass **OR** stamped steel with set-screw **OR** stamped steel with spring clips **OR** stamped steel with set-screw or spring clips, **as directed**.
 - f. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.
 3. Escutcheons for Existing Piping:
 - a. Chrome-Plated Piping: Split casting, cast brass with chrome-plated finish.
 - b. Insulated Piping: Split plate, stamped steel with concealed or exposed-rivet hinge and spring clips.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish **OR** plate, stamped steel with concealed hinge and spring clips, **as directed**.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish **OR** plate, stamped steel with concealed hinge and set-screw, **as directed**.
 - e. Bare Piping in Unfinished Service Spaces: Split casting, cast brass with polished chrome-plated finish **OR** casting, cast brass with rough-brass finish **OR** plate, stamped steel with concealed hinge and set-screw or spring clips **OR** plate, stamped steel with concealed or exposed-rivet hinge and set-screw or spring clips **OR** plate, stamped steel with exposed-rivet hinge and set-screw or spring clips, **as directed**.
 - f. Bare Piping in Equipment Rooms: Split casting, cast brass **OR** plate, stamped steel with set-screw or spring clips, **as directed**.
 - g. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting floor plate.



J. Sleeve Installation

1. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
2. Sleeves are not required for core-drilled holes.
3. Permanent sleeves are not required for holes formed by removable PE sleeves.
4. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
5. Install sleeves in new partitions, slabs, and walls as they are built.
6. For interior wall penetrations, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants".
7. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants".
8. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals.
9. Seal space outside of sleeves in concrete slabs and walls with grout.
10. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe unless otherwise indicated.
11. Install sleeve materials according to the following applications:
 - a. Sleeves for Piping Passing through Concrete Floor Slabs: Molded PE **OR** Molded PVC **OR** Galvanized-steel pipe, **as directed**.
 - b. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Galvanized-steel pipe **OR** Stack sleeve fittings, **as directed**.
 - 1) Extend sleeves 2 inches (50 mm) above finished floor level.
 - 2) For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Comply with requirements for flashing in Division 07 Section "Sheet Metal Flashing And Trim".
 - c. Sleeves for Piping Passing through Gypsum-Board Partitions:
 - 1) PVC-pipe **OR** Galvanized-steel-pipe, **as directed**, sleeves for pipes smaller than NPS 6 (DN 150).
 - 2) Galvanized-steel-sheet sleeves for pipes NPS 6 (DN 150) and larger.
 - 3) Exception: Sleeves are not required for water-supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
 - d. Sleeves for Piping Passing through Concrete Roof Slabs: Molded PE **OR** Molded PVC **OR** Galvanized-steel pipe, **as directed**.
 - e. Sleeves for Piping Passing through Exterior Concrete Walls:
 - 1) Galvanized-steel-pipe sleeves for pipes smaller than NPS 6 (DN 150).
 - 2) Cast-iron wall pipe sleeves for pipes NPS 6 (DN 150) and larger.
 - 3) Install sleeves that are large enough to provide 1-inch (25-mm) annular clear space between sleeve and pipe when sleeve seals are used.
 - f. Sleeves for Piping Passing through Interior Concrete Walls:
 - 1) PVC-pipe **OR** Galvanized-steel pipe, **as directed**, sleeves for pipes smaller than NPS 6 (DN 150).
 - 2) Galvanized-steel-sheet sleeves for pipes NPS 6 (DN 150) and larger.
12. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestop materials and installations.

K. Sleeve Seal Installation

1. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.
2. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe



and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

- L. Identification
 - 1. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
 - 2. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".
- M. Field Quality Control
 - 1. Perform tests and inspections.
 - 2. Tests and Inspections:
 - a. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - c. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - d. Energize circuits to electrical equipment and devices.
 - e. Start and run air compressors.
 - f. Coordinate with fire-alarm tests. Operate as required.
 - g. Coordinate with fire-pump tests. Operate as required.
 - h. Verify that equipment hose threads are same as local fire-department equipment.
 - 3. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
 - 4. Prepare test and inspection reports.
- N. Cleaning
 - 1. Clean dirt and debris from sprinklers.
 - 2. Remove and replace sprinklers with paint other than factory finish.
- O. Demonstration
 - 1. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.
- P. Piping Schedule
 - 1. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends; cast-iron threaded fittings; and threaded **OR** grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved, **as directed**, joints.
 - 2. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
 - 3. Copper-tube, extruded-tee connections may be used for tee branches in copper tubing instead of specified copper fittings. Branch-connection joints must be brazed.
 - 4. Standard-pressure, dry-pipe sprinkler system, NPS 2 (DN 50) and smaller, shall be one of the following:
 - a. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - b. Standard-weight **OR** Schedule 30 **OR** thinwall, **as directed**, galvanized-steel pipe with plain ends; plain-end-pipe fittings; and twist-locked joints.
 - c. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - d. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with plain ends; cast-or wrought-copper solder-joint fittings; and brazed joints.
 - e. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with plain ends; copper pressure-seal fittings; and pressure-sealed joints.
 - f. NPS 2 (DN 50), Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.



5. Standard-pressure, dry-pipe sprinkler system, NPS 2-1/2 to NPS 4 (DN 65 to DN 100), shall be one of the following:
 - a. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - b. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - c. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with plain ends; cast-or wrought-copper solder-joint fittings; and brazed joints.
 - d. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with plain ends; copper pressure-seal fittings; and pressure-sealed joints.
 - e. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.
6. Standard-pressure, dry-pipe sprinkler system, NPS 5 and NPS 6 (DN 125 and DN 150), shall be one of the following:
 - a. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - b. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - c. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with plain ends; cast-or wrought-copper solder-joint fittings; and brazed joints.
 - d. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.

Q. Sprinkler Schedule

1. Use sprinkler types in subparagraphs below for the following applications:
 - a. Rooms without Ceilings: Upright sprinklers.
 - b. Rooms with Suspended Ceilings: Dry pendent sprinklers **OR** Dry recessed sprinklers **OR** Dry flush sprinklers **OR** Dry concealed sprinklers, **as directed**.
 - c. Wall Mounting: Dry sidewall sprinklers.
 - d. Spaces Subject to Freezing: Upright sprinklers **OR** Dry pendent sprinklers **OR** Dry sidewall sprinklers, **as directed**.
 - e. Special Applications: Extended-coverage and quick-response sprinklers where indicated.
2. Provide sprinkler types in subparagraphs below with finishes indicated.
 - a. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
 - b. Flush Sprinklers: Bright chrome, with painted white escutcheon.
 - c. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
 - d. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 21 13 16 00



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SECTION 21 16 00 00 - PRESSURE-MAINTENANCE PUMPS

1.1 GENERAL

- A. Description Of Work
 - 1. This specification covers the furnishing and installation of materials for pressure-maintenance pumps. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.
- B. Summary
 - 1. Section Includes:
 - a. Multistage, pressure-maintenance pumps.
 - b. Regenerative-turbine, pressure-maintenance pumps.
 - c. Submersible, pressure-maintenance pumps.
 - d. Vertical-turbine, pressure-maintenance pumps.
- C. Performance Requirements
 - 1. Pump Equipment, Accessory, and Specialty Pressure Rating: 175 psig (1200 kPa) minimum unless higher pressure rating is indicated.
- D. Submittals
 - 1. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, performance curves, electrical characteristics, and furnished specialties and accessories.
 - 2. Shop Drawings: For pumps, accessories, and specialties. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
 - 3. Field quality-control reports.
 - 4. Operation and maintenance data.
- E. Quality Assurance
 - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.2 PRODUCTS

- A. Multistage, Pressure-Maintenance Pumps
 - 1. Description: Factory-assembled and -tested, multistage, barrel-type vertical pump as defined in HI 2.1-2.2 and HI 2.3; designed for surface installation with pump and motor direct coupled and mounted vertically.
 - 2. Pump Construction:
 - a. Barrel: Stainless steel.
 - b. Suction and Discharge Chamber: Cast iron with flanged inlet and outlet.
 - c. Pump Head/Motor Mount: Cast iron.
 - d. Impellers: Stainless steel, balanced, and keyed to shaft.
 - e. Pump Shaft: Stainless steel.
 - f. Seal: Mechanical type with carbon rotating face and silicon-carbide stationary seat.
 - g. Intermediate Chamber Bearings: Aluminum-oxide ceramic or bronze.
 - h. Chamber-Base Bearing: Tungsten carbide.
 - i. O-Rings: EPDM or NBR.



3. Motor: Single speed with permanently lubricated ball bearings and rigidly mounted to pump head. Comply with requirements in Division 15 Section "Common Motor Requirements for Fire Suppression Equipment."
 - a. Power Cord: Factory-connected to motor for field connection to controller and at least 10 feet (3 m) long.
 4. Nameplate: Permanently attached to pump and indicating capacity and characteristics.
- B. Regenerative-Turbine, Pressure-Maintenance Pumps
1. Description: Factory-assembled and -tested, close-coupled, single-stage, regenerative-turbine centrifugal pump as defined in HI 1.1-1.2 and HI 1.3; with pump and motor mounted horizontally.
 2. Pump Construction:
 - a. Casing: Radially split, cast iron, with threaded inlet and outlet.
 - b. Impeller: Bronze, balanced, and keyed to shaft.
 - c. Pump Shaft: Stainless steel **OR** steel, **as directed**, with deflector.
 - d. Shaft Sleeve: Bronze.
 - e. Seal: Mechanical type with spring-loaded rotating head.
 3. Motor: Single speed with permanently lubricated ball bearings. Comply with requirements in Division 15 Section "Common Motor Requirements for Fire Suppression Equipment."
 - a. Power Cord: Factory-connected to motor for field connection to controller and at least 10 feet (3 m) long.
 4. Nameplate: Permanently attached to pump and indicating capacity and characteristics.
- C. Submersible, Pressure-Maintenance Pumps
1. Description: Factory-assembled and -tested, vertical, multistage, submersible pump as defined in HI 2.1-2.2 and HI 2.3; with pump motor mounted below pump.
 2. Pump Construction:
 - a. Pump Head or Elbow: Cast iron, for surface discharge, with flanged or threaded connections.
 - b. Pump Shaft: Stainless steel.
 - c. Bearings: Bronze.
 - d. Bowl Section: Multiple cast-iron bowls with closed-type bronze or stainless-steel impellers.
 - e. Column Pipe: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with threaded ends and cast-iron or steel fittings, in sections 10 feet (3 m) or less, with strainer of cast or fabricated bronze or stainless steel between pump and bowl section.
 3. Motor: Single speed with permanently lubricated ball bearings and capable of continuous operation under water. Comply with requirements in Division 15 Section "Common Motor Requirements for Fire Suppression Equipment."
 - a. Power Cord: Capable of continuous under-water operation, factory-connected to motor for field connection to controller, and at least 10 feet (3 m) long.
 4. Base: Cast iron or steel with hole for electrical cable.
 5. Nameplate: Permanently attached to pump and indicating capacity and characteristics.
- D. Vertical-Turbine, Pressure-Maintenance Pumps
1. Description: Factory-assembled and -tested, vertical, multistage, open-line-shaft turbine pump as defined in HI 2.1-2.2 and HI 2.3; with pump motor mounted above pump head.
 2. Pump Construction:
 - a. Pump Head: Cast iron, for surface discharge, with flange except connections may be threaded in sizes in which flanges are not available.
 - b. Pump Head Seal: Stuffing box and stuffing.
 - c. For static water levels of 50 feet (15 m) or less and for water-lubricated bearings.
 - 1) Line Shaft: Stainless steel or steel, with corrosion-resistant shaft sleeves.
 - 2) Line Shaft Bearings: Rubber sleeve, water lubricated.
 - d. For static water levels between 50 and 200 feet (15 and 61 m) and for oil-lubricated bearings.
 - 1) Line Shaft: Steel.



- 2) Line Shaft Bearings: Corrosion resistant, oil lubricated.
 - e. Impeller Shaft: Monel metal or stainless steel.
 - f. Bowl Section: Multiple cast-iron bowls with closed-type bronze or stainless-steel impellers.
 - g. Column Pipe: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with threaded ends and cast-iron or steel fittings, in sections 10 feet (3 m) or less, with strainer of cast or fabricated bronze or stainless steel at bottom.
 3. Motor: Single speed with permanently lubricated ball bearings. Comply with requirements in Division 15 Section "Common Motor Requirements for Fire Suppression Equipment."
 - a. Power Cord: Factory-connected to motor for field connection to controller and at least 10 feet (3 m) long.
 4. Base: Cast iron or steel with hole for electrical cable.
 5. Nameplate: Permanently attached to pump and indicating capacity and characteristics.
- E. Motors
1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 15 Section "Common Motor Requirements for Fire Suppression Equipment."
 - a. Motor Sizes: Minimum size as indicated; if not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 16 Sections.
- 1.3 EXECUTION
- A. Equipment Installation
1. NFPA Standard: Comply with NFPA 20 for installation of pressure-maintenance pumps.
 2. Base-Mounted Pump Mounting: Install pumps on concrete bases. Comply with requirements for concrete bases specified in Division 3 Section "Cast-in-Place Concrete."
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - e. Attach pumps to equipment base using anchor bolts.
 3. Install multistage and regenerative-turbine, pressure-maintenance pumps according to HI 1.4.
 4. Install submersible and vertical-turbine, pressure-maintenance pumps according to HI 2.4.
- B. Field Quality Control
1. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 2. Tests and Inspections:
 - a. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 3. Pressure-maintenance pumps will be considered defective if they do not pass tests and inspections.
 4. Prepare test and inspection reports.
- C. Adjusting
1. Lubricate pumps as recommended by manufacturer.



2. Set field-adjustable pressure-switch ranges as indicated.

END OF SECTION 21 16 00 00



Task	Specification	Specification Description
21 22 16 00	01 22 16 00	No Specification Required



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SECTION 21 31 13 00 - ELECTRIC-DRIVE, CENTRIFUGAL FIRE PUMPS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for electric-drive, centrifugal fire pumps. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. End-suction, In-line, and Split-case fire pumps.
 - b. Fire-pump accessories and specialties.
 - c. Flowmeter systems.

C. Performance Requirements

1. Seismic Performance: Fire pumps shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Pump Equipment, Accessory, and Specialty Pressure Rating: 175 psig (1200 kPa) minimum unless higher pressure rating is indicated.

D. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For fire pumps, motor drivers, and fire-pump accessories and specialties. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
3. Seismic Qualification Certificates: For fire pumps, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Product Certificates: For each fire pump, from manufacturer.
5. Source quality-control reports.
6. Field quality-control reports.
7. Operation and maintenance data.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. NFPA Compliance: Comply with NFPA 20, "Installation of Stationary Pumps for Fire Protection."

1.2 PRODUCTS

A. General Requirements For Centrifugal Fire Pumps



1. Description: Factory-assembled and -tested fire-pump and driver unit.
2. Base: Fabricated and attached to fire-pump and driver unit with reinforcement to resist movement of pump during seismic events when base is anchored to building substrate.
3. Finish: Red paint applied to factory-assembled and -tested unit before shipping.

B. End-Suction Fire Pumps

1. Pump:
 - a. Standard: UL 448, for end-suction pumps for fire service.
 - b. Casing: Radially split case, cast iron with ASME B16.1 pipe-flange connections.
 - c. Impeller: Cast bronze, statically and dynamically balanced, and keyed to shaft.
 - d. Wear Rings: Replaceable bronze.
 - e. Shaft and Sleeve: Steel shaft with bronze sleeve.
 - 1) Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
 - 2) Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
 - f. Mounting: Pump and driver shafts are horizontal, with pump and driver on same base.
2. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard.
3. Driver:
 - a. Standard: UL 1004A.
 - b. Type: Electric motor; NEMA MG 1, polyphase Design B.

C. In-Line Fire Pumps

1. Pump:
 - a. Standard: UL 448, for in-line pumps for fire service.
 - b. Casing: Radially split case, cast iron with ASME B16.1 pipe-flange connections.
 - c. Impeller: Cast bronze, statically and dynamically balanced, and keyed to shaft.
 - d. Wear Rings: Replaceable bronze.
 - e. Shaft and Sleeve: Steel shaft with bronze sleeve.
 - 1) Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
 - 2) Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
 - f. Mounting: Pump and driver shaft is vertical, with motor above pump and pump on base.
2. Coupling: None or rigid.
3. Driver:
 - a. Standard: UL 1004A.
 - b. Type: Electric motor; NEMA MG 1, polyphase Design B.

D. Horizontally Mounted, Single-Stage, Split-Case Fire Pumps

1. Pump:
 - a. Standard: UL 448, for split-case pumps for fire service.
 - b. Casing: Axially split case, cast iron with ASME B16.1 pipe-flange connections.
 - c. Impeller: Cast bronze, statically and dynamically balanced, and keyed to shaft.
 - d. Wear Rings: Replaceable bronze.
 - e. Shaft and Sleeve: Steel shaft with bronze sleeve.
 - 1) Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
 - 2) Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
 - f. Mounting: Pump and driver shafts are horizontal, with pump and driver on same base.
2. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard.
3. Driver:
 - a. Standard: UL 1004A.
 - b. Type: Electric motor; NEMA MG 1, polyphase Design B.



- E. Horizontally Mounted, Multistage, Split-Case Fire Pumps
1. Pump:
 - a. Standard: UL 448, for split-case pumps for fire service.
 - b. Number of Stages: Two.
 - c. Casing: Axially split case, cast iron with ASME B16.1 pipe-flange connections.
 - d. Impeller: Cast bronze, statically and dynamically balanced, and keyed to shaft.
 - e. Wear Rings: Replaceable bronze.
 - f. Shaft and Sleeve: Steel shaft with bronze sleeve.
 - 1) Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
 - 2) Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
 - g. Mounting: Pump and driver shafts are horizontal, with pump and driver on same base.
 2. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard.
 3. Driver:
 - a. Standard: UL 1004A.
 - b. Type: Electric motor; NEMA MG 1, polyphase Design B.
- F. Vertically Mounted, Single-Stage, Split-Case Fire Pumps
1. Pump:
 - a. Standard: UL 448, for split-case pumps for fire service.
 - b. Casing: Axially split case, cast iron with ASME B16.1 pipe-flange connections.
 - c. Impeller: Cast bronze, statically and dynamically balanced, and keyed to shaft.
 - d. Wear Rings: Replaceable bronze.
 - e. Shaft and Sleeve: Steel shaft with bronze sleeve.
 - 1) Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
 - 2) Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
 - f. Mounting: Pump and driver shafts are vertical, with motor above pump and pump on base.
 2. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard.
 3. Driver:
 - a. Standard: UL 1004A.
 - b. Type: Electric motor; NEMA MG 1, polyphase Design B.
- G. Fire-Pump Accessories And Specialties
1. Automatic Air-Release Valves: Comply with NFPA 20 for installation in fire-pump casing.
 2. Circulation Relief Valves: UL 1478, brass, spring loaded; for installation in pump discharge piping.
 3. Relief Valves:
 - a. Description: UL 1478, bronze or cast iron, spring loaded; for installation in fire-suppression water-supply piping.
 4. Inlet Fitting: Eccentric tapered reducer at pump suction inlet.
 5. Outlet Fitting: Concentric tapered reducer at pump discharge outlet.
 6. Discharge Cone: Closed **OR** Open, **as directed**, type.
 7. Hose Valve Manifold Assembly:
 - a. Standard: Comply with requirements in NFPA 20.
 - b. Header Pipe: ASTM A 53/A 53M, Schedule 40, galvanized steel with ends threaded according to ASME B1.20.1.
 - c. Header Pipe Fittings: ASME B16.4, galvanized cast-iron threaded fittings.
 - d. Automatic Drain Valve: UL 1726.
 - e. Manifold:
 - 1) Test Connections: Comply with UL 405 except provide outlets without clappers instead of inlets.
 - 2) Body: Flush type, brass or ductile iron, with number of outlets required by NFPA 20.



- 3) Nipples: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with ends threaded according to ASME B1.20.1.
 - 4) Adapters and Caps with Chain: Brass or bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
 - 5) Escutcheon Plate: Brass or bronze; rectangular.
 - 6) Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
 - 7) Exposed Parts Finish: Polished **OR** Rough, **as directed**, brass, chrome plated, **as directed**.
 - 8) Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."
- OR**
- Manifold:
- 1) Test Connections: Comply with UL 405 except provide outlets without clappers instead of inlets.
 - 2) Body: Exposed type, brass, with number of outlets required by NFPA 20.
 - 3) Escutcheon Plate: Brass or bronze; round.
 - 4) Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads. Include caps and chains.
 - 5) Exposed Parts Finish: Polished **OR** Rough, **as directed**, brass, chrome plated, **as directed**.
 - 6) Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."

H. Flowmeter Systems

1. Description: UL-listed or FM-Approved, fire-pump flowmeter system with capability to indicate flow to not less than 175 percent of fire-pump rated capacity.
 2. Pressure Rating: 175 psig (1200 kPa) minimum **OR** 250 psig (1725 kPa), **as directed**.
 3. Sensor: Annubar probe, orifice plate, or venturi unless otherwise indicated. Sensor size shall match pipe, tubing, flowmeter, and fittings.
 4. Permanently Mounted Flowmeter: Compatible with flow sensor; with dial not less than 4-1/2 inches (115 mm) in diameter. Include bracket or device for wall mounting.
 - a. Tubing Package: NPS 1/8 or NPS 1/4 (DN 6 or DN 10) soft copper **OR** plastic, **as directed**, tubing with copper or brass fittings and valves.
- OR**
- Portable Flowmeter: Compatible with flow sensor; with dial not less than 4-1/2 inches (115 mm) in diameter and with two 12-foot- (3.7-m-) long hoses in carrying case.

I. Grout

1. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
2. Characteristics: Nonshrink and recommended for interior and exterior applications.
3. Design Mix: 5000-psi (34-MPa), 28-day compressive strength.
4. Packaging: Premixed and factory packaged.

J. Source Quality Control

1. Testing: Test and inspect fire pumps according to UL 448 requirements for "Operation Test" and "Manufacturing and Production Tests."
 - a. Verification of Performance: Rate fire pumps according to UL 448.
2. Fire pumps will be considered defective if they do not pass tests and inspections.
3. Prepare test and inspection reports.

1.3 EXECUTION

A. Installation



1. Fire-Pump Installation Standard: Comply with NFPA 20 for installation of fire pumps, relief valves, and related components.
 2. Equipment Mounting: Install fire pumps on concrete bases. Comply with requirements for concrete bases specified in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
 3. Install fire-pump suction and discharge piping equal to or larger than sizes required by NFPA 20.
 4. Support piping and pumps separately so weight of piping does not rest on pumps.
 5. Install valves that are same size as connecting piping. Comply with requirements for fire-protection valves specified in Division 21 Section(s) "Fire-suppression Standpipes" OR "Wet-pipe Sprinkler Systems", **as directed**.
 6. Install pressure gages on fire-pump suction and discharge flange pressure-gage tappings. Comply with requirements for pressure gages specified in Division 21 Section(s) "Fire-suppression Standpipes" OR "Wet-pipe Sprinkler Systems", **as directed**.
 7. Install piping hangers and supports, anchors, valves, gages, and equipment supports according to NFPA 20.
 8. Install flowmeters and sensors. Install flowmeter-system components and make connections according to NFPA 20 and manufacturer's written instructions.
 9. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not factory mounted. Furnish copies of manufacturers' wiring diagram submittals to electrical Installer.
 10. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- B. Alignment
1. Align end-suction and split-case pump and driver shafts after complete unit has been leveled on concrete base, grout has set, and anchor bolts have been tightened.
 2. After alignment is correct, tighten anchor bolts evenly. Fill baseplate completely with grout, with metal blocks and shims or wedges in place. Tighten anchor bolts after grout has hardened. Check alignment and make required corrections.
 3. Align piping connections.
 4. Align pump and driver shafts for angular and parallel alignment according to HI 1.4 and to tolerances specified by manufacturer.
- C. Connections
1. Comply with requirements for piping and valves specified in Division 21 Section(s) "Fire-suppression Standpipes" OR "Wet-pipe Sprinkler Systems", **as directed**. Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Install piping adjacent to pumps and equipment to allow service and maintenance.
 3. Connect relief-valve discharge to drainage piping or point of discharge.
 4. Connect flowmeter-system meters, sensors, and valves to tubing.
 5. Connect fire pumps to their controllers.
- D. Identification
1. Identify system components. Comply with requirements for fire-pump marking according to NFPA 20.
- E. Field Quality Control
1. Test each fire pump with its controller as a unit. Comply with requirements for electric-motor-driver fire-pump controllers specified in Division 21 Section(s) "Electric-drive, Centrifugal Fire Pumps" OR "Diesel-drive, Centrifugal Fire Pumps" OR "Electric-drive, Vertical-turbine Fire Pumps" OR "Diesel-drive, Vertical-turbine Fire Pumps".



2. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
3. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
4. Tests and Inspections:
 - a. After installing components, assemblies, and equipment including controller, test for compliance with requirements.
 - b. Test according to NFPA 20 for acceptance and performance testing.
 - c. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - d. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - e. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
5. Components, assemblies, and equipment will be considered defective if they do not pass tests and inspections.
6. Prepare test and inspection reports.
7. Furnish fire hoses in number, size, and length required to reach storm drain or other acceptable location to dispose of fire-pump test water. Hoses are for tests only and do not convey to Owner.

F. Demonstration

1. Train Owner's maintenance personnel to adjust, operate, and maintain fire pumps.

END OF SECTION 21 31 13 00



Task	Specification	Specification Description
21 31 13 00	21 16 00 00	Pressure-Maintenance Pumps



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SECTION 21 31 16 00 - DIESEL-DRIVE, CENTRIFUGAL FIRE PUMPS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for diesel-drive, centrifugal fire pumps. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. End-suction and Split-case fire pumps.
 - b. Fire-pump accessories and specialties.
 - c. Flowmeter systems.

C. Performance Requirements

1. Seismic Performance: Fire pumps shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Pump Equipment, Accessory, and Specialty Pressure Rating: 175 psig (1200 kPa) minimum unless higher pressure rating is indicated.

D. Submittals

1. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, performance curves, electrical characteristics, and furnished specialties and accessories.
2. Shop Drawings: For fire pumps, engine drivers, and fire-pump accessories and specialties. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
3. Seismic Qualification Certificates: For fire pumps, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Product Certificates: For each fire pump, from manufacturer.
5. Source quality-control reports.
6. Field quality-control reports.
7. Operation and maintenance data.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. NFPA Compliance: Comply with NFPA 20, "Installation of Stationary Pumps for Fire Protection."

1.2 PRODUCTS



- A. General Requirements For Centrifugal Fire Pumps
1. Description: Factory-assembled and -tested fire-pump and driver unit.
 2. Base: Fabricated and attached to fire-pump and driver unit with reinforcement to resist movement of pump during seismic events when base is anchored to building substrate.
 3. Finish: Red paint applied to factory-assembled and -tested unit before shipping.
- B. End-Suction Fire Pumps
1. Pump:
 - a. Standard: UL 448, for end-suction pumps for fire service.
 - b. Casing: Radially split case, cast iron with ASME B16.1 pipe-flange connections.
 - c. Impeller: Cast bronze, statically and dynamically balanced, and keyed to shaft.
 - d. Wear Rings: Replaceable bronze.
 - e. Shaft and Sleeve: Steel shaft with bronze sleeve.
 - 1) Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
 - 2) Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
 - f. Mounting: Pump and driver shafts are horizontal, with pump and driver on same base.
 2. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard.
 3. Driver:
 - a. Standard: UL 1247.
 - b. Type: Diesel engine.
 - c. Emergency Manual Operator: Factory wired for starting and operating standby engine in case of malfunction in main controller or wiring.
 - d. Engine Cooling System: Factory-installed radiator.
 - 1) Coolant: Type recommended by driver manufacturer.

OR

Engine Cooling System: Factory-installed water piping, valves, strainer, pressure regulator, heat exchanger, coolant pump, bypass piping, and fittings.
 - 1) Piping: ASTM B 88, Type L (ASTM B 88M, Type B), copper water tube; ASME B16.22, wrought-copper, solder-joint pressure fittings; AWS A5.8/A5.8M, BCuP Series brazing filler metal; and brazed joints.
 - e. Engine-Jacket Water Heater: Factory-installed electric elements.
 - f. Dual Batteries: Lead-acid-storage type with 100 percent standby reserve capacity.
 - g. Fuel System: Comply with NFPA 20.
 - 1) Fuel Storage Tank: Size indicated but not less than required by NFPA 20. Include floor legs, direct-reading level gage, and secondary containment tank with capacity at least equal to fuel storage tank.
 - h. Exhaust System: ASTM A 53/A 53M, Type E or S, Schedule 40, black steel pipe; ASME B16.9, weld-type pipe fittings; ASME B16.5, steel flanges; and ASME B16.21, nonmetallic gaskets. Fabricate double-wall, ventilated thimble from steel pipe.
 - 1) Exhaust Connector: Flexible type.
 - 2) Exhaust Silencer: Industrial **OR** Residential, **as directed**, type.
- C. Single-Stage, Split-Case Fire Pumps
1. Pump:
 - a. Standard: UL 448, for split-case pumps for fire service.
 - b. Casing: Axially split case, cast iron with ASME B16.1 pipe-flange connections.
 - c. Impeller: Cast bronze, statically and dynamically balanced, and keyed to shaft.
 - d. Wear Rings: Replaceable bronze.
 - e. Shaft and Sleeve: Steel shaft with bronze sleeve.
 - 1) Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
 - 2) Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
 - f. Mounting: Pump and driver shafts are horizontal, with pump and driver on same base.



2. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard.
 3. Driver:
 - a. Standard: UL 1247.
 - b. Type: Diesel engine.
 - c. Emergency Manual Operator: Factory wired for starting and operating standby engine in case of malfunction in main controller or wiring.
 - d. Engine Cooling System: Factory-installed radiator.
 - 1) Coolant: Type recommended by driver manufacturer.

OR

Engine Cooling System: Factory-installed water piping, valves, strainer, pressure regulator, heat exchanger, coolant pump, bypass piping, and fittings.

 - 1) Piping: ASTM B 88, Type L (ASTM B 88M, Type B), copper water tube; ASME B16.22, wrought-copper, solder-joint pressure fittings; AWS A5.8/A5.8M, BCuP Series brazing filler metal; and brazed joints.
 - e. Engine-Jacket Water Heater: Factory-installed electric elements.
 - f. Dual Batteries: Lead-acid-storage type with 100 percent standby reserve capacity.
 - g. Fuel System: Comply with NFPA 20.
 - 1) Fuel Storage Tank: Size indicated but not less than required by NFPA 20. Include floor legs, direct-reading level gage, and secondary containment tank with capacity at least equal to fuel storage tank.
 - h. Exhaust System: ASTM A 53/A 53M, Type E or S, Schedule 40, black steel pipe; ASME B16.9, weld-type pipe fittings; ASME B16.5, steel flanges; and ASME B16.21, nonmetallic gaskets. Fabricate double-wall, ventilated thimble from steel pipe.
 - 1) Exhaust Connector: Flexible type.
 - 2) Exhaust Silencer: Industrial **OR** Residential, **as directed**, type.
- D. Multistage, Split-Case Fire Pumps
1. Pump:
 - a. Standard: UL 448, for split-case pumps for fire service.
 - b. Number Stages: Two.
 - c. Casing: Axially split case, cast iron with ASME B16.1 pipe-flange connections.
 - d. Impeller: Cast bronze, statically and dynamically balanced, and keyed to shaft.
 - e. Wear Rings: Replaceable bronze.
 - f. Shaft and Sleeve: Steel shaft with bronze sleeve.
 - 1) Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
 - 2) Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
 - g. Mounting: Pump and driver shafts are horizontal, with pump and driver on same base.
 2. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard.
 3. Driver:
 - a. Standard: UL 1247.
 - b. Type: Diesel engine.
 - c. Emergency Manual Operator: Factory wired for starting and operating standby engine in case of malfunction in main controller or wiring.
 - d. Engine Cooling System: Factory-installed radiator.
 - 1) Coolant: Type recommended by driver manufacturer.

OR

Engine Cooling System: Factory-installed water piping, valves, strainer, pressure regulator, heat exchanger, coolant pump, bypass piping, and fittings.

 - 1) Piping: ASTM B 88, Type L (ASTM B 88M, Type B), copper water tube; ASME B16.22, wrought-copper, solder-joint pressure fittings; AWS A5.8/A5.8M, BCuP Series brazing filler metal; and brazed joints.
 - e. Engine-Jacket Water Heater: Factory-installed electric elements.
 - f. Dual Batteries: Lead-acid-storage type with 100 percent standby reserve capacity.



- g. Fuel System: Comply with NFPA 20.
 - 1) Fuel Storage Tank: Size indicated but not less than required by NFPA 20. Include floor legs, direct-reading level gage, and secondary containment tank with capacity at least equal to fuel storage tank.
 - h. Exhaust System: ASTM A 53/A 53M, Type E or S, Schedule 40, black steel pipe; ASME B16.9, weld-type pipe fittings; ASME B16.5, steel flanges; and ASME B16.21, nonmetallic gaskets. Fabricate double-wall, ventilated thimble from steel pipe.
 - 1) Exhaust Connector: Flexible type.
 - 2) Exhaust Silencer: Industrial **OR** Residential, **as directed**, type.
- E. Fire-Pump Accessories And Specialties
- 1. Automatic Air-Release Valves: Comply with NFPA 20 for installation in fire-pump casing.
 - 2. Circulation Relief Valves: UL 1478, brass, spring loaded; for installation in pump discharge piping.
 - 3. Relief Valves:
 - a. Description: UL 1478, bronze or cast iron, spring loaded; for installation in fire-suppression water-supply piping.
 - 4. Inlet Fitting: Eccentric tapered reducer at pump suction inlet.
 - 5. Outlet Fitting: Concentric tapered reducer at pump discharge outlet.
 - 6. Discharge Cone: Closed **OR** Open, **as directed**, type.
 - 7. Hose Valve Manifold Assembly:
 - a. Standard: Comply with requirements in NFPA 20.
 - b. Header Pipe: ASTM A 53/A 53M, Schedule 40, galvanized steel with ends threaded according to ASME B1.20.1.
 - c. Header Pipe Fittings: ASME B16.4, galvanized cast-iron threaded fittings.
 - d. Automatic Drain Valve: UL 1726.
 - e. Manifold:
 - 1) Test Connections: Comply with UL 405 except provide outlets without clappers instead of inlets.
 - 2) Body: Flush type, brass or ductile iron, with number of outlets required by NFPA 20.
 - 3) Nipples: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with ends threaded according to ASME B1.20.1.
 - 4) Adapters and Caps with Chain: Brass or bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
 - 5) Escutcheon Plate: Brass or bronze; rectangular.
 - 6) Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
 - 7) Exposed Parts Finish: Polished **OR** Rough, **as directed**, brass, **as directed**, chrome plated, **as directed**.
 - 8) Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."
- OR**
- Manifold:
- 1) Test Connections: Comply with UL 405 except provide outlets without clappers instead of inlets.
 - 2) Body: Exposed type, brass, with number of outlets required by NFPA 20.
 - 3) Escutcheon Plate: Brass or bronze; round.
 - 4) Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads. Include caps and chains.
 - 5) Exposed Parts Finish: Polished **OR** Rough, **as directed**, brass, **as directed**, chrome plated, **as directed**.
 - 6) Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."
- F. Flowmeter Systems
- 1. Description: UL-listed or FM-Approved, fire-pump flowmeter system with capability to indicate flow to not less than 175 percent of fire-pump rated capacity.



2. Pressure Rating: 175 psig (1200 kPa) minimum **OR** 250 psig (1725 kPa), **as directed**.
3. Sensor: Annubar probe, orifice plate, or venturi unless otherwise indicated. Sensor size shall match pipe, tubing, flowmeter, and fittings.
4. Permanently Mounted Flowmeter: Compatible with flow sensor; with dial not less than 4-1/2 inches (115 mm) in diameter. Include bracket or device for wall mounting.
 - a. Tubing Package: NPS 1/8 or NPS 1/4 (DN 6 or DN 10) soft copper **OR** plastic, **as directed**, tubing with copper or brass fittings and valves.

OR

Portable Flowmeter: Compatible with flow sensor; with dial not less than 4-1/2 inches (115 mm) in diameter and with two 12-foot- (3.7-m-) long hoses in carrying case.

G. Grout

1. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
2. Characteristics: Nonshrink and recommended for interior and exterior applications.
3. Design Mix: 5000-psi (34-MPa), 28-day compressive strength.
4. Packaging: Premixed and factory packaged.

H. Source Quality Control

1. Testing: Test and inspect fire pumps according to UL 448 requirements for "Operation Test" and "Manufacturing and Production Tests."
 - a. Verification of Performance: Rate fire pumps according to UL 448.
2. Fire pumps will be considered defective if they do not pass tests and inspections.
3. Prepare test and inspection reports.

1.3 EXECUTION

A. Installation

1. Fire-Pump Installation Standard: Comply with NFPA 20 for installation of fire pumps, relief valves, and related components.
2. Equipment Mounting: Install fire pumps on concrete bases. Comply with requirements for concrete bases specified in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install fire-pump suction and discharge piping equal to or larger than sizes required by NFPA 20.
4. Support piping and pumps separately so weight of piping does not rest on pumps.
5. Install valves that are same size as connecting piping. Comply with requirements for fire-protection valves specified in Division 21 Section(s) "Fire-suppression Standpipes" OR "Wet-pipe Sprinkler Systems", **as directed**.
6. Install pressure gages on fire-pump suction and discharge flange pressure-gage tappings. Comply with requirements for pressure gages specified in Division 21 Section(s) "Fire-suppression Standpipes" OR "Wet-pipe Sprinkler Systems", **as directed**.
7. Install piping hangers and supports, anchors, valves, gages, and equipment supports according to NFPA 20.
8. Install fuel system according to NFPA 20.
9. Install water supply and drain piping for diesel-engine heat exchangers. Extend drain piping from heat exchangers to point of disposal.
10. Install exhaust-system piping for diesel engines. Extend to point of termination outside structure. Install pipe and fittings with welded joints; install components having flanged connections with gasketed joints.



11. Install condensate-drain piping for diesel-engine exhaust system. Extend drain piping from low points of exhaust system to condensate traps and to point of disposal.
 12. Install flowmeters and sensors. Install flowmeter-system components and make connections according to NFPA 20 and manufacturer's written instructions.
 13. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not factory mounted. Furnish copies of manufacturers' wiring diagram submittals to electrical Installer.
 14. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- B. Alignment
1. Align end-suction and split-case pump and driver shafts after complete unit has been leveled on concrete base, grout has set, and anchor bolts have been tightened.
 2. After alignment is correct, tighten anchor bolts evenly. Fill baseplate completely with grout, with metal blocks and shims or wedges in place. Tighten anchor bolts after grout has hardened. Check alignment and make required corrections.
 3. Align piping connections.
 4. Align pump and driver shafts for angular and parallel alignment according to HI 1.4 and to tolerances specified by manufacturer.
- C. Connections
1. Comply with requirements for piping and valves specified in Division 21 Section(s) "Fire-suppression Standpipes" OR "Wet-pipe Sprinkler Systems", **as directed**. Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Install piping adjacent to pumps and equipment to allow service and maintenance.
 3. Connect relief-valve discharge to drainage piping or point of discharge.
 4. Connect flowmeter-system meters, sensors, and valves to tubing.
 5. Connect fire pumps to their controllers.
- D. Identification
1. Identify system components. Comply with requirements for fire-pump marking according to NFPA 20.
- E. Field Quality Control
1. Test each fire pump with its controller as a unit. Comply with requirements for diesel-engine-driver fire-pump controllers specified in Division 21 Section(s) "Electric-drive, Centrifugal Fire Pumps" OR "Diesel-drive, Centrifugal Fire Pumps" OR "Electric-drive, Vertical-turbine Fire Pumps" OR "Diesel-drive, Vertical-turbine Fire Pumps".
 2. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 3. Tests and Inspections:
 - a. After installing components, assemblies, and equipment including controller, test for compliance with requirements.
 - b. Test according to NFPA 20 for acceptance and performance testing.
 - c. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - d. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - e. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 4. Components, assemblies, and equipment will be considered defective if they do not pass tests and inspections.
 5. Prepare test and inspection reports.



6. Furnish fire hoses in number, size, and length required to reach storm drain or other acceptable location to dispose of fire-pump test water. Hoses are for tests only and do not convey to Owner.
- F. Startup Service
 1. Perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.
- G. Demonstration
 1. Train Owner's maintenance personnel to adjust, operate, and maintain fire pumps.

END OF SECTION 21 31 16 00



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Task	Specification	Specification Description
21 31 16 00	21 16 00 00	Pressure-Maintenance Pumps



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SECTION 22 00 00 00 - MPF PLUMBING

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Sanitary drainage and vent piping.
- B. Storm drainage piping.
- C. Domestic water service and distribution.
- D. Natural gas service and distribution.
- E. Compressed air system and distribution.
- F. Plumbing fixtures and trim, fittings and accessories, appurtenances and associated supports.
- G. Plumbing specialties associated with sanitary, storm, domestic water, air, and natural gas systems.
- H. Fire sprinkler piping.

1.2 SUBMITTALS

- A. Product Data: Required.
- B. Shop Drawings: Required.

1.3 QUALITY ASSURANCE

- A. Approval stamp label or other marking on piping made to standards.



- B. Comply with ASME B31.9, "Building Services Piping", for materials, products and installation.
- C. Comply with NSF 61, "Drinking Water System Components – Health Effects", for potable water piping and components.

1.4 APPROVALS

- A. Local authority review and approval:
 - 1. Plumbing plans.
 - 2. Riser diagrams and details.
 - 3. Specifications.

PART 2 - PRODUCTS

2.1 PIPING

- A. Piping systems shall be constructed of the following materials as scheduled below, subject to approval by authorities having jurisdiction.



SYSTEMS	PIPE	FITTINGS	REMARKS
Site sanitary drain (from 5 feet beyond building)	ASTM D2665 solid wall Polyvinylchloride (PVC) socket type, SDR-35	ASTM D3311 PVC, SDR-35 socket type fittings and solvent-cemented joints.	
Soil, waste, vent & storm drainage piping, underground in building to 5 feet outside of building	Service weight cast iron, bell and spigot	Cast iron bell and spigot with compression gaskets	
	ASTM D2665 solid wall PVC socket type, SDR-35	ASTM D3311 PVC, SDR-35 socket type fittings and solvent-cemented joints.	PVC allowed only where allowed by local codes.
Soil, waste, vent & storm drainage piping, above ground	Service weight cast iron, bell and spigot	Cast iron recessed drainage fittings with compression gaskets	
	Service weight cast iron, no-hub	Cast iron recessed drainage fittings with elastomeric gasket and stainless steel clamps	Not permitted for storm piping larger than 8".
	Copper drainage tube, type DWV	Cast brass recessed drainage fittings, with solder joints	Use soil pipe adapter for any connection to cast iron pipes at ground level
	Schedule 40 galvanized steel pipe, screwed ends	Galvanized cast iron recessed drainage fittings for waste piping; galvanized malleable iron fittings for vent piping	Permitted for use on pipes 1-1/2 inches and smaller only
	Schedule 40 galvanized steel pipe cut grooved with galvanized fittings and couplings ²	Galvanized grooved drainage pattern fittings.	Permitted for storm piping larger than 8".
	Polyvinylchloride (PVC) bell and spigot, SDR-35	ASTM D3311 PVC, SDR-35 socket type fittings and solvent-cemented joints.	PVC allowed only where allowed by local codes.
Acid waste & vent piping	Polypropylene flame retardant	Electric fusion coils, polypropylene coated	
Cold water piping, underground, 2-1/2 inches and smaller	Type K soft drawn copper tubing, with 95-5 in antimony or 96-4 tin silver	Wrought copper fittings, solder joint	1) Fitting pressure rating as per ANSI B16.18, B16.22
Site domestic water and fire water	Ductile Iron, Class 52, line inside of pipe and fittings with double thickness	Mechanical or push-on	



SYSTEMS	PIPE	FITTINGS	REMARKS
	cement with seal coat.		
	PVC, C-900 Class 200	Ductile Iron, cement lined with seal coat mechanical joint	May be used if acceptable to Local Authorities (Water Company and Fire Marshal)
Interior building or above ground domestic water systems, 4 inches and smaller (cold, hot & hot water systems)	Type L hard drawn copper tubing with 95-5 tin antimony solder joints	Cast bronze or wrought copper with solder joints	Fitting pressure rating as per ANSI B16.22, B16.18, 125 lb. steam and 300 lb. steam
Interior building or above ground domestic water piping, larger than 4 inches	Type L hard drawn copper tubing with 95-5 tin antimony solder joints	Soldered or cast bronze flanged fittings	Class 150, ANSI B16.24 flange
	Schedule 40 galvanized steel pipe, threaded	Galvanized malleable iron, screwed	Fitting pressure rating: 150 lb. steam
		Galvanized ductile iron, screwed or flanged	Fitting pressure rating: 125 and 300 lb. steam (screwed), 150 lb. (flanged)
	Schedule 40 galvanized steel pipe cut grooved ²	Victaulic style 75 or 77 galvanized and couplings.	Fitting pressure rating 500 WWP
Exposed final connections to fixtures	Chromium plated brass	Chromium plated brass	Fitting pressure rating: 125 lb. steam
Natural gas piping below grade	Schedule 40 black steel pipe	Welded steel fittings	Pipe coating and anodes in accordance with gas company requirements. Welding to be performed by a certified welder
	Thermoplastic gas pressure pipe	Mechanical fittings	Pipe and fitting manufacturer must be approved by gas co.
Relief valve discharge piping for water systems	Type L hard drawn copper tubing with 95-5 tin antimony solder joints	Cast bronze or wrought copper with solder joints	
Compressed air system, piping 2 inches and	Type L hard drawn copper tubing with 95-5 tin antimony	Cast bronze or wrought copper with solder joints	Provide dielectric unions for ferrous to non-ferrous pipe connections



SYSTEMS	PIPE	FITTINGS	REMARKS
smaller	solder joints		
	Schedule 40 black steel pipe	Screwed malleable iron fittings	
Compressed air system, piping 2-1/2 inch and larger	Schedule 40 black steel pipe	Welded steel fittings ¹	Provide dielectric unions for ferrous to non-ferrous pipe connections
Fire protection piping above ground inside building	Schedule 40 black steel pipe	Screwed cast iron or grooved malleable iron	Schedule 10 pipe with rolled grooved fittings and couplings may be used for piping 2-1/2" & larger
Natural gas piping above ground outside building	Schedule 40 black steel pipe	Screwed malleable iron for fittings 2 inches and smaller, welded steel for fittings larger than 2 inches	Pipe painting and support in accordance with gas company requirements. Welding to be performed by a certified welder
Natural gas piping inside building	Schedule 40 black steel pipe	Screwed malleable iron for fittings 2 inches and smaller, welded steel for fittings larger than 2 inches	Pipe painting and support in accordance with gas company requirements. Welding to be performed by a certified welder. Sleeve and vent for gas pipe in ceiling space and riser per gas company requirements

Footnotes:

1 - Threaded fittings permitted for Compressed Air.

2 - Couplings shall be galvanized when used with galvanized piping. All grooves cut in galvanized piping shall be properly cleaned and primed with zinc chromate.

2.2 VALVES

A. Domestic Water System Isolation Valves:

- 2" and smaller shall be 150 lb. WOG, two piece ball valves with bronze body, brass ball and trim with Teflon seats and seals, solder ends.
- 2-1/2" shall be class 125 bronze gate valves with rising stem, solder ends.
- 3" and larger shall be class 125 iron body bronze mounted O. S & Y rising stem with flanged ends.

B. Natural Gas:

- 2" and smaller shall be 300 lb. plug valves with ductile iron body and plug, non-lubricated, TFE sleeve and diaphragm, bolted bonnet, threaded ends, with hand operated lever.
- 2½" and larger shall be 150 lb. plug valves with ductile iron body and plug, non-lubricated, TFE sleeve and diaphragm, bolted bonnet, raised face flanged ends with hand operated lever for sizes through 3" and enclosed worm gear operator for sizes 4" and larger.

C. Compressed Air System Isolation Valves:



1. 2" and smaller shall be 150 lb. WOG, two piece ball valves with latch lock, bronze body, brass ball and trim with Teflon seats and seals, solder ends.
2. 2½" and larger shall be 150 lb. ball valves with carbon steel body, 316 stainless steel ball and stem, blow-out proof stem, reinforced TFE seats, TFE seals, lever operated, raised face flanged ends.

2.3 SPECIALTIES

- A. Roof Drains: Lacquered cast iron body with sump, removable metal dome strainer, membrane flange and membrane clamp with integral gravel stop, adjustable underdeck clamp, waterproofing flange, levelling frame, adjustable extension sleeve, perforated or slotted ballast guard extension. Overflow roof drains shall additionally have 2" high solid clamping collar.
- B. Floor Drains: Lacquered cast iron two piece body with double drainage flange, weep holes, and round, adjustable nickel-bronze strainer. Provide acid resistant floor drains in Battery Room and any other rooms containing acidic chemicals.
- C. Cleanout: Lacquered cast iron, two piece body with round scoriated cover in service areas and round cover, depressed to accept floor finish in finished floor areas.
- D. Water Hammer Arrestor: PDI WH-201, precharged.
- E. Hose Bibbs:
 1. Bronze or brass, hose thread spout, chrome plated with vacuum breaker.
- F. Hydrants:
 1. Wall hydrants: Non-freeze, recessed, lockable, stainless steel box type with concealed hose connection.
 2. Post Hydrant: Non-freeze, automatic draining, backflow preventer, ¾" hose nozzle, pipe casing and valve seat.
- G. Backflow Preventers:
 1. Reduced Pressure Backflow Preventers: ASSE 1013; bronze body; assembled with two gate valves, strainer, and four test cocks.

2.4 PLUMBING FIXTURES

- A. General
 1. Water closets, urinals, flush valves and faucets must bear WaterSense label.
 2. Water closets, urinals, flush valves and faucets manufacturers must be a WaterSense partner with US EPA.
- B. Flush Valve Water Closet:
 1. Bowl: Floor mounted vitreous china closet, siphon jet, 1.28 GPF, with elongated rim.
 2. Flush Valve: Exposed chrome plated, diaphragm type, manually operated, integral screwdriver stop, vacuum breaker.
 3. Seat: Solid molded white plastic, open front, self-sustaining stainless steel hinge.
 4. Foot supported carrier for wall mounting water closet.
 5. ADA/U.S.P.S. Handbook RE-4 compliant where indicated.
- C. Urinal:
 1. Urinal: Vitreous china with shields, siphon jet, 0.5 GPF, integral trap, stainless steel strainer, steel supporting hanger.



2. Flush Valve: Exposed chrome plated, diaphragm type, manually operated, integral screwdriver stop, vacuum breaker.
 3. Wall hung.
 4. ADA/U.S.P.S. Handbook RE-4 compliant where indicated.
- D. Lavatory:
1. Basin: Vitreous china 20 x 18 minimum, with concealed arm carrier.
 2. Trim: Chrome plated supply fitting with open grid strainer, water economy vandal-resistant aerator, all brass body.
 3. Faucet: Single lever faucet with aerator with 0.5 GPM flow restrictor.
 4. Wall mounted.
 5. ADA/U.S.P.S. Handbook RE-4 compliant, where indicated, with trap and wall supply guard.
- E. Counter Sink:
1. Bowl: Single compartment 25 x 22 x 8 inch outside dimensions, Type 302 stainless steel, 3-½ inch crumb cup and chromed brass drain, drilled ledge back.
 2. Trim: Chrome plated supply fitting with 8 inch spout, water economy vandal-resistant aerator, lever handles.
- F. Electric Water Cooler:
1. Cooler: Bi-level handicap wall mounted ADA/U.S.P.S. Handbook RE-4 compliant cooler, lead-free, with stainless steel top, vinyl on steel body, bubbler, stream regulator, mounting bracket.
 2. Capacity: 8.0 gph of 50 degree F water with inlet at 80 degree F and room temperature of 90 degree F.
 3. Refrigerant shall be R-134a.
- G. Mop Basin:
1. Receptor: 36 x 24 x 12 inch precast terrazzo, floor mounted.
 2. Trim: Exposed wall type supply with lever handles, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with caps and adjustable wall flanges, 30 inch of ¾ inch diameter plain end reinforced rubber hose, hose clamp, mop hanger.
 3. Drain: 3" cast iron "P" trap with strainer and cleanout.
- H. Service Sink:
1. Sink: Enameled cast iron, 22" x 18", plain back, rim guard, wall hanger.
 2. Trim: Service sink faucet, vacuum breaker, adjustable wall brace, pail hook, integral stops, ¾" hose thread on spout.
- I. Emergency Shower Eyewash:
1. Combination drench shower and eye/face wash unit meeting ANSI Standards and OSHA rules and regulations including emergency sign.
 2. Shower head: ABS green plastic shower head, instant action, stay open.
 3. Eye/face wash: Stainless steel receptor, floor mounted with twin feather flow chrome plated brass heads, push flag operated, stay open, manually closed.
 4. Supply: Tempered water thru thermostatic mixing valve.
- J. Disposer:
1. Shock absorbing mounting, all stainless steel cutting action, replaceable hammers and rind kicker, two-position stopper, lifetime lubrication, overload protection, 115 VAC, five (5) year warranty.
- K. Thermostatic Mixing Valves:
1. Cabinet mounted with check stops, adjustable thermostat factory set for 98F.

2.5 EQUIPMENT

- A. Water Storage Heaters:
 - 1. Factory-assembled and wired, electric or gas fired, vertical storage type.
 - 2. Welded steel ASME labeled pressure vessel; glass lined, with automatic immersion water thermostat, flanged or screw-in nichrome elements.
 - 3. Heavy gauge shelf for wall mounting.
- B. Point-of-Use Water Heaters:
 - 1. Wall mounted, instant flow, stainless steel heating coil, flow switch activated, UL listed.
- C. Compressed Air System:
 - 1. Compressors shall be factory assembled and tested, packaged, single or two stage with intercooler and aftercooler, heavy-duty asymmetrical rotary screw. Bearings shall be separate for radial and thrust loads. Cooling lubrication system shall be unit-mounted, air-cooled exchange package. Compressors shall include microprocessor based control modules for starting, capacity control and safety control of units. Control panel shall include air receiver pressure gage, discharge line pressure gage, air filter maintenance indicator, hourmeter, compressor discharge air and coolant temperature gage, control transformer, start- stop switches and numbered wiring terminal strip. Motor starter shall be factory mounted on compressor package and wired to motor and control panel. Compressors shall be housed in manufacturer's standard sound attenuating cabinets and shall limit sound levels to 80 dBA at 3 feet from equipment.
 - 2. Refrigerated air dryers shall be self-contained mechanical refrigeration type complete with heat exchanger, refrigeration compressor, automatic controls, moisture removal trap, and internal wiring and piping. Heat exchangers shall consist of air to air and refrigerant to air coils. Heat exchangers shall be provided with automatic control system to bypass refrigeration system on low or no load condition. Each dryer shall be provided with air inlet temperature gage, on/of switch , high temperature light, air outlet temperature gage and air outlet pressure gage. Provide one micron coalescing filter upstream of each refrigerated dryer.
- D. Central Stationary Vacuum Cleaning System
 - 1. Exhauster shall be multistage centrifugal type with motor drives sized to the minimum determined capacity in ICFM at the required vacuum pressure in inches of mercury and constructed of cast iron (not fabricated) heads and section.
 - 2. Separator shall be constructed of carbon steel and be suitable for operation at 12 inches of mercury and a storage volume of not less than 10 cubic feet. Bag cleaning shall be done with compressed air automatically controlled by an adjustable timer.
 - 3. Bleed system shall be modulating type which will automatically allow atmospheric air into the main tubing header in order to prevent the exhauster from going into surge and also maintain the necessary conveying velocity.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
 - 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 - 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.



3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-mounting fixtures with tubular waste piping attached to supports.
- F. Install fixtures level and plumb according to roughing-in drawings.
- G. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
- H. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- I. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- J. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- K. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- L. Install toilet seats on water closets.
- M. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- N. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- O. Install traps on fixture outlets.
 1. Exception: Omit trap on fixtures with integral traps.
 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- P. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.
- Q. Install escutcheons at piping wall and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 23 Section "Common Work for HVAC."
- R. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 7 Section "Joint Sealants."
- S. Provide dielectric connections wherever joining dissimilar metals.
- T. Install water hammer arrestors complete with accessible isolation valve.
- U. Install each plumbing fixture with chrome plated rigid or flexible supplies with screwdriver stops, reducers, and escutcheons.
- V. Compressed air system:
 1. Provide valves, crossovers and bypasses for shut-off and isolation of system components (compressors, dryers, filters and receivers) such that servicing of any one component will not shutdown operation.
 2. Locate receivers between compressors and dryers.



3. Where appropriate, mount air compressors, dryers, receivers and oil separators on 4" high concrete housekeeping pad.
4. Pipe auto drains from compressors, dryers, filters and receivers into drainage system.

3.2 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding."
- C. Connect wiring according to Division 26 Section "Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Install fresh batteries in sensor-operated mechanisms.

3.4 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities.

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END OF SECTION 22 00 00 00



SECTION 22 01 40 00 - EMERGENCY PLUMBING FIXTURES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for emergency plumbing fixtures. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work

B. Summary

1. This Section includes the following emergency plumbing fixtures:
 - a. Emergency showers.
 - b. Eyewash equipment.
 - c. Self-contained eyewash equipment.
 - d. Personal eyewash equipment.
 - e. Eye/face wash equipment.
 - f. Hand-held drench hoses.
 - g. Combination units.
 - h. Water-tempering equipment.

C. Definitions

1. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.
2. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.
3. Self-Contained Emergency Plumbing Fixture: Fixture with flushing-fluid-solution supply.
4. Tepid: Moderately warm.

D. Submittals

1. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.
2. Shop Drawings: Diagram power, signal, and control wiring.
3. Operation and maintenance data.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."
3. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
4. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

1.2 PRODUCTS

A. Emergency Showers:

1. Description: Plumbed, single-shower-head horizontal, wall-mounting **OR** vertical, ceiling-mounting **OR** freestanding, **as directed**, emergency shower.
 - a. Capacity: Deliver potable water at rate not less than 20 gpm (76 L/min.) for at least 15 minutes.



- b. Supply Piping: NPS 1 (DN 25) **OR** NPS 1-1/4 (DN 32) **OR** galvanized steel **OR** chrome-plated brass or stainless steel **OR** PVC, **as directed**, with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Pull rod **OR** chain, **as directed**.
 - d. Shower Head: 8-inch (200-mm) minimum diameter, chrome-plated brass or stainless steel **OR** plastic, **as directed**.
- 2. Description: Plumbed, multiple-spray emergency shower with eight **OR** 12 **OR** 16, **as directed**, small shower heads or nozzles.
 - a. Capacity: Deliver potable water at rate not less than 20 gpm (76 L/min.) for at least 15 minutes.
 - b. Supply Piping: NPS 1-1/4 (DN 32) minimum galvanized **OR** chrome-plated brass or stainless, **as directed**, steel with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Paddle **OR** Treadle, **as directed**.
- 3. Description: Plumbed, freeze-protected, freestanding emergency shower.
 - a. Capacity: Deliver potable water at rate not less than 20 gpm (76 L/min.) for at least 15 minutes.
 - b. Supply Piping: NPS 1-1/4 (DN 32) galvanized steel with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Pull rod **OR** chain, **as directed**.
 - d. Shower Head: 8-inch (200-mm) minimum diameter, chrome-plated brass or stainless steel **OR** plastic, **as directed**.
 - e. Heating System: 120 **OR** 240, **as directed**, -V ac electric; and insulation with protective jacket.

B. Eyewash Equipment

- 1. Description: Plumbed, freestanding eyewash equipment.
 - a. Capacity: Deliver potable water at rate not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
 - b. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Paddle **OR** Push bar **OR** Treadle, **as directed**.
 - d. Receptor: Chrome-plated brass or stainless-steel **OR** Plastic, **as directed**, bowl.
 - e. Drain Piping: NPS 1-1/4 (DN 32) minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2 **OR** Omit drain piping **OR** Include galvanized-steel indirect connection to drainage system, **as directed**.
- 2. Description: Plumbed, accessible, **as directed**, wall-mounting eyewash equipment with receptor and wall bracket.
 - a. Capacity: Deliver potable water at rate not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
 - b. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Paddle.
 - d. Receptor: Chrome-plated brass or stainless-steel **OR** Plastic, **as directed**, bowl.
 - e. Drain Piping: NPS 1-1/4 (DN 32) minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2.
- 3. Description: Plumbed, accessible, **as directed**, wall-mounting eyewash equipment with wall bracket.
 - a. Capacity: Deliver potable water at rate not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
 - b. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Paddle **OR** Movement sensor, **as directed**.
- 4. Description: Plumbed, adjacent-to-sink, swivel, counter-mounting eyewash equipment.
 - a. Capacity: Deliver potable water at rate not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.



- b. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Paddle.
- C. Self-Contained Eyewash Equipment:
 - 1. Description: Portable, pressurized, self-contained eyewash equipment.
 - a. Capacity: Deliver flushing fluid at rate not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
 - b. Tank: 10 gal. (3.8 L), stainless steel, cylindrical, and suitable for on-floor installation.
 - c. Flushing Fluid: Medically acceptable solution manufactured and labeled according to applicable regulations.
 - d. Piping: Chrome-plated copper alloy or stainless steel with flow regulator and stay-open control valve.
 - e. Control-Valve Actuator: Paddle.
 - f. Spray Heads: Twin with covers.
 - 2. Description: Static, nonpressurized, self-contained eyewash equipment.
 - a. Capacity: Deliver flushing fluid at rate not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
 - b. Tank: 14 gal. (53 L) minimum, plastic, and suitable for shelf mounting.
 - c. Flushing Fluid: Medically acceptable solution manufactured and labeled according to applicable regulations.
 - d. Actuator: Pull-down front panel.
 - e. Spray Heads: Protected, twin.
 - 3. Description: Freeze-protected, static, nonpressurized, self-contained eyewash equipment with heating system.
 - a. Capacity: Deliver flushing fluid at rate not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
 - b. Tank: 14 gal. (53 L) minimum **OR** 20 gal. (76 L) minimum, **as directed**, plastic, and suitable for shelf mounting.
 - c. Flushing Fluid: Medically acceptable solution manufactured and labeled according to applicable regulations.
 - d. Actuator: Pull-down front panel.
 - e. Spray Heads: Protected, twin.
 - f. Heating System: Electric, 120-V ac; and insulation with protective jacket.
- D. Personal Eyewash Equipment:
 - 1. Description: Portable, pressurized, personal eyewash equipment with spray heads.
 - a. Capacity: Deliver flushing fluid at rate not less than 0.4 gpm (1.5 L/min.), **as directed**.
 - b. Tank: 5 gal. (19 L), stainless steel, cylindrical, and with base suitable for on-floor installation.
 - c. Flushing Fluid: Medically acceptable solution manufactured and labeled according to applicable regulations.
 - d. Piping: Chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 - e. Control-Valve Actuator: Paddle.
 - f. Spray Heads: Twin with covers.
 - 2. Description: Portable, pressurized, personal eyewash equipment with spray heads and drench hose.
 - a. Capacity: Deliver flushing fluid at rate not less than 0.4 gpm (1.5 L/min.), **as directed**.
 - b. Tank: 5 gal. (19 L), stainless steel, cylindrical, and with base suitable for on-floor installation.
 - c. Flushing Fluid: Medically acceptable solution manufactured and labeled according to applicable regulations.
 - d. Piping: Chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 - e. Spray-Head, Control-Valve Actuator: Paddle.



- f. Spray Heads: Twin with covers.
- g. Drench Hose: Rubber or plastic.
 - 1) Control-Valve Actuator: Hand-held squeeze valve.
 - 2) Spray Head: Single with cover.

E. Eye/Face Wash Equipment:

1. Description: Plumbed, freestanding, pedestal eye/face wash equipment.
 - a. Capacity: Deliver potable water at rate not less than 3.0 gpm (11.4 L/min.) for at least 15 minutes.
 - b. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Paddle **OR** Push bar **OR** Treadle, **as directed**.
 - d. Receptor: Chrome-plated brass or stainless-steel **OR** Plastic, **as directed**, bowl.
 - e. Drain Piping: NPS 1-1/4 (DN 32) minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2. Include galvanized-steel indirect connection to drainage system.
2. Description: Plumbed, accessible, **as directed**, wall-mounting eye/face wash equipment with receptor and wall bracket.
 - a. Capacity: Deliver potable water at rate not less than 3.0 gpm (11.4 L/min.) for at least 15 minutes.
 - b. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Paddle.
 - d. Receptor: Chrome-plated brass or stainless-steel **OR** Plastic, **as directed**, bowl.
 - e. Drain Piping: NPS 1-1/4 (DN 32) minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2.
3. Description: Plumbed, accessible, **as directed**, wall-mounting eye/face wash equipment without receptor and with wall bracket.
 - a. Capacity: Deliver potable water at rate not less than 3.0 gpm (11.4 L/min.) for at least 15 minutes.
 - b. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Paddle.
4. Description: Plumbed, adjacent-to-sink, swivel, counter-mounting eye/face wash equipment.
 - a. Capacity: Deliver potable water at rate not less than 3.0 gpm (11.4 L/min.) for at least 15 minutes.
 - b. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Paddle.

F. Hand-Held Drench Hoses:

1. Description: Plumbed, wall-mounting, hand-held drench hose with wall bracket.
 - a. Capacity: Deliver potable water at rate not less than 3.0 gpm (11.4 L/min.) for at least 15 minutes.
 - b. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Paddle.
 - d. Hose: Coiled **OR** Plain, **as directed**, rubber or plastic.
 - e. Spray Heads: Single **OR** Twin, **as directed**.
2. Description: Plumbed, counter-mounting, hand-held drench hose.
 - a. Capacity: Deliver potable water at rate not less than 3.0 gpm (11.4 L/min.) for at least 15 minutes.
 - b. Supply Fitting: NPS 1/2 (DN 15) brass with flow regulator.
 - c. Hose: Rubber or plastic.
 - d. Control-Valve Actuator: Hand-held squeeze valve.



- e. Spray Heads: Single **OR** Twin, **as directed**.

G. Combination Units:

1. Description: Plumbed, accessible, **as directed**, freestanding, with emergency shower and eyewash **OR** eye/face wash **OR** drench hose, **as directed**, equipment.
 - a. Piping: Galvanized steel **OR** Chrome-plated brass or stainless steel **OR** PVC, **as directed**.
 - 1) Unit Supply: NPS 1-1/4 (DN 32) minimum **OR** NPS 1-1/2 (DN 40), **as directed**, from top **OR** side, **as directed**.
 - 2) Unit Drain: Outlet at side near bottom.
 - 3) Shower Supply: NPS 1 (DN 25) with flow regulator and stay-open control valve.
 - 4) Eyewash **OR** Eye/Face Wash **OR** Drench Hose, **as directed**, Supply: NPS 1/2 (DN 15) with flow regulator and stay-open control valve.
 - b. Shower Capacity: Deliver potable water at rate not less than 20 gpm (76 L/min.) for at least 15 minutes.
 - 1) Control-Valve Actuator: Pull rod **OR** Pull chain **OR** Treadle, **as directed**.
 - 2) Shower Head: 8-inch (200-mm) minimum diameter, chrome-plated brass or stainless steel **OR** plastic, **as directed**.
 - c. Eyewash Equipment: With capacity to deliver potable water at rate not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
 - 1) Control-Valve Actuator: Paddle **OR** Push bar, **as directed**.
 - 2) Receptor: Chrome-plated brass or stainless-steel **OR** Plastic, **as directed**, bowl.
 - d. Eye/Face Wash Equipment: With capacity to deliver potable water at rate not less than 3.0 gpm (11.4 L/min.) for at least 15 minutes.
 - 1) Control-Valve Actuator: Paddle **OR** Push bar, **as directed**.
 - 2) Receptor: Chrome-plated brass or stainless-steel **OR** Plastic, **as directed**, bowl.
 - e. Hand-Held Drench Hose: With capacity to deliver potable water at rate not less than 3.0 gpm (11.4 L/min.) for at least 15 minutes.
 - 1) Hose: Rubber or plastic.
 - 2) Control-Valve Actuator: Hand-held squeeze valve.
 - 3) Spray Head(s): Single **OR** Twin, **as directed**.
2. Description: Plumbed, accessible, **as directed**, freeze-protected, freestanding, with emergency shower and eye/face wash equipment.
 - a. Piping: Galvanized steel.
 - 1) Unit Supply: NPS 1-1/4 (DN 32) minimum **OR** NPS 1-1/2 (DN 40), **as directed**, from top **OR** side **OR** bottom, **as directed**.
 - 2) Shower Supply: NPS 1 (DN 25) with flow regulator and stay-open control valve.
 - 3) Eye/Face Wash Supply: NPS 1/2 (DN 15) with flow regulator and stay-open control valve.
 - b. Heating System: Electric, 120 **OR** 240, **as directed**, -V ac; and insulation with protective jacket.
 - c. Shower Capacity: Deliver potable water at rate not less than 20 gpm (76 L/min.) for at least 15 minutes.
 - 1) Control-Valve Actuator: Pull rod **OR** Pull chain **OR** Treadle, **as directed**.
 - 2) Shower Head: 8-inch (200-mm) minimum diameter, chrome-plated brass or stainless steel **OR** plastic, **as directed**.
 - d. Eye/Face Wash Equipment: With capacity to deliver potable water at rate not less than 3.0 gpm (11.4 L/min.) for at least 15 minutes.
 - 1) Control-Valve Actuator: Paddle **OR** Push bar, **as directed**.

H. Water-Tempering Equipment:

1. Description: Factory-fabricated, hot- and cold-water-tempering equipment with thermostatic mixing valve.
 - a. Thermostatic Mixing Valve: Designed to provide 85 deg F (29 deg C) tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F (3 deg C) throughout required 15-minute test period, and in case of unit failure to continue

- cold-water flow, with union connections, controls, metal piping, and corrosion-resistant enclosure.
2. Description: Factory-fabricated, steam and cold-water, water-tempering equipment with thermostatic mixing valve.
 - a. Thermostatic Mixing Valve: Designed to provide 85 deg F (29 deg C) tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F (3 deg C) throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, steam controls, heat exchanger, high-temperature-limit and freeze-protection devices, metal piping, and corrosion-resistant enclosure.
 3. Description: Factory-fabricated, water-tempering equipment with electric heating.
 - a. Heating System: Electric, designed to provide 85 deg F (29 deg C) tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F (3 deg C) throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, heating coils, high-temperature-limit device, metal piping, and corrosion-resistant enclosure.
 - 1) Electrical Characteristics: 208-V ac, 38 **OR** 220-V ac, 40 **OR** 277-V ac, 32, **as directed**, A, single phase, 60 Hz.

1.3 EXECUTION

A. Installation

1. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.
2. Install fixtures level and plumb.
3. Fasten fixtures to substrate.
4. Install shutoff valves in water-supply piping to fixtures. Use ball, gate, or globe valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Valves are specified in Division 22 Section "General-duty Valves For Plumbing Piping".
 - a. Exception: Omit shutoff valve on supply to group of plumbing fixtures that includes emergency plumbing fixture.
 - b. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.
5. Install shutoff valve and strainer in steam piping and shutoff valve in condensate return piping.
6. Install dielectric fitting in supply piping to fixture if piping and fixture connections are made of different metals. Dielectric fittings are specified in Division 22 Section "Common Work Results For Plumbing".
7. Install thermometers in supply and outlet piping connections to water-tempering equipment. Thermometers are specified in Division 22 Section "Meters And Gages For Plumbing Piping".
8. Install trap and waste to wall on drain outlet of fixture receptors that are indicated to be directly connected to drainage system.
9. Install indirect waste piping to wall on drain outlet of fixture receptors that are indicated to be indirectly connected to drainage system. Drainage piping is specified in Division 22 Section "Sanitary Waste And Vent Piping".
10. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Escutcheons are specified in Division 22 Section "Common Work Results For Plumbing".
11. Fill self-contained fixtures with flushing fluid.
12. Install equipment nameplates or equipment markers on fixtures and equipment signs on water-tempering equipment. Identification materials are specified in Division 22 Section "Identification For Plumbing Piping And Equipment".
13. Piping installation requirements are specified in other Division 14. Drawings indicate general arrangement of piping, fittings, and specialties.
14. Connect cold-water-supply piping to plumbed emergency plumbing fixtures not having water-tempering equipment.



15. Connect hot- and cold-water-supply piping to hot- and cold-water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures.
 16. Connect cold-water and steam supply and condensate return piping to steam and cold-water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures.
 17. Connect cold water and electrical power to electric heating water-tempering equipment.
 18. Directly connect emergency plumbing fixture receptors with trapped drain outlet to sanitary drainage and vent piping.
 19. Indirectly connect emergency plumbing fixture receptors without trapped drain outlet to sanitary or storm drainage piping.
 20. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 21. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
- B. Field Quality Control
1. Electrical-Component Testing: After electrical circuitry has been energized, test for compliance with requirements.
 - a. Test and adjust controls and safeties.
 2. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.
- C. Adjusting
1. Adjust or replace fixture flow regulators for proper flow.
 2. Adjust equipment temperature settings.

END OF SECTION 22 01 40 00



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SECTION 22 05 00 00 - CSF COMMON WORK RESULTS FOR PLUMBING

NOTE TO SPECIFIER

REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT AN APPROVED WRITTEN DEVIATION FROM USPS HEADQUARTERS SUBMITTED THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.22 05 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Dielectric fittings.
 - 3. Mechanical sleeve seals.
 - 4. Sleeves.
 - 5. Escutcheons.
 - 6. Grout.
 - 7. Plumbing demolition.
 - 8. Equipment installation requirements common to equipment sections.
 - 9. Plumbing identification.
 - 10. Concrete bases.
 - 11. Supports and anchorages.

1.2 DEFINITIONS

- A. Finished Spaces: Spaces other than plumbing and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and plumbing equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS

- A. Welding certificates.



1.4 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12.
- G. Solvent Cements for Joining Plastic Piping:
 - 1. ABS Piping: ASTM D 2235.
 - 2. CPVC Piping: ASTM F 493.
 - 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 4. PVC to ABS Piping Transition: ASTM D 3138.



2.3 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
- F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.4 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Sealing Elements: **[EPDM] [NBR] <Insert other>** interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- C. Pressure Plates: **[Plastic] [Carbon steel] [Stainless steel]**. Include two for each sealing element.
- D. Connecting Bolts and Nuts: **[Carbon steel with corrosion-resistant coating] [Stainless steel]** of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.



2.6 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: [Polished chrome-plated] [Rough brass] [Polished chrome-plated and rough brass].
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: [Polished chrome-plated] [Rough brass] [Polished chrome-plated and rough brass].

2.7 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.8 PLUMBING IDENTIFICATION

- A. Equipment Nameplates: Laminated three-layer plastic with engraved [black] [] letters on light contrasting background color.
- B. Tags
 - 1. Plastic Tags: Laminated three-layer plastic with engraved [black] [] letters on light contrasting background color. Tag size minimum 1-1/2 inches (38 mm) [diameter] [square] [].
 - 2. Metal Tags: Brass, Aluminum, or Stainless Steel [] with stamped letters; tag size minimum 1-1/2 inches (38 mm) diameter or square with smooth edges.
 - 3. Information Tags: Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches (83 x 143 mm) with grommet and self-locking nylon ties.
 - 4. Tag Chart: Typewritten letter size list in anodized aluminum frame and plastic laminated.
- C. Pipe Markers
 - 1. Color and Lettering: Conform to ASME A13.1.
 - 2. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.
 - 3. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings with flow direction.
 - 4. Plastic Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches (150 mm) wide by 4 mil (0.10 mm) thick, manufactured for direct burial service.



PART 3 - EXECUTION

NOTE TO SPECIFIER

THE FOLLOWING SYSTEMS NEED TO BE CUSTOMIZED AND/OR SELECTED FOR EACH PROJECT. SELECT THE APPLICABLE SYSTEM AND SUBMIT TO USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.

3.1 PLUMBING DEMOLITION

- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.



- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors.
- M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
 - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- Q. Verify final equipment locations for roughing-in.
- R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Braze Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.



- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 5. PVC Nonpressure Piping: Join according to ASTM D 2855.
 - 6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.



3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.6 INSTALLATION - PLUMBING IDENTIFICATION

- A. Install identifying devices after completion of coverings and painting.
- B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
- C. Install tags using corrosion resistant chain. Number tags consecutively by location.
- D. Install underground plastic pipe markers 6 to 8 inches (150 to 200 mm) below finished grade, directly above buried pipe.
- E. Identify plumbing equipment with plastic nameplates. Locate equipment labels where accessible and visible.
- F. Identify control panels and major control components outside panels with plastic nameplates.
- G. Identify valves in main and branch piping with tags.
- H. Identify piping, concealed or exposed, with plastic pipe markers and plastic tape pipe markers. Use tags on piping 3/4 inch (20 mm) diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.
- I. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.



5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of [50 feet (15 m)] <Insert dimension> along each run. Reduce intervals to [25 feet (7.6 m)] <Insert dimension> in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
8. Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

3.7 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 7. Use [**3000-psi**] <Insert other>, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "[**Cast-in-Place Concrete**] [**Miscellaneous Cast-in-Place Concrete**]."

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.9 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.10 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.



- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

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END OF SECTION



SECTION 22 05 00 00 - MPF COMMON WORK RESULTS FOR PLUMBING

NOTE TO SPECIFIER

*REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT AN APPROVED WRITTEN DEVIATION FROM USPS HEADQUARTERS SUBMITTED THROUGH THE CONTRACTING OFFICER.***

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.22 05 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Dielectric fittings.
 - 3. Mechanical sleeve seals.
 - 4. Sleeves.
 - 5. Escutcheons.
 - 6. Grout.
 - 7. Equipment installation requirements common to equipment sections.
 - 8. Plumbing identification.
 - 9. Concrete bases.
 - 10. Supports and anchorages.

1.2 DEFINITIONS

- A. Finished Spaces: Spaces other than plumbing and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and plumbing equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS

- A. Welding certificates.



1.4 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12.
- G. Solvent Cements for Joining Plastic Piping:
 - 1. ABS Piping: ASTM D 2235.
 - 2. CPVC Piping: ASTM F 493.
 - 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 4. PVC to ABS Piping Transition: ASTM D 3138.



2.3 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
- F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.4 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Sealing Elements: **[EPDM] [NBR] <Insert other>** interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- C. Pressure Plates: **[Plastic] [Carbon steel] [Stainless steel]**. Include two for each sealing element.
- D. Connecting Bolts and Nuts: **[Carbon steel with corrosion-resistant coating] [Stainless steel]** of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.



2.6 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: [Polished chrome-plated] [Rough brass] [Polished chrome-plated and rough brass].
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: [Polished chrome-plated] [Rough brass] [Polished chrome-plated and rough brass].

2.7 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.8 PLUMBING IDENTIFICATION

- A. Equipment Nameplates: Laminated three-layer plastic with engraved [black] [] letters on light contrasting background color.
- B. Tags
 - 1. Plastic Tags: Laminated three-layer plastic with engraved [black] [] letters on light contrasting background color. Tag size minimum 1-1/2 inches (38 mm) [diameter] [square] [].
 - 2. Metal Tags: Brass, Aluminum, or Stainless Steel [] with stamped letters; tag size minimum 1-1/2 inches (38 mm) diameter or square with smooth edges.
 - 3. Information Tags: Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches (83 x 143 mm) with grommet and self-locking nylon ties.
 - 4. Tag Chart: Typewritten letter size list in anodized aluminum frame and plastic laminated.
- C. Pipe Markers
 - 1. Color and Lettering: Conform to ASME A13.1.
 - 2. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.
 - 3. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings with flow direction.
 - 4. Plastic Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches (150 mm) wide by 4 mil (0.10 mm) thick, manufactured for direct burial service.



PART 3 - EXECUTION

NOTE TO SPECIFIER

THE FOLLOWING SYSTEMS NEED TO BE CUSTOMIZED AND/OR SELECTED FOR EACH PROJECT. SELECT THE APPLICABLE SYSTEM AND SUBMIT TO USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.

3.1 PLUMBING DEMOLITION

- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.



- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors.
- M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
 - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- Q. Verify final equipment locations for roughing-in.
- R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Braze Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.



- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 5. PVC Nonpressure Piping: Join according to ASTM D 2855.
 - 6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.



3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.6 INSTALLATION - PLUMBING IDENTIFICATION

- A. Install identifying devices after completion of coverings and painting.
- B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
- C. Install tags using corrosion resistant chain. Number tags consecutively by location.
- D. Install underground plastic pipe markers 6 to 8 inches (150 to 200 mm) below finished grade, directly above buried pipe.
- E. Identify plumbing equipment with plastic nameplates. Locate equipment labels where accessible and visible.
- F. Identify control panels and major control components outside panels with plastic nameplates.
- G. Identify valves in main and branch piping with tags.
- H. Identify piping, concealed or exposed, with plastic pipe markers and plastic tape pipe markers. Use tags on piping 3/4 inch (20 mm) diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.
- I. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.



5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of [50 feet (15 m)] <Insert dimension> along each run. Reduce intervals to [25 feet (7.6 m)] <Insert dimension> in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
8. Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

3.7 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 7. Use [**3000-psi**] <Insert other>, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "[**Cast-in-Place Concrete**] [**Miscellaneous Cast-in-Place Concrete**]."

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.9 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.10 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.



- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

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END OF SECTION



Task	Specification	Specification Description
22 05 19 00	01 22 16 00	No Specification Required
22 05 19 00	21 05 19 00	Meters and Gages for Plumbing Piping
22 05 19 00	21 05 19 00a	Meters and Gages for HVAC Piping



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SECTION 22 05 23 00 - PIPED UTILITIES BASIC MATERIALS AND METHODS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for piped utilities - basic materials and methods. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Piping joining materials.
 - b. Transition fittings.
 - c. Dielectric fittings.
 - d. Sleeves.
 - e. Identification devices.
 - f. Grout.
 - g. Flowable fill.
 - h. Piped utility demolition.
 - i. Piping system common requirements.
 - j. Equipment installation common requirements.
 - k. Painting.
 - l. Concrete bases.
 - m. Metal supports and anchorages.

C. Definitions

1. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.
2. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
3. ABS: Acrylonitrile-butadiene-styrene plastic.
4. CPVC: Chlorinated polyvinyl chloride plastic.
5. PE: Polyethylene plastic.
6. PVC: Polyvinyl chloride plastic.

D. Submittals

1. Product Data: For the following:
 - a. Dielectric fittings.
 - b. Identification devices.
2. Welding certificates.

E. Quality Assurance

1. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - a. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - b. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
3. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.



F. Delivery, Storage, And Handling

1. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
2. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.2 PRODUCTS

A. Piping Joining Materials

1. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - a. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness, unless otherwise indicated.
 - 1) Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - 2) Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - b. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
3. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
4. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
5. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
6. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
7. Solvent Cements for Joining Plastic Piping:
 - a. ABS Piping: ASTM D 2235.
 - b. CPVC Piping: ASTM F 493.
 - c. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - d. PVC to ABS Piping Transition: ASTM D 3138.
8. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

B. Transition Fittings

1. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
2. Transition Couplings NPS 1-1/2 (DN 40) and Smaller:
 - a. Underground Piping: Manufactured piping coupling or specified piping system fitting.
 - b. Aboveground Piping: Specified piping system fitting.
3. AWWA Transition Couplings NPS 2 (DN 50) and Larger:
 - a. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.
4. Plastic-to-Metal Transition Fittings:
 - a. Description: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint or threaded end.
5. Plastic-to-Metal Transition Unions:
 - a. Description: MSS SP-107, CPVC and PVC four-part union. Include brass or stainless-steel threaded end, solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.
6. Flexible Transition Couplings for Underground Nonpressure Drainage Piping:
 - a. Description: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.



C. Dielectric Fittings

1. Dielectric Fittings, General: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
2. Dielectric Unions:
 - a. Description: Factory fabricated, union, NPS 2 (DN 50) and smaller.
 - 1) Pressure Rating: 150 psig (1035 kPa) minimum **OR** 250 psig (1725 kPa), **as directed**, at 180 deg F (82 deg C).
 - 2) End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.
3. Dielectric Flanges:
 - a. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 (DN 65 to DN 100) and larger.
 - 1) Pressure Rating: 150 psig (1035 kPa) minimum **OR** 175 psig (1200 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - 2) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
4. Dielectric-Flange Kits:
 - a. Description: Nonconducting materials for field assembly of companion flanges, NPS 2-1/2 (DN 65) and larger.
 - 1) Pressure Rating: 150 psig (1035 kPa) minimum.
 - 2) Gasket: Neoprene or phenolic.
 - 3) Bolt Sleeves: Phenolic or polyethylene.
 - 4) Washers: Phenolic with steel backing washers.
5. Dielectric Couplings:
 - a. Description: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining, NPS 3 (DN 80) and smaller.
 - 1) Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
 - 2) End Connections: Threaded.
6. Dielectric Nipples:
 - a. Description: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining.
 - 1) Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
 - 2) End Connections: Threaded or grooved.

D. Sleeves

1. Mechanical sleeve seals for pipe penetrations are specified in Division 22 Section "Common Work Results For Plumbing".
2. Galvanized-Steel Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
3. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.
4. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
5. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.
6. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.
7. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

E. Identification Devices

1. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.
 - a. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
 - b. Location: Accessible and visible.
2. Stencils: Standard stencils prepared with letter sizes complying with recommendations in ASME A13.1. Minimum letter height is 1-1/4 inches (30 mm) for ducts, and 3/4 inch (20 mm) for access door signs and similar operational instructions.
 - a. Material: Fiberboard **OR** Brass, **as directed**.



- b. Stencil Paint: Exterior, oil-based, alkyd-gloss black enamel, unless otherwise indicated. Paint may be in pressurized spray-can form.
 - c. Identification Paint: Exterior, oil-based, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.
- 3. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.
- 4. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive-vinyl type with permanent adhesive.
- 5. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers, extending 360 degrees around pipe at each location.
- 6. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.
- 7. Lettering: Manufacturer's standard preprinted captions as selected by the Owner.
- 8. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
 - a. Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.
- 9. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils (0.08 mm) thick.
 - a. Width: 1-1/2 inches (40 mm) on pipes with OD, including insulation, less than 6 inches (150 mm); 2-1/2 inches (65 mm) for larger pipes.
 - b. Color: Comply with ASME A13.1, unless otherwise indicated.
- 10. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) sequenced numbers. Include 5/32-inch (4-mm) hole for fastener.
 - a. Material: 0.032-inch- (0.8-mm-) thick, polished brass **OR** aluminum, **as directed**.
 - b. Material: 0.0375-inch- (1-mm-) thick stainless steel.
 - c. Material: 3/32-inch- (2.4-mm-) thick plastic laminate with 2 black surfaces and a white inner layer.
 - d. Material: Valve manufacturer's standard solid plastic.
 - e. Size: 1-1/2 inches (40 mm) in diameter, unless otherwise indicated.
 - f. Shape: As indicated for each piping system.
- 11. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.
- 12. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
 - a. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
 - b. Thickness: 1/16 inch (1.6 mm), for units up to 20 sq. in. (130 sq. cm) or 8 inches (200 mm) in length, and 1/8 inch (3 mm) for larger units.
 - c. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.
- 13. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:
 - a. Green: Cooling equipment and components.
 - b. Yellow: Heating equipment and components.
 - c. Brown: Energy reclamation equipment and components.
 - d. Blue: Equipment and components that do not meet criteria above.
 - e. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
 - f. Terminology: Match schedules as closely as possible. Include the following:
 - 1) Name and plan number.
 - 2) Equipment service.
 - 3) Design capacity.
 - 4) Other design parameters such as pressure drop, entering and leaving conditions, and speed.



- g. Size: 2-1/2 by 4 inches (65 by 100 mm) for control devices, dampers, and valves; 4-1/2 by 6 inches (115 by 150 mm) for equipment.
 - 14. Plasticized Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.
 - a. Size: 3-1/4 by 5-5/8 inches (83 by 143 mm).
 - b. Fasteners: Brass grommets and wire.
 - c. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
 - 15. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in piped utility identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of piped utility systems and equipment.
 - a. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.
- F. Grout
- 1. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - a. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - c. Packaging: Premixed and factory packaged.
- G. Flowable Fill
- 1. Description: Low-strength-concrete, flowable-slurry mix.
 - a. Cement: ASTM C 150, Type I, portland.
 - b. Density: 115- to 145-lb/cu. ft. (1840- to 2325-kg/cu. m).
 - c. Aggregates: ASTM C 33, natural sand, fine and crushed gravel or stone, coarse
OR
Aggregates: ASTM C 33, natural sand, fine with admixture, ASTM C 618, fly-ash mineral.
 - d. Water: Comply with ASTM C 94/C 94M.
 - e. Strength: 100 to 200 psig (690 to 1380 kPa) at 28 days.

1.3 EXECUTION

- A. Piped Utility Demolition
- 1. Refer to Division 01 Section(s) "Cutting And Patching" AND Division 02 Section(s) "Selective Structure Demolition" for general demolition requirements and procedures.
 - 2. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - 3. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.
- B. Dielectric Fitting Applications
- 1. Dry Piping Systems: Connect piping of dissimilar metals with the following:
 - a. NPS 2 (DN 50) and Smaller: Dielectric unions.
 - b. NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Dielectric flanges or dielectric flange kits.



2. Wet Piping Systems: Connect piping of dissimilar metals with the following:
 - a. NPS 2 (DN 50) and Smaller: Dielectric couplings **OR** dielectric nipples, **as directed**.
 - b. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Dielectric nipples.
 - c. NPS 2-1/2 to NPS 8 (DN 65 to DN 200): Dielectric nipples or dielectric flange kits.
 - d. NPS 10 and NPS 12 (DN 250 and DN 300): Dielectric flange kits.

C. Piping Installation

1. Install piping according to the following requirements and Division 33 specifying piping systems.
2. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.
3. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
4. Install piping to permit valve servicing.
5. Install piping at indicated slopes.
6. Install piping free of sags and bends.
7. Install fittings for changes in direction and branch connections.
8. Select system components with pressure rating equal to or greater than system operating pressure.
9. Sleeves are not required for core-drilled holes, unless directed otherwise.
10. Permanent sleeves are not required for holes formed by removable PE sleeves, unless directed otherwise.
11. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
 - a. Cut sleeves to length for mounting flush with both surfaces.
 - 1) Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches (50 mm) above finished floor level.
 - b. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - 1) PVC **OR** Steel, **as directed**, Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
 - 2) Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
12. Verify final equipment locations for roughing-in.
13. Refer to equipment specifications in other Sections for roughing-in requirements.

D. Piping Joint Construction

1. Join pipe and fittings according to the following requirements and Division 33 specifying piping systems.
2. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
3. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
4. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
5. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1.1 "Quality Assurance" Article.
6. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
7. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.



8. Soldered Joints: Apply ASTM B 813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.
 9. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
 10. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.
 11. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
 - c. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - d. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - e. PVC Nonpressure Piping: Join according to ASTM D 2855.
 - f. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
 12. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
 13. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
 14. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - a. Plain-End PE Pipe and Fittings: Use butt fusion.
 - b. Plain-End PE Pipe and Socket Fittings: Use socket fusion.
 15. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.
- E. Piping Connections
1. Make connections according to the following, unless otherwise indicated:
 - a. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - b. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - c. Install dielectric fittings at connections of dissimilar metal pipes.
- F. Equipment Installation
1. Install equipment level and plumb, unless otherwise indicated.
 2. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.
 3. Install equipment to allow right of way to piping systems installed at required slope.
- G. Painting
1. Painting of piped utility systems, equipment, and components is specified in Division 09.
 2. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.
- H. Identification
1. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
 - a. Stenciled Markers: According to ASME A13.1.
 - b. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
 - c. Locate pipe markers on exposed piping according to the following:
 - 1) Near each valve and control device.



- 2) Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
- 3) Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
- 4) At manholes and similar access points that permit view of concealed piping.
- 5) Near major equipment items and other points of origination and termination.
2. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.
 - a. Lettering Size: Minimum 1/4 inch (6.4 mm) high for name of unit if viewing distance is less than 24 inches (610 mm), 1/2 inch (13 mm) high for distances up to 72 inches (1800 mm), and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
 - b. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
3. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

I. Concrete Bases

1. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - a. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of base.
 - c. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - f. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - g. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-place Concrete".

J. Erection Of Metal Supports And Anchorages

1. Refer to Division 05 Section "Metal Fabrications" for structural steel.
2. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.
3. Field Welding: Comply with AWS D1.1/D1.1M.

K. Grouting

1. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.
2. Clean surfaces that will come into contact with grout.
3. Provide forms as required for placement of grout.
4. Avoid air entrapment during placement of grout.
5. Place grout, completely filling equipment bases.
6. Place grout on concrete bases and provide smooth bearing surface for equipment.
7. Place grout around anchors.
8. Cure placed grout.

END OF SECTION 22 05 23 00



SECTION 22 05 23 00a - GENERAL-DUTY VALVES FOR PLUMBING PIPING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of general-duty valves for plumbing piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Bronze angle valves.
 - b. Brass ball valves.
 - c. Bronze ball valves.
 - d. Iron ball valves.
 - e. Iron, single-flange butterfly valves.
 - f. Iron, grooved-end butterfly valves.
 - g. Bronze lift check valves.
 - h. Bronze swing check valves.
 - i. Iron swing check valves.
 - j. Iron swing check valves with closure control.
 - k. Iron, grooved-end swing check valves.
 - l. Iron, center-guided check valves.
 - m. Iron, plate-type check valves.
 - n. Bronze gate valves.
 - o. Iron gate valves.
 - p. Bronze globe valves.
 - q. Iron globe valves.
 - r. Lubricated plug valves.
 - s. Chainwheels.

C. Definitions

1. CWP: Cold working pressure.
2. EPDM: Ethylene propylene copolymer rubber.
3. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
4. NRS: Nonrising stem.
5. OS&Y: Outside screw and yoke.
6. RS: Rising stem.
7. SWP: Steam working pressure.

D. Submittals

1. Product Data: For each type of valve indicated.

E. Quality Assurance

1. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
2. ASME Compliance:
 - a. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - b. ASME B31.1 for power piping valves.
 - c. ASME B31.9 for building services piping valves.
3. NSF Compliance: NSF 61 for valve materials for potable-water service.

F. Delivery, Storage, And Handling



1. Prepare valves for shipping as follows:
 - a. Protect internal parts against rust and corrosion.
 - b. Protect threads, flange faces, grooves, and weld ends.
 - c. Set angle, gate, and globe valves closed to prevent rattling.
 - d. Set ball and plug valves open to minimize exposure of functional surfaces.
 - e. Set butterfly valves closed or slightly open.
 - f. Block check valves in either closed or open position.
2. Use the following precautions during storage:
 - a. Maintain valve end protection.
 - b. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
3. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

1.2 PRODUCTS

A. General Requirements For Valves

1. Refer to valve schedule articles for applications of valves.
2. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
3. Valve Sizes: Same as upstream piping unless otherwise indicated.
4. Valve Actuator Types:
 - a. Gear Actuator: For quarter-turn valves NPS 8 (DN 200) and larger.
 - b. Handwheel: For valves other than quarter-turn types.
 - c. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller except plug valves, **as directed**.
 - d. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 5 **OR** 10, **as directed**, plug valves, for each size square plug-valve head.
 - e. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
5. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:
 - a. Gate Valves: With rising stem.
 - b. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 - c. Butterfly Valves: With extended neck.
6. Valve-End Connections:
 - a. Flanged: With flanges according to ASME B16.1 for iron valves.
 - b. Grooved: With grooves according to AWWA C606.
 - c. Solder Joint: With sockets according to ASME B16.18.
 - d. Threaded: With threads according to ASME B1.20.1.
7. Valve Bypass and Drain Connections: MSS SP-45.

B. Bronze Angle Valves

1. Class 125, Bronze Angle Valves with Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 1.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - 4) Ends: Threaded.
 - 5) Stem and Disc: Bronze.
 - 6) Packing: Asbestos free.
 - 7) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
2. Class 125, Bronze Angle Valves with Nonmetallic Disc:



- a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - 4) Ends: Threaded.
 - 5) Stem: Bronze.
 - 6) Disc: PTFE or TFE.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
 3. Class 150, Bronze Angle Valves with Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 1.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - 4) Ends: Threaded.
 - 5) Stem and Disc: Bronze.
 - 6) Packing: Asbestos free.
 - 7) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
 4. Class 150, Bronze Angle Valves with Nonmetallic Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - 4) Ends: Threaded.
 - 5) Stem: Bronze.
 - 6) Disc: PTFE or TFE.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
- C. Brass Ball Valves
 1. One-Piece, Reduced-Port, Brass Ball Valves with Brass Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) CWP Rating: 400 psig (2760 kPa).
 - 3) Body Design: One piece.
 - 4) Body Material: Forged brass.
 - 5) Ends: Threaded.
 - 6) Seats: PTFE or TFE.
 - 7) Stem: Brass.
 - 8) Ball: Chrome-plated brass.
 - 9) Port: Reduced.
 2. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Forged brass.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Brass.
 - 9) Ball: Chrome-plated brass.
 - 10) Port: Full.
 3. Two-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.

- 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Forged brass.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Stainless steel.
 - 9) Ball: Stainless steel, vented.
 - 10) Port: Full.
4. Two-Piece, Regular-Port, Brass Ball Valves with Brass Trim:
- a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Forged brass.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Brass.
 - 9) Ball: Chrome-plated brass.
 - 10) Port: Regular.
5. Two-Piece, Regular-Port, Brass Ball Valves with Stainless-Steel Trim:
- a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Brass or bronze.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Stainless steel.
 - 9) Ball: Stainless steel, vented.
 - 10) Port: Regular.
6. Three-Piece, Full-Port, Brass Ball Valves with Brass Trim:
- a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Three piece.
 - 5) Body Material: Forged brass.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Brass.
 - 9) Ball: Chrome-plated brass.
 - 10) Port: Full.
7. Three-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:
- a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Three piece.
 - 5) Body Material: Forged brass.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Stainless steel.



- 9) Ball: Stainless steel, vented.
- 10) Port: Full.

D. Bronze Ball Valves

1. One-Piece, Reduced-Port, Bronze Ball Valves with Bronze Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) CWP Rating: 400 psig (2760 kPa).
 - 3) Body Design: One piece.
 - 4) Body Material: Bronze.
 - 5) Ends: Threaded.
 - 6) Seats: PTFE or TFE.
 - 7) Stem: Bronze.
 - 8) Ball: Chrome-plated brass.
 - 9) Port: Reduced.
2. One-Piece, Reduced-Port, Bronze Ball Valves with Stainless-Steel Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) CWP Rating: 600 psig (4140 kPa).
 - 3) Body Design: One piece.
 - 4) Body Material: Bronze.
 - 5) Ends: Threaded.
 - 6) Seats: PTFE or TFE.
 - 7) Stem: Stainless steel.
 - 8) Ball: Stainless steel, vented.
 - 9) Port: Reduced.
3. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Bronze.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Bronze.
 - 9) Ball: Chrome-plated brass.
 - 10) Port: Full.
4. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Bronze.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Stainless steel.
 - 9) Ball: Stainless steel, vented.
 - 10) Port: Full.
5. Two-Piece, Regular-Port, Bronze Ball Valves with Bronze Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.



- 5) Body Material: Bronze.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Bronze.
 - 9) Ball: Chrome-plated brass.
 - 10) Port: Regular.
6. Two-Piece, Regular-Port, Bronze Ball Valves with Stainless-Steel Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Bronze.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Stainless steel.
 - 9) Ball: Stainless steel, vented.
 - 10) Port: Regular.
 7. Three-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Three piece.
 - 5) Body Material: Bronze.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Bronze.
 - 9) Ball: Chrome-plated brass.
 - 10) Port: Full.
 8. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Three piece.
 - 5) Body Material: Bronze.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Stainless steel.
 - 9) Ball: Stainless steel, vented.
 - 10) Port: Full.

E. Iron Ball Valves

1. Class 125, Iron Ball Valves:
 - a. Description:
 - 1) Standard: MSS SP-72.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Split body.
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Ends: Flanged.
 - 6) Seats: PTFE or TFE.
 - 7) Stem: Stainless steel.
 - 8) Ball: Stainless steel.
 - 9) Port: Full.



F. Iron, Single-Flange Butterfly Valves

1. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: EPDM.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Aluminum bronze.
2. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Aluminum-Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: NBR.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Aluminum bronze.
3. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Ductile-Iron Disc:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: EPDM.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Nickel-plated or -coated, **as directed**, ductile iron.
4. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Ductile-Iron Disc:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: NBR.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Nickel-plated or -coated, **as directed**, ductile iron.
5. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Stainless-Steel Disc:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: EPDM.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Stainless steel.
6. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Stainless-Steel Disc:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).



- 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- 5) Seat: NBR.
- 6) Stem: One- or two-piece stainless steel.
- 7) Disc: Stainless steel.

G. Iron, Grooved-End Butterfly Valves

1. 175 CWP, Iron, Grooved-End Butterfly Valves:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 175 psig (1200 kPa).
 - 3) Body Material: Coated, ductile iron.
 - 4) Stem: Two-piece stainless steel.
 - 5) Disc: Coated, ductile iron.
 - 6) Seal: EPDM.
2. 300 CWP, Iron, Grooved-End Butterfly Valves:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) NPS 8 (DN 200) and Smaller CWP Rating: 300 psig (2070 kPa).
 - 3) NPS 10 (DN 250) and Larger CWP Rating: 200 psig (1380 kPa).
 - 4) Body Material: Coated, ductile iron.
 - 5) Stem: Two-piece stainless steel.
 - 6) Disc: Coated, ductile iron.
 - 7) Seal: EPDM.

H. Bronze Lift Check Valves

1. Class 125, Lift Check Valves with Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 1.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Vertical flow.
 - 4) Body Material: ASTM B 61 or ASTM B 62, bronze.
 - 5) Ends: Threaded.
 - 6) Disc: Bronze.
2. Class 125, Lift Check Valves with Nonmetallic Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Vertical flow.
 - 4) Body Material: ASTM B 61 or ASTM B 62, bronze.
 - 5) Ends: Threaded.
 - 6) Disc: NBR, PTFE, or TFE.

I. Bronze Swing Check Valves

1. Class 125, Bronze Swing Check Valves with Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 3.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Horizontal flow.
 - 4) Body Material: ASTM B 62, bronze.
 - 5) Ends: Threaded.
 - 6) Disc: Bronze.
2. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:
 - a. Description:



- 1) Standard: MSS SP-80, Type 4.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Horizontal flow.
 - 4) Body Material: ASTM B 62, bronze.
 - 5) Ends: Threaded.
 - 6) Disc: PTFE or TFE.
3. Class 150, Bronze Swing Check Valves with Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 3.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Design: Horizontal flow.
 - 4) Body Material: ASTM B 62, bronze.
 - 5) Ends: Threaded.
 - 6) Disc: Bronze.
 4. Class 150, Bronze Swing Check Valves with Nonmetallic Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 4.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Design: Horizontal flow.
 - 4) Body Material: ASTM B 62, bronze.
 - 5) Ends: Threaded.
 - 6) Disc: PTFE or TFE.
- J. Iron Swing Check Valves
1. Class 125, Iron Swing Check Valves with Metal Seats:
 - a. Description:
 - 1) Standard: MSS SP-71, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Clear or full waterway.
 - 4) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 5) Ends: Flanged.
 - 6) Trim: Bronze.
 - 7) Gasket: Asbestos free.
 2. Class 125, Iron Swing Check Valves with Nonmetallic-to-Metal Seats:
 - a. Description:
 - 1) Standard: MSS SP-71, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Clear or full waterway.
 - 4) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 5) Ends: Flanged.
 - 6) Trim: Composition.
 - 7) Seat Ring: Bronze.
 - 8) Disc Holder: Bronze.
 - 9) Disc: PTFE or TFE.
 - 10) Gasket: Asbestos free.
 3. Class 250, Iron Swing Check Valves with Metal Seats:
 - a. Description:
 - 1) Standard: MSS SP-71, Type I.
 - 2) CWP Rating: 500 psig (3450 kPa).
 - 3) Body Design: Clear or full waterway.
 - 4) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 5) Ends: Flanged.
 - 6) Trim: Bronze.
 - 7) Gasket: Asbestos free.
- K. Iron Swing Check Valves With Closure Control



1. Class 125, Iron Swing Check Valves with Lever- and Spring-Closure Control:
 - a. Description:
 - 1) Standard: MSS SP-71, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Clear or full waterway.
 - 4) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 5) Ends: Flanged.
 - 6) Trim: Bronze.
 - 7) Gasket: Asbestos free.
 - 8) Closure Control: Factory-installed, exterior lever and spring.
 2. Class 125, Iron Swing Check Valves with Lever- and Weight-Closure Control:
 - a. Description:
 - 1) Standard: MSS SP-71, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Clear or full waterway.
 - 4) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 5) Ends: Flanged.
 - 6) Trim: Bronze.
 - 7) Gasket: Asbestos free.
 - 8) Closure Control: Factory-installed, exterior lever and weight.
- L. Iron, Grooved-End Swing Check Valves
1. 300 CWP, Iron, Grooved-End Swing Check Valves:
 - a. Description:
 - 1) CWP Rating: 300 psig (2070 kPa).
 - 2) Body Material: ASTM A 536, ductile iron.
 - 3) Seal: EPDM.
 - 4) Disc: Spring-operated, ductile iron or stainless steel.
- M. Iron, Center-Guided Check Valves
1. Class 125, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM A 126, gray iron.
 - 4) Style: Compact wafer.
 - 5) Seat: Bronze.
 2. Class 125, Iron, Globe, Center-Guided Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM A 126, gray iron.
 - 4) Style: Globe, spring loaded.
 - 5) Ends: Flanged.
 - 6) Seat: Bronze.
 3. Class 150, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 4) Style: Compact wafer.
 - 5) Seat: Bronze.
 4. Class 150, Iron, Globe, Center-Guided Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.



- 2) CWP Rating: 300 psig (2070 kPa).
- 3) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
- 4) Style: Globe, spring loaded.
- 5) Ends: Flanged.
- 6) Seat: Bronze.
5. Class 250, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) CWP Rating: 400 psig (2760 kPa).
 - 3) Body Material: ASTM A 126, gray iron.
 - 4) Style: Compact wafer, spring loaded.
 - 5) Seat: Bronze.
6. Class 250, Iron, Globe, Center-Guided Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) CWP Rating: 400 psig (2760 kPa).
 - 3) Body Material: ASTM A 126, gray iron.
 - 4) Style: Globe, spring loaded.
 - 5) Ends: Flanged.
 - 6) Seat: Bronze.
7. Class 300, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) CWP Rating: 500 psig (3450 kPa).
 - 3) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 4) Style: Compact wafer, spring loaded.
 - 5) Seat: Bronze.
8. Class 300, Iron, Globe, Center-Guided Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) CWP Rating: 500 psig (3450 kPa).
 - 3) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 4) Style: Globe, spring loaded.
 - 5) Ends: Flanged.
 - 6) Seat: Bronze.
9. Class 125, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM A 126, gray iron.
 - 4) Style: Compact wafer.
 - 5) Seat: EPDM **OR** NBR, **as directed**.
10. Class 125, Iron, Globe, Center-Guided Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM A 126, gray iron.
 - 4) Style: Globe, spring loaded.
 - 5) Ends: Flanged.
 - 6) Seat: EPDM **OR** NBR, **as directed**.
11. Class 150, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 4) Style: Compact wafer.

- 5) Seat: EPDM **OR** NBR, **as directed**.
12. Class 150, Iron, Globe, Center-Guided Check Valves with Resilient Seat:
- a. Description:
- 1) Standard: MSS SP-125.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 4) Style: Globe, spring loaded.
 - 5) Ends: Flanged.
 - 6) Seat: EPDM **OR** NBR, **as directed**.
13. Class 250, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:
- a. Description:
- 1) Standard: MSS SP-125.
 - 2) CWP Rating: 400 psig (2760 kPa).
 - 3) Body Material: ASTM A 126, gray iron.
 - 4) Style: Compact wafer, spring loaded.
 - 5) Seat: EPDM **OR** NBR, **as directed**.
14. Class 250, Iron, Globe, Center-Guided Check Valves with Resilient Seat:
- a. Description:
- 1) Standard: MSS SP-125.
 - 2) CWP Rating: 400 psig (2760 kPa).
 - 3) Body Material: ASTM A 126, gray iron.
 - 4) Style: Globe, spring loaded.
 - 5) Ends: Flanged.
 - 6) Seat: EPDM **OR** NBR, **as directed**.
15. Class 300, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:
- a. Description:
- 1) Standard: MSS SP-125.
 - 2) CWP Rating: 500 psig (3450 kPa).
 - 3) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 4) Style: Compact wafer, spring loaded.
 - 5) Seat: EPDM **OR** NBR, **as directed**.
16. Class 300, Iron, Globe, Center-Guided Check Valves with Resilient Seat:
- a. Description:
- 1) Standard: MSS SP-125.
 - 2) CWP Rating: 500 psig (3450 kPa).
 - 3) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 4) Style: Globe, spring loaded.
 - 5) Ends: Flanged.
 - 6) Seat: EPDM **OR** NBR, **as directed**.

N. Iron, Plate-Type Check Valves

1. Class 125, Iron, Dual-Plate Check Valves with Metal Seat:
- a. Description:
- 1) Standard: API 594.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Wafer, spring-loaded plates.
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Seat: Bronze.
2. Class 150, Iron, Dual-Plate Check Valves with Metal Seat:
- a. Description:
- 1) Standard: API 594.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Design: Wafer, spring-loaded plates.
 - 4) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 5) Seat: Bronze.



3. Class 250, Iron, Dual-Plate Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: API 594.
 - 2) CWP Rating: 400 psig (2760 kPa).
 - 3) Body Design: Wafer, spring-loaded plates.
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Seat: Bronze.
4. Class 300, Iron, Dual-Plate Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: API 594.
 - 2) CWP Rating: 500 psig (3450 kPa).
 - 3) Body Design: Wafer, spring-loaded plates.
 - 4) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 5) Seat: Bronze.
5. Class 125, Iron, Single-Plate Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: API 594.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Wafer, spring-loaded plate.
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Seat: EPDM **OR** NBR, **as directed**.
6. Class 125, Iron, Dual-Plate Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: API 594.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Wafer, spring-loaded plates.
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Seat: EPDM **OR** NBR, **as directed**.
7. Class 150, Iron, Dual-Plate Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: API 594.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Design: Wafer, spring-loaded plates.
 - 4) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 5) Seat: EPDM **OR** NBR, **as directed**.
8. Class 250, Iron, Wafer, Single-Plate Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: API 594.
 - 2) CWP Rating: 400 psig (2760 kPa).
 - 3) Body Design: Wafer, spring-loaded plate.
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Seat: EPDM **OR** NBR, **as directed**.
9. Class 250, Iron, Dual-Plate Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: API 594.
 - 2) CWP Rating: 400 psig (2760 kPa).
 - 3) Body Design: Wafer, spring-loaded plates.
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Seat: EPDM **OR** NBR, **as directed**.
10. Class 300, Iron, Dual-Plate Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: API 594.
 - 2) CWP Rating: 500 psig (3450 kPa).
 - 3) Body Design: Wafer, spring-loaded plates.
 - 4) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 5) Seat: EPDM **OR** NBR, **as directed**.

O. Bronze Gate Valves

1. Class 125, NRS Bronze Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 1.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - 4) Ends: Threaded or solder joint, **as directed**.
 - 5) Stem: Bronze.
 - 6) Disc: Solid wedge; bronze.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
2. Class 125, RS Bronze Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - 4) Ends: Threaded or solder joint, **as directed**.
 - 5) Stem: Bronze.
 - 6) Disc: Solid wedge; bronze.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
3. Class 150, NRS Bronze Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 1.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - 4) Ends: Threaded.
 - 5) Stem: Bronze.
 - 6) Disc: Solid wedge; bronze.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
4. Class 150, RS Bronze Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - 4) Ends: Threaded.
 - 5) Stem: Bronze.
 - 6) Disc: Solid wedge; bronze.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.

P. Iron Gate Valves

1. Class 125, NRS, Iron Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-70, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 4) Ends: Flanged.
 - 5) Trim: Bronze.
 - 6) Disc: Solid wedge.
 - 7) Packing and Gasket: Asbestos free.
2. Class 125, OS&Y, Iron Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-70, Type I.



- 2) CWP Rating: 200 psig (1380 kPa).
- 3) Body Material: ASTM A 126, gray iron with bolted bonnet.
- 4) Ends: Flanged.
- 5) Trim: Bronze.
- 6) Disc: Solid wedge.
- 7) Packing and Gasket: Asbestos free.
3. Class 250, NRS, Iron Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-70, Type I.
 - 2) CWP Rating: 500 psig (3450 kPa).
 - 3) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 4) Ends: Flanged.
 - 5) Trim: Bronze.
 - 6) Disc: Solid wedge.
 - 7) Packing and Gasket: Asbestos free.
4. Class 250, OS&Y, Iron Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-70, Type I.
 - 2) CWP Rating: 500 psig (3450 kPa).
 - 3) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 4) Ends: Flanged.
 - 5) Trim: Bronze.
 - 6) Disc: Solid wedge.
 - 7) Packing and Gasket: Asbestos free.

Q. Bronze Globe Valves

1. Class 125, Bronze Globe Valves with Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 1.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - 4) Ends: Threaded or solder joint, **as directed**.
 - 5) Stem and Disc: Bronze.
 - 6) Packing: Asbestos free.
 - 7) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
2. Class 125, Bronze Globe Valves with Nonmetallic Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - 4) Ends: Threaded or solder joint, **as directed**.
 - 5) Stem: Bronze.
 - 6) Disc: PTFE or TFE.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
3. Class 150, Bronze Globe Valves with Nonmetallic Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - 4) Ends: Threaded.
 - 5) Stem: Bronze.
 - 6) Disc: PTFE or TFE.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.

R. Iron Globe Valves

1. Class 125, Iron Globe Valves:
 - a. Description:
 - 1) Standard: MSS SP-85, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 4) Ends: Flanged.
 - 5) Trim: Bronze.
 - 6) Packing and Gasket: Asbestos free.
2. Class 250, Iron Globe Valves:
 - a. Description:
 - 1) Standard: MSS SP-85, Type I.
 - 2) CWP Rating: 500 psig (3450 kPa).
 - 3) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 4) Ends: Flanged.
 - 5) Trim: Bronze.
 - 6) Packing and Gasket: Asbestos free.

S. Lubricated Plug Valves

1. Class 125, Regular-Gland, Lubricated Plug Valves with Threaded Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type II.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - 4) Pattern: Regular or short **OR** Venturi, **as directed**.
 - 5) Plug: Cast iron or bronze with sealant groove.
2. Class 125, Regular-Gland, Lubricated Plug Valves with Flanged Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type II.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - 4) Pattern: Regular or short **OR** Venturi, **as directed**.
 - 5) Plug: Cast iron or bronze with sealant groove.
3. Class 125, Cylindrical, Lubricated Plug Valves with Threaded Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type IV.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - 4) Pattern: Regular or short **OR** Venturi, **as directed**.
 - 5) Plug: Cast iron or bronze with sealant groove.
4. Class 125, Cylindrical, Lubricated Plug Valves with Flanged Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type IV.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - 4) Pattern: Regular or short **OR** Venturi, **as directed**.
 - 5) Plug: Cast iron or bronze with sealant groove.
5. Class 250, Regular-Gland, Lubricated Plug Valves with Threaded Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type II.
 - 2) CWP Rating: 400 psig (2760 kPa).



- 3) Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - 4) Pattern: Regular or short **OR** Venturi, **as directed**.
 - 5) Plug: Cast iron or bronze with sealant groove.
- 6. Class 250, Regular-Gland, Lubricated Plug Valves with Flanged Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type II.
 - 2) CWP Rating: 400 psig (2760 kPa).
 - 3) Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - 4) Pattern: Regular or short **OR** Venturi, **as directed**.
 - 5) Plug: Cast iron or bronze with sealant groove.
- 7. Class 250, Cylindrical, Lubricated Plug Valves with Threaded Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type IV.
 - 2) CWP Rating: 400 psig (2760 kPa).
 - 3) Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - 4) Pattern: Regular or short **OR** Venturi, **as directed**.
 - 5) Plug: Cast iron or bronze with sealant groove.
- 8. Class 250, Cylindrical, Lubricated Plug Valves with Flanged Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type IV.
 - 2) CWP Rating: 400 psig (2760 kPa).
 - 3) Body Material: ASTM A 48/A 48M or ASTM A 126, Grade 40 cast iron with lubrication-sealing system.
 - 4) Pattern: Regular or short **OR** Venturi, **as directed**.
 - 5) Plug: Cast iron or bronze with sealant groove.

T. Chainwheels

- 1. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
 - a. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
 - b. Attachment: For connection to ball **OR** butterfly **OR** plug, **as directed**, valve stems.
 - c. Sprocket Rim with Chain Guides: Ductile iron **OR** Cast iron **OR** Aluminum **OR** Bronze, **as directed**, of type and size required for valve. Include zinc coating, **as directed**.
 - d. Chain: Hot-dip, galvanized steel **OR** Brass **OR** Stainless steel, **as directed**, of size required to fit sprocket rim.

1.3 EXECUTION

A. Valve Installation

- 1. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- 2. Locate valves for easy access and provide separate support where necessary.
- 3. Install valves in horizontal piping with stem at or above center of pipe.
- 4. Install valves in position to allow full stem movement.
- 5. Install chainwheels on operators for ball **OR** butterfly **OR** gate **OR** globe **OR** plug, **as directed**, valves NPS 4 (DN 100) and larger and more than 96 inches (2400 mm) above floor. Extend chains to 60 inches (1520 mm) above finished floor.
- 6. Install check valves for proper direction of flow and as follows:
 - a. Swing Check Valves: In horizontal position with hinge pin level.
 - b. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.
 - c. Lift Check Valves: With stem upright and plumb.



- B. Adjusting
1. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.
- C. General Requirements For Valve Applications
1. If valve applications are not indicated, use the following:
 - a. Shutoff Service: Ball **OR** butterfly **OR** gate **OR** plug, **as directed**, valves.
 - b. Butterfly Valve Dead-End Service: Single-flange (lug) type.
 - c. Throttling Service: Globe **OR** angle **OR** ball **OR** butterfly, **as directed**, valves.
 - d. Pump-Discharge Check Valves:
 - 1) NPS 2 (DN 50) and Smaller: Bronze swing check valves with bronze **OR** nonmetallic, **as directed**, disc.
 - 2) NPS 2-1/2 (DN 65) and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring or iron, center-guided, metal **OR** resilient, **as directed**, -seat check valves.
 - 3) NPS 2-1/2 (DN 65) and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
 2. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
 3. Select valves, except wafer types, with the following end connections:
 - a. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - b. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - c. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
 - d. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
 - e. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - f. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.
 - g. For Grooved-End Copper Tubing and Steel Piping: Valve ends may be grooved.
- D. Low-Pressure, Compressed-Air Valve Schedule (150 psig (1035 kPa) Or Less)
1. Pipe NPS 2 (DN 50) and Smaller:
 - a. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - b. Ball Valves: One **OR** Two **OR** Three, **as directed**, piece, full **OR** regular **OR** reduced, **as directed**, port, brass **OR** bronze, **as directed**, with brass **OR** bronze **OR** stainless-steel, **as directed**, trim.
 - c. Bronze Lift Check Valves: Class 125, bronze **OR** nonmetallic, **as directed**, disc.
 - d. Bronze Swing Check Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - e. Bronze Gate Valves: Class 125 **OR** Class 150, **as directed**, NRS **OR** RS, **as directed**.
 2. Pipe NPS 2-1/2 (DN 65) and Larger:
 - a. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
 - b. Iron, Single-Flange Butterfly Valves: 200 CWP, NBR seat, aluminum-bronze **OR** ductile-iron **OR** stainless-steel, **as directed**, disc.
 - c. Iron, Grooved-End Butterfly Valves: 175 **OR** 300, **as directed**, CWP.
 - d. Iron Swing Check Valves: Class 125 **OR** Class 250, **as directed**, metal **OR** nonmetallic-to-metal, **as directed**, seats.
 - e. Iron, Grooved-End Swing Check Valves: 300 CWP.
 - f. Iron, Center-Guided Check Valves: Class 125 **OR** Class 150 **OR** Class 250 **OR** Class 300, **as directed**, compact-wafer **OR** globe, **as directed**, metal **OR** resilient, **as directed**, seat.
 - g. Iron, Plate-Type Check Valves: Class 125 **OR** Class 150 **OR** Class 250 **OR** Class 300, **as directed**; single **OR** dual, **as directed**, plate; metal **OR** resilient, **as directed**, seat.



- h. Iron Gate Valves: Class 125 **OR** Class 250, **as directed**, NRS **OR** OS&Y, **as directed**.
- E. High-Pressure, Compressed-Air Valve Schedule (150 to 200 psig (1035 to 1380 kPa))
- 1. Pipe NPS 2 (DN 50) and Smaller:
 - a. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - b. Ball Valves: One **OR** Two **OR** Three, **as directed**, piece, full **OR** regular **OR** reduced, **as directed**, port, brass **OR** bronze, **as directed**, with brass **OR** bronze **OR** stainless-steel, **as directed**, trim.
 - c. Bronze Lift Check Valves: Class 125, bronze **OR** nonmetallic, **as directed**, disc.
 - d. Bronze Swing Check Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - e. Bronze Gate Valves: Class 125 **OR** Class 150, **as directed**, NRS **OR** RS, **as directed**.
 - 2. Pipe NPS 2-1/2 (DN 65) and Larger:
 - a. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
 - b. Iron, Single-Flange Butterfly Valves: 200 CWP, NBR seat, aluminum-bronze **OR** ductile-iron **OR** stainless-steel, **as directed**, disc.
 - c. Iron, Grooved-End Butterfly Valves: 175 **OR** 300, **as directed**, CWP.
 - d. Iron Swing Check Valves: Class 125 **OR** Class 250, **as directed**, metal **OR** nonmetallic-to-metal, **as directed**, seats.
 - e. Iron, Grooved-End Swing Check Valves: 300 CWP.
 - f. Iron, Center-Guided Check Valves: Class 125 **OR** Class 150 **OR** Class 250 **OR** Class 300, **as directed**, compact-wafer **OR** globe, **as directed**, metal **OR** resilient, **as directed**, seat.
 - g. Iron, Plate-Type Check Valves: Class 125 **OR** Class 150 **OR** Class 250 **OR** Class 300, **as directed**; single **OR** dual, **as directed**, plate; metal **OR** resilient, **as directed**, seat.
 - h. Iron Gate Valves: Class 125 **OR** Class 250, **as directed**, NRS **OR** OS&Y, **as directed**.
- F. Domestic, Hot- And Cold-Water Valve Schedule
- 1. Pipe NPS 2 (DN 50) and Smaller:
 - a. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - b. Bronze Angle Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - c. Ball Valves: One **OR** Two **OR** Three, **as directed**, piece, full **OR** regular **OR** reduced, **as directed**, port, brass **OR** bronze, **as directed**, with brass **OR** bronze **OR** stainless-steel, **as directed**, trim.
 - d. Bronze Swing Check Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - e. Bronze Gate Valves: Class 125 **OR** Class 150, **as directed**, NRS **OR** RS, **as directed**.
 - f. Bronze Globe Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - 2. Pipe NPS 2-1/2 (DN 65) and Larger:
 - a. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
 - b. Iron Ball Valves: Class 150.
 - c. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM **OR** NBR, **as directed**, seat, aluminum-bronze **OR** ductile-iron **OR** stainless-steel, **as directed**, disc.
 - d. Iron, Grooved-End Butterfly Valves: 175 **OR** 300, **as directed**, CWP.
 - e. Iron Swing Check Valves: Class 125 **OR** Class 250, **as directed**, metal **OR** nonmetallic-to-metal, **as directed**, seats.
 - f. Iron Swing Check Valves with Closure Control: Class 125, lever and spring **OR** weight, **as directed**.
 - g. Iron, Grooved-End Swing Check Valves: 300 CWP.
 - h. Iron, Center-Guided Check Valves: Class 125 **OR** Class 150 **OR** Class 250 **OR** Class 300, **as directed**, compact-wafer **OR** globe, **as directed**, metal **OR** resilient, **as directed**, seat.



- i. Iron, Plate-Type Check Valves: Class 125 **OR** Class 150 **OR** Class 250 **OR** Class 300, **as directed**; single **OR** dual, **as directed**, plate; metal **OR** resilient, **as directed**, seat.
- j. Iron Gate Valves: Class 125 **OR** Class 250, **as directed**, NRS **OR** OS&Y, **as directed**.
- k. Iron Globe Valves: Class 125 **OR** Class 250, **as directed**.

G. Sanitary-Waste And Storm-Drainage Valve Schedule

- 1. Pipe NPS 2 (DN 50) and Smaller:
 - a. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - b. Bronze Angle Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic **OR** stainless-steel, **as directed**, disc.
 - c. Ball Valves: One **OR** Two **OR** Three, **as directed**, piece, full **OR** regular **OR** reduced, **as directed**, port, brass **OR** bronze, **as directed**, with brass **OR** bronze **OR** stainless-steel, **as directed**, trim.
 - d. Bronze Swing Check Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - e. Bronze Gate Valves: Class 125 **OR** Class 150, **as directed**, NRS **OR** RS, **as directed**.
 - f. Bronze Globe Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
- 2. Pipe NPS 2-1/2 (DN 65) and Larger:
 - a. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
 - b. Iron Ball Valves: Class 150.
 - c. Iron Swing Check Valves: Class 125 **OR** Class 250, **as directed**, metal **OR** nonmetallic-to-metal, **as directed**, seats.
 - d. Iron Swing Check Valves with Closure Control: Class 125, lever and spring **OR** weight, **as directed**.
 - e. Iron, Grooved-End Swing Check Valves: 300 CWP.
 - f. Iron Gate Valves: Class 125 **OR** Class 250, **as directed**, NRS **OR** OS&Y, **as directed**.
 - g. Iron Globe Valves: Class 125 **OR** Class 250, **as directed**.
 - h. Lubricated Plug Valves: Class 125 **OR** Class 250, **as directed**, regular gland **OR** cylindrical, **as directed**, threaded **OR** flanged, **as directed**.

END OF SECTION 22 05 23 00a



SECTION 22 05 23 00b - GENERAL-DUTY VALVES FOR HVAC PIPING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of general-duty valves for HVAC piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Bronze angle valves.
 - b. Brass ball valves.
 - c. Bronze ball valves.
 - d. Iron ball valves.
 - e. Iron, single-flange butterfly valves.
 - f. Iron, grooved-end butterfly valves.
 - g. High-performance butterfly valves.
 - h. Bronze lift check valves.
 - i. Bronze swing check valves.
 - j. Iron swing check valves.
 - k. Iron swing check valves with closure control.
 - l. Iron, grooved-end swing-check valves.
 - m. Iron, center-guided check valves.
 - n. Iron, plate-type check valves.
 - o. Bronze gate valves.
 - p. Iron gate valves.
 - q. Bronze globe valves.
 - r. Iron globe valves.
 - s. Lubricated plug valves.
 - t. Eccentric plug valves.
 - u. Chainwheels.

C. Definitions

1. CWP: Cold working pressure.
2. EPDM: Ethylene propylene copolymer rubber.
3. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
4. NRS: Nonrising stem.
5. OS&Y: Outside screw and yoke.
6. RS: Rising stem.
7. SWP: Steam working pressure.

D. Submittals

1. Product Data: For each type of valve indicated.

E. Quality Assurance

1. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
2. ASME Compliance:
 - a. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - b. ASME B31.1 for power piping valves.
 - c. ASME B31.9 for building services piping valves.



F. Delivery, Storage, And Handling

1. Prepare valves for shipping as follows:
 - a. Protect internal parts against rust and corrosion.
 - b. Protect threads, flange faces, grooves, and weld ends.
 - c. Set angle, gate, and globe valves closed to prevent rattling.
 - d. Set ball and plug valves open to minimize exposure of functional surfaces.
 - e. Set butterfly valves closed or slightly open.
 - f. Block check valves in either closed or open position.
2. Use the following precautions during storage:
 - a. Maintain valve end protection.
 - b. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
3. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

1.2 PRODUCTS

A. General Requirements For Valves

1. Refer to HVAC valve schedule articles for applications of valves.
2. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
3. Valve Sizes: Same as upstream piping unless otherwise indicated.
4. Valve Actuator Types:
 - a. Gear Actuator: For quarter-turn valves NPS 8 (DN 200) and larger.
 - b. Handwheel: For valves other than quarter-turn types.
 - c. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller except plug valves, **as directed**.
 - d. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 5 **OR** 10, **as directed**, plug valves, for each size square plug-valve head.
 - e. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
5. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:
 - a. Gate Valves: With rising stem.
 - b. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 - c. Butterfly Valves: With extended neck.
6. Valve-End Connections:
 - a. Flanged: With flanges according to ASME B16.1 for iron valves.
 - b. Grooved: With grooves according to AWWA C606.
 - c. Solder Joint: With sockets according to ASME B16.18.
 - d. Threaded: With threads according to ASME B1.20.1.
7. Valve Bypass and Drain Connections: MSS SP-45.

B. Bronze Angle Valves

1. Class 125, Bronze Angle Valves with Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 1.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - 4) Ends: Threaded.
 - 5) Stem and Disc: Bronze.
 - 6) Packing: Asbestos free.
 - 7) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.



2. Class 125, Bronze Angle Valves with Nonmetallic Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - 4) Ends: Threaded.
 - 5) Stem: Bronze.
 - 6) Disc: PTFE or TFE.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
 3. Class 150, Bronze Angle Valves with Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 1.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - 4) Ends: Threaded.
 - 5) Stem and Disc: Bronze.
 - 6) Packing: Asbestos free.
 - 7) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
 4. Class 150, Bronze Angle Valves with Nonmetallic Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - 4) Ends: Threaded.
 - 5) Stem: Bronze.
 - 6) Disc: PTFE or TFE.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
- C. Brass Ball Valves
1. One-Piece, Reduced-Port, Brass Ball Valves with Brass Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) CWP Rating: 400 psig (2760 kPa).
 - 3) Body Design: One piece.
 - 4) Body Material: Forged brass.
 - 5) Ends: Threaded.
 - 6) Seats: PTFE or TFE.
 - 7) Stem: Brass.
 - 8) Ball: Chrome-plated brass.
 - 9) Port: Reduced.
 2. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Forged brass.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Brass.
 - 9) Ball: Chrome-plated brass.
 - 10) Port: Full.
 3. Two-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:
 - a. Description:

- 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Forged brass.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Stainless steel.
 - 9) Ball: Stainless steel, vented.
 - 10) Port: Full.
4. Two-Piece, Regular-Port, Brass Ball Valves with Brass Trim:
- a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Forged brass.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Brass.
 - 9) Ball: Chrome-plated brass.
 - 10) Port: Regular.
5. Two-Piece, Regular-Port, Brass Ball Valves with Stainless-Steel Trim:
- a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Brass or bronze.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Stainless steel.
 - 9) Ball: Stainless steel, vented.
 - 10) Port: Regular.
6. Three-Piece, Full-Port, Brass Ball Valves with Brass Trim:
- a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Three piece.
 - 5) Body Material: Forged brass.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Brass.
 - 9) Ball: Chrome-plated brass.
 - 10) Port: Full.
7. Three-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:
- a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Three piece.
 - 5) Body Material: Forged brass.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.



- 8) Stem: Stainless steel.
- 9) Ball: Stainless steel, vented.
- 10) Port: Full.

D. Bronze Ball Valves

1. One-Piece, Reduced-Port, Bronze Ball Valves with Bronze Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) CWP Rating: 400 psig (2760 kPa).
 - 3) Body Design: One piece.
 - 4) Body Material: Bronze.
 - 5) Ends: Threaded.
 - 6) Seats: PTFE or TFE.
 - 7) Stem: Bronze.
 - 8) Ball: Chrome-plated brass.
 - 9) Port: Reduced.
2. One-Piece, Reduced-Port, Bronze Ball Valves with Stainless-Steel Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) CWP Rating: 600 psig (4140 kPa).
 - 3) Body Design: One piece.
 - 4) Body Material: Bronze.
 - 5) Ends: Threaded.
 - 6) Seats: PTFE or TFE.
 - 7) Stem: Stainless steel.
 - 8) Ball: Stainless steel, vented.
 - 9) Port: Reduced.
3. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Bronze.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Bronze.
 - 9) Ball: Chrome-plated brass.
 - 10) Port: Full.
4. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Bronze.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Stainless steel.
 - 9) Ball: Stainless steel, vented.
 - 10) Port: Full.
5. Two-Piece, Regular-Port, Bronze Ball Valves with Bronze Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).

- 4) Body Design: Two piece.
- 5) Body Material: Bronze.
- 6) Ends: Threaded.
- 7) Seats: PTFE or TFE.
- 8) Stem: Bronze.
- 9) Ball: Chrome-plated brass.
- 10) Port: Regular.
- 6. Two-Piece, Regular-Port, Bronze Ball Valves with Stainless-Steel Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Bronze.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Stainless steel.
 - 9) Ball: Stainless steel, vented.
 - 10) Port: Regular.
- 7. Three-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Three piece.
 - 5) Body Material: Bronze.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Bronze.
 - 9) Ball: Chrome-plated brass.
 - 10) Port: Full.
- 8. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Three piece.
 - 5) Body Material: Bronze.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Stainless steel.
 - 9) Ball: Stainless steel, vented.
 - 10) Port: Full.

E. Iron Ball Valves

- 1. Class 125, Iron Ball Valves:
 - a. Description:
 - 1) Standard: MSS SP-72.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Split body.
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Ends: Flanged.
 - 6) Seats: PTFE or TFE.
 - 7) Stem: Stainless steel.
 - 8) Ball: Stainless steel.



9) Port: Full.

F. Iron, Single-Flange Butterfly Valves

1. 150 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 150 psig (1035 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: EPDM.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Aluminum bronze.
2. 150 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Aluminum-Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 150 psig (1035 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: NBR.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Aluminum bronze.
3. 150 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Ductile-Iron Disc:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 150 psig (1035 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: EPDM.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Nickel-plated or -coated, **as directed**, ductile iron.
4. 150 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Ductile-Iron Disc:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 150 psig (1035 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: NBR.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Nickel-plated or -coated, **as directed**, ductile iron.
5. 150 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Stainless-Steel Disc:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 150 psig (1035 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: EPDM.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Stainless steel.
6. 150 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Stainless-Steel Disc:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.



- 2) CWP Rating: 150 psig (1035 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: NBR.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Stainless steel.
7. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:
- a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: EPDM.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Aluminum bronze.
8. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Aluminum-Bronze Disc:
- a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: NBR.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Aluminum bronze.
9. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Ductile-Iron Disc:
- a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: EPDM.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Nickel-plated or -coated, **as directed**, ductile iron.
10. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Ductile-Iron Disc:
- a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: NBR.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Nickel-plated or -coated, **as directed**, ductile iron.
11. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Stainless-Steel Disc:
- a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: EPDM.



- 6) Stem: One- or two-piece stainless steel.
- 7) Disc: Stainless steel.
12. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Stainless-Steel Disc:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: NBR.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Stainless steel.
- G. Iron, Grooved-End Butterfly Valves
 1. 175 CWP, Iron, Grooved-End Butterfly Valves:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 175 psig (1200 kPa).
 - 3) Body Material: Coated, ductile iron.
 - 4) Stem: Two-piece stainless steel.
 - 5) Disc: Coated, ductile iron.
 - 6) Seal: EPDM.
 2. 300 CWP, Iron, Grooved-End Butterfly Valves:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) NPS 8 (DN 50) and Smaller CWP Rating: 300 psig (2070 kPa).
 - 3) NPS 10 (DN 250) and Larger CWP Rating: 200 psig (1380 kPa).
 - 4) Body Material: Coated, ductile iron.
 - 5) Stem: Two-piece stainless steel.
 - 6) Disc: Coated, ductile iron.
 - 7) Seal: EPDM.
- H. High-Performance Butterfly Valves
 1. Class 150, Single-Flange, High-Performance Butterfly Valves:
 - a. Description:
 - 1) Standard: MSS SP-68.
 - 2) CWP Rating: 285 psig (1965 kPa) at 100 deg F (38 deg C).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: Carbon steel, cast iron, ductile iron, or stainless steel.
 - 5) Seat: Reinforced PTFE or metal.
 - 6) Stem: Stainless steel; offset from seat plane.
 - 7) Disc: Carbon steel.
 - 8) Service: Bidirectional.
 2. Class 300, Single-Flange, High-Performance Butterfly Valves:
 - a. Description:
 - 1) Standard: MSS SP-68.
 - 2) CWP Rating: 720 psig (4965 kPa) at 100 deg F (38 deg C).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: Carbon steel, cast iron, or ductile iron.
 - 5) Seat: Reinforced PTFE or metal.
 - 6) Stem: Stainless steel; offset from seat plane.
 - 7) Disc: Carbon steel.
 - 8) Service: Bidirectional.

I. Bronze Lift Check Valves

1. Class 125, Lift Check Valves with Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 1.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Vertical flow.
 - 4) Body Material: ASTM B 61 or ASTM B 62, bronze.
 - 5) Ends: Threaded.
 - 6) Disc: Bronze.
2. Class 125, Lift Check Valves with Nonmetallic Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Vertical flow.
 - 4) Body Material: ASTM B 61 or ASTM B 62, bronze.
 - 5) Ends: Threaded.
 - 6) Disc: NBR, PTFE, or TFE.

J. Bronze Swing Check Valves

1. Class 125, Bronze Swing Check Valves with Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 3.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Horizontal flow.
 - 4) Body Material: ASTM B 62, bronze.
 - 5) Ends: Threaded.
 - 6) Disc: Bronze.
2. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 4.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Horizontal flow.
 - 4) Body Material: ASTM B 62, bronze.
 - 5) Ends: Threaded.
 - 6) Disc: PTFE or TFE.
3. Class 150, Bronze Swing Check Valves with Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 3.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Design: Horizontal flow.
 - 4) Body Material: ASTM B 62, bronze.
 - 5) Ends: Threaded.
 - 6) Disc: Bronze.
4. Class 150, Bronze Swing Check Valves with Nonmetallic Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 4.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Design: Horizontal flow.
 - 4) Body Material: ASTM B 62, bronze.
 - 5) Ends: Threaded.
 - 6) Disc: PTFE or TFE.

K. Iron Swing Check Valves

1. Class 125, Iron Swing Check Valves with Metal Seats:
 - a. Description:



- 1) Standard: MSS SP-71, Type I.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Design: Clear or full waterway.
 - 5) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 6) Ends: Flanged.
 - 7) Trim: Bronze.
 - 8) Gasket: Asbestos free.
2. Class 125, Iron Swing Check Valves with Nonmetallic-to-Metal Seats:
 - a. Description:
 - 1) Standard: MSS SP-71, Type I.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Design: Clear or full waterway.
 - 5) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 6) Ends: Flanged.
 - 7) Trim: Composition.
 - 8) Seat Ring: Bronze.
 - 9) Disc Holder: Bronze.
 - 10) Disc: PTFE or TFE.
 - 11) Gasket: Asbestos free.
 3. Class 250, Iron Swing Check Valves with Metal Seats:
 - a. Description:
 - 1) Standard: MSS SP-71, Type I.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 500 psig (3450 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
 - 4) Body Design: Clear or full waterway.
 - 5) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 6) Ends: Flanged.
 - 7) Trim: Bronze.
 - 8) Gasket: Asbestos free.
- L. Iron Swing Check Valves With Closure Control
1. Class 125, Iron Swing Check Valves with Lever- and Spring-Closure Control:
 - a. Description:
 - 1) Standard: MSS SP-71, Type I.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Design: Clear or full waterway.
 - 5) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 6) Ends: Flanged.
 - 7) Trim: Bronze.
 - 8) Gasket: Asbestos free.
 - 9) Closure Control: Factory-installed, exterior lever and spring.
 2. Class 125, Iron Swing Check Valves with Lever and Weight-Closure Control:
 - a. Description:
 - 1) Standard: MSS SP-71, Type I.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Design: Clear or full waterway.
 - 5) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 6) Ends: Flanged.
 - 7) Trim: Bronze.
 - 8) Gasket: Asbestos free.
 - 9) Closure Control: Factory-installed, exterior lever and weight.



M. Iron, Grooved-End Swing Check Valves

1. 300 CWP, Iron, Grooved-End Swing Check Valves:
 - a. Description:
 - 1) CWP Rating: 300 psig (2070 kPa).
 - 2) Body Material: ASTM A 536, ductile iron.
 - 3) Seal: EPDM.
 - 4) Disc: Spring operated, ductile iron or stainless steel.

N. Iron, Center-Guided Check Valves

1. Class 125, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Style: Compact wafer.
 - 6) Seat: Bronze.
2. Class 125, Iron, Globe, Center-Guided Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Style: Globe, spring loaded.
 - 6) Ends: Flanged.
 - 7) Seat: Bronze.
3. Class 150, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 300 psig (2070 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 250 psig (1725 kPa).
 - 4) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 5) Style: Compact wafer.
 - 6) Seat: Bronze.
4. Class 150, Iron, Globe, Center-Guided Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 300 psig (2070 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 250 psig (1725 kPa).
 - 4) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 5) Style: Globe, spring loaded.
 - 6) Ends: Flanged.
 - 7) Seat: Bronze.
5. Class 250, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 400 psig (2760 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Style: Compact wafer, spring loaded.
 - 6) Seat: Bronze.
6. Class 250, Iron, Globe, Center-Guided Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 400 psig (2760 kPa).



- 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Style: Globe, spring loaded.
 - 6) Ends: Flanged.
 - 7) Seat: Bronze.
7. Class 300, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:
- a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 500 psig (3450 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 400 psig (2760 kPa).
 - 4) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 5) Style: Compact wafer, spring loaded.
 - 6) Seat: Bronze.
8. Class 300, Iron, Globe, Center-Guided Check Valves with Metal Seat:
- a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 500 psig (3450 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 400 psig (2760 kPa).
 - 4) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 5) Style: Globe, spring loaded.
 - 6) Ends: Flanged.
 - 7) Seat: Bronze.
9. Class 125, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:
- a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Style: Compact wafer.
 - 6) Seat: EPDM **OR** BR, **as directed**.
10. Class 125, Iron, Globe, Center-Guided Check Valves with Resilient Seat:
- a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Style: Globe, spring loaded.
 - 6) Ends: Flanged.
 - 7) Seat: EPDM **OR** NBR, **as directed**.
11. Class 150, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:
- a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 300 psig (2070 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 250 psig (1725 kPa).
 - 4) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 5) Style: Compact wafer.
 - 6) Seat: EPDM **OR** NBR, **as directed**.
12. Class 150, Iron, Globe, Center-Guided Check Valves with Resilient Seat:
- a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 300 psig (2070 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 250 psig (1725 kPa).
 - 4) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 5) Style: Globe, spring loaded.
 - 6) Ends: Flanged.
 - 7) Seat: EPDM **OR** NBR, **as directed**.



13. Class 250, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 400 psig (2760 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Style: Compact wafer, spring loaded.
 - 6) Seat: EPDM **OR** NBR, **as directed**.
 14. Class 250, Iron, Globe, Center-Guided Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 400 psig (2760 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Style: Globe, spring loaded.
 - 6) Ends: Flanged.
 - 7) Seat: EPDM **OR** NBR, **as directed**.
 15. Class 300, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 500 psig (3450 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 400 psig (2760 kPa).
 - 4) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 5) Style: Compact wafer, spring loaded.
 - 6) Seat: EPDM **OR** NBR, **as directed**.
 16. Class 300, Iron, Globe, Center-Guided Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 500 psig (3450 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 400 psig (2760 kPa).
 - 4) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 5) Style: Globe, spring loaded.
 - 6) Ends: Flanged.
 - 7) Seat: EPDM **OR** NBR, **as directed**.
- O. Iron, Plate-Type Check Valves
1. Class 125, Iron, Dual-Plate Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: API 594.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Design: Wafer, spring-loaded plates.
 - 5) Body Material: ASTM A 126, gray iron.
 - 6) Seat: Bronze.
 2. Class 150, Iron, Dual-Plate Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: API 594.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 300 psig (2070 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 250 psig (1725 kPa).
 - 4) Body Design: Wafer, spring-loaded plates.
 - 5) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 6) Seat: Bronze.
 3. Class 250, Iron, Dual-Plate Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: API 594.



- 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 400 psig (2760 kPa).
- 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
- 4) Body Design: Wafer, spring-loaded plates.
- 5) Body Material: ASTM A 126, gray iron.
- 6) Seat: Bronze.
4. Class 300, Iron, Dual-Plate Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: API 594.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 500 psig (3450 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 400 psig (2760 kPa).
 - 4) Body Design: Wafer, spring-loaded plates.
 - 5) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 6) Seat: Bronze.
5. Class 125, Iron, Single-Plate Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: API 594.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Design: Wafer, spring-loaded plate.
 - 5) Body Material: ASTM A 126, gray iron.
 - 6) Seat: EPDM **OR** NBR, **as directed**.
6. Class 125, Iron, Dual-Plate Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: API 594.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Design: Wafer, spring-loaded plates.
 - 5) Body Material: ASTM A 126, gray iron.
 - 6) Seat: EPDM **OR** NBR, **as directed**.
7. Class 150, Iron, Dual-Plate Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: API 594.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 300 psig (2070 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 250 psig (1725 kPa).
 - 4) Body Design: Wafer, spring-loaded plates.
 - 5) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 6) Seat: EPDM **OR** NBR, **as directed**.
8. Class 250, Iron, Wafer, Single-Plate Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: API 594.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 400 psig (2760 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
 - 4) Body Design: Wafer, spring-loaded plate.
 - 5) Body Material: ASTM A 126, gray iron.
 - 6) Seat: EPDM **OR** NBR, **as directed**.
9. Class 250, Iron, Dual-Plate Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: API 594.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 400 psig (2760 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
 - 4) Body Design: Wafer, spring-loaded plates.
 - 5) Body Material: ASTM A 126, gray iron.
 - 6) Seat: EPDM **OR** NBR, **as directed**.
10. Class 300, Iron, Dual-Plate Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: API 594.



- 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 500 psig (3450 kPa).
- 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 400 psig (2760 kPa).
- 4) Body Design: Wafer, spring-loaded plates.
- 5) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
- 6) Seat: EPDM **OR** NBR, **as directed**.

P. Bronze Gate Valves

1. Class 125, NRS Bronze Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 1.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - 4) Ends: Threaded or solder joint, **as directed**.
 - 5) Stem: Bronze.
 - 6) Disc: Solid wedge; bronze.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
2. Class 125, RS Bronze Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - 4) Ends: Threaded or solder joint, **as directed**.
 - 5) Stem: Bronze.
 - 6) Disc: Solid wedge; bronze.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
3. Class 150, NRS Bronze Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 1.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - 4) Ends: Threaded.
 - 5) Stem: Bronze.
 - 6) Disc: Solid wedge; bronze.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
4. Class 150, RS Bronze Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - 4) Ends: Threaded.
 - 5) Stem: Bronze.
 - 6) Disc: Solid wedge; bronze.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.

Q. Iron Gate Valves

1. Class 125, NRS, Iron Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-70, Type I.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Material: ASTM A 126, gray iron with bolted bonnet.



- 5) Ends: Flanged.
 - 6) Trim: Bronze.
 - 7) Disc: Solid wedge.
 - 8) Packing and Gasket: Asbestos free.
 2. Class 125, OS&Y, Iron Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-70, Type I.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 5) Ends: Flanged.
 - 6) Trim: Bronze.
 - 7) Disc: Solid wedge.
 - 8) Packing and Gasket: Asbestos free.
 3. Class 250, NRS, Iron Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-70, Type I.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 500 psig (3450 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
 - 4) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 5) Ends: Flanged.
 - 6) Trim: Bronze.
 - 7) Disc: Solid wedge.
 - 8) Packing and Gasket: Asbestos free.
 4. Class 250, OS&Y, Iron Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-70, Type I.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 500 psig (3450 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
 - 4) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 5) Ends: Flanged.
 - 6) Trim: Bronze.
 - 7) Disc: Solid wedge.
 - 8) Packing and Gasket: Asbestos free.
- R. Bronze Globe Valves
1. Class 125, Bronze Globe Valves with Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 1.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - 4) Ends: Threaded or solder joint, **as directed**.
 - 5) Stem and Disc: Bronze.
 - 6) Packing: Asbestos free.
 - 7) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
 2. Class 125, Bronze Globe Valves with Nonmetallic Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - 4) Ends: Threaded or solder joint, **as directed**.
 - 5) Stem: Bronze.
 - 6) Disc: PTFE or TFE.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
 3. Class 150, Bronze Globe Valves with Nonmetallic Disc:

- a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - 4) Ends: Threaded.
 - 5) Stem: Bronze.
 - 6) Disc: PTFE or TFE.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.

S. Iron Globe Valves

- 1. Class 125, Iron Globe Valves:
 - a. Description:
 - 1) Standard: MSS SP-85, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 4) Ends: Flanged.
 - 5) Trim: Bronze.
 - 6) Packing and Gasket: Asbestos free.
- 2. Class 250, Iron Globe Valves:
 - a. Description:
 - 1) Standard: MSS SP-85, Type I.
 - 2) CWP Rating: 500 psig (3450 kPa).
 - 3) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 4) Ends: Flanged.
 - 5) Trim: Bronze.
 - 6) Packing and Gasket: Asbestos free.

T. Lubricated Plug Valves

- 1. Class 125, Regular-Gland, Lubricated Plug Valves with Threaded Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type II.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - 5) Pattern: Regular or short **OR** Venturi, **as directed**.
 - 6) Plug: Cast iron or bronze with sealant groove.
- 2. Class 125, Regular-Gland, Lubricated Plug Valves with Flanged Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type II.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - 5) Pattern: Regular or short **OR** Venturi, **as directed**.
 - 6) Plug: Cast iron or bronze with sealant groove.
- 3. Class 125, Cylindrical, Lubricated Plug Valves with Threaded Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type IV.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - 5) Pattern: Regular or short **OR** Venturi, **as directed**.



- 6) Plug: Cast iron or bronze with sealant groove.
4. Class 125, Cylindrical, Lubricated Plug Valves with Flanged Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type IV.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - 5) Pattern: Regular or short **OR Venturi, as directed.**
 - 6) Plug: Cast iron or bronze with sealant groove.
5. Class 250, Regular-Gland, Lubricated Plug Valves with Threaded Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type II.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 400 psig (2760 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
 - 4) Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - 5) Pattern: Regular or short **OR Venturi, as directed.**
 - 6) Plug: Cast iron or bronze with sealant groove.
6. Class 250, Regular-Gland, Lubricated Plug Valves with Flanged Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type II.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 400 psig (2760 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
 - 4) Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - 5) Pattern: Regular or short **OR Venturi, as directed.**
 - 6) Plug: Cast iron or bronze with sealant groove.
7. Class 250, Cylindrical, Lubricated Plug Valves with Threaded Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type IV.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 400 psig (2760 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
 - 4) Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - 5) Pattern: Regular or short **OR Venturi, as directed.**
 - 6) Plug: Cast iron or bronze with sealant groove.
8. Class 250, Cylindrical, Lubricated Plug Valves with Flanged Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type IV.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 400 psig (2760 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
 - 4) Body Material: ASTM A 48/A 48M or ASTM A 126, Grade 40 cast iron with lubrication-sealing system.
 - 5) Pattern: Regular or short **OR Venturi, as directed.**
 - 6) Plug: Cast iron or bronze with sealant groove.

U. Eccentric Plug Valves

1. 175 CWP, Eccentric Plug Valves with Resilient Seating.
 - a. Description:
 - 1) Standard: MSS SP-108.
 - 2) CWP Rating: 175 psig (1200 kPa) minimum.
 - 3) Body and Plug: ASTM A 48/A 48M, gray iron; ASTM A 126, gray iron; or ASTM A 536, ductile iron.
 - 4) Bearings: Oil-impregnated bronze or stainless steel.
 - 5) Ends: Flanged.



- 6) Stem-Seal Packing: Asbestos free.
- 7) Plug, Resilient-Seating Material: Suitable for potable-water service unless otherwise indicated.

V. Chainwheels

- 1. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
 - a. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
 - b. Attachment: For connection to ball **OR** butterfly **OR** plug, **as directed**, valve stems.
 - c. Sprocket Rim with Chain Guides: Ductile iron **OR** Cast iron **OR** Aluminum **OR** Bronze, **as directed**, of type and size required for valve. Include zinc coating, **as directed**.
 - d. Chain: Hot-dip, galvanized steel **OR** Brass **OR** Stainless steel, **as directed**, of size required to fit sprocket rim.

1.3 EXECUTION

A. Valve Installation

- 1. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- 2. Locate valves for easy access and provide separate support where necessary.
- 3. Install valves in horizontal piping with stem at or above center of pipe.
- 4. Install valves in position to allow full stem movement.
- 5. Install chainwheels on operators for ball **OR** butterfly **OR** gate **OR** globe **OR** plug, **as directed**, valves NPS 4 (DN 100) and larger and more than 96 inches (2400 mm) above floor. Extend chains to 60 inches (1520 mm) above finished floor.
- 6. Install check valves for proper direction of flow and as follows:
 - a. Swing Check Valves: In horizontal position with hinge pin level.
 - b. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.
 - c. Lift Check Valves: With stem upright and plumb.

B. Adjusting

- 1. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

C. General Requirements For Valve Applications

- 1. If valve applications are not indicated, use the following:
 - a. Shutoff Service: Ball, butterfly **OR** gate **OR** plug, **as directed**, valves.
 - b. Butterfly Valve Dead-End Service: Single-flange (lug) type.
 - c. Throttling Service except Steam: Globe **OR** angle **OR** ball **OR** butterfly, **as directed**, valves.
 - d. Throttling Service, Steam: Globe **OR** angle **OR** butterfly, **as directed**, valves.
 - e. Pump-Discharge Check Valves:
 - 1) NPS 2 (DN 50) and Smaller: Bronze swing check valves with bronze **OR** nonmetallic, **as directed**, disc.
 - 2) NPS 2-1/2 (DN 65) and Larger: Iron swing check valves with lever and weight or with spring or iron, center-guided, metal **OR** resilient, **as directed**, seat check valves.
- 2. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- 3. Select valves, except wafer types, with the following end connections:
 - a. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - b. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.



- c. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
- d. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
- e. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
- f. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.
- g. For Grooved-End Copper Tubing and Steel Piping except Steam and Steam Condensate Piping: Valve ends may be grooved.

D. Chilled-Water Valve Schedule

1. Pipe NPS 2 (DN 50) and Smaller:
 - a. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - b. Bronze Angle Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - c. Ball Valves: One **OR** Two **OR** Three, **as directed**, piece, full **OR** regular **OR** reduced, **as directed**, port, brass **OR** bronze, **as directed**, with brass **OR** bronze **OR** stainless-steel, **as directed**, trim.
 - d. Bronze Swing Check Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - e. Bronze Gate Valves: Class 125 **OR** Class 150, **as directed**, NRS **OR** RS, **as directed**, bronze.
 - f. Bronze Globe Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
2. Pipe NPS 2-1/2 (DN 65) and Larger:
 - a. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
 - b. Iron Ball Valves, NPS 2-1/2 to NPS 10 (DN 65 to DN 250): Class 150.
 - c. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): 200 CWP, EPDM **OR** NBR, **as directed**, seat, aluminum-bronze **OR** ductile-iron **OR** stainless-steel, **as directed**, disc.
 - d. Iron, Single-Flange Butterfly Valves, NPS 14 to NPS 24 (DN 350 to DN 600): 150 CWP, EPDM **OR** NBR, **as directed**, seat, aluminum-bronze **OR** ductile-iron **OR** stainless-steel, **as directed**, disc.
 - e. Iron, Grooved-End Butterfly Valves, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): 175 **OR** 300, **as directed**, CWP.
 - f. High-Performance Butterfly Valves: Class 150 **OR** Class 300, **as directed**, single flange.
 - g. Iron Swing Check Valves: Class 125 **OR** Class 250, **as directed**, metal **OR** nonmetallic-to-metal, **as directed**, seats.
 - h. Iron Swing Check Valves with Closure Control, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Class 125, lever and spring **OR** weight, **as directed**.
 - i. Iron, Grooved-End Check Valves, NPS 3 to NPS 12 (DN 80 to DN 300): 300 CWP.
 - j. Iron, Center-Guided Check Valves: Class 125 **OR** Class 150 **OR** Class 250 **OR** Class 300, **as directed**, compact-wafer **OR** globe, **as directed**, metal **OR** resilient, **as directed**, seat.
 - k. Iron, Plate-Type Check Valves: Class 125 **OR** Class 150 **OR** Class 250 **OR** Class 300, **as directed**; single **OR** dual, **as directed**, plate; metal **OR** resilient, **as directed**, seat.
 - l. Iron Gate Valves: Class 125 **OR** Class 250, **as directed**, NRS **OR** OS&Y, **as directed**.
 - m. Iron Globe Valves: Class 125 **OR** Class 250, **as directed**.
 - n. Lubricated Plug Valves: Class 125 **OR** Class 250, **as directed**, regular gland **OR** cylindrical, **as directed**, threaded **OR** flanged, **as directed**.
 - o. Eccentric Plug Valves: 175 CWP, resilient seating.

E. Condenser-Water Valve Schedule

1. Pipe NPS 2 (DN 50) and Smaller:
 - a. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.



- b. Bronze Angle Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - c. Ball Valves: One **OR** Two **OR** Three, **as directed**, piece, full **OR** regular **OR** reduced, **as directed**, port, brass **OR** bronze, **as directed**, with brass **OR** bronze **OR** stainless-steel, **as directed**, trim.
 - d. Bronze Swing Check Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - e. Bronze Gate Valves: Class 125 **OR** Class 150, **as directed**, NRS **OR** RS, **as directed**.
 - f. Bronze Globe Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
2. Pipe NPS 2-1/2 (DN 65) and Larger:
- a. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
 - b. Iron Ball Valves, NPS 2-1/2 to NPS 10 (DN 65 to DN 250): Class 150.
 - c. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): 200 CWP, EPDM **OR** NBR, **as directed**, seat, aluminum-bronze **OR** ductile-iron **OR** stainless-steel, **as directed**, disc.
 - d. Iron, Single-Flange Butterfly Valves, NPS 14 to NPS 24 (DN 350 to DN 600): 150 CWP, EPDM **OR** NBR, **as directed**, seat, aluminum-bronze **OR** ductile-iron **OR** stainless-steel, **as directed**, disc.
 - e. Iron, Grooved-End Butterfly Valves, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): 175 **OR** 300, **as directed**, CWP.
 - f. High-Performance Butterfly Valves: Class 150 **OR** Class 300, **as directed**, single flange.
 - g. Iron Swing Check Valves: Class 125 **OR** Class 250, **as directed**, metal **OR** nonmetallic-to-metal, **as directed**, seats.
 - h. Iron Swing Check Valves with Closure Control, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Class 125, lever and spring **OR** weight, **as directed**.
 - i. Iron, Grooved-End Check Valves, NPS 3 to NPS 12 (DN 80 to DN 300): 300 CWP.
 - j. Iron, Center-Guided Check Valves, NPS 2-1/2 to NPS 24 (DN 65 to DN 600): Class 125 **OR** Class 150 **OR** Class 250 **OR** Class 300, **as directed**, metal **OR** resilient, **as directed**, seat.
 - k. Iron, Plate-Type Check Valves: Class 125 **OR** Class 150 **OR** Class 250 **OR** Class 300, **as directed**; single **OR** dual, **as directed**, plate; metal **OR** resilient, **as directed**, seat.
 - l. Iron Gate Valves: Class 125 **OR** Class 250, **as directed**, NRS **OR** OS&Y, **as directed**.
 - m. Iron Globe Valves, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Class 125 **OR** Class 250, **as directed**.
 - n. Lubricated Plug Valves: Class 125 **OR** Class 250, **as directed**, regular gland **OR** cylindrical, **as directed**, threaded **OR** flanged, **as directed**.

F. Heating-Water Valve Schedule

- 1. Pipe NPS 2 (DN 50) and Smaller:
 - a. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - b. Bronze Angle Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - c. Ball Valves: One **OR** Two **OR** Three, **as directed**, piece, full **OR** regular **OR** reduced, **as directed**, port, brass **OR** bronze, **as directed**, with brass **OR** bronze **OR** stainless-steel, **as directed**, trim.
 - d. Bronze Swing Check Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - e. Bronze Gate Valves: Class 125 **OR** Class 150, **as directed**, NRS **OR** RS, **as directed**.
 - f. Bronze Globe Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
- 2. Pipe NPS 2-1/2 (DN 65) and Larger:



- a. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
 - b. Iron Ball Valves, NPS 2-1/2 to NPS 10 (DN 65 to DN 250): Class 150.
 - c. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): 200 CWP, EPDM **OR** NBR, **as directed**, seat, aluminum-bronze **OR** ductile-iron **OR** stainless-steel, **as directed**, disc.
 - d. Iron, Single-Flange Butterfly Valves, NPS 14 to NPS 24 (DN 350 to DN 600): 150 CWP, EPDM **OR** NBR, **as directed**, seat, aluminum-bronze **OR** ductile-iron **OR** stainless-steel, **as directed**, disc.
 - e. Iron, Grooved-End Butterfly Valves, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): 175 **OR** 300, **as directed**, CWP.
 - f. High-Performance Butterfly Valves: Class 150 **OR** Class 300, **as directed**, single flange.
 - g. Iron Swing Check Valves: Class 125 **OR** Class 250, **as directed**, metal **OR** nonmetallic-to-metal, **as directed**, seats.
 - h. Iron Swing Check Valves with Closure Control, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Class 125, lever and spring **OR** weight, **as directed**.
 - i. Iron, Grooved-End Check Valves, NPS 3 to NPS 12 (DN 80 to DN 300): 300 CWP.
 - j. Iron, Center-Guided Check Valves: Class 125 **OR** Class 150 **OR** Class 250 **OR** Class 300, **as directed**, compact-wafer **OR** globe, **as directed**, metal **OR** resilient, **as directed**, seat.
 - k. Iron, Plate-Type Check Valves: Class 125 **OR** Class 150 **OR** Class 250 **OR** Class 300, **as directed**; single **OR** dual, **as directed**, plate; metal **OR** resilient, **as directed**, seat.
 - l. Iron Gate Valves: Class 125 **OR** Class 250, **as directed**, NRS **OR** OS&Y, **as directed**.
 - m. Iron Globe Valves, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Class 125 **OR** Class 250, **as directed**.
- G. Low-Pressure Steam Valve Schedule (15 psig (104 kPa) Or Less)
- 1. Pipe NPS 2 (DN 50) and Smaller:
 - a. Bronze Angle Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - b. Ball Valves: One **OR** Two **OR** Three, **as directed**, piece, full **OR** regular **OR** reduced, **as directed**, port, brass **OR** bronze, **as directed**, with brass **OR** bronze **OR** stainless-steel, **as directed**, trim.
 - c. Bronze Swing Check Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - d. Bronze Gate Valves: Class 125 **OR** Class 150, **as directed**, NRS **OR** RS, **as directed**.
 - e. Bronze Globe Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - 2. Pipe NPS 2-1/2 (DN 65) and Larger:
 - a. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
 - b. Iron Ball Valves, NPS 2-1/2 to NPS 10 (DN 65 to DN 250): Class 150.
 - c. High-Performance Butterfly Valves: Class 150 **OR** Class 300, **as directed**, single flange.
 - d. Iron Swing Check Valves: Class 125 **OR** Class 250, **as directed**, metal **OR** nonmetallic-to-metal, **as directed**, seats.
 - e. Iron Swing Check Valves with Closure Control, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Class 125, lever and spring **OR** weight, **as directed**.
 - f. Iron Gate Valves: Class 125 **OR** Class 250, **as directed**, NRS **OR** OS&Y, **as directed**.
 - g. Iron Globe Valves, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Class 125 **OR** Class 250, **as directed**.
- H. High-Pressure Steam Valve Schedule (More Than 15 psig (104 kPa))
- 1. Pipe NPS 2 (DN 50) and Smaller:
 - a. Bronze Angle Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.



- b. Ball Valves: One **OR** Two **OR** Three, **as directed**, piece, full **OR** regular **OR** reduced, **as directed**, port, brass **OR** bronze, **as directed**, with brass **OR** bronze **OR** stainless-steel, **as directed**, trim.
 - c. Bronze Swing Check Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - d. Bronze Gate Valves: Class 125 **OR** Class 150, **as directed**, NRS **OR** RS, **as directed**, bronze.
 - e. Globe Valves: Class 125 **OR** 150, **as directed**, bronze, bronze **OR** nonmetallic, **as directed**, disc.
2. Pipe Sizes NPS 2-1/2 (DN 65) and Larger:
- a. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
 - b. Ball Valves, NPS 2-1/2 to NPS 10 (DN 65 to DN 250): Class 150, iron.
 - c. High-Performance Butterfly Valves: Class 150 **OR** Class 300, **as directed**, single flange.
 - d. Iron Swing Check Valves: Class 125 **OR** Class 250, **as directed**, metal **OR** nonmetallic-to-metal, **as directed**, seats.
 - e. Iron Swing Check Valves with Closure Control, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Class 125, lever and spring **OR** weight, **as directed**.
 - f. Iron Gate Valves: Class 125 **OR** Class 250, **as directed**, NRS **OR** OS&Y, **as directed**.
 - g. Iron Globe Valves, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Class 125 **OR** Class 250, **as directed**.
- I. Steam-Condensate Valve Schedule
1. Pipe NPS 2 (DN 50) and Smaller:
- a. Bronze Angle Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - b. Ball Valves: One **OR** Two **OR** Three, **as directed**, piece, full **OR** regular **OR** reduced, **as directed**, port, brass **OR** bronze, **as directed**, with brass **OR** bronze **OR** stainless-steel, **as directed**, trim.
 - c. Bronze Swing Check Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - d. Bronze Gate Valves: Class 125 **OR** Class 150, **as directed**, NRS **OR** RS, **as directed**.
 - e. Bronze Globe Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
2. Pipe NPS 2-1/2 (DN 65) and Larger:
- a. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
 - b. Iron Ball Valves, NPS 2-1/2 to NPS 10 (DN 65 to DN 250): Class 150.
 - c. High-Performance Butterfly Valves: Class 150 **OR** Class 300, **as directed**, single flange.
 - d. Iron Swing Check Valves: Class 125 **OR** Class 250, **as directed**, metal **OR** nonmetallic-to-metal, **as directed**, seats.
 - e. Iron Swing Check Valves with Closure Control: Class 125, lever and spring **OR** weight, **as directed**.
 - f. Iron Gate Valves: Class 125 **OR** Class 250, **as directed**, NRS **OR** OS&Y, **as directed**.
 - g. Iron Globe Valves, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Class 125 **OR** Class 250, **as directed**.
 - h. Lubricated Plug Valves: Class 125 **OR** Class 250, **as directed**, regular gland **OR** cylindrical, **as directed**, threaded **OR** flanged, **as directed**.

END OF SECTION 22 05 23 00b



SECTION 22 05 76 00 - STORM DRAINAGE PIPING SPECIALTIES

1.1 GENERAL

- A. Description Of Work
 - 1. This specification covers the furnishing and installation of materials for storm drainage piping specialties. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.
- B. Summary
 - 1. Section Includes:
 - a. Roof drains.
 - b. Miscellaneous storm drainage piping specialties.
 - c. Cleanouts.
 - d. Backwater valves.
 - e. Trench drains.
 - f. Channel drainage systems.
 - g. Through-penetration firestop assemblies.
 - h. Flashing materials.
- C. Submittals
 - 1. Product Data: For each type of product indicated.
- D. Quality Assurance
 - 1. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

1.2 PRODUCTS

- A. Metal Roof Drains
 - 1. Cast-Iron, Large-Sump, General-Purpose Roof Drains:
 - a. Standard: ASME A112.6.4, for general-purpose roof drains.
 - b. Body Material: Cast iron.
 - c. Dimension of Body: Nominal 14-inch (357-mm) diameter.
 - d. Combination Flashing Ring and Gravel Stop: Not required **OR** Required, **as directed**.
 - e. Flow-Control Weirs: Not required **OR** Required, **as directed**.
 - f. Outlet: Bottom **OR** Side, **as directed**.
 - g. Extension Collars: Not required **OR** Required, **as directed**.
 - h. Underdeck Clamp: Not required **OR** Required, **as directed**.
 - i. Expansion Joint: Not required **OR** Required, **as directed**.
 - j. Sump Receiver Plate: Not required **OR** Required, **as directed**.
 - k. Dome Material: Aluminum **OR** Cast iron **OR** PE **OR** Stainless steel, **as directed**.
 - l. Perforated Gravel Guard: Stainless steel **OR** Not required, **as directed**.
 - m. Vandal-Proof Dome: Not required **OR** Required, **as directed**.
 - n. Water Dam: Not required **OR** 2 inches (51 mm) high, **as directed**.
 - 2. Cast-Iron, Medium-Sump, General-Purpose Roof Drains:
 - a. Standard: ASME A112.6.4, for general-purpose roof drains.
 - b. Body Material: Cast iron.
 - c. Dimension of Body: 8- to 12-inch (203- to 305-mm) diameter.
 - d. Combination Flashing Ring and Gravel Stop: Not required **OR** Required, **as directed**.
 - e. Flow-Control Weirs: Not required **OR** Required, **as directed**.
 - f. Outlet: Bottom **OR** Side, **as directed**.
 - g. Extension Collars: Not required **OR** Required, **as directed**.



- h. Underdeck Clamp: Not required **OR** Required, **as directed**.
- i. Expansion Joint: Not required **OR** Required, **as directed**.
- j. Sump Receiver Plate: Not required **OR** Required, **as directed**.
- k. Dome Material: Aluminum **OR** Cast iron **OR** Copper **OR** PE **OR** Stainless steel, **as directed**.
- l. Wire Mesh: Stainless steel or brass over dome **OR** Not required, **as directed**.
- m. Perforated Gravel Guard: Stainless steel **OR** Not required, **as directed**.
- n. Vandal-Proof Dome: Not required **OR** Required, **as directed**.
- o. Water Dam: Not required **OR** 2 inches (51 mm) high, **as directed**.
- 3. Copper, Medium-Sump, General-Purpose Roof Drains:
 - a. Standard: ASME A112.6.4, for general-purpose roof drains.
 - b. Body Material: Copper.
 - c. Dimension of Body: 8- to 12-inch (203- to 305-mm) diameter.
 - d. Combination Flashing Ring and Gravel Stop: Not required **OR** Required, **as directed**.
 - e. Flow-Control Weirs: Not required **OR** Required, **as directed**.
 - f. Outlet: Bottom **OR** Side, **as directed**.
 - g. Extension Collars: Not required **OR** Required, **as directed**.
 - h. Underdeck Clamp: Not required **OR** Required, **as directed**.
 - i. Expansion Joint: Not required **OR** Required, **as directed**.
 - j. Sump Receiver Plate: Not required **OR** Required, **as directed**.
 - k. Dome Material: Aluminum **OR** Cast iron **OR** Copper **OR** PE **OR** Stainless steel, **as directed**.
 - l. Wire Mesh: Stainless steel or brass over dome **OR** Not required, **as directed**.
 - m. Perforated Gravel Guard: Stainless steel **OR** Not required, **as directed**.
 - n. Vandal-Proof Dome: Not required **OR** Required, **as directed**.
 - o. Water Dam: Not required **OR** 2 inches (51 mm) high, **as directed**.
- 4. Cast-Iron, Small-Sump, General-Purpose Roof Drains:
 - a. Standard: ASME A112.6.4, for general-purpose roof drains.
 - b. Body Material: Cast iron.
 - c. Dimension of Body: Nominal 8-inch (203-mm) diameter.
 - d. Combination Flashing Ring and Gravel Stop: Not required **OR** Required, **as directed**.
 - e. Outlet: Bottom **OR** Side, **as directed**.
 - f. Extension Collars: Not required **OR** Required, **as directed**.
 - g. Underdeck Clamp: Not required **OR** Required, **as directed**.
 - h. Expansion Joint: Not required **OR** Required, **as directed**.
 - i. Sump Receiver Plate: Not required **OR** Required, **as directed**.
 - j. Dome Material: Cast iron.
 - k. Wire Mesh: Stainless steel or brass over dome **OR** Not required, **as directed**.
 - l. Vandal-Proof Dome: Not required **OR** Required, **as directed**.
- 5. Copper, Small-Sump, General-Purpose Roof Drains:
 - a. Standard: ASME A112.6.4, for general-purpose roof drains.
 - b. Body Material: Copper.
 - c. Dimension of Body: Nominal 8-inch (203-mm) diameter.
 - d. Combination Flashing Ring and Gravel Stop: Not required **OR** Required, **as directed**.
 - e. Outlet: Bottom **OR** Side, **as directed**.
 - f. Extension Collars: Not required **OR** Required, **as directed**.
 - g. Underdeck Clamp: Not required **OR** Required, **as directed**.
 - h. Expansion Joint: Not required **OR** Required, **as directed**.
 - i. Sump Receiver Plate: Not required **OR** Required, **as directed**.
 - j. Dome Material: Cast iron.
 - k. Wire Mesh: Stainless steel or brass over dome **OR** Not required, **as directed**.
 - l. Vandal-Proof Dome: Not required **OR** Required, **as directed**.
- 6. Metal, Cornice and Gutter Roof Drains:
 - a. Standard: ASME A112.6.4, for cornice and gutter roof drains.
 - b. Body Material: Metal.



- c. Dimension of Body: Nominal 6-inch (152-mm) diameter.
- d. Outlet: Bottom **OR** Side **OR** 45-degree angle, **as directed**.
- e. Dome Material: Bronze.
- f. Vandal-Proof Dome: Not required **OR** Required, **as directed**.
- 7. Metal, Parapet Roof Drains:
 - a. Standard: ASME A112.6.4, for parapet roof drains.
 - b. Body Material: Cast iron.
 - c. Outlet: Back **OR** Angle, **as directed**.
 - d. Grate Material: Bronze **OR** Cast iron **OR** Nickel-bronze alloy, **as directed**.
 - e. Vandal-Proof Grate: Not required **OR** Required, **as directed**.
- 8. Metal, Large-Sump, Promenade Roof Drains:
 - a. Standard: ASME A112.6.4, for promenade roof drains.
 - b. Body Material: Cast iron.
 - c. Dimension of Body: Nominal 14-inch (357-mm) diameter.
 - d. Dimension of Frame and Grate: Nominal 14 inches (357 mm) square.
 - e. Outlet: Bottom.
 - f. Grate Material: Bronze **OR** Cast iron **OR** Nickel-bronze alloy, **as directed**.
 - g. Vandal-Proof Grate: Not required **OR** Required, **as directed**.
 - h. Extension Collars: Not required **OR** Required, **as directed**.
 - i. Underdeck Clamp: Not required **OR** Required, **as directed**.
 - j. Expansion Joint: Not required **OR** Required, **as directed**.
 - k. Sump Receiver Plate: Not required **OR** Required, **as directed**.
- 9. Metal, Medium-Sump, Promenade Roof Drains:
 - a. Standard: ASME A112.6.4, for promenade roof drains.
 - b. Body Material: Cast iron.
 - c. Dimension of Body: 11- to 12-inch (280- to 305-mm) diameter.
 - d. Dimension of Frame and Grate: Nominal 12 inches (305 mm) square.
 - e. Outlet: Bottom.
 - f. Grate Material: Bronze **OR** Cast iron **OR** Nickel-bronze alloy, **as directed**.
 - g. Vandal-Proof Grate: Not required **OR** Required, **as directed**.
 - h. Extension Collars: Not required **OR** Required, **as directed**.
 - i. Underdeck Clamp: Not required **OR** Required, **as directed**.
 - j. Expansion Joint: Not required **OR** Required, **as directed**.
 - k. Sump Receiver Plate: Not required **OR** Required, **as directed**.
- 10. Metal, Small-Sump, Promenade Roof Drains:
 - a. Standard: ASME A112.6.4, for promenade roof drains.
 - b. Body Material: Cast iron.
 - c. Dimension of Body: Nominal 8-inch (203-mm) diameter.
 - d. Dimension of Frame and Grate: Nominal 8 inches (203 mm) square.
 - e. Outlet: Bottom.
 - f. Grate Material: Bronze **OR** Cast iron **OR** Nickel-bronze alloy, **as directed**.
 - g. Vandal-Proof Grate: Not required **OR** Required, **as directed**.
 - h. Extension Collars: Not required **OR** Required, **as directed**.
 - i. Underdeck Clamp: Not required **OR** Required, **as directed**.
 - j. Expansion Joint: Not required **OR** Required, **as directed**.
 - k. Sump Receiver Plate: Not required **OR** Required, **as directed**.
- 11. Metal, Medium-Sump, Deck Roof Drains:
 - a. Standard: ASME A112.6.4, for deck roof drains; ASME A112.6.3, for floor drains.
 - b. Body Material: Metal.
 - c. Flange: Anchor **OR** Anchor with weep holes **OR** Not required, **as directed**.
 - d. Clamping Device: Not required **OR** Required, **as directed**.
 - e. Integral Backwater Valve: Not required **OR** Required, **as directed**.
 - f. Outlet: Bottom **OR** End **OR** Side, **as directed**.
 - g. Grate Material: Cast iron.
 - h. Grate Finish: Painted **OR** Not required, **as directed**.



- i. Overall Dimension of Frame and Grate: Nominal 14 inches (357 mm) round **OR** square, **as directed**.
 - j. Top-Loading Classification: Extra-Heavy Duty **OR** Heavy Duty, **as directed**.
 - k. Vandal-Proof Frame and Grate: Not required **OR** Required, **as directed**.
- 12. Metal, Small-Sump, Deck Roof Drains:
 - a. Standard: ASME A112.6.4, for deck roof drains; ASME A112.6.3, for floor drains.
 - b. Body Material: Metal.
 - c. Flange: Anchor **OR** Anchor with weep holes **OR** Not required, **as directed**.
 - d. Clamping Device: Not required **OR** Required, **as directed**.
 - e. Integral Backwater Valve: Not required **OR** Required, **as directed**.
 - f. Outlet: Bottom **OR** End **OR** Side, **as directed**.
 - g. Grate Material: Cast iron.
 - h. Grate Finish: Painted **OR** Not required, **as directed**.
 - i. Overall Dimension of Frame and Grate: Nominal 8 inches (203 mm) round **OR** square, **as directed**.
 - j. Top-Loading Classification: Extra-Heavy Duty **OR** Heavy Duty **OR** Light Duty **OR** Medium Duty, **as directed**.
 - k. Vandal-Proof Frame and Grate: Not required **OR** Required, **as directed**.
- B. Plastic Roof Drains
 - 1. Plastic Roof Drains:
 - a. Standard: ASME A112.6.4, for plastic roof drains.
 - b. Body Material: ABS or PVC.
 - c. Sump Diameter: **<Insert nominal dimension>**.
 - d. Combination Flashing Ring and Gravel Stop: Not required **OR** Required, **as directed**.
 - e. Outlet: Bottom.
 - f. Extension Collars: Not required **OR** Required, **as directed**.
 - g. Underdeck Clamp: Not required **OR** Required, **as directed**.
 - h. Expansion Joint: Not required **OR** Required, **as directed**.
 - i. Sump Receiver Plate: Not required **OR** Required, **as directed**.
 - j. Dome Material: Aluminum **OR** Cast iron **OR** PE **OR** Stainless steel, **as directed**.
 - k. Vandal-Proof Dome: Not required **OR** Required, **as directed**.
- C. Miscellaneous Storm Drainage Piping Specialties
 - 1. Downspout Adaptors:
 - a. Description: Manufactured, gray-iron casting, for attaching to horizontal-outlet, parapet roof drain and to exterior, sheet metal downspout.
 - b. Size: Inlet size to match parapet drain outlet.
 - 2. Downspout Boots:
 - a. Description: Manufactured, ASTM A 48/A 48M, gray-iron casting, with strap or ears for attaching to building; NPS 4 (DN 100) outlet; and shop-applied bituminous coating.
 - b. Size: Inlet size to match downspout and NPS 4 (DN 100) outlet.
 - 3. Conductor Nozzles:
 - a. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.
 - b. Size: Same as connected conductor.
- D. Cleanouts
 - 1. Floor Cleanouts:
 - a. Standard: ASME A112.36.2M, for adjustable housing **OR** cast-iron soil pipe with cast-iron ferrule **OR** heavy-duty, adjustable housing **OR** threaded, adjustable housing, **as directed**, cleanouts.
 - b. Size: Same as connected branch.
 - c. Type: Adjustable housing **OR** Cast-iron soil pipe with cast-iron ferrule **OR** Heavy-duty, adjustable housing **OR** Threaded, adjustable housing, **as directed**.
 - d. Body or Ferrule Material: Cast iron **OR** Stainless steel, **as directed**.



- e. Clamping Device: Not required **OR** Required, **as directed**.
 - f. Outlet Connection: Inside calk **OR** Spigot **OR** Threaded, **as directed**.
 - g. Closure: Brass plug with straight threads and gasket **OR** Brass plug with tapered threads **OR** Cast-iron plug **OR** Plastic plug, **as directed**.
 - h. Adjustable Housing Material: Cast iron **OR** Plastic, **as directed**, with threads **OR** set-screws or other device, **as directed**.
 - i. Frame and Cover Material and Finish: Nickel-bronze, copper alloy **OR** Painted cast iron **OR** Polished bronze **OR** Rough bronze **OR** Stainless steel, **as directed**.
 - j. Frame and Cover Shape: Round **OR** Square, **as directed**.
 - k. Top-Loading Classification: Extra-Heavy Duty **OR** Heavy Duty **OR** Light Duty **OR** Medium Duty, **as directed**.
 - l. Riser: ASTM A 74, Extra-Heavy **OR** Service, **as directed**, class, cast-iron drainage pipe fitting and riser to cleanout.
2. Test Tees:
 - a. Standard: ASME A112.36.2M and ASTM A 74, ASTM A 888, or CISPI 301, for cleanout test tees.
 - b. Size: Same as connected drainage piping.
 - c. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or hubless, cast-iron soil-pipe test tee as required to match connected piping.
 - d. Closure Plug: Countersunk or raised head, brass.
 - e. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
 3. Wall Cleanouts:
 - a. Standard: ASME A112.36.2M, for cleanouts. Include wall access.
 - b. Size: Same as connected drainage piping.
 - c. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch **OR** Hubless, cast-iron soil-pipe test tee, **as directed**, as required to match connected piping.
 - d. Closure: Countersunk **OR** Countersunk or raised-head **OR** Raised-head, **as directed**, drilled-and-threaded **OR** brass **OR** cast-iron, **as directed**, plug.
 - e. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
 - f. Wall Access: Round, deep, chrome-plated bronze **OR** flat, chrome-plated brass or stainless-steel, **as directed**, cover plate with screw.
 - g. Wall Access: Round **OR** Square, **as directed**, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.
 4. Plastic Floor Cleanouts:
 - a. Size: Same as connected branch.
 - b. Body Material: PVC.
 - c. Closure Plug: PVC.
 - d. Riser: Drainage pipe fitting and riser to cleanout of same material as drainage piping.
- E. Backwater Valves
1. Cast-Iron, Horizontal Backwater Valves:
 - a. Standard: ASME A112.14.1, for backwater valves.
 - b. Size: Same as connected piping.
 - c. Body Material: Cast iron.
 - d. Cover: Cast iron with bolted or threaded access check valve.
 - e. End Connections: Hub and spigot or hubless.
 - f. Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang closed **OR** open for airflow unless subject to backflow condition, **as directed**.
 - g. Extension: ASTM A 74, Service class; full-size, cast-iron soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.
 2. Cast-Iron, Drain-Outlet Backwater Valves:
 - a. Size: Same as floor drain outlet.
 - b. Body Material: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
 - c. Check Valve: Removable ball float.
 - d. Inlet: Threaded.



- e. Outlet: Threaded or spigot.
- 3. Plastic, Horizontal Backwater Valves:
 - a. Standard: ASME A112.14.1, for backwater valves.
 - b. Size: Same as connected piping.
 - c. Body Material: ABS **OR** PVC, **as directed**.
 - d. Cover: Same material as body with threaded access to check valve.
 - e. Check Valve: Removable swing check.
 - f. End Connections: Socket type.

F. Trench Drains

- 1. Trench Drains:
 - a. Standard: ASME A112.6.3, for trench drains.
 - b. Body Material: Cast iron.
 - c. Flange: Anchor **OR** Anchor with weep holes **OR** Not required, **as directed**.
 - d. Clamping Device: Not required **OR** Required, **as directed**.
 - e. Outlet: Bottom **OR** End **OR** Side, **as directed**.
 - f. Grate Material: Ductile iron or gray iron **OR** stainless steel, **as directed**.
 - g. Grate Finish: Painted **OR** Not required, **as directed**.
 - h. Dimensions of Frame and Grate: **<Insert dimensions>**.
 - i. Top-Loading Classification: Extra-Heavy Duty **OR** Heavy Duty **OR** Light Duty **OR** Medium Duty, **as directed**.

G. Channel Drainage Systems

- 1. Narrow, Sloped-Invert, Polymer-Concrete, Channel Drainage Systems:
 - a. Type: Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
 - 1) Channel Sections: Narrow, interlocking-joint, sloped-invert, polymer-concrete modular units with end caps. Include rounded bottom, with built-in invert slope of 0.6 percent and with outlets in number, sizes, and locations indicated. Include extension sections necessary for required depth.
 - a) Dimensions: 4-inch (102-mm) inside width. Include number of units required to form total lengths indicated.
 - b) Frame: Galvanized steel or gray iron for grates **OR** Not required, **as directed**.
 - 2) Grates: Manufacturer's designation "heavy duty" **OR** "medium duty", **as directed**, with slots or perforations, and of width and thickness that fit recesses in channel sections.
 - a) Material: Ductile iron **OR** Fiberglass **OR** Galvanized steel **OR** Gray iron **OR** Stainless steel, **as directed**.
 - b) Locking Mechanism: Manufacturer's standard device for securing grates to channel sections **OR** Not required, **as directed**.
 - 3) Covers: Solid ductile or gray iron, of width and thickness that fit recesses in channel sections, and of lengths indicated.
 - 4) Supports, Anchors, and Setting Devices: Manufacturer's standard unless otherwise indicated.
 - 5) Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.
- 2. Narrow, Level-Invert, Polymer-Concrete, Channel Drainage Systems:
 - a. Type: Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
 - 1) Channel Sections: Narrow, interlocking-joint, precast, polymer-concrete modular units with end caps. Include rounded bottom, with level invert and with NPS 4 (DN 100) outlets in number and locations indicated.
 - a) Dimensions: 5-inch (127-mm) inside width and 9-3/4-inch (248-mm) depth. Include number of units required to form total lengths indicated.



- b) Frame: Galvanized steel or gray iron for grates **OR** Not required, **as directed**.
 - 2) Grates: Manufacturer's designation "heavy duty" **OR** "medium duty", **as directed**, with slots or perforations, and of width and thickness that fit recesses in channel sections.
 - a) Material: Ductile iron **OR** Fiberglass **OR** Galvanized steel **OR** Gray iron **OR** Stainless steel, **as directed**.
 - b) Locking Mechanism: Manufacturer's standard device for securing grates to channel sections **OR** Not required, **as directed**.
 - 3) Covers: Solid ductile or gray iron, of width and thickness that fit recesses in channel sections, and of lengths indicated.
 - 4) Supports, Anchors, and Setting Devices: Manufacturer's standard unless otherwise indicated.
 - 5) Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.
 - 3. Wide, Level-Invert, Polymer-Concrete, Channel Drainage Systems:
 - a. Type: Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
 - 1) Channel Sections: Wide, interlocking-joint, precast, polymer-concrete modular units with end caps. Include flat or rounded bottom, with level invert and with outlets in number, sizes, and locations indicated.
 - a) Dimensions: 8-inch (203-mm) inside width and 13-3/4-inch (350-mm) depth. Include number of units required to form total lengths indicated.
 - b) Frame: Galvanized steel or gray iron for grates **OR** Not required, **as directed**.
 - 2) Grates: Manufacturer's designation "heavy duty" **OR** "medium duty", **as directed**, with slots or perforations, and of width and thickness that fit recesses in channel sections.
 - a) Material: Ductile iron **OR** Fiberglass **OR** Galvanized steel **OR** Gray iron **OR** Stainless steel, **as directed**.
 - b) Locking Mechanism: Manufacturer's standard device for securing grates to channel sections **OR** Not required, **as directed**.
 - 3) Covers: Solid ductile or gray iron, of width and thickness that fit recesses in channel sections, and of lengths indicated.
 - 4) Supports, Anchors, and Setting Devices: Manufacturer's standard unless otherwise indicated.
 - 5) Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.
- H. Through-Penetration Firestop Assemblies
- 1. Through-Penetration Firestop Assemblies:
 - a. Standard: ASTM E 814, for through-penetration firestop assemblies.
 - b. Certification and Listing: Intertek Testing Service NA for through-penetration firestop assemblies.
 - c. Size: Same as connected pipe.
 - d. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
 - e. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
 - f. Special Coating: Corrosion resistant on interior of fittings.
- I. Flashing Materials
- 1. Copper Sheet: ASTM B 152/B 152M, 12 oz./sq. ft. (3.7 kg/sq. m or 0.41-mm thickness).



2. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch (1.01-mm) minimum thickness unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.
3. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.
4. Fasteners: Metal compatible with material and substrate being fastened.
5. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
6. Solder: ASTM B 32, lead-free alloy.

1.3 EXECUTION

A. Installation

1. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions. Roofing materials are specified in Division 7 Sections.
 - a. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
 - b. Install expansion joints, if indicated, in roof drain outlets.
 - c. Position roof drains for easy access and maintenance.
2. Install downspout adapters on outlet of back-outlet parapet roof drains and connect to sheet metal downspouts.
3. Install downspout boots at grade with top 6 inches (152 mm) **OR** 12 inches (305 mm) **OR** 18 inches (457 mm), **as directed**, above grade. Secure to building wall.
4. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.
5. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:
 - a. Use cleanouts the same size as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
 - b. Locate cleanouts at each change in direction of piping greater than 45 degrees.
 - c. Locate cleanouts at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
 - d. Locate cleanouts at base of each vertical soil and waste stack.
6. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
7. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
8. Install horizontal backwater valves in floor with cover flush with floor.
9. Install drain-outlet backwater valves in outlet of drains.
10. Install test tees in vertical conductors and near floor.
11. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.
12. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface unless otherwise indicated.
13. Assemble channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.
14. Install through-penetration firestop assemblies in plastic conductors at concrete floor penetrations.
15. Install sleeve flashing device with each conductor passing through floors with waterproof membrane.

B. Connections

1. Comply with requirements for piping specified in Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

C. Flashing Installation



1. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - a. Lead Sheets: Burn joints of 6.0-lb/sq. ft. (30-kg/sq. m) lead sheets, 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of 4.0-lb/sq. ft. (20-kg/sq. m) lead sheets, 0.0625-inch (1.6-mm) thickness or thinner.
 - b. Copper Sheets: Solder joints of copper sheets.
 2. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - a. Pipe Flashing: Sleeve type, matching the pipe size, with a minimum length of 10 inches (250 mm) and with skirt or flange extending at least 8 inches (200 mm) around pipe.
 - b. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
 - c. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.
 3. Set flashing on floors and roofs in solid coating of bituminous cement.
 4. Secure flashing into sleeve and specialty clamping ring or device.
 5. Fabricate and install flashing and pans, sumps, and other drainage shapes.
- D. Protection
1. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
 2. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 05 76 00



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SECTION 22 07 19 00 - FIRE-SUPPRESSION SYSTEMS INSULATION

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for fire-suppression systems insulation. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Insulation Materials:
 - 1) Calcium silicate.
 - 2) Cellular glass.
 - 3) Flexible elastomeric.
 - 4) Mineral fiber.
 - 5) Phenolic.
 - 6) Polyisocyanurate.
 - 7) Polyolefin.
 - 8) Polystyrene.
 - b. Insulating cements.
 - c. Adhesives.
 - d. Mastics.
 - e. Lagging adhesives.
 - f. Sealants.
 - g. Factory-applied jackets.
 - h. Field-applied fabric-reinforcing mesh.
 - i. Field-applied cloths.
 - j. Field-applied jackets.
 - k. Tapes.
 - l. Securements.
 - m. Corner angles.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
3. Shop Drawings:
 - a. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - b. Detail attachment and covering of heat tracing inside insulation.
 - c. Detail insulation application at pipe expansion joints for each type of insulation.
 - d. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - e. Detail removable insulation at piping specialties and equipment connections.
 - f. Detail application of field-applied jackets.
 - g. Detail application at linkages of control devices.
 - h. Detail field application for fire-suppression water storage tanks.
4. Field quality-control reports.

D. Quality Assurance



1. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 - a. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - b. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

E. Delivery, Storage, And Handling

1. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.2 PRODUCTS

A. Insulation Materials

1. Comply with requirements in Part 1.3 schedule articles for where insulating materials shall be applied.
2. Products shall not contain asbestos, lead, mercury, or mercury compounds.
3. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
4. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
5. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
6. Calcium Silicate:
 - a. Preformed Pipe Sections: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
 - b. Prefabricated Fitting Covers: Comply with ASTM C 450 and ASTM C 585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.
7. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - a. Block Insulation: ASTM C 552, Type I.
 - b. Special-Shaped Insulation: ASTM C 552, Type III.
 - c. Board Insulation: ASTM C 552, Type IV.
 - d. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
 - e. Preformed Pipe Insulation with Factory-Applied ASJ **OR** ASJ-SSL, **as directed**: Comply with ASTM C 552, Type II, Class 2.
 - f. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
8. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
9. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
10. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For equipment applications, provide insulation without factory-applied jacket **OR** with factory-applied ASJ **OR** with factory-applied FSK jacket, **as directed**. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
11. Mineral-Fiber, Preformed Pipe Insulation:
 - a. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, without factory-applied



- jacket **OR** with factory-applied ASJ **OR** with factory-applied ASJ-SSL, **as directed**. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- b. Type II, 1200 deg F (649 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, without factory-applied jacket **OR** with factory-applied ASJ **OR** with factory-applied ASJ-SSL, **as directed**. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
12. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ **OR** FSK jacket, **as directed**, complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. (40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F (55 deg C) is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 13. Phenolic:
 - a. Preformed pipe insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type III, Grade 1.
 - b. Block insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type II, Grade 1.
 - c. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
 - d. Factory-Applied Jacket: Requirements are specified in "Factory-Applied Jackets" Article.
 - 1) Preformed Pipe Insulation: None **OR** ASJ, **as directed**.
 - 2) Board for Equipment Applications: None **OR** ASJ, **as directed**.
 14. Polyisocyanurate: Unfaced, preformed, rigid cellular polyisocyanurate material intended for use as thermal insulation.
 - a. Comply with ASTM C 591, Type I or Type IV, except thermal conductivity (k-value) shall not exceed 0.19 Btu x in./h x sq. ft. x deg F (0.027 W/m x K) at 75 deg F (24 deg C) after 180 days of aging.
 - b. Flame-spread index shall be 25 or less and smoke-developed index shall be 50 or less for thickness up to 1-1/2 inches (38 mm) as tested by ASTM E 84.
 - c. Fabricate shapes according to ASTM C 450 and ASTM C 585.
 - d. Factory-Applied Jacket: Requirements are specified in "Factory-Applied Jackets" Article.
 - 1) Pipe Applications: None **OR** ASJ **OR** ASJ-SSL **OR** PVDC **OR** PVDC-SSL, **as directed**.
 - 2) Equipment Applications: None **OR** ASJ **OR** ASJ-SSL **OR** PVDC **OR** PVDC-SSL, **as directed**.
 15. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.
 16. Polystyrene: Rigid, extruded cellular polystyrene intended for use as thermal insulation. Comply with ASTM C 578, Type IV or Type XIII, except thermal conductivity (k-value) shall not exceed 0.26 Btu x in./h x sq. ft. x deg F (0.038 W/m x K) after 180 days of aging. Fabricate shapes according to ASTM C 450 and ASTM C 585.
- B. Insulating Cements
1. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
 2. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.
 3. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
- C. Adhesives
1. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
 2. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F (10 to 427 deg C).
 - a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).



3. Cellular-Glass, Phenolic, Polyisocyanurate, and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F (minus 59 to plus 149 deg C).
 - a. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - a. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
5. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Polystyrene Adhesive: Solvent- or water-based, synthetic resin adhesive with a service temperature range of minus 20 to plus 140 deg F (29 to plus 60 deg C).
7. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.
 - a. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
8. PVC Jacket Adhesive: Compatible with PVC jacket.
 - a. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Mastics

1. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
 - a. For indoor applications, use mastics that have a VOC content of <Insert value> g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
 - a. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
 - b. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
 - c. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
 - d. Color: White.
3. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
 - a. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.
 - b. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
 - c. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
 - d. Color: White.
4. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
 - a. Water-Vapor Permeance: ASTM F 1249, 3 perms (2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
 - b. Service Temperature Range: Minus 20 to plus 200 deg F (Minus 29 to plus 93 deg C).
 - c. Solids Content: 63 percent by volume and 73 percent by weight.
 - d. Color: White.

E. Lagging Adhesives

1. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.
 - a. For indoor applications, use lagging adhesives that have a VOC content of <Insert value> g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over equipment and pipe insulation.
 - c. Service Temperature Range: Minus 50 to plus 180 deg F (Minus 46 to plus 82 deg C).
 - d. Color: White.



F. Sealants

1. Joint Sealants:

- a. Materials shall be compatible with insulation materials, jackets, and substrates.
- b. Permanently flexible, elastomeric sealant.
- c. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
- d. Color: White or gray.
- e. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. FSK and Metal Jacket Flashing Sealants:

- a. Materials shall be compatible with insulation materials, jackets, and substrates.
- b. Fire- and water-resistant, flexible, elastomeric sealant.
- c. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
- d. Color: Aluminum.
- e. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

- a. Materials shall be compatible with insulation materials, jackets, and substrates.
- b. Fire- and water-resistant, flexible, elastomeric sealant.
- c. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
- d. Color: White.
- e. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. Factory-Applied Jackets

1. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

- a. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
- b. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
- c. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
- d. PVDC Jacket for Indoor Applications: 4-mil- (0.10-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms (0.013 metric perms) when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
- e. PVDC Jacket for Outdoor Applications: 6-mil- (0.15-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms (0.007 metric perms) when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
- f. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

H. Field-Applied Fabric-Reinforcing Mesh

1. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. (68 g/sq. m) with a thread count of 10 strands by 10 strands/sq. inch (4 strands by 4 strands/sq. mm) for covering pipe and pipe fittings.
2. Woven Glass-Fiber Fabric for Equipment Insulation: Approximately 6 oz./sq. yd. (203 g/sq. m) with a thread count of 5 strands by 5 strands/sq. inch (2 strands by 2 strands/sq. mm) for covering equipment.
3. Woven Polyester Fabric: Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. inch (4 strands by 4 strands/sq. mm), in a Leno weave.

I. Field-Applied Cloths

1. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd. (271 g/sq. m).



J. Field-Applied Jackets

1. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
2. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - a. Adhesive: As recommended by jacket material manufacturer.
 - b. Color: White **OR** Color-code jackets based on system. Color as selected by the Owner, **as directed**.
 - c. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - 1) Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
 - d. Factory-fabricated tank heads and tank side panels.
3. Metal Jacket:
 - a. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005, Temper H-14.
 - 1) Sheet and roll stock ready for shop or field sizing **OR** Factory cut and rolled to size, **as directed**.
 - 2) Finish and thickness are indicated in field-applied jacket schedules.
 - 3) Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper **OR** 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper **OR** 2.5-mil- (0.063-mm-) thick Polysurlyn, **as directed**.
 - 4) Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper **OR** 2.5-mil- (0.063-mm-) thick Polysurlyn, **as directed**.
 - 5) Factory-Fabricated Fitting Covers:
 - a) Same material, finish, and thickness as jacket.
 - b) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - c) Tee covers.
 - d) Flange and union covers.
 - e) End caps.
 - f) Beveled collars.
 - g) Valve covers.
 - h) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
 - b. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.
 - 1) Sheet and roll stock ready for shop or field sizing **OR** Factory cut and rolled to size, **as directed**.
 - 2) Material, finish, and thickness are indicated in field-applied jacket schedules.
 - 3) Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper **OR** 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper **OR** 2.5-mil- (0.063-mm-) thick Polysurlyn, **as directed**.
 - 4) Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper **OR** 2.5-mil- (0.063-mm-) thick Polysurlyn, **as directed**.
 - 5) Factory-Fabricated Fitting Covers:
 - a) Same material, finish, and thickness as jacket.
 - b) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - c) Tee covers.
 - d) Flange and union covers.
 - e) End caps.
 - f) Beveled collars.
 - g) Valve covers.
 - h) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

K. Tapes



1. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 - a. Width: 3 inches (75 mm).
 - b. Thickness: 11.5 mils (0.29 mm).
 - c. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
 - d. Elongation: 2 percent.
 - e. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
 - f. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
 2. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 - a. Width: 3 inches (75 mm).
 - b. Thickness: 6.5 mils (0.16 mm).
 - c. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
 - d. Elongation: 2 percent.
 - e. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
 - f. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
 3. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
 - a. Width: 2 inches (50 mm).
 - b. Thickness: 6 mils (0.15 mm).
 - c. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
 - d. Elongation: 500 percent.
 - e. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.
 4. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 - a. Width: 2 inches (50 mm).
 - b. Thickness: 3.7 mils (0.093 mm).
 - c. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
 - d. Elongation: 5 percent.
 - e. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.
 5. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.
 - a. Width: 3 inches (75 mm).
 - b. Film Thickness: 4 mils (0.10 mm).
 - c. Adhesive Thickness: 1.5 mils (0.04 mm).
 - d. Elongation at Break: 145 percent.
 - e. Tensile Strength: 55 lbf/inch (10.1 N/mm) in width.
 6. PVDC Tape for Outdoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.
 - a. Width: 3 inches (75 mm).
 - b. Film Thickness: 6 mils (0.15 mm).
 - c. Adhesive Thickness: 1.5 mils (0.04 mm).
 - d. Elongation at Break: 145 percent.
 - e. Tensile Strength: 55 lbf/inch (10.1 N/mm) in width.
- L. Securements
1. Bands:
 - a. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 **OR** Type 316, **as directed**; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm) **OR** 3/4 inch (19 mm), **as directed**, wide with wing seal **OR** closed seal, **as directed**.
 - b. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) **OR** 3/4 inch (19 mm), **as directed**, wide with wing seal **OR** closed seal, **as directed**.
 - c. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
 2. Insulation Pins and Hangers:
 - a. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in

position indicated when self-locking washer is in place. Comply with the following requirements:

- 1) Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
- 2) Spindle: Copper- or zinc-coated, low carbon steel **OR** Aluminum **OR** Stainless steel, **as directed**, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
- 3) Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
- b. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - 1) Baseplate: Galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
 - 2) Spindle: Copper- or zinc-coated, low carbon steel **OR** Aluminum **OR** Stainless steel, **as directed**, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
 - 3) Adhesive-backed base with a peel-off protective cover.
- c. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, galvanized-steel **OR** aluminum **OR** stainless-steel, **as directed**, sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.
 - 1) Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
3. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.
4. Wire: 0.080-inch (2.0-mm) nickel-copper alloy **OR** 0.062-inch (1.6-mm) soft-annealed, stainless steel **OR** 0.062-inch (1.6-mm) soft-annealed, galvanized steel, **as directed**.

1.3 EXECUTION

A. Preparation

1. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
OR
Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 - a. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils (0.127 mm) thick and an epoxy finish 5 mils (0.127 mm) thick if operating in a temperature range between 140 and 300 deg F (60 and 149 deg C). Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 - b. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
3. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

B. General Installation Requirements

1. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.



2. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.
3. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
4. Install insulation with longitudinal seams at top and bottom of horizontal runs.
5. Install multiple layers of insulation with longitudinal and end seams staggered.
6. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
7. Keep insulation materials dry during application and finishing.
8. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
9. Install insulation with least number of joints practical.
10. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - a. Install insulation continuously through hangers and around anchor attachments.
 - b. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - c. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - d. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
11. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
12. Install insulation with factory-applied jackets as follows:
 - a. Draw jacket tight and smooth.
 - b. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
 - c. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) **OR** 4 inches (100 mm), **as directed**, o.c.
 - 1) For below ambient services, apply vapor-barrier mastic over staples.
 - d. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - e. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
13. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
14. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
15. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
16. For above ambient services, do not install insulation to the following:
 - a. Vibration-control devices.
 - b. Testing agency labels and stamps.
 - c. Nameplates and data plates.
 - d. Manholes.
 - e. Handholes.
 - f. Cleanouts.

C. Penetrations



1. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - a. Seal penetrations with flashing sealant.
 - b. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - c. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
 - d. Seal jacket to roof flashing with flashing sealant.
2. Insulation Installation at Below-Grade Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
3. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - a. Seal penetrations with flashing sealant.
 - b. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - c. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
 - d. Seal jacket to wall flashing with flashing sealant.
4. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
5. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - a. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
6. Insulation Installation at Floor Penetrations:
 - a. Pipe: Install insulation continuously through floor penetrations.
 - b. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping".

D. Equipment, Tank, And Vessel Insulation Installation

1. Secure insulation with adhesive and anchor pins and speed washers.
 - a. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 **OR** 50, **as directed**, percent coverage of tank and vessel surfaces.
 - b. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
 - c. Protect exposed corners with secured corner angles.
 - d. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
 - 1) Do not weld anchor pins to ASME-labeled pressure vessels.
 - 2) Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
 - 3) On tanks and vessels, maximum anchor-pin spacing is 3 inches (75 mm) from insulation end joints, and 16 inches (400 mm) o.c. in both directions.
 - 4) Do not overcompress insulation during installation.
 - 5) Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
 - 6) Impale insulation over anchor pins and attach speed washers.
 - 7) Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.



- e. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
 - f. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches (150 mm) from each end. Install wire or cable between two circumferential girdles 12 inches (300 mm) o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches (1200 mm) o.c. Use this network for securing insulation with tie wire or bands.
 - g. Stagger joints between insulation layers at least 3 inches (75 mm).
 - h. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
 - i. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
 - j. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.
2. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.
 - a. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
 - b. Seal longitudinal seams and end joints.
- E. General Pipe Insulation Installation
1. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
 2. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - a. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 - b. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - c. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - d. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 - e. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
 - f. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 - g. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for



- above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
- h. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 - i. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
3. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
 4. Install removable insulation covers at locations indicated. Installation shall conform to the following:
 - a. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 - b. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 - c. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
 - d. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 - e. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

F. Calcium Silicate Insulation Installation

1. Insulation Installation on Straight Pipes and Tubes:
 - a. Secure single-layer insulation with stainless-steel bands at 12-inch (300-mm) intervals and tighten bands without deforming insulation materials.
 - b. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches (75 mm). Secure inner layer with wire spaced at 12-inch (300-mm) intervals. Secure outer layer with stainless-steel bands at 12-inch (300-mm) intervals.
 - c. Apply a skim coat of mineral-fiber, hydraulic-setting cement to insulation surface. When cement is dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch (25 mm). Apply finish coat of lagging adhesive over glass cloth or tape. Thin finish coat to achieve smooth, uniform finish.
2. Insulation Installation on Pipe Flanges:
 - a. Install preformed pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.
 - d. Finish flange insulation same as pipe insulation.
3. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install preformed sections of same material as straight segments of pipe insulation when available.



- b. When preformed insulation sections of insulation are not available, install mitered sections of calcium silicate insulation. Secure insulation materials with wire or bands.
 - c. Finish fittings insulation same as pipe insulation.
 - 4. Insulation Installation on Valves and Pipe Specialties:
 - a. Install mitered segments of calcium silicate insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - b. Install insulation to flanges as specified for flange insulation application.
 - c. Finish valve and specialty insulation same as pipe insulation.
- G. Cellular-Glass Insulation Installation
 - 1. Insulation Installation on Straight Pipes and Tubes:
 - a. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 - b. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and applicable insulation joint sealant.
 - c. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
 - d. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
 - 2. Insulation Installation on Pipe Flanges:
 - a. Install preformed pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
 - d. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.
 - 3. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install preformed sections of same material as straight segments of pipe insulation when available.
 - b. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.
 - 4. Insulation Installation on Valves and Pipe Specialties:
 - a. Install preformed sections of cellular-glass insulation to valve body.
 - b. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - c. Install insulation to flanges as specified for flange insulation application.
- H. Flexible Elastomeric Insulation Installation
 - 1. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
 - 2. Insulation Installation on Pipe Flanges:
 - a. Install pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 - d. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
 - 3. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install mitered sections of pipe insulation.
 - b. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.



4. Insulation Installation on Valves and Pipe Specialties:
 - a. Install preformed valve covers manufactured of same material as pipe insulation when available.
 - b. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - c. Install insulation to flanges as specified for flange insulation application.
 - d. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

I. Mineral-Fiber Insulation Installation

1. Insulation Installation on Straight Pipes and Tubes:
 - a. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 - b. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and applicable insulation joint sealant.
 - c. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
 - d. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
2. Insulation Installation on Pipe Flanges:
 - a. Install preformed pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 - d. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.
3. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install preformed sections of same material as straight segments of pipe insulation when available.
 - b. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
4. Insulation Installation on Valves and Pipe Specialties:
 - a. Install preformed sections of same material as straight segments of pipe insulation when available.
 - b. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 - c. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - d. Install insulation to flanges as specified for flange insulation application.

J. Phenolic Insulation Installation

1. General Installation Requirements:
 - a. Secure single-layer insulation with stainless-steel bands at 12-inch (300-mm) intervals and tighten bands without deforming insulation materials.
 - b. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches (75 mm). Secure inner layer with 0.062-inch (1.6-mm) wire spaced at 12-inch (300-mm) intervals. Secure outer layer with stainless-steel bands at 12-inch (300-mm) intervals.
2. Insulation Installation on Straight Pipes and Tubes:
 - a. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.



- b. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and applicable insulation joint sealant.
 - c. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
 - d. For insulation with factory-applied jackets with vapor retarders on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
 3. Insulation Installation on Pipe Flanges:
 - a. Install preformed pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.
 4. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install preformed insulation sections of same material as straight segments of pipe insulation.
 5. Insulation Installation on Valves and Pipe Specialties:
 - a. Install preformed insulation sections of same material as straight segments of pipe insulation.
 - b. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - c. Install insulation to flanges as specified for flange insulation application.
- K. Polyisocyanurate Insulation Installation
 1. Insulation Installation on Straight Pipes and Tubes:
 - a. Secure each layer of insulation to pipe with tape or bands and tighten without deforming insulation materials. Orient longitudinal joints between half sections in 3 and 9 o'clock positions on the pipe.
 - b. For insulation with factory-applied jackets with vapor barriers, do not staple longitudinal tabs but secure tabs with additional adhesive or tape as recommended by insulation material manufacturer and seal with vapor-barrier mastic.
 - c. All insulation shall be tightly butted and free of voids and gaps at all joints. Vapor barrier must be continuous. Before installing jacket material, install vapor-barrier system.
 2. Insulation Installation on Pipe Flanges:
 - a. Install preformed pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, same thickness of adjacent pipe insulation, not to exceed 1-1/2-inch (38-mm) thickness.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyisocyanurate block insulation of same thickness as pipe insulation.
 3. Insulation Installation on Fittings and Elbows:
 - a. Install preformed sections of same material as straight segments of pipe insulation.
 4. Insulation Installation on Valves and Pipe Specialties:
 - a. Install preformed sections of polyisocyanurate insulation to valve body.
 - b. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - c. Install insulation to flanges as specified for flange insulation application.
- L. Polyolefin Insulation Installation
 1. Insulation Installation on Straight Pipes and Tubes:
 - a. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
 2. Insulation Installation on Pipe Flanges:
 - a. Install pipe insulation to outer diameter of pipe flange.



- b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.
 - d. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- 3. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install mitered sections of polyolefin pipe insulation.
 - b. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- 4. Insulation Installation on Valves and Pipe Specialties:
 - a. Install cut sections of polyolefin pipe and sheet insulation to valve body.
 - b. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - c. Install insulation to flanges as specified for flange insulation application.
 - d. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

M. Polystyrene Insulation Installation

- 1. Insulation Installation on Straight Pipes and Tubes:
 - a. Secure each layer of insulation with tape or bands and tighten bands without deforming insulation materials. Orient longitudinal joints between half sections in 3 and 9 o'clock positions on the pipe.
 - b. For insulation with factory-applied jackets with vapor barriers, do not staple longitudinal tabs but secure tabs with additional adhesive or tape as recommended by insulation material manufacturer and seal with vapor-barrier mastic.
 - c. All insulation shall be tightly butted and free of voids and gaps at all joints. Vapor barrier must be continuous. Before installing jacket material, install vapor-barrier system.
- 2. Insulation Installation on Pipe Flanges:
 - a. Install preformed pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, same thickness of adjacent pipe insulation, not to exceed 1-1/2-inch (38-mm) thickness.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polystyrene block insulation of same thickness as pipe insulation.
- 3. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install preformed insulation sections of same material as straight segments of pipe insulation.
- 4. Insulation Installation on Valves and Pipe Specialties:
 - a. Install preformed section of polystyrene insulation to valve body.
 - b. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - c. Install insulation to flanges as specified for flange insulation application.

N. Field-Applied Jacket Installation

- 1. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
 - a. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
 - b. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of lagging adhesive.
 - c. Completely encapsulate insulation with coating, leaving no exposed insulation.
- 2. Where FSK jackets are indicated, install as follows:
 - a. Draw jacket material smooth and tight.
 - b. Install lap or joint strips with same material as jacket.



- c. Secure jacket to insulation with manufacturer's recommended adhesive.
 - d. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
 - e. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
 3. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
 - a. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
 4. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.
 5. Where PVDC jackets are indicated, install as follows:
 - a. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
 - b. Wrap factory-presizes jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches (50 mm) over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
 - c. Continuous jacket can be spiral wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
 - d. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches (850 mm) or less. The 33-1/2-inch- (850-mm-) circumference limit allows for 2-inch- (50-mm-) overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
 - e. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.
- O. Finishes
1. Equipment and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 07.
 - a. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - 1) Finish Coat Material: Interior, flat, latex-emulsion size.
 2. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
 3. Color: Final color as selected by the Owner. Vary first and second coats to allow visual inspection of the completed Work.
 4. Do not field paint aluminum or stainless-steel jackets.
- P. Field Quality Control
1. Perform tests and inspections.
 2. Tests and Inspections:
 - a. Inspect field-insulated equipment, randomly selected by the Owner, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
 - b. Inspect pipe, fittings, strainers, and valves, randomly selected by the Owner, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of



inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

3. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

Q. Equipment Insulation Schedule

1. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.
2. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.
3. Fire-suppression water storage tank insulation shall be one of the following:
 - a. Cellular Glass: 2 inches (50 mm) thick.
 - b. Flexible Elastomeric: 1 inch (25 mm) thick.
 - c. Mineral-Fiber Board: 1 inch (25 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Mineral-Fiber Pipe and Tank: 1 inch (25 mm) thick.
 - e. Phenolic: 1 inch (25 mm) thick.
 - f. Polyisocyanurate: 1 inch (25 mm) thick.
 - g. Polyolefin: 1 inch (25 mm) thick.

R. Piping Insulation Schedule, General

1. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
2. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - a. Indoor fire-suppression piping.
 - b. Underground piping.

S. Indoor Piping Insulation Schedule

1. Indoor Engine Coolant Piping for Remote Radiator of Engine-Driven Fire Pump:
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Calcium Silicate: 2 inches (50 mm) thick.
 - 2) Cellular Glass: 2 inches (50 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe, Type I or II: 2 inches (50 mm) thick.
2. Indoor Engine Exhaust Piping and Silencer, All Pipe Sizes: Calcium silicate, 4 inches (100 mm) thick.

T. Outdoor, Aboveground Piping Insulation Schedule

1. Outdoor Engine Coolant Piping for Remote Radiator of Engine-Driven Fire Pump:
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Calcium Silicate: 2 inches (50 mm) thick.
 - 2) Cellular Glass: 2 inches (50 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe, Type I or II: 2 inches (50 mm) thick.
2. Outdoor Engine Exhaust Piping and Silencer, All Pipe Sizes: Calcium silicate, 4 inches (100 mm) thick.
3. Outdoor Fire-Suppression Piping Filled with Water:
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Cellular Glass: 2 inches (50 mm) thick.
 - 2) Flexible Elastomeric: 2 inches (50 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.
 - 4) Phenolic: 2 inches (50 mm) thick.
 - 5) Polyisocyanurate: 2 inches (50 mm) thick.
 - 6) Polyolefin: 2 inches (50 mm) thick.
 - 7) Polystyrene: 2 inches (50 mm) thick.



U. Indoor, Field-Applied Jacket Schedule

1. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
2. If more than one material is listed, selection from materials listed is Contractor's option.
3. Piping, Concealed:
 - a. None.
 - b. Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - c. Painted Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.
 - d. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
4. Piping, Exposed:
 - a. None.
 - b. PVC **OR** PVC, Color-Coded by System, **as directed**: 20 mils (0.5 mm) **OR** 30 mils (0.8 mm), **as directed**, thick.
 - c. Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - d. Painted Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.
 - e. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.

V. Outdoor, Field-Applied Jacket Schedule

1. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
2. If more than one material is listed, selection from materials listed is Contractor's option.
3. Equipment, Concealed:
 - a. None.
 - b. PVC **OR** PVC, Color-Coded by System, **as directed**: 20 mils (0.5 mm) **OR** 30 mils (0.8 mm), **as directed**, thick.
 - c. Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - d. Painted Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.
 - e. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
4. Equipment, Exposed, up to 48 Inches (1200 mm) in Diameter or with Flat Surfaces up to 72 Inches (1800 mm):
 - a. Aluminum **OR** Painted Aluminum, **as directed**, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**, with Z-Shaped Locking Seam, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - b. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed**, with Z-Shaped Locking Seam, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.



5. Equipment, Exposed, Larger Than 48 Inches (1200 mm) in Diameter or with Flat Surfaces Larger Than 72 Inches (1800 mm):
 - a. Aluminum **OR** Painted Aluminum, **as directed**, Smooth **OR** Stucco Embossed, **as directed**, with 1-1/4-Inch- (32-mm-) Deep Corrugations **OR** 2-1/2-Inch- (65-mm-) Deep Corrugations **OR** 4-by-1-Inch (100-by-25-mm) Box Ribs, **as directed**: 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - b. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth **OR** Stucco Embossed, **as directed**, with 1-1/4-Inch- (32-mm-) Deep Corrugations **OR** 2-1/2-Inch- (65-mm-) Deep Corrugations **OR** 4-by-1-Inch (100-by-25-mm) Box Ribs, **as directed**: 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
6. Outdoor Exposed Piping:
 - a. PVC: 20 mils (0.5 mm) **OR** 30 mils (0.8 mm) **OR** 40 mils (1.0 mm), **as directed**, thick.
 - b. Aluminum **OR** Painted Aluminum, **as directed**, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**, with Z-Shaped Locking Seam, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - c. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed** with Z-Shaped Locking Seam, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.

END OF SECTION 22 07 19 00



SECTION 22 07 19 00a - CSF PLUMBING PIPING INSULATION

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.22 07 19 00a

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Piping insulation.
 2. Insulation jackets.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 1. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
 2. ASTM C177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
 3. ASTM C335 - Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.
 4. ASTM C518 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 5. ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
 6. ASTM C547 - Mineral Fiber Pipe Insulation.
 7. ASTM C553 - Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 8. ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.
 9. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
 10. ASTM E84 - Surface Burning Characteristics of Building Materials.
 11. ASTM E96 - Water Vapor Transmission of Materials.
- B. National Fire Protection Association (NFPA):
 1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.



- C. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
 - 1. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- D. Underwriters Laboratories, Inc. (UL):
 - 1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data:
 - a. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 3 years documented experience.
 - 2. Installer: Company specializing in performing the Work of this Section with minimum 3 years documented experience.
- B. Materials:
 - 1. Flame spread/smoke developed rating of 25/50 or less in accordance with ASTM E84, NFPA 255 and UL 723.
 - 2. Insulation for duct, pipe and equipment for above grade exposed to weather outside building shall be certified as being self-extinguishing for 1 inch thickness less than 53 seconds when tested in accordance with ASTM D1692.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver materials to site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Store insulation in original wrapping and protect from weather and construction traffic.
- D. Protect insulation against dirt, water, chemical, and mechanical damage.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Jobsite Requirements
 - 1. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
 - 2. Maintain temperature during and after installation for minimum period of 24 hours.

NOTE TO SPECIFIER

"REQUIRED Article (ENVIRONMENTAL REQUIREMENTS) follows. Do not revise this Part, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer."



1.7 ENVIRONMENTAL REQUIREMENTS

A. Energy efficiency:

1. Insulation: Minimum thickness in accordance with ASHRAE 90.1. Provide additional thickness to ensure surface temperatures are below 100 degrees and to prevent condensation on cold surfaces.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 PIPING INSULATION

A. Glass Fiber

1. Manufacturers:
 - a. CertainTeed Insulation, Valley Forge, PA (800) 233-8990.
 - b. Other acceptable manufacturers offering equivalent products.
 - 1) Knauf Fiber Glass.
 - 2) Manville Insulation, Inc.
 - 3) Owens-Corning Fiberglass
2. Insulation: ASTM C547; rigid molded, noncombustible.
 - a. 'K' ('ksi') value : ASTM C335, 0.24 at 75 degrees F.
 - b. Minimum Service Temperature: -20 degrees F.
 - c. Maximum Service Temperature: 300 degrees F.
 - d. Maximum Moisture Absorption: 0.2 percent by volume.
3. Vapor Barrier Jacket
 - a. ASTM C921, White kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
 - b. Moisture Vapor Transmission: ASTM E96; 0.02 perm inches.
 - c. Secure with self sealing longitudinal laps and butt strips.
 - d. Secure with vapor barrier mastic.
4. Tie Wire: 18 gage stainless steel with twisted ends on maximum 12 inch centers.
5. For insulation outdoors, provide stainless steel jacket, bonded, overlapped, screwed with pop rivets or screws, and sealant placed on joints as per manufacturers recommendation for a water-tight joint.

B. Cellular Foam

1. Manufacturers:
 - a. Armstrong World Industries, Inc, Lancaster, PA (800) 448-1405.
 - b. Other acceptable manufacturers offering equivalent products.
 - 1) Halstead Industries, Inc.
 - 2) Rubatex Corporation, Armaflex II.
2. Insulation: ASTM C534; flexible, cellular elastomeric, molded or sheet.
 - a. 'K' ('ksi') Value: ASTM C177 or C518; 0.27 at 75 degrees F,
 - b. Minimum Service Temperature: -40 degrees F.
 - c. Maximum Service Temperature: 220 degrees F.
 - d. Maximum Moisture Absorption: ASTM D1056; 1.0 percent (pipe) by volume, 1.0 percent (sheet) by volume.



- e. Moisture Vapor Transmission: ASTM E96; 0.20 perm inches.
- f. Maximum Flame Spread: ASTM E84; 25.
- g. Maximum Smoke Developed: ASTM E84; 50.
- h. Connection: Waterproof vapor barrier adhesive.
- 3. Elastomeric Foam Adhesive
 - a. Manufacturers:
 - 1) Dow U.S.A.
 - 2) H. B. Fuller Co.
 - 3) Rubatex Corporation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify that piping has been tested before applying insulation materials.
 - 2. Verify that ductwork has been tested before applying insulation materials.
 - 3. Verify that surfaces are clean, foreign material removed, and dry.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION - PIPING INSULATION

- A. Install materials in accordance with manufacturer's instructions and ASHRAE 90.1.
- B. On exposed piping, locate insulation and cover seams in least visible locations.
- C. Insulated dual temperature pipes or cold pipes conveying fluids below ambient temperature:
 - 1. Provide vapor barrier jackets, factory applied or field applied.
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe.
 - 3. PVC fitting covers may be used.
 - 4. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations.
 - 5. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- D. For insulated pipes conveying fluids above ambient temperature:
 - 1. Provide standard jackets, with or without vapor barrier, factory applied or field applied.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe.
 - 3. Finish with glass cloth and adhesive.
 - 4. PVC fitting covers may be used.
 - 5. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
 - 6. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.



- E. Inserts and Shields:
1. Application: Piping 3 inches diameter or larger.
 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 3. Insert Location: Between support shield and piping and under the finish jacket.
 4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- F. Finish insulation at supports, protrusions, and interruptions.
- G. For all insulated piping located 8 feet and below, provide a PVC jacket. For all exposed insulated piping above 8 feet finish with manufacturer's standard all-service jacket for fiberglass or cellular glass insulated pipe. No jacket required for elastomeric foam insulation.
- H. For exterior applications, provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with banded aluminum jacket with seams located on bottom side of horizontal piping.
- I. For buried piping, use elastomeric foam insulation only.
- J. For heat traced piping, insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.3 CONSTRUCTION

- A. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated.

3.4 PIPING INSULATION SCHEDULE

- A. Glass Fiber Insulation Schedule:

PIPING SYSTEMS	PIPE SIZE Inch	THICKNESS Inch
Plumbing Systems:		
Domestic Hot Water Supply	All	1"
Domestic Hot Water Recirc	All	1"
Tempered Domestic Water Supply	All	1/2"
Tempered Domestic Water Recirc	All	1/2"
Domestic Cold Water	All	1/2"
Horizontal Rain Leaders - Above Grade	All	1"
Other Systems:		
Piping Exposed to Freezing with Heat Tracing	All	2"

- B. Cellular Foam Insulation Schedule

PIPING SYSTEMS	PIPE SIZE Inch	THICKNESS Inch
Plumbing Systems:		
Domestic hot water supply	All	1/2"



Domestic hot water recirc	All	1/2"
Tempered Domestic Water Supply	All	3/8"
Tempered Domestic Water Recirc	All	3/8"
Domestic Cold Water	All	3/8"
Moisture Condensate Drains - Above Grade	All	3/4"
Horizontal Waste Lines from AC Equipment	All	3/4"
HVAC Refrigerant Lines (suction only)	All	3/4"
Other Systems:		
Piping exposed to freezing with heat tracing	All	1"

USPS CSF Specifications issued: 10/1/2013

Last revised: 4/5/2011

END OF SECTION



SECTION 22 08 00 00 - MPF COMMISSIONING OF PLUMBING**

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT AN APPROVED, WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN & CONSTRUCTION SUBMITTED THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.22 08 00 00

PART 1 - GENERAL

PART 2 - WORK INCLUDED

- A. Systems and equipment testing and start-up.
- B. Validation of proper and thorough installation of Division 22 systems and equipment.
- C. Prefunctional performance testing of equipment and systems.
- D. Documentation of tests, procedures, and installations.
- E. Coordination of Training Events.
- F. Generic Start-Up Procedures for mechanical systems and equipment.

PART 3 - GENERAL DESCRIPTION

- A. Commissioning (Cx) is the process of ensuring that all building systems are installed and perform interactively according to the design intent; that systems are efficient and cost effective and meet the Owner's operational needs; that the installation is adequately documented; and that the Operators are adequately trained. It serves as a tool to minimize post-occupancy operational problems. It establishes testing and communication protocols in an effort to advance the building systems from installation to full dynamic operation and optimization.
- B. The USPS shall retain an independent Commissioning Authority (CxA) to provide Commissioning Services through their preapproved vendors.
- C. Commissioning Authority (CxA) shall work to direct and oversee the Cx process and perform functional performance testing.
- D. This Section outlines the Cx procedures specific to the Division 22 Contractors. Requirements common to all work are described in Specifications 019113.

PART 4 - SCOPE

NOTE TO SPECIFIER

THE FOLLOWING SYSTEMS NEED TO BE CUSTOMIZED OR SELECTED FOR EACH PROJECT

REFER TO "NOTE TO SPECIFIER" IN SPECIFICATION 019113 PART 3 FOR SPECIFIC GUIDELINES ON WHAT EQUIPMENT AND SYSTEMS MAY BE COMMISSIONED. EDIT THE LIST ACCORDINGLY.



- A. The following equipment and/or systems may be commissioned in compliance with Specifications 019113, or with Contracting Officer approval:

Compressed Air Systems

Sewage Ejectors and Sump Pumps

Sprinkler System Pumps

PART 5 - RELATED WORK AND DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section
- B. Commissioning Plan: The Cx Plan shall be available for reference as it outlines responsibilities outside of the Construction Contract. It provides the Contractor and the Owner an understanding of the planned commissioning activities for that project.
- C. Section 013300 - Submittal Procedures: Stipulates additional copies of submittals to be submitted and refers to other sections for additional submittal requirements related to Cx.
- D. Section 017704 – Closeout Procedures and Training: Defines the milestones in completion incorporating the Cx process.
- E. Section 019113 – General Commissioning Requirements: Specifies the general facility commissioning procedures common across all Divisions and the Contractor's responsibilities for the commissioning process.
- F. Individual Specification Sections: Individual sections stipulate installation, start-up, warranty, O&M documentation, and training requirements for the system or device specified in the Section.
- G. Section 250804 – Building Automation System (BAS) Commissioning: Details the commissioning procedures specific to the BAS.
- H. Section 230800 – Commissioning of HVAC: Details the commissioning procedures specific to Division 23 work.
- I. Section 260800 – Commissioning of Electrical Systems: Details the commissioning procedures specific to Division 26 work.

PART 6 - DEFINITIONS AND ABBREVIATIONS

- A. Refer to Section 019113 and the Cx Plan.

PART 7 - REFERENCE STANDARDS

- A. ASHRAE Guideline, "Preparation of operating and Maintenance Documentation for Building Systems"
- B. National Environmental Balancing Bureau (NEBB)
- C. AABC Commissioning Group (ACG)
- D. National Fire Protection Association (NFPA)



PART 8 - DOCUMENTATION

- A. In addition to the documentation required in Section 019113, Contractor shall provide to the CxA the following per the procedures specified herein and in other Sections of the specification:

All referenced charts such as vibration severity chart and room noise criteria (NC) curves.

Vibration Severity Charts

- a. Factory Test Reports: Contractor shall provide any factory testing documentation or certified test reports required by the specifications. These shall be provided prior to Acceptance Phase.

Field Testing Agency Reports: Provide all documentation of work of independent testing agencies required by the specification. These shall be provided prior to Acceptance Phase. Field Testing Agency Reports should be provided in pdf electronic format. These may include but are not limited to:

- b. Potable Water Disinfection
- c. Water Treatment
- d. Pipe Pressure Testing

Completed Test and Balance Reports.

PART 9 - SEQUENCING AND SCHEDULING

- A. Refer to Section 019113 and the Cx Plan.

PART 10 - COORDINATION MANAGEMENT PROTOCOLS

- A. Coordination responsibilities and management protocols relative to Cx are defined in the Commissioning Plan. Contractor shall have input in the protocols and all Parties will commit to scheduling obligations. The CxA will record and distribute.

PART 11 - CONTRACTOR RESPONSIBILITIES

- A. Refer to Section 019113: Detailed Contractor responsibilities common to all Divisions are specified in this Section.
- B. The following are additional responsibilities or notable responsibilities specific to Division 22.
- C. Construction Phase:
 1. Provide skilled technicians qualified to perform the work required.
 2. Provide factory-trained and authorized technicians where required by the Contract Documents.
 3. Review and return draft Start-Up Procedures and submit along with the Contractor mark-ups, and manufacturer's application, installation and start-up information.
 4. Provide assistance to the CxA in preparation of the specific Functional Performance Test (FPT) procedures. Contractors, subcontractors and vendors shall review FPT procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests. Damage caused to equipment performed in accordance with the approved procedures will be the responsibility of the Contractor.
 5. Thoroughly complete and inspect installation of systems and equipment as detailed throughout Contract Documents, as required by reference or industry standards, and as specifically indicated elsewhere this Section.
 6. Start-up, and test/adjust/balance systems and equipment prior to functional performance testing by the CxA. Start-Up Procedures shall be in accordance with Contract Documents, reference or industry standards, and specifically elsewhere in Part I of this Section.
 7. Record Start-up Procedures and certify that the systems and equipment have been started and or tested in accordance with the requirements specified above. Each task or item shall be indicated with the Party actually performing the task or procedure.



B. Acceptance Phase:

Assist CxA in functional performance testing. Assistance will generally include the following:

1. Manipulate systems and equipment to facilitate testing (as dictated by the Cx Plan; in some cases this will entail only an initial sample);
2. Provide any specialized instrumentation necessary for functional performance testing;
3. Respond to all Action Items which are assigned to the respective Division 22 Contractors.
4. Resolve all deficiencies which are determined to be within the Division 22 scope of work.

C. Warranty Phase

Maintain record documentation of any configurations, set ups, parameters etc, that change throughout the warranty period.

1. Provide representative for off season testing as required by CxA.
2. Respond to Warranty issues as required by Division 1 and the General Conditions.

PART 12 - EQUIPMENT SUPPLIER RESPONSIBILITIES

- A. Refer to Section 019113.

PART 13 - CONTRACTOR NOTIFICATION AND SCHEDULING

- A. Refer to Section 019113.

PART 14 - START-UP PROCEDURES AND DOCUMENTATION

- A. Refer to Section 019113 and as detailed in Part 3 below.

PART 15 - EQUIPMENT NAMEPLATE DATA

- A. Refer to Division 1 and 019113.

PART 16 - FUNCTIONAL PERFORMANCE TESTING

- A. Contractor shall participate in the initial samples of Functional Performance Testing.

PART 17 - FPT ACCEPTANCE CRITERIA

- A. Acceptance criteria for tests are indicated in Section 019113 and in the specification Sections applicable to the systems being tested. Generally, unless indicated otherwise, the criteria for acceptance will be that specified with the individual system, equipment, component, or device.

PART 18 - TRAINING

- A. Contractors, Subcontractor, Vendors, and other applicable Parties shall prepare and conduct training sessions on the installed systems and equipment they are responsible for per the requirements of Section 019113 and the individual Specifications.



PART 19 - O&M MANUAL CONTENT - PREPARATION AND LOGISTICS

- A. Refer to Division 1 and 019113 and the individual Specifications.

PART 20 - PRODUCTS

PART 21 - INSTRUMENTATION

- A. All testing equipment used by any Party shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified.
- B. Standard Testing Instrumentation: Standard instrumentation used for testing air and water flows, temperatures, humidity, noise levels, amperage, voltage, and pressure differential in air and water systems shall be provided by CxA.
- C. Special Tools: Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and turned over to the Owner upon project completion.

PART 22 - TEST KITS FOR METERS AND GAGES

- A. Test kits for meters and gages shall be provided to the Owner new. Previously used kits will be unacceptable. Kits shall be submitted prior to the Acceptance Phase. Kits included shall be as a minimum:

Digital indication of temperature and pressure with associated sensors to work with the P/T test ports

Companion readout kit (with fittings) for calibrated balancing valve with ranges as required by all devices on this project

PART 23 - EXECUTION

PART 24 - START-UP PROCEDURES - GENERAL

- A. Start-Up Procedures are the direct responsibility of the Contractor as a basic element of validating that the installation is correct per industry wide best practices as it relates to quality control. These items shall provide a guideline for the Contractor to determine the level of care required for start-up of the systems. The Contractor shall synthesize their own internal quality control practices, those of the manufacturer, and any applicable codes and standards to supplement the start up procedures for project-specific applications. These supplemented procedures will be turned over to the CxA for development of the project-specific start-up procedures.

NOTE TO SPECIFIER

THE FOLLOWING ITEEMS NEED TO BE CUSTOMIZED OR SELECTED FOR EACH PROJECT. EDIT THE LIST ACCORDINGLY.

PART 25 - PROCEDURES COMMON TO ALL SYSTEMS

- A. The following start up verifications/procedures are common to all systems:
Checkout shall proceed from devices to the components to the systems.
Verify labeling is affixed per spec and visible



Verify prerequisite procedures are done.
Inspect for damage and ensure none is present.
Verify system is applied per the manufacturer's recommendations
Verify system has been started up per the manufacturer's recommendations
Verify that access is provided for inspection, operation and repair
Verify that access is provided for replacement of the equipment
Verify the record drawings, submittal data and O&M documentation accurately reflect the installed systems
Verify all gages and test ports are provided as required by contract documents and manufacturer's recommendations
Verify all recorded nameplate data is accurate
Installation is done to ensure safe operation and maintenance.
Verify specified replacement material/attic stock has been provided as required by the Construction Documents
Verify all rotating parts are properly lubricated
Verify all monitoring and ensure all alarms are active and set per Owner's requirements

END OF SECTION

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 9/10/2010

END OF SECTION



SECTION 22 10 00 00 - CSF PLUMBING PIPING AND PUMPS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.22 10 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Pipe and pipe fittings.
 2. Valves.
 3. Sanitary sewer piping system.
 4. Domestic water piping.
 5. Storm water piping system.
 6. Fuel gas piping system.
 7. Fuel oil piping system.
 8. Backflow preventers.
 9. Cleanouts.
 10. Trap Primers
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 REFERENCES

- A. American National Standards Institute, Inc. (ANSI):
 1. ANSI B31.9 - Building Service Piping.
 2. ANSI B31.2 and ANSI/AGA LC 1a - Fuel Gas Piping.
- B. American Society of Mechanical Engineers (AMSE):
 1. ASME Sec. 9 - Welding and Brazing Qualifications.
 2. ASME B16.1-1989 - Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800.
 3. ASME B16.3-1992- Malleable Iron Threaded Fittings.
 4. ASME B16.4-1992- Cast Iron Threaded Fittings Class 125 and 250.
 5. ASME B16.18-1984 - Cast Bronze Solder-Joint Pressure Fittings.
 6. ASME B16.22-1995- Wrought Copper and Bronze Solder-Joint Pressure Fittings
 7. ASME B16.23-1992- Cast Copper Alloy Solder-Joint Drainage Fittings - DWV.



8. ASME B16.26-1988- Cast Bronze Fittings for Flared Copper Tubes.

C. American Society for Testing and Materials (ASTM):

1. ASTM A47-99 - Ferritic Malleable Iron Castings.
2. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
3. ASTM A74 -98- Cast Iron Soil Pipe and Fittings.
4. ASTM B32-96 - Solder Metal.
5. ASTM B42-98- Seamless Copper Pipe, Standard Sizes.
6. ASTM B75-99 - Seamless Copper Tube.
7. ASTM B88-99 - Seamless Copper Water Tube.
8. ASTM B251-99 - Wrought Seamless Copper and Copper-Alloy Tube.
9. ASTM C564-95a - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
10. ASTM D2447-99 - Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.

D. American Welding Society (AWS):

1. AWS A5.8-92 - Specification for Filler Metals for Brazing and Braze Welding.

E. Cast Iron Soil Pipe Institute (CISPI):

1. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.
2. CISPI 310 - Joints for Hubless Cast Iron Sanitary Systems.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

1. Product Data: Data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
2. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.

1. Project Record Documents: Accurately record the following:
 - a. Actual locations of valves.
2. Operation and Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

B. Regulatory Requirements:

1.5 DELIVERY, STORAGE, AND HANDLING



- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements: Do not install underground piping when bedding is wet or frozen.

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

PART 2 - PRODUCTS

2.1 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Cast Iron Pipe: ASTM A74 service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets, or oakum and lead.
- B. Cast Iron Pipe: CISPI 301, hubless, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: ASTM C564, neoprene gasket system stainless steel clamp-and-shield assemblies.
- C. PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.
 - 1. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns.
 - 2. Shall not be allowed in return air plenums or any other area not allowed by code.

NOTE TO SPECIFIER

Where permitted by local code.

2.2 SANITARY SEWER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: ASTM A74, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: ASTM C564, neoprene gasket system
- B. Cast Iron Pipe: CISPI 301, hubless, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.



- C. PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.
1. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns.

NOTE TO SPECIFIER

Where permitted by local code.

2.3 WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Pipe sizes less than 3 inch shall comply with one or combination of following:
1. Seamless Copper Tubing: Type "K" soft copper to comply with ASTM B 88 latest edition and installed with wrought copper (95-5 Tin Antimony solder joint) fittings in accordance with ASME B16.22. Joints: ASTM B32, Solder, Grade 95TA, 100 percent lead free solder.
 2. Polyvinyl Chloride (PVC) Water Pipe: Pipe shall conform to ASTM D 2241 with an SDR 21 rating and shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 1785 classification. Pipe joints shall be integrally molded bell ends in accordance with ASTM D 3139 with factory supplied elastomeric gaskets and lubricant.
- B. Pipe sizes 3 inch and larger shall comply with one of the following:
1. Ductile Iron Water Pipe: In accordance with AWWA C 151, Fittings shall be either mechanical joint or push-on joint complying with AWWA C 110 or AWWA C-111 (CLASS 50).
 2. Polyvinyl Chloride (PVC) Water Pipe: Pipe shall meet the requirements of AWWA C-900 and comply with ASTM D 2241, rated SDR 21 (Class 150). Pipe shall be continually marked as for smaller pipes. Pipe joints shall be integrally molded bell ends in accordance with ASTM D 3034, Table 2, with factory supplied elastomeric gaskets and lubricant.

2.4 WATER PIPING, ABOVE GRADE

- A. Copper Tubing: ASTM B88, Type L, hard drawn.
1. Fittings: ASME B16.18, cast bronze, or ASME B16.22, wrought copper and bronze.
 2. Joints: ASTM B32, solder, Grade 95TA. 100 percent lead free solder.

2.5 STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Cast Iron Pipe: ASTM A74 service weight.
1. Fittings: Cast iron.
 2. Joints: ASTM C564, neoprene gasket system.
- B. Cast Iron Pipe: CISP 301, hubless, service weight.
1. Fittings: Cast iron.
 2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.
- C. PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.
1. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns.
 2. Shall not be allowed in return air plenums or any other area not allowed by code.

NOTE TO SPECIFIER

Where permitted by local code.



2.6 STORM WATER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: ASTM A74 service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: ASTM C564, neoprene gasket system
- B. Cast Iron Pipe: CISP 301, hubless, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.
- C. PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.
 - 1. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns.

NOTE TO SPECIFIER

Where permitted by local code.

2.7 FUEL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Steel Pipe: ASTM A53, Schedule 40 black.
 - 1. Fittings: ASTM A234, forged steel welding type, with AWWA C105 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape for 2 1/2" and larger pipe..
 - 2. Joints: ANSI B31.1, ANSI B31.2, ANSI B31.9, ASME Sec1 welded.

2.8 FUEL GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53, Schedule 40 black.
 - 1. Fittings: ASME B16.3, malleable iron, or ASTM A234, forged steel welding type.
 - 2. Joints: NFPA 54, up to 2 1/2" - threaded or 3" and above - welded to ANSI B331.1, ANSI B31.2, ANSI B31.9, ASME Sec 1.

2.9 FUEL OIL PIPING

- A. Steel Pipe: ASTM A 53, Type E or S, Grade B, Schedule 40, black.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern, with threaded ends according to ASME B1.20.1.
 - 2. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends according to ASME B1.20.1.
 - 3. Cast-Iron Flanges and Flanged Fittings: ASME B16.1, Class 125.
 - 4. Steel Welding Fittings: ASME B16.9, wrought steel or ASME B16.11, forged steel.
 - 5. Steel Threaded Fittings: ASME B16.11, forged steel with threaded ends according to ASME B1.20.1.
 - 6. Steel Flanges and Flanged Fittings: ASME B16.5.
 - 7. Gasket Material: Thickness, material, and type suitable for fuel oil.
- B. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), water tube, drawn temper.
 - 1. Copper Fittings: ASME B16.22, wrought copper, streamlined pattern.
 - 2. Brazing Filler Metals: AWS A5.8, Silver Classification BAg-1. Filler metal containing phosphorus is prohibited.
 - 3. Bronze Flanges and Flanged Fittings: ASME B16.24, Class 150.



4. Gasket Material: Thickness, material, and type suitable for fuel oil.
- C. Soft Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), water tube, annealed temper.
 1. Copper Fittings: ASME B16.22, wrought copper, streamlined pattern.
 2. Brazing Filler Metals: AWS A5.8, Silver Classification BAg-1. Filler metal containing phosphorus is prohibited.

2.10 FLANGES, UNIONS, AND COUPLINGS

- A. Pipe Size 2 Inches and Under:
 1. Copper tube and pipe: 150 psig bronze unions with soldered joints.
- B. Pipe Size Over 2 Inches:
 1. Copper tube and pipe: 150 psig slip-on bronze flanges: 1/16 inch thick performed neoprene gaskets.
- C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.11 GATE VALVES

- A. Manufacturers:
 1. Grinnell Corporation.
 2. Other acceptable manufacturers offering equivalent products.
 - a. Milwaukee Valve Company.
 - b. Nibco Incorporated.
 - c. Red-White Valve Corporation.
- B. Over 2 Inches: Iron body, bronze trim, rising stem, handwheel, OS&Y, single wedge, flanged ends.

2.12 GLOBE VALVES (Balancing Valve)

- A. Manufacturers:
 1. Grinnell Corporation.
 2. Other acceptable manufacturers offering equivalent products.
 - a. Milwaukee Valve Company.
 - b. Nibco Incorporated.
 - c. Red-White Valve Corporation.
- B. Up to and including 2 Inches: Bronze body, bronze trim, rising stem, handwheel, inside screw, renewable composition disc, solder or screwed ends, with back seating capacity (repackable under pressure).
- C. Over 2 Inches: Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

2.13 BALL VALVES

- A. Manufacturers:
 1. Grinnell Corporation.
 2. Other acceptable manufacturers offering equivalent products.
 - a. Hammond Valve.
 - b. Milwaukee Valve Company.



- c. Red-White Valve Corporation.
 - d. Nibco
 - e. Apollo
- B. Up to 2 Inches: Bronze two piece body, stainless or chrome plated steel ball, Teflon seats and stuffing box ring, lever handle solder or threaded ends. Note: Three piece full port ball valves are recommended up to 3". Also recommended to add option for extended handle stem for insulated pipes
- C. Over 2 Inches: Cast steel body, chrome plated steel ball, Teflon seat and stuffing box seals, lever handle, flanged.

2.14 SWING CHECK VALVES

- A. Manufacturers:
- 1. Grinnell Corp.
 - 2. Other acceptable manufacturers offering equivalent products.
 - a. Hammond Valve.
 - b. Nibco, Incorporated.
 - c. Stockham Valves & Fittings.
- B. Valve should have a provision for regrounding without removal of valve from line.
- C. Up to and including 2 Inches: All bronze, 125 psig swp at 350 degrees F.
- D. Over 2 Inches: Flanged iron body, bronze mounted, 125 psig swp at 450 degrees F

2.15 WATER PRESSURE REDUCING VALVES

- A. Manufacturers:
- 1. Armstrong Pumps, Inc, N. Tonawanda, NY (716) 693-8813.
 - 2. Other acceptable manufacturers offering equivalent products.
 - a. Bell & Gossett.
 - b. Watts Regulator Company.
 - c. Zurn Industries, Incorporated.
- B. Construction
- 1. Up to 2 Inches: Bronze body construction with bronze working parts.
 - a. Diaphragm operated with anti-siphon check valve.
 - b. Stainless steel inlet strainer.
 - c. Built-in thermal expansion by pass check valve.
 - 2. Over 2 Inches: Valve shall maintain constant downstream pressure regardless of varying inlet pressure.
 - a. Hydraulically operated, pilot control, diaphragm type globe valve.
 - b. Main valve shall have single removable seat and resilient disc.
 - c. Stem guided at both ends by bearing in valve cover and internal bearing in valve seat.
 - d. Direct acting pilot control, adjustable, spring loaded, normally open diaphragm valve.
 - e. 125 Class - 175 psig max pressure rating with water temp rating up to 180 degree F max.
 - f. Main valve body and cover - Cast iron ASTM A48
 - g. Main valve trim - Bronze ASTM B61
 - h. Pilot Control system - Cast bronze ASTM B62 with 303 stainless steel trim.



2.16 RELIEF VALVES

- A. Manufacturers:
 - 1. Conbraco Industries, Incorporated.
 - 2. Other acceptable manufacturers offering equivalent products.
 - a. IMI Cash Valve, Incorporated.
 - b. Watts Regulator Company.
 - c. Bell & Gossett.
- B. 2 inches and smaller:
 - 1. Heavy bronze body construction, Teflon seat, steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labeled.
 - 2. Fluid shall not discharge into spring chamber.
 - 3. Valve shall have low blow down differential.
 - 4. Valve seat and all working parts to be constructed of non-ferrous material.
 - 5. Working Pressure - 125 psig at 250 degrees F.

2.17 STRAINERS

- A. Manufacturers:
 - 1. Armstrong International.
 - 2. Other acceptable manufacturers offering equivalent products.
 - a. Grinnell Corporation.
 - b. Honeywell.
 - c. Bell & Gossett.
- B. Size 2 inch and Under: Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.
- C. Size 2-1/2 inch to 4 inch: Flanged iron body for 175 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

2.18 BACKFLOW PREVENTERS

- A. Manufacturers:
 - 1. Watts, of following types:
 - a. Reduced Pressure Type: Model No. 909.
 - b. Double Detector Check: ; 909 RPDA.
 - c. Verify acceptable model with local codes.
 - 2. Other acceptable manufacturers offering equivalent products.
 - a. Watts
 - b. Wilkins.
 - c. Zurn
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions permitted.
- C. Unit shall operate completely automatic and be fitted with tight closing shutoff valves and test cocks at each end.
- D. All parts must be replaceable without removing unit from line.
- E. Total pressure drop through complete backflow preventer shall not exceed 10 psi at rated flow.



- F. Backflow preventer assembly shall include strainer basket upstream of the backflow preventer.

2.19 CLEANOUTS:

- A. Manufacturers:
 - 1. Josam.
 - 2. Other acceptable manufacturers offering equivalent products.
 - a. Zurn.
 - b. Wade.
 - c. J. R. Smith.
 - d. Ancon.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions permitted.

2.20 TRAP PRIMER:

- A. Manufacturers:
 - 1. Jay R. Smith Figure 2698.
- B. Water saver trap primer with chrome 1-1/4 inch P-trap and wall supply.
- C. Provide supply 1/2 inch type K copper, with no joints, from wall supply to floor drain (see drawings).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify that excavations are to required grade, dry, and not over-excavated.
- C. Report in writing to Contracting Officer's Representative prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.



- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient.
- D. Install piping to conserve building space and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Install expansion loops in piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Provide clearance for installation of insulation and access to valves and fittings.
- H. Provide access where valves and equipment are not exposed. Coordinate size and location of access doors with Section 083113.
- I. Establish elevations of buried piping outside the building to ensure not less than 12 inches deep nor less than 6 inches below frost line. Maintain minimum cover per local code.
- J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer after welding.
- K. Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting. Refer to Section 099100.
- L. Excavate in accordance with Sections 312300 for work of this Section.
- M. Backfill in accordance with Sections 312300 for work of this Section.
- N. Install bell and spigot pipe with bell end upstream.
- O. Install valves with stems upright or horizontal, not inverted.
- P. The use of lead-containing solder for plumbing and plumbing fixtures is prohibited in the construction of this project.

3.4 APPLICATION

- A. Use grooved mechanical couplings and fasteners only in accessible locations.
- B. Install unions on all bypasses. Install valves and unions ahead of all traps & strainers and at all connections to equipment to facilitate replacement and removal. All unions are to be accessible.
- C. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.
- D. Install gate valves for 4 inches and larger pipe or butterfly valves, balls valves for 3 inches and smaller pipe for shut-off and to isolate equipment, part of systems, or vertical risers.
- E. Install globe or ball valves for throttling, bypass, or manual flow control services.
- F. Provide spring loaded check valves on discharge of water pumps.

3.5 CONSTRUCTION



- A. Site Tolerances:
 - 1. oil or Waste
 - a. System Component - Main or Branch
 - b. 1 inch fall in 4 feet
 - c. Direction of fall is the direction of flow.
 - 2. Roof Drain & Parking Drain
 - a. System Component - Main or Branch
 - b. 1 inch fall in 8 feet
 - c. Direction of fall is the direction of flow.
 - 3. Domestic Water
 - a. System Component - Main or Branch
 - b. 1 inch fall in 60 feet
 - c. Direction of fall is the direction of flow.

3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Prior to starting work, verify system is complete, flushed and clean.
- B. Ensure pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.
- D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.
- F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual equal to that of incoming water or 0.3 mg/L.

3.7 SERVICE CONNECTIONS

- A. Connect to existing Sanitary and Storm Sewer Services and extend to main. Before commencing work check invert elevations required for sewer connections, confirm inverts.
- B. Connect to existing Domestic Water Service and extend to main.
 - 1. Provide reduced pressure double check Backflow Preventer when required by local authority having jurisdiction.
 - 2. Provide Water Meter when required by local authority.
- C. Connect to existing gas meter and regulators. Gas service distribution piping to have initial minimum pressure of approximately 8 inch wc. Coordinate with local utility for available pressure and installation requirements.



END OF SECTION



SECTION 22 11 16 00 - COMPRESSED-AIR PIPING FOR LABORATORY AND HEALTHCARE FACILITIES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for compressed-air piping for laboratory and healthcare facilities. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Compressed-air piping and specialties for nonmedical laboratory facilities, designated "laboratory air," operating at 50 psig (345 kPa) **OR** 100 psig (690 kPa) **OR** 125 psig (860 kPa), **as directed**.
 - b. Medical air piping and specialties, designated "medical air," operating at 50 to 55 psig (345 to 380 kPa).
 - c. Dental air piping and specialties, designated "dental air," operating at 80 to 100 psig (550 to 690 kPa).
 - d. Gas-powered-tool air piping and specialties, designated "instrument air," operating at 175 psig (1200 kPa).
 - e. Healthcare laboratory air piping and specialties, designated "medical laboratory air," operating at 100 psig (690 kPa).

C. Definitions

1. D.I.S.S.: Diameter-index safety system.
2. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
3. Medical Compressed-Air Piping Systems: Include medical air, dental air, instrument air, and medical laboratory air piping systems.

D. Submittals

1. Product Data: For the following:
 - a. Compressed-air tubes and fittings.
 - b. Compressed-air valves and valve boxes.
 - c. Medical compressed-air service connections.
 - d. Medical compressed-air pressure control panels.
 - e. Medical compressed-air manifolds.
 - f. Medical compressed-air alarm system components.
2. Shop Drawings: Diagram power, signal, and control wiring.
3. Piping Material Certification: Signed by Installer certifying that medical compressed-air piping materials comply with NFPA 99 requirements.
4. Brazing certificates.
5. Field quality-control test reports.
6. Operation and maintenance data.

E. Quality Assurance

1. Installer Qualifications:
 - a. Medical Compressed-Air Piping Systems for Healthcare Facilities: Qualify installers according to ASSE Standard #6010.
 - b. Pressure-Seal Joining Procedure for Copper Tubing: Qualify operators according to training provided by Viega; Plumbing and Heating Systems.



2. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the vacuum piping testing indicated, that is a member of the Medical Gas Professional Healthcare Organization **OR** is an NRTL, **as directed**, and that is acceptable to authorities having jurisdiction.
 - a. Qualify testing personnel according to ASSE Standard #6020 for inspectors and ASSE Standard #6030 for verifiers.
3. Source Limitations: Obtain compressed-air service connections of same type and from same manufacturer as service connections provided for in Division 22 Section "Gas Piping For Laboratory And Healthcare Facilities".
4. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications," or AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."
5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
6. ASME Compliance:
 - a. Comply with ASME B31.1, "Power Piping," for laboratory compressed-air piping operating at more than 150 psig (1035 kPa).
 - b. Comply with ASME B31.9, "Building Services Piping," for laboratory compressed-air piping operating at 150 psig (1035 kPa) or less.
7. Comply with NFPA 99, "Health Care Facilities," for medical compressed-air system materials and installation in healthcare facilities.

F. Project Conditions

1. Interruption of Existing Laboratory and Medical Compressed-Air Service(s): Do not interrupt laboratory or medical compressed-air service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - a. Notify Owner no fewer than two days in advance of proposed interruption of laboratory and medical compressed-air service(s).
 - b. Do not proceed with interruption of laboratory and medical compressed-air service(s) without Owner's written permission.

1.2 PRODUCTS

A. Pipes, Tubes, And Fittings

1. Copper Medical Gas Tube: ASTM B 819, Type K **OR** Type L, **as directed**, seamless, drawn temper, that has been manufacturer cleaned, purged, and sealed for medical gas service or according to CGA G-4.1 for oxygen service. Include standard color marking "OXY," "MED," "OXY/MED," "OXY/ACR," or "ACR/MED" in green for Type K tube and in blue for Type L tube.
 - a. General Requirements for Copper Fittings: Manufacturer cleaned, purged, and bagged for oxygen service according to CGA G-4.1.
 - b. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type or MSS SP-73, with dimensions for brazed joints.
 - c. Copper Unions: ASME B16.22 or MSS SP-123, wrought copper or cast-copper alloy.
 - d. Press-Type Fittings:
 - 1) NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
 - 2) NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.
2. Memory-Metal Couplings: Cryogenic compression fitting made of ASTM F 2063, nickel-titanium, shape-memory alloy, and that has been manufacturer cleaned, purged, and sealed for oxygen service according to CGA G-4.1.



3. Copper Water Tube: ASTM B 88, Type M (ASTM B 88M, Type C), seamless, drawn temper.
 - a. Copper Fittings: ASME B16.18, cast-copper or ASME B16.22, wrought-copper, solder-joint pressure type.
 - b. Press-Type Fittings:
 - 1) NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
 - 2) NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.
 4. PVC Pipe: ASTM D 1785, Schedule 40.
 - a. PVC Fittings: ASTM D 2466, Schedule 40, socket type.
- B. Joining Materials
1. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
 2. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
 3. Threaded-Joint Tape: PTFE.
 4. Solvent Cement for Joining PVC Piping: ASTM D 2564. Include primer complying with ASTM F 656.
- C. Valves
1. General Requirements for Valves: Manufacturer cleaned, purged, and bagged according to CGA G-4.1 for oxygen service.
 2. Ball Valves: MSS SP-110, 3-piece body, brass or bronze.
 - a. Pressure Rating: 300 psig (2070 kPa) minimum.
 - b. Ball: Full-port, chrome-plated brass.
 - c. Seats: PTFE or TFE.
 - d. Handle: Lever type with locking device, **as directed**.
 - e. Stem: Blowout proof with PTFE or TFE seal.
 - f. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.
 3. Check Valves: In-line pattern, bronze.
 - a. Pressure Rating: 300 psig (2070 kPa) minimum.
 - b. Operation: Spring loaded.
 - c. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.
 4. Zone Valves: MSS SP-110, 3-piece-body, brass or bronze ball valve with gage.
 - a. Pressure Rating: 300 psig (2070 kPa) minimum.
 - b. Ball: Full-port, chrome-plated brass.
 - c. Seats: PTFE or TFE.
 - d. Handle: Lever type with locking device, **as directed**.
 - e. Stem: Blowout proof with PTFE or TFE seal.
 - f. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.
 - g. Pressure Gage: Manufacturer installed on one copper-tube extension.
 5. Zone Valve Boxes: Formed steel with anchors for recessed mounting, holes with grommets in box sides for tubing extension protection, and of size for single or multiple valves with pressure gages and in sizes required to permit manual operation of valves.
 - a. Interior Finish: Factory-applied white enamel.
 - b. Cover Plate: Aluminum or extruded-anodized aluminum **OR** Satin-chrome finish steel **OR** Stainless steel with NAAMM AMP 503, No. 4 finish, **as directed**, with frangible or removable windows.
 - c. Valve-Box Windows: Clear or tinted transparent plastic with labeling that includes rooms served, according to NFPA 99.

OR

Zone Valve Boxes: Formed or extruded aluminum with anchors for recessed mounting, holes with grommets in box sides for tubing extension protection, and of size for single or multiple valves with pressure gages and in sizes required to permit manual operation of valves.



- a. Interior Finish: Factory-applied white enamel.
 - b. Cover Plate: Aluminum or extruded-anodized aluminum **OR** Stainless steel with NAAMM AMP 503, No. 4 finish, **as directed**, with frangible or removable windows.
 - c. Valve-Box Windows: Clear or tinted transparent plastic with labeling that includes rooms served, according to NFPA 99.
 6. Safety Valves: Bronze-body, ASME-construction, poppet, pressure-relief type with settings to match system requirements.
 7. Pressure Regulators: Bronze body and trim; spring-loaded, diaphragm-operated relieving type; manual pressure-setting adjustment; rated for 250-psig (1725-kPa) minimum inlet pressure; and capable of controlling delivered air pressure within 0.5 psig for each 10-psig (5.0 kPa for each 100-kPa) inlet pressure.
 8. Automatic Drain Valves: Stainless-steel body and internal parts, rated for 200-psig (1380-kPa) minimum working pressure, capable of automatic discharge of collected condensate. Include mounting bracket where wall mounting is indicated, **as directed**.
- D. Medical Compressed-Air Service Connections
1. Connection Devices: For specific medical compressed-air pressure and service listed. Include roughing-in assemblies, finishing assemblies, and cover plates. Individual cover plates are not required if service connection is in multiple unit or assembly with cover plate. Furnish recessed-type units made for concealed piping unless otherwise indicated.
 - a. Roughing-in Assembly:
 - 1) Steel outlet box for recessed mounting and concealed piping.
 - 2) Brass-body outlet block with secondary check valve that will prevent gas flow when primary valve is removed.
 - 3) Double seals that will prevent air leakage.
 - 4) ASTM B 819, NPS 3/8 (DN 10) copper outlet tube brazed to valve with service marking and tube-end dust cap.
 - b. Finishing Assembly:
 - 1) Brass housing with primary check valve.
 - 2) Double seals that will prevent air leakage.
 - 3) Cover plate with gas-service label.
 - c. Quick-Coupler Service Connections: Pressure outlet with noninterchangeable keyed indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment, and with positive-locking ring that retains equipment stem in valve during use.
 - d. D.I.S.S. Service Connections: Pressure outlets, complying with CGA V-5, with threaded indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment.
 - 1) Medical Air Service Connections: CGA V-5, D.I.S.S. No. 1160.
 - 2) Instrument Air Service Connections: CGA V-5, D.I.S.S. No. 1160.
 - e. Cover Plates: One piece, stainless steel, with NAAMM AMP 503, No. 4 finish **OR** metal, with chrome-plated finish **OR** anodized aluminum, **as directed**, and permanent, color-coded, identifying label matching corresponding service.
- E. Medical Compressed-Air Pressure Control Panels
1. Description: Steel box and support brackets for recessed roughing in with stainless-steel or anodized-aluminum cover plate with printed operating instructions. Include manifold assembly consisting of inlet supply valve, inlet supply pressure gage, line-pressure control regulator, outlet supply pressure gage, D.I.S.S. service connection, and piping outlet for remote service connection.
 - a. Minimum Working Pressure: 200 psig (1380 kPa).
 - b. Line-Pressure Control Regulator: Self-relieving diaphragm type with precision manual adjustment.
 - c. Pressure Gages: 0- to 300-psig (0- to 2070-kPa) range.



- d. Service Connection: CGA V-5, D.I.S.S. No. 1160, instrument air outlet.
- e. Before final assembly, provide temporary dust shield and U-tube for testing.
- f. Label cover plate "Air Pressure Control."

F. Medical Compressed-Air Manifolds

1. General Requirements for Medical Compressed-Air Manifolds: Comply with NFPA 99, Ch. 5, "Manifolds for Gas Cylinders without Reserve Supply."
2. Central Control Panel Unit: Weatherproof cabinet, supply and delivery pressure gages, electrical alarm system connections and transformer, indicator lights or devices, manifold connection, pressure changeover switch, line-pressure regulator, shutoff valves, and safety valve.
3. Manifold and Headers: Duplex, nonferrous-metal header for number of cylinders indicated, divided into two equal banks. Units include design for 2000-psig (13.8-MPa) minimum inlet pressure. Include cylinder bank headers with inlet (pigtail) connections complying with CGA V-1, individual inlet check valves, shutoff valve, pressure regulator, check valve, and pressure gage.
4. Compressed-Air Cylinders: Will be furnished by Owner **OR** Number and type of compressed-air cylinders required for complete manifold systems, **as directed**.
5. Operation: Automatic, pressure-switch-activated changeover from one cylinder bank to the other when first bank becomes exhausted, without line-pressure fluctuation or resetting of regulators and without supply interruption by shutoff of either cylinder bank header.
6. Mounting: Wall with mounting brackets for manifold control cabinet and headers **OR** Floor with support legs for manifold control cabinet, **as directed**.
7. Label manifold control unit with permanent label identifying compressed air and system operating pressure.
8. Medical Air Manifolds: For 4 cylinders and 1250-cu. ft./h (9.85-L/s) **OR** 8 cylinders and 2500-cu. ft./h (19.7-L/s), **as directed**, capacity at 55-psig (380-kPa) line pressure.
9. Instrument Air Manifolds: For 8 cylinders and 2000-cu. ft./h (15.7-L/s) **OR** 12 cylinders and 3000-cu. ft./h (23.6-L/s), **as directed**, capacity at 200-psig (1380-kPa) minimum line pressure.

G. Medical Compressed-Air-Piping Alarm Systems

1. Panels for medical compressed-air piping systems may be combined in single panels with medical vacuum and medical gas piping systems.
2. Components: Designed for continuous service and to operate on power supplied from 120 **OR** 240 **OR** 277, **as directed**, -V ac power source to alarm panels and with connections for low-voltage wiring to remote sensing devices. Include step-down transformers if required.
3. Dew Point Monitors: Continuous line monitoring, having panel with gage or digital display, pipeline sensing element, electrical connections for alarm system, factory- or field-installed valved bypass, and visual and cancelable audio signal for dryer site and master alarm panels. Alarm signals when pressure dew point rises above 39 deg F (4 deg C) at 55 psig (380 kPa).
 - a. Operation: Chilled-mirror method **OR** Chilled-mirror method or hygrometer moisture analyzer with sensor probe **OR** Hygrometer moisture analyzer with sensor probe, **as directed**.
4. Pressure Switches or Transducer Sensors: Continuous line monitoring with electrical connections for alarm system.
 - a. Low-Pressure Operating Range: 0- to 100-psig (0- to 690-kPa).
 - b. High-Pressure Operating Range: Up to 250-psig (1725-kPa).
5. Carbon Monoxide Monitors: Panel with gage or digital display, pipeline sensing element, electrical connections for alarm system, and factory- or field-installed valved bypass. Alarm signals when carbon monoxide level rises above 10 ppm.
6. General Requirements for Medical Compressed-Air Alarm Panels: Factory wired with audible and color-coded visible signals to indicate specified functions.
 - a. Mounting: Exposed, surface **OR** Recessed, **as directed**, installation.
 - b. Enclosures: Fabricated from minimum 0.047-inch- (1.2-mm-) thick steel or minimum 0.05-inch- (1.27-mm-) thick aluminum, with knockouts for electrical and piping connections.
7. Master Alarm Panels: Separate trouble alarm signals, pressure gages, and indicators for medical compressed-air piping systems.

- a. Include alarm signals when the following conditions exist:
 - 1) Medical Air: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa), backup air compressor is in operation, pressure drop across filter assembly increases more than 2 psig (13.8 kPa), dew point rises above 39 deg F (4 deg C) at 55 psig (380 kPa), carbon monoxide level rises above 10 ppm, and high water level is reached in receiver for liquid-ring, medical air compressor systems.
 - 2) Dental Air: Pressure drops below 65 psig (450 kPa) or rises above 110 psig (760 kPa), backup air compressor is in operation, pressure drop across filter assembly increases more than 2 psig (13.8 kPa), dew point rises above 50 deg F (10 deg C) at 125 psig (860 kPa), and carbon monoxide level rises above 10 ppm.
 - 3) Instrument Air: Pressure drops below 165 psig (1140 kPa) or rises above 185 psig (1275 kPa).
 - 4) Medical Laboratory Air: Pressure drops below 90 psig (630 kPa) or rises above 110 psig (760 kPa).
 8. Anesthetizing-Area Alarm Panels: Separate trouble alarm signals, pressure gages, and indicators for medical compressed-air piping systems.
 - a. Include alarm signals when the following conditions exist:
 - 1) Medical Air: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa).
 - 2) Instrument Air: Pressure drops below 165 psig (1140 kPa) or rises above 185 psig (1275 kPa).
 9. Area Alarm Panels: Separate trouble alarm signals, pressure gages, and indicators for medical compressed-air piping systems.
 - a. Include alarm signals when the following condition exists:
 - 1) Medical Air: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa).
 10. Dental-Area Alarm Panels: Separate trouble alarm signals, pressure gages, and indicators for medical compressed-air piping systems.
 - a. Include alarm signals when the following conditions exist:
 - 1) Dental Air: Pressure drops below 65 psig (450 kPa) or rises above 110 psig (760 kPa), backup air compressor is in operation, pressure drop across filter assembly increases more than 2 psig (13.8 kPa), dew point rises above 50 deg F (10 deg C) at 125 psig (860 kPa), and carbon monoxide level rises above 10 ppm.
 - 2) Instrument Air: Pressure drops below 165 psig (1140 kPa) or rises above 185 psig (1275 kPa).
 11. Medical Laboratory Area Alarm Panels: Separate trouble alarm signals, pressure gages,; and indicators for medical compressed-air piping systems.
 - a. Include alarm signals when the following condition exists:
 - 1) Medical Laboratory Air: Pressure drops below 90 psig (630 kPa) or rises above 110 psig (760 kPa).
- H. Computer Interface Cabinet
1. Description: Wall-mounting, welded-steel control cabinet with gasketed door, mounting brackets, grounding device, and white-enamel finish for connection of medical compressed-air- piping-system alarms to facility computer. Include factory-installed signal circuit boards, power transformer, circuit breaker, wiring terminal board, and internal wiring capable of interfacing 20, **as directed**, alarm signals.
- I. Compressed-Air-Cylinder Storage Racks
1. Wall Storage Racks: Fabricate racks with chain restraints for upright cylinders as indicated or provide equivalent manufactured wall racks.
 2. Freestanding Storage Racks: Fabricate racks as indicated or provide equivalent manufactured storage racks.



- J. Flexible Pipe Connectors
1. Description: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - a. Working-Pressure Rating: 200 psig (1380 kPa) **OR** 250 psig (1725 kPa), **as directed**, minimum.
 - b. End Connections: Threaded copper pipe or plain-end copper tube.
- K. Sleeves
1. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
 2. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with set screws.
- L. Escutcheons
1. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to closely fit around pipe and tube and OD that completely covers opening.
 2. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-plated finish.
 3. One-Piece, Cast-Brass Escutcheons: With set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass, **as directed**.
 4. Split-Casting, Cast-Brass Escutcheons: With concealed hinge and set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass, **as directed**.
 5. One-Piece, Stamped-Steel Escutcheons: With set screw **OR** spring clips, **as directed**, and chrome-plated finish.
 6. Split-Plate, Stamped-Steel Escutcheons: With concealed **OR** exposed-rivet, **as directed**, hinge, set screw **OR** spring clips, **as directed**, and chrome-plated finish.
 7. One-Piece, Floor-Plate Escutcheons: Cast iron.
 8. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.
- M. Grout
1. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - a. Characteristics: Post-hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - c. Packaging: Premixed and factory packaged.
- N. Nitrogen
1. Description: Comply with USP 28 - NF 23 for oil-free dry nitrogen.

1.3 EXECUTION

- A. Piping Applications
1. Connect new tubing to existing tubing with memory-metal couplings.
 2. Laboratory Air Piping: Use one of the following piping materials for each size range:
 - a. NPS 4 (DN 100) and Smaller: Type L, copper medical gas tube; wrought-copper fittings; and brazed joints.
 - b. NPS 4 (DN 100) and Smaller: Type L, copper medical gas tube; press-type fittings; and pressure-sealed joints.
 - c. NPS 5 to NPS 8 (DN 125 to DN 200): Type L, copper medical gas tube; wrought-copper fittings; and brazed joints.
 3. Medical Air Piping: Use Type L, copper medical gas tube; wrought-copper fittings; and brazed joints.



4. Dental Air Piping: Use Type L, copper medical gas tube; wrought-copper fittings; and brazed joints.
5. Instrument Air Piping:
 - a. NPS 3 (DN 80) and Smaller: Use Type K **OR** Type L, **as directed**, copper medical gas tube; wrought-copper fittings; and brazed joints.
 - b. NPS 3-1/2 (DN 90) and Larger: Use Type K, copper medical gas tube; wrought-copper fittings; and brazed joints.
6. Medical Laboratory Air Piping: Use Type L, copper medical gas tube; wrought-copper fittings; and brazed joints.
7. Drain Piping: Use one of the following piping materials:
 - a. Copper water tube, cast- or wrought-copper fittings, and soldered **OR** press-type fittings, and pressure-sealed, **as directed**, joints.
 - b. PVC pipe, PVC fittings, and solvent-cemented joints.

B. Piping Installation

1. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
2. Comply with ASSE Standard #6010 for installation of compressed-air piping.
3. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
4. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
5. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and coordinate with other services occupying that space.
6. Install piping adjacent to equipment and specialties to allow service and maintenance.
7. Install air and drain piping with 1 percent slope downward in direction of flow.
8. Install nipples, unions, special fittings, and valves with pressure ratings same as or higher than system pressure rating used in applications below unless otherwise indicated.
9. Install eccentric reducers, if available, where compressed-air piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.
10. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.
11. Install thermometer and pressure gage on discharge piping from each air compressor and on each receiver. Comply with requirements in Division 22 Section "Meters And Gages For Plumbing Piping".
12. Install piping to permit valve servicing.
13. Install piping free of sags and bends.
14. Install fittings for changes in direction and branch connections.
15. Install medical compressed-air piping to medical compressed-air service connections specified in this Section, to medical compressed-air service connections in equipment specified in Division 22 Section "Gas Piping For Laboratory And Healthcare Facilities", and to equipment specified in other Sections requiring medical compressed-air service.
16. Install seismic restraints on compressed-air piping. Seismic-restraint devices are specified in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment".
17. Install compressed-air service connections recessed in walls. Attach roughing-in assembly to substrate; attach finishing assembly to roughing-in assembly.
18. Connect compressed-air piping to air compressors and to compressed-air outlets and equipment requiring compressed-air service.
19. Install unions in copper compressed-air tubing adjacent to each valve and at final connection to each piece of equipment, machine, and specialty.



- C. Valve Installation
1. Install shutoff valve at each connection to and from compressed-air equipment and specialties.
 2. Install check valves to maintain correct direction of compressed-air flow from compressed-air equipment.
 3. Install valve boxes recessed in wall and anchored to substrate. Single boxes may be used for multiple valves that serve same area or function.
 4. Install zone valves and gages in valve boxes. Rotate valves to angle that prevents closure of cover when valve is in closed position.
 5. Install safety valves on compressed-air receivers where required by NFPA 99 and where recommended by specialty manufacturers.
 6. Install pressure regulators on compressed-air piping where reduced pressure is required.
 7. Install automatic drain valves on equipment, specialties, and piping with drain connection. Run drain piping to floor drain so contents spill over or into it.
 8. Install flexible pipe connectors in discharge piping and in inlet air piping from remote air-inlet filter, **as directed**, of each air compressor.
- D. Joint Construction
1. Ream ends of PVC pipes and remove burrs.
 2. Remove scale, slag, dirt, and debris from outside of cleaned tubing and fittings before assembly.
 3. Threaded Joints: Apply appropriate tape to external pipe threads.
 4. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter. Continuously purge joint with oil-free dry nitrogen during brazing.
 5. Soldered Joints: Apply ASTM B 813, water-flushable flux to tube end. Join copper tube and fittings according to ASTM B 828.
 6. Pressure-Sealed Joints: Join copper tube and press-type fittings with tools recommended by fitting manufacturer.
 7. Memory-Metal Coupling Joints: Join new copper tube to existing tube according to procedures developed by fitting manufacturer for installation of memory-metal coupling joints.
 8. Solvent-Cemented Joints: Clean and dry joining surfaces. Join PVC pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. Apply primer and join according to ASME B31.9 for solvent-cemented joints, and ASTM D 2672.
- E. Compressed-Air Service Component Installation
1. Install compressed-air pressure control panel in walls. Attach to substrate.
 2. Install compressed-air manifolds on concrete base, **as directed**, anchored to substrate.
 3. Install compressed-air cylinders and connect to manifold piping.
 4. Install compressed-air manifolds with seismic restraints as indicated.
 5. Install compressed-air-cylinder wall storage racks attached to substrate.
- F. Medical Compressed-Air-Piping Alarm System Installation
1. Alarm panels for medical compressed-air piping systems may be combined in single panels with medical vacuum piping systems and medical gas piping systems.
 2. Install alarm system components for medical compressed-air-piping according to and in locations required by NFPA 99.
 3. Install area and master alarm panels for medical compressed-air piping system where indicated.
 4. Install computer interface cabinet with connection to medical compressed-air-piping alarm system and to facility computer.
- G. Sleeve Installation
1. Sleeves are not required for core-drilled holes.
 2. Permanent sleeves are not required for holes formed by removable PE sleeves.

3. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs using galvanized-steel pipe **OR** galvanized-steel sheet **OR** stack sleeve fittings **OR** PVC pipe, **as directed**.
 - a. Wall Penetrations: Cut sleeves to length for mounting flush with both surfaces.
 - b. Floor Penetrations: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

OR

Install sleeves in new walls and slabs as new walls and slabs are constructed.
4. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. PVC **OR** Steel, **as directed**, Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
 - b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger penetrating gypsum board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim" for flashing.
 - 1) Seal space outside of sleeve fittings with grout.
5. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping".

H. Escutcheon Installation

1. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - a. New Piping:
 - 1) Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 - 2) Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish **OR** stamped steel with set screw **OR** stamped steel with set screw or spring clips **OR** stamped steel with spring clips, **as directed**.
 - 3) Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish **OR** One piece or split casting, cast brass with polished chrome-plated finish **OR** Split casting, cast brass with polished chrome-plated finish **OR** One piece, stamped steel with set screw **OR** One piece or split plate, stamped steel with set screw **OR** Split plate, stamped steel with set screw, **as directed**.
 - 4) Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish **OR** cast brass with rough-brass finish **OR** stamped steel with set screw **OR** stamped steel with spring clips **OR** stamped steel with set screw or spring clips, **as directed**.
 - 5) Bare Piping in Equipment Rooms: One piece, cast brass **OR** stamped steel with set screw **OR** stamped steel with spring clips **OR** stamped steel with set screw or spring clips, **as directed**.
 - 6) Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.
 - b. Existing Piping:
 - 1) Chrome-Plated Piping: Split casting, cast brass with chrome-plated finish.
 - 2) Insulated Piping: Split plate, stamped steel with concealed **OR** exposed-rivet, **as directed**, hinge and spring clips.
 - 3) Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish **OR** plate, stamped steel with concealed hinge and spring clips, **as directed**.



- 4) Bare Piping at Ceiling Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish **OR** plate, stamped steel with concealed hinge and set screw, **as directed**.
- 5) Bare Piping in Unfinished Service Spaces: Split casting, cast brass with polished chrome-plated finish **OR** casting, cast brass with rough-brass finish **OR** plate, stamped steel with concealed hinge and set screw or spring clips **OR** plate, stamped steel with concealed or exposed-rivet hinge and set screw or spring clips **OR** plate, stamped steel with exposed-rivet hinge and set screw or spring clips, **as directed**.
- 6) Bare Piping in Equipment Rooms: Split casting, cast brass **OR** plate, stamped steel with set screw or spring clips, **as directed**.
- 7) Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting floor plate.

I. Hanger And Support Installation

1. Comply with requirements in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment" for seismic-restraint devices.
2. Comply with requirements in Division 22 Section "Hangers And Supports For Plumbing Piping And Equipment" for pipe hanger and support devices.
3. Vertical Piping: MSS Type 8 or 42, clamps.
4. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel, clevis hangers.
 - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable, roller hangers.
5. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze. Comply with requirements in Division 22 Section "Hangers And Supports For Plumbing Piping And Equipment" for trapeze hangers.
6. Base of Vertical Piping: MSS Type 52, spring hangers.
7. Support horizontal piping within 12 inches (300 mm) of each fitting and coupling.
8. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
9. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1/4 (DN 8): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 3/8 and NPS 1/2 (DN 10 and DN 15): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
 - c. NPS 3/4 (DN 20): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
 - d. NPS 1 (DN 25): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
 - e. NPS 1-1/4 (DN 32): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
 - f. NPS 1-1/2 (DN 40): 10 feet (3 m) with 3/8-inch (10-mm) rod.
 - g. NPS 2 (DN 50): 11 feet (3.4 m) with 3/8-inch (10-mm) rod.
 - h. NPS 2-1/2 (DN 65): 13 feet (4 m) with 1/2-inch (13-mm) rod.
 - i. NPS 3 (DN 80): 14 feet (4.3 m) with 1/2-inch (13-mm) rod.
 - j. NPS 3-1/2 (DN 90): 15 feet (4.6 m) with 1/2-inch (13-mm) rod.
 - k. NPS 4 (DN 100): 16 feet (4.9 m) with 1/2-inch (13-mm) rod.
 - l. NPS 5 (DN 125): 18 feet (5.5 m) with 1/2-inch (13-mm) rod.
 - m. NPS 6 (DN 150): 20 feet (6 m) with 5/8-inch (16-mm) rod.
 - n. NPS 8 (DN 200): 23 feet (7 m) with 3/4-inch (19-mm) rod.
10. Install supports for vertical copper tubing every 10 feet (3 m).

J. Labeling And Identification

1. Install identifying labels and devices for nonmedical laboratory compressed-air piping, valves, and specialties. Comply with requirements in Division 22 Section "Identification For Plumbing Piping And Equipment".
2. Install identifying labels and devices for medical compressed-air piping systems according to NFPA 99. Use the following or similar captions and color-coding for piping products where required by NFPA 99:
 - a. Medical Air: Black letters on yellow background.



- b. Dental Air: Black letters on yellow-and-white diagonal stripe background.
 - c. Instrument Air: White letters on red background.
 - d. Medical Laboratory Air: Black letters on yellow-and-white checkerboard background.
- K. Field Quality Control For Compressed-Air Piping In Nonmedical Laboratory Facilities
 - 1. Perform tests and inspections of compressed-air piping in nonmedical laboratory facilities and prepare test reports.
 - 2. Tests and Inspections:
 - a. Piping Leak Tests for Compressed-Air Piping: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry nitrogen to pressure of 50 psig (345 kPa) above system operating pressure, but not less than 150 psig (1035 kPa). Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
 - b. Repair leaks and retest until no leaks exist.
 - c. Inspect filters and pressure regulators for proper operation.
- L. Field Quality Control For Medical Compressed-Air Piping In Healthcare Facilities
 - 1. Perform tests and inspections of medical compressed-air piping systems in healthcare facilities and prepare test reports.
 - 2. Tests and Inspections:
 - a. Medical Compressed-Air Testing Coordination: Perform tests, inspections, verifications, and certification of medical compressed-air piping systems concurrently with tests, inspections, and certification of medical vacuum piping and medical gas piping systems.
 - b. Preparation: Perform the following Installer tests according to requirements in NFPA 99 and ASSE Standard #6010:
 - 1) Initial blowdown.
 - 2) Initial pressure test.
 - 3) Cross-connection test.
 - 4) Piping purge test.
 - 5) Standing pressure test for positive-pressure medical compressed-air piping.
 - 6) Repair leaks and retest until no leaks exist.
 - c. System Verification: Comply with requirements in NFPA 99, ASSE Standard #6020, and ASSE Standard #6030 for verification of medical compressed-air piping systems and perform the following tests and inspections:
 - 1) Standing pressure test.
 - 2) Individual-pressurization **OR** Individual-pressurization or pressure-differential **OR** Pressure-differential, **as directed**, cross-connection test.
 - 3) Valve test.
 - 4) Master and area alarm tests.
 - 5) Piping purge test.
 - 6) Piping particulate test.
 - 7) Piping purity test.
 - 8) Final tie-in test.
 - 9) Operational pressure test.
 - 10) Medical air purity test.
 - 11) Verify correct labeling of equipment and components.
 - d. Testing Certification: Certify that specified tests, inspections, and procedures have been performed and certify report results. Include the following:
 - 1) Inspections performed.
 - 2) Procedures, materials, and gases used.
 - 3) Test methods used.
 - 4) Results of tests.
 - 3. Remove and replace components that do not pass tests and inspections and retest as specified above.



END OF SECTION 22 11 16 00



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SECTION 22 11 16 00a - VACUUM PIPING FOR LABORATORY AND HEALTHCARE FACILITIES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for vacuum piping for laboratory and healthcare facilities. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Laboratory low-vacuum piping and specialties, designated "laboratory low vacuum" operating at 12 inches mercury (40.6 kPa vacuum) **OR** 20 inches mercury (67.7 kPa vacuum), **as directed**.
 - b. Laboratory high-vacuum piping and specialties, designated "laboratory high vacuum" operating at 24 inches mercury (81.3 kPa vacuum) **OR** 29 inches mercury (98.2 kPa vacuum), **as directed**.
 - c. Medical surgical vacuum piping and specialties, designated "medical vacuum" operating at 15 inches mercury (380 mm mercury or 50.7 kPa vacuum) **OR** 20 inches mercury (510 mm mercury or 67.7 kPa vacuum) **OR** 30 inches mercury (760 mm mercury or 101.4 kPa vacuum), **as directed**.
 - d. Waste anesthetic gas disposal piping and specialties, designated "WAGD evacuation" operating at 14 inches mercury (355 mm mercury or 47.2 kPa vacuum) **OR** 15 inches mercury (380 mm mercury or 50.7 kPa vacuum), **as directed**.
 - e. Dental vacuum piping and specialties, designated "dental vacuum" operating at 10 inches mercury (255 mm mercury or 33.8 kPa vacuum) **OR** 12 inches mercury (305 mm mercury or 40.6 kPa vacuum), **as directed**.
 - f. Oral-evacuation piping and specialties, designated "HVE" operating at 5 inches mercury (127 mm mercury or 16.9 kPa vacuum) **OR** 8 inches mercury (203 mm mercury or 27.0 kPa vacuum), **as directed**.
 - g. Healthcare laboratory vacuum piping and specialties, designated "medical laboratory vacuum" operating at 12 inches mercury (40.6 kPa vacuum) **OR** 20 inches mercury (67.7 kPa vacuum) **OR** 24 inches mercury (81.3 kPa vacuum), **as directed**.

C. Definitions

1. D.I.S.S.: Diameter-index safety system.
2. HVE: High-volume (oral) evacuation.
3. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
4. WAGD: Waste anesthetic gas disposal.
5. Medical vacuum piping systems include medical vacuum, WAGD evacuation, dental vacuum, HVE, and medical laboratory vacuum piping systems.

D. Submittals

1. Product Data: For the following:
 - a. Vacuum pipes **OR** tubes, **as directed**, and fittings.
 - b. Vacuum valves and valve boxes.
 - c. Medical vacuum service connections and vacuum-bottle brackets.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content.
3. Shop Drawings: Diagram power, signal, and control wiring.



4. Piping Material Certification: Signed by Installer certifying that medical vacuum piping materials comply with NFPA 99 requirements.
5. Qualification Data: For Installer and testing agency.
6. Brazing certificates.
7. Field quality-control test reports.
8. Operation and maintenance data.

E. Quality Assurance

1. Installer Qualifications:
 - a. Medical Vacuum Piping Systems for Healthcare Facilities: Qualify installers according to ASSE Standard #6010.
 - b. Extruded-Tee Outlet Procedure: Qualify operators according to training provided by T-DRILL Industries Inc., for making branch outlets.
 - c. Pressure-Seal Joining Procedure for Copper Tubing: Qualify operators according to training provided by Viega; Plumbing and Heating Systems.
2. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the vacuum piping testing indicated, that is a member of the Medical Gas Professional Healthcare Organization or is an NRTL, and that is acceptable to authorities having jurisdiction.
 - a. Qualify testing personnel according to ASSE Standard #6020 for inspectors and ASSE Standard #6030 for verifiers.
3. Source Limitations: Obtain vacuum service connections of same type and from same manufacture as service connections provided for in Division 22 Section "Gas Piping For Laboratory And Healthcare Facilities".
4. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications," or AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."
5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
6. Comply with ASME B31.9, "Building Services Piping," for vacuum piping in laboratory facilities.
7. NFPA Compliance: Comply with NFPA 99, "Health Care Facilities," for medical vacuum system materials and installation in healthcare facilities.

F. Project Conditions

1. Interruption of Existing Laboratory or Medical Vacuum Service(s): Do not interrupt laboratory or medical vacuum service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of laboratory or medical vacuum service(s).
 - b. Do not proceed with interruption of laboratory or medical vacuum service(s) without the Owner's written permission.

1.2 PRODUCTS

A. Pipes, Tubes, And Fittings

1. Copper Medical Gas Tube: ASTM B 819, Type L, seamless, drawn temper that has been manufacturer cleaned, purged, and sealed for medical gas service or according to CGA G-4.1 for oxygen service. Include standard color marking "OXY," "MED," "OXY/MED," "OXY/ACR," or "ACR/MED" in blue.
 - a. General Requirements for Copper Fittings: Manufacturer cleaned, purged, and bagged for oxygen service according to CGA G-4.1.



- b. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type or MSS SP-73, with dimensions for brazed joints.
 - c. Copper Unions: ASME B16.22 or MSS SP-123, wrought copper or cast-copper alloy.
 - d. Press-Type Fittings:
 - 1) NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
 - 2) NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.
 - 2. Copper Water Tube: ASTM B 88, Type M (ASTM B 88M, Type C), seamless, drawn temper.
 - a. Cast-Copper Fittings: ASME B16.18, solder-joint pressure type.
 - b. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type.
 - c. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150.
 - d. Copper Unions: ASME B16.22 or MSS SP-123, wrought copper or cast-copper alloy.
 - e. Press-Type Fittings:
 - 1) NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
 - 2) NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.
 - 3. Extruded-Tee Outlets: ASTM F 2014 procedure for making branch outlets in copper tube.
 - 4. Memory-Metal Couplings: Cryogenic compression fitting made of ASTM F 2063, nickel-titanium, shape-memory alloy, and that has been manufacturer cleaned, purged, and sealed for oxygen service according to CGA G-4.1.
 - 5. PVC Pipe: ASTM D 1785, Schedule 40 and Schedule 80.
 - a. PVC Pressure Fittings: ASTM D 2466, Schedule 40 and ASTM D 2467, Schedule 80; socket type.
- B. Joining Materials
- 1. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
 - 2. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
 - 3. Threaded-Joint Tape: PTFE.
 - 4. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness, full-face type.
 - 5. Flange Bolts and Nuts: ASME B18.2.1, carbon steel.
 - 6. Solvent Cement for Joining PVC Piping: ASTM D 2564. Include primer complying with ASTM F 656.
 - a. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Valves
- 1. General Requirements for Valves: Manufacturer cleaned, purged, and bagged according to CGA G-4.1 for oxygen service.
 - a. Exception: Factory cleaning and bagging are not required for valves for WAGD service.
 - 2. Copper-Alloy Ball Valves: MSS SP-110, 3-piece body, brass or bronze.
 - a. Pressure Rating: 300 psig (2070 kPa) minimum.
 - b. Ball: Full-port, chrome-plated brass.
 - c. Seats: PTFE or TFE.
 - d. Handle: Lever type with locking device, **as directed**.
 - e. Stem: Blowout proof with PTFE or TFE seal.
 - f. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.
 - 3. Bronze Check Valves: In-line pattern.
 - a. Pressure Rating: 300 psig (2070 kPa) minimum.
 - b. Operation: Spring loaded.



- c. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.
- 4. Zone Valves: MSS SP-110, 3-piece-body, brass or bronze ball valve with gage.
 - a. Pressure Rating: 300 psig (2070 kPa) minimum.
 - b. Ball: Full-port, chrome-plated brass.
 - c. Seats: PTFE or TFE.
 - d. Handle: Lever type with locking device, **as directed**.
 - e. Stem: Blowout proof with PTFE or TFE seal.
 - f. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.
 - g. Vacuum Gage: Manufacturer installed on one copper-tube extension.
- 5. Zone Valve Boxes: Formed steel with anchors for recessed mounting, holes with grommets in box sides for tubing extension protection, and of size for single or multiple valves with vacuum gages and in sizes required to permit manual operation of valves.
 - a. Interior Finish: Factory-applied white enamel.
 - b. Cover Plate: Aluminum or extruded-anodized aluminum **OR** Satin-chrome finish steel **OR** Stainless steel with NAAMM AMP 503, No. 4 finish, **as directed**, with frangible or removable windows.
 - c. Valve-Box Windows: Clear or tinted transparent plastic with labeling that includes rooms served, according to NFPA 99.
- 6. Zone Valve Boxes: Formed or extruded aluminum with anchors for recessed mounting, holes with grommets in box sides for tubing extension protection, and of size for single or multiple valves with vacuum gages and in sizes required to permit manual operation of valves.
 - a. Interior Finish: Factory-applied white enamel.
 - b. Cover Plate: Aluminum or extruded-anodized aluminum **OR** Stainless steel with NAAMM AMP 503, No. 4 finish, **as directed**, with frangible or removable windows.
 - c. Valve-Box Windows: Clear or tinted transparent plastic with labeling that includes rooms served, according to NFPA 99.
- 7. PVC Ball Valves: MSS SP-122, with union ends and 150-psig (1035-kPa) minimum working-pressure rating and suitable for vacuum service.
- 8. PVC Butterfly Valves: Lug type with lever handle and 150-psig (1035-kPa) minimum working-pressure rating and suitable for vacuum service.
- 9. PVC Check Valves: Ball-, in-line-, piston-, or swing-check design with flanged or union ends and 70-psig (480-kPa) **OR** 100-psig (690-kPa), **as directed**, minimum working-pressure rating and suitable for vacuum service.
- 10. Safety Valves: Bronze-body, ASME-construction, pressure-relief type with settings to match system requirements.
- 11. Automatic Drain Valves: Stainless-steel body and internal parts, rated for 200-psig (1380-kPa) minimum working pressure, capable of automatic discharge of collected condensate. Include mounting bracket where wall mounting is indicated.

D. Medical Vacuum Service Connections

- 1. Connection Devices: For specific medical vacuum service listed. Include roughing-in assemblies, finishing assemblies, and cover plates. Individual cover plates are not required if service connection is in multiple unit or assembly with cover plate. Furnish recessed-type units made for concealed piping unless otherwise indicated.
 - a. Roughing-in Assembly:
 - 1) Steel outlet box for recessed mounting and concealed piping.
 - 2) Brass-body inlet block.
 - 3) Seals that will prevent vacuum leakage.
 - 4) ASTM B 819, NPS 3/8 (DN 10) copper outlet tube brazed to valve with service marking and tube-end dust cap.
 - b. Finishing Assembly:
 - 1) Brass housing with primary check valve.
 - 2) Seals that will prevent vacuum leakage.
 - 3) Cover plate with gas-service label.



- c. Quick-Coupler Service Connections: Suction inlets for medical vacuum **OR** medical vacuum and WAGD evacuation **OR** WAGD evacuation, **as directed**, service outlets with noninterchangeable keyed indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment, and with positive-locking ring that retains equipment stem in valve during use.
 - d. D.I.S.S. Service Connections: Suction inlets, complying with CGA V-5, with threaded indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment.
 - 1) Medical Vacuum Service Connections: CGA V-5, D.I.S.S. No. 1220.
 - 2) WAGD Evacuation Service Connections: CGA V-5, D.I.S.S. No. 2220.
 - e. Vacuum Bottle Brackets: One piece, with pattern and finish matching corresponding service cover plate.
 - f. Cover Plates: One piece, stainless steel, with NAAMM AMP 503, No. 4 finish **OR** metal, with chrome-plated finish **OR** anodized aluminum, **as directed**, and permanent, color-coded, identifying label matching corresponding service.
- E. Medical Vacuum Piping Alarm Systems
- 1. Panels for medical vacuum piping systems may be combined in single panels with medical compressed-air and medical gas piping systems.
 - 2. Components: Designed for continuous service and to operate on power supplied from 120-V **OR** 240-V **OR** 277-V, **as directed**, ac power source to alarm panels and with connections for low-voltage wiring to remote sensing devices. Include step-down transformers if required.
 - 3. Vacuum Switches or Transducer Sensors: Continuous line monitoring with electrical connections for alarm system.
 - a. Vacuum Operating Range: 0- to 30-in. Hg (0- to 101-kPa vacuum).
 - 4. General Requirements for Medical Vacuum Alarm Panels: Factory wired with audible and color-coded visible signals to indicate specified functions.
 - a. Mounting: Exposed, surface **OR** Recessed, **as directed**, installation.
 - b. Enclosures: Fabricated from minimum 0.047-inch- (1.2-mm-) thick steel or minimum 0.05-inch- (1.27-mm-) thick aluminum, with knockouts for electrical and piping connections.
 - 5. Master Alarm Panels: With separate trouble alarm signals, vacuum gages, and indicators for medical vacuum piping systems.
 - a. Include alarm signals when the following conditions exist:
 - 1) Medical Vacuum: Vacuum drops below 12-in. Hg (40 kPa vacuum) and backup vacuum pump is in operation.
 - 2) WAGD Evacuation: Vacuum drops below 12-in. Hg (40 kPa vacuum).
 - 3) Dental Vacuum: Vacuum drops below 6-in. Hg (20 kPa vacuum) and backup vacuum producer is in operation.
 - 4) HVE: 4-in. Hg (13 kPa vacuum) and backup vacuum producer is in operation.
 - 5) Medical Laboratory Vacuum: Vacuum drops below 10-in. Hg (34 kPa vacuum).
 - 6. Anesthetizing-Area Alarm Panels: Separate trouble alarm signals; vacuum gages; and indicators for medical vacuum piping systems.
 - a. Include alarm signals when the following conditions exist:
 - 1) Medical Vacuum: Vacuum drops below 12-in. Hg (40 kPa vacuum).
 - 2) WAGD Evacuation: Vacuum drops below 12-in. Hg (40 kPa vacuum).
 - 7. Area Alarm Panels: Separate trouble alarm signals; vacuum gages; and indicators for medical vacuum piping systems.
 - a. Include alarm signals when the following condition exists:
 - 1) Medical Vacuum: Vacuum drops below 12-in. Hg (40 kPa vacuum).
 - 8. Dental Area Alarm Panels: Separate trouble alarm signals; vacuum gages; and indicators for medical vacuum piping systems.
 - a. Include alarm signals when the following conditions exist:
 - 1) Dental Vacuum: Vacuum drops below 6-in. Hg (20 kPa vacuum) and backup vacuum producer is in operation.
 - 2) HVE: 4-in. Hg (13 kPa vacuum) and backup vacuum producer is in operation.



9. Medical Laboratory Area Alarm Panels: Separate trouble alarm signals; vacuum gages; and indicators for medical vacuum piping systems.
 - a. Include alarm signals when the following condition exists:
 - 1) Medical Vacuum: Vacuum drops below 12-in. Hg (40 kPa vacuum).
- F. Computer Interface Cabinet
 1. Description: Wall-mounting, welded-steel, control cabinet with gasketed door, mounting brackets, grounding device, and white-enamel finish for connection of medical vacuum piping system alarms to facility computer. Include factory-installed signal circuit boards, power transformer, circuit breaker, wiring terminal board, and internal wiring capable of interfacing 20 alarm signals.
- G. Flexible Pipe Connectors
 1. Description: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - a. Working-Pressure Rating: 200 psig (1380 kPa) **OR** 250 psig (1725 kPa), **as directed**, minimum.
 - b. End Connections: Threaded copper pipe or plain-end copper tube.
- H. Sleeves
 1. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
 2. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with set screws.
- I. Escutcheons
 1. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to closely fit around pipe and tube and OD that completely covers opening.
 2. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-plated finish.
 3. One-Piece, Cast-Brass Escutcheons: With set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass **OR** Polished chrome-plated and rough brass, **as directed**.
 4. Split-Casting, Cast-Brass Escutcheons: With concealed hinge and set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass **OR** Polished chrome-plated and rough brass, **as directed**.
 5. One-Piece, Stamped-Steel Escutcheons: With set screw **OR** spring clips, **as directed**, and chrome-plated finish.
 6. Split-Plate, Stamped-Steel Escutcheons: With concealed **OR** exposed-rivet, **as directed**, hinge, set screw **OR** spring clips, **as directed**, and chrome-plated finish.
 7. One-Piece, Floor-Plate Escutcheons: Cast iron.
 8. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.
- J. Grout
 1. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - a. Characteristics: Post-hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - c. Packaging: Premixed and factory packaged.
- K. Nitrogen
 1. Description: Comply with USP 28 - NF 23 for oil-free dry nitrogen.



1.3 EXECUTION

A. Preparation

1. Cleaning of Medical Gas Tubing: If manufacturer-cleaned and -capped fittings or tubing are not available or if precleaned fittings or tubing must be recleaned because of exposure, have supplier or separate agency acceptable to authorities having jurisdiction perform the following procedures:
 - a. Clean medical gas tube and fittings, valves, gages, and other components of oil, grease, and other readily oxidizable materials as required for oxygen service according to CGA G-4.1, "Cleaning Equipment for Oxygen Service."
 - b. Wash medical gas tubing and components in hot, alkaline-cleaner-water solution of sodium carbonate or trisodium phosphate in proportion of 1 lb (0.453 kg) of chemical to 3 gal. (11.3 L) of water.
 - 1) Scrub to ensure complete cleaning.
 - 2) Rinse with clean, hot water to remove cleaning solution.

B. Piping Applications

1. Connect new copper tubing to existing tubing with memory-metal couplings.
2. Nonhealthcare Laboratory Low Vacuum Piping: Use one of the following piping materials for each size range:
 - a. NPS 4 (DN 100) and Smaller: Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; wrought-copper fittings; and brazed **OR** soldered, **as directed**, joints.
 - b. NPS 4 (DN 100) and Smaller: Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; press-type fittings; and pressure-sealed joints.
 - c. NPS 5 to NPS 8 (DN 125 to DN 200): Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; wrought-copper fittings; and brazed **OR** soldered, **as directed**, joints.
3. Nonhealthcare Laboratory High Vacuum Piping: Use one of the following piping materials for each size range:
 - a. NPS 4 (DN 100) and Smaller: Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; wrought-copper fittings; and brazed **OR** soldered, **as directed**, joints.
 - b. NPS 4 (DN 100) and Smaller: Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; press-type fittings; and pressure-sealed joints.
 - c. NPS 5 to NPS 8 (DN 125 to DN 200): Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; wrought-copper fittings; and brazed **OR** soldered, **as directed**, joints.
4. Medical Vacuum Piping: Use one of the following piping materials for each size range:
 - a. NPS 4 (DN 100) and Smaller: Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; wrought-copper fittings; and brazed joints.
 - b. NPS 4 (DN 100) and Smaller: Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; press-type fittings; and pressure-sealed joints.
 - c. NPS 5 to NPS 8 (DN 125 to DN 200): Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; wrought-copper fittings; and brazed joints.
5. WAGD Evacuation Piping: Use one of the following piping materials for each size range:
 - a. NPS 4 (DN 100) and Smaller: Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; wrought-copper fittings; and brazed joints.
 - b. NPS 4 (DN 100) and Smaller: Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; press-type fittings; and pressure-sealed joints.
 - c. NPS 5 to NPS 8 (DN 125 to DN 200): Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; wrought-copper fittings; and brazed joints.
6. Dental Vacuum Piping: Use one of the following piping materials for each size range:
 - a. NPS 4 (DN 100) and Smaller: Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; wrought-copper fittings; and brazed **OR** soldered, **as directed**, joints.
 - b. NPS 4 (DN 100) and Smaller: Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; press-type fittings; and pressure-sealed joints.
 - c. NPS 5 to NPS 8 (DN 125 to DN 200): Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; wrought-copper fittings; and brazed **OR** soldered, **as directed**, joints.
7. HVE Piping: Use one of the following piping materials for each size range:



- a. NPS 4 (DN 100) and Smaller: Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; wrought-copper fittings; and brazed **OR** soldered, **as directed**, joints.
 - b. NPS 4 (DN 100) and Smaller: Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; press-type fittings; and pressure-sealed joints.
 - c. NPS 4 (DN 100) and Smaller: Schedule 40 PVC pipe, Schedule 40 PVC fittings **OR** Schedule 80 PVC pipe, Schedule 80 PVC fittings, **as directed**, and solvent-cemented joints.
 - d. NPS 5 to NPS 8 (DN 125 to DN 200): Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; wrought-copper fittings; and brazed **OR** soldered, **as directed**, joints.
 - e. NPS 5 to NPS 8 (DN 125 to DN 200): Schedule 40 PVC pipe, Schedule 40 PVC fittings **OR** Schedule 80 PVC pipe, Schedule 80 PVC fittings, **as directed**, and solvent-cemented joints.
8. Medical Laboratory Vacuum Piping: Use one of the following piping materials for each size range:
- a. NPS 4 (DN 100) and Smaller: Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; wrought-copper fittings; and brazed joints.
 - b. NPS 4 (DN 100) and Smaller: Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; press-type fittings; and pressure-sealed joints.
 - c. NPS 5 to NPS 8 (DN 125 to DN 200): Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; wrought-copper fittings; and brazed joints.
9. Drain Piping: Use one of the following piping materials:
- a. Copper water tube, cast- or wrought-copper fittings, and soldered **OR** press-type fittings, and pressure-sealed, **as directed**, joints.
 - b. PVC pipe, PVC fittings, and solvent-cemented joints.

C. Piping Installation

1. Drawing plans, schematics, and diagrams indicate general location and arrangement of vacuum piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
2. Comply with ASSE Standard #6010 for installation of vacuum piping.
3. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
4. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
5. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and coordinate with other services occupying that space.
6. Install piping adjacent to equipment and specialties to allow service and maintenance.
7. Install vacuum and drain piping with 1 percent slope downward in direction of flow.
8. Install nipples, unions, and special fittings, and valves with pressure ratings same as or higher than piping pressure rating used in applications below unless otherwise indicated.
9. Install eccentric reducers, if available, where vacuum piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.
10. Provide drain leg and drain trap at end of each main and branch and at low points.
11. Install thermometer and vacuum gage on inlet piping to each vacuum producer and on each receiver and separator, **as directed**. Comply with requirements in Division 22 Section "Meters And Gages For Plumbing Piping".
12. Install piping to permit valve servicing.
13. Install piping free of sags and bends.
14. Install fittings for changes in direction and for branch connections. Extruded-tee branch outlets in copper tubing may be made where specified.
15. Install medical vacuum piping to medical vacuum service connections specified in this Section and to equipment specified in other Sections requiring medical vacuum service.



16. Install seismic restraints on vacuum piping. Seismic-restraint devices are specified in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment".
 17. Install medical vacuum service connections recessed in walls. Attach roughing-in assembly to substrate; attach finishing assembly to roughing-in assembly.
 18. Install medical vacuum bottle bracket adjacent to each wall-mounted medical vacuum service connection suction inlet.
 19. Connect vacuum piping to vacuum producers and to equipment requiring vacuum service.
 20. Install unions, in copper vacuum tubing adjacent to each valve and at final connection to each piece of equipment, machine, and specialty.
 21. Install unions, in PVC vacuum piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment, machine, and specialty.
 22. Install flanges, in PVC vacuum piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment, machine, and specialty.
- D. Valve Applications
1. Valves for Copper Vacuum Tubing: Use copper alloy ball and bronze check types.
 2. Valves for PVC Vacuum Piping:
 - a. NPS 4 (DN 100) and Smaller: Use copper alloy ball and bronze **OR** PVC ball, butterfly, and, **as directed**, check types.
 - b. NPS 5 (DN 125) and Larger: Use PVC butterfly and check types.
- E. Valve Installation
1. Install shutoff valve at each connection to and from vacuum equipment and specialties.
 2. Install check valves to maintain correct direction of vacuum flow to vacuum-producing equipment.
 3. Install valve boxes recessed in wall and anchored to substrate. Single boxes may be used for multiple valves that serve same area or function.
 4. Install zone valves and gages in valve boxes. Rotate valves to angle that prevents closure of cover when valve is in closed position.
 5. Install safety valves on vacuum receivers, where required by NFPA 99, and where recommended by specialty manufacturers.
 6. Install automatic drain valves on equipment, specialties, and piping with drain connection. Run drain piping to floor drain, so contents spill over or into it.
 7. Install flexible pipe connectors in suction inlet piping to each vacuum producer.
- F. Joint Construction
1. Ream ends of pipes and tubes and remove burrs.
 2. Remove scale, slag, dirt, and debris from outside of cleaned tubing and fittings before assembly.
 3. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 4. Threaded Joints: Apply appropriate tape to external pipe threads.
 5. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter. Continuously purge joint with oil-free dry nitrogen during brazing.
 6. Soldered Joints: Apply ASTM B 813, water-flushable flux to tube end. Join copper tube and fittings according to ASTM B 828.
 7. Extruded-Tee Outlets: Form branches in copper tube according to ASTM F 2014, with tools recommended by procedure manufacture.
 8. Flanged Joints:
 - a. Copper Tubing: Install flange on copper tubes. Use pipe-flange gasket between flanges. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.
 - b. PVC Piping: Install PVC flange on PVC pipes. Use pipe-flange gasket between flanges. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.
 9. Pressure-Sealed Joints: Join copper tube and copper and copper-alloy fittings with tools recommended by fitting manufacturer.
 10. Memory-Metal Coupling Joints: Join new copper tube to existing tube according to procedures developed by fitting manufacturer for installation of memory-metal coupling joints.
 11. Solvent-Cemented Joints: Clean and dry joining surfaces. Join PVC pipe and fittings according to the following:



- a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
- b. Apply primer and join according to ASME B31.9 for solvent-cemented joints and to ASTM D 2672.

G. Medical Vacuum Piping Alarm System Installation

1. Panels for medical vacuum piping systems may be combined in single panels with medical compressed-air piping systems and medical gas piping systems.
2. Install medical vacuum piping system alarm system components in locations required by and according to NFPA 99.
3. Install medical vacuum piping system area and master alarm panels where indicated.
4. Install computer interface cabinet with connection to medical vacuum piping alarm system and to facility computer.

H. Sleeve Installation

1. Sleeves are not required for core-drilled holes.
2. Permanent sleeves are not required for holes formed by removable PE sleeves.
3. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs using galvanized-steel pipe **OR** galvanized-steel sheet **OR** stack sleeve fittings **OR** PVC pipe, **as directed**.
 - a. Wall Penetrations: Cut sleeves to length for mounting flush with both surfaces.
 - b. Floor Penetrations: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

OR

Install sleeves in new walls and slabs as new walls and slabs are constructed.

4. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. PVC **OR** Steel, **as directed**, Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
 - b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim" for flashing.
 - 1) Seal space outside of sleeve fittings with grout.
5. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping".

I. Escutcheon Installation

1. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - a. New Piping:
 - 1) Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 - 2) Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish **OR** stamped steel with set screw **OR** stamped steel with set screw or spring clips **OR** stamped steel with spring clips, **as directed**.
 - 3) Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish **OR** One piece or split casting, cast brass with polished chrome-plated finish **OR** Split casting, cast brass with polished chrome-plated finish **OR** One-piece, stamped steel with set screw **OR** One piece or split plate, stamped steel with set screw **OR** Split plate, stamped steel with set screw, **as directed**.



- 4) Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish **OR** cast brass with rough-brass finish **OR** stamped steel with set screw **OR** stamped steel with spring clips **OR** stamped steel with set screw or spring clips, **as directed**.
 - 5) Bare Piping in Equipment Rooms: One piece, cast brass **OR** stamped steel with set screw **OR** stamped steel with spring clips **OR** stamped steel with set screw or spring clips, **as directed**.
 - 6) Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.
 - b. Existing Piping:
 - 1) Chrome-Plated Piping: Split casting, cast brass with chrome-plated finish.
 - 2) Insulated Piping: Split plate, stamped steel with concealed **OR** exposed-rivet, **as directed**, hinge and spring clips.
 - 3) Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish **OR** plate, stamped steel with concealed hinge and spring clips, **as directed**.
 - 4) Bare Piping at Ceiling Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish **OR** plate, stamped steel with concealed hinge and set screw, **as directed**.
 - 5) Bare Piping in Unfinished Service Spaces: Split casting, cast brass with polished chrome-plated finish **OR** casting, cast brass with rough-brass finish **OR** plate, stamped steel with concealed hinge and set screw or spring clips **OR** plate, stamped steel with concealed or exposed-rivet hinge and set screw or spring clips **OR** plate, stamped steel with exposed-rivet hinge and set screw or spring clips, **as directed**.
 - 6) Bare Piping in Equipment Rooms: Split casting, cast brass **OR** plate, stamped steel with set screw or spring clips, **as directed**.
 - 7) Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting floor plate.
- J. Hanger And Support Installation
1. Comply with requirements in Division 22 Section "Hangers And Supports For Plumbing Piping And Equipment" for pipe hanger and support devices.
 2. Vertical Piping: MSS Type 8 or 42, clamps.
 3. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel, clevis hangers.
 - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable, roller hangers.
 4. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze. Comply with requirements in Division 22 Section "Hangers And Supports For Plumbing Piping And Equipment" for trapeze hangers.
 5. Base of Vertical Piping: MSS Type 52, spring hangers.
 6. Support horizontal piping within 12 inches (300 mm) of each fitting and coupling.
 7. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
 8. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1/4 (DN 8): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 3/8 and NPS 1/2 (DN 10 and DN 15): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
 - c. NPS 3/4 (DN 20): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
 - d. NPS 1 (DN 25): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
 - e. NPS 1-1/4 (DN 32): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
 - f. NPS 1-1/2 (DN 40): 10 feet (3 m) with 3/8-inch (10-mm) rod.
 - g. NPS 2 (DN 50): 11 feet (3.4 m) with 3/8-inch (10-mm) rod.
 - h. NPS 2-1/2 (DN 65): 13 feet (4 m) with 1/2-inch (13-mm) rod.
 - i. NPS 3 (DN 80): 14 feet (4.3 m) with 1/2-inch (13-mm) rod.
 - j. NPS 3-1/2 (DN 90): 15 feet (4.6 m) with 1/2-inch (13-mm) rod.
 - k. NPS 4 (DN 100): 16 feet (4.9 m) with 1/2-inch (13-mm) rod.
 - l. NPS 5 (DN 125): 18 feet (5.5 m) with 1/2-inch (13-mm) rod.



- m. NPS 6 (DN 150): 20 feet (6 m) with 5/8-inch (16-mm) rod.
 - n. NPS 8 (DN 200): 23 feet (7 m) with 3/4-inch (19-mm) rod.
 - 9. Install supports for vertical copper tubing every 10 feet (3 m).
 - 10. Install hangers **OR** vinyl-coated hangers, **as directed**, for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1 (DN 25) and Smaller: 30 inches (760 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 1-1/2 to NPS 2 (DN 40 to DN 50): 36 inches (900 mm) with 3/8-inch (10-mm) rod.
 - c. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): 42 inches (1150 mm) with 1/2-inch (13-mm) rod.
 - d. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1220 mm) with 1/2-inch (13-mm) rod.
 - e. NPS 6 and NPS 8 (DN 150 and DN 200): 54 inches (1350 mm) with 5/8-inch (16-mm) rod.
 - 11. Install supports for vertical PVC piping every 48 inches (1220 mm).
- K. Labeling And Identification
 - 1. Install identifying labels and devices for laboratory vacuum piping, valves, and specialties. Comply with requirements in Division 22 Section "Identification For Plumbing Piping And Equipment".
 - 2. Install identifying labels and devices for medical vacuum piping systems according to NFPA 99. Use the following or similar captions and color-coding for piping products where required by NFPA 99:
 - a. Medical Vacuum: Black letters on white background.
 - b. WAGD: White letters on violet background.
 - c. Dental Vacuum: Black boxed letters on white-and-black diagonal stripe background.
 - d. HVE: Black boxed letters on white-and-black diagonal stripe background.
 - e. Medical Laboratory Vacuum: Black boxed letters on white-and-black checkerboard background.
- L. Field Quality Control For Laboratory Facility Nonmedical Vacuum Piping
 - 1. Perform tests and inspections of vacuum piping in nonmedical laboratory facilities.
 - 2. Tests and Inspections:
 - a. Piping Leak Tests for Vacuum Piping: Test new and modified parts of existing piping. Cap and fill vacuum piping with oil-free, dry nitrogen. Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
 - 1) Test Pressure for Copper Tubing: 100 psig (690 kPa) **OR** 150 psig (1035 kPa), **as directed**.
 - 2) Test Pressure for PVC Piping: 50 psig (345 kPa) **OR** 100 psig (690 kPa), **as directed**.
 - b. Repair leaks and retest until no leaks exist.
 - c. Inspect filters for proper operation.
 - 3. Prepare test reports.
- M. Field Quality Control For Healthcare Facility Medical Vacuum Piping
 - 1. Perform tests and inspections of medical vacuum piping systems in healthcare facilities and prepare test reports.
 - 2. Tests and Inspections:
 - a. Medical Vacuum Testing Coordination: Perform tests, inspections, verifications, and certification of medical vacuum piping systems concurrently with tests, inspections, and certification of medical compressed-air piping and medical gas piping systems.
 - b. Perform the following Installer tests according to requirements in NFPA 99 and ASSE Standard #6010:
 - 1) Initial blow down.
 - 2) Initial pressure test.
 - 3) Cross-connection test.
 - 4) Piping purge test.



- 5) Standing pressure test for vacuum systems.
 - 6) Repair leaks and retest until no leaks exist.
 - c. System Verification: Comply with requirements in NFPA 99, ASSE Standard #6020, and ASSE Standard #6030 for verification of medical vacuum piping systems and perform the following tests and inspections:
 - 1) Standing pressure test.
 - 2) Individual-pressurization **OR** Pressure-differential, **as directed**, cross-connection test.
 - 3) Valve test.
 - 4) Master and area alarm tests.
 - 5) Piping purge test.
 - 6) Final tie-in test.
 - 7) Operational vacuum test.
 - 8) Verify correct labeling of equipment and components.
 - d. Testing Certification: Certify that specified tests, inspections, and procedures have been performed and certify report results. Include the following:
 - 1) Inspections performed.
 - 2) Procedures, materials, and gases used.
 - 3) Test methods used.
 - 4) Results of tests.
 3. Remove and replace components that do not pass tests and inspections and retest as specified above.
- N. Demonstration
1. Train Owner's maintenance personnel to adjust, operate, and maintain medical vacuum alarm systems.

END OF SECTION 22 11 16 00a



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SECTION 22 11 16 00b - GAS PIPING FOR LABORATORY AND HEALTHCARE FACILITIES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for gas piping for laboratory and healthcare facilities. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Carbon dioxide piping and specialties designated "medical carbon dioxide" operating at 50 to 55 psig (345 to 380 kPa).
 - b. Helium piping, designated "medical helium" operating at 50 to 55 psig (345 to 380 kPa).
 - c. Nitrogen piping and specialties designated "medical nitrogen" operating at 160 to 185 psig (1100 to 1275 kPa) **OR** higher than 200 psig (1380 kPa), **as directed**.
 - d. Nitrous oxide piping and specialties designated "medical nitrous oxide" operating at 50 to 55 psig (345 to 380 kPa).
 - e. Oxygen piping and specialties designated "medical oxygen" operating at 50 to 55 psig (345 to 380 kPa).

C. Definitions

1. CR: Chlorosulfonated polyethylene synthetic rubber.
2. D.I.S.S.: Diameter-index safety system.
3. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
4. Medical gas piping systems include medical carbon dioxide, medical helium, medical nitrogen, medical nitrous oxide, and medical oxygen nonflammable gas for healthcare facility patient care or for healthcare laboratory applications.
5. Specialty Gas: Gas, other than medical gas, for nonmedical laboratory facility applications.

D. Performance Requirements

1. Seismic Performance: Gas manifolds, Bulk gas storage tanks, Gas manifolds and bulk gas storage tanks, and piping shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

E. Submittals

1. Product Data: For the following:
 - a. Tubes and fittings.
 - b. Valves and valve boxes.
 - c. Medical gas service connections.
 - d. Electrical service connections.
 - e. Patient service consoles.
 - f. Medical nitrogen pressure control panels.
 - g. Ceiling columns. Include integral service connections.
 - h. Ceiling hose assemblies. Include integral service connections.
 - i. Gas manifolds.
 - j. Bulk gas storage tanks. Include rated capacities and operating weights.
 - k. Medical gas alarm system components.
 - l. Gas cylinder storage racks.
2. Shop Drawings: Diagram power, signal, and control wiring.



3. Piping Material Certification: Signed by Installer certifying that medical gas piping materials comply with NFPA 99 requirements.
4. Brazing certificates.
5. Manufacturer Seismic Qualification Certification: Submit certification that gas manifolds and bulk gas storage tanks, accessories, and components will withstand seismic forces defined in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment". Include the following:
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
6. Certificates of Shop Inspection and Data Report for Bulk Gas Storage Tanks: As required by ASME Boiler and Pressure Vessel Code.
7. Field quality-control test reports.
8. Operation and maintenance data.

F. Quality Assurance

1. Installer Qualifications:
 - a. Medical Gas Piping Systems for Healthcare Facilities: Qualify installers according to ASSE Standard #6010 for installers.
2. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the medical gas piping testing indicated, that is a member of the Medical Gas Professional Healthcare Organization or is an NRTL as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - a. Qualify testing personnel according to ASSE Standard #6020 for inspectors and ASSE Standard #6030 for verifiers.
3. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications"; or AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."
4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
5. ASME Compliance: Fabricate and label bulk medical gas storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
6. NFPA Compliance:
 - a. Comply with NFPA 50, "Bulk Oxygen Systems at Consumer Sites," for bulk oxygen storage tanks.
 - b. Comply with NFPA 99, "Health Care Facilities," for medical gas piping system materials and installation.
7. CGA Compliance: Comply with CGA G-8.1, "Nitrous Oxide Systems at Consumer Sites," for bulk nitrous oxide storage tanks.
8. UL Compliance:
 - a. Comply with UL 498, "Attachment Plugs and Receptacles," for electrical service connections.
 - b. Comply with UL 544, "Medical and Dental Equipment," for medical gas specialties.

G. Project Conditions

1. Interruption of Existing Specialty and Medical Gas Service(s): Do not interrupt specialty or medical gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - a. Notify Owner no fewer than two days in advance of proposed interruption of specialty and medical gas service(s).
 - b. Do not proceed with interruption of specialty and medical gas service(s) without Owner's written permission.



1.2 PRODUCTS

A. Pipes, Tubes, And Fittings

1. Copper Medical Gas Tube: ASTM B 819, Type K **OR** Type L, **as directed**, seamless, drawn temper that has been manufacturer cleaned, purged, and sealed for medical gas service or according to CGA G-4.1 for oxygen service. Include standard color marking "OXY," "MED," "OXY/MED," "OXY/ACR," or "ACR/MED" in green for Type K tube and blue for Type L tube.
 - a. General Requirements for Copper Fittings: Manufacturer cleaned, purged, and bagged for oxygen service according to CGA G-4.1.
 - b. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type or MSS SP-73, with dimensions for brazed joints.
 - c. Copper Unions: ASME B16.22 or MSS SP-123, wrought copper or cast-copper alloy.
 - d. Press-Type Fittings:
 - 1) NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
 - 2) NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.
 - e. Memory-Metal Couplings: Cryogenic compression fitting made of ASTM F 2063, nickel-titanium, shape-memory-alloy, and that has been manufacturer cleaned, purged, and sealed for oxygen service according to CGA G-4.1.
2. PVC Pipe: ASTM D 1785, Schedule 40 and Schedule 80.
 - a. PVC Fittings: ASTM D 2466, Schedule 40 **OR** ASTM D 2467, Schedule 80, **as directed**; socket type.

B. Joining Materials

1. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys.
2. Threaded-Joint Tape: PTFE.
3. Solvent Cement for Joining PVC Piping: ASTM D 2564. Include primer complying with ASTM F 656.

C. Valves

1. General Requirements for Valves: Manufacturer cleaned, purged, and bagged according to CGA G-4.1 for oxygen service.
2. Ball Valves: MSS SP-110, 3-piece body, brass or bronze.
 - a. Pressure Rating: 300 psig (2070 kPa) minimum.
 - b. Ball: Full-port, chrome-plated brass.
 - c. Seats: PTFE or TFE.
 - d. Handle: Lever type with locking device, **as directed**.
 - e. Stem: Blowout proof with PTFE or TFE seal.
 - f. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.
3. Check Valves: In-line pattern, bronze.
 - a. Pressure Rating: 300 psig (2070 kPa) minimum.
 - b. Operation: Spring loaded.
 - c. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.
4. Zone Valves: MSS SP-110, 3-piece-body, brass or bronze ball valve with gage.
 - a. Pressure Rating: 300 psig (2070 kPa) minimum.
 - b. Ball: Full-port, chrome-plated brass.
 - c. Seats: PTFE or TFE.
 - d. Handle: Lever type with locking device, **as directed**.
 - e. Stem: Blowout proof with PTFE or TFE seal.
 - f. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.
 - g. Pressure Gage: Manufacturer-installed on one copper-tube extension.
5. Zone Valve Boxes: Formed steel with anchors for recessed mounting, holes with grommets in box sides for tubing extension protection, and of size for single or multiple valves with pressure gages and in sizes required to permit manual operation of valves.
 - a. Interior Finish: Factory-applied white enamel.



- b. Cover Plate: Aluminum or extruded-anodized aluminum **OR** Satin-chrome finish steel **OR** Stainless steel with NAAMM AMP 503, No. 4 finish, **as directed**, with frangible or removable windows.
- c. Valve-Box Windows: Clear or tinted transparent plastic with labeling that includes rooms served, according to NFPA 99.

OR

Zone Valve Boxes: Formed or extruded aluminum with anchors for recessed mounting, holes with grommets in box sides for tubing extension protection, and of size for single or multiple valves with pressure gages and in sizes required to permit manual operation of valves.

- a. Interior Finish: Factory-applied white enamel.
 - b. Cover Plate: Aluminum or extruded-anodized aluminum **OR** Stainless steel with NAAMM AMP 503, No. 4 finish, **as directed**, with frangible or removable windows.
 - c. Valve-Box Windows: Clear or tinted transparent plastic with labeling that includes rooms served, according to NFPA 99.
6. Emergency Oxygen Connections: Low-pressure oxygen inlet assembly for connection to building oxygen piping systems.
 - a. Enclosure: Weatherproof hinged locking cover with caption similar to "Emergency Low-Pressure Gaseous Oxygen Inlet."
 - b. Inlet: Manufacturer-installed, NPS 1 or NPS 1-1/4 (DN 25 or DN 32), ASTM B 819, copper tubing with NPS 1 (DN 25) minimum ball valve and plugged inlet.
 - c. Safety Valve: Bronze-body, pressure relief valve set at 75 or 80 psig (520 or 550 kPa).
 - d. Instrumentation: Pressure gage.
 7. Safety Valves: Bronze-body, ASME-construction, poppet, pressure-relief type with settings to match system requirements.
 8. Pressure Regulators: Bronze **OR** Stainless-steel, **as directed**, body and trim; spring-loaded, diaphragm-operated, relieving type; manual pressure-setting adjustment; rated for 250-psig (1725-kPa) minimum inlet pressure; and capable of controlling delivered gas pressure within 0.5 psig for each 10-psig (5.0 kPa for each 100-kPa) inlet pressure.

D. Medical Gas Service Connections

1. General Requirements for Medical Gas Service Connections: For specific medical gas pressure and suction service listed. Include roughing-in assemblies, finishing assemblies, and cover plates. Individual cover plates are not required if service connection is in multiple unit or assembly with cover plate. Furnish recessed-type units made for concealed piping unless otherwise indicated.
 - a. Roughing-in Assembly:
 - 1) Steel outlet box for recessed mounting and concealed piping.
 - 2) Brass-body outlet block with secondary check valve that will prevent gas flow when primary valve is removed. Suction inlets to be without secondary valve.
 - 3) Double seals that will prevent gas leakage.
 - 4) ASTM B 819, NPS 3/8 (DN 10) copper outlet tube brazed to valve with service marking and tube-end dust cap.
 - b. Finishing Assembly:
 - 1) Brass housing with primary check valve.
 - 2) Double seals that will prevent gas leakage.
 - 3) Cover plate with gas-service label.
 - c. Quick-Coupler Service Connections: Pressure outlets for carbon dioxide, nitrous oxide, oxygen, and **<Insert medical gas>** service connections with noninterchangeable keyed indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment, and with positive-locking ring that retains equipment stem in valve during use.
 - d. D.I.S.S. Service Connections: Pressure outlets, complying with CGA V-5, with threaded indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment.
 - 1) Medical Carbon Dioxide Service Connections: D.I.S.S. No. 1080.



- 2) Medical Helium Service Connections: D.I.S.S. No. 1060.
 - 3) Medical Nitrogen Service Connections: D.I.S.S. No. 1120.
 - 4) Medical Nitrous Oxide Service Connections: D.I.S.S. No. 1040.
 - 5) Medical Oxygen Service Connections: D.I.S.S. No. 1240.
 - e. Cover Plates: One piece, stainless steel, with NAAMM AMP 503, No. 4 finish **OR** metal, with chrome-plated finish **OR** anodized aluminum, **as directed**, and permanent, color-coded, identifying label matching corresponding service.
- E. Electrical Service Connections
1. Power Outlets: UL 498, Hospital Grade, 125-V receptacles; color selected. Include the following configurations complying with NEMA WD 1:
 - a. L5-20R, locking type, 20 A, single or duplex.
 - b. L5-20R, isolated ground, locking type, 20 A, single or duplex.
 - c. Explosion proof, 20 A, 2 pole, 3 wire, single; suitable for Class I, Group C hazardous location and interchangeable with receptacles used in nonhazardous areas; flush mounted.
 - d. 5-20R, straight blade, 20 A, duplex.
 - e. 5-20R, isolated ground, straight blade, 20 A, duplex.
 2. Electrical Accessory Outlets: Provide the following configured receptacles in color selected:
 - a. Patient Equipment Ground Jack: Single pole, 30 A.
 - b. Patient Monitoring: Single, 5 and 37 pin.
 3. Wall Outlet Cover Plates: One piece, stainless steel, with NAAMM AMP 503, No. 4 finish **OR** metal, with chrome-plated finish **OR** anodized aluminum, **as directed**, and permanent identifying label.
- F. Patient Service Consoles
1. General Requirements for Patient Service Consoles: Recessed- or semirecessed-mounting wall units with medical gas service connections as specified in "Medical Gas Service Connections" Article and electrical service connections as specified in "Electrical Service Connections" Article, **as directed**. Include labels indicating services, and the following:
 - a. Recessed- or semirecessed-mounting steel console box or mounting bracket.
 - b. Concealed supplies.
 - c. Cover Plate: One piece, anodized aluminum **OR** stainless steel, **as directed**, and permanent identifying label with service connections for the following:
 - 1) Medical Air: Quick-coupler pressure outlet.
 - 2) Medical Oxygen: Quick-coupler pressure outlet.
 - 3) Medical Vacuum: Quick-coupler suction inlet.
 - 4) Medical vacuum bottle bracket.
 - 5) L5-20R, locking type, 20 A, single **OR** duplex, **as directed**.
- G. Medical Nitrogen Pressure Control Panels
1. Description: Steel box and support brackets for recessed roughing-in with stainless-steel or anodized-aluminum cover plate with printed operating instructions. Include manifold assembly consisting of inlet supply valve, inlet supply pressure gage, line-pressure control regulator, outlet supply pressure gage, D.I.S.S. service connection, and piping outlet for remote service connection.
 - a. Minimum Working Pressure: 200 psig (1380 kPa).
 - b. Line-Pressure Control Regulator: Self-relieving diaphragm type with precision manual adjustment.
 - c. Pressure Gages: 0- to 300-psig (0- to 2070-kPa) range.
 - d. Service Connection: CGA V-5, D.I.S.S. No. 1120, nitrogen outlet.
 - e. Before final assembly, provide temporary dust shield and U-tube for testing.
 - f. Label cover plate "Nitrogen Pressure Control."
- H. Ceiling Columns
1. General Requirements for Ceiling Columns: Ceiling-mounting units with medical gas service connections as specified in "Medical Gas Service Connections" Article and electrical service



connections as specified in "Electrical Service Connections" Article, **as directed**. Include labels indicating services, and the following:

- a. Ceiling-Mounting Plate: Manufacturer's standard plate or roughing-in assembly.
- b. Exposed Surfaces: Minimum 0.0375-inch- (0.95-mm-) thick stainless steel with NAAMM AMP 503, No. 4 directional polish.
- c. Servicing: Include access panels or means of removing shroud.
- d. Blank cover plates for cutouts not having service connections.
- e. ASTM B 819, NPS 3/8 (DN 10) copper-tube extensions for connection to medical gas systems.
- f. Service Connections: Type and number indicated.
- g. Dust Covers: For medical gas service connection.
2. Rigid Ceiling Columns: 44-inch- (1120-mm-) long, rectangular fixed column section with 2 **OR** 4, **as directed**, double intravenous medication hooks. Include 0.078-inch- (2.0-mm-) thick, stainless-steel bottom plate with the following service connections:
 - a. Instrument Air: One D.I.S.S. No. 1160 pressure outlet(s).
 - b. Medical Air: One quick-coupler **OR** D.I.S.S. No. 1160, **as directed**, pressure outlet(s).
 - c. Medical Carbon Dioxide: One quick-coupler **OR** D.I.S.S. No. 1080, **as directed**, pressure outlet(s).
 - d. Medical Helium: One D.I.S.S. No. 1060, pressure outlet(s).
 - e. Medical Nitrogen: One D.I.S.S. No. 1120 pressure outlet(s).
 - f. Medical Nitrous Oxide: One quick-coupler **OR** D.I.S.S. No. 1040, **as directed**, pressure outlet(s).
 - g. Medical Oxygen: Two quick-coupler **OR** D.I.S.S. No. 1240, **as directed**, pressure outlets.
 - h. Medical Vacuum: Two quick-coupler **OR** D.I.S.S. No. 1220, **as directed**, suction inlets.
 - i. Vacuum Bottle Brackets: Two.
 - j. WAGD Evacuation: One quick-coupler **OR** D.I.S.S. No. 2220, **as directed**, suction inlet(s).
 - k. Power: 2 **OR** 4, **as directed**, L5-20R, locking-type, 20-A, single receptacles.
 - l. Patient Equipment: 2 **OR** 4, **as directed**, ground-jack, single-pole, 30-A receptacles.
3. Retractable Ceiling Columns: Manually adjustable using release and lock handles capable of locking column in all positions from fully retracted to fully extended; 15-inch- (380-mm-) long, rectangular counterbalanced telescoping section with 2 **OR** 4, **as directed**, double intravenous medication hooks; and 36-inch- (915-mm-) long, fixed column section. Include 0.078-inch- (2.0-mm-) thick, stainless-steel bottom plate with the following service connections:
 - a. Instrument Air: One D.I.S.S. No. 1160 pressure outlet(s).
 - b. Medical Air: One quick-coupler **OR** D.I.S.S. No. 1160, **as directed**, pressure outlet(s).
 - c. Medical Carbon Dioxide: One quick-coupler **OR** D.I.S.S. No. 1080, **as directed**, pressure outlet(s).
 - d. Medical Helium: One D.I.S.S. No. 1060, pressure outlet(s).
 - e. Medical Nitrogen: One D.I.S.S. No. 1120 pressure outlet(s).
 - f. Medical Nitrous Oxide: One quick-coupler **OR** D.I.S.S. No. 1040, **as directed**, pressure outlet(s).
 - g. Medical Oxygen: Two quick-coupler **OR** D.I.S.S. No. 1240, **as directed**, pressure outlets.
 - h. Medical Vacuum: Two quick-coupler **OR** D.I.S.S. No. 1220, **as directed**, suction inlets.
 - i. Vacuum Bottle Brackets: Two.
 - j. WAGD Evacuation: One quick-coupler **OR** D.I.S.S. No. 2220, **as directed**, suction inlet(s).
 - k. Power: 2 **OR** 4, **as directed**, L5-20R, locking-type, 20-A, single receptacles.
 - l. Patient Equipment: 2 **OR** 4, **as directed**, ground-jack, single-pole, 30-A receptacles.
- I. Ceiling Hose Assemblies
 1. Ceiling Hose Assemblies, General: Ceiling-mounting units with medical gas service connections as specified in "Medical Gas Service Connections" Article and electrical service connections as specified in "Electrical Service Connections" Article, **as directed**. Include labels indicating services, and the following:
 - a. Ceiling-Mounting Plate: Manufacturer's standard plate or roughing-in assembly.



- b. Exposed Surfaces: Minimum 0.0375-inch- (0.95-mm-) thick stainless steel with NAAMM AMP 503, No. 4 directional polish.
 - c. Servicing: Include access panels or means of removing shroud.
 - d. Blank cover plates for cutouts not having service connections.
 - e. ASTM B 819, NPS 3/8 (DN 10) copper-tube extensions for connection to medical gas systems.
 - f. Service Connections: Type and number indicated.
 - g. Dust Covers: For medical gas service connection.
 - 2. Hose-Reel Service Assemblies: Individual, concealed, retractable hose-reel units with stainless-steel face plates, steel mounting boxes, factory- or field-fabricated mounting brackets, and color-coded service hoses with adjustable stops and service connections matching hoses. Include 15 feet (4.5 m) minimum of conductive, CR, 1/4- or 5/16-inch- (6.4- or 7.9-mm-) ID, medical gas hoses rated for 200-psig (1380-kPa) minimum working pressure, and the following service connections:
 - a. Instrument Air Hose: D.I.S.S. No. 1160 pressure outlet.
 - b. Medical Air Hose: Quick-coupler **OR** D.I.S.S. No. 1160, **as directed**, pressure outlet.
 - c. Medical Carbon Dioxide Hose: Quick-coupler **OR** D.I.S.S. No. 1080, **as directed**, pressure outlet.
 - d. Medical Nitrogen Hose: D.I.S.S. No. 1120 pressure outlet.
 - e. Medical Nitrous Oxide Hose: Quick-coupler **OR** D.I.S.S. No. 1040, **as directed**, pressure outlet.
 - f. Medical Oxygen Hose: Quick-coupler **OR** D.I.S.S. No. 1240, **as directed**, pressure outlet.
 - g. Medical Vacuum Hose: Quick-coupler **OR** D.I.S.S. No. 1220, **as directed**, suction inlet.
 - h. WAGD Evacuation Hose: Quick-coupler **OR** D.I.S.S. No. 2220, **as directed**, suction inlet.
 - i. Power: L5-20R, locking-type, 20-A, single, power receptacle.
 - 3. Fixed Hose Service Assemblies: Individual, concealed hose connection with stainless-steel face plates, steel mounting boxes, factory- or field-fabricated mounting brackets, and color-coded service hoses with retractor device and service connections matching hoses. Include 72 inches (1830 mm) of conductive, CR, 1/4- or 5/16-inch- (6.4- or 7.9-mm-), ID, medical gas hoses rated for 200-psig (1380-kPa) minimum working pressure, and the following service hose connections:
 - a. Instrument Air Hose: D.I.S.S. No. 1160 pressure outlet.
 - b. Medical Air Hose: Quick-coupler **OR** D.I.S.S. No. 1160, **as directed**, pressure outlet.
 - c. Medical Carbon Dioxide Hose: Quick-coupler **OR** D.I.S.S. No. 1080, **as directed**, pressure outlet.
 - d. Medical Nitrogen Hose: D.I.S.S. No. 1120 pressure outlet.
 - e. Medical Nitrous Oxide Hose: Quick-coupler **OR** D.I.S.S. No. 1040, **as directed**, pressure outlet.
 - f. Medical Oxygen Hose: Quick-coupler **OR** D.I.S.S. No. 1240, **as directed**, pressure outlet.
 - g. Medical Vacuum Hose: Quick-coupler **OR** D.I.S.S. No. 1220, **as directed**, suction inlet.
 - h. WAGD Evacuation Hose: Quick-coupler **OR** D.I.S.S. No. 2220, **as directed**, suction inlet.
 - i. Power: L5-20R, locking-type, 20-A, single, power receptacle.
- J. Gas Manifolds
- 1. Simplex Specialty Gas Manifolds:
 - a. Control Panel Unit: Weatherproof cabinet, supply and delivery pressure gages, electrical alarm system connections and transformer, indicator lights or devices, manifold connection, line-pressure regulator, shutoff valves, and safety valve.
 - b. Manifold and Header: Nonferrous-metal header for number of cylinders indicated. Units include design for 2000-psig (13.8-MPa) minimum inlet pressure. Include cylinder bank header with inlet (pigtail) connections complying with CGA V-1, individual inlet check valves, shutoff valve, pressure regulator, check valve, and pressure gage.
 - c. **<Insert specialty gas>** Manifold: For **<Insert number cylinders>** capacity at 55-psig (380-kPa) line pressure, with electric heater or orifice design that will prevent freezing during high demand.
 - d. Specialty Gas Cylinders: Will be furnished by Owner **OR** Number and type of medical gas cylinders required for complete manifold systems, **as directed**.



- e. Label manifold control unit with permanent label identifying specialty gas type and system operating pressure.
- f. Mounting: Wall with mounting brackets for manifold control cabinet and header **OR** Floor with support legs for manifold control cabinet, **as directed**.
- 2. Duplex Specialty Gas Manifolds:
 - a. Central Control Panel Unit: Weatherproof cabinet, supply and delivery pressure gages, electrical alarm system connections and transformer, indicator lights or devices, manifold connection, line-pressure regulator, shutoff valves, and safety valve.
 - b. Manifold and Headers: Duplex, nonferrous-metal header for number of cylinders indicated, divided into two equal banks. Units include design for 2000-psig (13.8-MPa) minimum inlet pressure. Include cylinder bank headers with inlet (pigtail) connections complying with CGA V-1, individual inlet check valves, shutoff valve, pressure regulator, check valve, and pressure gage.
 - c. Operation: Automatic, pressure-switch-activated changeover from one cylinder bank to the other when first bank becomes exhausted, without line-pressure fluctuation or resetting of regulators and without supply interruption by shutoff of either cylinder bank header.
 - d. **<Insert specialty gas>** Manifold: For **<Insert number cylinders>** capacity at 55-psig (380-kPa) line pressure, with electric heater or orifice design that will prevent freezing during high demand.
 - e. Specialty Gas Cylinders: Will be furnished by Owner **OR** Number and type of medical gas cylinders required for complete manifold systems, **as directed**.
 - f. Label manifold control unit with permanent label identifying specialty gas type and system operating pressure.
 - g. Mounting: Wall with mounting brackets for manifold control cabinet and headers **OR** Floor with support legs for manifold control cabinet, **as directed**.
- 3. Medical Gas Manifolds: Comply with NFPA 99, Ch. 5, for high-pressure medical gas cylinders.
 - a. Central Control Panel Unit: Weatherproof cabinet, supply and delivery pressure gages, electrical alarm system connections and transformer, indicator lights or devices, manifold connection, pressure changeover switch, line-pressure regulator, shutoff valves, and safety valve.
 - b. Manifold and Headers: Duplex, nonferrous-metal header for number of cylinders indicated, divided into two equal banks. Units include design for 2000-psig (13.8-MPa) minimum inlet pressure, except nitrous oxide manifolds may be designed for 800 psig (5520 kPa) and carbon dioxide manifolds may be designed for 1500 psig (10.35 MPa). Include cylinder bank headers with inlet (pigtail) connections complying with CGA V-1, individual inlet check valves, shutoff valve, pressure regulator, check valve, and pressure gage.
 - c. Operation: Automatic, pressure-switch-activated changeover from one cylinder bank to the other when first bank becomes exhausted, without line-pressure fluctuation or resetting of regulators and without supply interruption by shutoff of either cylinder bank header.
 - d. Medical Carbon Dioxide Manifolds: For 2 cylinders and 250-cfh (1.97-L/s) **OR** 4 cylinders and 500-cfh (3.94-L/s), **as directed**, capacity at 55-psig (380-kPa) line pressure.
 - e. Medical Helium Manifolds: For 2 cylinders and 250-cfh (1.97-L/s) **OR** 4 cylinders and 500-cfh (3.94-L/s), **as directed**, capacity at 55-psig (380-kPa) line pressure.
 - f. Medical Nitrous Oxide Manifolds: For 8 cylinders and 1333-cfh (10.5-L/s) **OR** 12 cylinders and 2000-cfh (15.7-L/s), **as directed**, capacity at 55-psig (380-kPa) line pressure, with electric heater or orifice design that will prevent freezing during high demand.
 - g. Medical Nitrogen Manifolds: For 8 cylinders and 2000-cfh (15.7-L/s) **OR** 12 cylinders and 3000-cfh (23.6-L/s), **as directed**, capacity at 180-psig (1240-kPa) **OR** higher than 200-psig (1380-kPa), **as directed**, line pressure.
 - h. Medical Oxygen Manifolds: For 12 cylinders and 1500-cfh (11.8-L/s) **OR** 20 cylinders 2500-cfh (19.7-L/s), **as directed**, capacity at 55-psig (380-kPa), **as directed**, line pressure.
 - i. Medical Gas Cylinders: Will be furnished by Owner **OR** Number and type of medical gas cylinders required for complete manifold systems, **as directed**.
 - j. Label manifold control unit with permanent label identifying medical gas type and system operating pressure.



- k. Mounting: Wall with mounting brackets for manifold control cabinet and headers **OR** Floor with support legs for manifold control cabinet, **as directed**.

K. Bulk Gas Storage Tanks

1. Bulk Specialty Gas Storage Tanks:
2. Bulk Medical Gas Storage Tanks:
 - a. Bulk Medical Gas Storage Tank Systems: Bulk storage tank with connections for alarm system, continuous supply, and reserve supply that will operate only during emergencies, complying with NFPA 99, "Health Care Facilities."
 - b. Controls: Include actuating switch for alarm system connection and means for automatic actuating of reserve supply.
 - c. Bulk Medical Gas Storage Tanks: Vertical mounting, double-wall construction with inner vessel fabricated according to ASME Boiler and Pressure Vessel Code for unfired pressure vessels and suitable for medical gas service. Include insulation and vacuum seal between walls. Fabricate outer shell from carbon steel with factory-applied manufacturer's standard protective paint finish suitable for exterior installation. Include the following features, specialties, and components:
 - 1) Safety Valves: ASME construction with pressure setting to correspond to tank working pressure and as required for component or system being protected.
 - 2) Pressure Gages: For tank pressure and facility service line pressure.
 - 3) Contents Gage: High- and low-level indicator with electric signal circuit connection.
 - 4) Drain Valves: For piping, inner vessel, and outer shell.
 - 5) Fill Assembly: Fill connection, piping, valves, relief devices, and controls.
 - 6) Facility Service Assembly: Piping, valves, relief devices, vaporizer, shutoff valve, pressure regulator, line shutoff valve or check valve, and reserve supply connection for connection to building service piping.
 - 7) Include permanent label showing medical gas type, storage tank capacity, tank pressure rating, vaporizer capacity, and operating instructions.
 - 8) Liquid Oxygen Storage Tank: Nickel-steel or stainless-steel inner vessel with 250-psig (1725-kPa) minimum working pressure. Include electric **OR** steam **OR** ambient vaporizer, **as directed**.
 - 9) Liquid Nitrous Oxide Storage Tank: Steel-alloy inner vessel with 300-psig (2070-kPa) minimum working pressure. Include electric **OR** steam, **as directed**, vaporizer.
 - d. Oxygen Reserve Supply: Manifold header for high-pressure cylinders, fabricated from copper-tube or brass pipe and fittings and suitable for pressures up to 4000 psig (27.6 MPa). Include header inlet connections complying with CGA V-1, with individual inlet check valves, header shutoff valve, header pressure regulator, line shutoff valve or check valve, pressure gage, and inlet connections for number of cylinders indicated.
 - e. Nitrous Oxide Reserve Supply: Manifold header for high-pressure cylinders, fabricated from copper-tube or brass pipe and fittings and suitable for pressures up to 4000 psig (27.6 MPa). Include header inlet connections complying with CGA V-1, with individual inlet check valves, header shutoff valve, header pressure regulator, line shutoff valve or check valve, pressure gage, inlet connections for number of cylinders indicated, and electric heater.

L. Medical Gas Piping Alarm Systems

1. Panels for medical gas piping systems may be combined in single panels with medical compressed-air and medical vacuum piping systems.
2. Components: Designed for continuous service and to operate on power supplied from 120 **OR** 240 **OR** 277, **as directed**, -V ac power source to alarm panels and with connections for low-voltage wiring to remote sensing devices. Include step-down transformers if required.
3. Pressure Switches or Pressure Transducer Sensors: Continuous line monitoring with electrical connections for alarm system.
 - a. Low-Pressure Operating Range: 0- to 100-psig (0- to 690-kPa).
 - b. High-Pressure Operating Range: Up to 250-psig (1725-kPa).



4. General Requirements for Medical Gas Alarm Panels: Factory wired with audible and color-coded visible signals to indicate specified functions.
 - a. Mounting: Exposed, surface **OR** Recessed, **as directed**, installation.
 - b. Enclosures: Fabricated from minimum 0.047-inch- (1.2-mm-) thick steel or minimum 0.05-inch- (1.27-mm-) thick aluminum, with knockouts for electrical and piping connections.
5. Master Alarm Panels: With separate trouble alarm signals, pressure gages, and indicators for medical gas piping systems.
 - a. Include alarm signals when the following conditions exist:
 - 1) Medical Carbon Dioxide: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa) and changeover is made to alternate bank.
 - 2) Medical Helium: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa) and changeover is made to alternate bank.
 - 3) Medical Nitrogen: Pressure drops below 145 psig (1000 kPa) or rises above 200 psig (1380 kPa) and changeover is made to alternate bank.
 - 4) Medical Nitrous Oxide (for bulk oxygen storage tank system with cylinder reserve): Liquid level is low, pressure downstream from main shutoff valve drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa), changeover is made to reserve, reserve is in use, and reserve level is low.
 - 5) Medical Nitrous Oxide (for nitrous oxide manifold system): Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa) and changeover is made to alternate bank.
 - 6) Medical Oxygen (for bulk oxygen storage tank system with cylinder reserve): Liquid level is low, pressure downstream from main shutoff valve drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa), changeover is made to reserve, reserve is in use, reserve level is low, and reserve pressure is low.
 - 7) Medical Oxygen (for oxygen manifold system): Pressure downstream from main shutoff valve drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa) and changeover is made to alternate bank.
6. Anesthetizing-Area Alarm Panels: Separate trouble alarm signals; pressure gages; and indicators for medical gas piping systems.
 - a. Include alarm signals when the following conditions exist:
 - 1) Medical Carbon Dioxide: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa).
 - 2) Medical Helium: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa).
 - 3) Medical Nitrous Oxide: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa).
 - 4) Medical Nitrogen: Pressure drops below 145 psig (1000 kPa) or rises above 200 psig (1380 kPa).
 - 5) Medical Oxygen: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa).
7. Area Alarm Panels: Separate trouble alarm signals; pressure and vacuum gages; and indicators for medical gas piping systems.
 - a. Include alarm signals when the following conditions exist:
 - 1) Oxygen: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa).
8. Dental Area Alarm Panels: Separate trouble alarm signals; pressure and vacuum gages; and indicators for medical gas piping systems.
 - a. Include alarm signals when the following conditions exist:
 - 1) Medical Nitrogen: Pressure drops below 145 psig (1000 kPa) or rises above 200 psig (1380 kPa) and changeover is made to alternate bank.
 - 2) Medical Nitrous Oxide (for bulk nitrous oxide storage tank system with cylinder reserve): Liquid level is low, pressure downstream from main shutoff valve drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa), changeover is made to reserve, reserve is in use, and reserve level is low.



- 3) Medical Nitrous Oxide (for nitrous oxide manifold system): Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa) and changeover is made to alternate bank.
 - 4) Medical Oxygen (for bulk oxygen storage tank system with cylinder reserve): Liquid level is low, pressure downstream from main shutoff valve drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa), changeover is made to reserve, reserve is in use, reserve level is low, and reserve pressure is low.
 - 5) Medical Oxygen (for nitrous oxide manifold system): Pressure downstream from main shutoff valve drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa) and changeover is made to alternate bank.
9. Medical Laboratory Area Alarm Panels: Separate trouble alarm signals; pressure and vacuum gages; and indicators for medical gas piping systems.
- a. Include alarm signals when the following conditions exist:
 - 1) Medical Carbon Dioxide: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa).
 - 2) Medical Helium: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa).
 - 3) Medical Oxygen: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa).
- M. Computer Interface Cabinet
1. Description: Wall-mounting, welded-steel, control cabinet with gasketed door, mounting brackets, grounding device, and white-enamel finish for connection of medical gas system alarms to facility computer. Include factory-installed signal circuit boards, power transformer, circuit breaker, wiring terminal board, and internal wiring capable of interfacing 20, **as directed**, alarm signals.
- N. Gas Cylinder Storage Racks
1. Wall Storage Racks: Fabricate racks with chain restraints for upright cylinders as indicated or provide equivalent manufactured wall racks.
 2. Freestanding Storage Racks: Fabricate racks as indicated or provide equivalent manufactured storage racks.
- O. Sleeves
1. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
 2. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with set screws.
- P. Escutcheons
1. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to closely fit around pipe and tube and OD that completely covers opening.
 2. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-plated finish.
 3. One-Piece, Cast-Brass Escutcheons: With set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass, **as directed**.
 4. Split-Casting, Cast-Brass Escutcheons: With concealed hinge and set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass, **as directed**.
 5. One-Piece, Stamped-Steel Escutcheons: With set screw **OR** spring clips, **as directed**, and chrome-plated finish.
 6. Split-Plate, Stamped-Steel Escutcheons: With concealed **OR** exposed-rivet, **as directed**, hinge, set screw **OR** spring clips, **as directed**, and chrome-plated finish.
 7. One-Piece, Floor-Plate Escutcheons: Cast iron.
 8. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.
- Q. Grout



1. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - a. Characteristics: Post-hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - c. Packaging: Premixed and factory packaged.

R. Nitrogen

1. Description: Comply with USP 28 - NF 23 for oil-free dry nitrogen.

1.3 EXECUTION

A. Earthwork

1. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling and for underground warning tapes.

B. Piping Applications

1. Nonhealthcare, Specialty Gas Piping: Type L, copper medical gas tube; wrought-copper fittings; and brazed **OR** press-type fittings and pressure-sealed, **as directed**, joints.
2. Nonhealthcare, Specialty Gas Piping NPS 2-1/2 (DN 65) and Smaller: Type K **OR** Type L, **as directed**, copper medical gas tube; wrought-copper fittings; and brazed **OR** press-type fittings and pressure-sealed, **as directed**, joints.
3. Nonhealthcare, Specialty Gas Piping NPS 3 (DN 80) and Larger: Type K, copper tube; wrought-copper fittings; and brazed **OR** press-type fittings and pressure-sealed, **as directed**, joints.
4. Medical Gas Piping: Use Type L, copper medical gas tube; wrought-copper fittings; and brazed joints.
5. Medical Gas Piping Except Nitrogen: Use Type L, copper medical gas tube; wrought-copper fittings; and brazed joints.
6. Medical Nitrogen Piping: Type L, copper medical gas tube; wrought-copper fittings; and brazed joints.
7. Medical Nitrogen Piping NPS 2-1/2 (DN 65) and Smaller: Type K **OR** Type L, **as directed**, copper medical gas tube; wrought-copper fittings; and brazed joints.
8. Medical Nitrogen Piping NPS 3 (DN 80) and Larger: Type K, copper tube; wrought-copper fittings; and brazed joints.
9. Protective Conduit: Use PVC pipe, PVC fittings, and solvent-cemented joints.

C. Piping Installation

1. Drawing plans, schematics, and diagrams indicate general location and arrangement of gas piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
2. Comply with ASSE Standard #6010 for installation of medical gas piping.
3. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
4. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
5. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and coordinate with other services occupying that space.
6. Install piping adjacent to equipment and specialties to allow service and maintenance.
7. Install nipples, unions, and special fittings, and valves with pressure ratings same as or higher than system pressure rating used in applications below unless otherwise indicated.
8. Install piping to permit valve servicing.
9. Install piping free of sags and bends.
10. Install fittings for changes in direction and branch connections.



11. Install medical gas piping to medical gas service connections specified in this Section, to medical gas service connections in equipment specified in this Section, and to equipment specified in other Sections requiring medical gas service.
 12. Install exterior, buried medical gas piping in protective conduit fabricated with PVC pipe and fittings. Do not extend conduit through foundation wall.
 13. Install seismic restraints on gas piping. Seismic-restraint devices are specified in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment".
 14. Install medical gas service connections recessed in walls. Attach roughing-in assembly to substrate; attach finishing assembly to roughing-in assembly.
 15. Connect gas piping to gas sources and to gas outlets and equipment requiring gas service.
 16. Install unions, in copper tubing adjacent to each valve and at final connection to each piece of equipment and specialty.
- D. Valve Installation
1. Install shutoff valve at each connection to gas laboratory and healthcare equipment and specialties.
 2. Install check valves to maintain correct direction of gas flow from laboratory and healthcare gas supplies.
 3. Install valve boxes recessed in wall and anchored to substrate. Single boxes may be used for multiple valves that serve same area or function.
 4. Install zone valves and gages in valve boxes. Rotate valves to angle that prevents closure of cover when valve is in closed position.
 5. Install pressure regulators on gas piping where reduced pressure is required.
 6. Install emergency oxygen connection with pressure relief valve and full-size discharge piping to outside, with check valve downstream from pressure relief valve and with ball valve and check valve in supply main from bulk oxygen storage tank.
- E. Joint Construction
1. Ream ends of PVC pipes and remove burrs.
 2. Remove scale, slag, dirt, and debris from outside of cleaned tubing and fittings before assembly.
 3. Threaded Joints: Apply appropriate tape to external pipe threads.
 4. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter. Continuously purge joint with oil-free, dry nitrogen during brazing.
 5. Pressure-Sealed Joints: Join copper tube and press-type fittings with tools recommended by fitting manufacturer.
 6. Memory-Metal Coupling Joints: Join new copper tube to existing tube according to procedures developed by fitting manufacturer for installation of memory-metal coupling joints.
 7. Solvent-Cemented Joints: Clean and dry joining surfaces. Join PVC pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. Apply primer and join according to ASME B31.9 for solvent-cemented joints and to ASTM D 2672.
- F. Gas Service Component Installation
1. Assemble patient service console with service connections. Install with supplies concealed, in walls. Attach console box or mounting bracket to substrate.
 2. Install nitrogen pressure-control panels in walls. Attach to substrate.
 3. Assemble ceiling columns and install anchored to substrate. Provide structural steel, hanger rods, anchors, and fasteners in addition to components furnished with specialties necessary to fabricate supports.
 4. Assemble ceiling assemblies and install anchored to substrate. Provide structural steel, hanger rods, anchors, and fasteners in addition to components furnished with specialties necessary to fabricate supports.
 5. Install gas manifolds on concrete base, **as directed**, anchored to substrate.
 6. Install gas cylinders and connect to manifold piping.



7. Install gas manifolds with seismic restraints as indicated.
8. Install bulk gas storage tanks and reserve supply tanks level on concrete bases. Set tanks and connect gas piping to tanks according to applicable requirements in NFPA 50 for bulk oxygen storage systems, **as directed**. Install tanks level and plumb, firmly anchored to concrete bases; maintain NFPA 50 and tank manufacturer's recommended clearances. Orient tanks so controls and devices are accessible for servicing.
9. Install bulk gas storage tanks and reserve supply tanks with seismic restraints.

G. Medical Gas Piping Alarm System Installation

1. Install medical gas alarm system components in locations required by and according to NFPA 99.
2. Install medical gas area and master alarm panels where indicated.
3. Install computer interface cabinet with connection to medical gas piping alarm system and facility computer.

H. Sleeve Installation

1. Sleeves are not required for core-drilled holes.
2. Permanent sleeves are not required for holes formed by removable PE sleeves.
3. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs using galvanized-steel pipe **OR** galvanized-steel sheet **OR** stack sleeve fittings **OR** PVC pipe, **as directed**.
 - a. Wall Penetrations: Cut sleeves to length for mounting flush with both surfaces.
 - b. Floor Penetrations: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

OR

Install sleeves in new walls and slabs as new walls and slabs are constructed.

4. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. PVC **OR** Steel, **as directed**, Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
 - b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim" for flashing.
 - 1) Seal space outside of sleeve fittings with grout.
5. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping".

I. Escutcheon Installation

1. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - a. New Piping:
 - 1) Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 - 2) Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish **OR** stamped steel with set screw **OR** stamped steel with set screw or spring clips **OR** stamped steel with spring clips, **as directed**.
 - 3) Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish **OR** One piece or split casting, cast brass with polished chrome-plated finish **OR** Split casting, cast brass with polished chrome-plated finish **OR** One piece, stamped steel with set screw **OR** One piece or split plate, stamped steel with set screw **OR** Split plate, stamped steel with set screw, **as directed**.



- 4) Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish **OR** cast brass with rough-brass finish **OR** stamped steel with set screw **OR** stamped steel with spring clips **OR** stamped steel with set screw or spring clips, **as directed**.
- 5) Bare Piping in Equipment Rooms: One piece, cast brass **OR** stamped steel with set screw **OR** stamped steel with spring clips **OR** stamped steel with set screw or spring clips, **as directed**.
- 6) Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.
- b. Existing Piping:
 - 1) Chrome-Plated Piping: Split casting, cast brass with chrome-plated finish.
 - 2) Insulated Piping: Split plate, stamped steel with concealed **OR** exposed-rivet, **as directed**, hinge and spring clips.
 - 3) Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish **OR** plate, stamped steel with concealed hinge and spring clips, **as directed**.
 - 4) Bare Piping at Ceiling Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish **OR** plate, stamped steel with concealed hinge and set screw, **as directed**.
 - 5) Bare Piping in Unfinished Service Spaces: Split casting, cast brass with polished chrome-plated finish **OR** casting, cast brass with rough-brass finish **OR** plate, stamped steel with concealed hinge and set screw or spring clips **OR** plate, stamped steel with concealed or exposed-rivet hinge and set screw or spring clips **OR** plate, stamped steel with exposed-rivet hinge and set screw or spring clips, **as directed**.
 - 6) Bare Piping in Equipment Rooms: Split casting, cast brass **OR** plate, stamped steel with set screw or spring clips, **as directed**.
 - 7) Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting floor plate.

J. Hanger And Support Installation

1. Comply with requirements in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment" for seismic-restraint devices.
2. Comply with requirements in Division 22 Section "Hangers And Supports For Plumbing Piping And Equipment" for pipe hanger and support devices.
3. Vertical Piping: MSS Type 8 or 42, clamps.
4. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel, clevis hangers.
 - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable, roller hangers.
5. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze. Comply with requirements in Division 22 Section "Hangers And Supports For Plumbing Piping And Equipment" for trapeze hangers.
6. Base of Vertical Piping: MSS Type 52, spring hangers.
7. Support horizontal piping within 12 inches (300 mm) of each fitting and coupling.
8. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
9. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1/4 (DN 8): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 3/8 and NPS 1/2 (DN 10 and DN 15): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
 - c. NPS 3/4 (DN 20): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
 - d. NPS 1 (DN 25): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
 - e. NPS 1-1/4 (DN 32): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
 - f. NPS 1-1/2 (DN 40): 10 feet (3 m) with 3/8-inch (10-mm) rod.
 - g. NPS 2 (DN 50): 11 feet (3.4 m) with 3/8-inch (10-mm) rod.
 - h. NPS 2-1/2 (DN 65): 13 feet (4 m) with 1/2-inch (13-mm) rod.
 - i. NPS 3 (DN 80): 14 feet (4.3 m) with 1/2-inch (13-mm) rod.
 - j. NPS 3-1/2 (DN 90): 15 feet (4.6 m) with 1/2-inch (13-mm) rod.



- k. NPS 4 (DN 100): 16 feet (4.9 m) with 1/2-inch (13-mm) rod.
 - l. NPS 5 (DN 125): 18 feet (5.5 m) with 1/2-inch (13-mm) rod.
 - m. NPS 6 (DN 150): 20 feet (6 m) with 5/8-inch (16-mm) rod.
 - n. NPS 8 (DN 200): 23 feet (7 m) with 3/4-inch (19-mm) rod.
- 10. Install supports for vertical copper tubing every 10 feet (3 m).
- K. Labeling And Identification
 - 1. Install identifying labels and devices for specialty gas piping, valves, and specialties. Comply with requirements in Division 22 Section "Identification For Plumbing Piping And Equipment".
 - 2. Install identifying labels and devices for healthcare medical gas piping systems according to NFPA 99. Use the following or similar captions and color-coding for piping products where required by NFPA 99:
 - a. Carbon Dioxide: Black or white letters on gray background.
 - b. Helium: White letters on brown background.
 - c. Nitrogen: White letters on black background.
 - d. Nitrous Oxide: White letters on blue background.
 - e. Oxygen: White letters on green background or green letters on white background.
- L. Field Quality Control For Laboratory Facility Specialty Gas
 - 1. Perform field tests and inspections of specialty gas piping for nonhealthcare laboratory facilities and prepare test reports.
 - 2. Tests and Inspections:
 - a. Piping Leak Tests for Specialty Gas Piping: Test new and modified parts of existing piping. Cap and fill specialty gas piping with oil-free, dry nitrogen to pressure of 50 psig (345 kPa) above system operating pressure, but not less than 150 psig (1035 kPa). Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
 - b. Repair leaks and retest until no leaks exist.
 - c. Inspect specialty gas regulators for proper operation.
- M. Field Quality Control For Healthcare Facility Medical Gas
 - 1. Perform tests and inspections of medical gas piping systems in healthcare facilities and prepare test reports.
 - 2. Tests and Inspections:
 - a. Medical Gas Piping Testing Coordination: Perform tests, inspections, verifications, and certification of medical gas piping systems concurrently with tests, inspections, and certification of medical compressed-air piping and medical vacuum piping systems.
 - b. Preparation: Perform the following Installer tests according to requirements in NFPA 99 and ASSE Standard #6010:
 - 1) Initial blow down.
 - 2) Initial pressure test.
 - 3) Cross-connection test.
 - 4) Piping purge test.
 - 5) Standing pressure test for positive pressure medical gas piping.
 - 6) Standing pressure test for vacuum systems.
 - 7) Repair leaks and retest until no leaks exist.
 - c. System Verification: Comply with requirements in NFPA 99, ASSE Standard #6020, and ASSE Standard #6030 for verification of medical gas piping systems and perform the following tests and inspections:
 - 1) Standing pressure test.
 - 2) Individual-pressurization **OR** Pressure-differential, **as directed**, cross-connection test.
 - 3) Valve test.
 - 4) Master and area alarm tests.
 - 5) Piping purge test.



- 6) Piping particulate test.
- 7) Piping purity test.
- 8) Final tie-in test.
- 9) Operational pressure test.
- 10) Medical gas concentration test.
- 11) Medical air purity test.
- 12) Verify correct labeling of equipment and components.
- 13) Verify the following source equipment:
 - a) Medical gas supply sources.
- d. Testing Certification: Certify that specified tests, inspections, and procedures have been performed and certify report results. Include the following:
 - 1) Inspections performed.
 - 2) Procedures, materials, and gases used.
 - 3) Test methods used.
 - 4) Results of tests.
3. Remove and replace components that do not pass tests and inspections and retest as specified above.

END OF SECTION 22 11 16 00b



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SECTION 22 11 16 00C - CSF DOMESTIC WATER PIPING

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.22 11 16 00c

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
 2. Specialty valves.
 3. Flexible connectors.
 4. Water meters furnished by utility company for installation by Contractor.
 5. Escutcheons.
 6. Sleeves and sleeve seals.
- B. Related Section:
 1. Division 22 Section "Facility Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Domestic water piping and support and installation shall withstand effects of earthquake motions determined according to ASCE/SEI 7, where required by local codes/ordinance.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.



- B. Comply with NSF 14 for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.
- C. Comply with NSF 61 for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
 - 1. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
 - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
 - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint ends.
- B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.
 - 1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

2.3 DUCTILE-IRON PIPE AND FITTINGS

- A. Push-on-Joint or Mechanical Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 - 1. Standard-Pattern, Push-on-Joint Fittings: AWWA C110, ductile or gray iron.
 - a. Gaskets: AWWA C111, rubber.

2.4 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.5 SPECIALTY VALVES

- A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.
- B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.



2.6 TRANSITION FITTINGS

- A. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- B. Sleeve-Type Transition Coupling: AWWA C219.

2.7 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
 - 1. Description:
 - a. Pressure Rating: 150 psig at 180 deg F.
 - b. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 - 1. Description:
 - a. Factory-fabricated, bolted, companion-flange assembly.
 - b. Pressure Rating: 150 psig.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Kits:
 - 1. Description:
 - a. Nonconducting materials for field assembly of companion flanges.
 - b. Pressure Rating: 150 psig.
 - c. Gasket: Neoprene or phenolic.
 - d. Bolt Sleeves: Phenolic or polyethylene.
 - e. Washers: Phenolic with steel backing washers.
- E. Dielectric Nipples:
 - 1. Description:
 - a. Electroplated steel nipple complying with ASTM F 1545.
 - b. Pressure Rating: 300 psig at 225 deg F.
 - c. End Connections: Male threaded or grooved.
 - d. Lining: Inert and noncorrosive, propylene.

2.8 FLEXIBLE CONNECTORS

- A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - 1. Working-Pressure Rating: Minimum 200 psig.
 - 2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
 - 3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.
- B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
 - 1. Working-Pressure Rating: Minimum 200 psig.
 - 2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
 - 3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.



2.9 ESCUTCHEONS

- A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
- B. One Piece, Cast Brass: Polished, chrome-plated finish with setscrews.
- C. Split Casting, Cast Brass: Polished, chrome-plated finish with concealed hinge and setscrew.
- D. G.One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- E. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.10 SLEEVES

- A. Cast-Iron Wall Pipes: Fabricated of cast iron, and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- D. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.
- E. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with setscrews.

2.11 SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Stainless steel.
 - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.12 GROUT

- A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.



PART 1 - EXECUTION

2.13 EARTHWORK

- A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

2.14 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.
- E. Install shutoff valve immediately upstream of each dielectric fitting.
- F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.
- G. Install domestic water piping level and plumb.
- H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- J. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- L. Install piping adjacent to equipment and specialties to allow service and maintenance.
- M. Install piping to permit valve servicing.
- N. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- O. Install piping free of sags and bends.
- P. Install fittings for changes in direction and branch connections.
- Q. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- R. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump.



- S. Install thermostats in hot-water circulation piping.

2.15 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Braze Joints" Chapter.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- F. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

2.16 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.
- C. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.

2.17 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller:

2.18 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 64: Use dielectric flanges or flange kits.



2.19 FLEXIBLE CONNECTOR INSTALLATION

- A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.
- B. Install bronze-hose flexible connectors in copper domestic water tubing.
- C. Install stainless-steel-hose flexible connectors in steel domestic water piping.

2.20 WATER METER INSTALLATION

- A. Install water meters according to AWWA M6, utility company's requirements, and the following:
- B. Install displacement-type water meters with shutoff valve on water-meter inlet. Install valve on water-meter outlet and valved bypass around meter unless prohibited by authorities having jurisdiction.
- C. Install compound-type water meters with shutoff valves on water-meter inlet and outlet and on valved bypass around meter. Support meters, valves, and piping on brick or concrete piers.
- D. Install remote registration system according to standards of utility company and of authorities having jurisdiction.

2.21 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - 3. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 6. NPS 6: 10 feet with 5/8-inch rod.
- E. Install supports for vertical copper tubing every 10 feet.
- F. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
 - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 - 3. NPS 2: 10 feet with 3/8-inch rod.
 - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 - 5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
 - 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
 - 7. NPS 6: 12 feet with 3/4-inch rod.

- G. Install supports for vertical steel piping every 15 feet.

2.22 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
 - 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
 - 4. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

2.23 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and floors.
- B. Escutcheons for New Piping:
 - 1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 - 2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, [cast brass with polished chrome-plated finish] [stamped steel with set screw] [stamped steel with set screw or spring clips] [stamped steel with spring clips].
 - 3. Bare Piping at Ceiling Penetrations in Finished Spaces: [One piece, cast brass with polished chrome-plated finish] [One piece or split casting, cast brass with polished chrome-plated finish] [Split casting, cast brass with polished chrome-plated finish] [One piece, stamped steel with set screw] [One piece or split plate, stamped steel with set screw] [Split plate, stamped steel with set screw].
 - 4. Bare Piping in Unfinished Service Spaces: One piece, [cast brass with polished chrome-plated finish] [cast brass with rough-brass finish] [stamped steel with set screw] [stamped steel with spring clips] [stamped steel with set screw or spring clips].
 - 5. Bare Piping in Equipment Rooms: One piece, [cast brass] [stamped steel with set screw] [stamped steel with spring clips] [stamped steel with set screw or spring clips].
 - 6. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.
- C. Escutcheons for Existing Piping:
 - 1. Chrome-Plated Piping: Split casting, cast brass with chrome-plated finish.
 - 2. Insulated Piping: Split plate, stamped steel with concealed hinge and spring clips.
 - 3. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish.
 - 4. Bare Piping at Ceiling Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish.
 - 5. Bare Piping in Unfinished Service Spaces: Split casting, cast brass with polished chrome-plated finish.
 - 6. Bare Piping in Equipment Rooms: Split casting, cast brass.



7. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting floor plate.

2.24 SLEEVE INSTALLATION

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
- B. Sleeves are not required for core-drilled holes.
- C. Permanent sleeves are not required for holes formed by removable PE sleeves.
- D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- E. Install sleeves in new partitions, slabs, and walls as they are built.
- F. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
- G. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
- H. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals specified in this Section.
- I. Seal space outside of sleeves in concrete slabs and walls with grout.
- J. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.
- K. Install sleeve materials according to the following applications:
 - 1. Sleeves for Piping Passing through Concrete Floor Slabs: Steel pipe.
 - 2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Stack sleeve fittings.
 - a. Extend sleeves 2 inches above finished floor level.
 - b. For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
 - 3. Sleeves for Piping Passing through Gypsum-Board Partitions:
 - a. Steel pipe sleeves for pipes smaller than NPS 6.
 - b. Galvanized-steel sheet sleeves for pipes NPS 6 and larger.
 - c. Exception: Sleeves are not required for water supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
 - 4. Sleeves for Piping Passing through Concrete Roof Slabs: Steel pipe.
 - 5. Sleeves for Piping Passing through Exterior Concrete Walls:
 - a. Steel pipe sleeves for pipes smaller than NPS 6.
 - b. Cast-iron wall pipe sleeves for pipes NPS 6 and larger.
 - c. Install sleeves that are large enough to provide 1/2-inch annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.
- L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestop materials and installations.



2.25 SLEEVE SEAL INSTALLATION

- A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.
- B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

2.26 IDENTIFICATION

- A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.
- B. Label pressure piping with system operating pressure.

2.27 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Piping Inspections:
 - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - 2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 - 3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- C. Piping Tests:
 - 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - 2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - 3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - 5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
 - 6. Prepare reports for tests and for corrective action required.
- D. Domestic water piping will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.



2.28 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

2.29 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Under-building-slab, domestic water, building service piping, NPS 3 and smaller, shall be the following:
 - 1. Soft copper tube, ASTM B 88, Type K; wrought-copper solder-joint fittings; and brazed joints.
- D. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 6, shall be the following:
 - 1. Push-on-joint or mechanical joint, ductile-iron pipe; standard-pattern push-on-joint or mechanical fittings; and gasketed joints.
- E. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper solder-joint fittings; and soldered joints.
- F. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper solder-joint fittings; and soldered joints.
- G. Aboveground domestic water piping, NPS 5 and NPS 6, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper solder-joint fittings; and soldered joints.

2.30 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
 - 2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
 - 3. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.



- 4. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.
- C. Iron grooved-end valves may be used with grooved-end piping.

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END OF SECTION



SECTION 22 11 16 00C - MPF DOMESTIC WATER PIPING

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Specialty valves.
3. Flexible connectors.
4. Water meters furnished by utility company for installation by Contractor.
5. Escutcheons.
6. Sleeves and sleeve seals.

B. Related Section:

1. Division 22 Section "Facility Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Domestic water piping and support and installation shall withstand effects of earthquake motions determined according to ASCE/SEI 7, where required by local codes/ordinance.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.



- C. Comply with NSF 61 for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
 - 1. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
 - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
 - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint ends.
- B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.
 - 1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

2.3 DUCTILE-IRON PIPE AND FITTINGS

- A. Push-on-Joint or Mechanical Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 - 1. Standard-Pattern, Push-on-Joint Fittings: AWWA C110, ductile or gray iron.
 - a. Gaskets: AWWA C111, rubber.

2.4 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.5 SPECIALTY VALVES

- A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.
- B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.



2.6 TRANSITION FITTINGS

- A. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- B. Sleeve-Type Transition Coupling: AWWA C219.

2.7 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
 - 1. Description:
 - a. Pressure Rating: 150 psig at 180 deg F.
 - b. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 - 1. Description:
 - a. Factory-fabricated, bolted, companion-flange assembly.
 - b. Pressure Rating: 150 psig.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Kits:
 - 1. Description:
 - a. Nonconducting materials for field assembly of companion flanges.
 - b. Pressure Rating: 150 psig.
 - c. Gasket: Neoprene or phenolic.
 - d. Bolt Sleeves: Phenolic or polyethylene.
 - e. Washers: Phenolic with steel backing washers.
- E. Dielectric Nipples:
 - 1. Description:
 - a. Electroplated steel nipple complying with ASTM F 1545.
 - b. Pressure Rating: 300 psig at 225 deg F.
 - c. End Connections: Male threaded or grooved.
 - d. Lining: Inert and noncorrosive, propylene.

2.8 FLEXIBLE CONNECTORS

- A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - 1. Working-Pressure Rating: Minimum 200 psig.
 - 2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
 - 3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.
- B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
 - 1. Working-Pressure Rating: Minimum 200 psig.
 - 2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
 - 3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.



2.9 ESCUTCHEONS

- A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
- B. One Piece, Cast Brass: Polished, chrome-plated finish with setscrews.
- C. Split Casting, Cast Brass: Polished, chrome-plated finish with concealed hinge and setscrew.
- D. G.One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- E. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.10 SLEEVES

- A. Cast-Iron Wall Pipes: Fabricated of cast iron, and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- D. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.
- E. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with setscrews.

2.11 SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Stainless steel.
 - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.12 GROUT

- A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.



PART 1 - EXECUTION

2.13 EARTHWORK

- A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

2.14 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.
- E. Install shutoff valve immediately upstream of each dielectric fitting.
- F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.
- G. Install domestic water piping level and plumb.
- H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- J. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- L. Install piping adjacent to equipment and specialties to allow service and maintenance.
- M. Install piping to permit valve servicing.
- N. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- O. Install piping free of sags and bends.
- P. Install fittings for changes in direction and branch connections.
- Q. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- R. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump.



- S. Install thermostats in hot-water circulation piping.

2.15 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Braze Joints" Chapter.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- F. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

2.16 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.
- C. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.

2.17 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller:

2.18 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 64: Use dielectric flanges or flange kits.



2.19 FLEXIBLE CONNECTOR INSTALLATION

- A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.
- B. Install bronze-hose flexible connectors in copper domestic water tubing.
- C. Install stainless-steel-hose flexible connectors in steel domestic water piping.

2.20 WATER METER INSTALLATION

- A. Install water meters according to AWWA M6, utility company's requirements, and the following:
- B. Install displacement-type water meters with shutoff valve on water-meter inlet. Install valve on water-meter outlet and valved bypass around meter unless prohibited by authorities having jurisdiction.
- C. Install compound-type water meters with shutoff valves on water-meter inlet and outlet and on valved bypass around meter. Support meters, valves, and piping on brick or concrete piers.
- D. Install remote registration system according to standards of utility company and of authorities having jurisdiction.

2.21 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - 3. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 6. NPS 6: 10 feet with 5/8-inch rod.
- E. Install supports for vertical copper tubing every 10 feet.
- F. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
 - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 - 3. NPS 2: 10 feet with 3/8-inch rod.
 - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 - 5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
 - 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
 - 7. NPS 6: 12 feet with 3/4-inch rod.

- G. Install supports for vertical steel piping every 15 feet.

2.22 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
 4. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

2.23 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and floors.
- B. Escutcheons for New Piping:
 1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, [cast brass with polished chrome-plated finish] [stamped steel with set screw] [stamped steel with set screw or spring clips] [stamped steel with spring clips].
 3. Bare Piping at Ceiling Penetrations in Finished Spaces: [One piece, cast brass with polished chrome-plated finish] [One piece or split casting, cast brass with polished chrome-plated finish] [Split casting, cast brass with polished chrome-plated finish] [One piece, stamped steel with set screw] [One piece or split plate, stamped steel with set screw] [Split plate, stamped steel with set screw].
 4. Bare Piping in Unfinished Service Spaces: One piece, [cast brass with polished chrome-plated finish] [cast brass with rough-brass finish] [stamped steel with set screw] [stamped steel with spring clips] [stamped steel with set screw or spring clips].
 5. Bare Piping in Equipment Rooms: One piece, [cast brass] [stamped steel with set screw] [stamped steel with spring clips] [stamped steel with set screw or spring clips].
 6. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.
- C. Escutcheons for Existing Piping:
 1. Chrome-Plated Piping: Split casting, cast brass with chrome-plated finish.
 2. Insulated Piping: Split plate, stamped steel with concealed hinge and spring clips.
 3. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish.
 4. Bare Piping at Ceiling Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish.
 5. Bare Piping in Unfinished Service Spaces: Split casting, cast brass with polished chrome-plated finish.
 6. Bare Piping in Equipment Rooms: Split casting, cast brass.



7. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting floor plate.

2.24 SLEEVE INSTALLATION

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
- B. Sleeves are not required for core-drilled holes.
- C. Permanent sleeves are not required for holes formed by removable PE sleeves.
- D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- E. Install sleeves in new partitions, slabs, and walls as they are built.
- F. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
- G. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
- H. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals specified in this Section.
- I. Seal space outside of sleeves in concrete slabs and walls with grout.
- J. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.
- K. Install sleeve materials according to the following applications:
 - 1. Sleeves for Piping Passing through Concrete Floor Slabs: Steel pipe.
 - 2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Stack sleeve fittings.
 - a. Extend sleeves 2 inches above finished floor level.
 - b. For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
 - 3. Sleeves for Piping Passing through Gypsum-Board Partitions:
 - a. Steel pipe sleeves for pipes smaller than NPS 6.
 - b. Galvanized-steel sheet sleeves for pipes NPS 6 and larger.
 - c. Exception: Sleeves are not required for water supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
 - 4. Sleeves for Piping Passing through Concrete Roof Slabs: Steel pipe.
 - 5. Sleeves for Piping Passing through Exterior Concrete Walls:
 - a. Steel pipe sleeves for pipes smaller than NPS 6.
 - b. Cast-iron wall pipe sleeves for pipes NPS 6 and larger.
 - c. Install sleeves that are large enough to provide 1/2-inch annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.
- L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestop materials and installations.



2.25 SLEEVE SEAL INSTALLATION

- A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.
- B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

2.26 IDENTIFICATION

- A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.
- B. Label pressure piping with system operating pressure.

2.27 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Piping Inspections:
 - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - 2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 - 3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- C. Piping Tests:
 - 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - 2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - 3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - 5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
 - 6. Prepare reports for tests and for corrective action required.
- D. Domestic water piping will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.



2.28 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

2.29 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Under-building-slab, domestic water, building service piping, NPS 3 and smaller, shall be the following:
 - 1. Soft copper tube, ASTM B 88, Type K; wrought-copper solder-joint fittings; and brazed joints.
- D. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 6, shall be the following:
 - 1. Push-on-joint or mechanical joint, ductile-iron pipe; standard-pattern push-on-joint or mechanical fittings; and gasketed joints.
- E. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper solder-joint fittings; and soldered joints.
- F. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper solder-joint fittings; and soldered joints.
- G. Aboveground domestic water piping, NPS 5 and NPS 6, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper solder-joint fittings; and soldered joints.

2.30 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
 - 2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
 - 3. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.



- 4. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.
- C. Iron grooved-end valves may be used with grooved-end piping.

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END OF SECTION 22 11 16 00c



Task	Specification	Specification Description
22 11 16 00	22 05 23 00	Piped Utilities Basic Materials And Methods
22 11 16 00	21 05 00 00	Common Work Results for Fire Suppression



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SECTION 22 11 19 00 - ELECTRONIC AIR CLEANERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for electronic air cleaners. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Electronic air cleaners.
 - b. Side-service housings.
 - c. Front- and rear-access filter frames.
 - d. Filter gages.

C. Submittals

1. Product Data: For each type of product indicated. Include dimensions; operating characteristics; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.
2. LEED Submittal:
 - a. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
3. Shop Drawings: For each electronic air cleaner. Include plans, elevations, sections, details, and attachments to other work.
 - a. Show filter assembly, dimensions, materials, and methods of assembly of components.
 - b. Include setting drawings, templates, and requirements for installing anchor bolts and anchorages.
 - c. Wiring Diagrams: For power, signal, and control wiring.
4. Field quality-control reports.
5. Operation and Maintenance Data: For each type of filter and housing to include in emergency, operation, and maintenance manuals.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. ASHRAE Compliance:
 - a. Comply with applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," and Section 7 - "Construction and Startup."
 - b. Comply with ASHRAE 52.1 for arrestance and with ASHRAE 52.2 for MERV for methods of testing and rating air-filter units.
3. Comply with NFPA 90A and NFPA 90B.
4. Comply with ARI 850.
5. Comply with UL 867.

1.2 PRODUCTS

A. Electronic Air Cleaners

1. Description: Factory-fabricated electronic air cleaner operating by electrostatic precipitation principles.



2. Prefilter Media: Four **OR** Six, **as directed**, alternate layers of galvanized-steel **OR** aluminum **OR** stainless-steel, **as directed**, flat and herringbone-crimp screen.
3. Prefilter: Comply with requirements in Division 23 Section "Particulate Air Filtration" for flat **OR** pleated **OR** ring, **as directed**, panel. Size and airflow capacity shall match those of electronic air cleaners.
 - a. Depth: 1 inch (25 mm) **OR** 2 inches (50 mm) **OR** 4 inches (100 mm), **as directed**.
 - b. Filter Unit Class: UL 900, Class 1 **OR** Class 2, **as directed**.
 - c. Arrestance: 85 percent when tested according to ASHRAE 52.1.
 - d. MERV: 8 when tested according to ASHRAE 52.2.
4. Final Filter: Comply with requirements in Division 23 Section "Particulate Air Filtration" for supported bag **OR** unsupported bag **OR** rigid-cell box **OR** V-bank cell **OR** self-supported pocket, **as directed**. Size and airflow capacity shall match those of gas-phase filters.
 - a. Depth: 12 inches (300 mm) **OR** 18 inches (450 mm) **OR** 24 inches (600 mm), **as directed**.
 - b. Filter Unit Class: UL 900, Class 1 **OR** Class 2, **as directed**.
 - c. Arrestance: 85 percent when tested according to ASHRAE 52.1.
 - d. MERV: 13 when tested according to ASHRAE 52.2.
5. Collection Cells: Aluminum, independently supported and nested.
 - a. Ionizing Section: Alternately spaced grounded struts and charged ionizing wires.
 - b. Collecting Section: Alternately grounded and charged plates, with insulators located out of airstream.
6. Power Pack: Self-contained, prewired rectifying unit to convert 120 **OR** 208/240 **OR** 480, **as directed**, -V ac, single-phase, 60-Hz power to approximately 12,000-V dc for ionizer and 6000-V dc for collector; include overload protection, on-off switch, pilot light showing operating status, and access door interlock.
7. Safety Accessories: Manual-reset safety switches and warning lights for filter plenum access doors, signal lights and safety switching upstream and downstream from unit within duct, and enameled high-voltage warning signs.
8. Collection Section Cleaning System:
 - a. Detergent Reservoir Tank: 30 gal. (110 L) **OR** 55 gal. (200 L), **as directed**, with pump, motor, solenoid valve, level sensor, backflow preventer, wye-strainer, and ball valve.
 - b. Detergent.
 - c. Dispensing System: Motor-driven oscillating copper manifolds with brass spray nozzles on each side of the collector.
9. Mist Eliminators: Upstream **OR** Upstream and downstream **OR** Downstream, **as directed**.
10. Controls: Programmable logic controller in remotely mounted NEMA 250, Type 12 enclosure; with integral time clock and manual override.
 - a. Contacts for enable-disable control by building automation system.
11. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

B. Fan Section

1. Fan: Forward curved, belt driven.
2. Motor:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - b. Type: Permanent-split capacitor with SCR for speed adjustment **OR** Electronically commutated motor, **as directed**.
 - c. Fan-Motor Assembly Isolation: Rubber isolators.
 - d. Enclosure: Totally enclosed, fan cooled, and explosion proof **OR** dust-ignition proof, **as directed**.
 - e. Enclosure Materials: Cast iron **OR** Cast aluminum **OR** Rolled steel, **as directed**.
 - f. Motor Bearings: Sealed ball.
 - g. Unusual Service Conditions:
 - 1) Ambient Temperature: <Insert deg F (deg C)>.



- 2) Altitude: <Insert feet (m)> above sea level.
 - 3) High humidity.
 - h. Efficiency: Premium efficient.
 - i. NEMA Design: <Insert designation>.
 - j. Service Factor: <Insert value>.
 - k. Motor Speed: Single speed **OR** Multispeed, **as directed**.
 - 1) Speed Control: Infinitely adjustable with pneumatic-electric and electronic controls.
- C. Cabinet
- 1. Description: 16-gage galvanized steel with epoxy powder finish for suspended, wall, frame, or duct mounting.
- D. Side-Service Housings
- 1. Description: Factory-assembled, side-service housings, with bottom drain, **as directed**, constructed of galvanized steel **OR** aluminum, **as directed**, and configured for stacking, with flanges to connect to duct or casing system.
 - 2. Access Doors: Hinged with continuous **OR** Continuous, **as directed**, gaskets on perimeter and positive-locking devices.
 - 3. Sealing: Incorporate positive-sealing gasket material on channels to seal top and bottom of filter cartridge frames to prevent bypass of unfiltered air.
 - 4. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- E. Front- And Rear-Access Filter Frames
- 1. Framing System: Galvanized-steel **OR** Aluminum, **as directed**, framing members with access for either upstream (front) or downstream (rear) filter servicing, cut to size and prepunched for assembly into modules with bottom drain, **as directed**, and configured for stacking. Vertically support filters to prevent deflection of horizontal members without interfering with either filter installation or operation.
 - 2. Prefilters: Incorporate a separate track with spring clips, **as directed**, removable from front or back, **as directed**.
 - 3. Final Filters: Integral tracks to accommodate particulate **OR** gas-phase, **as directed**, disposable filters.
 - 4. Sealing: Factory-installed, positive-sealing device for each row of filters to ensure seal between gasketed filter elements to prevent bypass of unfiltered air.
 - 5. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- F. Filter Gages
- 1. Diaphragm type, with dial and pointer in metal case, vent valves, black figures on white background, and front recalibration adjustment.
 - a. Diameter: 4-1/2 inches (115 mm) **OR** 2 inches (50 mm), **as directed**.
 - b. Scale Range for Filter Media Having a Recommended Final Resistance of 0.5-Inch wg (125 Pa) or Less: 0- to 0.5-inch wg (0 to 125 Pa).
 - c. Scale Range for Filter Media Having a Recommended Final Resistance of 0.5- to 1-Inch wg (125 to 250 Pa) or Less: 0- to 1.0-inch wg (0 to 250 Pa).
 - d. Scale Range for Filter Media Having a Recommended Final Resistance of 1.0- to 2.0-Inch wg (250 to 500 Pa) or Less: 0- to 2.0-inch wg (0 to 500 Pa).
 - e. Scale Range for Filter Media Having a Recommended Final Resistance of 2.0- to 3.0-Inch wg (500 to 750 Pa) or Less: 0- to 3.0-inch wg (0 to 750 Pa).
 - f. Scale Range for Filter Media Having a Recommended Final Resistance of 3.0- to 4.0-Inch wg (750 to 1000 Pa) or Less: 0- to 4.0-inch wg (0 to 1000 Pa).
 - 2. Manometer-Type Filter Gage: Molded plastic, with epoxy-coated aluminum scale, logarithmic-curve tube gage, with integral leveling indicator, graduated to read from 0- to 3.0-inch wg (0 to 750 Pa), and accurate within 3 percent of full-scale range.
 - 3. Accessories: Static-pressure tips, tubing, gage connections, and mounting bracket.



1.3 EXECUTION

A. Installation

1. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.
2. Install filters in position to prevent passage of unfiltered air.
3. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.
4. Operate electronic air cleaners for 24 hours as part of startup before filters are put into operation.
5. Install filter-gage, static-pressure taps upstream and downstream from filters. Install filter gages on filter banks with separate static-pressure taps upstream and downstream from filters. Mount filter gages on outside of filter housing or filter plenum in an accessible position. Adjust and level inclined gages.
6. Install and connect water-supply and drainage piping.
7. Coordinate filter installations with duct and air-handling-unit installations.

B. Field Quality Control

1. Perform tests and inspections.
2. Tests and Inspections: Test for leakage of unfiltered air while system is operating.
3. Air filter will be considered defective if it does not pass tests and inspections.
4. Prepare test and inspection reports.

C. Cleaning

1. After completing system installation and testing, adjusting, and balancing air-handling and air-distribution systems, clean filter housings and install new prefilter and final-filter media.

END OF SECTION 22 11 19 00



SECTION 22 11 19 00A - CSF DOMESTIC WATER PIPING SPECIALTIES

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.22 11 19 00a

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following domestic water piping specialties:
 - 1. Vacuum breakers.
 - 2. Backflow preventers.
 - 3. Water pressure-reducing valves.
 - 4. Balancing valves.
 - 5. Temperature-actuated water mixing valves.
 - 6. Strainers.
 - 7. Hose bibbs.
 - 8. Wall hydrants.
 - 9. Drain valves.
 - 10. Water hammer arresters.
 - 11. Trap-seal primer valves.
- B. See Division 22 Section "Domestic Water Piping" for water meters.
- C. See Division 22 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.

1.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.



- C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. NSF Compliance:
 - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
 - 2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
 - 1. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Ames Co.
 - b. Cash Acme.
 - c. Conbraco Industries, Inc.
 - d. FEBCO; SPX Valves & Controls.
 - e. Rain Bird Corporation.
 - f. Toro Company (The); Irrigation Div.
 - g. Watts Industries, Inc.; Water Products Div.
 - h. Zurn Plumbing Products Group; Wilkins Div.
 - 2. Standard: ASSE 1001.
 - 3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
 - 4. Body: Bronze.
 - 5. Inlet and Outlet Connections: Threaded.
 - 6. Finish: Chrome plated.

2.2 BACKFLOW PREVENTERS

- A. Intermediate Atmospheric-Vent Backflow Preventers:
 - 1. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cash Acme.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Honeywell Water Controls.
 - e. Legend Valve.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Plumbing Products Group; Wilkins Div.
 - 2. Standard: ASSE 1012.
 - 3. Operation: Continuous-pressure applications.
 - 4. Size: As indicated on drawings.
 - 5. Body: Bronze.
 - 6. End Connections: Union, solder joint.
 - 7. Finish: Rough bronze.
- B. Reduced-Pressure-Principle Backflow Preventers:



1. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Ames Co.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Flomatic Corporation.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. Zurn Plumbing Products Group; Wilkins Div.
 2. Standard: ASSE 1013.
 3. Operation: Continuous-pressure applications.
 4. Pressure Loss: 7 psig maximum, through middle 1/3 of flow range.
 5. Size: As indicated on drawings.
 6. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
 7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
 8. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
- C. Double-Check Backflow-Prevention Assemblies:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Ames Co.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Flomatic Corporation.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. Zurn Plumbing Products Group; Wilkins Div.
 2. Standard: ASSE 1015.
 3. Operation: Continuous-pressure applications, unless otherwise indicated.
 4. Pressure Loss: 4 psig maximum, through middle 1/3 of flow range.
 5. Size: As indicated on drawings.
 6. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
 7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
 8. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

2.3 WATER PRESSURE-REDUCING VALVES

- A. Water Regulators <Insert drawing designation if any>:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cash Acme.
 - b. Conbraco Industries, Inc.
 - c. Honeywell Water Controls.
 - d. Watts Industries, Inc.; Water Products Div.
 - e. Zurn Plumbing Products Group; Wilkins Div.
 - f. <Insert manufacturer's name.>
 2. Standard: ASSE 1003.
 3. Pressure Rating: Initial working pressure of 150 psig.
 4. Size: As indicated on drawings.



5. Body: Bronze with chrome-plated finish for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
6. Valves for Booster Heater Water Supply: Include integral bypass.
7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

2.4 BALANCING VALVES

A. Memory-Stop Balancing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Conbraco Industries, Inc.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Div.
 - e. Hammond Valve.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. Red-White Valve Corp.
2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psig minimum CWP.
4. Size: NPS 2 or smaller.
5. Body: Copper alloy.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

B. Primary, Thermostatic, Water Mixing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armstrong International, Inc.
 - b. Lawler Manufacturing Company, Inc.
 - c. Leonard Valve Company.
 - d. Powers; a Watts Industries Co.
 - e. Symmons Industries, Inc.
2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig.
4. Type: Cabinet-type, thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded[union] inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Valve Pressure Rating: 125 psig minimum, unless otherwise indicated.
9. Valve Finish: Chrome plated or rough bronze.
10. Piping Finish: Copper.
11. Cabinet: Factory-fabricated, stainless steel, for mounting and with hinged, stainless-steel door.

2.5 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.



2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:
 - a. Strainers NPS 2 and Smaller 0.033 inch.
 - b. Strainers NPS 2-1/2 to NPS 4: 0.062 inch.
 - c. Strainers NPS 5 and Larger: 0.125 inch.
6. Drain: Pipe plug or factory-installed, hose-end drain valve.

2.6 HOSE BIBBS

- A. Hose Bibbs:
 1. Standard: ASME A112.18.1 for sediment faucets.
 2. Body Material: Bronze.
 3. Seat: Bronze, replaceable.
 4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
 5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
 6. Pressure Rating: 125 psig.
 7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
 8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
 9. Finish for Service Areas: Chrome or nickel plated.
 10. Finish for Finished Rooms: Chrome or nickel plated.
 11. Operation for Equipment Rooms: Wheel handle or operating key.
 12. Operation for Service Areas: Operating key.
 13. Operation for Finished Rooms: Operating key.
 14. Include operating key with each operating-key hose bibb.
 15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.7 WALL HYDRANTS

- A. Nonfreeze Wall Hydrants where local climate conditions require:
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. Prier Products, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Tyler Pipe; Wade Div.
 - f. Watts Drainage Products Inc.
 - g. Woodford Manufacturing Company.
 - h. Zurn Plumbing Products Group; Light Commercial Operation.
 - i. Zurn Plumbing Products Group; Specification Drainage Operation.
 2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
 3. Pressure Rating: 125 psig.
 4. Operation: Loose key.
 5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
 6. Inlet: NPS 3/4.
 7. Outlet: Concealed, with integral vacuum breaker or nonremovable hose-connection vacuum breaker complying with ASSE 1011; and garden-hose thread complying with ASME B1.20.7.Box: Deep, flush mounting with cover.
 8. Box and Cover Finish: Polished nickel bronze.
 9. Nozzle and Wall-Plate Finish: Polished nickel bronze.



10. Operating Keys(s): Two with each wall hydrant.

B. Moderate-Climate Wall Hydrants where local climate conditions allow:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. Prier Products, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Tyler Pipe; Wade Div.
 - f. Watts Drainage Products Inc.
 - g. Woodford Manufacturing Company.
 - h. Zurn Plumbing Products Group; Light Commercial Operation.
 - i. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Inlet: NPS 3/4.
6. Outlet: Concealed, with integral vacuum breaker or nonremovable hose-connection vacuum breaker complying with ASSE 1011; and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounting with cover.
8. Box and Cover Finish: Polished nickel bronze.
9. Nozzle and Wall-Plate Finish: Polished nickel bronze.
10. Operating Keys(s): Two with each wall hydrant.

2.8 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.9 WATER HAMMER ARRESTERS

A. Water Hammer Arresters <Insert drawing designation if any>:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. AMTROL, Inc.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. PPP Inc.
 - e. Sioux Chief Manufacturing Company, Inc.
 - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - g. Tyler Pipe; Wade Div.
 - h. Watts Drainage Products Inc.
 - i. Zurn Plumbing Products Group; Specification Drainage Operation.



2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.10 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. MIFAB, Inc.
 - b. PPP Inc.
 - c. Sioux Chief Manufacturing Company, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. <Insert manufacturer.>
2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 1. Locate backflow preventers in same room as connected equipment or system.
 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
 3. Do not install bypass piping around backflow preventers.
- C. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- D. Install balancing valves in locations where they can easily be adjusted.
- E. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.
- F. Install water hammer arresters in water piping according to PDI-WH 201.
- G. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- H. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.



- I. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
 1. Test each reduced-pressure-principle backflow preventer and double-check backflow-prevention assembly according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.3 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

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END OF SECTION



SECTION 22 11 19 00A - MPF DOMESTIC WATER PIPING SPECIALTIES

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following domestic water piping specialties:
 - 1. Vacuum breakers.
 - 2. Backflow preventers.
 - 3. Water pressure-reducing valves.
 - 4. Balancing valves.
 - 5. Temperature-actuated water mixing valves.
 - 6. Strainers.
 - 7. Hose bibbs.
 - 8. Wall hydrants.
 - 9. Drain valves.
 - 10. Water hammer arresters.
 - 11. Trap-seal primer valves.
- B. See Division 22 Section "Domestic Water Piping" for water meters.
- C. See Division 22 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.

1.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and maintenance data.



1.4 QUALITY ASSURANCE

- A. NSF Compliance:
 - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
 - 2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
 - 1. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Ames Co.
 - b. Cash Acme.
 - c. Conbraco Industries, Inc.
 - d. FEBCO; SPX Valves & Controls.
 - e. Rain Bird Corporation.
 - f. Toro Company (The); Irrigation Div.
 - g. Watts Industries, Inc.; Water Products Div.
 - h. Zurn Plumbing Products Group; Wilkins Div.
 - 2. Standard: ASSE 1001.
 - 3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
 - 4. Body: Bronze.
 - 5. Inlet and Outlet Connections: Threaded.
 - 6. Finish: Chrome plated.

2.2 BACKFLOW PREVENTERS

- A. Intermediate Atmospheric-Vent Backflow Preventers:
 - 1. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cash Acme.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Honeywell Water Controls.
 - e. Legend Valve.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Plumbing Products Group; Wilkins Div.
 - 2. Standard: ASSE 1012.
 - 3. Operation: Continuous-pressure applications.
 - 4. Size: As indicated on drawings.
 - 5. Body: Bronze.
 - 6. End Connections: Union, solder joint.
 - 7. Finish: Rough bronze.
- B. Reduced-Pressure-Principle Backflow Preventers:
 - 1. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Ames Co.



- b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Flomatic Corporation.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. Zurn Plumbing Products Group; Wilkins Div.
 - 2. Standard: ASSE 1013.
 - 3. Operation: Continuous-pressure applications.
 - 4. Pressure Loss: 7 psig maximum, through middle 1/3 of flow range.
 - 5. Size: As indicated on drawings.
 - 6. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
 - 7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
 - 8. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
- C. Double-Check Backflow-Prevention Assemblies:
- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Ames Co.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Flomatic Corporation.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. Zurn Plumbing Products Group; Wilkins Div.
 - 2. Standard: ASSE 1015.
 - 3. Operation: Continuous-pressure applications, unless otherwise indicated.
 - 4. Pressure Loss: 4 psig maximum, through middle 1/3 of flow range.
 - 5. Size: As indicated on drawings.
 - 6. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
 - 7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
 - 8. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

2.3 WATER PRESSURE-REDUCING VALVES

- A. Water Regulators <Insert drawing designation if any>:
- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cash Acme.
 - b. Conbraco Industries, Inc.
 - c. Honeywell Water Controls.
 - d. Watts Industries, Inc.; Water Products Div.
 - e. Zurn Plumbing Products Group; Wilkins Div.
 - f. <Insert manufacturer's name.>
 - 2. Standard: ASSE 1003.
 - 3. Pressure Rating: Initial working pressure of 150 psig.
 - 4. Size: As indicated on drawings.
 - 5. Body: Bronze with chrome-plated finish for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
 - 6. Valves for Booster Heater Water Supply: Include integral bypass.
 - 7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.



2.4 BALANCING VALVES

A. Memory-Stop Balancing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Conbraco Industries, Inc.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Div.
 - e. Hammond Valve.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. Red-White Valve Corp.
2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psig minimum CWP.
4. Size: NPS 2 or smaller.
5. Body: Copper alloy.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

B. Primary, Thermostatic, Water Mixing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armstrong International, Inc.
 - b. Lawler Manufacturing Company, Inc.
 - c. Leonard Valve Company.
 - d. Powers; a Watts Industries Co.
 - e. Symmons Industries, Inc.
2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig.
4. Type: Cabinet-type, thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded[union] inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Valve Pressure Rating: 125 psig minimum, unless otherwise indicated.
9. Valve Finish: Chrome plated or rough bronze.
10. Piping Finish: Copper.
11. Cabinet: Factory-fabricated, stainless steel, for mounting and with hinged, stainless-steel door.

2.5 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:
 - a. Strainers NPS 2 and Smaller 0.033 inch.
 - b. Strainers NPS 2-1/2 to NPS 4: 0.062 inch.



- c. Strainers NPS 5 and Larger: 0.125 inch.
- 6. Drain: Pipe plug or factory-installed, hose-end drain valve.

2.6 HOSE BIBBS

- A. Hose Bibbs:
 - 1. Standard: ASME A112.18.1 for sediment faucets.
 - 2. Body Material: Bronze.
 - 3. Seat: Bronze, replaceable.
 - 4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
 - 5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
 - 6. Pressure Rating: 125 psig.
 - 7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
 - 8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
 - 9. Finish for Service Areas: Chrome or nickel plated.
 - 10. Finish for Finished Rooms: Chrome or nickel plated.
 - 11. Operation for Equipment Rooms: Wheel handle or operating key.
 - 12. Operation for Service Areas: Operating key.
 - 13. Operation for Finished Rooms: Operating key.
 - 14. Include operating key with each operating-key hose bibb.
 - 15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.7 WALL HYDRANTS

- A. Nonfreeze Wall Hydrants where local climate conditions require:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. Prier Products, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Tyler Pipe; Wade Div.
 - f. Watts Drainage Products Inc.
 - g. Woodford Manufacturing Company.
 - h. Zurn Plumbing Products Group; Light Commercial Operation.
 - i. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
 - 3. Pressure Rating: 125 psig.
 - 4. Operation: Loose key.
 - 5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
 - 6. Inlet: NPS 3/4.
 - 7. Outlet: Concealed, with integral vacuum breaker or nonremovable hose-connection vacuum breaker complying with ASSE 1011; and garden-hose thread complying with ASME B1.20.7.Box: Deep, flush mounting with cover.
 - 8. Box and Cover Finish: Polished nickel bronze.
 - 9. Nozzle and Wall-Plate Finish: Polished nickel bronze.
 - 10. Operating Keys(s): Two with each wall hydrant.
- B. Moderate-Climate Wall Hydrants where local climate conditions allow:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Josam Company.
 - b. MIFAB, Inc.



- c. Prier Products, Inc.
- d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
- e. Tyler Pipe; Wade Div.
- f. Watts Drainage Products Inc.
- g. Woodford Manufacturing Company.
- h. Zurn Plumbing Products Group; Light Commercial Operation.
- i. Zurn Plumbing Products Group; Specification Drainage Operation.
- 2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
- 3. Pressure Rating: 125 psig.
- 4. Operation: Loose key.
- 5. Inlet: NPS 3/4.
- 6. Outlet: Concealed, with integral vacuum breaker or nonremovable hose-connection vacuum breaker complying with ASSE 1011; and garden-hose thread complying with ASME B1.20.7.
- 7. Box: Deep, flush mounting with cover.
- 8. Box and Cover Finish: Polished nickel bronze.
- 9. Nozzle and Wall-Plate Finish: Polished nickel bronze.
- 10. Operating Keys(s): Two with each wall hydrant.

2.8 DRAIN VALVES

- A. Ball-Valve-Type, Hose-End Drain Valves:
 - 1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
 - 2. Pressure Rating: 400-psig minimum CWP.
 - 3. Size: NPS 3/4.
 - 4. Body: Copper alloy.
 - 5. Ball: Chrome-plated brass.
 - 6. Seats and Seals: Replaceable.
 - 7. Handle: Vinyl-covered steel.
 - 8. Inlet: Threaded or solder joint.
 - 9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.9 WATER HAMMER ARRESTERS

- A. Water Hammer Arresters <Insert drawing designation if any>:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. AMTROL, Inc.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. PPP Inc.
 - e. Sioux Chief Manufacturing Company, Inc.
 - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - g. Tyler Pipe; Wade Div.
 - h. Watts Drainage Products Inc.
 - i. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASSE 1010 or PDI-WH 201.
 - 3. Type: Metal bellows.
 - 4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.



2.10 TRAP-SEAL PRIMER VALVES

- A. Supply-Type, Trap-Seal Primer Valves:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. MIFAB, Inc.
 - b. PPP Inc.
 - c. Sioux Chief Manufacturing Company, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. <Insert manufacturer.>
 - 2. Standard: ASSE 1018.
 - 3. Pressure Rating: 125 psig minimum.
 - 4. Body: Bronze.
 - 5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
 - 6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
 - 7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 - 1. Locate backflow preventers in same room as connected equipment or system.
 - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
 - 3. Do not install bypass piping around backflow preventers.
- C. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- D. Install balancing valves in locations where they can easily be adjusted.
- E. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.
- F. Install water hammer arresters in water piping according to PDI-WH 201.
- G. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- H. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- I. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."



3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
 - 1. Test each reduced-pressure-principle backflow preventer and double-check backflow-prevention assembly according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.3 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

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END OF SECTION 22 11 19 00A



Task	Specification	Specification Description
22 11 19 00	01 22 16 00	No Specification Required
22 11 19 00	22 05 23 00	Piped Utilities Basic Materials And Methods
22 11 19 00	21 05 00 00	Common Work Results for Fire Suppression



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SECTION 22 11 23 39 - WATER SUPPLY WELLS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for water supply wells. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Cable-tool, Rotary drilled, Reverse-rotary drilled, and Driven water supply wells.
 - b. Jet, Line-shaft, and Submersible well pumps.

C. Definitions

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. PA: Polyamide (nylon) plastic.
3. PE: Polyethylene plastic.
4. PP: Polypropylene plastic.
5. PVC: Polyvinyl chloride plastic.

D. Submittals

1. Product Data: Submit certified performance curves and rated capacities of selected well pumps and furnished specialties for each type and size of well pump indicated.
2. Shop Drawings: Show layout and connections for well pumps.
 - a. Wiring Diagrams: Power, signal, and control wiring.
3. Field quality-control reports.
4. Operation and maintenance data.

E. Quality Assurance

1. Well Driller Qualifications: An experienced water supply well driller licensed in the jurisdiction where Project is located.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
3. Comply with AWWA A100 for water supply wells.

F. Project Conditions

1. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 - a. Notify Owner no fewer than seven days in advance of proposed interruption of water service.
 - b. Do not proceed with interruption of water service without Owner's written permission.
2. Well Drilling Water: Provide temporary water and piping for drilling purposes. Provide necessary piping for water supply.

1.2 PRODUCTS

A. Well Casings

1. Steel Casing: AWWA C200, single ply, steel pipe with threaded ends and threaded couplings for threaded joints.



2. ABS Casing: ASTM F 480, ABS, Schedule 40 **OR** 80, **as directed**, bell-and-spigot pipe and couplings for solvent-cemented joints.
 3. PVC Casing: ASTM F 480 and NSF 14, **as directed**, PVC, Schedule 40 **OR** 80, **as directed**, bell-and-spigot pipe and couplings for solvent-cemented joints. Include NSF listing mark "NSF wc," **as directed**.
 4. Pitless Adapter: Fitting, of shape required to fit onto casing, with waterproof seals.
 5. Pitless Unit: Factory-assembled equipment that includes pitless adapter.
 6. Well Seals: Casing cap, with holes for piping and cables, that fits into top of casing and is removable, waterproof, and vermin proof.
- B. Grout
1. Cement: ASTM C 150, Type II.
 2. Aggregates: ASTM C 33, fine and coarse grades.
 3. Water: Potable.
- C. Water Well Screens
1. Screen Material: Fabricated of ASTM A 666, Type 304 stainless steel, welded; with continuous-slot, V-shaped openings that widen inwardly **OR** tube; with slotted or perforated surface and designed for well-screen applications, **as directed**.
 - a. Screen Couplings: Butt-type, stainless-steel coupling rings.
 - b. Screen Fittings: Screen, with necessary fittings, closes bottom and makes tight seal between top of screen and well casing.
 - c. Maximum Entering Velocity: 0.1 fps (0.03 m/s).
- D. Pack Materials
1. Coarse, uniformly graded filter sand, maximum 1/8 inch (3 mm) in diameter.
 2. Fine gravel, maximum 1/4 inch (6 mm) in diameter.
- E. Jet-Type Well Pumps
1. Description: Shallow **OR** Deep, **as directed**, -well-design, jet well pump; self-priming; centrifugal pump capable of continuous operation; with the following features:
 - a. Housing: Cast iron.
 - b. Impeller: Single stage **OR** Multistage, **as directed**, centrifugal; fabricated of corrosion-resistant materials.
 - c. Seals: Mechanical.
 - d. Shaft: Stainless steel.
 - e. Motor: Manufacturer's standard, NEMA MG 1 motor, panel, and accessories.
 - f. Motor Controls: Electronic; variable speed.
 - g. Check valve, ejector, and pressure-control valve.
 2. Pump Accessories:
 - a. Compression Tanks: Comply with requirements in Division 22 Section "Facility Indoor Potable-water Storage Tanks" **OR** Precharged butyl rubber diaphragm, steel shell, fused polymeric lining, and 100-psig (690-kPa) working pressure, **as directed**.
 - b. Pressure Switches: For pump control; for installation in piping.
 - c. Water Piping: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with threaded ends.
 - 1) Cast-Iron Fittings: ASME B16.4, threaded, galvanized.
 - d. Water Piping: ASTM D 2239, SDR Numbers 5.3, 7, or 9 PE pipe; made with PE compound number required to give pressure rating not less than 160 psig (1100 kPa) **OR** 200 psig (1380 kPa), **as directed**. Include NSF listing mark "NSF pw."
 - 1) Fittings for PE Pipe: ASTM D 2609, made of PA, PP, or PVC with serrated, male insert ends matching inside of pipe. Include bands or crimp rings.
- F. Line-Shaft Well Pumps
1. Description: Line-shaft, water **OR** oil, **as directed**, -lubricated, vertical-turbine well pump complying with HI 2.1-2.2 and HI 2.3; with the following features:



- a. Impeller Material: Stainless steel **OR** Carbon steel **OR** Bronze, **as directed**.
- b. Motor: Full-voltage starting, vertical hollow- or solid-shaft, squirrel-cage induction type complying with ANSI C50.10.
- c. Pump Base: Cast iron or fabricated steel.
- d. Column Pipe: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with threaded ends and cast-iron or steel threaded couplings.

G. Submersible Well Pumps

- 1. Description: Submersible, vertical-turbine well pump complying with HI 2.1-2.2 and HI 2.3; with the following features:
 - a. Impeller Material: Stainless steel **OR** Silicon bronze, **as directed**.
 - b. Motor: Capable of continuous operation under water, with protected submersible power cable.
 - c. Column Pipe: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with threaded ends and cast-iron or steel threaded couplings.
 - d. Discharge Piping: ASTM D 2239, SDR Numbers 5.3, 7, or 9 PE pipe; made with PE compound number required to give pressure rating not less than 160 psig (1100 kPa) **OR** 200 psig (1380 kPa), **as directed**. Include NSF listing mark "NSF pw."
 - 1) Insert Fittings for PE Pipe: ASTM D 2609, made of PA, PP, or PVC with serrated, male insert ends matching inside of pipe. Include bands or crimp rings.

H. Motors

- 1. General requirements for motors are specified in Division 22 Section "Common Motor Requirements For Plumbing Equipment".
 - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 22.

1.3 EXECUTION

A. Preparation

- 1. Pilot-Hole Data: Review pilot-hole test analysis furnished by Owner.
- 2. Neighborhood Well Data: Review operating and test analyses.

B. Installation

- 1. Construct well using cable-tool **OR** rotary drilling **OR** reverse-rotary drilling **OR** driven, **as directed**, method.
- 2. Take samples of substrata formation at 10-foot (3-m) intervals and at changes in formation throughout entire depth of each water supply well. Carefully preserve samples on-site in glass jars properly labeled for identification.
- 3. If selecting rotary drilled or reverse-rotary drilled method, excavate for mud pit or provide aboveground structure, acceptable to authorities having jurisdiction, to allow settlement of cuttings and circulation of drill fluids back to well without discharging to on-site waterways.
- 4. Enlarge pilot hole and install permanent casing, screen, and grout. Install first section of casing with hardened steel driving shoe of an OD slightly larger than casing couplings if threaded couplings are used.
- 5. Set casing and liners round, plumb, and true to line.
- 6. Join casing pipe as follows:
 - a. Ream ends of pipe and remove burrs.
 - b. Remove scale, slag, dirt, and debris from inside and outside casing before installation.
 - c. Cut bevel in ends of steel casing pipe and make threaded joints.
 - d. Clean and make solvent-cemented joints for ABS and PVC casings.
- 7. If rotary drilled or reverse-rotary drilled well, mix grout in proportions of 1 cu. ft. (0.03 cu. m) or a 94-lb (42.6-kg) sack of cement with 5 to 6 gal. (19 to 23 L) of water. Bentonite clay may be added



in amounts of 3 to 5 lb/cu. ft. (1.4 to 2.3 kg/0.03 cu. m) for a 94-lb (42.6-kg) sack of cement. If bentonite clay is added, water may be increased to 6.5 gal./cu. ft. (25 L/0.03 cu. m) of cement.

8. If rotary drilled or reverse-rotary drilled well, place grout continuously, from bottom to top surface, to ensure filling of annular space in one operation. Do not perform other operations in well within 72 hours after grouting of casing. When quick-setting cement is used, this period may be reduced to 24 hours.
9. Provide permanent casing with temporary well cap. Install with top of casing 36 inches (910 mm) above finished grade, **as directed**.
10. Develop wells to maximum yield per foot (meter) of drawdown.
 - a. Extract maximum practical quantity of sand, drill fluid, and other fine materials from water-bearing formation.
 - b. Avoid settlement and disturbance of strata above water-bearing formation.
 - c. Do not disturb sealing around well casings.
 - d. Continue developing wells until water contains no more than 2 ppm of sand by weight when pumped at maximum testing rate.
11. Install jet well pumps with ejector in or attached to pump housing. Place check valve on suction line to prevent drainage of compression tank.
12. Install jet well pumps and pressure and suction lines. Install ejector where pressure and suction lines connect above well screen. Install check valve in suction line, or install foot valve below ejector, to prevent drainage of compression tank.
13. Install line-shaft **OR** submersible, **as directed**, well pumps according to HI 2.1-2.4 and provide access for periodic maintenance.
 - a. Before lowering permanent pump into well, lower a dummy pump that is slightly longer and wider than permanent pump to determine that permanent pump can be installed. Correct alignment problems.
 - b. Before lowering permanent pump into well, start pump to verify correct rotation.
 - c. Securely tighten discharge piping joints.
 - d. Locate line-shaft well pump near well bottom; locate motor above grade. Install driver plate to correctly align motor and pump.
 - e. Connect motor to submersible pump and locate near well bottom.
 - 1) Connect power cable while connection points are dry and undamaged.
 - 2) Do not damage power cable during installation; use cable clamps that do not have sharp edges.
 - 3) Install water-sealed surface plate that will support pump and piping.

C. Connections

1. Piping installation requirements are specified in Division 22 Section "Facility Water Distribution Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
 - a. Connect piping between well pump and water piping.
 - b. Connect water distribution system in trench to well pipe at pitless adapter **OR** unit, **as directed**.
 - c. Connect building water distribution to well pipe inside well house.
2. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
3. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

D. Well Abandonment

1. Comply with AWWA A100 when abandoning water supply wells. Fill and seal holes and casings and restore ground surface to finished grade.
OR
Follow well-abandonment procedures of authorities having jurisdiction. Restore ground surface to finished grade.

E. Field Quality Control



1. Plumbness and Alignment Testing: Comply with AWWA A100.
2. Furnish samples of water-bearing formation to testing laboratory and well-screen manufacturer for mechanical sieve analysis.
3. Prepare reports on static level of ground water, level of water for various pumping rates, and depth to water-bearing strata.
4. Performance Testing: Conduct final pumping tests after wells have been constructed, cleaned, and tested for plumbness and alignment.
 - a. Provide discharge piping to conduct water to locations where disposal will not create a nuisance or endanger adjacent property. Comply with requirements of authorities having jurisdiction.
 - b. Measure elevation to water level in wells.
 - c. Perform two bailer or air-ejection tests to determine expected yield. Test at depths with sufficient quantity of water to satisfy desired yields.
 - d. Test Pump: Variable capacity test pump with capacity equal to maximum expected yields at pressure equal to drawdown in wells, plus losses in pump columns and discharge pipes.
 - e. Start and adjust test pumps and equipment to required pumping rates.
 - f. Record readings of water levels in wells and pumping rates at 30-minute maximum intervals throughout 24-hour minimum period.
 - g. Record maximum yields when drawdown is 60 inches (1500 mm) above top of suction screens after designated times.
 - h. Operate pumping units continuously for eight hours after maximum drawdown is reached.
 - i. Record returning water levels in wells and plot curves of well recovery rates.
 - j. Remove sand, stones, and other foreign materials that may become deposited in wells after completing final tests.
5. Water Analysis Testing:
 - a. Engage] a qualified testing agency to make bacteriological, physical, and chemical analyses of water from each finished well and report the results. Make analyses according to requirements of authorities having jurisdiction.

OR

Analyze water sample from each finished well for bacteriological, physical, and chemical quality and report the results. Make analyses according to requirements of authorities having jurisdiction.

F. Cleaning

1. Disinfect water supply wells according to AWWA A100 and AWWA C654 before testing well pumps.
- OR**
- Follow water supply well disinfection procedures required by authorities having jurisdiction before testing well pumps.

G. Protection

1. Water Quality Protection: Prevent well contamination, including undesirable physical and chemical characteristics.
2. Ensure that mud pit will not leak or overflow into streams or wetlands. When well is accepted, remove mud and solids in mud pit from Project site and restore site to finished grade.
3. Provide casings, seals, sterilizing agents, and other materials to eliminate contamination; shut off contaminated water.
4. Exercise care to prevent breakdown or collapse of strata overlaying that from which water is to be drawn.
5. Protect water supply wells to prevent tampering and introducing foreign matter. Retain temporary well cap until installation is complete.

END OF SECTION 22 11 23 39



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Task	Specification	Specification Description
22 11 23 39	22 05 23 00	Piped Utilities Basic Materials And Methods
22 12 23 13	22 34 00 00	Fuel-Fired, Domestic Water Heaters



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SECTION 22 12 23 26 - FACILITY FUEL-OIL PIPING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for facility fuel-oil piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes fuel-oil, fuel-oil and diesel-fuel-oil, and diesel-fuel-oil distribution systems and the following:
 - a. Pipes, tubes, and fittings.
 - b. Piping and tubing joining materials.
 - c. Piping specialties.
 - d. Valves.
 - e. Vertical, steel, fuel-oil ASTs.
 - f. Horizontal, steel, fuel-oil ASTs.
 - g. Containment-dike, steel, fuel-oil ASTs.
 - h. Insulated, steel, fuel-oil ASTs.
 - i. Concrete-vaulted, steel, fuel-oil ASTs.
 - j. Steel, fuel-oil USTs with STI-P3.
 - k. Composite, steel, fuel-oil USTs.
 - l. Jacketed, steel, fuel-oil USTs.
 - m. FRP fuel-oil USTs.
 - n. Fuel-oil AST accessories.
 - o. Fuel-oil UST accessories.
 - p. Fuel-oil storage tank piping specialties.
 - q. Fuel-oil storage tank pumps.
 - r. Fuel-transfer pumps.
 - s. Fuel maintenance system.
 - t. Liquid-level gage system.
 - u. Leak-detection and monitoring system.
 - v. Mechanical sleeve seals.
 - w. Grout.
 - x. Concrete bases.

C. Definitions

1. AST: Aboveground storage tank.
2. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
3. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
4. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
5. FPM: Vinylidene fluoride-hexafluoropropylene copolymer rubber.
6. FRP: Glass-fiber-reinforced plastic.
7. UST: Underground storage tank.

D. Performance Requirements

1. Maximum Operating-Pressure Ratings: 3-psig (21-kPa) fuel-oil supply pressure at oil-fired appliances.



2. Delegated Design: Design restraint and anchors for fuel-oil piping, ASTs, and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
3. Seismic Performance: Factory-installed support attachments for AST shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event, **as directed**."

E. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For facility fuel-oil piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
3. Delegated-Design Submittal: For fuel-oil piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Detail fabrication and assembly of anchors and seismic restraints.
 - b. Design Calculations: Calculate requirements for selecting seismic restraints.
 - c. Detail fabrication and assembly of pipe anchors, hangers, supports for multiple pipes, and attachments of the same to building structure.
4. Seismic Qualification Certificates: For ASTs, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
5. Brazing certificates.
6. Welding certificates.
7. Field quality-control reports.
8. Operation and Maintenance Data.
9. Warranty: Sample of special warranty.

F. Quality Assurance

1. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
2. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
3. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
5. Comply with ASME B31.9, "Building Services Piping," for fuel-oil piping materials, installation, testing, and inspecting.
6. Comply with requirements of the EPA and of state and local authorities having jurisdiction. Include recording of fuel-oil storage tanks and monitoring of tanks and piping.

G. Delivery, Storage, And Handling

1. Lift and support fuel-oil storage tanks only at designated lifting or supporting points, as shown on Shop Drawings. Do not move or lift tanks unless empty.
2. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.



3. Store pipes and tubes with protective PE coating to avoid damaging the coating and to protect from direct sunlight.
4. Store PE pipes and valves protected from direct sunlight.

H. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-oil storage tanks and flexible, double-containment piping and related equipment that fail in materials or workmanship within specified warranty period.
 - a. Storage Tanks:
 - 1) Failures include, but are not limited to, the following when used for storage of fuel oil at temperatures not exceeding 150 deg F (66 deg C):
 - a) Structural failures including cracking, breakup, and collapse.
 - b) Corrosion failure including external and internal corrosion of steel tanks.
 - 2) Warranty Period: 30 years from date of Final Completion.
 - b. Flexible, Double-Containment Piping and Related Equipment:
 - 1) Failures due to defective materials or workmanship for materials installed together, including piping, dispenser sumps, entry boots, and sump mounting adapters.
 - 2) Warranty Period: 10 **OR** 30, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Pipes, Tubes, And Fittings

1. See Part 1.3 piping schedule articles for where pipes, tubes, fittings, and joining materials are applied in various services.
2. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - a. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - b. Wrought-Steel Welding Fittings: ASTM A 234/A 234M, for butt and socket welding.
 - c. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 - d. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - 1) Material Group: 1.1.
 - 2) End Connections: Threaded or butt welding to match pipe.
 - 3) Lapped Face: Not permitted underground.
 - 4) Gasket Materials: Asbestos free, ASME B16.20 metallic, or ASME B16.21 nonmetallic, gaskets compatible with fuel oil.
 - 5) Bolts and Nuts: ASME B18.2.1, cadmium-plated steel.
 - e. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
 - 1) Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
3. Drawn-Temper Copper Tube: Comply with ASTM B 88, Type K (ASTM B 88M, Type A) **OR** ASTM B 88, Type L (ASTM B 88M, Type B), **as directed**.
 - a. Copper Fittings: ASME B16.22, wrought copper, streamlined pattern.
 - b. Bronze Flanges and Flanged Fittings: ASME B16.24, Class 150.
 - 1) Gasket Material: Asbestos free, ASME B16.20, metallic, or ASME B16.21 nonmetallic, gaskets compatible with fuel oil.
 - 2) Bolts and Nuts: ASME B18.2.1, cadmium-plated steel.
4. Annealed-Temper Copper Tube: Comply with ASTM B 88, Type K (ASTM B 88M, Type A) **OR** ASTM B 88, Type L (ASTM B 88M, Type B), **as directed**.
 - a. Copper Fittings: ASME B16.22, wrought copper, streamlined pattern.
 - b. Flare Fittings: Comply with ASME B16.26 and SAE J513.
 - 1) Copper fittings with long nuts.
 - 2) Metal-to-metal compression seal without gasket.
 - 3) Dryseal threads complying with ASME B1.20.3.



B. Double-Containment Pipe And Fittings

1. Flexible, Double-Containment Piping: Comply with UL 971.
 - a. Pipe Materials: PVDF complying with ASTM D 3222 for carrier pipe with mechanical couplings to seal carrier, and PE pipe complying with ASTM D 4976 for containment piping.
 - b. Fiberglass **OR** PE, **as directed**, sumps.
 - c. Watertight sump entry boots, pipe adapters with test ports and tubes, coaxial fittings, and couplings.
 - d. Minimum Operating Pressure Rating: 10 psig (69 kPa).
 - e. Plastic to Steel Pipe Transition Fittings: Factory-fabricated fittings with plastic end matching or compatible with carrier piping, and steel pipe end complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - f. Include design and fabrication of double-containment pipe and fitting assemblies with provision for field installation of cable leak-detection system in annular space between carrier and containment piping.
2. Rigid, Double-Containment Piping: Comply with UL 971.
 - a. RTRP: ASTM D 2996 or ASTM D 2997 carrier and containment piping and mechanical couplings to seal carrier and containment piping or individually bonded joints.
 - 1) Minimum Operating-Pressure Rating for RTRP NPS 2 and NPS 3 (DN 50 and DN 80): 150 psig (1035 kPa).
 - 2) Minimum Operating-Pressure Rating for RTRP NPS 4 and NPS 6 (DN 100 and DN 150): 125 psig (860 kPa). Compliance with UL 971 is not required for NPS 6 (DN 150) and larger piping.
 - 3) Fittings: RTRF complying with ASTM D 2996 or ASTM D 2997, and made by RTRP manufacturer; watertight sump entry boots, termination, or other end fittings.
 - b. Include design and fabrication of double-containment pipe and fitting assemblies with provision for field installation of cable leak-detection system in annular space between carrier and containment piping.

C. Piping Specialties

1. Flexible Connectors: Comply with UL 567.
 - a. Metallic Connectors:
 - 1) Listed and labeled for aboveground and underground applications by an NRTL acceptable to authorities having jurisdiction.
 - 2) Stainless-steel bellows with woven, flexible, bronze or stainless-steel, wire-reinforcing protective jacket.
 - 3) Minimum Operating Pressure: 150 psig (1035 kPa).
 - 4) End Connections: Socket, flanged, or threaded end to match connected piping.
 - 5) Maximum Length: 30 inches (762 mm).
 - 6) Swivel end, 50-psig (345-kPa) maximum operating pressure.
 - 7) Factory-furnished anode.
 - b. Nonmetallic Connectors:
 - 1) Listed and labeled for underground applications by an NRTL acceptable to authorities having jurisdiction.
 - 2) PTFE bellows with woven, flexible, bronze or stainless-steel, wire-reinforcing protective jacket.
 - 3) Minimum Operating Pressure: 150 psig (1035 kPa).
 - 4) End Connections: Socket, flanged, or threaded end to match connected piping.
 - 5) Maximum Length: 30 inches (762 mm).
 - 6) Swivel end, 50-psig (345-kPa) maximum operating pressure.
 - 7) Factory-furnished anode.
2. Y-Pattern Strainers:
 - a. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
 - b. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.



- c. Strainer Screen: 60 **OR** 80, **as directed**, -mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
 - d. CWP Rating: 125 psig (860 kPa).
 - 3. Basket Strainers:
 - a. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
 - b. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
 - c. Strainer Screen: 60 **OR** 80, **as directed**, -mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
 - d. CWP Rating: 125 psig (860 kPa).
 - 4. T-Pattern Strainers:
 - a. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
 - b. End Connections: Grooved ends.
 - c. Strainer Screen: 60 **OR** 80, **as directed**, -mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
 - d. CWP Rating: 750 psig (5170 kPa).
 - 5. Manual Air Vents:
 - a. Body: Bronze.
 - b. Internal Parts: Nonferrous.
 - c. Operator: Screwdriver or thumbscrew.
 - d. Inlet Connection: NPS 1/2 (DN 15).
 - e. Discharge Connection: NPS 1/8 (DN 6).
 - f. CWP Rating: 150 psig (1035 kPa).
 - g. Maximum Operating Temperature: 225 deg F (107 deg C).
- D. Joining Materials
- 1. Joint Compound and Tape: Suitable for fuel oil.
 - 2. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
 - 3. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F (540 deg C) complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.
 - 4. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.
- E. Manual Fuel-Oil Shutoff Valves
- 1. See valve schedule in Part 1.3 for where each valve type is applied in various services.
 - 2. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller for Liquid Service: Comply with UL 842.
 - a. CWP Rating: 125 psig (860 kPa).
 - b. Threaded Ends: Comply with ASME B1.20.1.
 - c. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
 - d. Tamperproof Feature: Locking feature for valves indicated in the valve schedule.
 - e. Service Mark: Initials "WOG" shall be permanently marked on valve body.
 - 3. General Requirements for Metallic Valves, NPS 2-1/2 (DN 65) and Larger: Comply with UL 842.
 - a. CWP Rating: 125 psig (860 kPa).
 - b. Flanged Ends: Comply with ASME B16.5 for steel flanges.
 - c. Tamperproof Feature: Locking feature for valves indicated in the valve schedule.
 - d. Service Mark: Initials "WOG" shall be permanently marked on valve body.
 - 4. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.
 - a. Body: Bronze, complying with ASTM B 584.
 - b. Ball: Chrome-plated brass.
 - c. Stem: Bronze; blowout proof.
 - d. Seats: Reinforced TFE; blowout proof.
 - e. Packing: Separate packnut with adjustable-stem packing threaded ends.



- f. Ends: Threaded, flared, or socket as indicated in the valve schedule.
- g. CWP Rating: 600 psig (4140 kPa).
- h. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- 5. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
 - a. Body: Bronze, complying with ASTM B 584.
 - b. Ball: Chrome-plated bronze.
 - c. Stem: Bronze; blowout proof.
 - d. Seats: Reinforced TFE; blowout proof.
 - e. Packing: Threaded-body packnut design with adjustable-stem packing.
 - f. Ends: Threaded, flared, or socket as indicated in the valve schedule.
 - g. CWP Rating: 600 psig (4140 kPa).
 - h. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- 6. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.
 - a. Body: Bronze, complying with ASTM B 584.
 - b. Ball: Chrome-plated bronze.
 - c. Stem: Bronze; blowout proof.
 - d. Seats: Reinforced TFE.
 - e. Packing: Threaded-body packnut design with adjustable-stem packing.
 - f. Ends: Threaded, flared, or socket as indicated in the valve schedule.
 - g. CWP Rating: 600 psig (4140 kPa).
 - h. Service Mark: Initials "WOG" shall be permanently marked on valve body.

F. Specialty Valves

- 1. Pressure Relief Valves: Comply with UL 842.
 - a. Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.
 - b. Body: Brass, bronze, or cast steel.
 - c. Springs: Stainless steel, interchangeable.
 - d. Seat and Seal: Nitrile rubber.
 - e. Orifice: Stainless steel, interchangeable.
 - f. Factory-Applied Finish: Baked enamel.
 - g. Maximum Inlet Pressure: 150 psig (1035 kPa).
 - h. Relief Pressure Setting: 60 psig (414 kPa).
- 2. Oil Safety Valves: Comply with UL 842.
 - a. Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.
 - b. Body: Brass, bronze, or cast steel.
 - c. Springs: Stainless steel.
 - d. Seat and Diaphragm: Nitrile rubber.
 - e. Orifice: Stainless steel, interchangeable.
 - f. Factory-Applied Finish: Baked enamel.
 - g. Manual override port.
 - h. Maximum Inlet Pressure: 60 psig (414 kPa).
 - i. Maximum Outlet Pressure: 3 psig (21 kPa).
- 3. Emergency Shutoff Valves: Comply with UL 842.
 - a. Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.
 - b. Single **OR** Double, **as directed**, poppet valve.
 - c. Body: ASTM A 126, cast iron.
 - d. Disk: FPM.
 - e. Poppet Spring: Stainless steel.
 - f. Stem: Plated brass.
 - g. O-Ring: FPM.
 - h. Packing Nut: PTFE-coated brass.
 - i. Fusible link to close valve at 165 deg F (74 deg C).



- j. Thermal relief to vent line pressure buildup due to fire.
 - k. Air test port.
 - l. Maximum Operating Pressure: 0.5 psig (3.45 kPa).
- 4. Mechanical Leak Detector: Comply with UL 842.
 - a. Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.
 - b. Body: ASTM A 126, cast iron.
 - c. O-Rings: Elastomeric compatible with fuel oil.
 - d. Piston and Stem Seals: PTFE.
 - e. Stem and Spring: Stainless steel.
 - f. Piston Cylinder: Burnished brass.
 - g. Indicated Leak Rate: Maximum 3 gph (3 mL/s) at 10 psig (69 kPa).
 - h. Leak Indication: Reduced flow.
- G. Vertical, Steel, Fuel-Oil AST
 - 1. Description:
 - a. UL 142, single-wall, vertical, steel tank.
 - b. UL 142 and STI F921, **as directed**, double-wall, vertical, steel tank; with primary- and secondary-containment walls and interstitial space.
 - 2. Construction: Fabricated with welded, carbon steel suitable for operation at atmospheric pressure and for storing fuel oil with specific gravity up to 1.1 and maintained temperature up to 150 deg F (66 deg C).
- H. Horizontal, Steel, Fuel-Oil AST
 - 1. Description:
 - a. UL 142, single-wall, horizontal, steel tank.
 - b. UL 142 and STI F921, **as directed**, double-wall, horizontal, steel tank; with primary- and secondary-containment walls and interstitial space.
 - 2. Construction: Fabricated with welded, carbon steel; suitable for operation at atmospheric pressure and for storing fuel oil with specific gravity up to 1.1 and with maintained temperature up to 150 deg F (66 deg C).
 - 3. Supports:
 - a. Manufacturer's standard structural steel welded to tank.
 - b. Manufacturer's standard type and number, steel or cast-iron cradles, for field installation.
- I. Containment-Dike, Steel, Fuel-Oil AST
 - 1. Description: UL 142 and STI F911, single-wall, horizontal, steel tank; with open or enclosed **OR** enclosed, **as directed**, secondary-containment dike with capacity greater than tank capacity.
 - 2. Construction: Fabricated with welded, carbon steel; suitable for operation at atmospheric pressure and for storing fuel oil with specific gravity up to 1.1 and with maintained temperature up to 150 deg F (66 deg C).
- J. Insulated, Steel, Fuel-Oil AST
 - 1. Description: UL 142 and UL 2085 **OR** UL 142, UL 2085, and STI F941, **as directed**, thermally insulated and fire-resistant, double-wall, horizontal, steel tank; with primary- and secondary-containment walls and insulation and with interstitial space.
 - 2. Construction: Fabricated with welded, carbon steel and insulation; suitable for operation at atmospheric pressure and for storing fuel oil with specific gravity up to 1.1 and with test temperature according to UL 2085.
- K. Concrete-Vaulted, Steel, Fuel-Oil AST
 - 1. Description: UL 142 and UL 2085 **OR** UL 142, UL 2085, and STI F941, **as directed**; thermally insulated, fire-resistant and protected, double-wall, horizontal, steel tank; with primary- and secondary-containment walls and insulation and with interstitial space.



2. Construction: Fabricated with welded, carbon steel and insulation and encased in concrete that will protect from bullets; suitable for operation at atmospheric pressure and for storing fuel oil with specific gravity up to 1.1 and with test temperature according to UL 2085.
- L. Steel, Fuel-Oil UST With STI-P3
1. Description: UL 58 and STI P3, double-wall, horizontal, steel tank; with cathodic protection and electrical isolation.
 - a. Containment Method: STI-P3, Type I, with primary and secondary walls in contact **OR** Type II, with interstitial space, **as directed**.
 2. Construction: Fabricated with welded steel; suitable for operation at atmospheric pressure and for storing liquids with specific gravity up to 1.1; fabricated for the following loads:
 - a. Depth of Bury: 3 feet (1 m) from top of tank to finished surface.
 - b. External Hydrostatic Pressure: To withstand general buckling with safety factor of 2:1 if hole is fully flooded.
 - c. Surface Loads: AASHTO's "Specifications for Highway Bridges," H-20 axle loads of 32,000 lb (14 515 kg).
 3. Corrosion-Protection System: Protect tank and factory-installed piping by engineered and installed corrosion-protection system according to STI P3, with means of monitoring cathodic protection.
- M. Composite, Steel, Fuel-Oil UST
1. Description: UL 58, double-wall, horizontal, composite tank; with coating complying with UL 1746 and STI F894.
 - a. Containment Method: STI F894, Type I, with primary and secondary walls in contact **OR** Type II, with interstitial space, **as directed**.
 2. Construction: Fabricated with welded steel and factory coating according to UL 1746 and STI F894; suitable for operation at atmospheric pressure and for storing liquids with specific gravity up to 1.1; fabricated for the following loads:
 - a. Depth of Bury: 3 feet (1 m) from top of tank to finished surface.
 - b. External Hydrostatic Pressure: To withstand general buckling with safety factor of 2:1 if hole is fully flooded.
 - c. Surface Loads: AASHTO's "Specifications for Highway Bridges," H-20 axle loads of 32,000 lb (14 515 kg).
- N. Jacketed, Steel, Fuel-Oil UST
1. Description: Jacketed, horizontal, steel tank; complying with UL 58, and with plastic or fiberglass jacket and corrosion-protection system according to UL 1746 and STI F922, **as directed**.
 2. Construction: Tank fabricated with welded carbon steel, and jacket fabricated with plastic or fiberglass and vacuum-sealed interstitial space; suitable for operation at atmospheric pressure and with integral leak-detection device. Tank fabricated for the following loads:
 - a. Depth of Bury: 3 feet (1 m) from top of tank to finished surface.
 - b. External Hydrostatic Pressure: To withstand general buckling with safety factor of 2:1 if hole is fully flooded.
 - c. Surface Loads: AASHTO's "Specifications for Highway Bridges," H-20 axle loads of 32,000 lb (14 515 kg).
- O. FRP Fuel-Oil UST
1. Description: Horizontal, FRP UST; UL 1316, double wall, with interstitial space and integral, hydrostatic, leak-detection and monitoring system, **as directed**.
 2. Construction: Fabricated with fiberglass-reinforced polyester resins; suitable for operation at atmospheric pressure; fabricated for the following loads:
 - a. Depth of Bury: 3 feet (1 m) from top of tank to finished surface.
 - b. External Hydrostatic Pressure: To withstand general buckling with safety factor of 2:1 if hole is fully flooded.



- c. Surface Loads: AASHTO's "Specifications for Highway Bridges," H-20 axle loads of 32,000 lb (14 515 kg).

P. Shop Painting Of AST

1. Apply manufacturer's standard prime coat to exterior steel surface of AST and supports.
2. Prepare exterior steel surface of AST and tank supports.
3. Shop Cleaning: After fabrication, blast clean according to SSPC-SP 6/NACE No. 3 **OR** SSPC-SP 10/NACE No. 2, **as directed**.
4. After cleaning, remove dust or residue from cleaned surfaces.
5. If surface develops rust before prime coat is applied, repeat surface preparation.
6. Apply manufacturer's standard prime coat to shop-cleaned, dry surface same day as surface preparation.
7. Apply manufacturer's standard two-component, epoxy finish coats.

Q. Fuel-Oil AST Accessories

1. Tank Manholes (for horizontal tanks and some vertical tanks): 22-inch- (560-mm-) minimum diameter; bolted, flanged, and gasketed; centered on top of tank.
2. Tank Manholes (for vertical tanks): 22-inch- (560-mm-) minimum diameter; bolted, flanged, and gasketed; on top and at side of tank.
3. For Horizontal Tanks: Threaded pipe connection fittings on top of tank, for fill, supply, return, vent, sounding, and gaging. Include cast-iron plugs for shipping.
4. For Vertical Tanks: Threaded pipe connection fittings on top or sides of tank as indicated, for fill, supply, return, vent, sounding, and gaging. Include cast-iron plugs for shipping.
5. Striker Plates: Inside tank, on bottom below fill, vent, sounding, gage, and other tube openings.
6. Lifting Lugs: For handling and installation.
7. Ladders (for horizontal tanks and some vertical tanks): Carbon-steel ladder inside tank, anchored to top and bottom, and located as indicated. Include reinforcement of tank at bottom of ladder.
8. Ladders (for vertical tanks): Carbon-steel ladder outside tank, anchored to top and side wall. Comply with requirements in Division 05 Section "Metal Fabrications" for exterior steel ladder.
 - a. Cage: Include welded steel cage around ladders for tanks 20 feet (6 m) high or higher.
9. Supply Tube: Extension of supply piping fitting into tank, terminating 6 inches (150 mm) above tank bottom and cut at a 45-degree angle (1:1 slope).
10. Sounding and Gage Tubes: Extension of fitting into tank, terminating 6 inches (150 mm) above tank bottom and cut at a 45-degree angle (1:1 slope).

R. Fuel-Oil UST Accessories

1. Tank Manholes: 22-inch- (560-mm-) minimum diameter; bolted, flanged, and gasketed, with extension collar; for access to inside of tank.
2. Steel Tank Masonry Supports: Two 6-by-6-by-3/8-inch (150-by-150-by-10-mm) steel angles, 72 inches (1800 mm) long, located longitudinally on tank on each side of manholes and continuously welded in place.
3. Threaded pipe connection fittings on top of tank for fill, supply, return, vent, sounding, and gaging, in locations and of sizes indicated. Include cast-iron plugs for shipping.
4. Striker Plates: Inside tank, on bottom below fill, vent, sounding, gage, and other tube openings.
5. Lifting Lugs: For handling and installation.
6. Ladders: Carbon-steel ladder inside tank, anchored to top and bottom. Include reinforcement of tank at bottom of ladder.
7. Supply Tube: Extension of supply piping fitting into tank, terminating 6 inches (150 mm) above tank bottom and cut at a 45-degree angle (1:1 slope).
8. Sounding and Gage Tubes: Extension of fitting into tank, terminating 6 inches (150 mm) above tank bottom and cut at a 45-degree angle (1:1 slope).
9. Containment Sumps: Fiberglass **OR** PE, **as directed**, with sump base, add-on extension pieces as required, sump top, lid, and gasket-seal joints. Include sump entry boots for pipe penetrations through sidewalls.



10. Sump Entry Boots: Two-part pipe fitting for field assembly and of size required to fit over pipe. Include gaskets shaped to fit sump sidewall, sleeves, seals, and clamps as required for liquid-tight pipe penetrations.
11. Anchor Straps: Storage tank manufacturer's standard anchoring system, with straps, strap-insulating material, cables and turnbuckles, of strength at least one and one-half times maximum uplift force of empty tank without backfill in place.
12. Filter Mat: Geotextile woven or spun filter fabric, in 1 or more layers, for minimum total weight of 3 oz./sq. yd. (101.7 g/sq. m).
13. Overfill Prevention Valves: Factory fabricated or shop or field assembled from manufacturer's standard components. Include drop tube, cap, fill nozzle adaptor, check valve mechanism or other devices, and vent if required to restrict flow at 95 percent of tank capacity and to provide complete shutoff of filling at 98 **OR** 99, **as directed**, percent of tank capacity.

S. Fuel-Oil Storage Tank Piping Specialties

1. Fitting Materials: Cast iron, malleable iron, brass, or corrosion-resistant metal; suitable for fuel-oil service.
 - a. Surface, Flush-Mounted Fittings: Waterproof and suitable for truck traffic.
 - b. Aboveground-Mounted Fittings: Weatherproof.
2. Spill-Containment Fill Boxes: Flush mounting, with drainage feature to drain oil into tank, threaded fill-pipe connection, and wrench operation.
3. Fill Boxes: Flush mounting, with threaded fill-pipe connection and wrench operation.
4. Locking Fill Boxes: Flush mounting, with locking-type inner fill cap for standard padlock and threaded fill-pipe connection.
5. Supply and Sounding Drop Tubes: Fuel-oil supply piping or fitting, inside tank, terminating 6 inches (150 mm) above bottom of tank, and with end cut at a 45-degree angle (1:1 slope).
6. Pipe Adapters and Extensions: Compatible with piping and fittings.
7. Suction Strainers and Check Valves: Bronze or corrosion-resistant metal components.
8. Foot Valves and Antisiphon Valves: Poppet-type, bronze or corrosion-resistant metal components.
9. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.
10. Metal Manholes: 22-inch- (560-mm-) minimum diameter frame and cover. Furnish manhole units of adequate size for access to fittings if size is not indicated.
11. Monitoring Well Caps: Locking pipe plug and manhole.

T. Submersible Fuel-Oil Pumps

1. Description: Comply with UL 79, UL 87, and UL 343.
 - a. Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.
 - b. Impeller: Turbine.
 - c. Housing and Volute: Cast iron.
 - d. Bearings: Bronze, self-lubricating.
 - e. Seals: Mechanical.
 - f. Shaft: Polished steel.
 - g. Suspension Piping: Telescoping to accommodate tank diameter and depth of bury.
 - h. Base: Steel.
 - i. Pressure Relief: Built in.
 - j. Discharge Check Valve: Built in.
 - k. Drive: Direct, close coupled.
2. Controls: Pump controller panel complying with UL 353 and UL 508C and with interlock and terminals for connections to fuel-oil-burning equipment **OR** diesel-driven fire pumps **OR** diesel-driven emergency generators **OR** diesel-fuel-oil dispenser, **as directed**.
 - a. Run pumps to maintain minimum manifold pressure with outdoor-air temperature less than 60 deg F (16 deg C).



- b. Run pumps on seven-day schedule.
- c. Stage pumps on pressure at a common supply manifold.
- d. Alternate pumps to equalize run time.
- e. Alarm motor failure.
- f. Manual reset dry-run protection. Stop pumps if fuel level falls below pump suction.
- g. Deenergize and alarm pump locked rotor condition.
- h. Alarm open circuit, high and low voltage.
- i. Indicating lights for power on, run, and off normal conditions.
- j. Interface with automatic control system is specified in Division 23 Section "Instrumentation And Control For Hvac" to control and indicate the following:
 - 1) Start/stop pump set when required by schedule, fuel-fired appliance operation, day tank level control, or weather conditions.
 - 2) Operating status.
 - 3) Alarm off-normal status.
- 3. Motor: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Thermal-Overload Protection: Motor-winding temperature sensor.
 - c. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 22.

U. Simplex Fuel-Oil Transfer Pumps

- 1. Description: Comply with UL 343, and HI M109.
 - a. Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.
 - b. Type: Positive-displacement, rotary type.
 - c. Impeller: Steel gear with crescent **OR** Carbon vane, **as directed**.
 - d. Housing: Cast-iron foot mounted.
 - e. Bearings: Bronze, self-lubricating.
 - f. Shaft: Polished steel.
 - g. Seals: Mechanical.
 - h. Base: Steel.
 - i. Pressure Relief: Built in.
 - j. Discharge Check Valve: Built in.
- 2. Drive: V-belt with guard; gear reducer; or direct, close coupled **OR** V-belt with guard **OR** Gear reducer **OR** Direct, close coupled, **as directed**.
- 3. Controls:
 - a. Run pump to maintain minimum manifold pressure with outdoor-air temperature less than 60 deg F (16 deg C).
 - b. Run pump on seven-day schedule.
 - c. Alarm motor failure.
 - d. Manual reset dry-run protection. Stop pump if fuel level falls below pump suction.
 - e. Deenergize and alarm pump locked rotor condition.
 - f. Alarm open circuit, high and low voltage.
 - g. Indicating lights for power on, run, and off normal conditions.
 - h. Interface with automatic control system is specified in Division 23 Section "Instrumentation And Control For Hvac" to control and indicate the following:
 - 1) Start/stop pump set when required by schedule, fuel-fired appliance operation, day tank level control, or weather conditions.
 - 2) Operating status.
 - 3) Alarm off-normal status.
- 4. Motor: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".



- a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- b. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 22.

V. Duplex **OR** Triplex, **as directed**, Fuel-Oil Transfer Pump Sets

1. Description: Comply with HI M109.
 - a. Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.
 - b. Type: Positive-displacement, rotary type.
 - c. Impeller: Steel gear with crescent **OR** Carbon vane, **as directed**.
 - d. Housing: Cast-iron foot mounted.
 - e. Bearings: Bronze, self-lubricating.
 - f. Shaft: Polished steel.
 - g. Seals: Mechanical.
 - h. Base: Steel.
 - i. Pressure Relief: Built in.
 - j. Discharge Check Valve: Built in.
2. Drive: V-belt with guard, gear reducer, or direct close coupled **OR** V-belt with guard **OR** Gear reducer **OR** Direct close coupled, **as directed**.
3. Controls:
 - a. Run pumps to maintain minimum manifold pressure with outdoor-air temperature less than 60 deg F (16 deg C).
 - b. Run pumps on seven-day schedule.
 - c. Stage pumps on pressure at a common supply manifold.
 - d. Alternate pumps to equalize run time.
 - e. Alarm motor failure.
 - f. Manual reset dry-run protection. Stop pumps if fuel level falls below pump suction.
 - g. Deenergize and alarm pump locked rotor condition.
 - h. Alarm open circuit, high and low voltage.
 - i. Indicating lights for power on, run, and off normal conditions.
 - j. Interface with automatic control system is specified in Division 23 Section "Instrumentation And Control For Hvac" to control and indicate the following:
 - 1) Start/stop pump set when required by schedule, fuel-fired appliance operation, day tank level control, or weather conditions.
 - 2) Operating status.
 - 3) Alarm off-normal status.
4. Motor: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 22.
5. Piping Furnished with Pumps: Steel with ferrous fittings and threaded or welded joints.
6. Strainers Furnished with Pumps: Duplex, basket type with corrosion-resistant-metal-screen baskets.

W. Fuel Maintenance System

1. Description: Factory fabricated and wired fuel maintenance system for fuel-oil filtration; with enclosure, filter, fuel-oil pump, and controls; FMG approved, listed, and labeled by an NRTL acceptable to authorities having jurisdiction.
 - a. Enclosure: NEMA 250, Type 3R, painted steel containing pumps, filters, accessories, and controls. Hinged door on the front of enclosure.



- b. Pump: Comply with HI M109, steel-gear-with-crescent, positive-displacement, direct-coupled, rotary-type.
 - c. Materials: Cast-iron housing; bronze bearings; steel shaft; mechanical seals; and built-in, pressure relief bypass valve.
 - d. Motor: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2) Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 22.
 - e. Piping: Steel with malleable-iron fittings and threaded joints or wrought-steel fittings and welded joints.
 - f. Multistage Filter: Spin-on, replaceable types.
 - 1) Stage 1: 100-mesh strainer.
 - 2) Stage 2: Centrifuge to separate particulates and water from oil.
 - 3) Stage 3: Coalescing water and particulate filter.
 - 4) Stage 4: 30-micron particulate removal.
 - 5) Stage 5: 10-micron particulate removal.
 - 6) Stage 6: Minimum 99.5 percent water removal with see-through bowl and water-sensor probe.
 - 7) Stage 7: 1.5 **OR** 3, **as directed**, -micron particulate removal.
 - g. Multiple-Tank Manifolds:
 - 1) Manifold fabricated of Schedule 80, black steel pipe and threaded nipples for two **OR** three **OR** four, **as directed**, tanks.
 - 2) Solenoid valves for supply and return piping to each tank.
 - 3) Strainers for each tank supply connection.
 - h. Programmable Logic Controller:
 - 1) Alarm on maximum 15-in. Hg (51-kPa) vacuum at pump suction indicating plugged filter.
 - 2) Alarm on high water level in filter.
 - 3) Alarm leak in enclosure.
 - 4) Touch screen; with minimum 2-line, 20-character, backlit, LCD display.
 - 5) Controller strip heater with thermostat.
 - i. Interface with automatic control system is specified in Division 23 Section "Instrumentation And Control For Hvac" to control and indicate the following:
 - 1) Start/stop system when required by schedule.
 - 2) Operating status.
 - 3) Alarm off-normal status.
- X. Liquid-Level Gage System
- 1. Description: Calibrated, liquid-level gage system complying with UL 180 with floats **OR** UL 1238 with probes, **as directed**, or other sensors and remote annunciator panel.
 - 2. Annunciator Panel: With visual and audible, high-tank-level and low-tank-level alarms, fuel indicator with registration in gallons (liters), and overfill alarm. Include gage volume range that covers fuel-oil storage capacity.
 - 3. Controls: Electrical, operating on 120-V ac.
- Y. Leak-Detection And Monitoring System
- 1. Cable and Sensor System: Comply with UL 1238.
 - a. Calibrated, leak-detection and monitoring system with probes and other sensors and remote alarm panel for fuel-oil storage tanks and fuel-oil piping.
 - b. Include fittings and devices required for testing.
 - c. Controls: Electrical, operating on 120-V ac.
 - d. Calibrated, liquid-level gage complying with UL 180 with floats **OR** UL 1238 with probes, **as directed**, or other sensors and remote annunciator panel.



- e. Remote Annunciator Panel: With visual and audible, high-tank-level and low-tank-level alarms, fuel indicator with registration in gallons (liters), and overfill alarm. Include gage volume range that covers fuel-oil storage capacity.
 - f. Controls: Electrical, operating on 120-V ac.
- 2. Hydrostatic System: Comply with UL 1238.
 - a. Calibrated, leak-detection and monitoring system with brine antifreeze solution, reservoir sensor, and electronic control panel to monitor leaks in inner and outer tank walls.
 - b. Include fittings and devices required for testing.
 - c. Controls: Electrical, operating on 120-V ac.
 - d. Calibrated, liquid-level gage complying with UL 180 with floats **OR** UL 1238 with probes, **as directed**, or other sensors and remote annunciator panel.
 - e. Remote Annunciator Panel: With visual and audible, high-tank-level and low-tank-level alarms, fuel indicator with registration in gallons (liters), and overfill alarm. Include gage volume range that covers fuel-oil storage capacity.
 - f. Controls: Electrical, operating on 120-V ac.
- Z. Fuel Oil
 - 1. Fuel Oil: ASTM D 396, Grade No. 1 **OR** No. 2, **as directed**.
 - 2. Diesel Fuel Oil: ASTM D 975, Grade Low Sulfur **OR** No. 1-D, special-purpose **OR** No. 2-D, general-purpose, **as directed**, high volatility.
- AA. Sleeves
 - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
 - 2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- BB. Mechanical Sleeve Seals
 - 1. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - a. Sealing Elements: EPDM **OR** NBR, **as directed**, interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe and sleeve.
 - b. Pressure Plates: Plastic **OR** Carbon steel **OR** Stainless steel, **as directed**.
 - c. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating **OR** Stainless steel, **as directed**, of length required to secure pressure plates to sealing elements. Include one nut and bolt for each sealing element.
- CC. Escutcheons
 - 1. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to fit around pipe or tube and with OD that completely covers opening.
 - 2. One-Piece, Deep-Pattern Escutcheons: Deep-drawn brass with polished chrome-plated finish.
 - 3. One-Piece, Cast-Brass Escutcheons: With set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass, **as directed**.
 - 4. Split-Casting, Cast-Brass Escutcheons: With concealed hinge and set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass, **as directed**.
 - 5. One-Piece, Stamped-Steel Escutcheons: With set screw **OR** spring clips, **as directed**, and chrome-plated finish.
 - 6. Split-Plate, Stamped-Steel Escutcheons: With concealed **OR** exposed-rivet, **as directed**, hinge, set screw **OR** spring clips, **as directed**, and chrome-plated finish.
 - 7. One-Piece, Floor-Plate Escutcheons: Cast-iron floor plate.
 - 8. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.
- DD. Grout
 - 1. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.



- a. Characteristics: Posthardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
- b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- c. Packaging: Premixed and factory packaged.

EE. Labeling And Identifying

- 1. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (152 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (762 mm) deep; colored yellow.

FF. Concrete Manholes

- 1. Precast Concrete Manhole Sections: ASTM C 478 (ASTM C 478M), base and concentric-cone sections with integral ladder or steps.
- 2. Cast-Iron Frame and Cover: Heavy-duty, water-resistant, cast-iron manhole frame, gasket, and bolted cover; 24-inch- (609-mm-) diameter, inside opening dimension; 8-inch (203-mm) frame riser height.

GG. Source Quality Control

- 1. Pressure test and inspect fuel-oil storage tanks, after fabrication and before shipment, according to ASME and the following:
 - a. Vertical **OR** Horizontal, **as directed**, Single-Wall Steel ASTs: UL 142.
 - b. Vertical **OR** Horizontal, **as directed**, Double-Wall Steel ASTs: UL 142, STI F921, and STI R931.
 - c. Horizontal, Containment-Dike, Steel ASTs: UL 142 and STI F911.
 - d. Horizontal, Concrete-Vaulted **OR** Concrete-Vaulted and Insulated **OR** Insulated, **as directed**, Steel ASTs: UL 142 and UL 2085.
 - e. Horizontal, Steel USTs with the STI-P3 Corrosion-Protection System: UL 58 and STI P3.
 - f. Composite **OR** Composite and Jacketed **OR** Jacketed, **as directed**, Steel USTs: UL 58.
 - g. FRP USTs: UL 1316.
- 2. Affix standards organization's code stamp.

1.3 EXECUTION

A. Earthwork

- 1. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

B. Preparation

- 1. Close equipment shutoff valves before turning off fuel oil to premises or piping section.
- 2. Comply with NFPA 30 and NFPA 31 requirements for prevention of accidental ignition.

C. Outdoor Piping Installation

- 1. Install underground fuel-oil piping buried at least 18 inches (457 mm) below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.
 - a. If fuel-oil piping is installed with less than 12 inches (305 mm) of cover to finished grade, install in containment piping.
- 2. Steel Piping with Protective Coating:
 - a. Apply joint cover kits to pipe after joining, to cover, seal, and protect joints.
 - b. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer. Review protective coating damage prior to repair.

OR

Replace pipe having damaged PE coating with new pipe.

3. Install double-containment, fuel-oil pipe at a minimum slope of 1 percent downward toward fuel-oil storage tank sump.
4. Install vent pipe at a minimum slope of 2 percent downward toward fuel-oil storage tank sump.
5. Assemble and install entry boots for pipe penetrations through sump sidewalls for liquid-tight joints.
6. Install metal pipes and tubes, fittings, valves, and flexible connectors at piping connections to AST and UST.
7. Install fittings for changes in direction in rigid pipe.
8. Install system components with pressure rating equal to or greater than system operating pressure.
9. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Install sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
10. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
11. Mechanical Sleeve Seal Installation: Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
12. Install pressure gage on suction **OR** suction and discharge, **as directed**, from each pump. Pressure gages are specified in Division 23 Section "Meters And Gages For Hvac Piping".

D. Indoor Piping Installation

1. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
2. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
3. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
4. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
5. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
6. Install piping free of sags and bends.
7. Install fittings for changes in direction and branch connections.
8. Install escutcheons for penetrations of walls, ceilings, and floors.
 - a. New Piping:
 - 1) Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - 2) Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
OR
Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - 3) Piping at Ceiling Penetrations in Finished Spaces: One-piece **OR** Split-casting, **as directed**, cast-brass type with polished chrome-plated finish.
OR
Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type **OR** Split-plate, stamped-steel type with concealed hinge, **as directed**, and set screw.
 - 4) Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated **OR** rough-brass, **as directed**, finish.
OR



- Piping in Unfinished Service Spaces: One-piece, stamped-steel type with set screw **OR** spring clips, **as directed**.
 - 5) Piping in Equipment Rooms: One-piece, cast-brass type.
 - OR**
 - Piping in Equipment Rooms: One-piece, stamped-steel type with set screw **OR** spring clips, **as directed**.
 - 6) Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- 9. Existing Piping:
 - 1) Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - OR**
 - Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
 - 2) Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - OR**
 - Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
 - 3) Piping in Unfinished Service Spaces: Split-casting, cast-brass type with polished chrome-plated **OR** rough-brass, **as directed**, finish.
 - OR**
 - Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and set screw or spring clips.
 - 4) Piping in Equipment Rooms: Split-casting, cast-brass type.
 - OR**
 - Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
 - 5) Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
- 10. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping".
- 11. Verify final equipment locations for roughing-in.
- 12. Comply with requirements for equipment specifications in Division 14 AND Division 21 for roughing-in requirements.
- 13. Conceal pipe installations in walls, pipe spaces, or utility spaces; above ceilings; below grade or floors; and in floor channels unless indicated to be exposed to view.
- 14. Prohibited Locations:
 - a. Do not install fuel-oil piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
 - b. Do not install fuel-oil piping in solid walls or partitions.
- 15. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- 16. Connect branch piping from top or side of horizontal piping.
- 17. Install unions in pipes NPS 2 (DN 50) and smaller at final connection to each piece of equipment and elsewhere as indicated. Unions are not required on flanged devices.
- 18. Do not use fuel-oil piping as grounding electrode.
- 19. Install Y-pattern **OR** basket **OR** T-pattern, **as directed**, strainer on inlet side of fuel-oil pump.

E. Valve Installation

- 1. Install manual fuel-oil shutoff valves on branch connections to fuel-oil appliance.
- 2. Install valves in accessible locations.
- 3. Protect valves from physical damage.
- 4. Install metal tag attached with metal chain indicating fuel-oil piping systems.
- 5. Identify valves as specified in Division 23 Section "Identification For Hvac Piping And Equipment".
- 6. Install oil safety valves at inlet of each oil-fired appliance.



7. Install pressure relief valves in distribution piping between the supply and return lines.
8. Install one-piece, bronze ball valve with hose end connection at low points in fuel-oil piping.
9. Install manual air vents at high points in fuel-oil piping.
10. Install emergency shutoff valves at dispensers (for systems with fuel-oil or diesel-fuel-oil dispensers).

F. Piping Joint Construction

1. Ream ends of pipes and tubes and remove burrs.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
4. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to "Quality Assurance" Article.
 - a. Bevel plain ends of steel pipe.
 - b. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
5. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
6. Flanged Joints: Install gasket material, size, type, and thickness for service application. Install gasket concentrically positioned.
7. Flared Joints: Comply with SAE J513. Tighten finger tight, then use wrench according to fitting manufacturer's written recommendations. Do not overtighten.
8. Fiberglass-Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

G. Fuel-Oil AST Installation

1. Install tank bases and supports.
2. Connect piping and vent fittings.
3. Install ground connections.
4. Install tank leak-detection and monitoring devices.
5. Install steel ASTs according to STI R912.
6. Install insulated and concrete-vaulted, steel ASTs according to STI R942.
7. Fill storage tanks with fuel oil.

H. Fuel-Oil UST Installation

1. Excavate to sufficient depth for a minimum of 3 feet (1 m) of earth cover from top of tank to finished grade. Allow for cast-in-place, concrete-ballast base plus 6 inches (150 mm) of sand or pea gravel between ballast base and tank. Extend excavation at least 12 inches (300 mm) around perimeter of tank.
2. Set tie-down eyelets for hold-down straps in concrete-ballast base and tie to reinforcing steel.
3. Place 6 inches (152 mm) of clean sand or pea gravel on top of concrete-ballast base.
4. Set tank on fill materials and install hold-down straps.
5. Connect piping.
6. Install tank leak-detection and monitoring devices.
7. Install containment sumps.
8. Backfill excavation with clean sand or pea gravel in 12-inch (305-mm) lifts and tamp backfill lift to consolidate.
9. Install filter mat between top of backfill material and earth fill.
10. Install steel USTs with the STI-P3 corrosion-protection system according to STI R821 and STI R891. Protect anodes during tank placement and backfilling operations.



11. Install composite, steel USTs according to STI R913 and STI R891.
12. Install jacketed, steel USTs according to STI R923 and STI R891.
13. Install FRP USTs with FRP hold-down straps, manhole extensions, and manhole risers.
14. Fill storage tanks with fuel oil.

I. Hanger And Support Installation

1. Pipe hanger and support and equipment support materials and installation requirements are specified in Division 23 Section "Hangers And Supports For Hvac Piping And Equipment".
2. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - a. NPS 1-1/4 (DN 32) and Smaller: Maximum span, 84 inches (2130 mm); minimum rod size, 3/8 inch (10 mm).
 - b. NPS 1-1/2 (DN 40): Maximum span, 108 inches (2740 mm); minimum rod size, 3/8 inch (10 mm).
 - c. NPS 2 (DN 50): Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (10 mm).
 - d. NPS 2-1/2 (DN 65): Maximum span, 11 feet (3.4 m); minimum rod size, 1/2 inch (13 mm).
 - e. NPS 3 (DN 80): Maximum span, 12 feet (3.7 m); minimum rod size, 1/2 inch (13 mm).
 - f. NPS 4 (DN 100): Maximum span, 13 feet (4 m); minimum rod size, 5/8 inch (16 mm).
3. Support vertical steel pipe at each floor and at spacing not greater than 15 feet (4.5 m).
4. Install hangers for horizontal, drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:
 - a. NPS 3/4 (DN 20) and Smaller: Maximum span, 60 inches (1524 mm); minimum rod size, 3/8 inch (10 mm).
 - b. NPS 1 (DN 25): Maximum span, 72 inches (1830 mm); minimum rod size, 3/8 inch (10 mm).
 - c. NPS 1-1/4 (DN 32): Maximum span, 84 inches (2130 mm); minimum rod size, 3/8 inch (10 mm).
 - d. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 96 inches (2440 mm); minimum rod size, 3/8 inch (10 mm).
 - e. NPS 2-1/2 (DN 65): Maximum span, 108 inches (2740 mm); minimum rod size, 1/2 inch (13 mm).
 - f. NPS 3 (DN 80): Maximum span, 10 feet (3 m); minimum rod size, 1/2 inch (13 mm).
 - g. NPS 4 (DN 100): Maximum span, 11 feet (3.4 m); minimum rod size, 5/8 inch (16 mm).
5. Support vertical copper tube at each floor and at spacing not greater than 10 feet (3 m).

J. Fuel-Oil Pump Installation

1. Submersible Pumps:
 - a. Suspend pumps from supply piping and anchored to bottom of tank.
2. Transfer Pumps:
 - a. Install pumps with access space for periodic maintenance including removal of motors, impellers, and accessories.
 - b. Set pumps on and anchor to concrete base.
3. Install two-piece, full-port ball valves at suction and discharge of pumps.
4. Install mechanical leak-detector valves at pump discharge.
5. Install Y-pattern **OR** basket **OR** T-pattern, **as directed**, strainer on inlet side of simplex fuel-oil pumps.
6. Install check valve on discharge of simplex fuel-oil pumps.
7. Install suction piping with minimum fittings and change of direction.
8. Install vacuum and pressure gage, upstream and downstream respectively, at each pump to measure the differential pressure across the pump. Pressure gages are specified in Division 23 Section "Meters And Gages For Hvac Piping".

K. Fuel Maintenance System Installation

1. Install suction line, with foot valve, at one end of storage tank, 1 inch (25 mm) from the bottom of tank.
2. Install return line at the opposite end of storage tank from suction line.



- L. Liquid-Level Gage System Installation
1. Install liquid-level gage system. Locate panel inside building where indicated.
- M. Leak-Detection And Monitoring System Installation
1. Install leak-detection and monitoring system. Install alarm panel inside building where indicated.
 - a. Double-Wall, Fuel-Oil Storage Tanks: Install probes **OR** Install probes or use factory-installed integral probes **OR** Use factory-installed integral probes, **as directed**, in interstitial space.
 - b. Single-Wall, Fuel-Oil Storage Tanks: Install probes as indicated.
 - c. Double-Containment, Fuel-Oil Piping: Install leak-detection sensor probes in fuel-oil storage tank containment sumps and at low points in piping **OR** cable probes in interstitial space of double-containment piping, **as directed**.
 - d. Install liquid-level gage.
- N. Connections
1. Install piping adjacent to equipment to allow service and maintenance.
 2. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment having threaded pipe connection.
 3. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.
 4. Connect piping to equipment with ball valve and union. Install union between valve and equipment.
 5. Install flexible piping connectors at final connection to burners or oil-fired appliances that must be moved for maintenance access.
- O. Labeling And Identifying
1. Nameplates, pipe identification, and signs are specified in Division 23 Section "Identification For Hvac Piping And Equipment".
OR
Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplates and signs on or near each service regulator, service meter, and earthquake valve.
 - a. Text: In addition to identifying unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
 2. Install detectable warning tape directly above fuel-oil piping, 12 inches (304 mm) below finished grade, except 6 inches (152 mm) below subgrade under pavements and slabs. Terminate tracer wire in an accessible area, and identify as "tracer wire" for future use with plastic-laminate sign.
 - a. Piping: Over underground fuel-oil distribution piping.
 - b. Fuel-Oil Storage Tanks: Over edges of each UST.
- P. Field Painting Of AST
1. If shop painting AST, prepare and touch up damaged exterior surface of AST and supports, **as directed**, as specified in "Shop Painting of AST" Article.
 2. If field painting AST, prepare exterior steel surface of AST and tank supports, **as directed**.
 3. Field Cleaning: After fabrication, blast clean according to SSPC-SP 6/NACE No. 3 **OR** SSPC-SP 10/NACE No. 2, **as directed**.
 4. After cleaning, remove dust or residue from cleaned surfaces.
 5. If surfaces develop rust before prime coat is applied, repeat surface preparation.
 6. Prepare surface of AST and supports, **as directed**, and apply painting systems according to specifications in Division 09 Section "High-performance Coatings" for severe **OR** moderate **OR** mild, **as directed**, environment high-gloss **OR** semigloss, **as directed**, finish for ferrous metal.
- Q. Field Painting Of Aboveground Piping
1. Comply with requirements in Division 07 for painting interior and exterior fuel-oil piping.



2. Paint exposed, exterior metal piping, valves, and piping specialties, except components with factory-applied paint or protective coating.
 - a. Alkyd System: MPI EXT 5.1D.
 - 1) Prime Coat: Alkyd anticorrosive metal primer.
 - 2) Intermediate Coat (for a Premium Grade system): Exterior alkyd enamel matching topcoat.
 - 3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - 4) Color: Gray, **as directed**.
3. Paint exposed, interior metal piping, valves, and piping specialties, except components with factory-applied paint or protective coating.
 - a. Latex Over Alkyd Primer System: MPI INT 5.1Q.
 - 1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
 - 2) Intermediate Coat (for a Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - 4) Color: Gray, **as directed**.
 - b. Alkyd System: MPI INT 5.1E.
 - 1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
 - 2) Intermediate Coat (for a Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - 4) Color: Gray, **as directed**.
4. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

R. Concrete Bases

1. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - a. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (457-mm) centers around the full perimeter of the base.
 - c. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - f. Use 3000-psig (20.7-MPa), **unless directed otherwise**, 28-day, compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-place Concrete".

S. Field Quality Control

1. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Tests and Inspections:
 - a. Tanks: Minimum hydrostatic or compressed-air test pressures for fuel-oil storage tanks that have not been factory tested and do not bear the ASME code stamp or a listing mark acceptable to authorities having jurisdiction:
 - 1) Single-Wall Tanks: Minimum 3 psig (20.7 kPa) and maximum 5 psig (34.5 kPa).
 - 2) Double-Wall Tanks:
 - a) Inner Tanks: Minimum 3 psig (20.7 kPa) and maximum 5 psig (34.5 kPa).
 - b) Interstitial Space: Minimum 3 psig (20.7 kPa) and maximum 5 psig (34.5 kPa), or 5.3-in. Hg (18-kPa) vacuum.

- 3) Where vertical height of fill and vent pipes is such that the static head imposed on the bottom of the tank is greater than 10 psig (69 kPa), hydrostatically test the tank and fill and vent pipes to a pressure equal to the static head thus imposed.
- 4) Maintain the test pressure for one hour.
- b. Piping: Minimum hydrostatic or pneumatic test-pressures measured at highest point in system:
 - 1) Fuel-Oil Distribution Piping: Minimum 5 psig (34.5 kPa) for minimum 30 minutes.
 - 2) Fuel-Oil, Double-Containment Piping:
 - a) Carrier Pipe: Minimum 5 psig (34.5 kPa) for minimum 30 minutes.
 - b) Containment Conduit: Minimum 5 psig (34.5 kPa) for minimum 60 minutes.
 - 3) Suction Piping: Minimum 20-in. Hg (68 kPa) for minimum 30 minutes.
 - 4) Isolate storage tanks if test pressure in piping will cause pressure in storage tanks to exceed 10 psig (69 kPa).
- c. Inspect and test fuel-oil piping according to NFPA 31, "Tests of Piping" Paragraph; and according to requirements of authorities having jurisdiction.
- d. Test liquid-level gage for accuracy by manually measuring fuel-oil levels at not less than three **OR** four **OR** five, **as directed**, different depths while filling tank and checking against gage indication.
- e. Test leak-detection and monitoring system for accuracy by manually operating sensors and checking against alarm panel indication.
- f. Start fuel-oil transfer pumps to verify for proper operation of pump and check for leaks.
- g. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- h. Bleed air from fuel-oil piping using manual air vents.
3. Fuel-oil piping and equipment will be considered defective if it does not pass tests and inspections.
4. Prepare test and inspection reports.

T. Outdoor Piping Schedule

1. Underground fuel-oil piping shall be one of the following. Size indicated is carrier-pipe size.
 - a. Flexible, double-containment piping.
 - b. Rigid, double-containment piping.
2. Underground fuel-oil-tank fill and vent piping shall be one of the following:
 - a. NPS 2 (DN 50) and Smaller: Steel pipe, steel or malleable-iron threaded fittings, and threaded joints. Coat pipe and fittings with protective coating for steel piping.
 - b. NPS 2-1/2 (DN 65) and Larger: Steel pipe, steel welding fittings, and welded joints. Coat pipe and fittings with protective coating for steel piping.
3. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
4. Aboveground fuel-oil piping shall be one of the following:
 - a. NPS 2 (DN 50) and Smaller: Steel pipe, steel or malleable-iron threaded fittings, and threaded joints.
 - b. NPS 2-1/2 (DN 65) and Larger: Steel pipe, steel welding fittings, and welded joints.
 - c. Annealed **OR** Drawn, **as directed**,-temper copper tube with wrought-copper fittings and brazed joints.

U. Indoor Piping Schedule

1. Aboveground fuel-oil piping shall be one of the following:
 - a. NPS 1/2 (DN 15) and Smaller: Steel pipe, steel or malleable-iron threaded fittings, and threaded joints **OR** Annealed-temper copper pipe, wrought copper fittings, and brazed or flared joints, **as directed**.
 - b. NPS 5/8 to NPS 2 (DN 18 to DN 50): Steel pipe, steel or malleable-iron threaded fittings, and threaded joints **OR** Drawn temper copper pipe, wrought copper fittings, and brazed joints, **as directed**.



- c. NPS 2-1/2 (DN 65) and Larger: Steel pipe, steel fittings, and welded or flanged joints **OR** Drawn temper copper pipe, wrought copper fittings, and brazed or flanged joints, **as directed**.
 - d. Steel pipe with malleable-iron fittings and threaded joints.
 - e. Steel pipe with wrought-steel fittings and welded joints.
 - f. Annealed-temper copper tube, brass fittings, and flared joints.
 - g. Drawn-temper copper tubing, copper fittings, and brazed joints.
- V. Aboveground Manual Fuel-Oil Shutoff Valve Schedule
 - 1. Distribution piping valves for pipe NPS 2 (DN 50) and smaller shall be one of the following:
 - a. One-piece, bronze ball valve with bronze trim.
 - b. Two-piece, full **OR** regular, **as directed**, -port, bronze ball valves with bronze trim.
 - 2. Distribution piping valves for pipe NPS 2-1/2 (DN 65) and larger shall be one of the following:
 - a. Two-piece, full **OR** regular, **as directed**, -port, bronze ball valves with bronze trim.
 - b. Bronze, nonlubricated **OR** lubricated, **as directed**, plug valve.
 - 3. Valves in branch piping for single appliance shall be one of the following:
 - a. One-piece, bronze ball valve with bronze trim.
 - b. Two-piece, full **OR** regular, **as directed**, -port, bronze ball valves with bronze trim.

END OF SECTION 22 12 23 26



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Task	Specification	Specification Description
22 12 23 26	22 05 23 00	Piped Utilities Basic Materials And Methods



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SECTION 22 13 16 00 - CSF SANITARY WASTE AND VENT PIPING

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.22 13 16 00

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following soil and waste, sanitary drainage and vent piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.

1.2 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control inspection and test reports.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; and "NSF-drain" for plastic drain piping.



PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Hub-and-Spigot, Cast-Iron Pipe and Fittings: ASTM A 74, Service class.
 - 1. Gaskets: ASTM C 564, rubber.
- B. Hubless Cast-Iron Pipe and Fittings: ASTM A 888 or CISPI 301.
 - 1. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.
 - 2. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - a. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
 - b. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
- C. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Schedule 40, galvanized. Include ends matching joining method.
 - 1. Drainage Fittings: ASME B16.12, galvanized, threaded, cast-iron drainage pattern.
 - 2. Pressure Fittings:
 - a. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
 - b. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
 - c. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
 - d. Cast-Iron Flanges: ASME B16.1, Class 125.
 - e. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.
- D. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
 - 1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought-copper, solder-joint fittings.
- E. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40, solid wall.
 - 1. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.
 - 2. Solvent Cement and Adhesive Primer:
 - a. Use ABS solvent cement that has a VOC content of 325 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Solid-Wall PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.
 - 1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.
 - 2. Solvent Cement and Adhesive Primer:
 - a. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).



PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
- B. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- C. Aboveground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
 - 1. Hubless cast-iron soil pipe and fittings and heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
 - 2. Copper DWV tube, copper drainage fittings, and soldered joints.
 - 3. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints. Not to be used in plenum spaces.
 - 4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints. Not to be used in plenum spaces.
- D. Aboveground, soil, waste, and vent piping NPS 5 and larger shall be any of the following:
 - 1. Hubless cast-iron soil pipe and fittings and heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
 - 2. Copper DWV tube, copper drainage fittings, and soldered joints.
 - 3. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
 - 4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- E. Underground in building (to 5 feet outside building), soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
 - 1. Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and compression joints.
 - 2. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints. Not to be used in plenum spaces.
 - 3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints. Not to be used in plenum spaces.
- F. Underground in building (to 5 feet outside building), soil and waste Piping NPS 5 and larger shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and compression joints.
 - 2. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints. Not to be used in plenum spaces.
 - 3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints. Not to be used in plenum spaces.

3.2 PIPING INSTALLATION

- A. Sanitary sewer piping outside the building is specified in Division 22 Section "Facility Sanitary Sewers."
- B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation water-



tight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

- E. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 22 Section "Common Work Results for Plumbing."
- F. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- G. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- H. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- I. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- J. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- K. Install ABS soil and waste drainage and vent piping according to ASTM D 2661.
- L. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.
- M. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
 - 2. Hubless Joints: Make with rubber gasket and sleeve or clamp.
- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- D. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.



3.4 VALVE INSTALLATION

- A. General-duty valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- B. Shutoff Valves: Install shutoff valve on each sewage pump discharge.
 - 1. Use gate or full-port ball valve for piping NPS 2 and smaller.
 - 2. Use gate valve for piping NPS 2-1/2 and larger.
- C. Check Valves: Install swing check valve, downstream from shutoff valve, on each sewage pump discharge.
- D. Backwater Valves: Install backwater valves in piping subject to sewage backflow.
 - 1. Horizontal Piping: Horizontal backwater valves.[Use normally closed type, unless otherwise indicated.]
 - 2. Floor Drains: Drain outlet backwater valves, unless drain has integral backwater valve.
 - 3. Install backwater valves in accessible locations.
 - 4. Backwater valves are specified in Division 22 Section "Sanitary Waste Piping Specialties."

3.5 HANGER AND SUPPORT INSTALLATION

- A. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. NPS 6: 60 inches with 3/4-inch rod.
 - 5. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 84 inches with 3/8-inch rod.
 - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 - 3. NPS 2: 10 feet with 3/8-inch rod.



4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 5. NPS 3: 12 feet with 1/2-inch rod.
 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
 7. NPS 6: 12 feet with 3/4-inch rod.
- I. Install supports for vertical steel piping every 15 feet.
- J. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
 4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 5. NPS 6: 10 feet with 5/8-inch rod.
- K. Install supports for vertical copper tubing every 10 feet.
- L. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
 2. NPS 3: 48 inches with 1/2-inch rod.
 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
 4. NPS 6: 48 inches with 3/4-inch rod.
- M. Install supports for vertical ABS and PVC piping every 48 inches.
- N. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- B. Connect drainage and vent piping to the following:
1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.



- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction.
 - 1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 2. Prepare reports for tests and required corrective action.

3.8 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.9 PROTECTION

- A. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

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END OF SECTION



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SECTION 22 13 16 00 - MPF SANITARY WASTE AND VENT PIPING

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following soil and waste, sanitary drainage and vent piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.

1.2 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control inspection and test reports.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; and "NSF-drain" for plastic drain piping.



PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Hub-and-Spigot, Cast-Iron Pipe and Fittings: ASTM A 74, Service class.
 - 1. Gaskets: ASTM C 564, rubber.
- B. Hubless Cast-Iron Pipe and Fittings: ASTM A 888 or CISPI 301.
 - 1. Solvent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.
 - 2. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - a. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
 - b. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
- C. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Schedule 40, galvanized. Include ends matching joining method.
 - 1. Drainage Fittings: ASME B16.12, galvanized, threaded, cast-iron drainage pattern.
 - 2. Pressure Fittings:
 - a. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
 - b. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
 - c. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
 - d. Cast-Iron Flanges: ASME B16.1, Class 125.
 - e. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.
- D. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
 - 1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought-copper, solder-joint fittings.
- E. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40, solid wall.
 - 1. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.
 - 2. Solvent Cement and Adhesive Primer:
 - a. Use ABS solvent cement that has a VOC content of 325 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Solid-Wall PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.
 - 1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.
 - 2. Solvent Cement and Adhesive Primer:
 - a. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).



PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
- B. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- C. Aboveground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
 - 1. Hubless cast-iron soil pipe and fittings and heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
 - 2. Copper DWV tube, copper drainage fittings, and soldered joints.
 - 3. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints. Not to be used in plenum spaces.
 - 4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints. Not to be used in plenum spaces.
- D. Aboveground, soil, waste, and vent piping NPS 5 and larger shall be any of the following:
 - 1. Hubless cast-iron soil pipe and fittings and heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
 - 2. Copper DWV tube, copper drainage fittings, and soldered joints.
 - 3. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
 - 4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- E. Underground in building (to 5 feet outside building), soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
 - 1. Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and compression joints.
- F. Underground in building (to 5 feet outside building), soil and waste Piping NPS 5 and larger shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and compression joints.

3.2 PIPING INSTALLATION

- A. Sanitary sewer piping outside the building is specified in Division 22 Section "Facility Sanitary Sewers."
- B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."
- E. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 22 Section "Common Work Results for Plumbing."
- F. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."



- G. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- H. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- I. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- J. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- K. Install ABS soil and waste drainage and vent piping according to ASTM D 2661.
- L. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.
- M. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
 - 2. Hubless Joints: Make with rubber gasket and sleeve or clamp.
- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- D. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.4 VALVE INSTALLATION

- A. General-duty valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- B. Shutoff Valves: Install shutoff valve on each sewage pump discharge.
 - 1. Use gate or full-port ball valve for piping NPS 2 and smaller.
 - 2. Use gate valve for piping NPS 2-1/2 and larger.
- C. Check Valves: Install swing check valve, downstream from shutoff valve, on each sewage pump discharge.



- D. Backwater Valves: Install backwater valves in piping subject to sewage backflow.
 - 1. Horizontal Piping: Horizontal backwater valves.[Use normally closed type, unless otherwise indicated.]
 - 2. Floor Drains: Drain outlet backwater valves, unless drain has integral backwater valve.
 - 3. Install backwater valves in accessible locations.
 - 4. Backwater valves are specified in Division 22 Section "Sanitary Waste Piping Specialties."

3.5 HANGER AND SUPPORT INSTALLATION

- A. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. NPS 6: 60 inches with 3/4-inch rod.
 - 5. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 84 inches with 3/8-inch rod.
 - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 - 3. NPS 2: 10 feet with 3/8-inch rod.
 - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 - 5. NPS 3: 12 feet with 1/2-inch rod.
 - 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
 - 7. NPS 6: 12 feet with 3/4-inch rod.
- I. Install supports for vertical steel piping every 15 feet.
- J. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.



2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
5. NPS 6: 10 feet with 5/8-inch rod.

- K. Install supports for vertical copper tubing every 10 feet.
- L. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
 2. NPS 3: 48 inches with 1/2-inch rod.
 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
 4. NPS 6: 48 inches with 3/4-inch rod.
- M. Install supports for vertical ABS and PVC piping every 48 inches.
- N. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- B. Connect drainage and vent piping to the following:
1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction.
1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 2. Prepare reports for tests and required corrective action.



3.8 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.9 PROTECTION

- A. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

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Task	Specification	Specification Description
22 13 16 00	22 05 23 00	Piped Utilities Basic Materials And Methods
22 13 16 00	22 11 23 39	Water Supply Wells
22 13 16 00	21 05 00 00	Common Work Results for Fire Suppression



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SECTION 22 13 19 00 - CSF SANITARY WASTE PIPING SPECIALTIES

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.22 13 19 00

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following sanitary drainage piping specialties:
 1. Cleanouts.
 2. Floor drains.
 3. Roof flashing assemblies.
 4. Miscellaneous sanitary drainage piping specialties.
 5. Flashing materials.
 6. Grease interceptors.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.3 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 CLEANOUTS

- A. Exposed Cast-Iron Cleanouts :
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Josam Company; Josam Div.



- b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
 - 3. Size: Same as connected drainage piping
 - 4. Body Material: As required to match connected piping.
 - 5. Closure: Countersunk brass or cast-iron plug.
 - 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- B. Cast-Iron Floor Cleanouts:
- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Josam Company; Josam Div.
 - b. Oatey.
 - c. Sioux Chief Manufacturing Company, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Tyler Pipe; Wade Div.
 - f. Watts Drainage Products Inc.
 - g. Zurn Plumbing Products Group; Light Commercial Operation.
 - h. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.36.2M for adjustable housing cleanout.
 - 3. Size: Same as connected branch.
 - 4. Closure: Brass plug with straight threads and gasket OR cast-iron plug.
 - 5. Top Loading Classification: **[Extra Heavy] [Heavy] [Light] [Medium]** Duty.
 - 6. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
- C. Cast-Iron Wall Cleanouts:
- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.36.2M. Include wall access.
 - 3. Size: Same as connected drainage piping.
 - 4. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
 - 5. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

2.2 FLOOR DRAINS

- A. Cast-Iron Floor Drains :
- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Commercial Enameling Co.
 - b. Josam Company; Josam Div.
 - c. MIFAB, Inc.
 - d. Prier Products, Inc.
 - e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - f. Tyler Pipe; Wade Div.
 - g. Watts Drainage Products Inc.



- h. Zurn Plumbing Products Group; Light Commercial Operation.
- i. Zurn Plumbing Products Group; Specification Drainage Operation.
- 2. Standard: ASME A112.6.3 with backwater valve, if required.
- 3. Body Material: Gray iron.
- 4. Backwater Valve: Integral, ASME A112.14.1, swing-check type, if required.
- 5. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel, where required. .
- 6. Sediment Bucket:
- 7. Top or Strainer Material: Nickel bronze.
- 8. Top of Body and Strainer Finish: [Nickel bronze] [Polished bronze] [Rough bronze] <Insert finish>.
- 9. Top Shape: Square.
- 10. Top Loading Classification: **[Extra Heavy-Duty] [Heavy Duty] [Light Duty] [Medium Duty]**.

2.3 ROOF FLASHING ASSEMBLIES

- A. Roof Flashing Assemblies:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Acorn Engineering Company; Elmdor/Stoneman Div.
 - b. Thaler Metal Industries Ltd.
- B. Description: Manufactured assembly made of 6.0-lb/sq. ft., 0.0938-inch-thick, lead flashing collar and skirt extending at least 10 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.
 - 1. Open-Top Vent Cap: Without cap.
 - 2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
 - 3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

- A. Open Drains:
 - 1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
 - 2. Size: Same as connected waste piping.
- B. Deep-Seal Traps:
 - 1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
 - 2. Size: Same as connected waste piping.
 - a. NPS 2: 4-inch- minimum water seal.
 - b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.
- C. Floor-Drain, Trap-Seal Primer Fittings:
 - 1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
 - 2. Size: Same as floor drain outlet with NPS 1/2 side inlet.
- D. Air-Gap Fittings:
 - 1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
 - 2. Body: Bronze or cast iron.
 - 3. Inlet: Opening in top of body.
 - 4. Outlet: Larger than inlet.



5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device :

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

F. Stack Flashing Fittings :

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

G. Vent Caps :

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

2.5 FLASHING MATERIALS

- A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
 1. General Use: 6-lb/sq. ft., 0.0938-inch thickness.
- B. Fasteners: Metal compatible with material and substrate being fastened.
- C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- D. Solder: ASTM B 32, lead-free alloy.
- E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.6 GREASE INTERCEPTORS

A. Grease Interceptors :

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Applied Chemical Technology, Incorporated.
 - b. Josam Company; Josam Div.
 - c. MIFAB, Inc.
 - d. Rockford Sanitary Systems, Inc.
 - e. Schier Products Company.
 - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - g. Tyler Pipe; Wade Div.
 - h. Watts Drainage Products Inc.
 - i. Zurn Plumbing Products Group; Light Commercial Operation.
 - j. Zurn Plumbing Products Group; Specification Drainage Operation.
 - k. Ashland Trap Distribution Co.
 - l. Bio-Microbics, Inc.
 - m. Canplas LLC.
 - n. Schier Products Company.



- o. Zurn Plumbing Products Group; Light Commercial Operation.
2. Standard: ASME A112.14.3 and PDI-G101, for intercepting and retaining fats, oils, and greases from food-preparation or processing wastewater.
3. Large facilities may require custom large (750 gallons and above) unit per local utility requirements.
4. Plumbing and Drainage Institute Seal.
5. Body Material: Cast iron for small systems. Large systems will be concrete or plastic tanks with integral baffles and manhole access.
6. Interior Lining: Corrosion-resistant enamel.
7. Exterior Coating: Corrosion-resistant enamel.
8. Body Extension: As **required**.
9. Operation: Manual manual cleaning

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.
 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 4. Locate at base of each vertical soil and waste stack.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 1. Position floor drains for easy access and maintenance.
 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- F. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- G. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- H. Assemble open drain fittings and install with top of hub 2 inches above floor.



- I. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- J. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
 - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 - 2. Size: Same as floor drain inlet.
- K. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- L. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- M. Install vent caps on each vent pipe passing through roof.
- N. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.
 - 1. Above-Floor Installation: Set unit with bottom resting on floor, unless otherwise indicated.
 - 2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
 - 3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
 - 4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.
- O. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- P. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: 6.0-lb/sq. ft., 0.0938-inch thickness or thinner.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.



- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.5 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

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END OF SECTION



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SECTION 22 13 19 00 - MPF SANITARY WASTE PIPING SPECIALTIES

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following sanitary drainage piping specialties:
 - 1. Cleanouts.
 - 2. Floor drains.
 - 3. Roof flashing assemblies.
 - 4. Miscellaneous sanitary drainage piping specialties.
 - 5. Flashing materials.
 - 6. Grease interceptors.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.3 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 CLEANOUTS

- A. Exposed Cast-Iron Cleanouts :
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.



- e. Watts Drainage Products Inc.
- f. Zurn Plumbing Products Group; Specification Drainage Operation.
- 2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
- 3. Size: Same as connected drainage piping
- 4. Body Material: As required to match connected piping.
- 5. Closure: Countersunk brass or cast-iron plug.
- 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Floor Cleanouts:

- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Josam Company; Josam Div.
 - b. Oatey.
 - c. Sioux Chief Manufacturing Company, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Tyler Pipe; Wade Div.
 - f. Watts Drainage Products Inc.
 - g. Zurn Plumbing Products Group; Light Commercial Operation.
 - h. Zurn Plumbing Products Group; Specification Drainage Operation.
- 2. Standard: ASME A112.36.2M for adjustable housing cleanout.
- 3. Size: Same as connected branch.
- 4. Closure: Brass plug with straight threads and gasket OR cast-iron plug.
- 5. Top Loading Classification: **[Extra Heavy] [Heavy] [Light] [Medium]** Duty.
- 6. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
- 2. Standard: ASME A112.36.2M. Include wall access.
- 3. Size: Same as connected drainage piping.
- 4. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- 5. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains :

- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Commercial Enameling Co.
 - b. Josam Company; Josam Div.
 - c. MIFAB, Inc.
 - d. Prier Products, Inc.
 - e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - f. Tyler Pipe; Wade Div.
 - g. Watts Drainage Products Inc.
 - h. Zurn Plumbing Products Group; Light Commercial Operation.
 - i. Zurn Plumbing Products Group; Specification Drainage Operation.
- 2. Standard: ASME A112.6.3 with backwater valve, if required.



3. Body Material: Gray iron.
4. Backwater Valve: Integral, ASME A112.14.1, swing-check type, if required.
5. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel, where required. .
6. Sediment Bucket:
7. Top or Strainer Material: Nickel bronze.
8. Top of Body and Strainer Finish: [Nickel bronze] [Polished bronze] [Rough bronze] <Insert finish>.
9. Top Shape: Square.
10. Top Loading Classification: **[Extra Heavy-Duty] [Heavy Duty] [Light Duty] [Medium Duty]**.

2.3 ROOF FLASHING ASSEMBLIES

- A. Roof Flashing Assemblies:
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Acorn Engineering Company; Elmdor/Stoneman Div.
 - b. Thaler Metal Industries Ltd.
- B. Description: Manufactured assembly made of 6.0-lb/sq. ft., 0.0938-inch-thick, lead flashing collar and skirt extending at least 10 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.
 1. Open-Top Vent Cap: Without cap.
 2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
 3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

- A. Open Drains:
 1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
 2. Size: Same as connected waste piping.
- B. Deep-Seal Traps:
 1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
 2. Size: Same as connected waste piping.
 - a. NPS 2: 4-inch- minimum water seal.
 - b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.
- C. Floor-Drain, Trap-Seal Primer Fittings:
 1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
 2. Size: Same as floor drain outlet with NPS 1/2 side inlet.
- D. Air-Gap Fittings:
 1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
 2. Body: Bronze or cast iron.
 3. Inlet: Opening in top of body.
 4. Outlet: Larger than inlet.
 5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.
- E. Sleeve Flashing Device :



1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

F. Stack Flashing Fittings :

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

G. Vent Caps :

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

2.5 FLASHING MATERIALS

- A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
 1. General Use: 6-lb/sq. ft., 0.0938-inch thickness.
- B. Fasteners: Metal compatible with material and substrate being fastened.
- C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- D. Solder: ASTM B 32, lead-free alloy.
- E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.6 GREASE INTERCEPTORS

A. Grease Interceptors :

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Applied Chemical Technology, Incorporated.
 - b. Josam Company; Josam Div.
 - c. MIFAB, Inc.
 - d. Rockford Sanitary Systems, Inc.
 - e. Schier Products Company.
 - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - g. Tyler Pipe; Wade Div.
 - h. Watts Drainage Products Inc.
 - i. Zurn Plumbing Products Group; Light Commercial Operation.
 - j. Zurn Plumbing Products Group; Specification Drainage Operation.
 - k. Ashland Trap Distribution Co.
 - l. Bio-Microbics, Inc.
 - m. Canplas LLC.
 - n. Schier Products Company.
 - o. Zurn Plumbing Products Group; Light Commercial Operation.
2. Standard: ASME A112.14.3 and PDI-G101, for intercepting and retaining fats, oils, and greases from food-preparation or processing wastewater.



3. Large facilities may require custom large (750 gallons and above) unit per local utility requirements.
4. Plumbing and Drainage Institute Seal.
5. Body Material: Cast iron for small systems. Large systems will be concrete or plastic tanks with integral baffles and manhole access.
6. Interior Lining: Corrosion-resistant enamel.
7. Exterior Coating: Corrosion-resistant enamel.
8. Body Extension: As **required**.
9. Operation: Manual manual cleaning

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.
 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 4. Locate at base of each vertical soil and waste stack.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 1. Position floor drains for easy access and maintenance.
 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- F. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- G. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- H. Assemble open drain fittings and install with top of hub 2 inches above floor.
- I. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- J. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.



1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 2. Size: Same as floor drain inlet.
- K. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- L. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- M. Install vent caps on each vent pipe passing through roof.
- N. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.
1. Above-Floor Installation: Set unit with bottom resting on floor, unless otherwise indicated.
 2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
 3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
 4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.
- O. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- P. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
1. Lead Sheets: 6.0-lb/sq. ft., 0.0938-inch thickness or thinner.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."



- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.5 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

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SECTION 22 13 19 13 - HIGH-EFFICIENCY PARTICULATE FILTRATION

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for high-efficiency particulate filtration. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. HEPA rigid-cell box filters.
 - b. HEPA V-bank cell filters.
 - c. HEPA filter diffusers.
 - d. HEPA filter fan modules.
 - e. ULPA filters.
 - f. 95 percent DOP filters.
 - g. Front- and rear-access filter frames.
 - h. Side-service housings.
 - i. Filter gages.

C. Submittals

1. Product Data: For each type of product indicated. Include dimensions; operating characteristics; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.
2. LEED Submittals:
 - a. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with applicable requirements in ASHRAE 62.1, Section 5, "Systems and Equipment."
3. Shop Drawings: For air filters. Include plans, elevations, sections, details, and attachments to other work.
 - a. Show filter rack assembly, dimensions, materials, and methods of assembly of components.
 - b. Include setting drawings, templates, and requirements for installing anchor bolts and anchorages.
 - c. Wiring Diagrams: For power, signal, and control wiring.
4. Field quality-control reports.
5. Operation and Maintenance Data: For each type of filter and rack to include in emergency, operation, and maintenance manuals.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended use.
2. ASHRAE Compliance:
 - a. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
3. Comply with IEST-RP-CC001.3.
4. Comply with UL 586.
5. Comply with IEST-RP-CC007.1.
6. Comply with NFPA 90A and NFPA 90B.

E. Coordination

1. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.



1.2 PRODUCTS

A. HEPA Rigid-Cell Box Filters

1. Description: Factory-fabricated, disposable, packaged air filters with media perpendicular to airflow and with holding frames.
2. Filter Unit Class: UL 900, Class 1 **OR** Class 2, **as directed**.
3. Media: Fibrous material, constructed so individual pleats are maintained under rated-airflow conditions.
 - a. Internal Separators: None **OR** Aluminum in media folds, **as directed**.
 - b. Gasket Material: None **OR** Neoprene **OR** Blue gel, **as directed**.
 - c. Gasket Location: None **OR** Upstream **OR** Upstream and Downstream **OR** Downstream, **as directed**.
 - d. Faceguard Material: Aluminum **OR** Stainless steel, **as directed**.
 - e. Faceguard Location: None **OR** Upstream **OR** Upstream and Downstream **OR** Downstream, **as directed**.
4. Filter-Media Frames:
 - a. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 - b. Materials: Stainless steel **OR** Fire-retardant plywood **OR** Fabricated aluminum **OR** Fire-retardant particleboard **OR** Galvanized sheet **OR** Non-fire-retardant particleboard, **as directed**.
 - c. Style: Box **OR** Double-turned flange **OR** Deep channel **OR** Double-turned flange, one side, **as directed**.
5. Mounting Frames: Welded galvanized steel with gaskets and fasteners; suitable for bolting together into built-up filter banks.

B. HEPA V-Bank Cell Filters

1. Description: Factory-fabricated, disposable, packaged air filters with media at an angle to airflow and with holding frames.
2. Filter Unit Class: UL 900, Class 1 **OR** Class 2, **as directed**.
3. Media: Fibrous material, constructed so individual pleats are maintained under rated-airflow conditions.
 - a. Internal Separators: None **OR** Aluminum in media folds, **as directed**.
 - b. Gasket Material: None **OR** Neoprene **OR** Blue gel, **as directed**.
 - c. Gasket Location: None **OR** Upstream **OR** Upstream and Downstream **OR** Downstream, **as directed**.
 - d. Faceguard Material: Aluminum **OR** Stainless steel, **as directed**.
 - e. Faceguard Location: None **OR** Upstream **OR** Upstream and Downstream **OR** Downstream, **as directed**.
4. Filter-Media Frames:
 - a. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 - b. Materials: Stainless steel **OR** Fire-retardant plywood **OR** Fabricated aluminum **OR** Fire-retardant particleboard **OR** Galvanized sheet **OR** Non-fire-retardant particleboard, **as directed**.
 - c. Style: Box **OR** Double-turned flange **OR** Deep channel **OR** Double-turned flange, one side, **as directed**.
5. Mounting Frames: Welded galvanized steel with gaskets and fasteners; suitable for bolting together into built-up filter banks.

C. HEPA Filter Diffusers

1. Description: Factory-fabricated, individually ducted, HEPA filter-holding ceiling modules.
2. Media: Fibrous glass, constructed of continuous sheets with closely spaced pleats with glass filament separators.
 - a. Media to Module Side Bond: Urethane sealant.



- b. Media to Frame Side Bond: Polyurethane foam **OR** Silicone **OR** Neoprene adhesive **OR** Fiberglass-mat packing **OR** Thermosetting sealant **OR** Knife edge in fluid-filled channel, **as directed**.
 - c. Application: Class 100 **OR** Class 10 **OR** Class 1, **as directed**, clean room.
 - 3. Casing:
 - a. Configuration: Ducted inlet **OR** Plenum inlet **OR** Plenum inlet with prefilter, **as directed**.
 - b. Module Material: Extruded aluminum, 16 gage with mill finish.
 - c. Suspension: Ceiling grid.
 - 4. Accessories:
 - a. Diffusion damper.
 - b. Diffusion-damper adjustment port.
 - c. Filter test port.
- D. HEPA Filter Fan Modules
 - 1. Description: Factory-fabricated, HEPA filter ceiling module with fan.
 - 2. Casing:
 - a. Configuration: Ducted inlet **OR** Plenum inlet **OR** Plenum inlet with prefilter, **as directed**.
 - b. Module Material: Extruded aluminum, 16 gage with mill finish.
 - c. Suspension: Ceiling grid **OR** Independent, **as directed**.
 - 3. Media: Fibrous glass, constructed of continuous sheets with closely spaced pleats with aluminum separators **OR** vinyl-coated aluminum separators **OR** separators of ribbons of filter media, **as directed**.
 - a. Frame Material: 3/4-inch- (19-mm-) thick, fire-retardant plywood **OR** 3/4-inch- (19-mm-) thick, fire-retardant particleboard **OR** 3/4-inch- (19-mm-) thick plywood **OR** 3/4-inch- (19-mm-) thick particleboard **OR** Galvanized steel **OR** Aluminized steel **OR** Cadmium-plated steel **OR** Stainless steel **OR** Aluminum, **as directed**.
 - b. Media to Frame Side Bond: Polyurethane foam **OR** Silicone **OR** Neoprene adhesive **OR** Fiberglass-mat packing **OR** Thermosetting sealant **OR** Knife edge in fluid-filled channel, **as directed**.
 - c. Face Gasket: Neoprene expanded rubber **OR** Ceramic fiber **OR** Silicone, **as directed**.
 - d. Faceguard: Plastic **OR** Stainless steel, **as directed**.
 - 4. Accessories: Filter test port.
 - 5. Control: Variable speed.
 - 6. Motor:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - b. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 22.
 - c. Type: Permanent-split capacitor with SCR for speed adjustment **OR** Electronically commutated motor, **as directed**.
 - d. Fan-Motor Assembly Isolation: Rubber isolators.
 - e. Enclosure: Open dripproof **OR** Totally enclosed, fan cooled **OR** Totally enclosed, air over **OR** Open, externally ventilated **OR** Totally enclosed, nonventilated **OR** Severe duty **OR** Explosion proof **OR** Dust-ignition-proof machine, **as directed**.
 - f. Enclosure Materials: Cast iron **OR** Cast aluminum **OR** Rolled steel, **as directed**.
 - g. Motor Bearings: **<Insert special requirements>**.
 - h. Unusual Service Conditions:
 - 1) Ambient Temperature: **<Insert deg F (deg C)>**.
 - 2) Altitude: **<Insert feet (m)>** above sea level.
 - 3) High humidity.
 - i. Efficiency: Premium efficient.
 - j. NEMA Design: **<Insert designation>**.
 - k. Service Factor: **<Insert value>**.
 - l. Motor Speed: Single speed **OR** Multispeed, **as directed**.
 - 1) Speed Control: Infinitely adjustable with pneumatic-electric and electronic controls.



E. ULPA Filters

1. Description: Factory-fabricated, ULPA filters with holding casing.
2. Media: Fibrous glass, constructed of continuous sheets with closely spaced pleats with aluminum separators **OR** vinyl-coated aluminum separators **OR** separators of ribbons of filter media, **as directed**.
3. Frame Material: 3/4-inch- (19-mm-) thick, fire-retardant plywood **OR** 3/4-inch- (19-mm-) thick, fire-retardant particleboard **OR** 3/4-inch- (19-mm-) thick plywood **OR** 3/4-inch- (19-mm-) thick particleboard **OR** Galvanized steel **OR** Aluminized steel **OR** Cadmium-plated steel **OR** Stainless steel **OR** Aluminum, **as directed**.
4. Media to Frame Side Bond: Polyurethane foam **OR** Silicone **OR** Neoprene adhesive **OR** Fiberglass-mat packing **OR** Thermosetting sealant **OR** Knife-edge in fluid-filled channel, **as directed**.
5. Face Gasket: Neoprene expanded rubber **OR** Ceramic fiber **OR** Silicone, **as directed**.
6. Mounting Frames: Construct downstream corners of holding device with cushion pads to protect media. Provide bolted filter-sealing mechanism to mount and continuously seal each individual filter.

F. 95 Percent DOP Filters

1. Description: Factory-fabricated, 95 percent DOP filters with holding casing.
2. Media: Fibrous glass, constructed of continuous sheets with closely spaced pleats with aluminum separators **OR** vinyl-coated aluminum separators **OR** separators of ribbons of filter media, **as directed**.
3. Frame Material: 3/4-inch- (19-mm-) thick, fire-retardant plywood **OR** 3/4-inch- (19-mm-) thick, fire-retardant particleboard **OR** 3/4-inch- (19-mm-) thick plywood **OR** 3/4-inch- (19-mm-) thick particleboard **OR** Galvanized steel **OR** Aluminized steel **OR** Cadmium-plated steel **OR** Stainless steel **OR** Aluminum, **as directed**.
4. Frame Style: Box single header **OR** Double header **OR** Double turned flange **OR** 3/4-inch- (19-mm-) deep channel, **as directed**.
5. Media to Frame Side Bond: Polyurethane foam **OR** Silicone **OR** Neoprene adhesive **OR** Fiberglass-mat packing **OR** Thermosetting sealant **OR** Knife edge in fluid-filled channel, **as directed**.
6. Face Guard Material: Galvanized **OR** Aluminum, **as directed**, mesh.
7. Face Guard Location: Upstream **OR** Upstream and Downstream **OR** Downstream, **as directed**.
8. Gasket Material: Neoprene expanded rubber **OR** Ceramic fiber **OR** Silicone, **as directed**.
9. Gasket Location: Upstream **OR** Upstream and Downstream **OR** Downstream, **as directed**.
10. Mounting Frames: Construct downstream corners of holding device with cushion pads to protect media. Provide bolted filter-sealing mechanism to mount and continuously seal each individual filter.

G. Front- And Rear-Access Filter Frames

1. Framing System: Aluminum framing members with access for either upstream (front) or downstream (rear) filter servicing, cut to size and prepunched for assembly into modules. Vertically support filters to prevent deflection of horizontal members without interfering with either filter installation or operation.
2. Prefilters: Incorporate a separate track, removable from front or back.
3. Sealing: Factory-installed, positive-sealing device for each row of filters to ensure seal between gasketed filter elements to prevent bypass of unfiltered air.
4. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

H. Side-Service Housings

1. Description: Factory-assembled, side-service housings, constructed of 0.064-inch- (1.6-mm-) thick, galvanized steel **OR** stainless steel **OR** double-wall casing with 1-inch (25-mm) insulation, **as directed**, to hold filters. Side servicing is through gasketed access doors on one side, and



- housings are capable of connection to other housings. Equip housings with metal slide channel tracks with clamping mechanisms to hold filters, and the following:
- a. Pressure tap and fitting.
 - b. DOP/freon test ports.
 - c. Decontamination ports.
 - d. Isolation dampers.
 - e. Lifting lugs.
2. Prefilters: Integral tracks to accommodate 2-, 4-, and 6-inch- (50-, 100-, and 150-mm-) thick, disposable filters.
 3. Access Doors: Continuous gaskets on perimeter and positive-locking swivel, **as directed**, devices. Provide ribbed bagging rim behind access door and PVC bags for bag-in, bag-out arrangement, **as directed**. Arrange so filter cartridges can be loaded from an access door for each tier and section of the following:
 - a. Combination prefilter and HEPA filter.
OR
 Prefilter.
OR
 HEPA filter.
 - b. Upstream and downstream test section.
 4. Sealing: Incorporate positive-sealing gasket material on channels to seal top and bottom of filter cartridge frames to prevent bypass of unfiltered air.
 5. Accessories:
 - a. Filter change-out trays.
 - b. Document-storage pocket.
 - c. Filter removal rod.
 6. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

I. Filter Gages

1. Diaphragm type with dial and pointer in metal case, vent valves, black figures on white background, and front recalibration adjustment.
 - a. Diameter: 4-1/2 inches (115 mm) **OR** 2 inches (50 mm), **as directed**.
 - b. Scale Range for Filter Media Having a Recommended Final Resistance of 0.5-Inch wg (125 Pa) or Less: 0- to 0.5-inch wg (0 to 125 Pa).
 - c. Scale Range for Filter Media Having a Recommended Final Resistance of 0.5- to 1.0-Inch wg (125 to 250 Pa) or Less: 0- to 1.0-inch wg (0 to 250 Pa).
 - d. Scale Range for Filter Media Having a Recommended Final Resistance of 1.0- to 2.0-Inch wg (250 to 500 Pa) or Less: 0- to 2.0-inch wg (0 to 500 Pa).
 - e. Scale Range for Filter Media Having a Recommended Final Resistance of 2.0- to 3.0-Inch wg (500 to 750 Pa) or Less: 0- to 3.0-inch wg (0 to 750 Pa).
 - f. Scale Range for Filter Media Having a Recommended Final Resistance of 3.0- to 4.0-Inch wg (750 to 1000 Pa) or Less: 0- to 4.0-inch wg (0 to 1000 Pa).
2. Manometer-Type Filter Gage: Molded plastic, with epoxy-coated aluminum scale, logarithmic-curve tube gage with integral leveling gage; graduated to read from 0- to 3.0-inch wg (0 to 750 Pa) and accurate within 3 percent of full-scale range.
3. Accessories: Static-pressure tips, tubing, gage connections, and mounting bracket.

1.3 EXECUTION

A. Installation

1. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.
2. Install filters in position to prevent passage of unfiltered air.
3. Install filter gage for each filter bank.



4. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters that were used during construction and testing with new, clean filters.
5. Install filter-gage static-pressure taps upstream and downstream from filters. Install filter gages on filter banks with separate static-pressure taps upstream and downstream from filters. Mount filter gages on outside of filter housing or filter plenum in an accessible position. Adjust and level inclined gages.
6. Coordinate filter installations with duct and air-handling unit installations.

B. Field Quality Control

1. Perform tests and inspections.
2. Tests and Inspections:
 - a. Operate automatic roll filters to demonstrate compliance with requirements.
 - b. Test for leakage of unfiltered air while system is operating.
 - c. HEPA Filters: Pressurize housing to a minimum of 3.0-inch wg (750 Pa) or to designed operating pressure, whichever is higher; test housing joints, door seals, and sealing edges of filter with soapy water to check for air leaks.
 - d. HEPA Filters: Pressurize housing to a minimum of 3.0-inch wg (750 Pa) or to designed operating pressure, whichever is higher; and test housing joints, door seals, and sealing edges of filter for air leaks according to pressure-decay method in ASME N510.
3. Air filter will be considered defective if it does not pass tests and inspections.
4. Prepare test and inspection reports.

C. Cleaning

1. After completing system installation and testing, adjusting, and balancing air-handling and air-distribution systems, clean filter housings and install new filter media.

END OF SECTION 22 13 19 13



Task	Specification	Specification Description
22 13 19 33	22 05 23 00	Piped Utilities Basic Materials And Methods
22 13 19 33	22 05 23 00a	General-Duty Valves for Plumbing Piping
22 13 19 33	22 05 23 00b	General-Duty Valves for HVAC Piping
22 13 19 33	22 05 76 00	Storm Drainage Piping Specialties
22 13 23 00	01 22 16 00	No Specification Required



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SECTION 22 13 29 13 - SEWAGE PUMPS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for sewage pumps. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Submersible effluent pumps.
 - b. Submersible sewage pumps.
 - c. Wet-pit-volute sewage pumps.
 - d. Sewage-pump, reverse-flow assemblies.
 - e. Sewage-pump basins and basin covers.
 - f. Progressing-cavity sewage pumps.
 - g. Packaged, submersible sewage-pump units.
 - h. Packaged wastewater-pump units.

C. Submittals

1. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Wiring Diagrams: For power, signal, and control wiring.
3. Operation and Maintenance Data: For pumps and controls, to include in operation and maintenance manuals.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. UL Compliance: Comply with UL 778 for motor-operated water pumps.

E. Delivery, Storage, And Handling

1. Retain shipping flange protective covers and protective coatings during storage.
2. Protect bearings and couplings against damage.
3. Comply with pump manufacturer's written rigging instructions for handling.

F. Coordination

1. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.2 PRODUCTS

A. Submersible Effluent Pumps

1. Submersible, Fixed-Position, Single-Seal Effluent Pumps:
 - a. Description: Factory-assembled and -tested effluent-pump unit.
 - b. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal effluent pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Casing: Cast iron, with open inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
 - d. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron **OR** ASTM A 532/A 532M, abrasion-resistant cast iron **OR** ASTM B 584, cast bronze, **as**



- directed**, and stainless steel, **as directed**, closed or semiopen design for clear wastewater, and keyed and secured to shaft.
- e. Pump and Motor Shaft: Stainless steel **OR** steel, **as directed**, with factory-sealed, grease-lubricated ball bearings.
 - f. Seal: Mechanical.
 - g. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
 - 1) Motor Housing Fluid: Air **OR** Oil, **as directed**.
 - h. Controls (rod-and-float type):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**.
 - 2) Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
 - 5) High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - i. Controls (float- and pressure-switch types):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**; pedestal-mounted **OR** wall-mounted, **as directed**.
 - 2) Switch Type: Mechanical-float **OR** Mercury-float **OR** Pressure, **as directed**, type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - j. Control-Interface Features:
 - 1) Remote Alarm Contacts: For remote alarm interface.
 - 2) Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - a) On-off status of pump.
 - b) Alarm status.
2. Submersible, Fixed-Position, Double-Seal Effluent Pumps:
- a. Description: Factory-assembled and -tested effluent-pump unit.
 - b. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal effluent pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Casing: Cast iron, with open inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
 - d. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron **OR** ASTM A 532/A 532M, abrasion-resistant cast iron **OR** ASTM B 584, cast bronze, **as directed**, and stainless steel, **as directed**, closed or semiopen design for clear wastewater, and keyed and secured to shaft.
 - e. Pump and Motor Shaft: Stainless steel **OR** steel, **as directed**, with factory-sealed, grease-lubricated ball bearings.
 - f. Seals: Mechanical.
 - g. Moisture-Sensing Probe: Internal moisture sensor and moisture alarm.
 - h. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
 - 1) Motor Housing Fluid: Air **OR** Oil, **as directed**.
 - i. Controls (rod-and-float type):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**.
 - 2) Switch Type: Pedestal-mounted float switch with float rods and rod buttons.



- 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
- 4) Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
- 5) High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
- j. Controls (float- and pressure-switch types):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**; pedestal-mounted **OR** wall-mounted, **as directed**.
 - 2) Switch Type: Mechanical-float **OR** Mercury-float **OR** Pressure, **as directed**, type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
- k. Control-Interface Features:
 - 1) Remote Alarm Contacts: For remote alarm interface.
 - 2) Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - a) On-off status of pump.
 - b) Alarm status.
3. Submersible, Quick-Disconnect, Single-Seal Effluent Pumps:
 - a. Description: Factory-assembled and -tested effluent-pump unit with guide-rail supports.
 - b. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal effluent pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Casing: Cast iron, with open inlet, and discharge fittings for connection to guide-rail support.
 - d. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron **OR** ASTM A 532/A 532M, abrasion-resistant cast iron **OR** ASTM B 584, cast bronze, **as directed**, and stainless steel, **as directed**, closed or semiopen design for clear wastewater, and keyed and secured to shaft.
 - e. Pump and Motor Shaft: Stainless steel **OR** steel, **as directed**, with factory-sealed, grease-lubricated ball bearings.
 - f. Seal: Mechanical.
 - g. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
 - 1) Motor Housing Fluid: Air **OR** Oil, **as directed**.
 - h. Controls (rod-and-float type):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**.
 - 2) Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
 - 5) High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - i. Controls (float- and pressure-switch types):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**; pedestal-mounted **OR** wall-mounted, **as directed**.
 - 2) Switch Type: Mechanical-float **OR** Mercury-float **OR** Pressure, **as directed**, type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.



- 4) High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
- j. Control-Interface Features:
 - 1) Remote Alarm Contacts: For remote alarm interface.
 - 2) Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - a) On-off status of pump.
 - b) Alarm status.
- k. Guide-Rail Supports:
 - 1) Standard: SWPA's "Submersible Sewage Pumping Systems (SWPA) Handbook."
 - 2) Guide Rails: Vertical pipes or structural members, made of galvanized steel or other corrosion-resistant metal, attached to baseplate and basin sidewall or cover.
 - 3) Baseplate: Corrosion-resistant metal plate, attached to basin floor, supporting guide rails and stationary elbow.
 - 4) Pump Yoke: Motor-mounted or casing-mounted yokes or other attachments for aligning pump during connection of flanges.
 - 5) Movable Elbow: Pump discharge-elbow fitting with flange, seal, and positioning device.
 - 6) Stationary Elbow: Fixed discharge-elbow fitting with flange that mates to movable-elbow flange and support attached to baseplate.
 - 7) Lifting Cable: Stainless steel; attached to pump and cover at manhole.
4. Submersible, Quick-Disconnect, Double-Seal Effluent Pumps:
 - a. Description: Factory-assembled and -tested effluent-pump unit with guide-rail supports.
 - b. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal effluent pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Casing: Cast iron, with open inlet, and discharge fittings for connection to guide-rail support.
 - d. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron **OR** ASTM A 532/A 532M, abrasion-resistant cast iron **OR** ASTM B 584, cast bronze, **as directed**, and stainless steel, **as directed**, closed or semiopen design for clear wastewater, and keyed and secured to shaft.
 - e. Pump and Motor Shaft: Stainless steel **OR** steel, **as directed**, with factory-sealed, grease-lubricated ball bearings.
 - f. Seals: Mechanical.
 - g. Moisture-Sensing Probe: Internal moisture sensor and moisture alarm.
 - h. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
 - 1) Motor Housing Fluid: Air **OR** Oil, **as directed**.
 - i. Controls (rod-and-float type):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**.
 - 2) Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
 - 5) High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - j. Controls (float- and pressure-switch types):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**; pedestal-mounted **OR** wall-mounted, **as directed**.
 - 2) Switch Type: Mechanical-float **OR** Mercury-float **OR** Pressure, **as directed**, type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.



- 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - k. Control-Interface Features:
 - 1) Remote Alarm Contacts: For remote alarm interface.
 - 2) Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - a) On-off status of pump.
 - b) Alarm status.
 - l. Guide-Rail Supports:
 - 1) Standard: SWPA's "Submersible Sewage Pumping Systems (SWPA) Handbook."
 - 2) Guide Rails: Vertical pipes or structural members, made of galvanized steel or other corrosion-resistant metal, attached to baseplate and basin sidewall or cover.
 - 3) Baseplate: Corrosion-resistant metal plate, attached to basin floor, supporting guide rails and stationary elbow.
 - 4) Pump Yoke: Motor-mounted or casing-mounted yokes or other attachments for aligning pump during connection of flanges.
 - 5) Movable Elbow: Pump discharge-elbow fitting with flange, seal, and positioning device.
 - 6) Stationary Elbow: Fixed discharge-elbow fitting with flange that mates to movable-elbow flange and support attached to baseplate.
 - 7) Lifting Cable: Stainless steel; attached to pump and cover at manhole.
- B. Submersible Sewage Pumps
- 1. Submersible, Fixed-Position, Single-Seal Sewage Pumps:
 - a. Description: Factory-assembled and -tested sewage-pump unit.
 - b. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sewage pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Casing: Cast iron, with open inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
 - d. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron **OR** ASTM A 532/A 532M, abrasion-resistant cast iron **OR** ASTM B 584, cast bronze, **as directed**, and stainless steel, **as directed**, nonclog, open, or semiopen design for solids handling, and keyed and secured to shaft.
 - e. Pump and Motor Shaft: Stainless steel **OR** steel, **as directed**, with factory-sealed, grease-lubricated ball bearings.
 - f. Seal: Mechanical.
 - g. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
 - 1) Motor Housing Fluid: Air **OR** Oil, **as directed**.
 - h. Controls (rod-and-float type):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**.
 - 2) Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
 - 5) High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - i. Controls (float- and pressure-switch types):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**; pedestal-mounted **OR** wall-mounted, **as directed**.



- 2) Switch Type: Mechanical-float **OR** Mercury-float **OR** Pressure, **as directed**, type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
- 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
- 4) High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
- j. Control-Interface Features:
 - 1) Remote Alarm Contacts: For remote alarm interface.
 - 2) Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - a) On-off status of pump.
 - b) Alarm status.
2. Submersible, Fixed-Position, Double-Seal Sewage Pumps:
 - a. Description: Factory-assembled and -tested sewage-pump unit.
 - b. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sewage pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Casing: Cast iron, with open inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
 - d. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron **OR** ASTM A 532/A 532M, abrasion-resistant cast iron **OR** ASTM B 584, cast bronze, **as directed**, and stainless steel, **as directed**, nonclog, open, or semiopen design for solids handling, and keyed and secured to shaft.
 - e. Pump and Motor Shaft: Stainless steel **OR** steel, **as directed**, with factory-sealed, grease-lubricated ball bearings.
 - f. Seals: Mechanical.
 - g. Moisture-Sensing Probe: Internal moisture sensor and moisture alarm.
 - h. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
 - 1) Motor Housing Fluid: Air **OR** Oil, **as directed**.
 - i. Controls (rod-and-float type):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**.
 - 2) Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
 - 5) High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - j. Controls (float- and pressure-switch types):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**; pedestal-mounted **OR** wall-mounted, **as directed**.
 - 2) Switch Type: Mechanical-float **OR** Mercury-float **OR** Pressure, **as directed**, type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - k. Control-Interface Features:
 - 1) Remote Alarm Contacts: For remote alarm interface.
 - 2) Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - a) On-off status of pump.



- b) Alarm status.
3. Submersible, Quick-Disconnect, Single-Seal Sewage Pumps:
- a. Description: Factory-assembled and -tested sewage-pump unit with guide-rail supports.
 - b. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sewage pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Casing: Cast iron, with open inlet, and discharge fittings for connection to guide-rail support.
 - d. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron **OR** ASTM A 532/A 532M, abrasion-resistant cast iron **OR** ASTM B 584, cast bronze, **as directed**, and stainless steel, **as directed**, nonclog, open, or semiopen design for solids handling, and keyed and secured to shaft.
 - e. Pump and Motor Shaft: Stainless steel **OR** steel, **as directed**, with factory-sealed, grease-lubricated ball bearings.
 - f. Seal: Mechanical.
 - g. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
 - 1) Motor Housing Fluid: Air **OR** Oil, **as directed**.
 - h. Controls (rod-and-float type):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**.
 - 2) Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
 - 5) High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - i. Controls (float- and pressure-switch types):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**; pedestal-mounted **OR** wall-mounted, **as directed**.
 - 2) Switch Type: Mechanical-float **OR** Mercury-float **OR** Pressure, **as directed**, type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - j. Control-Interface Features:
 - 1) Remote Alarm Contacts: For remote alarm interface.
 - 2) Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - a) On-off status of pump.
 - b) Alarm status.
 - k. Guide-Rail Supports:
 - 1) Standard: SWPA's "Submersible Sewage Pumping Systems (SWPA) Handbook."
 - 2) Guide Rails: Vertical pipes or structural members, made of galvanized steel or other corrosion-resistant metal, attached to baseplate and basin sidewall or cover.
 - 3) Baseplate: Corrosion-resistant metal plate, attached to basin floor, supporting guide rails and stationary elbow.
 - 4) Pump Yoke: Motor-mounted or casing-mounted yokes or other attachments for aligning pump during connection of flanges.
 - 5) Movable Elbow: Pump discharge-elbow fitting with flange, seal, and positioning device.
 - 6) Stationary Elbow: Fixed discharge-elbow fitting with flange that mates to movable-elbow flange and support attached to baseplate.
 - 7) Lifting Cable: Stainless steel; attached to pump and cover at manhole.



4. Submersible, Quick-Disconnect, Double-Seal Sewage Pumps:
 - a. Description: Factory-assembled and -tested sewage-pump unit with guide-rail supports.
 - b. Pump type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sewage pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Casing: Cast iron, with open inlet, and discharge fittings for connection to guide-rail support.
 - d. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron **OR** ASTM A 532/A 532M, abrasion-resistant cast iron **OR** ASTM B 584, cast bronze, **as directed**, and stainless steel, **as directed**, nonclog, open, or semiopen design for solids handling, and keyed and secured to shaft.
 - e. Pump and Motor Shaft: Stainless steel **OR** steel, **as directed**, with factory-sealed, grease-lubricated ball bearings.
 - f. Seals: Mechanical.
 - g. Moisture-Sensing Probe: Internal moisture sensor and moisture alarm.
 - h. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
 - 1) Motor Housing Fluid: Air **OR** Oil, **as directed**.
 - i. Controls (rod-and-float type):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**.
 - 2) Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
 - 5) High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - j. Controls (float- and pressure-switch types):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**; pedestal-mounted **OR** wall-mounted, **as directed**.
 - 2) Switch Type: Mechanical-float **OR** Mercury-float **OR** Pressure, **as directed**, type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - k. Control-Interface Features:
 - 1) Remote Alarm Contacts: For remote alarm interface.
 - 2) Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - a) On-off status of pump.
 - b) Alarm status.
 - l. Guide-Rail Supports:
 - 1) Standard: SWPA's "Submersible Sewage Pumping Systems (SWPA) Handbook."
 - 2) Guide Rails: Vertical pipes or structural members, made of galvanized steel or other corrosion-resistant metal, attached to baseplate and basin sidewall or cover.
 - 3) Baseplate: Corrosion-resistant metal plate, attached to basin floor, supporting guide rails and stationary elbow.
 - 4) Pump Yoke: Motor-mounted or casing-mounted yokes or other attachments for aligning pump during connection of flanges.
 - 5) Movable Elbow: Pump discharge-elbow fitting with flange, seal, and positioning device.
 - 6) Stationary Elbow: Fixed discharge-elbow fitting with flange that mates to movable-elbow flange and support attached to baseplate.



- 7) Lifting Cable: Stainless steel; attached to pump and cover at manhole.
5. Submersible, Quick-Disconnect, Grinder Sewage Pumps:
 - a. Description: Factory-assembled and -tested, grinder sewage-pump unit with guide-rail supports.
 - b. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sewage pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Casing: Cast iron, with open inlet, and discharge fittings for connection to guide-rail supports.
 - d. Impeller: Bronze or stainless steel; statically and dynamically balanced, with stainless-steel cutter, grinder, or slicer assembly; capable of handling solids; and keyed and secured to shaft.
 - e. Pump and Motor Shaft: Stainless steel **OR** steel, **as directed**, with factory-sealed, grease-lubricated ball bearings.
 - f. Seal: Mechanical.
 - g. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
 - 1) Motor Housing Fluid: Air **OR** Oil, **as directed**.
 - h. Controls (rod-and-float type):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**.
 - 2) Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
 - 5) High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - i. Controls (float- and pressure-switch types):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**; pedestal-mounted **OR** wall-mounted, **as directed**.
 - 2) Switch Type: Mechanical-float **OR** Mercury-float **OR** Pressure, **as directed**, type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - j. Control-Interface Features:
 - 1) Remote Alarm Contacts: For remote alarm interface.
 - 2) Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - a) On-off status of pump.
 - b) Alarm status.
 - k. Guide-Rail Supports:
 - 1) Standard: SWPA's "Submersible Sewage Pumping Systems (SWPA) Handbook."
 - 2) Guide Rails: Vertical pipes or structural members, made of galvanized steel or other corrosion-resistant metal, attached to baseplate and basin sidewall or cover.
 - 3) Baseplate: Corrosion-resistant metal plate, attached to basin floor, supporting guide rails and stationary elbow.
 - 4) Pump Yoke: Motor-mounted or casing-mounted yokes or other attachments for aligning pump during connection of flanges.
 - 5) Movable Elbow: Pump discharge-elbow fitting with flange, seal, and positioning device.
 - 6) Stationary Elbow: Fixed discharge-elbow fitting with flange that mates to movable-elbow flange and support attached to baseplate.
 - 7) Lifting Cable: Stainless steel; attached to pump and cover at manhole.



6. Submersible, Quick-Disconnect, Progressing-Cavity, Grinder Sewage Pumps:
 - a. Description: Factory-assembled and -tested progressing-cavity, grinder sewage-pump unit with guide-rail supports.
 - b. Pump Type: Submersible, progressing-cavity, single-screw rotary, grinder sewage pump as defined in HI 3.1-3.5.
 - c. Pump Body: Cast iron.
 - d. Pump Bearings: Radial and thrust types.
 - e. Pump Shaft: Steel.
 - f. Rotor: Stainless steel.
 - g. Stator: Buna-N **OR** Natural rubber, **as directed**.
 - h. Seal: Packing gland and mechanical types.
 - i. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
 - j. Controls (rod-and-float type):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**.
 - 2) Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
 - 5) High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - k. Controls (float- and pressure-switch types):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**; pedestal-mounted **OR** wall-mounted, **as directed**.
 - 2) Switch Type: Mechanical-float **OR** Mercury-float **OR** Pressure, **as directed**, type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - l. Control-Interface Features:
 - 1) Remote Alarm Contacts: For remote alarm interface.
 - 2) Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - a) On-off status of pump.
 - b) Alarm status.
 - m. Guide-Rail Supports:
 - 1) Standard: SWPA's "Submersible Sewage Pumping Systems (SWPA) Handbook."
 - 2) Guide Rails: Vertical pipes or structural members, made of galvanized steel or other corrosion-resistant metal, attached to baseplate and basin sidewall or cover.
 - 3) Baseplate: Corrosion-resistant metal plate, attached to basin floor, supporting guide rails and stationary elbow.
 - 4) Pump Yoke: Motor-mounted or casing-mounted yokes or other attachments for aligning pump during connection of flanges.
 - 5) Movable Elbow: Pump discharge-elbow fitting with flange, seal, and positioning device.
 - 6) Stationary Elbow: Fixed discharge-elbow fitting with flange that mates to movable-elbow flange and support attached to baseplate.
 - 7) Lifting Cable: Stainless steel; attached to pump and cover at manhole.

C. Wet-Pit-Volute Sewage Pumps

1. Description: Factory-assembled and -tested sewage-pump unit.



2. Pump Type: Wet-pit-volute, single-stage, separately-coupled, overhung-impeller, centrifugal sewage pump as defined in HI 1.1-1.2 and HI 1.3.
 3. Pump Casing: Cast iron, with open inlet and threaded or flanged connection for discharge piping.
 4. Pump Shaft: Stainless-steel **OR** steel, **as directed**.
 5. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron **OR** ASTM A 532/A 532M, abrasion-resistant cast iron **OR** ASTM B 584, cast bronze, **as directed**, nonclog, open, or semiopen design for solids handling, and keyed and secured to shaft.
 6. Sleeve Bearings: Bronze. Include oil-lubricated, intermediate sleeve bearings at 48-inch (1200-mm) maximum intervals if basin depth is more than 48 inches (1200 mm), and grease-lubricated, ball-type thrust bearings.
 7. Pump and Motor Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
 8. Pump Discharge Piping: Factory or field fabricated, galvanized, ASTM A 53/A 53M, Schedule 40, steel pipe with ASME B16.1, Class 125, cast-iron flanges and flanged fittings or ASME B16.4, Class 125, gray iron threaded fittings, **as directed**.
 - a. Modify piping configuration to accommodate reverse-flow assembly.
 9. Support Plate: Cast iron or coated steel and strong enough to support pumps, motors, and controls. Refer to Part 1.2 "Sewage-Pump Basins and Basin Covers" Article for requirements.
 10. Shaft Seal: Stuffing box, with graphite-impregnated braided-yarn rings and bronze packing gland.
 11. Motor: Single-speed; grease-lubricated ball bearings and mounted on vertical, cast-iron pedestal.
 12. Controls (rod-and-float type):
 - a. Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**.
 - b. Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
 - c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - d. Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
 - e. High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 13. Controls (float- and pressure-switch types):
 - a. Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**; pedestal-mounted **OR** wall-mounted, **as directed**.
 - b. Switch Type: Mechanical-float **OR** Mercury-float **OR** Pressure, **as directed**, type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
 - c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - d. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 14. Control-Interface Features:
 - a. Remote Alarm Contacts: For remote alarm interface.
 - b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - 1) On-off status of pump.
 - 2) Alarm status.
- D. Sewage-Pump, Reverse-Flow Assemblies
1. Description: Factory-fabricated, sewage pump reverse-flow assembly for factory or field assembly and installation in sewage pump basin. Include the following corrosion-resistant-metal components:
 - a. Inlet Fitting: One combination inlet-overflow strainer fitting.
 - b. Valves: Two shutoff valves and two check valves.
 - c. Strainers: Two strainer housings with reverse-flow, self-flushing strainers.
 - d. Pipe and Fittings: Size and configuration required to connect to sewage pumps and piping.

E. Sewage-Pump Basins And Basin Covers



1. Basins: Factory-fabricated, watertight, cylindrical, basin sump with top flange and sidewall openings for pipe connections.
 - a. Material: Cast iron **OR** Fiberglass **OR** Polyethylene, **as directed**.
 - b. Reinforcement: Mounting plates for pumps, fittings, guide-rail supports if used, and accessories.
 - c. Anchor Flange: Same material as or compatible with basin sump, cast in or attached to sump, in location and of size required to anchor basin in concrete slab.
2. Basin Covers: Fabricate metal cover with openings having gaskets, seals, and bushings; for access to pumps, pump shafts, control rods, discharge piping, vent connections, and power cables.
 - a. Reinforcement: Steel or cast iron, capable of supporting foot traffic for basins installed in foot-traffic areas.

F. Progressing-Cavity Sewage Pumps

1. Description: Factory-assembled and -tested progressing-cavity, single-screw rotary pump as defined in HI 3.1-3.5.
2. Pump Body: Cast iron with feet for base or floor installation.
3. Pump Bearings: Radial and thrust types.
4. Pump Shaft: Steel.
5. Rotor: Chrome-plated steel.
6. Stator: Buna-N **OR** Natural rubber, **as directed**.
7. Seals: Packing gland and mechanical types.
8. Coupling: Flexible.
9. Motor: Single-speed; grease-lubricated ball bearings.

G. Packaged, Submersible Sewage-Pump Units

1. Packaged, Submersible, Grinder, Sewage-Pump Units:
 - a. Description: Factory-assembled and -tested, automatic-operation, basin-mounted, grinder, sewage-pump unit.
 - b. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller centrifugal pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Casing: Cast iron.
 - d. Impeller: Stainless-steel grinder, cutter, or slicer type with shredding ring.
 - e. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
 - f. Control (for simplex pump unit): Manufacturer's standard panel for one pump.
 - g. Controls (for duplex pump unit): Automatic, with mechanical- or mercury-float switches and alternator.
 - h. Pump Discharge Piping: Factory or field fabricated, galvanized, ASTM A 53/A 53M, Schedule 40, steel pipe with ASME B16.4, Class 125, gray iron threaded fittings, **as directed**.
 - i. Basin: Watertight plastic, **as directed**, and of size required for pumps, with inlet pipe connection and gastight cover with pump discharge and vent connections.
2. Packaged, Submersible, Nonclog, Sewage-Pump Units:
 - a. Description: Factory-assembled and -tested, automatic-operation, basin-mounted, sewage-pump unit.
 - b. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller centrifugal pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Casing: Cast iron.
 - d. Impeller: Brass or cast iron; statically and dynamically balanced, non-clog design, and capable of handling 2-inch (50-mm) diameter solids.
 - e. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.



- f. Control (for simplex pump units): Manufacturer's standard panel for one pump.
 - g. Controls (for duplex pump unit): Automatic, with mechanical- or mercury-float switches and alternator.
 - h. Pump Discharge Piping: Factory or field fabricated, galvanized, ASTM A 53/A 53M, Schedule 40, steel pipe with ASME B16.4, Class 125, gray iron threaded fittings, **as directed**.
 - i. Basin: Watertight plastic, **as directed**, and of size required for pumps, with inlet pipe connection and gastight cover with pump discharge and vent connections.
- H. Packaged Wastewater-Pump Units
- 1. Packaged, Wet-Pit-Volute, Wastewater-Pump Units:
 - a. Description: Factory-assembled and -tested, automatic-operation, basin-mounted, effluent-pump unit.
 - b. Pump Type: Wet-pit-volute, single-stage, separately-coupled, overhung-impeller centrifugal pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Body and Impeller: Corrosion-resistant materials.
 - d. Motor: With built-in overload protection and mounted vertically on basin cover.
 - e. Power Cord: Three-conductor, waterproof cable of length required but not less than 72 inches (1830 mm) and with grounding plug and cable-sealing assembly for connection at pump.
 - f. Control: Float switch.
 - g. Pump Discharge Piping: Factory or field fabricated, galvanized, ASTM A 53/A 53M, Schedule 40, steel pipe with ASME B16.4, Class 125, gray iron threaded fittings, **as directed**.
 - h. Basin: Watertight, aluminum, plastic, or coated steel with inlet pipe connection and gastight cover with vent and pump discharge connections.
 - 2. Packaged, Submersible Wastewater-Pump Units:
 - a. Description: Factory-assembled and -tested, automatic-operation, effluent-pump unit with basin.
 - b. Pump Type: Submersible, end-suction, single-stage, overhung-impeller, centrifugal pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Body and Impeller: Corrosion-resistant materials.
 - d. Pump Seals: Mechanical.
 - e. Motor: Hermetically sealed, capacitor-start type, with built-in overload protection.
 - f. Power Cord: Three-conductor, waterproof cable of length required but not less than 72 inches (1830 mm) and with grounding plug and cable-sealing assembly for connection at pump.
 - g. Control: Float switch.
 - h. Pump Discharge Piping: Factory or field fabricated, galvanized, ASTM A 53/A 53M, Schedule 40, steel pipe with ASME B16.4, Class 125, gray iron threaded fittings, **as directed**.
 - i. Basin: Watertight plastic with inlet pipe connection and gastight cover with vent and pump discharge connections.
- I. Motors
- 1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 22 Section "Common Motor Requirements For Plumbing Equipment".
 - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 22.
 - 2. Motors for submersible pumps shall be hermetically sealed.

1.3 EXECUTION

A. Earthwork

1. Excavation and filling are specified in Division 31 Section "Earth Moving".

B. Examination

1. Examine roughing-in for plumbing piping to verify actual locations of sanitary drainage and vent piping connections before sewage pump installation.

C. Installation

1. Pump Installation Standards:
 - a. Comply with HI 1.4 for installation of centrifugal pumps.
 - b. Comply with HI 3.1-3.5 for installation of progressing-cavity sewage pumps.
2. Equipment Mounting (for equipment supported on slabs-on-grade): Install progressing-cavity sewage pumps on concrete base using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-place Concrete".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1 inch (25 mm), **as directed**.
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - c. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Equipment Mounting: Install progressing-cavity sewage pumps using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements for vibration isolation devices specified in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1 inch (25 mm), **as directed**.
4. Equipment Mounting: Install progressing-cavity sewage pumps on vibration isolation equipment base. Comply with requirements specified in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment".
5. Wiring Method (for pumps with wall-mounted controls): Comply with requirements in Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
6. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

D. Connections

1. Comply with requirements for piping specified in Division 22 Section "Sanitary Waste And Vent Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install piping adjacent to equipment to allow service and maintenance.

E. Field Quality Control

1. Perform tests and inspections.
2. Tests and Inspections:
 - a. Perform each visual and mechanical inspection.
 - b. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - c. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Pumps and controls will be considered defective if they do not pass tests and inspections.



-
4. Prepare test and inspection reports.
- F. Startup Service
1. Engage a factory-authorized service representative to perform **OR** Perform, **as directed**, startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.
- G. Adjusting
1. Adjust pumps to function smoothly, and lubricate as recommended by manufacturer.
 2. Adjust control set points.
- H. Demonstration
1. Train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps.

END OF SECTION 22 13 29 13



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Task	Specification	Specification Description
22 13 29 16	22 13 29 13	Sewage Pumps
22 13 29 33	01 22 16 00	No Specification Required
22 13 63 00	01 22 16 00	No Specification Required
22 13 66 00	01 22 16 00	No Specification Required



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SECTION 22 14 13 00 - CSF FACILITY STORM DRAINAGE PIPING

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.22 14 13 00

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following storm drainage piping inside the building.
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.

1.2 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
 - 1. Storm Drainage Piping: 10-foot head of water.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control inspection and test reports.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Hub-and-Spigot, Cast-Iron Pipe and Fittings: ASTM A 74, Service class.
 - 1. Gaskets: ASTM C 564, rubber.
- B. Hubless Cast-Iron Pipe and Fittings: ASTM A 888 or CISPI 301.
 - 1. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - a. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
 - b. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
- C. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40, solid wall.
 - 1. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.
 - 2. Solvent Cement and Adhesive Primer:
 - a. Use ABS solvent cement that has a VOC content of 325 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Solid-Wall PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.
 - 1. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns.
 - 2. Solvent Cement and Adhesive Primer:
 - a. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
- B. Aboveground storm drainage piping NPS 6 and smaller shall be the following:
 - 1. Hubless cast-iron soil pipe and fittings; standard shielded, stainless-steel couplings; and coupled joints.
 - 2. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
 - 3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- C. Aboveground storm drainage piping NPS 8 and larger shall be the following:
 - 1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and coupled joints.
 - 2. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
 - 3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- D. Underground storm drainage piping NPS 6 and smaller shall be the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.



3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

- E. Underground storm drainage piping NPS 8 and larger shall be the following:
1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 2. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
 3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

3.2 PIPING INSTALLATION

- A. Storm sewer and drainage piping outside the building are specified in Division 33 Section "Storm Utility Drainage Piping."
- B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- C. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers. Cleanouts are specified in Division 22 Section "Storm Drainage Piping Specialties."
- D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."
- E. Install wall-penetration-fitting system at each service pipe penetration through foundation wall. Make installation watertight.
- F. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- G. Make changes in direction for storm piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- H. Lay buried building drain piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- I. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:
1. Building Storm Drain: 1 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.
- J. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- K. Install ABS storm drainage piping according to ASTM D 2661.
- L. Install PVC storm drainage piping according to ASTM D 2665.
- M. Install underground ABS and PVC storm drainage piping according to ASTM D 2321.
- N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- C. Hubless Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- D. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- E. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.4 VALVE INSTALLATION

- A. Backwater Valves: Install backwater valves in piping subject to backflow.
 - 1. Horizontal Piping: Horizontal backwater valves.[Use normally closed type, unless otherwise indicated.]
 - 2. Install backwater valves in accessible locations.
 - 3. Backwater valve are specified in Division 22 Section "Storm Drainage Piping Specialties."

3.5 HANGER AND SUPPORT INSTALLATION

- A. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. NPS 6: 60 inches with 3/4-inch rod.
 - 5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.



6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 1. NPS 1-1/4: 84 inches with 3/8-inch rod.
 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 3. NPS 2: 10 feet with 3/8-inch rod.
 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 5. NPS 3: 12 feet with 1/2-inch rod.
 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
 7. NPS 6: 12 feet with 3/4-inch rod.
 8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.
- I. Install supports for vertical steel piping every 15 feet.
- J. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
 4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 5. NPS 6: 10 feet with 5/8-inch rod.
 6. NPS 8: 10 feet with 3/4-inch rod.
- K. Install supports for vertical copper tubing every 10 feet.
- L. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
 2. NPS 3: 48 inches with 1/2-inch rod.
 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
 4. NPS 6: 48 inches with 3/4-inch rod.
 5. NPS 8 to NPS 12: 48 inches with 7/8-inch rod.
- M. Install supports for vertical ABS and PVC piping every 48 inches.
- N. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
- B. Connect storm drainage piping to roof drains and storm drainage specialties.

3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.



2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test storm drainage piping according to procedures of authorities having jurisdiction.

3.8 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

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END OF SECTION



SECTION 22 14 13 00 - MPF FACILITY STORM DRAINAGE PIPING

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following storm drainage piping inside the building.
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.

1.2 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
 - 1. Storm Drainage Piping: 10-foot head of water.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control inspection and test reports.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping.



PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Hub-and-Spigot, Cast-Iron Pipe and Fittings: ASTM A 74, Service class.
 - 1. Gaskets: ASTM C 564, rubber.
- B. Hubless Cast-Iron Pipe and Fittings: ASTM A 888 or CISPI 301.
 - 1. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - a. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
 - b. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
- C. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Schedule 40, galvanized. Include ends matching joining method.
 - 1. Drainage Fittings: ASME B16.12, galvanized, threaded, cast-iron drainage pattern.
 - 2. Pressure Fittings:
 - a. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
 - b. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
 - c. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
 - d. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.
- D. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
 - 1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- E. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40, solid wall.
 - 1. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.
 - 2. Solvent Cement and Adhesive Primer:
 - a. Use ABS solvent cement that has a VOC content of 325 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Solid-Wall PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.
 - 1. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns.
 - 2. Solvent Cement and Adhesive Primer:
 - a. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.



- B. Aboveground storm drainage piping NPS 6 and smaller shall be the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless cast-iron soil pipe and fittings; standard shielded, stainless-steel couplings; and coupled joints.
 - 3. Steel pipe, drainage fittings, and threaded joints.
 - 4. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
 - 5. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- C. Aboveground storm drainage piping NPS 8 and larger shall be the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and coupled joints.
 - 3. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
 - 4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- D. Underground storm drainage piping NPS 6 and smaller shall be the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
- E. Underground storm drainage piping NPS 8 and larger shall be the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

3.2 PIPING INSTALLATION

- A. Storm sewer and drainage piping outside the building are specified in Division 33 Section "Storm Utility Drainage Piping."
- B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- C. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers. Cleanouts are specified in Division 22 Section "Storm Drainage Piping Specialties."
- D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."
- E. Install wall-penetration-fitting system at each service pipe penetration through foundation wall. Make installation watertight.
- F. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- G. Make changes in direction for storm piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- H. Lay buried building drain piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- I. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Storm Drain: 1 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.



- J. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- K. Install ABS storm drainage piping according to ASTM D 2661.
- L. Install PVC storm drainage piping according to ASTM D 2665.
- M. Install underground ABS and PVC storm drainage piping according to ASTM D 2321.
- N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- C. Hubless Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- D. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- E. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.4 VALVE INSTALLATION

- A. Backwater Valves: Install backwater valves in piping subject to backflow.
 - 1. Horizontal Piping: Horizontal backwater valves.[Use normally closed type, unless otherwise indicated.]
 - 2. Install backwater valves in accessible locations.
 - 3. Backwater valve are specified in Division 22 Section "Storm Drainage Piping Specialties."

3.5 HANGER AND SUPPORT INSTALLATION

- A. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."



- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. NPS 6: 60 inches with 3/4-inch rod.
 - 5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.
 - 6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 84 inches with 3/8-inch rod.
 - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 - 3. NPS 2: 10 feet with 3/8-inch rod.
 - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 - 5. NPS 3: 12 feet with 1/2-inch rod.
 - 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
 - 7. NPS 6: 12 feet with 3/4-inch rod.
 - 8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.
- I. Install supports for vertical steel piping every 15 feet.
- J. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 5. NPS 6: 10 feet with 5/8-inch rod.
 - 6. NPS 8: 10 feet with 3/4-inch rod.
- K. Install supports for vertical copper tubing every 10 feet.
- L. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
 - 2. NPS 3: 48 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
 - 4. NPS 6: 48 inches with 3/4-inch rod.
 - 5. NPS 8 to NPS 12: 48 inches with 7/8-inch rod.
- M. Install supports for vertical ABS and PVC piping every 48 inches.
- N. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.



- B. Connect storm drainage piping to roof drains and storm drainage specialties.

3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test storm drainage piping according to procedures of authorities having jurisdiction.

3.8 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

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END OF SECTION 22 14 13 00



SECTION 22 14 29 13 - SUMP PUMPS

1.1 GENERAL

- A. Description Of Work
 - 1. This specification covers the furnishing and installation of materials for sump pumps. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.
- B. Summary
 - 1. Section Includes:
 - a. Submersible sump pumps.
 - b. Wet-pit-volute sump pumps.
 - c. Sump-pump basins and basin covers.
 - d. Packaged drainage-pump units.
- C. Submittals
 - 1. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 - 2. Wiring Diagrams: For power, signal, and control wiring.
 - 3. Operation and Maintenance Data: For pumps and controls, to include in operation and maintenance manuals.
- D. Quality Assurance
 - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. UL Compliance: Comply with UL 778 for motor-operated water pumps.
- E. Delivery, Storage, And Handling
 - 1. Retain shipping flange protective covers and protective coatings during storage.
 - 2. Protect bearings and couplings against damage.
 - 3. Comply with pump manufacturer's written rigging instructions for handling.

1.2 PRODUCTS

- A. Submersible Sump Pumps
 - 1. Submersible, Fixed-Position, Single-Seal Sump Pumps:
 - a. Description: Factory-assembled and -tested sump-pump unit.
 - b. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Casing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
 - d. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron **OR** ASTM A 532/A 532M, abrasion-resistant cast iron **OR** ASTM B 584, cast bronze, **as directed**, semiopen, **as directed**, design for clear wastewater handling, and keyed and secured to shaft.
 - e. Pump and Motor Shaft: Stainless steel **OR** steel, **as directed**, with factory-sealed, grease-lubricated ball bearings.
 - f. Seal: Mechanical.



- g. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
 - 1) Motor Housing Fluid: Air **OR** Oil, **as directed**.
 - h. Controls (rod-and-float type):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**.
 - 2) Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
 - 5) High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - i. Controls (float- and pressure-switch types):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**; pedestal-mounted **OR** wall-mounted, **as directed**.
 - 2) Switch Type: Mechanical-float **OR** Mercury-float **OR** Pressure, **as directed**, type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - j. Control-Interface Features:
 - 1) Remote Alarm Contacts: For remote alarm interface.
 - 2) Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - a) On-off status of pump.
 - b) Alarm status.
2. Submersible, Fixed-Position, Double-Seal Sump Pumps:
- a. Description: Factory-assembled and -tested sump-pump unit.
 - b. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Casing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
 - d. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron **OR** ASTM A 532/A 532M, abrasion-resistant cast iron **OR** ASTM B 584, cast bronze, **as directed**, semiopen, **as directed**, design for clear wastewater handling, and keyed and secured to shaft.
 - e. Pump and Motor Shaft: Stainless steel **OR** steel, **as directed**, with factory-sealed, grease-lubricated ball bearings.
 - f. Seals: Mechanical.
 - g. Moisture-Sensing Probe: Internal moisture sensor and moisture alarm.
 - h. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
 - 1) Motor Housing Fluid: Air **OR** Oil, **as directed**.
 - i. Controls (rod-and-float type):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**.
 - 2) Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).



- 5) High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - j. Controls (float- and pressure-switch types):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**; pedestal-mounted **OR** wall-mounted, **as directed**.
 - 2) Switch Type: Mechanical-float **OR** Mercury-float **OR** Pressure, **as directed**, type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - k. Control-Interface Features:
 - 1) Remote Alarm Contacts: For remote alarm interface.
 - 2) Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - a) On-off status of pump.
 - b) Alarm status.
- B. Wet-Pit-Volute Sump Pumps
1. Description: Factory-assembled and -tested sump-pump unit.
 2. Pump Type: Wet-pit-volute, single-stage, separately-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.
 3. Pump Casing: Cast iron, with strainer inlet and threaded connection for NPS 2 (DN 50) and smaller and flanged connection for NPS 2-1/2 (DN 65) and larger discharge piping.
 4. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron **OR** ASTM A 532/A 532M, abrasion-resistant cast iron **OR** ASTM B 584, cast bronze, **as directed**, semiopen, **as directed**, design for clear wastewater handling, and keyed and secured to shaft.
 5. Sleeve Bearings: Bronze. Include oil-lubricated, intermediate sleeve bearings at 48-inch (1200-mm) maximum intervals if basin depth is more than 48 inches (1200 mm), and grease-lubricated, ball-type thrust bearings.
 6. Pump and Motor Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
 7. Pump Discharge Piping: Factory or field fabricated, galvanized, ASTM A 53/A 53M, Schedule 40, steel pipe with ASME B16.1, Class 125, cast-iron flanges and flanged fittings or ASME B16.4, Class 125, gray iron threaded fittings, **as directed**.
 8. Support Plate: Cast iron or coated steel and strong enough to support pumps, motors, and controls. Refer to Part 1.2 "Sump-Pump Basins and Basin Covers" Article for requirements.
 9. Shaft Seal: Stuffing box, with graphite-impregnated braided-yarn rings and bronze packing gland.
 10. Motor: Single-speed; grease-lubricated ball bearings and mounting on vertical, cast-iron pedestal.
 11. Controls (rod-and-float type):
 - a. Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**.
 - b. Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
 - c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - d. Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
 - e. High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 12. Controls (float- and pressure-switch types):
 - a. Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**; pedestal-mounted **OR** wall-mounted, **as directed**.
 - b. Switch Type: Mechanical-float **OR** Mercury-float **OR** Pressure, **as directed**, type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.



- c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - d. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
- 13. Control-Interface Features:
 - a. Remote Alarm Contacts: For remote alarm interface.
 - b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - 1) On-off status of pump.
 - 2) Alarm status.
- C. Sump-Pump Basins And Basin Covers
 - 1. Basins: Factory-fabricated, watertight, cylindrical, basin sump with top flange and sidewall openings for pipe connections.
 - a. Material: Cast iron **OR** Fiberglass **OR** Polyethylene, **as directed**.
 - b. Reinforcement: Mounting plates for pumps, fittings, and accessories.
 - c. Anchor Flange: Same material as or compatible with basin sump, cast in or attached to sump, in location and of size required to anchor basin in concrete slab.
 - 2. Basin Covers: Fabricate metal cover with openings having gaskets, seals, and bushings; for access to pumps, pump shafts, control rods, discharge piping, vent connections, and power cables.
 - a. Reinforcement: Steel or cast iron, capable of supporting foot traffic for basins installed in foot-traffic areas.
- D. Packaged Drainage-Pump Units
 - 1. Packaged Pedestal Drainage-Pump Units:
 - a. Description: Factory-assembled and -tested, automatic-operation, freestanding, sump-pump unit.
 - b. Pump Type: Wet-pit-volute, single-stage, separately-coupled, overhung-impeller centrifugal pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Casing: Corrosion-resistant material, with strainer inlet, design that permits flow into impeller, and vertical discharge for piping connection.
 - d. Impeller: Aluminum, brass, or plastic.
 - e. Motor: With built-in overload protection and mounted vertically on sump pump column.
 - f. Power Cord: Three-conductor, waterproof cable of length required but not less than 72 inches (1830 mm), with grounding plug and cable-sealing assembly for connection at pump.
 - g. Control: Float switch.
 - 2. Packaged Submersible Drainage-Pump Units:
 - a. Description: Factory-assembled and -tested, automatic-operation, basin-mounted, sump-pump unit.
 - b. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller centrifugal pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Casing: Metal.
 - d. Impeller: Brass.
 - e. Pump Seal: Mechanical.
 - f. Motor: Hermetically sealed, capacitor-start type, with built-in overload protection.
 - g. Power Cord: Three-conductor, waterproof cable of length required but not less than 72 inches (1830 mm), with grounding plug and cable-sealing assembly for connection at pump.
 - h. Pump Discharge Piping: Factory or field fabricated, galvanized, ASTM A 53/A 53M, Schedule 40, steel pipe with ASME B16.4, Class 125, gray iron threaded fittings, **as directed**.
 - i. Control: Motor-mounted float switch.



j. Basin: Plastic.

E. Motors

1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 22 Section "Common Motor Requirements For Plumbing Equipment".
 - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 22.
2. Motors for submersible pumps shall be hermetically sealed.

1.3 EXECUTION

A. Earthwork

1. Excavation and filling are specified in Division 31 Section "Earth Moving".

B. Examination

1. Examine roughing-in for plumbing piping to verify actual locations of storm drainage piping connections before sump pump installation.

C. Installation

1. Pump Installation Standards: Comply with HI 1.4 for installation of sump pumps.

D. Connections

1. Comply with requirements for piping specified in Division 22 Section "Facility Storm Drainage Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install piping adjacent to equipment to allow service and maintenance.

E. Field Quality Control

1. Perform tests and inspections.
2. Tests and Inspections:
 - a. Perform each visual and mechanical inspection.
 - b. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - c. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Pumps and controls will be considered defective if they do not pass tests and inspections.
4. Prepare test and inspection reports.

F. Startup Service

1. Engage a factory-authorized service representative to perform **OR** Perform, **as directed**, startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.

G. Adjusting

1. Adjust pumps to function smoothly, and lubricate as recommended by manufacturer.
2. Adjust control set points.

H. Demonstration

1. Train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps.



END OF SECTION 22 14 29 13



Task	Specification	Specification Description
22 14 29 13	22 05 23 00	Piped Utilities Basic Materials And Methods
22 14 29 16	22 13 29 13	Sewage Pumps



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SECTION 22 15 13 00 - MPF COMPRESSED-AIR PIPING

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes piping and related specialties for general-service compressed-air systems operating at 200 psig or less.
- B. See Division 22 Section "General-Service Packaged Air Compressors and Receivers" for general-service air compressors and accessories.

1.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Compressed-air piping and support and installation shall withstand effects of seismic events determined according to SEI/ASCE 7, "Minimum Design Loads for Buildings and Other Structures.", where applicable.

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Pressure regulators. Include rated capacities and operating characteristics.
 - 2. Automatic drain valves.
 - 3. Filters. Include rated capacities and operating characteristics.
 - 4. Lubricators. Include rated capacities and operating characteristics.
- B. Field quality-control test reports.
- C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for low-pressure compressed-air piping.

PART 2 - PRODUCTS**2.1 PIPES, TUBES, AND FITTINGS**

- A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B, black or hot-dip zinc coated with ends threaded according to ASME B1.20.1.
 - 1. Steel Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized seamless steel pipe. Include ends matching joining method.
 - 2. Malleable-Iron Fittings: ASME B16.3, Class 150 or 300, threaded.
 - 3. Malleable-Iron Unions: ASME B16.39, Class 150 or 300, threaded.
 - 4. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel, threaded.
 - 5. Wrought-Steel Butt-Welding Fittings: ASME B16.9, Schedule 40.
 - 6. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel.
- B. Copper Tube: ASTM B 88, Type L seamless, drawn-temper, water tube.
 - 1. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type or MSS SP-73, wrought copper with dimensions for brazed joints.
 - 2. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150 or 300.
 - 3. Copper Unions: ASME B16.22 or MSS SP-123.
- C. Transition Couplings for Metal Piping: Metal coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for compressed-air piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, full-face, asbestos free, 1/8-inch maximum thickness.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated.
- E. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer complying with ASTM F 656.

2.3 VALVES

- A. Metal Ball, Butterfly, Check, Gate, and Globe Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping."

2.4 DIELECTRIC FITTINGS

- A. General Requirements for Dielectric Fittings: Combination fitting of copper alloy and ferrous materials with insulating material; suitable for system fluid, pressure, and temperature. Include threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Dielectric Unions: Factory-fabricated union assembly, for 250-psig minimum working pressure at 200 deg F.



2.5 FLEXIBLE PIPE CONNECTORS

- A. Bronze-Hose Flexible Pipe Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - 1. Working-Pressure Rating: 200 psig minimum.
 - 2. End Connections, NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
 - 3. End Connections, NPS 2-1/2 and Larger: Flanged copper alloy.
- B. Stainless-Steel-Hose Flexible Pipe Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
 - 1. Working-Pressure Rating: 200 psig minimum.
 - 2. End Connections, NPS 2 and Smaller: Threaded steel pipe nipple.
 - 3. End Connections, NPS 2-1/2 and Larger: Flanged steel nipple.

2.6 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.7 ESCUTCHEONS

- A. General Requirements: Manufactured wall and ceiling escutcheons and floor plates, with ID to closely fit around pipe and tube and OD that completely covers opening.
- B. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Escutcheons: With set screw.
 - 1. Finish: [Polished chrome-plated] [Rough brass] [Polished chrome-plated and rough brass].
- D. One-Piece, Stamped-Steel Escutcheons: With set screw or spring clips and chrome-plated finish.
- E. One-Piece, Floor-Plate Escutcheons: Cast iron.

2.8 SPECIALTIES

- A. Safety Valves: ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," construction; National Board certified, labeled, and factory sealed; constructed of bronze body with poppet-type safety valve for compressed-air service.
 - 1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.
- B. Air-Main Pressure Regulators: Bronze body, pilot-operated direct acting, spring-loaded manual pressure-setting adjustment, and rated for 250-psig inlet pressure, unless otherwise indicated.
- C. Air-Line Pressure Regulators: Diaphragm or pilot operated, bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 200-psig minimum inlet pressure, unless otherwise indicated.
- D. Automatic Drain Valves: Stainless-steel body and internal parts, rated for 200-psig minimum working pressure, capable of automatic discharge of collected condensate. Include mounting bracket if wall mounting is indicated.



- E. Coalescing Filters: Coalescing type with activated carbon capable of removing water and oil aerosols; with color-change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded. Include mounting bracket if wall mounting is indicated.
- F. Mechanical Filters: Two-stage, mechanical-separation-type, air-line filters. Equip with deflector plates, resin-impregnated-ribbon-type filters with edge filtration, and drain cock. Include mounting bracket if wall mounting is indicated.

2.9 QUICK COUPLINGS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Aeroquip Corporation; Eaton Corp.
 2. Bowes Manufacturing Inc.
 3. Foster Manufacturing, Inc.
 4. Milton Industries, Inc.
 5. Parker Hannifin Corp.; Fluid Connectors Group; Quick Coupling Div.
 6. Schrader-Bridgeport; Amflo Div.
 7. Schrader-Bridgeport/Standard Thomson.
 8. Snap-Tite, Inc.; Quick Disconnect & Valve Division.
 9. TOMCO Products Inc.
- B. General Requirements for Quick Couplings: Assembly with locking-mechanism feature for quick connection and disconnection of compressed-air hose.
- C. Automatic-Shutoff Quick Couplings: Straight-through brass body with O-ring or gasket seal and stainless-steel or nickel-plated-steel operating parts.
 1. Socket End: With one-way valve and threaded inlet for connection to piping or threaded hose fitting.
 2. Plug End: **[Flow-sensor-bleeder, check-valve] [Straight-through]** type with barbed outlet for attaching hose.
- D. Valveless Quick Couplings: Straight-through brass body with stainless-steel or nickel-plated-steel operating parts.
 1. Socket End: With O-ring or gasket seal, without valve, and with barbed inlet for attaching hose.
 2. Plug End: With barbed outlet for attaching hose.

2.10 HOSE ASSEMBLIES

- A. Description: Compatible hose, clamps, couplings, and splicers suitable for compressed-air service, of nominal diameter indicated, and rated for 300-psig minimum working pressure, unless otherwise indicated.
 1. Hose: Reinforced double-wire-braid, CR-covered hose for compressed-air service.
 2. Hose Clamps: Stainless-steel clamps or bands.
 3. Hose Couplings: Two-piece, straight-through, threaded brass or stainless-steel O-ring or gasket-seal swivel coupling with barbed ends for connecting two sections of hose.
 4. Hose Splicers: One-piece, straight-through brass or stainless-steel fitting with barbed ends for connecting two sections of hose.



PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Compressed-Air Piping between Air Compressors and Receivers: Use[**one of**] the following piping materials for each size range:
 - 1. NPS 2 and Smaller: Steel pipe; threaded, malleable-iron fittings; and threaded joints.
 - 2. NPS 2 and Smaller: Type L, copper tube; wrought-copper fittings; and brazed joints.
 - 3. NPS 2-1/2 and Larger: Steel pipe; welded, welded steel fittings.
- B. Low-Pressure Compressed-Air Distribution Piping: Use[**one of**] the following piping materials for each size range:
 - 1. NPS 2 and Smaller: Steel pipe; threaded, malleable-iron fittings; and threaded joints.
 - 2. NPS 2 and Smaller: Type L, copper tube; wrought-copper fittings; and brazed joints.
 - 3. NPS 2-1/2 and Larger: Steel pipe; welded, welded steel fittings.
- C. Drain Piping: Use[**one of**] the following piping materials:
 - 1. NPS 2 and Smaller: Steel pipe; threaded, malleable-iron fittings; and threaded joints.
 - 2. NPS 2 and Smaller: Type L, copper tube; wrought-copper fittings; and brazed joints.

3.2 VALVE APPLICATIONS

- A. Comply with requirements in "Valve Applications" Article in Division 22 Section "General-Duty Valves for Plumbing Piping."
- B. Equipment Isolation Valves: Safety-exhaust, copper-alloy ball valve with exhaust vent and pressure rating at least as great as piping system operating pressure.

3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping concealed from view and protected from physical contact by building occupants, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and to coordinate with other services occupying that space.
- E. Install piping adjacent to equipment and machines to allow service and maintenance.
- F. Install air and drain piping with 1 percent slope downward in direction of flow.
- G. Install nipples, flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating, unless otherwise indicated.
- H. Equipment and Specialty Flanged Connections:
 - 1. Use steel companion flange with gasket for connection to steel pipe.



2. Use cast-copper-alloy companion flange with gasket and brazed[**or soldered**] joint for connection to copper tube. Do not use soldered joints for connection to air compressors or to equipment or machines producing shock or vibration.
- I. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.
- J. Install thermometer and pressure gage on discharge piping from each air compressor and on each receiver. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping."
- K. Install piping to permit valve servicing.
- L. Install piping free of sags and bends.
- M. Install fittings for changes in direction and branch connections.
- N. Install seismic restraints on piping. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- O. Install unions, adjacent to each valve and at final connection to each piece of equipment and machine.

3.4 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from pipe and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Apply appropriate tape or thread compound to external pipe threads.
- D. Brazed Joints for Copper Tubing: Join according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- E. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Join according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Flanged Joints: Use asbestos-free, nonmetallic gasket suitable for compressed air. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.
- G. Solvent-Cemented Joints for PVC Piping: Clean and dry joining surfaces. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer and join according to ASME B31.9 for solvent-cemented joints and to ASTM D 2672.
- H. Dissimilar Metal Piping Material Joints: Use dielectric fittings.

3.5 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping."
- B. Install shutoff valves and unions or flanged joints at compressed-air piping to air compressors.
- C. Install shutoff valve at inlet to each automatic drain valve, filter, lubricator, and pressure regulator.



- D. Install check valves to maintain correct direction of compressed-air flow to and from compressed-air piping specialties and equipment.

3.6 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric unions in piping at connections of dissimilar metal piping and tubing.

3.7 FLEXIBLE PIPE CONNECTOR INSTALLATION

- A. Install flexible pipe connectors in discharge piping[**and in inlet air piping from remote air-inlet filter**] of each air compressor.
- B. Install bronze-hose flexible pipe connectors in copper compressed-air tubing.
- C. Install stainless-steel-hose flexible pipe connectors in steel compressed-air piping.

3.8 SPECIALTY INSTALLATION

- A. Install safety valves on receivers in quantity and size to relieve at least the capacity of connected air compressors.
- B. Install air-main pressure regulators in compressed-air piping at or near air compressors.
- C. Install air-line pressure regulators in branch piping to equipment.
- D. Install automatic drain valves on aftercoolers, receivers, and dryers. Discharge condensate onto nearest floor drain.
- E. Install coalescing filters in compressed-air piping at or near air compressors and upstream from mechanical filters. Mount on wall at locations indicated.
- F. Install mechanical filters in compressed-air piping at or near air compressors and downstream from coalescing filters. Mount on wall at locations indicated.
- G. Install quick couplings at piping terminals for hose connections.
- H. Install hose assemblies at hose connections.

3.9 SLEEVE INSTALLATION

- A. Install sleeves for pipes passing through concrete and masonry walls, gypsum board partitions, and concrete floor and roof slabs using galvanized-steel pipe.
- B. Install sleeves in new walls and slabs as new walls and slabs are constructed.
- C. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use Steel Pipe Sleeves.
- D. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.10 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 - 2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, [cast brass with polished chrome-plated finish] [stamped steel with set screw] [stamped steel with set screw or spring clips] [stamped steel with spring clips].
 - 3. Bare Piping at Ceiling Penetrations in Finished Spaces: [One piece, cast brass with polished chrome-plated finish] [One piece, stamped steel with set screw].
 - 4. Bare Piping in Unfinished Service Spaces: One piece, [cast brass with polished chrome-plated finish] [cast brass with rough-brass finish] [stamped steel with set screw] [stamped steel with spring clips] [stamped steel with set screw or spring clips].
 - 5. Bare Piping in Equipment Rooms: One piece, [cast brass] [stamped steel with set screw] [stamped steel with spring clips] [stamped steel with set screw or spring clips].
 - 6. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.

3.11 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.
- C. Vertical Piping: MSS Type 8 or 42, clamps.
- D. Individual, Straight, Horizontal Piping Runs:
 - 1. 100 Feet or Less: MSS Type 1, adjustable, steel clevis hangers.
 - 2. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
- E. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
- F. Base of Vertical Piping: MSS Type 52, spring hangers.
- G. Support horizontal piping within 12 inches of each fitting and coupling.
- H. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- I. Install hangers for Schedule 40, steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1/4 to NPS 1/2: 96 inches with 3/8-inch rod.
 - 2. NPS 3/4 to NPS 1-1/4: 84 inches with 3/8-inch rod.
 - 3. NPS 1-1/2: 12 feet with 3/8-inch rod.
 - 4. NPS 2: 13 feet with 3/8-inch rod.
- J. Install supports for vertical, Schedule 40, steel piping every 15 feet.
- K. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1/4: 60 inches with 3/8-inch rod.
 - 2. NPS 3/8 and NPS 1/2: 72 inches with 3/8-inch rod.
 - 3. NPS 3/4: 84 inches with 3/8-inch rod.
 - 4. NPS 1: 96 inches with 3/8-inch rod.
 - 5. NPS 1-1/4: 108 inches with 3/8-inch rod.
 - 6. NPS 1-1/2: 10 feet with 3/8-inch rod.



7. NPS 2: 11 feet with 3/8-inch rod.

L. Install supports for vertical copper tubing every 10 feet.

3.12 LABELING AND IDENTIFICATION

A. Install identifying labels and devices for general-service compressed-air piping, valves, and specialties. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.13 FIELD QUALITY CONTROL

A. Perform field tests and inspections.

B. Tests and Inspections:

1. Piping Leak Tests: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry air or gaseous nitrogen to pressure of 50 psig above system operating pressure, but not less than 150 psig. Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
2. Repair leaks and retest until no leaks exist.
3. Inspect all accessories for proper operation.

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END OF SECTION 22 15 13 00



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SECTION 22 15 19 00 - MPF GENERAL-SERVICE PACKAGED AIR COMPRESSORS AND RECEIVERS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Lubricated, reciprocating air compressors.
 2. Oil-flooded, rotary-screw air compressors.
 3. Inlet-air filters.
 4. Refrigerant compressed-air dryers.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
1. Wiring Diagrams: For power, signal, and control wiring.

NOTE TO SPECIFIER

Retain subparagraph below for facilities located in seismic zones. .

- B. Seismic Qualification Certificates: For compressed-air equipment, accessories, and components, from manufacturers.
- C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASME Compliance: Fabricate and label receivers to comply with ASME Boiler and Pressure Vessel Code.



PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PACKAGED AIR COMPRESSORS AND RECEIVERS

- A. General Description: Factory-assembled, -wired, -piped, and -tested; electric-motor-driven; air-cooled; continuous-duty air compressors and receivers that deliver air of quality equal to intake air.
- B. Control Panels: Automatic control station with load control and protection functions. Comply with NEMA ICS 2 and UL 508.
 - 1. Enclosure: NEMA ICS 6, Type 12 control panel unless otherwise indicated.
 - 2. Motor Controllers: Full-voltage, combination magnetic type with undervoltage release feature and motor-circuit-protector-type disconnecting means and short-circuit protective device.
 - 3. Control Voltage: 120-V ac or less, using integral control power transformer.
 - 4. Motor Overload Protection: Overload relay in each phase.
 - 5. Starting Devices: Hand-off-automatic selector switch in cover of control panel, plus pilot device for automatic control.

NOTE TO SPECIFIER

Retain first subparagraph below if Project has duplex and multiplex air compressors.

- 6. Automatic control switches to [alternate lead-lag compressors for duplex] [sequence lead-lag compressors for multiplex] air compressors.
- 7. Instrumentation: Include discharge-air pressure gage, air-filter maintenance indicator, hour meter, compressor discharge-air and coolant temperature gages, and control transformer.
- 8. Alarm Signal Device: For connection to alarm system to indicate when backup air compressor is operating.
- C. Receivers: Steel tank constructed according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 1. Pressure Rating: At least as high as highest discharge pressure of connected compressors, and bearing appropriate code symbols.
 - 2. Interior Finish: Corrosion-resistant coating.
 - 3. Accessories: Include safety valve, pressure gage, drain, and pressure-reducing valve.

NOTE TO SPECIFIER

Retain subparagraph below for facilities located in seismic zones.

- D. Mounting Frame: Fabricate mounting and attachment to pressure vessel with reinforcement strong enough to resist packaged equipment movement during a seismic event when base is anchored to building structure.

2.2 LUBRICATED, RECIPROCATING AIR COMPRESSORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. CompAir, Ltd.
 - 2. Curtis-Toledo.
 - 3. Gardner Denver, Inc.
 - 4. General Air Products, Inc.
 - 5. Ingersoll-Rand; Air Solutions Group.
 - 6. Kaeser Compressors, Inc.
 - 7. Powerex, Inc.



8. Quincy Compressor; an EnPro Industries company.
9. <Insert manufacturer's name>.

- B. Compressor(s): Lubricated, reciprocating-piston type with lubricated compression chamber and crank-case.
 1. Submerged gear-type oil pump.
 2. Oil filter.
 3. Combined high discharge-air temperature and low lubrication-oil pressure switch.
 4. Belt guard totally enclosing pulleys and belts.
- C. Capacities and Characteristics:
 - a. Refer to drawings.

2.3 OIL-FLOODED, ROTARY-SCREW AIR COMPRESSORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. CompAir, Ltd.
 2. Gardner Denver, Inc.
 3. Ingersoll-Rand; Air Solutions Group.
 4. Kaeser Compressors, Inc.
 5. Quincy Compressor; an EnPro Industries company.
 6. Sullair Corporation.
 7. <Insert manufacturer's name>.
- B. Compressor(s): Oil-flooded, rotary-screw type with lubricated helical screws and lubricated gear box.
 1. Coupling: Nonlubricated, flexible type.
 2. Cooling/Lubrication System: Unit-mounted, air-cooled exchanger package prepiped to unit; with air pressure circulation system with coolant stop valve, full-flow coolant filter, and thermal bypass valve.
 3. Air Filter: Dry type, with maintenance indicator and cleanable replaceable filter element.
 4. Air/Coolant Receiver and Separation System: 150-psig-rated steel tank with ASME safety valve, coolant-level gage, multistage air-coolant separator element, minimum pressure valve, blowdown valve, discharge check valve, coolant stop valve, full-flow coolant filter, and thermal bypass valve.
 5. Capacity Control: Capacity modulation between zero and 100 percent air delivery, with operating pressures between 50 and 100 psig. Include necessary control to hold constant pressure. When air demand is zero, unload compressor by using pressure switch and blowdown valve.
- C. Capacities and Characteristics:
 1. Refer to drawings

2.4 INLET-AIR FILTERS

- A. Description: Combination inlet-air filter-silencer, suitable for remote installation, for each air compressor.

NOTE TO SPECIFIER

Revise first subparagraph below if filter is in-line type and installed in an interior space. Install gooseneck with screen on exterior air inlet.

1. Construction: Weatherproof housing for replaceable, dry-type filter element, with silencer tubes or other method of sound reduction.
2. Capacity: Match capacity of air compressor, with filter having collection efficiency of 99 percent retention of particles larger than 10 micrometers.

MPF GENERAL-SERVICE PACKAGED AIR COMPRESSORS



- B. Description: Combination inlet-air filter-silencer, suitable for remote installation, for multiple air compressors.

NOTE TO SPECIFIER

Revise first subparagraph below if filter is in-line type and installed in an interior space. Install gooseneck with screen on exterior air inlet.

1. Construction: Weatherproof housing for replaceable, dry-type filter element, with silencer tubes or other method of sound reduction.
2. Capacity: Match total capacity of connected air compressors, with filter having collection efficiency of 99 percent retention of particles larger than 10 micrometers.

2.5 REFRIGERANT COMPRESSED-AIR DRYERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Air/Tak, Inc.
2. Arrow Pneumatics, Inc.
3. Atlas Copco.
4. Curtis-Toledo.
5. Domnick Hunter Limited; ZANDER, Inc.
6. Donaldson Company, Inc.; Donaldson Ultrafilter Co.
7. Hankison International.
8. Ingersoll-Rand; Air Solutions Group.
9. Kaeser Compressors, Inc.
10. Numatics, Incorporated.
11. SPX Air Treatment.
12. Van Air Systems, Inc.
13. Wilkerson Operations; Pneumatic Division.
14. Zeks Compressed Air Solutions.
15. <Insert manufacturer's name>.

- B. Description: Noncycling, air-cooled, electric-motor-driven unit with steel enclosure and capability to deliver 35 deg F, 100-psig air at dew point. Include automatic ejection of condensate from airstream, step-down transformers, disconnect switches, inlet and outlet pressure gages, thermometers, automatic controls, and filters.

- C. Capacities and Characteristics:
- a. Refer to drawings.

2.6 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 22 Section "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.



PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Equipment Mounting: Install air compressors and air dryers on concrete bases using elastomeric pads. Comply with requirements in Division 03 Sections.
 - 1. Minimum Deflection: 1/4 inch.
- B. Install compressed-air equipment anchored to substrate.
- C. Install the following devices on compressed-air equipment:
 - 1. Thermometer, Pressure Gage, and Safety Valve: Install on each compressed-air receiver.
 - 2. Pressure Regulators: Install downstream from air compressors.
 - 3. Automatic Drain Valves: Install on aftercoolers, receivers, and dryers. Discharge condensate over nearest floor drain.

NOTE TO SPECIFIER

Retain paragraph below if a factory-authorized service representative is required.

- D. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Check for lubricating oil in lubricated-type equipment.
 - 3. Check belt drives for proper tension.
 - 4. Verify that air-compressor inlet filters and piping are clear.
 - 5. Check for equipment vibration-control supports and flexible pipe connectors and verify that equipment is properly attached to substrate.
 - 6. Check safety valves for correct settings. Ensure that settings are higher than air-compressor discharge pressure but not higher than rating of system components.
 - 7. Check for proper seismic restraints, if required.
 - 8. Drain receiver tanks.
 - 9. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 10. Test and adjust controls and safeties.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Division 22 Section "General-Service Compressed-Air Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.

3.3 IDENTIFICATION

- A. Identify general-service air compressors and components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain air compressors and air dryers.



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END OF SECTION 22 15 19 00



Task	Specification	Specification Description
22 15 19 19	01 22 16 00	No Specification Required



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SECTION 22 33 00 00 - CSF ELECTRIC DOMESTIC WATER HEATERS**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where a Water Heater is part of the Work.

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.22 33 00 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Commercial electric water heaters.

NOTE TO SPECIFIER

Use paragraph below for an Instantaneous Point-of-Use Electric Water Heater as part of the Work.

2. Instantaneous point-of-use electric water heater.

- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

- a. Product Data: Indicate rated capacity, weight, specialties, accessories, dimensions, required clearances, piping and wiring connections.

B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.

1. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service location name, address, and telephone number.

1.3 REFERENCES

- A. NFPA 70 - National Electric Code.



1.4 QUALITY ASSURANCE

- A. Provide water heaters that are UL listed and labeled.
- B. Provide water heaters listed with the California Energy Commission.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

NOTE TO SPECIFIER

"REQUIRED Article (ENVIRONMENTAL REQUIREMENTS) follows. Do not revise this Article, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer."

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Energy Efficiency:
 - 1. Minimum energy efficiency: Comply with ASHRAE 90.1.
 - a. Electric water heaters: Provide instantaneous point-of-use electric water heaters for lavatories and hand sinks located away from the domestic hot water mains; use electric tank type water heaters, unless gas fired type is approved by USPS Contracting Officer.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, model numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Commercial Electric Water Heaters: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. A.O. Smith Water Products Company, Irving, TX (800) 527-1953.
 - 2. Lochinvar Corporation, Nashville, TN (615) 889-8900.
 - 3. Ruud Water Heater, Montgomery, AL (334) 260-1500.
 - 4. State Industries Incorporated, Ashland City, TN (800) 365-8170.

NOTE TO SPECIFIER

Use paragraph below for an Instantaneous Point-of-Use Electric Water Heater as part of the Work.

- B. Instantaneous Point-of-Use Electric Water Heaters: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Chronomite Laboratories, Incorporated, Carson, CA (800) 447-4963.
 - 2. Eemax, Incorporated, Monroe, CT (800) 543-6163.
 - 3. PVI Industries, Incorporated, Fort Worth, TX (800) 433-5654.



- C. Refer to Specification Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 COMMERCIAL ELECTRIC WATER HEATERS

- A. Model, Capacity, and Electrical Requirements: Indicated on Drawings.
- B. Type: Factory-assembled and wired, electric, vertical storage, 150 psi working pressure.
- C. Tank: Glass lined welded steel; 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber encased in corrosion-resistant steel jacket; baked-on enamel finish.
- D. Controls: Automatic immersion water thermostat; externally adjustable temperature range from 60 to 180 degrees F, flanged or screw-in nichrome elements, high temperature limit thermostat.
- E. Accessories: Brass water connections and dip tube, drain valve, high-density magnesium anode, and ASME rated temperature and pressure relief valve.

NOTE TO SPECIFIER

Use paragraph below for an Instantaneous Point-of-Use Electric Water Heater as part of the Work.

2.3 INSTANTANEOUS POINT-OF-USE ELECTRIC WATER HEATERS

- A. Model and Electrical Requirements: Indicated on Drawings.
- B. Type: Automatic, electric resistance heated, under counter or under lavatory wall-mounting, insulated, tankless type, with integral controls, rated for 150 psi pressure.
- C. Jacket: Aluminum or steel with baked-on enamel finish.
- D. Controls: Adjustable thermostat temperature control.
- E. Safety Control: Automatic, high-temperature-limit cutoff.
- F. Provide temperature and pressure relief valve when required by local code.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer's Representative prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.



- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Set and connect units in accordance with manufacturer's published instructions at locations indicated on Drawings.
- B. Install units plumb and level, rigidly connected to adjacent construction.
- C. Maintain manufacturer's recommended clearances. Orient unit for clear access to controls and devices requiring servicing.
- D. Install and connect units in conformance with NFPA 70.
- E. Connect hot and cold water piping to units with shutoff valve, check valve, and union. Extend relief valve to location indicated on Drawings.
- F. The use of lead-containing solder for plumbing and plumbing fixtures is prohibited in the construction of this project.

3.3 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Test and adjust unit operation and adjust controls as specified in Section 230593.

NOTE TO SPECIFIER

DRAWING COORDINATION ITEMS

1. *Locations and sizes of water heaters drawn to scale. Show access and service space required.*
2. *Schematic drawings showing connections to water heaters. Include cold-water inlets, hot-water outlets, hot water circulating piping, electric power, controls, relief valves, specialties, and accessories. Show locations of temperature and pressure relief valves to be installed in piping.*
3. *Metal pans below water heaters, when required. Show detail plans on Architectural Drawings and coordinate with Mechanical Drawings.*
4. *Water Heater Schedule indicating capacity, recovery, and other data not specified.*

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END OF SECTION



Task	Specification	Specification Description
22 33 30 16	22 34 00 00	Fuel-Fired, Domestic Water Heaters



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SECTION 22 34 00 00 - FUEL-FIRED, DOMESTIC WATER HEATERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for fuel-fired water heaters. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following fuel-fired water heaters:
 - a. Household, atmospheric, storage, gas water heaters.
 - b. Household, direct-vent, storage, gas water heaters.
 - c. Household, power-vent, storage, gas water heaters.
 - d. Instantaneous, tankless, gas water heaters.
 - e. Commercial, atmospheric, storage, gas water heaters.
 - f. Commercial, power-burner, storage, gas water heaters.
 - g. Commercial, power-vent, storage, gas water heaters.
 - h. Commercial, high-efficiency, gas water heaters.
 - i. Commercial, coil-type, finned-tube, gas water heaters.
 - j. Commercial, grid-type, finned-tube, gas water heaters.
 - k. Household, oil-fired water heaters.
 - l. Commercial, oil-fired water heaters.
 - m. Large-capacity, oil-fired water heaters.
 - n. Dual-fuel, gas and oil-fired water heaters.
 - o. Compression tanks.
 - p. Water heater accessories.

C. Definitions

1. LP Gas: Liquefied-petroleum fuel gas.

D. Submittals

1. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.
2. LEED Submittal:
 - a. Product Data for Prerequisite EA 2: Documentation indicating that units comply with ASHRAE/IESNA 90.1, Section 7 - "Service Water Heating."
3. Shop Drawings: Diagram power, signal, and control wiring.
4. Manufacturer Seismic Qualification Certification: Submit certification that commercial water heaters, accessories, and components will withstand seismic forces defined in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment". Include the following:
 5. Field quality-control test reports.
 6. Operation and maintenance data.
 7. Warranty: Special warranty specified in this Section.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1.
3. ASME Compliance:



- a. Where ASME-code construction is indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- b. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.
- 4. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with potable water.

F. Warranty

- 1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired water heaters that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Structural failures including storage tank and supports.
 - 2) Faulty operation of controls.
 - 3) Deterioration of metals, metal finishes, and other materials beyond normal use.
 - b. Warranty Period(s): From date of Final Completion:
 - 1) Household, Gas Water Heaters:
 - a) Storage Tank: Five **OR** Six **OR** 10, **as directed**, years.
 - b) Controls and Other Components: Two **OR** Three, **as directed**, years.
 - 2) Instantaneous, Gas Water Heaters:
 - a) Heat Exchanger: Five years.
 - b) Controls and Other Components: Three years.
 - 3) Commercial, Gas Water Heaters:
 - a) Storage Tank: Three **OR** Five, **as directed**, years.
 - b) Controls and Other Components: Three **OR** Five, **as directed**, years.
 - 4) Oil-Fired Water Heaters:
 - a) Storage Tank: Three **OR** Five, **as directed**, years.
 - b) Burner and Controls: One **OR** Two **OR** Three, **as directed**, year(s).
 - c) Other Components: Three **OR** Five, **as directed**, years.
 - 5) Dual-Fuel Water Heaters:
 - a) Storage Tank: Three **OR** Five, **as directed**, years.
 - b) Burner and Controls: One **OR** Two **OR** Three, **as directed**, year(s).
 - c) Other Components: Three **OR** Five, **as directed**, years.
 - 6) Compression Tanks: One year.

1.2 PRODUCTS

A. Household, Gas Water Heaters

- 1. Household, Atmospheric, Storage, Gas Water Heaters: Comply with ANSI Z21.10.1/CSA 4.1.
 - a. Storage-Tank Construction: Steel.
 - 1) Tappings: ASME B1.20.1 pipe thread.
 - 2) Pressure Rating: 150 psig (1035 kPa).
 - 3) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
 - b. Factory-Installed, Storage-Tank Appurtenances:
 - 1) Anode Rod: Replaceable magnesium.
 - 2) Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - 3) Drain Valve: ASSE 1005.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2, **as directed**.
 - 5) Jacket: Steel with enameled finish.
 - 6) Burner: For use with atmospheric water heaters and for natural-gas **OR** LP-gas, **as directed**, fuel.
 - 7) Automatic Ignition: ANSI Z21.20, electric, automatic, gas-ignition system.



- 8) Temperature Control: Adjustable thermostat.
- 9) Heat Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
- 10) Combination Temperature and Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.
- c. Draft Hood: Low-profile-type, draft diverter; complying with ANSI Z21.12.
- d. Automatic Damper: ANSI Z21.66, electrically operated **OR** mechanically activated **OR** thermally activated, **as directed**, automatic-vent-damper device with size matching draft hood.
- 2. Household, Direct-Vent, Storage, Gas Water Heaters: Comply with ANSI Z21.10.1/CSA 4.1.
 - a. Storage-Tank Construction: Steel.
 - 1) Tappings: ASME B1.20.1 pipe thread.
 - 2) Pressure Rating: 150 psig (1035 kPa).
 - 3) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
 - b. Factory-Installed, Storage-Tank Appurtenances:
 - 1) Anode Rod: Replaceable magnesium.
 - 2) Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - 3) Drain Valve: ASSE 1005.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2, **as directed**.
 - 5) Jacket: Steel with enameled finish.
 - 6) Burner: For use with direct-vent water heaters and for natural-gas **OR** LP-gas, **as directed**, fuel.
 - 7) Automatic Ignition: ANSI Z21.20, electric, automatic, gas-ignition system.
 - 8) Temperature Control: Adjustable thermostat.
 - 9) Heat Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
 - 10) Combination Temperature and Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.
 - c. Direct-Vent System: Through-wall **OR** Through-roof, **as directed**, coaxial- or double-channel, vent assembly with water heater manufacturers' outside intake/exhaust screen.
- 3. Household, Power-Vent, Storage, Gas Water Heaters: Comply with ANSI Z21.10.1/CSA 4.1.
 - a. Storage-Tank Construction: Steel.
 - 1) Tappings: ASME B1.20.1 pipe thread.
 - 2) Pressure Rating: 150 psig (1035 kPa).
 - 3) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
 - b. Factory-Installed, Storage-Tank Appurtenances:
 - 1) Anode Rod: Replaceable magnesium.
 - 2) Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - 3) Drain Valve: ASSE 1005.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2, **as directed**.
 - 5) Jacket: Steel with enameled finish.
 - 6) Burner: For use with power-vent water heaters and for natural-gas **OR** LP-gas, **as directed**, fuel.
 - 7) Automatic Ignition: ANSI Z21.20, electric, automatic, gas-ignition system.
 - 8) Temperature Control: Adjustable thermostat.
 - 9) Heat Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
 - 10) Combination Temperature and Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.
 - c. Power-Vent System: Exhaust fan, interlocked with burner.



B. Instantaneous, Gas Water Heaters

1. Description: Comply with ANSI Z21.10.3/CSA 4.3, except storage is not required.
 - a. Construction: Copper piping or tubing complying with NSF 61 barrier materials for potable water, without storage capacity.
 - 1) Tappings: ASME B1.20.1 pipe thread.
 - 2) Pressure Rating: 150 psig (1035 kPa).
 - 3) Heat Exchanger: Copper tubing.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2, **as directed**.
 - 5) Burner: For use with tankless water heaters and for natural-gas **OR** LP-gas, **as directed**, fuel.
 - 6) Automatic Ignition: Manufacturer's proprietary system for automatic, gas ignition.
 - 7) Temperature Control: Adjustable thermostat.
 - 8) Jacket: Metal with enameled finish or plastic.
 - b. Support: Bracket for wall mounting.

C. Commercial, Gas Water Heaters

1. Commercial, Atmospheric, Storage, Gas Water Heaters: Comply with ANSI Z21.10.3/CSA 4.3.
 - a. Storage-Tank Construction: ASME-code **OR** Non-ASME-code, **as directed**, steel with 150-psig (1035-kPa) working-pressure rating.
 - 1) Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - a) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - 2) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - 3) Lining: Cement **OR** Glass **OR** Nickel plate **OR** Phenolic coating **OR** Sheet copper, **as directed**, complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
 - b. Factory-Installed, Storage-Tank Appurtenances:
 - 1) Anode Rod: Replaceable magnesium.
 - 2) Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - 3) Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
 - 5) Jacket: Steel with enameled finish.
 - 6) Burner: For use with atmospheric water heaters and for natural-gas **OR** LP-gas, **as directed**, fuel.
 - 7) Automatic Ignition: ANSI Z21.20, electric, automatic, gas-ignition system.
 - 8) Temperature Control: Adjustable thermostat.
 - 9) Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
 - 10) Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
 - c. Special Requirements: NSF 5 construction.
 - d. Draft Hood: Draft diverter; complying with ANSI Z21.12.
 - e. Automatic Damper: ANSI Z21.66, electrically operated **OR** mechanically activated **OR** thermally activated, **as directed**, automatic-vent-damper device with size matching draft hood.
 - f. Building Automation System Interface: Normally closed dry contacts for enabling and disabling water heater.
2. Commercial, Power-Burner, Storage, Gas Water Heaters: Comply with ANSI Z21.10.3/CSA 4.3.



- a. Storage-Tank Construction: ASME-code **OR** Non-ASME-code, **as directed**, steel with 150-psig (1035-kPa) working-pressure rating.
 - 1) Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - a) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - 2) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - 3) Lining: Cement **OR** Glass **OR** Nickel plate **OR** Phenolic coating **OR** Sheet copper, **as directed**, complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
 - b. Factory-Installed, Storage-Tank Appurtenances:
 - 1) Anode Rod: Replaceable magnesium.
 - 2) Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - 3) Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
 - 5) Jacket: Steel with enameled finish.
 - 6) Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
 - c. Burner: Comply with UL 795 for power-burner water heaters and for natural-gas **OR** LP-gas, **as directed**, fuel.
 - 1) Automatic Ignition: ANSI Z21.20, electric, automatic, gas-ignition system.
 - d. Temperature Control: Adjustable thermostat.
 - e. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
 - f. Special Requirements: NSF 5 construction.
 - g. Draft Hood: Draft diverter; complying with ANSI Z21.12.
 - h. Building Automation System Interface: Normally closed dry contacts for enabling and disabling water heater.
3. Commercial, Power-Vent, Storage, Gas Water Heaters: Comply with ANSI Z21.10.3/CSA 4.3.
 - a. Storage-Tank Construction: ASME-code **OR** Non-ASME-code, **as directed**, steel with 150-psig (1035-kPa) working-pressure rating.
 - 1) Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - a) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - 2) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - 3) Lining: Cement **OR** Glass **OR** Nickel plate **OR** Phenolic coating **OR** Sheet copper, **as directed**, complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
 - b. Factory-Installed, Storage-Tank Appurtenances:
 - 1) Anode Rod: Replaceable magnesium.
 - 2) Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - 3) Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
 - 5) Jacket: Steel with enameled finish.



- 6) Burner: For use with power-vent water heaters and for natural-gas **OR** LP-gas, **as directed**, fuel.
- 7) Automatic Ignition: ANSI Z21.20, electric, automatic, gas-ignition system.
- 8) Temperature Control: Adjustable thermostat.
- 9) Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
- 10) Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valve with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
- c. Special Requirements: NSF 5 construction.
- d. Power-Vent System: Exhaust fan, interlocked with burner.
- e. Building Automation System Interface: Normally closed dry contacts for enabling and disabling water heater.
- 4. Commercial, High-Efficiency, Gas Water Heaters: Comply with ANSI Z21.10.3/CSA 4.3.
 - a. Description: Manufacturer's proprietary design to provide at least 84 **OR** 85 **OR** 88 **OR** 95, **as directed**, percent combustion efficiency at optimum operating conditions. Following features and attributes may be modified or omitted if water heater otherwise complies with requirements for performance.
 - b. Storage-Tank Construction: ASME-code steel with 150-psig (1035-kPa) minimum working-pressure rating.
 - 1) Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - a) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - 2) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - 3) Lining: Cement **OR** Glass **OR** Nickel plate **OR** Phenolic coating **OR** Sheet copper, **as directed**, complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
 - c. Factory-Installed, Storage-Tank Appurtenances:
 - 1) Anode Rod: Replaceable magnesium.
 - 2) Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - 3) Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
 - 5) Jacket: Steel with enameled finish.
 - 6) Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
 - d. Burner or Heat Exchanger: Comply with UL 795 or approved testing agency requirements for high-efficiency water heaters and for natural-gas **OR** LP-gas, **as directed**, fuel.
 - e. Temperature Control: Adjustable thermostat.
 - f. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
 - g. Building Automation System Interface: Normally closed dry contacts for enabling and disabling water heater.
 - h. Draft Hood: Draft diverter; complying with ANSI Z21.12.
- 5. Commercial, Coil-Type, Finned-Tube, Gas Water Heaters: Comply with ANSI Z21.13 for hot-water boilers.
 - a. Description: Packaged unit with boiler, storage tank, pump, piping, and controls.



- b. Boiler Construction: ASME code with 160-psig (1100-kPa) working-pressure rating for hot-water-boiler-type water heater.
 - 1) Heat Exchanger: Helix or spiral, finned-copper-tube coils with bronze headers.
 - 2) Connections: Factory fabricated of materials compatible with boiler. Attach to boiler before testing.
 - a) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
- c. Boiler Appurtenances:
 - 1) Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire boiler except connections and controls.
 - 2) Jacket: Steel with enameled finish.
 - 3) Burner: For use with coil-type, finned-tube water heaters and for natural-gas **OR** LP-gas, **as directed**, fuel.
 - 4) Temperature Control: Adjustable, storage tank temperature-control fitting and flow switch, interlocked with circulator and burner.
 - 5) Safety Control: Automatic, high-temperature-limit cutoff device or system.
 - 6) Automatic Ignition: Intermittent electronic ignition complying with ANSI Z21.20.
- d. Building Automation System Interface: Normally closed dry contacts for enabling and disabling water heater.
- e. Support: Steel base or skids.
- f. Draft Hood: Draft diverter; complying with ANSI Z21.12.
- g. Automatic Damper: ANSI Z21.66, electrically operated **OR** mechanically activated **OR** thermally activated, **as directed**, automatic-vent-damper device with size matching draft hood.
- h. Hot-Water Storage Tank: Connected with piping to circulating pump and water heater.
 - 1) Construction: According to ASME Boiler and Pressure Vessel Code: Section VIII, steel with 150-psig (1035-kPa) **OR** 125-psig (860-kPa), **as directed**, working-pressure rating.
 - 2) Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - a) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - 3) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
 - 5) Jacket: Steel with enameled finish.
 - 6) Anode Rods: Factory installed, magnesium.
 - 7) Drain Valve: Corrosion-resistant metal complying with ASSE 1005, factory installed.
 - 8) Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
- i. Circulating Pump: UL 778, all-bronze, centrifugal, overhung-impeller, separately coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3. Include mechanical seals, 125-psig (860-kPa) minimum working-pressure rating, and 225 deg F (107 deg C) continuous-water-temperature rating.
- j. Piping: Copper tubing; copper, solder-joint fittings; and brazed or flanged joints.
- k. Mounting: Water heater, tank, and accessories factory mounted on skids.
- 6. Commercial, Grid-Type, Finned-Tube, Gas Water Heaters: Comply with ANSI Z21.13 for hot-water boilers.
 - a. Description: Packaged unit with boiler, storage tank, pump, piping, and controls.



- b. Boiler Construction: ASME code with 160-psig (1100-kPa) working-pressure rating for hot-water-boiler-type water heater.
 - 1) Heat Exchanger: Horizontal, straight, finned-copper tubes with bronze headers.
 - 2) Connections: Factory fabricated of materials compatible with boiler. Attach to boiler before testing.
 - a) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
- c. Boiler Appurtenances:
 - 1) Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire boiler except connections and controls.
 - 2) Jacket: Steel with enameled finish.
 - 3) Burner: For use with grid-type, finned-tube water heaters and for natural-gas **OR** LP-gas, **as directed**, fuel.
 - 4) Temperature Control: Adjustable, storage tank temperature-control fitting and flow switch, interlocked with circulator and burner.
 - 5) Safety Control: Automatic, high-temperature-limit cutoff device or system.
 - 6) Automatic Ignition: Intermittent electronic ignition complying with ANSI Z21.20.
- d. Building Automation System Interface: Normally closed dry contacts for enabling and disabling water heater.
- e. Support: Steel base or skids.
- f. Draft Hood: Draft diverter; complying with ANSI Z21.12.
- g. Automatic Damper: ANSI Z21.66, electrically operated **OR** mechanically activated **OR** thermally activated, **as directed**, automatic-vent-damper device with size matching draft hood.
- h. Hot-Water Storage Tank: Connected with piping to circulating pump and water heater.
 - 1) Construction: According to ASME Boiler and Pressure Vessel Code: Section VIII, steel with 150-psig (1035-kPa) **OR** 125-psig (860-kPa), **as directed**, working-pressure rating.
 - 2) Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - a) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - 3) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
 - 5) Jacket: Steel with enameled finish.
 - 6) Anode Rods: Factory installed, magnesium.
 - 7) Drain Valve: Corrosion-resistant metal complying with ASSE 1005, factory installed.
 - 8) Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
- i. Circulating Pump: UL 778, all-bronze, centrifugal, overhung-impeller, separately-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3. Include mechanical seals, 125-psig (860-kPa) minimum working-pressure rating, and 225 deg F (107 deg C) continuous-water-temperature rating.
- j. Piping: Copper tubing; copper, solder-joint fittings; and brazed or flanged joints.
- k. Mounting: Water heater, tank, and accessories factory mounted on skids.

D. Oil-Fired Water Heaters



1. Household, Oil-Fired Water Heaters: Comply with UL 732 for storage water heaters.
 - a. Storage-Tank Construction: Steel.
 - 1) Tappings: ASME B1.20.1 pipe thread.
 - 2) Pressure Rating: 150 psig (1035 kPa).
 - 3) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
 - b. Factory-Installed, Storage-Tank Appurtenances:
 - 1) Anode Rod: Replaceable magnesium.
 - 2) Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - 3) Drain Valve: ASSE 1005.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2, **as directed**.
 - 5) Jacket: Steel with enameled finish.
 - 6) Temperature Control: Adjustable thermostat.
 - 7) Heat Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
 - 8) Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
 - c. Oil Burner: Comply with UL 296 for use with No. 2 fuel oil.
 - d. Draft Regulator: Barometric type or adjustable-damper device.
2. Commercial, Oil-Fired Water Heaters: Comply with UL 732 for storage water heaters.
 - a. Storage-Tank Construction: ASME-code **OR** Non-ASME-code, **as directed**, steel with 150-psig (1035-kPa) minimum working-pressure rating.
 - 1) Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - a) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - 2) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - 3) Lining: Cement **OR** Glass **OR** Nickel plate **OR** Phenolic coating **OR** Sheet copper, **as directed**, complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
 - b. Factory-Installed, Storage-Tank Appurtenances:
 - 1) Anode Rod: Replaceable magnesium.
 - 2) Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - 3) Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2, **as directed**.
 - 5) Jacket: Steel with enameled finish.
 - 6) Temperature Control: Adjustable thermostat.
 - 7) Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
 - c. Oil Burners: Comply with UL 296 for use with No. 2 fuel oil.
 - d. Safety Control: Automatic, high-temperature-limit cutoff device or system.
 - e. Draft Regulator: Barometric type or adjustable-damper device.
 - f. Building Automation System Interface: Normally closed dry contacts for enabling and disabling water heater.
3. Large-Capacity, Oil-Fired Water Heaters: Comply with UL 732 for storage water heaters except when capacity is greater than 120 gal. (454 L).
 - a. Storage-Tank Construction: ASME-code steel with 150-psig (1035-kPa) minimum working-pressure rating.



- 1) Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - a) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
- 2) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
- 3) Lining: Cement **OR** Glass **OR** Nickel plate **OR** Phenolic coating **OR** Sheet copper, **as directed**, complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
- b. Factory-Installed, Storage-Tank Appurtenances:
 - 1) Anode Rod: Replaceable magnesium.
 - 2) Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - 3) Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2, **as directed**.
 - 5) Jacket: Steel with enameled finish.
 - 6) Temperature Control: Adjustable thermostat.
 - 7) Safety Control: Automatic, high-temperature-limit cutoff device or system.
 - 8) Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
- c. Oil Burner: Comply with UL 296 for use with No. 2 fuel oil.
- d. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
- e. Draft Regulator: Barometric type or adjustable-damper device.
- f. Building Automation System Interface: Normally closed dry contacts for enabling and disabling water heater.

E. Dual-Fuel Water Heaters

1. Description: Comply with ANSI Z21.10.3/CSA 4.3 or UL 732 requirements appropriate for dual-fuel, gas and oil-fired water heaters.
 - a. Storage-Tank Construction: ASME-code steel with 150-psig (1035-kPa) minimum working-pressure rating.
 - 1) Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - a) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - 2) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - 3) Lining: Cement **OR** Glass **OR** Nickel plate **OR** Phenolic coating **OR** Sheet copper, **as directed**, complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
 - b. Factory-Installed, Storage-Tank Appurtenances:
 - 1) Anode Rod: Replaceable magnesium.
 - 2) Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - 3) Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2, **as directed**.
 - 5) Jacket: Steel with enameled finish.
 - 6) Temperature Control: Adjustable thermostat.



- 7) Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
 - c. Dual-Fuel Burners: Combination gas-oil burner assembly, complying with appropriate requirements of UL 795; or comply with UL 296 for oil burners for No. 2 fuel oil and UL 795 for natural-gas **OR** LP-gas, **as directed**, fuel.
 - d. Safety Control: Automatic, high-temperature-limit cutoff device or system.
 - e. Vent Connection: According to standards of authorities having jurisdiction for dual-fuel water heaters.
 - f. Building Automation System Interface: Normally closed dry contacts for enabling and disabling water heater.
- F. Compression Tanks
1. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
 - a. Construction:
 - 1) Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
 - 2) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - 3) Air-Charging Valve: Factory installed.
- G. Water Heater Accessories
1. Gas Shutoff Valves: ANSI Z21.15/CGA 9.1, manually operated. Furnish for installation in piping.
 2. Gas Pressure Regulators: ANSI Z21.18, appliance type. Include pressure rating, capacity, and pressure differential required between gas supply and water heater.
 3. Gas Automatic Valves: ANSI Z21.21, appliance, electrically operated, on-off automatic valve.
 4. Combination Temperature and Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select each relief valve with sensing element that extends into storage tank.
 - a. Gas Water Heaters: ANSI Z21.22/CSA 4.4.
 - b. Oil-Fired Water Heaters: ASME rated and stamped and complying with ASME PTC 25.3.
 5. Pressure Relief Valves: Include pressure setting less than working-pressure rating of water heater.
 - a. Gas Water Heaters: ANSI Z21.22/CSA 4.4.
 - b. Oil-Fired Water Heaters: ASME rated and stamped and complying with ASME PTC 25.3.
 6. Water Heater Stand and Drain Pan Units: High-density-polyethylene-plastic, 18-inch- (457-mm-) high, enclosed-base stand complying with IAPMO PS 103 and IAS No. 2. Include integral or separate drain pan with raised edge and NPS 1 (DN 25) drain outlet with ASME B1.20.1 pipe thread.
 7. Water Heater Stands: Water heater manufacturer's factory-fabricated steel stand for floor mounting and capable of supporting water heater and water. Provide dimension that will support bottom of water heater a minimum of 18 inches (457 mm) above the floor.
 8. Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated steel bracket for wall mounting and capable of supporting water heater and water.
 9. Drain Pans: Corrosion-resistant metal with raised edge. Provide dimensions not less than base of water heater and include drain outlet not less than NPS 3/4 (DN 20).
 10. Piping Manifold Kits: Water heater manufacturer's factory-fabricated inlet and outlet piping arrangement for multiple-unit installation. Include piping and valves for field assembly that is capable of isolating each water heater and of providing balanced flow through each water heater.
 11. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2, **as directed**.
- H. Source Quality Control



1. Test and inspect water heater storage tanks, specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
2. Hydrostatically test commercial water heater storage tanks before shipment to minimum of one and one-half times pressure rating.
3. Prepare test reports.

1.3 EXECUTION

A. Water Heater Installation

1. Install commercial water heaters on concrete bases.
 - a. Exception: Omit concrete bases for commercial water heaters if installation on stand, bracket, suspended platform, or direct on floor is indicated.
 - b. Concrete base construction requirements are specified in Division 22 Section "Common Work Results For Plumbing".
2. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
3. Install seismic restraints for commercial water heaters. Anchor to substrate.
4. Install gas water heaters according to NFPA 54.
5. Install gas shutoff valves on gas supplies to gas water heaters without shutoff valves.
6. Install gas pressure regulators on gas supplies to gas water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
7. Install automatic gas valves on gas supplies to gas water heaters, if required for operation of safety control.
8. Install oil-fired water heaters according to NFPA 31.
9. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater, relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
10. Install combination temperature and pressure relief valves in water piping for water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
11. Install water heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 22 Section "Domestic Water Piping Specialties" for hose-end drain valves.
12. Install thermometer on outlet piping of water heaters. Refer to Division 22 Section "Meters And Gages For Plumbing Piping" for thermometers.
13. Install pressure gage(s) on inlet and outlet piping of commercial, fuel-fired water heater piping. Refer to Division 22 Section "Meters And Gages For Plumbing Piping" for pressure gages.
14. Assemble and install inlet and outlet piping manifold kits for multiple water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each water heater. Include shutoff valve and thermometer in each water heater inlet and outlet, and throttling valve in each water heater outlet. Refer to Division 22 Section "General-duty Valves For Plumbing Piping" for general-duty valves and to Division 22 Section "Meters And Gages For Plumbing Piping" for thermometers.
15. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.
16. Fill water heaters with water.
17. Charge compression tanks with air.

B. Connections



1. Piping installation requirements are specified in other Division 14. Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.
 3. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 4. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
- C. Field Quality Control
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
 2. Perform the following field tests and inspections and prepare test reports:
 - a. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - b. Operational Test: After electrical circuitry has been energized, confirm proper operation.
 - c. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 3. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.
- D. Demonstration
1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain instantaneous and commercial water heaters.

END OF SECTION 22 34 00 00



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Task	Specification	Specification Description
22 34 46 00	22 34 00 00	Fuel-Fired, Domestic Water Heaters



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SECTION 22 40 00 00 - MPF PLUMBING FIXTURES

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Faucets for lavatories and sinks.
 - 2. Flushometers.
 - 3. Toilet seats.
 - 4. Protective shielding guards.
 - 5. Fixture supports.
 - 6. Disposers.
 - 7. Water closets.
 - 8. Urinals.
 - 9. Lavatories.
 - 10. Kitchen sinks.
 - 11. Service sinks.
- B. Related Sections include the following:
 - 1. Division 22 Section "Emergency Plumbing Fixtures."
 - 2. Division 22 Section "Drinking Fountains and Water Coolers."

1.2 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. FRP: Fiberglass-reinforced plastic.
- D. PMMA: Polymethyl methacrylate (acrylic) plastic.
- E. PVC: Polyvinyl chloride plastic.



1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Documentation indicating flow and water consumption requirements.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. General: Water closets, urinals, flush valves and faucets must bear WaterSense label and be a WaterSense partner with US EPA.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities and ADA/USPS Handbook RE-4 for plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 - 1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
 - 2. Vitreous-China Fixtures: ASME A112.19.2M.
 - 3. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
- H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
 - 1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
 - 2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
 - 3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
 - 4. Faucets: ASME A112.18.1.
 - 5. Hose-Connection Vacuum Breakers: ASSE 1011.
 - 6. Hose-Coupling Threads: ASME B1.20.7.
 - 7. NSF Potable-Water Materials: NSF 61.
 - 8. Pipe Threads: ASME B1.20.1.
 - 9. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
 - 10. Supply Fittings: ASME A112.18.1.
 - 11. Brass Waste Fittings: ASME A112.18.2.
- I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
 - 1. Atmospheric Vacuum Breakers: ASSE 1001.
 - 2. Brass and Copper Supplies: ASME A112.18.1.
 - 3. Manual-Operation Flushometers: ASSE 1037.
 - 4. Plastic Tubular Fittings: ASTM F 409.
 - 5. Brass Waste Fittings: ASME A112.18.2.



- J. Comply with the following applicable standards and other requirements specified for miscellaneous components:
1. Disposers: ASSE 1008 and UL 430.
 2. Flexible Water Connectors: ASME A112.18.6.
 3. Grab Bars: ASTM F 446.
 4. Hose-Coupling Threads: ASME B1.20.7.
 5. Off-Floor Fixture Supports: ASME A112.6.1M.
 6. Pipe Threads: ASME B1.20.1.
 7. Plastic Toilet Seats: ANSI Z124.5.
 8. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 LAVATORY FAUCETS

- A. Lavatory Faucets:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Standard Companies, Inc.
 - b. Bradley Corporation.
 - c. Chicago Faucets.
 - d. Delta Faucet Company.
 - e. Elkay Manufacturing Co.
 - f. Just Manufacturing Company.
 - g. Kohler Co.
 - h. Royal Brass Mfg. Co.
 - i. Speakman Company.
 - j. T & S Brass and Bronze Works, Inc.
 - k. Zurn Plumbing Products Group; Commercial Brass Operation.
 2. Description: Single-handle-control mixing valve. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
 - a. Body Material: Commercial, solid brass.
 - b. Finish: Polished chrome plate.
 - c. Maximum Flow Rate: 0.5 gpm.
 - d. Centers: 4 inches or Single hole as required.
 - e. Mounting: Deck, exposed.
 - f. Inlet(s): NPS 3/8 tubing, with NPS 1/2 male adaptor.
 - g. Spout: Rigid type.
 - h. Spout Outlet: Aerator, 0.5 gpm.
 - i. Drain: Grid.

2.2 SINK FAUCETS

- A. Sink Faucets:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Standard Companies, Inc.
 - b. Bradley Corporation.
 - c. Broadway Collection.
 - d. Chicago Faucets.
 - e. Delta Faucet Company.
 - f. Elkay Manufacturing Co.



- g. Just Manufacturing Company.
 - h. Kohler Co.
 - i. Royal Brass Mfg. Co.
 - j. Sayco; a Briggs Plumbing Products, Inc. Company.
 - k. Speakman Company.
 - l. T & S Brass and Bronze Works, Inc.
 - m. Zurn Plumbing Products Group; Commercial Brass Operation.
2. Description: Kitchen faucet without spray. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
- a. Body Material: Commercial, solid brass.
 - b. Finish: Polished chrome plate.
 - c. Maximum Flow Rate: 1.5 gpm.
 - d. Mixing Valve: Single control.
 - e. Centers: 4 inches or 8 inches, as required.
 - f. Mounting: Deck], exposed.
 - g. Handle(s): Lever.
 - h. Inlet(s): NPS 3/8 tubing with NPS 1/2 male adapter.
 - i. Spout Type: Swing, solid brass.
 - j. Spout Outlet: Aerator].

2.3 FLUSHOMETERS

- A. Flushometers:
- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Coyne & Delany Co.
 - b. Sloan Valve Company.
 - c. Zurn Plumbing Products Group; Commercial Brass Operation.
 - d. TOTO USA, Inc.
 - 2. Description: Flushometer for urinal and water-closet-type fixture. Include brass body with corrosion-resistant internal components, non-hold-open feature, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.
 - a. Internal Design: Diaphragm operation.
 - b. Style: Exposed.
 - c. Stops: Integral screwdriver stops.
 - d. Inlet Size: NPS 3/4 for urinals, NPS 1 for water closets.
 - e. Trip Mechanism: Oscillating, lever-handle actuator.
 - f. Consumption: 0.5 gal./flush for urinals, 1.28 gal./flush for water closets.
 - g. Tailpiece Size: NPS 3/4 for urinals, NPS 1-1/4 for water closets length to top of bowl.

2.4 TOILET SEATS

- A. Toilet Seats:
- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Bemis Manufacturing Company.
 - b. Centoco Manufacturing Corp.
 - c. Church Seats.
 - d. Olsonite Corp.
 - 2. Description: Toilet seat for water-closet-type fixture.



- a. Material: Molded, solid plastic with antimicrobial agent.
- b. Configuration: Open front without cover.
- c. Size: Elongated.
- d. Hinge Type: SS, self-sustaining.
- e. Class: Standard commercial.
- f. Color: White.

2.5 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers,:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Engineered Brass Co.
 - b. Insul-Tect Products Co.; a Subsidiary of MVG Molded Products.
 - c. McGuire Manufacturing Co., Inc.
 - d. Plumberex Specialty Products Inc.
 - e. TCI Products.
 - f. TRUEBRO, Inc.
 - g. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.
2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

2.6 FIXTURE SUPPORTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Josam Company.
2. MIFAB Manufacturing Inc.
3. Smith, Jay R. Mfg. Co.
4. Tyler Pipe; Wade Div.
5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
6. Zurn Plumbing Products Group; Specification Drainage Operation.

B. Water-Closet Supports:

1. Description: Combination carrier designed for accessible mounting height of wall-mounting, water-closet-type fixture. Include single or double, vertical or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

C. Urinal Supports:

1. Description: Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture] [II, urinal carrier with hanger and bearing plates] for wall-mounting, urinal-type fixture. Include steel uprights with feet.
2. Accessible-Fixture Support: Include rectangular steel uprights.

D. Lavatory Supports:

1. Description: Type [I, lavatory carrier with exposed arms and tie rods] [II, lavatory carrier with concealed arms and tie rod] [III, lavatory carrier with hanger plate and tie rod] for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
2. Accessible-Fixture Support: Include rectangular steel uprights.



2.7 DISPOSERS

A. Disposers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Franke Consumer Products, Inc.; Kitchen Systems Div.
 - b. General Electric Company.
 - c. In-Sink-Erator; a div. of Emerson Electric Co.
 - d. KitchenAid.
 - e. Maytag Co.
2. Description: Batch-feed, food-waste disposer. Include reset button; wall switch; corrosion-resistant chamber with jam-resistant, cutlery- or stainless-steel grinder or shredder; NPS 1-1/2 outlet; quick-mounting, stainless-steel sink flange; antisplash guard; and combination cover/stopper.
 - a. Type: Batch-feed, stainless steel construction with lifetime lubrication and replaceable hammers and rind kicker.
 - b. Shock absorbing mounting
 - c. Model: [Not applicable] [Sound-insulated chamber] [Sound-insulated chamber and stainless-steel outer shell].
 - d. Motor: 115-V ac, 1725 rpm, 1 hp with overload protection.

2.8 WATER CLOSETS

A. Water Closets:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Standard Companies, Inc.
 - b. Briggs Plumbing Products, Inc.
 - c. Crane Plumbing, L.L.C./Fiat Products.
 - d. Eljer.
 - e. Gerber Plumbing Fixtures LLC.
 - f. Kohler Co.
 - g. TOTO USA, Inc.
2. Description: Accessible, floor-mounting, floor-outlet, vitreous-china fixture designed for flushometer valve operation.
3. Supply: NPS 1 chrome-plated brass or copper with screwdriver stop.
4. Style: Flushometer valve.
 - a. Bowl Type: Elongated, siphon-jet design. Include bolt caps matching fixture.
 - b. Height: Standard or Accessible as indicated on drawings.
 - c. Design Consumption: 1.28 gal./flush.
 - d. Color: White.
5. Flushometer:
6. Toilet Seat:

2.9 URINALS

A. Urinals:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Standard Companies, Inc.
 - b. Briggs Plumbing Products, Inc.



- c. Crane Plumbing, L.L.C./Fiat Products.
 - d. Eljer.
 - e. Kohler Co.
 - f. TOTO USA, Inc.
2. Description: Accessible, wall-mounting, back-outlet, vitreous-china fixture designed for flushometer valve operation.
- a. Type: Siphon jet.
 - b. Strainer or Trapway: Open trapway with integral trap. Stainless steel strainer
 - c. Design Consumption: 0.5 gal./flush.
 - d. Color: [White] <Insert color>.
 - e. Supply Spud Size: NPS 3/4.
 - f. Outlet Size: NPS 3.
 - g. Flushometer:
 - h. Fixture Support: Urinal carrier.

2.10 LAVATORIES

A. Lavatories:

- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Standard Companies, Inc.
 - b. Eljer.
 - c. Kohler Co.
 - d. Briggs Plumbing Products, Inc.
 - e. Crane Plumbing, L.L.C./Fiat Products.
 - f. Eljer.
 - g. Gerber Plumbing Fixtures LLC.
 - h. TOTO USA, Inc.
- 2. Description: Accessible, wall fixture.
 - a. Type: With back.
 - b. Size: 20 by 18 inches minimum, rectangular.
 - c. Faucet Hole Punching: Three holes, 4-inch centers.
 - d. Faucet Hole Location: Top.
 - e. Color: White.
 - f. Faucet: Lavatory with grid drain.
 - g. Supplies: NPS 3/8 chrome-plated copper with stops.
 - h. Protective Shielding Guard(s): Where designated.
 - i. Fixture Support: Lavatory concealed arm carrier.

2.11 KITCHEN SINKS

A. Kitchen Sinks:

- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dayton Products, Inc.
 - b. Elkay Manufacturing Co.
 - c. Franke Consumer Products, Inc., Kitchen Systems Div.
 - d. Just Manufacturing Company.
 - e. Kohler Co.
 - f. Moen, Inc.
 - g. Revere Sink.
 - h. Sterling Plumbing Group, Inc.

2. Description: One-compartment, counter-mounting, stainless-steel kitchen sink.
 - a. Overall Dimensions: 25 x 22 x 8.
 - b. Metal Thickness: 0.050 inch
 - c. Bowl:
 - 1) Drain: 3-1/2-inch crumb cup, outlet for disposer].
 - a) Location: Centered in bowl.
 - d. Sink Faucet:
 - e. Supplies: NPS 1/2 chrome-plated copper with stops.
 - f. Drain Piping: NPS 1-1/2 chrome-plated, cast-brass P-trap; 0.045-inch- thick tubular brass waste to wall; continuous waste; and wall escutcheon(s).
 - g. Disposer: As designated.

2.12 SERVICE SINKS

- A. Service Sinks:
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Standard Companies, Inc.
 - b. Commercial Enameling Company.
 - c. Eljer.
 - d. Kohler Co.
 - e. Crane Plumbing, L.L.C./Fiat Products.
 - f. Eljer.
 - g. Kohler Co.
 2. Description: Trap-standard- and wall-mounting, enameled, cast-iron fixture with roll-rim with back and stainless steel rim guard on front and sides.
 - a. Size: 22 by 18 inches.
 - b. Color: White.
 - c. Faucet: Service sink faucet with vacuum breaker, adjustable wall brace, pail hook, integral stops, 3/4" hose thread on spout.
 - d. Drain: Grid with NPS 3 outlet.
 - e. Trap Standard: NPS 3 enameled, cast iron with cleanout and floor flange.
 - f. Fixture Support: Service Sink wall support.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
 3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.



- E. Install wall-mounting fixtures with tubular waste piping attached to supports.
- F. Install fixtures level and plumb according to roughing-in drawings.
- G. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
- H. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- I. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- J. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- K. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- L. Install toilet seats on water closets.
- M. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- N. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- O. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- P. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- Q. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.
- R. Install escutcheons at piping wall and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- S. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."



3.3 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Install fresh batteries in sensor-operated mechanisms.

3.4 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

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END OF SECTION 22 40 00 00



SECTION 22 40 00 00 - CSF PLUMBING FIXTURES

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.22 40 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Water closets.
 - 2. Urinals.
 - 3. Lavatories.
 - 4. Sinks.
 - 5. Service sinks.
 - 6. Electric water coolers.
 - 7. Wall hydrants
 - 8. Roof drains
 - 9. Floor drains
 - 10. Shock absorbers.
 - 11. Protective shielding guards
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 079200 - Joint Sealants: Seal fixtures to walls and floors.
 - 2. Section 221000 - Plumbing Piping and Pumps

1.2 REFERENCES

- A. American Society of Mechanical Engineers (ASME):
 - 1. ASME A112.18.1 - Finished and Rough Brass Plumbing Fixture Fittings.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.



1. Product Data:
 - a. Product Data: Provide catalogue illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 1. Project Record Documents: Accurately record the following:
 - a. Operation and Maintenance Data: Include fixture trim exploded view and replacement parts lists.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Accept fixtures on site in factory packaging. Inspect for damage.
- C. C. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

Verify that water closets, urinals, flush valves and faucets bear WaterSense label and the manufactures are a WaterSense partner with US EPA.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. American Standard, Piscataway, NJ (800) 442-1902.
 2. Beneke/Sanderson Plumbing Products, Columbus, MS (800) 647-1042.
 3. Church Seat Co., Sheboygan Falls, WI (800) 233-7328.
 4. Delta Faucet Company, Indianapolis, IN (317) 818-0396.
 5. Eljer Plumbingware, Dallas, TX (800) 898-4048.
 6. Fiat Products, Evanston, IL (847) 864-7600.
 7. Gerber Plumbing Products, Woodbridge, IL (866) 538-5536
 8. Josam, Michigan City, IN (219) 872-5531.
 9. Just Manufacturing Company, Franklin Park, IL (847) 678-5150 (800) 456-4537.
 10. Kohler Plumbing, Kohler, WI (920) 457-4441.
 11. McGuire, Cheshire, CT (203) 699-1801.
 12. Sloan Valve Company, Franklin Park, IL (800) 982-5839.
 13. Jay R. Smith Manufacturing Company, Montgomery, AL (334) 277-8520.
 14. Stern-Williams, Shawnee Mission, KS (913) 362-5635.
 15. Woodford Manufacturing Company, Colorado Springs, CO (719) 574-1101 (800) 621-6031.
 16. Zurn Hydromechanics, Inc., Erie, PA (814) 455-0921.
- B. Furnish and install Products as indicated in Plumbing Fixture Schedule at the end of this Section.
- C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
 - 2. Verify that electric power is available and of the correct characteristics.
- C. Report in writing to Contracting Officer's Representative prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

- A. Plumbing Fixtures:
 - 1. Install in accordance with manufacturer's instructions.
 - 2. Install each fixture with trap, easily removable for servicing and cleaning.
 - 3. Provide chrome plated rigid or flexible supplies to fixtures with screwdriver stops, reducers, and escutcheons.
 - 4. Install components level and plumb.
 - 5. Install and secure fixtures in place with wall carriers and bolts.
 - 6. Seal fixtures to wall and floor surfaces with sealant as specified in Section 079200, color to match fixture.
 - 7. Connect wall hung urinals to waste piping with red brass nipples.
 - 8. Water Closets: Provide adjustable cast iron fixture supports for all wall hung water closets, except where single vertical carriers in shallow walls occur. Secure carrier foot supports to floor with 1/2 inch anchor bolts and 1/2 inch Phillips expansion shields drilled into concrete slab. Rough in centerline of carrier inlet in accordance with fixture manufacturer's standard rough-in dimensions.
 - 9. Urinals Supported on Steel Studding: To be securely attached to 1/4 inch thick by 6 inch wide steel wall plate extending at least one stud beyond fixture mounting point, welded to each stud it passes. Use 1/8 inch fillet weld across the full width of the steel stud flange, or bolt on by use of not less than two 1/4 inch "U" bolts per stud.
 - 10. Lavatories Supported on Steel Studding: To be securely attached to 1/4 inch thick by 4 inch wide steel wall plate extending at least one stud beyond fixture mounting point, welded to each stud it passes. Use 1/8 inch fillet weld across the full width of the steel stud flange or bolt on by use of not less than two 1/4 inch "U" bolts per stud.
 - 11. The use of lead-containing solder for plumbing and plumbing fixtures is prohibited in the construction of this project.
- B. Trap Primers
 - 1. Install primers under sinks and/or lavatories out of line of sight.
 - 2. Trap primers to have approval of plumbing and drainage institute.



3. Install trap primers in accordance with manufacturer's recommendations.

C. Backflow Preventers

1. Install in accordance with manufacturer's recommendations.
2. Pipe relief through fixed air gap and discharge to sewer.
3. Install adjacent to wall and/or floor utilizing stand-off brackets, angle frame, and/or concrete piers.
4. Test unit for leaks and pressure drop. Clean and/or replace soiled strainer media.

D. Protective Shielding Guards

1. Manufactured, plastic enclosure for covering hot- and cold-water supplies, trap and drain piping, and complying with ADA requirements and meeting ANSI code for barrier-free design. Provide at all accessible sinks and lavatories.

3.4 ADJUSTING

- A. Refer to Specification Section 017300
- B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.5 CLEANING

- A. Refer to Specification Section 01700
- B. At completion clean plumbing fixtures and equipment.

3.6 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.

3.7 PLUMBING FIXTURE SCHEDULE

NOTE TO SPECIFIER

Verify that water closets, urinals, flush valves and faucets bear WaterSense label and the manufactures are a WaterSense partner with US EPA.

A. Water Closet (P-1)

1. Bowl:
 - a. Floor mounted, vitreous china closet bowl, with elongated rim.
 - b. Manufacturer:
 - 1) Refer to approved manufacturers in Part 2.
2. Flush Valve:
 - a. ASME A112.18.1; exposed chrome plated, diaphragm type with oscillating handle, escutcheon, seat bumper, integral screwdriver stop and vacuum breaker ; maximum 1.28 gallon flush volume.
 - b. Manufacturer:
 - 1) Sloan: #111-1.5FYB.
 - 2) Zurn: #Z 6000 WS 1 YB.
3. Seat:
 - a. Solid white plastic, open front, extended back, brass bolts, bolt caps, without cover.



- b. Manufacturer:
 - 1) Beneke: #533.
 - 2) Church: #5321.112.
 - 3) Kohler: #K-4670-C.
 - 4. Fixture Support:
 - a. Manufacturer: Refer to approved manufacturers in Part 2.
- B. Water Closet -Handicap (P-2)
 - 1. Bowl:
 - a. Floor mounted, 18 inch high, vitreous china closet bowl, with elongated rim.
 - b. Manufacturer:
 - 1) Refer to approved manufacturers in Part 2.
 - 2. Flush Valve:
 - a. ASME A112.18.1; exposed chrome plated, diaphragm type with oscillating handle, escutcheon, seat bumper, integral screwdriver stop and vacuum breaker ; maximum 1.28 gallon flush volume.
 - b. Manufacturer:
 - 1) Sloan: #111-1.5FYB.
 - 2) Zurn: #Z 6000 WS 1 YB.
 - 3. Seat:
 - a. Solid white plastic, open front, extended back, brass bolts, bolt caps, without cover.
 - b. Manufacturer:
 - 1) Beneke: #533.
 - 2) Church: #5321.112.
 - 3) Kohler: #K-4670-C.
 - 4. Fixture Support:
 - a. Manufacturer: J.R. Smith 100 or 200 series adjustable support. J.R. Smith compact 400 series for furred spaces not sufficient for the adjustable 200 series.
- C. Water Closet -Handicap, Pressure-Assist Tank (P-3)
 - 1. Bowl:
 - a. Floor mounted, 18 inch high, vitreous china closet bowl, with elongated rim, flush tank, right or left hand trip lever as required, maximum 1.1 gallon flush.
 - b. Manufacturer:
 - 1) Refer to approved manufacturers in Part 2.
 - 2. Seat:
 - a. Solid white plastic, open front, extended back, brass bolts, bolt caps, without cover.
 - b. Manufacturer:
 - 1) Beneke: #533.
 - 2) Church: #5321.112.
 - 3) Kohler: #K-4670-C.
 - 3. Supplies:
 - a. Manufacturer:
 - 1) Brass Craft: #FR3911EC.
 - 2) Kohler: #K-7606P.
 - 3) McGuire: #2166 chrome supply.
- D. Lavatory - Single Lever (P-4)
 - 1. Bowl:
 - a. 20 x 18 inch vitreous china lavatory.
 - b. Manufacturer:
 - 1) American Standard: # 0355.012, Lucerne.
 - 2) Eljer: #051-2101, Signature.
 - 3) Kohler: #K-2007, Kingston.
 - 2. Faucet:
 - a. Single lever faucet with aerator with 0.5 GPM flow restrictor.
 - b. Manufacturer:

- 1) American Standard: # 2000.100.
- 2) Delta: #520.
3. Fittings:
 - a. Manufacturer:
 - 1) McGuire: #155-A grid drain with 1-1/4 inch tailpiece.
 - 2) McGuire: #8872, 1-1/4 inch semi-cast brass P-trap.
 - 3) McGuire: #2165 supplies to wall, chrome nipple with stop.
 - 4) McGuire: #155-WC offset tailpiece.
4. Mounting height of 32 inches from basin rim to finished floor.

E. Lavatory - Single Lever Handicap (P-5)

1. Bowl:
 - a. 20 x 18 inch vitreous china lavatory.
 - b. Manufacturer:
 - 1) American Standard: #0355.012, Lucerne.
 - 2) Eljer: #051-2101, Signature.
 - 3) Kohler: #K-2007, Kingston.
2. Faucet:
 - a. Single lever faucet with aerator with 0.5 GPM flow restrictor.
 - b. Manufacturer:
 - 1) American Standard: # 2000.100.
 - 2) Delta: #520.
3. Fittings:
 - a. Manufacturer:
 - 1) McGuire: #155-A grid drain with 1-1/4 inch tailpiece.
 - 2) McGuire: #8872, 1-1/4 inch semi-cast brass P-trap.
 - 3) McGuire: #2165 supplies to wall, chrome nipple with stop.
 - 4) McGuire: #155-WC offset tailpiece. Provide insulation on drain and hot water supply.
4. Mounting height of 32 inches from basin rim to finished floor.
5. Offset p-trap.
6. Concealed support arms in wall: Smith, Wade or Zurn.

F. Sink - One Compartment Handicap (P-6)

1. Sink:
 - a. Stainless steel sink with nominal I.D. of 12 inch by 16 inch by 6 1/2 inches deep.
 - b. Manufacturer:
 - 1) Elkay: #[_____].
 - 2) Just: #SL-17519-B-GR.
2. Fittings:
 - a. Manufacturer:
 - 1) McGuire: #151 drain with 1-1/2 inch tailpiece. Provide insulation on drain and hot water supply.
 - 2) McGuire: #8912, 1-1/2 inch by 1-1/2 inch semi-cast brass P-trap.
 - 3) McGuire: #111, 1-1/2 inch continuous waste.
 - 4) McGuire: #2165 supplies to wall, chrome nipple with stop.
 - 5) American Standard: #4205.074 kitchen faucet with hose spray.

G. Service Sink - Floor Basin (P-7)

1. Sink:
 - a. 24 inches by 24 inches by 10 inches deep, square fiberglass service basin.
 - b. Manufacturer:
 - 1) Fiat.
 - 2) Stern-Williams.
 - 3) Zurn
2. Fittings:



- a. Manufacturer: T & S: #B-695 service sink faucet with vacuum breaker.
 3. Mounting height from center line of faucet to finished floor shall be 36 inches.
 4. Mounting height from center line of vacuum breaker to finished floor shall be 7 feet, 6 inches.
 5. See piping detail on drawings.
- H. Electric Water Cooler – Bi-Level Handicap Wall Hung (P-8)
1. Electric Water Cooler :
 - a. 7.5 gph at 90 degree room temperature.
 - b. Manufacturer:
 - 1) Elkay: #EZTL8C, with LKAPREZL apron for upper unit.
 - 2) Halsey Taylor: #HAC8FSBL-VR-Q, with cane touch apron for upper unit.
 - 3) Oasis: #P8AMSL, with apron for upper unit.
 - 4) Sunroc: #NWCA-8F-BLN, with ADA apron extension kit for upper unit.
 2. Fittings:
 - a. Manufacturer:
 - 1) McGuire: #8872, 1-1/4 inch semi-cast brass p-trap.
 - 2) McGuire: #2165 supply to wall, chrome nipple with stop.
 3. Satin finished stainless steel apron and cabinet.
- I. Urinal - Wall Hung (P-9)
1. Urinal:
 - a. Vitreous china washout urinal with 3/4 inch top spud and wall hanger.
 - b. Water Consumption: 0.125 gal/flush (nominal 0.13 gal/flush) maximum.
 - c. Manufacturer:
 - 1) American Standard: 6590.125, Washbrook.
 - 2) Kohler: #K-4904-ET, Bardon.
 - 3) Sloan: #WEUS-1000.1001-0.13, fixture and valve package.
 - 4) Zurn: #Z5798, EcoVantage.
 2. Fittings:
 - a. Manufacturer:
 - 1) Delta: #81T231.
 - 2) Sloan: Included with Sloan fixture package.
 - 3) Zurn: Z6003AV-ULF.
 3. Fixture Support:
 - a. Manufacturer: J.R. Smith adjustable support.
- J. Urinal - Wall Hung Handicap (P-10)
1. Urinal:
 - a. Vitreous china washout urinal with 3/4 inch top spud and wall hanger.
 - b. Water Consumption: 0.125 gal/flush (nominal 0.13 gal/flush) maximum.
 - c. Manufacturer:
 - 1) American Standard: 6590.125, Washbrook.
 - 2) Kohler: #K-4904-ET, Bardon.
 - 3) Sloan: #WEUS-1000.1001-0.13, fixture and valve package.
 - 4) Zurn: #Z5798, EcoVantage.
 2. Fittings:
 - a. Manufacturer:
 - 1) Delta: #81T231.
 - 2) Sloan: Included with Sloan fixture package.
 - 3) Zurn: Z6003AV-ULF.
 3. Mount at handicapped height.
 4. Fixture Support:
 - a. Manufacturer: J.R. Smith adjustable support.

NOTE TO SPECIFIER

Delete requirement for Non-Freeze wall hydrants if geographic location permits.



K. Wall Hydrants - Non-Freeze (P-11)

NOTE TO SPECIFIER

Retain paragraph 1, below, to specify recessed hydrants for CSF Medium Buildings. Delete for CSF Small Buildings or Modular facilities.

1. Wall Hydrants:
 - a. Anti-siphon non-freeze recessed wall hydrant, cast polished brass face, with vacuum breaker.
 - b. Manufacturer:
 - 1) Woodford #B65-PB.
 - 2) J.R. Smith: #5509QT-PB.

NOTE TO SPECIFIER

Retain paragraph 1, below to specify exposed hydrants for CSF Small Buildings or Modular facilities. Delete for CSF Medium Buildings.

2. Wall Hydrants:
 - a. Anti-siphon non-freeze exposed wall hydrant, polished brass finish, with vacuum breaker.
 - b. Manufacturer:
 - 1) Woodford #65-PB.
 - 2) J.R. Smith: #5609QT-PB.
3. Mounting height of 18 inches from centerline of hydrant to finished grade.

L. Roof Drain (P-12)

1. Roof Drain:
 - a. Manufacturer: J.R. Smith: Model as follows:
 - 1) Without insulation above roof slab: #1010-C-R-A
 - 2) With insulation above roof slab: Figure Number 1015-C-R-A
 - b. Provide deck clamp, sump receiver, and aluminum dome.
 - c. Size of drain as shown on drawings.

M. Overflow Roof Drain (P-13)

1. Overflow Roof Drain:
 - a. Provide deck clamp, sump receiver, and aluminum dome, 2 inch water dam collar.
 - b. See drawings for detail of sump receiver and drain installation.
 - c. Manufacturer: J.R. Smith: #1080-C-R-A.

N. Floor Drain - Regular (P-14)

1. Floor Drain:
 - a. Cast iron floor drain with polished nickel-bronze top, adjustable strainer with flashing clamp device.
 - b. Provide flashing clamp on drains installed above first floor, slab on grade.
 - c. Size of drain as shown on drawings.
 - d. Manufacturer:
 - 1) Josam: #3000-S.
 - 2) J.R. Smith: #2005-A (and suffix "P", if required, see drawings).
 - 3) Zurn: #Z-415-S.

O. Shock Absorbers (P-15)

1. Shock Absorbers:
 - a. Manufacturer:
 - 1) Josam.
 - 2) J. R. Smith: #5005 through 5050, sized as recommended by manufacturer.
 - 3) Zurn: #Z-1700, Shocktrol (for small equipment with maximum 1 inch line size).



- P. Floor Clean-out (P-16)
 - 1. Floor Clean-out:
 - a. Cast iron body and frame, clean-out plug and adjustable round top.
 - b. Manufacturer:
 - 1) Wade: 6000-Z.
- Q. Trap Primer
 - 1. Water Saving trap primer
 - a. Utilize when possible on all traps where sinks or lavs are in close proximity.
 - 1) Zurn: Z1021.
 - 2. Trap primer
 - a. Bronze body with integral vacuum breaker and low pressure differential operation.
 - b. Manufacturer:
 - 1) Zurn: Z1022.

USPS CSF Specifications issued: 10/1/2013
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END OF SECTION



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Task	Specification	Specification Description
22 41 39 00	22 01 40 00	Emergency Plumbing Fixtures
22 42 13 00	22 01 40 00	Emergency Plumbing Fixtures
22 42 16 00	22 01 40 00	Emergency Plumbing Fixtures
22 42 19 00	01 22 16 00	No Specification Required
22 42 19 00	22 01 40 00	Emergency Plumbing Fixtures
22 42 23 00	22 01 40 00	Emergency Plumbing Fixtures
22 42 33 00	22 01 40 00	Emergency Plumbing Fixtures
22 42 39 00	01 22 16 00	No Specification Required
22 42 39 00	22 01 40 00	Emergency Plumbing Fixtures
22 42 43 00	22 01 40 00	Emergency Plumbing Fixtures
22 42 46 00	22 01 40 00	Emergency Plumbing Fixtures



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SECTION 22 43 39 00 - MEDICAL PLUMBING FIXTURES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for medical plumbing fixtures. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following medical plumbing fixtures and related components:
 - a. Faucets for lavatories, showers, and sinks.
 - b. Laminar-flow, faucet-spout outlets.
 - c. Flushometers.
 - d. Toilet seats.
 - e. Protective shielding guards.
 - f. Fixture supports.
 - g. Bedpan washers.
 - h. Water closets.
 - i. Lavatories.
 - j. Individual showers.
 - k. Patients' combination toilets.
 - l. Clinical sinks.
 - m. Plaster sinks.
 - n. Surgeons' scrub sinks.
 - o. Surgeons' instrument sinks.
 - p. Bathing units.
 - q. Sitz baths.
 - r. Bedpan washing equipment.
 - s. Hydrotherapy whirlpools.
 - t. Outlet boxes.
 - u. Morgue equipment.

C. Definitions

1. Accessible Medical Plumbing Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
2. Fitting: Device that controls the flow of water into or out of the medical plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads, drains and tailpieces, and traps and waste pipes.
3. FRP: Fiberglass-reinforced plastic.
4. PMMA: Polymethyl methacrylate (acrylic) plastic.

D. Submittals

1. Product Data: For each type of medical plumbing fixture indicated.
2. LEED Submittal:
 - a. Product Data for Credit WE 2, 3.1, and 3.2: Documentation indicating flow and water consumption requirements.
3. Shop Drawings: Diagram power, signal, and control wiring.
4. Operation and maintenance data.

E. Quality Assurance



1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act", **as directed**; for plumbing fixtures for people with disabilities.
3. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
4. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
5. Select combinations fixtures and trim, faucets, fittings, and other components that are compatible.
6. Comply with the following applicable standards and other requirements specified for medical plumbing fixtures:
 - a. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
 - b. Plastic Bathtubs: ANSI Z124.1.
 - c. Plastic Shower Enclosures: ANSI Z124.2.
 - d. Slip-Resistant Bathing Surfaces: ASTM F 462.
 - e. Vitreous-China Fixtures: ASME A112.19.2M.
7. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
 - a. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
 - b. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
 - c. Faucets: ASME A112.18.1.
 - d. Hose-Connection Vacuum Breakers: ASSE 1011.
 - e. Hose-Coupling Threads: ASME B1.20.7.
 - f. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
 - g. NSF Materials: NSF 61.
 - h. Pipe Threads: ASME B1.20.1.
 - i. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
 - j. Supply Fittings: ASME A112.18.1.
 - k. Brass Waste Fittings: ASME A112.18.2.
8. Comply with the following applicable standards and other requirements specified for bathtub and shower faucets:
 - a. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
 - b. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
 - c. Faucets: ASME A112.18.1.
 - d. Hand-Held Showers: ASSE 1014.
 - e. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
 - f. Hose-Coupling Threads: ASME B1.20.7.
 - g. Manual-Control Antiscald Faucets: ASTM F 444.
 - h. Pipe Threads: ASME B1.20.1.
 - i. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
 - j. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
 - k. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
9. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
 - a. Atmospheric Vacuum Breakers: ASSE 1001.
 - b. Brass and Copper Supplies: ASME A112.18.1.
 - c. Flexible Water Connectors: ASME A112.18.6.
 - d. Manual-Operation Flushometers: ASSE 1037.
 - e. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
 - f. Brass Waste Fittings: ASME A112.18.2.
10. Comply with the following applicable standards and other requirements specified for miscellaneous components:



- a. Grab Bars: ASTM F 446.
- b. Hose-Coupling Threads: ASME B1.20.7.
- c. Off-Floor Fixture Supports: ASME A112.6.1M.
- d. Pipe Threads: ASME B1.20.1.
- e. Plastic Toilet Seats: ANSI Z124.5.
- f. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.2 PRODUCTS

A. Lavatory Faucets

1. Description: Faucet for lavatory-type medical plumbing fixture. Coordinate faucet inlets with supplies, connectors, and fixture holes; coordinate outlet with spout and fixture receptor.
 - a. Maximum Flow Rate: 2.2 gpm (8.3 L/min.).
 - b. Body Material: Solid brass.
 - c. Finish: Polished chrome plate.
 - d. Type: Single-control mixing **OR** Single-valve nonmixing **OR** Two-handle mixing, **as directed**.
 - e. Tempering System: Not required **OR** Thermostatic **OR** Pressure balance, **as directed**.
 - f. Supply Centers: Single hole **OR** 4 inches (102 mm) **OR** 6 inches (152 mm) **OR** 8 inches (203 mm) **OR** 12 inches (305 mm) **OR** Adjustable, **as directed**.
 - g. Mounting: Deck, exposed **OR** Deck, concealed **OR** Back/wall, exposed **OR** Back/wall, concealed, **as directed**.
 - h. Handle(s): Single lever **OR** Cross, four arm **OR** Wrist blade, 4 inches (102 mm) **OR** Elbow, 6 inches (152 mm) **OR** Not applicable, **as directed**.
 - i. Temperature Indicators: Color-coded for hot and cold water.
 - j. Inlet(s): NPS 3/8 (DN 10) tubing, plain end **OR** NPS 3/8 (DN 10) tubing, with NPS 1/2 (DN 15) male adaptor **OR** NPS 1/2 (DN 15) male shank **OR** NPS 1/2 (DN 15) female shank, **as directed**.
 - k. Spout: Rigid **OR** Swing **OR** Rigid gooseneck **OR** Swivel gooseneck, **as directed**, brass.
 - l. Spout Outlet: Aerator **OR** Spray **OR** Laminar flow **OR** Plain end **OR** Spray, 0.5 gpm (1.5 L/min.), **as directed**.
 - m. Operation: Compression, manual **OR** Noncompression, manual **OR** Automatic, hard-wired electric sensor, **as directed**.
 - n. Drain: Pop up **OR** See fixture, **as directed**.

B. Shower Faucets

1. Description: Faucet for shower-type medical plumbing fixtures. Include hot- and cold-water indicators; check stops; and shower head, arm, and flange. Coordinate faucet inlets with supplies.
 - a. Maximum Flow Rate: 2.5 gpm (9.5 L/min.), unless otherwise indicated.
 - b. Body Material: Solid brass.
 - c. Finish: Polished chrome plate.
 - d. Type: Thermostatic **OR** Pressure balance **OR** Thermostatic and pressure balance, **as directed**, with integral or field-installed check stops on hot- and cold-water supplies.
 - e. Mounting: Exposed **OR** Concealed, **as directed**.
 - f. Handle(s): Single lever **OR** Cross, four arm **OR** Not applicable, **as directed**.
 - g. Temperature Indicators: Color-coded for hot and cold water.
 - h. Diverter Valve: Not required **OR** Integral with mixing valve **OR** Not integral with mixing valve, **as directed**.
 - i. Backflow Protection Device for Hand-Held Shower: Required **OR** Not required, **as directed**.
 - j. Operation: Compression, manual **OR** Noncompression, manual **OR** Automatic, hard-wired electric sensor, **as directed**.
 - k. Antiscald Device: Integral with mixing valve **OR** Not required, **as directed**.



- l. Supply Connections: NPS 1/2 (DN 15) **OR** NPS 1/2 (DN 15), union **OR** Sweat, **as directed**.
- m. Shower Head Material: Brass with chrome-plated finish.
- n. Head Type: Ball joint **OR** Without ball joint **OR** Hand held, slide-bar mounted **OR** Hand held, hook mounted, **as directed**.
- o. Spray Pattern: Fixed **OR** Adjustable, **as directed**.
- p. Integral Volume Control: Required **OR** Not required, **as directed**.
- q. Shower-Arm, Flow-Control Fitting: Not required **OR** 1.5 gpm (5.7 L/min.) **OR** 2.0 gpm (7.6 L/min.), **as directed**.

C. Sink Faucets

1. Description: Faucet for sink-type medical plumbing fixtures. Coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
 - a. Maximum Flow Rate: 2.5 gpm (9.5 L/min.), unless otherwise indicated.
 - b. Body Material: Solid brass.
 - c. Finish: Polished chrome plate **OR** Rough chrome plate, **as directed**.
 - d. Type: Sink faucet **OR** Clinical-sink faucet with stops in shanks, vacuum breaker, hose-thread outlet, and pail hook, **as directed**.
 - e. Tempering Device: Thermostatic **OR** Pressure balance **OR** Not required, **as directed**.
 - f. Mixing Valve: Single control **OR** Two-lever handle, **as directed**.
 - g. Backflow Protection Device for Hose Outlet: Required **OR** Not required **OR** Not applicable, **as directed**.
 - h. Supply Centers: Single hole **OR** 4 inches (102 mm) **OR** 6 inches (152 mm) **OR** 8 inches (203 mm) **OR** Adjustable, **as directed**.
 - i. Mounting: Deck, exposed **OR** Deck, concealed **OR** Back/wall, exposed **OR** Back/wall, concealed, **as directed**.
 - j. Handle(s): Lever **OR** Knob **OR** Cross, four arm **OR** Wrist blade, 4 inches (102 mm) **OR** Elbow, 6 inches (152 mm) **OR** Not applicable, **as directed**.
 - k. Temperature Indicators: Color-coded for hot water on left and cold water on right.
 - l. Inlet(s): NPS 3/8 (DN 10) plain-end tubing **OR** NPS 3/8 (DN 10) tubing with NPS 1/2 (DN 15) male adapter **OR** NPS 1/2 (DN 15) male shank **OR** NPS 1/2 (DN 15) female shank, **as directed**.
 - m. Spout: Rigid, solid **OR** Swing tubular **OR** Rigid, gooseneck, solid **OR** Swivel, gooseneck, solid, **as directed**, brass with wall brace, **as directed**.
 - n. Spout Outlet: Aerator **OR** Swivel aerator/spray **OR** Spray **OR** Laminar flow **OR** Hose thread **OR** Plain end, **as directed**.
 - o. Vacuum Breaker: Required **OR** Not required, **as directed**.
 - p. Operation: Compression, manual **OR** Noncompression, manual **OR** Automatic, hard-wired electric sensor, **as directed**.

D. Laminar-Flow Faucet-Spout Outlets

1. Description: Chrome-plated-brass faucet-spout outlet that produces non-aerating laminar stream. Include male or female thread that mates with faucet outlet for attachment to faucets where indicated and flow-rate range that includes flow of faucet.

E. Flushometers

1. Description: Flushometer for clinical-sink-type **OR** water-closet-type, **as directed**, medical plumbing fixture. Include brass body with corrosion-resistant internal components, non-hold-open feature, **as directed**, control stop with check valve, vacuum breaker, and copper or brass tubing, and polished chrome-plated finish on exposed parts.
 - a. Internal Design: Diaphragm operation.
 - b. Style: Exposed **OR** Concealed, **as directed**.
 - c. Inlet Size: NPS 1 (DN 25).
 - d. Trip Mechanism: Oscillating, lever-handle actuator **OR** Mechanical, push-button actuator with stainless-steel access plate **OR** Hydraulic, push-button actuator **OR** Foot-pedal



- actuator **OR** Hard-wired, electric-sensor actuator **OR** Battery-operated sensor actuator, **as directed**.
 - e. Consumption: 1.6 gal./flush (6.0 L/flush) **OR** 3.5 gal./flush (13.3 L/flush), **as directed**.
 - f. Tailpiece Size: NPS 1-1/4 (DN 32) **OR** NPS 1-1/2 (DN 40), **as directed**, and standard length to top of bowl.
 - g. Integral Bedpan Washer: Not required **OR** Factory fabricated, attached to tailpiece, and with spray head, **as directed**.
- F. Toilet Seats
- 1. Description: Plastic toilet seat for water-closet-type medical plumbing fixture.
 - a. Material: Molded, solid plastic with antimicrobial agent, **as directed**.
 - b. Configuration: Closed **OR** Open, **as directed**, front with **OR** without, **as directed**, cover.
 - c. Size: Elongated, unless otherwise indicated.
 - d. Class: Standard **OR** Heavy-duty, **as directed**, commercial.
 - e. Hinge Type: Stainless-steel CK, check **OR** SC, self-sustaining check, **as directed**.
 - f. Color: White **OR** Black, **as directed**.
- G. Protective Shielding Guards
- 1. Protective Shielding Pipe Covers:
 - a. Description: Manufactured plastic wraps for covering medical plumbing fixture hot-water supply **OR** hot- and cold-water supplies, **as directed**, and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.
 - 2. Protective Shielding Piping Enclosures:
 - a. Description: Manufactured plastic enclosure for covering medical plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.
- H. Fixture Supports
- 1. Water-Closet Supports:
 - a. Description: Combination carrier designed for accessible **OR** standard, **as directed**, mounting height of wall-mounting, water-closet-type medical plumbing fixture. Include single or double, vertical or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.
 - 2. Lavatory Supports:
 - a. Description: Type I, lavatory carrier with exposed arms and tie rods **OR** Type II, lavatory carrier with concealed arms and tie rod **OR** Type III, lavatory carrier with hanger plate and tie rod, **as directed**, for wall-mounting, lavatory-type medical plumbing fixture. Include steel uprights with feet.
 - b. Accessible-Fixture Support: Include rectangular steel uprights.
 - 3. Sink Supports:
 - a. Description: Type I, sink carrier with exposed arms and tie rods **OR** Type II, sink carrier with hanger plate, bearing studs, and tie rod **OR** Type III, sink carrier with hanger plate and exposed arms, **as directed**, for sink-type medical plumbing fixture. Include steel uprights with feet.
 - 4. Bedpan Washers
 - a. Description: Wall-mounting, hand-held, hand-control **OR** single-pedal, foot-control **OR** double-pedal, hot- and cold-water control, **as directed**, medical plumbing fixture.
 - 1) Hose: 48-inch- (1220-mm-) long rubber or vinyl hose with spray nozzle, wall bracket, and hook.
 - 2) Self-closing valve.
 - 3) Loose-key supply stop.
 - 4) Vacuum Breaker: Wall mounting, atmospheric.
 - 5) Finish: Polished, chrome-plated finish on metal parts exposed after installation.
- I. Water Closets

1. Wall-Mounting Water Closets:
 - a. Description: Accessible, wall-mounting **OR** Wall-mounting, **as directed**, back-outlet, vitreous-china medical plumbing fixture designed for bedpan washing and flushometer valve operation.
 - 1) Style: Flushometer valve.
 - a) Bowl Type: Elongated with siphon-jet design and bedpan lugs or slots.
 - b) Design Consumption: 1.6 gal./flush (6 L/flush).
 - c) Color: White.
2. Floor-Mounting Water Closets:
 - a. Description: Accessible, floor-mounting **OR** Floor-mounting, **as directed**, floor-outlet, vitreous-china medical plumbing fixture designed for bedpan washing and flushometer valve operation.
 - 1) Style: Flushometer valve.
 - a) Bowl Type: Elongated with siphon-jet design and bedpan lugs or slots. Include bolt caps matching fixture.
 - b) Height: Standard **OR** Accessible, **as directed**.
 - c) Design Consumption: 1.6 gal./flush (6 L/flush).
 - d) Color: White.

J. Lavatories

1. Wall-Mounting Lavatories:
 - a. Description: Accessible, wall-mounting **OR** Wall-mounting, **as directed**, vitreous-china medical plumbing fixture.
 - 1) Type: With back **OR** Ledge back **OR** Shelf back **OR** Slab, **as directed**.
 - 2) Size: 18 by 15 inches (457 by 381 mm) **OR** 19 by 16 inches (483 by 406 mm) **OR** 20 by 18 inches (508 by 457 mm) **OR** 24 by 20 inches (610 by 508 mm), **as directed**, rectangular.
 - 3) Faucet Hole Punching: One hole **OR** Three holes, 2-inch (51-mm) centers **OR** Three holes, 4-inch (102-mm) centers, **as directed**.
 - 4) Faucet Hole Location: Top **OR** Front wall **OR** Inclined panel, **as directed**.
 - 5) Color: White.
 - 6) Faucet: Lavatory with pop-up waste **OR** for separate drain, **as directed**.
 - 7) Supplies: NPS 3/8 (DN 10) chrome-plated copper tubes or flexible connectors, **as directed**, with stops.
 - 8) Drain: See faucet **OR** Grid **OR** Grid with offset, **as directed**.
 - a) Location: Not applicable.
 - 9) Drain Piping: NPS 1-1/4 (DN 32) **OR** NPS 1-1/4 by NPS 1-1/2 (DN 32 by DN 40), **as directed**, chrome-plated, cast-brass P-trap; NPS 1-1/4 (DN 32) **OR** NPS 1-1/2 (DN 40), **as directed**, 0.032-inch- (0.8-mm-) **OR** 0.045-inch- (1.1-mm-), **as directed**, thick tubular brass waste to wall; and wall escutcheon.
 - 10) Protective Shielding Guard(s): Designation, as directed by the Owner.
 - 11) Fixture Support: Lavatory.
2. Counter-Mounting Lavatories:
 - a. Description: Accessible, **as directed**, Counter-mounting **OR** Undercounter-mounting, **as directed**, vitreous-china, medical plumbing fixture.
 - 1) Type: Flat rim with ledge **OR** Self-rimming, **as directed**.
 - 2) Rectangular Lavatory Size: 18 by 15 inches (457 by 381 mm) **OR** 19 by 16 inches (483 by 406 mm) **OR** 20 by 18 inches (508 by 457 mm) **OR** 24 by 20 inches (610 by 508 mm), **as directed**.
 - 3) Oval Lavatory Size: 19 by 16 inches (483 by 406 mm) **OR** 20 by 17 inches (508 by 432 mm), **as directed**.
 - 4) Round Lavatory Size: 18 inches (457 mm) **OR** 19 inches (483 mm), **as directed**, in diameter.
 - 5) Faucet Hole Punching: One hole **OR** Three holes, 2-inch (51-mm) centers **OR** Three holes, 4-inch (102-mm) centers, **as directed**.



- 6) Faucet Hole Location: Top **OR** Front wall **OR** Inclined panel, **as directed**.
 - 7) Color: White.
 - 8) Faucet: Lavatory with pop-up waste **OR** for separate drain, **as directed**.
 - 9) Supplies: NPS 3/8 (DN 10) chrome-plated copper tubes or flexible connectors, **as directed**, with stops.
 - 10) Drain: See faucet **OR** Grid **OR** Grid with offset, **as directed**.
 - a) Location: Not applicable.
 - 11) Drain Piping: NPS 1-1/4 (DN 32) **OR** NPS 1-1/4 by NPS 1-1/2 (DN 32 by DN 40), **as directed**, chrome-plated, cast-brass P-trap; NPS 1-1/4 (DN 32) **OR** NPS 1-1/2 (DN 40), **as directed**, 0.032-inch- (0.8-mm-) **OR** 0.045-inch- (1.1-mm-), **as directed**, thick tubular brass waste to wall; and wall escutcheon.
 - 12) Protective Shielding Guard(s): Designation, as directed by the Owner.
- K. Individual Showers:
1. Description: Accessible, **as directed**, FRP **OR** PMMA, **as directed**, shower enclosure medical plumbing fixture with slip-resistant bathing surface complying with ASTM F 462. Comply with ADA requirements for use by people with disabilities.
 - a. Size: 36 by 34 inches (915 by 865 mm) **OR** 42 by 36 inches (1065 by 915 mm) **OR** 43 by 39 inches (1090 by 990 mm) **OR** 48 by 34 inches (1220 by 865 mm) **OR** 52 by 36 inches (1320 by 915 mm) **OR** 60 by 36 inches (1525 by 915 mm) **OR** 72 by 36 inches (1830 by 915 mm), **as directed**.
 - b. Surround: One piece.
 - c. Color: White.
 - d. Faucet: Shower.
 - e. Drain: Grid, NPS 2 (DN 50).
 - 1) Location: Left side **OR** Center **OR** Right side, **as directed**.
 - f. Accessories: If not furnished as integral components of specified fixture. Accessories are specified in Division 10 Section "Toilet, Bath, And Laundry Accessories".
 - 1) Grab bar(s).
 - 2) Normal-duty **OR** Heavy-duty, **as directed**, shower-curtain rod.
 - 3) Vinyl **OR** Duck **OR** Antibacterial, **as directed**, shower curtain.
 - 4) Shower-curtain hooks.
 - 5) Folding seat, **as directed**.
- L. Patients' Combination Toilets
1. Swing-Away, Patients' Combination Toilets:
 - a. Description: Factory-fabricated, combination water closet and lavatory medical plumbing fixture.
 - 1) Cabinet: Fixed installation with storage space and toilet paper holder.
 - a) Material: Stainless steel **OR** Stainless steel, plastic laminate, or fiberglass, **as directed**, with laminated-wood or -plastic **OR** solid-plastic **OR** stainless-steel, **as directed**, top surface.
 - b) Color: Not applicable.
 - c) Mounting: Wall bracket.
 - 2) Water Closet: Swivel, floor-mounting, back-outlet **OR** floor-outlet, **as directed**, flushometer valve design.
 - a) Material: Stainless steel.
 - b) Orientation: Left **OR** Right, **as directed**, hand.
 - c) Color: Not applicable.
 - d) Toilet Seat: White, solid plastic.
 - e) Flushometer: Concealed flushometer valve with push-button trip mechanism, check stop, and vacuum breaker on tailpiece.
 - f) Fixture Support: Floor plate.
 - g) Seal: For outlet.
 - 3) Lavatory: Counter mounting.
 - a) Material: Stainless steel.

- b) Color: Not applicable.
 - c) Faucet: Gooseneck type with wrist-blade handles **OR** Swing-spout type with single lever, **as directed**.
 - d) Drain: Grid, NPS 1-1/4 (DN 32).
 - e) Drain Piping: NPS 1-1/4 (DN 32) chrome-plated, cast-brass P-trap; tubular-brass waste to wall; and wall flange.
 - 4) Bedpan Washer: On flushometer valve tailpiece or separate attachment affixed to unit.
- 2. Static, Patients' Combination Toilets:
 - a. Description: Factory-fabricated, combination water closet and lavatory fixture.
 - 1) Cabinet: Fixed installation; swing-away cabinet or retractable, water-closet cover design with storage space and toilet paper holder.
 - a) Material: Stainless steel **OR** Stainless steel, plastic laminate, or fiberglass, **as directed**, with laminated-wood or -plastic **OR** solid-plastic **OR** stainless-steel, **as directed**, top surface.
 - b) Color: Not applicable.
 - c) Mounting: Wall bracket.
 - 2) Water Closet: Floor-mounting, floor-outlet, flushometer valve design.
 - a) Material: Stainless steel or vitreous china.
 - b) Orientation: Left **OR** Right, **as directed**, hand.
 - c) Color: Not applicable.
 - d) Toilet Seat: White, solid plastic.
 - e) Flushometer: Concealed flushometer valve with push-button trip mechanism, check stop, and vacuum breaker on tailpiece.
 - f) Seal: For outlet.
 - 3) Lavatory: Counter mounting.
 - a) Material: Stainless steel.
 - b) Color: Not applicable.
 - c) Faucet: Gooseneck type with wrist-blade handles **OR** Swing-spout type with single lever, **as directed**.
 - d) Drain: Grid, NPS 1-1/4 (DN 32).
 - e) Drain Piping: NPS 1-1/4 (DN 32) chrome-plated, cast-brass P-trap; tubular-brass waste to wall; and wall flange.
 - 4) Bedpan Washer: On flushometer valve tailpiece or separate attachment affixed to unit.

M. Clinical Sinks

- 1. Wall-Mounting Clinical Sinks:
 - a. Description: Wall-mounting, back-outlet, vitreous-china, flushing-rim, service-sink-type medical plumbing fixture.
 - 1) Size: Approximately 25 by 20 inches (635 by 510 mm).
 - 2) Color: White.
 - 3) Rim Guard: Stainless steel on front and also on sides if flat rim.
 - 4) Faucet: Sink, polished, chrome-plated, solid-brass, service-sink faucet type, including integral stops in shanks, vacuum breaker, hose-thread outlet, and pail hook.
- 2. Floor-Mounting Clinical Sinks:
 - a. Description: Floor-mounting, bottom-outlet, vitreous-china, flushing-rim, service-sink-type medical plumbing fixture. Include bolt caps.
 - 1) Size: Approximately 27 by 20 inches (685 by 510 mm).
 - 2) Color: White.
 - 3) Rim Guards: Stainless steel on front and sides.
 - 4) Sink Base: 10-inch (25.4-mm) -high, cast terrazzo if required.



- 5) Faucet: Sink, polished, chrome-plated, solid-brass, service-sink faucet type, including integral stops in shanks, vacuum breaker, hose-thread outlet, and pail hook.

N. Plaster Sinks:

1. Description: Wall-mounting, vitreous-china medical plumbing fixture.
 - a. Size: 24 by 22 inches (610 by 560 mm) **OR** 30 by 22 inches (760 by 560 mm), **as directed**, with back or ledge faucet holes.
 - b. Color: White.
 - c. Faucet Holes: One **OR** Two, **as directed**, in back or ledge.
 - d. Faucet: Sink.
 - e. Supplies: NPS 1/2 (DN 15) chrome-plated copper tubes or flexible connectors, **as directed**, with stops.
 - f. Drain: Grid, NPS 1-1/2 (DN 40) with NPS 1-1/2 (DN 40) to NPS 2 (DN 50) adaptor, **as directed**.
 - g. Drain Piping: NPS 1-1/2 (DN 40) **OR** NPS 2 (DN 50), **as directed**, chrome-plated brass; 0.045-inch- (1.1-mm-) thick waste to interceptor; interceptor to wall; and wall flange.
 - h. Plaster Interceptor:
 - 1) Description: Cast-iron or steel body and removable cover with acid-resistant-enameled interior lining and outside coating; removable, corrosion-resistant metal screens or strainer; and NPS 1-1/2 (DN 40) **OR** NPS 2 (DN 50), **as directed**, inlet and outlet.
2. Fixture Support: Sink with white-enameled-steel brackets.

O. Surgeons' Scrub Sinks

1. Stainless-Steel Surgeons' Scrub Sinks:
 - a. Description: Wall-mounting, sink-type medical plumbing fixture.
 - 1) Size: Approximately 31 by 20 inches (790 by 510 mm) with back with 1 faucet hole.
 - 2) Faucet: Chrome-plated-brass, gooseneck type matching fixture.
 - 3) Operation: Foot-pedal **OR** Knee **OR** Automatic, hard-wired electric sensor, **as directed**, control.
 - 4) Supplies: NPS 1/2 (DN 15) chrome-plated copper tubes or flexible connectors, **as directed**, with stops.
 - 5) Drain: Grid, NPS 1-1/2 (DN 40).
 - 6) Drain Piping: NPS 1-1/2 (DN 40) chrome-plated, cast-brass P-trap; 0.045-inch- (1.1-mm-) thick tubular-brass waste to wall; and wall flange.
 - 7) Fixture Support: Sink.
2. Vitreous-China Surgeons' Scrub Sinks:
 - a. Description: Wall-mounting, sink-type medical plumbing fixture.
 - 1) Size: 28 by 22 inches (710 by 560 mm) **OR** 30 by 22 inches (760 by 560 mm), **as directed**, with back or ledge with 1 faucet hole.
 - 2) Color: White.
 - 3) Faucet: Chrome-plated-brass, gooseneck-type matching fixture.
 - 4) Operation: Foot-pedal **OR** Knee, **as directed**, control.
 - 5) Supplies: NPS 1/2 (DN 15) chrome-plated copper tubes or flexible connectors, **as directed**, with stops.
 - 6) Drain: Grid, NPS 1-1/2 (DN 40).
 - 7) Drain Piping: NPS 1-1/2 (DN 40) chrome-plated, cast-brass P-trap; 0.045-inch- (1.1-mm-) thick tubular-brass waste to wall; and wall flange.
 - 8) Fixture Support: Sink.

P. Surgeons' Instrument Sinks:

1. Description: Wall-mounting, stainless-steel, sink-type medical plumbing fixture. Include instrument tray on each side.
 - a. Size: 28 by 20 inches (710 by 510 mm) with 1 hole for deck-mounting faucet.



- b. Faucet: Chrome-plated-brass, gooseneck type matching fixture with knee **OR** foot-pedal, **as directed**, control for mixing hot- and cold-water supplies.
- c. Supplies: NPS 1/2 (DN 15) chrome-plated copper tubes or flexible connectors, **as directed**, with stops.
- d. Drain: Grid, NPS 1-1/2 (DN 40).
- e. Drain Piping: NPS 1-1/2 (DN 40) chrome-plated, cast-brass P-trap; 0.045-inch- (1.1-mm-) thick tubular-brass waste to wall; and wall flange.
- f. Fixture Support: Sink.

Q. Bathing Units

1. Institutional Bath Tubs:

- a. Description: Enameled, cast-iron, island medical plumbing fixture with separate wall-mounting faucet.
 - 1) Size: 66 by 30 by 18 inches (1680 by 765 by 455 mm).
 - 2) Base: Enameled, cast iron to raise rim of bathtub to 28 inches (710 mm) above the floor.
 - 3) Faucet: Shower **OR** Sink, **as directed**, modified to include tub filler spout.
 - 4) Supplies: NPS 1/2 (DN 15) chrome-plated copper tubes or flexible connectors, **as directed**, with stops. Include atmospheric vacuum breaker.
 - 5) Drain: NPS 1-1/2 (DN 40); chrome-plated exposed parts; brass pop-up waste and overflow.
 - 6) Drain Piping: NPS 1-1/2 (DN 40) chrome-plated, cast-brass P-trap; 0.045-inch- (1.1-mm-) thick tubular-brass waste to wall; and wall flange.

2. Bathing Units:

- a. Description: Plastic-tub, institutional side-entry bath **OR** whirlpool-bath, **as directed**, fixture with integral controls.
 - 1) Tub Size: 60 by 30 inches (1525 by 765 mm).
 - 2) Controls: Vacuum breakers on supplies, thermostatic mixing valve, tub fill spout, and hand-held shower head.
 - 3) Supplies: NPS 3/4 (DN 20) **OR** NPS 1 (DN 25), **as directed**, copper tubing with ball, gate, or globe valves.
 - 4) Drain: NPS 1-1/2 (DN 40) and NPS 2 (DN 50).
 - 5) Drain Piping: NPS 1-1/2 (DN 40) **OR** NPS 2 (DN 50), **as directed**, cast-brass P-trap, waste to wall, and wall flange. Include combined drain piping if two drains.

3. Bathing Units:

- a. Description: Plastic-tub, institutional side-entry **OR** transfer-lift-entry **OR** slide-on-entry, **as directed**, adjustable-height **OR** fixed-height, **as directed**, bath fixture with integral controls.
 - 1) Tub Size: 60 by 30 inches (1525 by 765 mm).
 - 2) Controls: Vacuum breakers on supplies, thermostatic mixing valve, tub fill spout, and hand-held shower head.
 - 3) Supplies: NPS 3/4 (DN 20) **OR** NPS 1 (DN 25), **as directed**, copper tubing with ball, gate, or globe valves.
 - 4) Drain: NPS 1-1/2 (DN 40) and NPS 2 (DN 50).
 - 5) Drain Piping: NPS 1-1/2 (DN 40) **OR** NPS 2 (DN 50), **as directed**, cast-brass P-trap, waste to wall, and wall flange. Include combined drain piping if two drains.
 - 6) Lift System: Not required.

4. Bathing Units:

- a. Description: Plastic-tub, institutional front-entry shower fixture with integral controls.
 - 1) Cabinet Size: 35 by 41 inches (889 by 1041 mm).
 - 2) Controls: Vacuum breakers on supplies, thermostatic mixing valve, tub fill spout, and hand-held shower head.
 - 3) Supplies: NPS 3/4 (DN 20) **OR** NPS 1 (DN 25), **as directed**, copper tubing with ball, gate, or globe valves.
 - 4) Drain: NPS 2 (DN 50).
 - 5) Drain Piping: NPS 2 (DN 50) cast-brass P-trap, waste to wall, and wall flange.



5. Residential Bath Tubs:

- a. Description: Plastic island or against-wall-installation, **as directed**, medical plumbing fixture with side door, seat, and separate wall-mounting faucet.
 - 1) Size 1
 - a) Size: Approximately 60 by 32 by 21 inches (1525 by 815 by 535 mm).
 - b) Seat: Integral.
 - c) Drain Location: Left **OR** Right, **as directed**, end.
 - 2) Size 2
 - a) Size: Approximately 60 by 42 by 24.5 inches (1525 by 1070 by 620 mm).
 - b) Seat: Integral bench **OR** None, **as directed**.
 - c) Drain Location: Right end.
 - 3) Material: PMMA.
 - 4) Skirt: Front only **OR** Full, on three sides, **as directed**.
 - 5) Door: Side opening with rubber sealing gasket.
 - 6) Faucet: Shower **OR** Sink, **as directed**, modified to include tub filler spout.
 - 7) Supplies: NPS 1/2 (DN 15) chrome-plated copper tubes or flexible connectors, **as directed**, with stops. Include atmospheric vacuum breaker.
 - 8) Drain: NPS 1-1/2 (DN 40); chrome-plated exposed parts; brass pop-up waste and overflow.
 - 9) Drain Piping: NPS 1-1/2 (DN 40) cast-brass P-trap and 0.045-inch- (1.1-mm-) thick, tubular-brass waste to wall.

R. Sitz Baths:

1. Description: Pedestal-mounting **OR** Wall-mounting, **as directed**, vitreous-china, perineal bath medical plumbing fixture.
 - a. Color: White.
 - b. Drain: NPS 1-1/2 (DN 40) with removable overflow attachment.
 - c. Drain Piping: NPS 1-1/2 (DN 40) chrome-plated, cast-brass P-trap; waste to wall; and wall flange.
 - d. Fixture Support: Sink.
 - e. Faucet:
 - 1) Description: Wall-mounting, single-lever-handle, thermostatic-mixing-valve faucet with concealed supplies and wall-mounting thermometer.
 - a) Material: Brass body and escutcheon.
 - b) Flow Rate: Modified to 1.5 gpm (5.7 L/min.) maximum, unless otherwise indicated.
 - c) Finish: Polished chrome plate.
 - d) Temperature Indicators: Color-coded for hot and cold water.
 - f. Exposed Piping: Chrome-plated; brass pipe or copper tube.

S. Bedpan Washing Equipment

1. Bedpan Washers/Sanitizers:
 - a. Description: Recessed-mounting **OR** On-wall-mounting **OR** Pedestal-mounting, **as directed**, medical plumbing fixture for cleaning bedpans and urinals having cast-iron chamber and waste assembly with spray nozzles and enameled-steel **OR** stainless-steel, **as directed**, front panel and cover box.
 - 1) Controls: Electric, 120-V ac, automatic operation with timer, solenoid valves, and circuit breaker.
 - 2) Door Mechanism: Foot-pedal operation.
 - 3) Supplies: NPS 1 (DN 25) cold water and NPS 3/8 (DN 10) hot water **OR** steam, **as directed**.
 - 4) Drain: NPS 3 (DN 80) P-trap and soil pipe.
 - 5) Atmospheric Vent: NPS 2 (DN 50).
 - 6) Mounting Hardware: Matching fixture mounting arrangement.
 - 7) Accessories:
 - a) Bedpan Rack(s): One **OR** Two, **as directed**.

- b) Urinal Rack(s): One **OR** Two, **as directed**.
 - c) Drain Tray(s): One **OR** Two, **as directed**.
 - 2. Bedpan Washers/Disinfectors:
 - a. Description: Freestanding-mounting **OR** On-wall-mounting **OR** Undercounter-mounting, **as directed**, medical plumbing fixture for cleaning bedpans and urinals; with steam generator, pump, and spray nozzle.
 - 1) Controls: Electric, automatic operation.
 - 2) Cabinet: Stainless steel.
 - 3) Wash Chamber: Stainless steel.
 - 4) Supplies: NPS 1/2 (DN 15) cold water and NPS 1/2 (DN 15) hot water.
 - 5) Drain: NPS 4 (DN 100) P-trap and soil pipe.
 - 6) Mounting Hardware: Matching fixture mounting arrangement.
- T. Hydrotherapy Whirlpools
 - 1. Podiatry Whirlpools:
 - a. Description: Stationary, stainless-steel tank for feet and ankles.
 - 1) Water Capacity: 15 gal. (57 L).
 - 2) Drain: Waste connection.
 - 3) Controls.
 - 4) Thermometer: Control panel or tank mounted.
 - 5) One electric turbine ejector.
 - 2. Upper-Extremity Whirlpools:
 - a. Description: Stationary, pedestal-mounted, stainless-steel tank for arms, hands, and elbows.
 - 1) Water Capacity: 25 gal. (95 L).
 - 2) Drain: Waste connection.
 - 3) One arm support.
 - 4) Controls.
 - 5) Thermometer: Control panel or tank mounted.
 - 6) One electric turbine ejector.
 - 3. High-Tank Body Whirlpools:
 - a. Description: Stationary, stainless-steel tank for legs, hip, and back.
 - 1) Water Capacity: 105 gal. (397 L).
 - 2) Drain: Waste connection.
 - 3) Controls.
 - 4) Thermometer: Control panel or tank mounted.
 - 5) One electric turbine ejector.
 - 4. Low-Tank Body Whirlpools:
 - a. Description: Stationary, extended-length stainless-steel tank for legs, hip, and lower back.
 - 1) Water Capacity: 105 gal. (397 L).
 - 2) Drain: Waste connection.
 - 3) Controls.
 - 4) Thermometer: Control panel or tank mounted.
 - 5) Head rest.
 - 6) One electric turbine ejector.
 - 5. Small, Hubbard Immersion Tanks:
 - a. Description: Stationary, butterfly-shaped tank, for full-body massage
 - 1) Tank Dimensions: 93 by 64 by 22 inches (2362 by 1626 by 560 mm).
 - 2) Overall Height: 34 to 38 inches (864 to 965 mm).
 - 3) Water Capacity: 268 gal. (1014 L).
 - 4) Material: Stainless steel.
 - 5) Supports: Legs or base.
 - 6) Controls.
 - 7) Thermometer: Control panel or tank rim mounted.
 - 8) Supply: Over-the-rim fill spout.



- 9) Drains: Two waste connections.
- 10) Electric Turbine Ejectors: Two; one rail mounted on each side.
- 11) Thermostatic, mixing-valve assembly.
- 12) Hose and hand-held shower.
- 13) Wash-out-hose assembly.
- 14) Stretcher lift.
- 15) Overhead electric, **as directed**, hoist.
6. Medium, Hubbard Immersion Tanks:
 - a. Description: Stationary, butterfly-shaped tank, for full-body massage.
 - 1) Tank Dimensions: 100 by 73 by 24 inches (2540 by 1854 by 610 mm).
 - 2) Overall Height: 34 to 38 inches (864 to 965 mm).
 - 3) Water Capacity: 377 gal. (1468 L).
 - 4) Material: Stainless steel.
 - 5) Supports: Legs or base.
 - 6) Controls.
 - 7) Thermometer: Control panel or tank rim mounted.
 - 8) Supply: Over-the-rim fill spout.
 - 9) Drain: One waste connection.
 - 10) Electric Turbine Ejector: One, panel mounted.
 - 11) Thermostatic, mixing-valve assembly.
 - 12) Hose and hand-held shower.
 - 13) Wash-out-hose assembly.
 - 14) Stretcher lift.
 - 15) Overhead electric, **as directed**, hoist.
7. Large, Hubbard Immersion Tanks:
 - a. Description: Stationary, butterfly-shaped tank, for full-body massage.
 - 1) Tank Dimensions: 106 by 77 by 22 inches (2692 by 1956 by 560 mm).
 - 2) Overall Height: 34 inches (864 mm).
 - 3) Water Capacity: 425 gal. (1609 L).
 - 4) Material: Stainless steel.
 - 5) Supports: Legs or base.
 - 6) Controls.
 - 7) Thermometer: Control panel or tank rim mounted.
 - 8) Supply: Over-the-rim fill spout.
 - 9) Drain(s): One or two waste connections.
 - 10) Electric Turbine Ejectors: Two; one rail mounted on each side.
 - 11) Thermostatic, mixing-valve assembly.
 - 12) Hose and hand-held shower.
 - 13) Wash-out-hose assembly.
 - 14) Stretcher lift.
 - 15) Overhead electric, **as directed**, hoist.
8. Full-Body Immersion Tanks:
 - a. Description: Stationary, rectangular tank, for full-body massage
 - 1) Tank Dimensions: 90 by 32 by 19 inches (2286 by 813 by 483 mm) **OR** 95 by 41 by 22 inches (2413 by 1041 by 560 mm), **as directed**.
 - 2) Overall Height: 32 or 34 inches (813 or 860 mm).
 - 3) Water Capacity: 195 gal. (738 L) **OR** 260 gal. (984 L), **as directed**.
 - 4) Material: Stainless steel.
 - 5) Supports: Legs or base.
 - 6) Controls.
 - 7) Thermometer: Control panel or tank rim mounted.
 - 8) Supply: Over-the-rim fill spout.
 - 9) Drain(s): One or two waste connections.
 - 10) Electric Turbine Ejector: One, tank mounted at end **OR** on rail **OR** on side, **as directed**.
 - 11) Thermostatic, mixing-valve assembly.

- 12) Hose and hand-held shower.
- 13) Wash-out-hose assembly.
- 14) Stretcher lift.
- 15) Overhead electric, **as directed**, hoist.

U. Outlet Boxes

1. Dialysis Equipment Outlet Boxes:

- a. Description: Recessed-mounting outlet box with water supply and drain connections.
 - 1) Box and Faceplate: Stainless steel.
 - 2) Supply Fitting(s): 1 **OR** 2, **as directed**, NPS 1/2 (DN 15) PVC ball valve(s) and adapter with male hose-thread outlet.
 - 3) Drain: NPS 2 (DN 50) standpipe, P-trap, and direct waste connection to drainage piping.
- b. Reinforcement: 2-by-4-inch (50-by-100-mm) fire-retardant-treated-wood blocking between studs. Fire-retardant-treated wood blocking is specified in Division 06 Section "Rough Carpentry".

V. Morgue Equipment

1. Autopsy Tables:

- a. Description: Pedestal stainless-steel table with sink; designed for downdraft ventilation.
 - 1) Material: Stainless steel.
 - 2) Overall Size: Approximately 88 by 30 inches (2250 by 760 mm) with deck faucet holes.
 - 3) Faucet: Deck mounted with wrist- or elbow-blade handles.
 - 4) Aspirator: Deck mounted.
 - 5) Removable body supports.
 - 6) Rinse Assembly: Deck-mounted faucet with hose.
 - 7) Disposer: Not required **OR** Required, **as directed**.
 - 8) Fixture Support: Sink.
 - 9) Receptacle: Duplex, hospital grade with ground-fault interruption.
 - 10) Supplies: Chrome-plated copper tubes or flexible connectors, **as directed**, with atmospheric vacuum breakers and stops.
 - 11) Drain: Chrome-plated, cast-brass P-trap and waste to wall.

2. Dissecting Sinks:

- a. Description: Wall-mounting sink with backsplash.
 - 1) Material: Stainless steel.
 - 2) Overall Size: 84 by 28 inches (2134 by 711 mm) with back faucet holes.
 - 3) Sink Size: Approximately 30 inches (763 mm) wide.
 - 4) Equipment drawer.
 - 5) Faucet: Back mounted with wrist- or elbow-blade handles.
 - 6) Aspirator: Back mounted.
 - 7) Rinse Assembly: One back-mounted faucet with hose.
 - 8) Disposer: Not required **OR** Required, **as directed**.
 - 9) Fixture Support: Sink.
 - 10) Supplies: Chrome-plated copper tubes or flexible connectors, **as directed**, with atmospheric vacuum breakers and stops.
 - 11) Drain: Chrome-plated, cast-brass P-trap and waste to wall.
 - 12) Back-mounted, hand-held-type eye wash.

1.3 EXECUTION

A. Installation

1. Assemble medical plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.



2. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
 - a. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 - b. Use carrier supports without waste fitting for fixtures with tubular waste piping.
 - c. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
 3. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
 4. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
 5. Install wall-mounting fixtures with tubular waste piping attached to supports.
 6. Install counter-mounting fixtures in and attached to casework.
 7. Install fixtures level and plumb according to roughing-in drawings.
 8. Install water-supply piping with stop on each supply to each fixture to be connected to domestic water piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
 - a. Exception: Use ball, gate, or globe valve if stops are not specified with fixture. Valves are specified in Division 22 Section "General-duty Valves For Plumbing Piping".
 9. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
 10. Install flushometer valves for accessible water closets with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
 11. Install toilet seats on water closets.
 12. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
 13. Install shower flow-control fittings with specified maximum flow rates in shower arms.
 14. Install traps on fixture outlets.
 - a. Exception: Omit trap on fixtures with integral traps.
 15. Install escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results For Plumbing".
 16. Set showers in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results For Plumbing".
 17. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants".
- B. Connections
1. Piping installation requirements are specified in other Division 14.. Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Connect water supplies from domestic water piping to medical plumbing fixtures.
 3. Connect drain piping from medical plumbing fixtures to sanitary waste and vent piping.
 4. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 5. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
- C. Field Quality Control
1. Verify that installed medical plumbing fixtures are categories and types specified for locations where installed.
 2. Check that medical plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
 3. Inspect installed medical plumbing fixtures for damage. Replace damaged fixtures and components.
 4. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
 5. Install fresh batteries in sensor-operated mechanisms.



- D. Adjusting
 - 1. Operate and adjust faucets and controls. Replace damaged and malfunctioning medical plumbing fixtures, fittings, and controls.
 - 2. Adjust water pressure at faucets, shower valves, and flushometer valves to produce proper flow and stream.
 - 3. Replace washers and seals of leaking and dripping faucets and stops.
- E. Cleaning
 - 1. Clean medical plumbing fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
 - a. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
 - b. Remove sediment and debris from drains.
 - 2. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.
- F. Protection
 - 1. Provide protective covering for installed fixtures and fittings.
 - 2. Do not allow use of medical plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 43 39 00



Task	Specification	Specification Description
22 43 39 00	22 01 40 00	Emergency Plumbing Fixtures



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SECTION 22 45 00 00 - MPF EMERGENCY PLUMBING FIXTURES

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following emergency plumbing fixtures:
 - 1. Emergency showers.
 - 2. Eye/face wash equipment.
 - 3. Combination units.
 - 4. Water-tempering equipment.
- B. See Division 22 Section "Domestic Water Piping Specialties" for backflow preventers.
- C. See Division 22 Section "Sanitary Waste Piping Specialties" for floor drains.

1.2 DEFINITIONS

- A. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.
- C. Tepid: Moderately warm.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.
- B. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."



- B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act" for plumbing fixtures for people with disabilities.
- C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

PART 2 - PRODUCTS

2.1 EMERGENCY SHOWERS

- A. Emergency Showers:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Bradley Corporation.
 - b. Chicago Faucets.
 - c. Encon Safety Products.
 - d. Guardian Equipment Co.
 - e. Haws Corporation.
 - f. Lab Safety Supply Inc.
 - g. Speakman Company.
 - 2. Description: Plumbed, single-shower-head vertical, freestanding emergency shower.
 - a. Capacity: Deliver potable water at rate not less than 20 gpm for at least 15 minutes.
 - b. Supply Piping: NPS 1galvanized steel, chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Pull rod or chain.
 - d. Shower Head: 8-inch minimum diameter, chrome-plated brass, stainless steel or plastic.

2.2 EYE/FACE WASH EQUIPMENT

- A. Eye/Face Wash Equipment:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Bradley Corporation.
 - b. Chicago Faucets.
 - c. Encon Safety Products.
 - d. Guardian Equipment Co.
 - e. Haws Corporation.
 - f. Lab Safety Supply Inc.
 - g. Speakman Company.
 - 2. Description: Plumbed, accessible, wall-mounting eye/face wash equipment with receptor and wall bracket.
 - a. Capacity: Deliver potable water at rate not less than 3.0 gpm for at least 15 minutes.
 - b. Supply Piping: NPS 1/2 chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Paddle.
 - d. Receptor: [Chrome-plated brass or stainless-steel] [Plastic] bowl.
 - e. Drain Piping: NPS 1-1/4 minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2.



2.3 COMBINATION UNITS

A. Combination Units:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Bradley Corporation.
 - b. Chicago Faucets.
 - c. Encon Safety Products.
 - d. Guardian Equipment Co.
 - e. Haws Corporation.
 - f. Lab Safety Supply Inc.
 - g. Speakman Company.
2. Description: Plumbed, accessible, freestanding, with emergency shower and eye/face wash equipment.
 - a. Piping: Galvanized steel.
 - 1) Unit Supply: NPS 1-1/4 minimum.
 - 2) Unit Drain: Outlet at side near bottom.
 - 3) Shower Supply: NPS 1 with flow regulator and stay-open control valve.
 - 4) Eye/Face Wash Supply: NPS 1/2 with flow regulator and stay-open control valve.
 - b. Shower Capacity: Deliver potable water at rate not less than 20 gpm for at least 15 minutes.
 - 1) Control-Valve Actuator: Pull rod or chain.
 - 2) Receptor: Sloped floor drain.
 - c. Eye/Face Wash Equipment: With capacity to deliver potable water at rate not less than 3.0 gpm for at least 15 minutes.
 - 1) Control-Valve Actuator: Paddle.
 - 2) Receptor: Chrome-plated brass or stainless-steel or plastic bowl.

2.4 WATER-TEMPERING EQUIPMENT

A. Water-Tempering Equipment:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armstrong International, Inc.
 - b. Bradley Corporation.
 - c. Encon Safety Products.
 - d. Haws Corporation.
 - e. Lawler Manufacturing Co., Inc.
 - f. Leonard Valve Company.
 - g. Powers, a Watts Industries Co.
 - h. Speakman Company.
 - i. Therm-Omega-Tech, Inc.
 - j. Western Emergency Equipment.
2. Description: Factory-fabricated, hot- and cold-water-tempering equipment with thermostatic mixing valve.
 - a. Thermostatic Mixing Valve: Designed to provide tepid, 75 deg F potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, metal piping, and corrosion-resistant enclosure.



PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.
- B. Install fixtures level and plumb.
- C. Fasten fixtures to substrate.
- D. Install shutoff valves in water-supply piping to fixtures. Use ball, gate, or globe valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
 - 1. Exception: Omit shutoff valve on supply to group of plumbing fixtures that includes emergency plumbing fixture.
 - 2. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.
- E. Install shutoff valve and strainer in steam piping and shutoff valve in condensate return piping.
- F. Install dielectric fitting in supply piping to fixture if piping and fixture connections are made of different metals. Dielectric fittings are specified in Division 22 Section "Common Work Results for Plumbing."
- G. Install thermometers in supply and outlet piping connections to water-tempering equipment. Thermometers are specified in Division 22 Section "Meters and Gages for Plumbing Piping."
- H. Install trap and waste to wall on drain outlet of fixture receptors that are indicated to be directly connected to drainage system.
- I. Install indirect waste piping to wall on drain outlet of fixture receptors that are indicated to be indirectly connected to drainage system. Drainage piping is specified in Division 22 Section "Sanitary Waste and Vent Piping."
- J. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- K. Install equipment nameplates or equipment markers on fixtures and equipment signs on water-tempering equipment. Identification materials are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."
- L. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- M. Connect cold-water-supply piping to plumbed emergency plumbing fixtures not having water-tempering equipment.
- N. Connect hot- and cold-water-supply piping to hot- and cold-water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures.
- O. Directly connect emergency plumbing fixture receptors with trapped drain outlet to sanitary drainage and vent piping.
- P. Indirectly connect emergency plumbing fixture receptors without trapped drain outlet to sanitary or storm drainage piping.



- Q. Adjust or replace fixture flow regulators for proper flow.
- R. Adjust equipment temperature settings.

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END OF SECTION 22 45 00 00



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SECTION 22 45 00 00 - CSF EMERGENCY PLUMBING FIXTURES

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.22 45 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following emergency plumbing fixtures:
 - 1. Emergency showers.
 - 2. Eye/face wash equipment.
 - 3. Combination units.
 - 4. Water-tempering equipment.
- B. See Division 22 Section "Domestic Water Piping Specialties" for backflow preventers.
- C. See Division 22 Section "Sanitary Waste Piping Specialties" for floor drains.

1.2 DEFINITIONS

- A. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.
- C. Tepid: Moderately warm.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.
- B. Operation and maintenance data.



1.4 QUALITY ASSURANCE

- A. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."
- B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act" for plumbing fixtures for people with disabilities.
- C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

PART 2 - PRODUCTS

2.1 EMERGENCY SHOWERS

- A. Emergency Showers:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Bradley Corporation.
 - b. Chicago Faucets.
 - c. Encon Safety Products.
 - d. Guardian Equipment Co.
 - e. Haws Corporation.
 - f. Lab Safety Supply Inc.
 - g. Speakman Company.
 - 2. Description: Plumbed, single-shower-head vertical, freestanding emergency shower.
 - a. Capacity: Deliver potable water at rate not less than 20 gpm for at least 15 minutes.
 - b. Supply Piping: NPS 1galvanized steel, chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Pull rod or chain.
 - d. Shower Head: 8-inch minimum diameter, chrome-plated brass, stainless steel or plastic.

2.2 EYE/FACE WASH EQUIPMENT

- A. Eye/Face Wash Equipment:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Bradley Corporation.
 - b. Chicago Faucets.
 - c. Encon Safety Products.
 - d. Guardian Equipment Co.
 - e. Haws Corporation.
 - f. Lab Safety Supply Inc.
 - g. Speakman Company.
 - 2. Description: Plumbed, accessible, wall-mounting eye/face wash equipment with receptor and wall bracket.
 - a. Capacity: Deliver potable water at rate not less than 3.0 gpm for at least 15 minutes.
 - b. Supply Piping: NPS 1/2 chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Paddle.
 - d. Receptor: [Chrome-plated brass or stainless-steel] [Plastic] bowl.



- e. Drain Piping: NPS 1-1/4 minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2.

2.3 COMBINATION UNITS

A. Combination Units:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Bradley Corporation.
 - b. Chicago Faucets.
 - c. Encon Safety Products.
 - d. Guardian Equipment Co.
 - e. Haws Corporation.
 - f. Lab Safety Supply Inc.
 - g. Speakman Company.
2. Description: Plumbed, accessible, freestanding, with emergency shower and eye/face wash equipment.
 - a. Piping: Galvanized steel.
 - 1) Unit Supply: NPS 1-1/4 minimum.
 - 2) Unit Drain: Outlet at side near bottom.
 - 3) Shower Supply: NPS 1 with flow regulator and stay-open control valve.
 - 4) Eye/Face Wash Supply: NPS 1/2 with flow regulator and stay-open control valve.
 - b. Shower Capacity: Deliver potable water at rate not less than 20 gpm for at least 15 minutes.
 - 1) Control-Valve Actuator: Pull rod or chain.
 - 2) Receptor: Sloped floor drain.
 - c. Eye/Face Wash Equipment: With capacity to deliver potable water at rate not less than 3.0 gpm for at least 15 minutes.
 - 1) Control-Valve Actuator: Paddle.
 - 2) Receptor: Chrome-plated brass or stainless-steel or plastic bowl.

2.4 WATER-TEMPERING EQUIPMENT

A. Water-Tempering Equipment:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armstrong International, Inc.
 - b. Bradley Corporation.
 - c. Encon Safety Products.
 - d. Haws Corporation.
 - e. Lawler Manufacturing Co., Inc.
 - f. Leonard Valve Company.
 - g. Powers, a Watts Industries Co.
 - h. Speakman Company.
 - i. Therm-Omega-Tech, Inc.
 - j. Western Emergency Equipment.
2. Description: Factory-fabricated, hot- and cold-water-tempering equipment with thermostatic mixing valve.



- a. Thermostatic Mixing Valve: Designed to provide tepid, 75 deg F potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, metal piping, and corrosion-resistant enclosure.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.
- B. Install fixtures level and plumb.
- C. Fasten fixtures to substrate.
- D. Install shutoff valves in water-supply piping to fixtures. Use ball, gate, or globe valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
 - 1. Exception: Omit shutoff valve on supply to group of plumbing fixtures that includes emergency plumbing fixture.
 - 2. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.
- E. Install shutoff valve and strainer in steam piping and shutoff valve in condensate return piping.
- F. Install dielectric fitting in supply piping to fixture if piping and fixture connections are made of different metals. Dielectric fittings are specified in Division 22 Section "Common Work Results for Plumbing."
- G. Install thermometers in supply and outlet piping connections to water-tempering equipment. Thermometers are specified in Division 22 Section "Meters and Gages for Plumbing Piping."
- H. Install trap and waste to wall on drain outlet of fixture receptors that are indicated to be directly connected to drainage system.
- I. Install indirect waste piping to wall on drain outlet of fixture receptors that are indicated to be indirectly connected to drainage system. Drainage piping is specified in Division 22 Section "Sanitary Waste and Vent Piping."
- J. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- K. Install equipment nameplates or equipment markers on fixtures and equipment signs on water-tempering equipment. Identification materials are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."
- L. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- M. Connect cold-water-supply piping to plumbed emergency plumbing fixtures not having water-tempering equipment.
- N. Connect hot- and cold-water-supply piping to hot- and cold-water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures.



- O. Directly connect emergency plumbing fixture receptors with trapped drain outlet to sanitary drainage and vent piping.
- P. Indirectly connect emergency plumbing fixture receptors without trapped drain outlet to sanitary or storm drainage piping.
- Q. Adjust or replace fixture flow regulators for proper flow.
- R. Adjust equipment temperature settings.

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SECTION 22 47 00 00 - MPF DRINKING FOUNTAINS AND WATER COOLERS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Type PB, pressure with bubbler, Style W, wall-mounting water coolers.
 - 2. Fixture supports.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities and ADA/USPS Handbook RE-4 for plumbing fixtures for people with disabilities.
- C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- D. ARI Standard: Comply with ARI's "Directory of Certified Drinking Water Coolers" for style classifications.
- E. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.



- F. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants" for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.

PART 2 - PRODUCTS

2.1 PRESSURE WATER COOLERS

A. Water Coolers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Elkay Manufacturing Co.
 - b. Halsey Taylor.
 - c. Haws Corporation.
 - d. Larco, Inc.
 - e. Oasis Corporation.
 - f. Sunroc Corp.
2. Description: ARI 1010, Type PB, pressure with bubbler, Style W, bi-level wall mounting water cooler.
 - a. Cabinet: Vinyl-covered steel with stainless-steel top.
 - b. Bubbler: One, with adjustable stream regulator, located on deck.
 - c. Control: [Push button] [Foot pedal] <Insert control>.
 - d. Supply: NPS 3/8 with ball, gate, or globe valve.
 - e. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
 - f. Drain: Grid with NPS 1-1/4 minimum horizontal waste and trap complying with ASME A112.18.2.
 - g. Cooling System: Electric, hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
 - 1) Capacity: 8 gph of 50 deg F cooled water from 80 deg F inlet water and 90 deg F ambient air temperature.
 - 2) Electrical Characteristics: 120-V ac; single phase; 60 Hz.
 - h. Support: Type II, water cooler carrier. Refer to "Fixture Supports" Article.

2.2 FIXTURE SUPPORTS

- #### A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Josam Co.
 2. MIFAB Manufacturing, Inc.
 3. Smith, Jay R. Mfg. Co.
 4. Tyler Pipe; Wade Div.
 5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
 6. Zurn Plumbing Products Group; Specification Drainage Operation.
- #### B. Description: ASME A112.6.1M, water cooler carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.
1. Type I: Hanger-type carrier with two vertical uprights.
 2. Type II: Bilevel, hanger-type carrier with three vertical uprights.



PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Use carrier off-floor supports for wall-mounting fixtures, unless otherwise indicated.
- B. Set freestanding and pedestal drinking fountains on floor.
- C. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view.

3.2 INSTALLATION

- A. Install off-floor supports affixed to building substrate and attach wall-mounting fixtures, unless otherwise indicated.
- B. Install fixtures level and plumb. For fixtures indicated for children, install at height required by authorities having jurisdiction.
- C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- E. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- F. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

- A. Connect fixtures with water supplies, traps, and risers, and with soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Water Cooler Testing: After electrical circuitry has been energized, test for compliance with requirements. Test and adjust controls and safeties.
 - 1. Remove and replace malfunctioning units and retest as specified above.
 - 2. Report test results in writing.

3.5 ADJUSTING

- A. Adjust fixture flow regulators for proper flow and stream height.



- B. Adjust water cooler temperature settings.

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END OF SECTION 22 47 00 00



Task	Specification	Specification Description
22 47 13 00	01 22 16 00	No Specification Required
22 47 16 00	01 22 16 00	No Specification Required
22 47 16 00	22 01 40 00	Emergency Plumbing Fixtures
22 51 13 00	01 22 16 00	No Specification Required
22 51 16 00	01 22 16 00	No Specification Required
22 51 19 00	01 22 16 00	No Specification Required



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SECTION 22 66 83 16 - CHEMICAL-WASTE SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for chemical-waste systems for laboratory and healthcare facilities. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

C. Summary

1. Section Includes:
 - a. Single-wall piping.
 - b. Double-containment piping.
 - c. Field-fabrication containment piping.
 - d. Piping specialties.
 - e. Neutralization tanks.
 - f. Neutralization systems.
 - g. Manholes.
 - h. Leak-detection systems.

D. Definitions

1. CR: Chlorosulfonated polyethylene synthetic rubber.
2. FPM: Vinylidene fluoride-hexafluoro propylene copolymer rubber.

E. Performance Requirements

1. Single-Wall Piping Pressure Rating: 10 feet head of water (30 kPa).
2. Double-Containment Piping Pressure Rating:
 - a. Carrier Piping: 5-psig (34.5-kPa) air test pressure.
 - b. Containment Piping: 5-psig (34.5-kPa) air test pressure.
3. Field-Fabrication Containment-Piping Pressure Rating: 5-psig (34.5-kPa) air test pressure.
4. Delegated Design: Design seismic restraints for aboveground piping, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

F. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content.
3. Shop Drawings: For neutralization system and leak-detection system. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail neutralization-system assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Detail leak-detection-system assemblies and indicate required clearances, method of field assembly, components, and location and size of each field connection.
 - c. Wiring Diagrams: For power, signal, and control wiring.
4. Delegated-Design Submittal: For seismic restraints of aboveground piping, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
5. Profile Drawings for Outdoor Underground Piping: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet (1:500) and vertical scale of not



less than 1 inch equals 5 feet (1:50). Indicate underground structures and pipes. Show types, sizes, materials, and elevations of other utilities crossing system piping.

6. Field quality-control test reports.
7. Operation and Maintenance Data: For chemical-waste specialties and neutralization tanks, neutralization systems, and leak-detection systems to include in emergency, operation, and maintenance manuals.

G. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. NFPA Compliance: Comply with NFPA 70, "National Electrical Code."

H. Delivery, Storage, And Handling

1. Deliver and store piping and specialties with sealing plugs in ends or with end protection.
2. Do not store plastic pipe or fittings in direct sunlight.
3. Protect pipe, fittings, and seals from dirt and damage.

I. Project Conditions

1. Interruption of Existing Chemical-Waste Service: Do not interrupt chemical-waste service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary chemical-waste service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of chemical-waste service.
 - b. Do not proceed with interruption of chemical-waste service without the Owner's written permission.

1.2 PRODUCTS

A. Single-Wall Pipe And Fittings

1. PE Drainage Pipe and Fittings: Made of ASTM D 4976, PE resin.
 - a. Pipe: ASTM F 1412, Schedule 40.
 - b. Fittings: ASTM F 1412, Schedule 40, socket-fusion, drainage pattern complying with ASTM D 3311.
2. PP Drainage Pipe and Fittings: ASTM F 1412, pipe extruded and drainage-pattern fittings molded, with Schedule 40 dimensions, from PP resin with fire-retardant additive complying with ASTM D 4101; with fusion **OR** fusion- and mechanical **OR** mechanical, **as directed**, joint ends.
 - a. Exception: Pipe and fittings made from PP resin without fire-retardant additive may be used for underground installation.
3. PVC Drainage Pipe and Fittings: ASTM D 2665, pipe and drainage-pattern fittings.
4. PVDF Drainage Pipe and Fittings: ASTM F 1673, Schedule 40, pipe and drainage-pattern fittings. Include fittings with fusion **OR** fusion- and mechanical **OR** mechanical, **as directed**, joint ends.
5. Fiberglass Pipe and Fittings, Centrifugally Cast: ASTM D 2997, Type II, Grade 1 **OR** Grade 2, **as directed**, Class A **OR** Class B **OR** Class C, **as directed**, RTRP pipe; with ASTM D 5685, Type 4, RTRF fittings matching pipe; and adhesive-bonding **OR** butt-and-wrap-joint, **as directed**, materials. Include wall thickness that will provide 160-psig (1105-kPa) minimum, sustained water test pressure rating.
6. Fiberglass Pipe and Fittings, Filament Wound: ASTM D 2996, Type I, Grade 1 **OR** Grade 2, **as directed**, Class A **OR** Class B **OR** Class C **OR** Class E **OR** Class F, **as directed**, RTRP pipe; ASTM D 5685, Type 1, RTRF fittings matching pipe; and adhesive-bonding **OR** butt-and-wrap-joint, **as directed**, materials. Include wall thickness that will provide 160-psig (1105-kPa) minimum, sustained water test pressure rating.



7. High-Silicon-Iron, Hub-and-Plain-End Pipe and Fittings: ASTM A 861, pipe and drainage-pattern fittings; acid-resistant packing; and lead calking materials.
 8. High-Silicon-Iron, Mechanical-Joint Pipe and Fittings: ASTM A 861, pipe and drainage-pattern fittings; and stainless-steel clamps with TFE inner sleeve and CR outer sleeve.
 9. Stainless-Steel Drainage Pipe and Fittings: ASME A112.3.1, ASTM A 666, Type 316L, stainless-steel pipe and drainage-pattern fittings; with socket and spigot ends for gasket joints; and having piping manufacturer's FPM lip-seal rubber gaskets shaped to fit socket groove, with plastic backup ring.
 10. Borosilicate Glass Pipe and Fittings: ASTM C 1053, pipe and drainage-pattern fittings; with manufacturer's standard couplings.
 - a. Covering: Factory-applied polystyrene for pipe installed underground.
 11. Adapters and Transition Fittings: Assemblies with combination of clamps, couplings, adapters, and gaskets; compatible with piping and system liquid; made for joining different piping materials.
- B. Double-Containment Pipe And Fittings
1. Description: Factory-fabricated, double-wall pipe and fittings. Sizes indicate carrier-pipe size; with carrier (inner) pipe and fittings; annular-space, carrier-pipe supports; containment (outer) pipe and fittings; and joining materials and fasteners. Include manufacturer's standard piping materials according to the following:
 - a. PE, Double-Containment Drainage Pipe and Fittings: Made of ASTM D 4976, PE resin.
 - 1) Carrier and Containment Pipes: ASTM F 1412, Schedule 40.
 - 2) Fittings: ASTM F 1412, Schedule 40 drainage pattern complying with ASTM D 3311.
 - b. PP, Double-Containment Drainage Pipe and Fittings: Made of ASTM D 4101, PP resin.
 - 1) Carrier and Containment Pipes: ASTM F 1412, Schedule 40.
 - 2) Fittings: ASTM F 1412, Schedule 40 drainage pattern complying with ASTM D 3311.
 - c. PP/PVC, Double-Containment Drainage Pipe and Fittings:
 - 1) PP Carrier Pipe: ASTM F 1412, Schedule 40; made of ASTM D 4101, PP resin.
 - 2) PP Carrier-Pipe Fittings: ASTM F 1412, Schedule 40 drainage pattern complying with ASTM D 3311; made of ASTM D 4101, PP resin.
 - 3) PVC Containment Pipe: ASTM D 2665, PVC pipe.
 - 4) PVC Containment Pipe Fittings: ASTM D 2665, PVC drainage pattern.
 - d. PVDF, Double-Containment Drainage Pipe and Fittings: Made of ASTM D 3222, PVDF resin.
 - 1) Carrier and Containment Pipes: ASTM F 1673, Schedule 40.
 - 2) Fittings: ASTM F 1673, Schedule 40 drainage pattern complying with ASTM D 3311.
 - e. PVDF/PVC, Double-Containment Drainage Pipe and Fittings:
 - 1) PVDF Carrier Pipe: ASTM F 1673, Schedule 40; made of ASTM D 3222, PVDF resin.
 - 2) PVDF Carrier-Pipe Fittings: ASTM F 1673, Schedule 40 drainage pattern complying with ASTM D 3311; made of ASTM D 3222, PVDF resin.
 - 3) PVC Containment Pipe: ASTM D 2665, PVC pipe.
 - 4) PVC Containment Pipe Fittings: ASTM D 2665, PVC drainage pattern.
 2. Include design and fabrication of double-containment pipe and fitting assemblies with provision for field installation of cable leak-detection system in annular space between carrier and containment piping.
- C. Field-Fabrication Containment Piping
1. Description: Containment split pipe and split fittings with carrier-pipe centralizers. Include manufacturer's fastening devices and materials.
 - a. Material: HDPE **OR** PP **OR** Yellow PVC **OR** Clear PVC, **as directed**, pipe and fittings.
 - b. Fastening System: FPM gaskets, clamps, and pins.



- c. Material: Clear PVC pipe and fittings with adhesive channels, for use with drainage-pattern carrier piping.
 - d. Fastening System: Adhesive.
- D. Joining Materials
 - 1. Couplings: Assemblies with combination of clamps, gaskets, sleeves, and threaded or flanged parts; compatible with piping and system liquid; and made by piping manufacturer for joining system piping.
 - 2. Adapters and Transition Fittings: Assemblies with combination of clamps, couplings, adapters, gaskets, and threaded or flanged parts; compatible with piping and system liquid; and made for joining different piping materials.
 - 3. Flanges: Assemblies of companion flanges and gaskets complying with ASME B16.21 and compatible with system liquid, and bolts and nuts.
 - 4. Solvent Cement for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - a. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 5. Fiberglass-Pipe Adhesive: As furnished or recommended by pipe manufacturer.
 - a. Use fiberglass adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Piping Specialties
 - 1. Plastic Dilution Traps:
 - a. Material: Corrosion-resistant PP, with removable base.
 - b. End Connections: Mechanical joint.
 - c. Dilution Tanks: 1-gal. (3.8-L) capacity, with clear base unless colored base is indicated; with two NPS 1-1/2 (DN 40) top inlets and one NPS 1-1/2 (DN 40) side outlet.
 - d. Small Dilution Jars: 1-pint (0.5-L) capacity, with clear base unless colored base is indicated; with NPS 1-1/2 (DN 40) top inlet and NPS 1-1/2 (DN 40) side outlet.
 - e. Large Dilution Jars: 1-quart (1-L) capacity; with NPS 1-1/2 (DN 40) top inlet and NPS 1-1/2 (DN 40) side outlet.
 - 2. High-Silicon-Iron Dilution Traps:
 - a. Standard: ASTM A 861.
 - b. Size: NPS 1-1/2 or NPS 2 (DN 40 or DN 50) as required for fixture and waste.
 - c. End Connections: Mechanical.
 - 3. Glass, Drain-Line, Interceptor Traps:
 - a. Standard: ASTM C 1053.
 - b. Type: Drum trap.
 - c. Size: NPS 1-1/2 (DN 40), NPS 2 by NPS 1-1/2 (DN 50 by DN 40), or NPS 2 (DN 50), as required to match connecting piping.
 - 4. Corrosion-Resistant Traps:
 - a. Type: P-trap or drum trap.
 - b. Size: NPS 1-1/2 or NPS 2 (DN 40 or DN 50), as required to match connected piping.
 - c. High-Silicon Iron: ASTM A 861, with horizontal outlet and hub-and-plain or plain ends to match connecting piping.
 - d. PP: ASTM D 4101, with mechanical-joint pipe connections.
 - e. PVDF: ASTM D 3222, with mechanical-joint pipe connections.
 - f. Glass: ASTM C 1053, with coupling pipe connections.
 - 5. High-Silicon-Iron Floor Drains:
 - a. Standard: ASTM A 861.
 - b. Body: With integral flashing flange and weep holes; and with flashing ring and stainless-steel strip, sediment basin and funnel attachment, **as directed**.



- c. Top: 8-3/4-inch (222-mm) diameter with grate.
 - d. Size: NPS 2, NPS 3, NPS 4, or NPS 6 (DN 50, DN 80, DN 100, or DN 150) outlet as indicated.
 - 6. Stainless-Steel Floor Drains:
 - a. Standard: ASME A112.3.1, ASTM A 666, Type 316L.
 - b. Body: With 8.5-by-8.5-inch (215-by-215-mm) **OR** 12.4-by-12.4-inch (315-by-315-mm), **as directed**, top with grate.
 - c. Outlet: Bottom, of size indicated.
 - 7. PP Floor Drains:
 - a. Body: With 7- to 9-inch (178- to 230-mm) top diameter, with flashing flange and weep holes; and with flashing clamp, basket strainer, funnel attachment, and trap-primer connection, **as directed**.
 - b. Outlet: Bottom, to match connecting pipe, with NPS 2, NPS 3, NPS 4, or NPS 6 (DN 50, DN 80, DN 100, or DN 150) outlet as indicated.
 - 8. High-Silicon-Iron Cleanouts:
 - a. Standard: ASTM A 861, fitting with PTFE gasket and closure plug, of design appropriate for piping application.
 - 9. Stainless-Steel Cleanouts:
 - a. Standard: ASME A112.3.1, ASTM A 666, Type 316L, stainless steel.
 - b. Aboveground Piping: Cleanout tee of size matching piping.
 - c. Underground and Underslab Piping: Floor access cleanout of size matching piping.
 - 10. High-Silicon-Iron Backwater Valves:
 - a. Standard: ASTM A 861.
 - b. Body: Hub-and-plain end with swing-check valve; and with high-silicon-iron pipe extension of length to reach floor surface, and high-silicon-iron closure plug, **as directed**.
 - 11. Plastic Backwater Valves:
 - a. Description: Full-port NPS 3 (DN 80) check valve, PP or PVDF, matching or compatible with system piping and compatible with system liquid, with EPDM seals and flanged ends.
 - 1) Exception: PVC material for use with PVC piping systems.
 - 12. High-Silicon-Iron Sink Outlets:
 - a. Standard: ASTM A 861, high-silicon iron, NPS 1-1/2 (DN 40), with clamping device and 4-, 6-, or 8-inch- (100-, 150-, or 200-mm-) high overflow fitting, as indicated.
 - 13. PP Sink Outlets:
 - a. Description: NPS 1-1/2 (DN 40), with clamping device, stopper, and 7-inch- (178-mm-) high overflow fitting.
 - 14. Glass Sink Outlets:
 - a. Standard: ASTM C 1053, components for field assembly, NPS 1-1/2 (DN 40); with sink assembly of outlet, strainer, gasket, and locknut; overflow fitting of length indicated; and tailpiece assembly of borosilicate glass and locknut.
- F. Neutralization Tanks
- 1. Plastic Neutralization Tanks:
 - a. Description: Corrosion-resistant plastic materials; with removable, gastight cover; interior, sidewall, dip-tube inlet; outlet; vent; and threaded or flanged, sidewall pipe connections.
 - 1) Material: HDPE **OR** ASTM D 4101, PP, **as directed**.
 - 2) Tank Capacity: as directed by the Owner.
 - 3) Dip Tube: On outlet pipe instead of inlet pipe.
 - 4) Extension: HDPE, PE, or PP.
 - 5) Traffic Cover: Light-duty **OR** Heavy-duty pedestrian or light-duty vehicular, steel plate over, **as directed**, plastic, bolted.
 - 6) Limestone: Chips or lumps, with more than 90 percent calcium carbonate content and 1- to 3-inch (25- to 75-mm) diameter.
- OR**



Dolomitic Limestone: Chips or lumps, with more than 90 percent combined magnesium carbonate and calcium carbonate content and 1- to 3-inch (25- to 75-mm) diameter.

2. Ceramic Neutralization Tanks:

a. Description: Corrosion-resistant, cast-ceramic shell; with removable, reinforced-plastic, gastight cover; inlet; interior, sidewall, dip-tube outlet; vent; and bell, sidewall pipe connections.

1) Extension: Ceramic, of size and length indicated, and with cast-iron manhole frame and cover.

OR

Extension: Steel with protective coating, 28-inch (710-mm) diameter, and cast-iron manhole frame and cover.

2) Limestone: Chips or lumps, with more than 90 percent calcium carbonate content and 1- to 3-inch (25- to 75-mm) diameter.

OR

Dolomitic Limestone: Chips or lumps, with more than 90 percent combined magnesium carbonate and calcium carbonate content and 1- to 3-inch (25- to 75-mm) diameter.

3. Collection Tanks: Corrosion-resistant, cast-ceramic shell. Include removable, reinforced-plastic, gastight cover; inlet; vent; and bell, sidewall pipe connections.

a. Extension: Ceramic **OR** Steel with protective coating, **as directed**, 28-inch (710-mm) minimum diameter, and cast-iron manhole frame and cover.

G. Neutralization Systems

1. Plastic-Tank Neutralization Systems:

a. Description: Automatic system for neutralizing chemical waste.

1) Controls: Factory-wired and -tested, 120-V ac, to operate probes, control valves, and metering pumps and to monitor pH of effluent; with wiring and electrical-power terminals.

2) Panel: NEMA 250, Type 4X enclosure, unless otherwise indicated; with manufacturer's standard features, control devices, and indicators, but not less than the following:

a) Power light and on/off switch.

b) pH analyzer with meter and high- and low-pH indicators.

c) Low caustic- and acid-solution level indicators.

d) Alarm horn with silencer and reset switch.

e) Agitator running light with on/off switch.

f) Running lights with on/off switches for caustic- and acid-solution pumps.

3) Strip chart recorder with capacity for 30-day record.

4) Piping between Tanks: Same material as chemical-waste piping system unless otherwise indicated.

5) Interceptor Tank: Same material as mixing tank; with removable, gastight cover; and sidewall inlet and outlet piping connections.

6) Neutralization Tank: Same material as mixing tank; with removable, gastight cover; sidewall inlet and outlet piping connections; and vent connection in sidewall or top.

a) Limestone: Chips or lumps, with more than 90 percent calcium carbonate content and 1- to 3-inch (25- to 75-mm) diameter.

OR

Dolomitic Limestone: Chips or lumps, with more than 90 percent combined magnesium carbonate and calcium carbonate content and 1- to 3-inch (25- to 75-mm) diameter.

7) Mixing Tank: With removable, gastight cover; sidewall inlet and outlet piping connections; vent connection in sidewall or top; neutralizing-solution piping connections; and openings in top for probe and agitator.



- a) Material: HDPE **OR** ASTM D 4101, PP, **as directed**.
 - b) pH Probe: Type and length suitable for mixing-tank size.
 - c) Agitator: Electric, with stainless-steel shaft and propeller.
- 8) Caustic-Solution Storage Tank: PP.
 - a) Caustic Chemical: Sodium hydroxide solution.
- 9) Acid Storage Tank: PP.
 - a) Acid Chemical: Sulfuric acid solution.
- 10) Metering Pumps: Types suitable for neutralizing solutions.
- 11) Sampling Tank: Same material as mixing tank; with removable, gastight cover; sidewall inlet and outlet piping connections; and opening in top for probe.
 - a) pH probe: Type and length suitable for sampling-tank size.
- 2. Ceramic-Tank Neutralization Systems:
 - a. Description: Automatic system for neutralizing chemical waste.
 - 1) Controls: Factory-wired and -tested, 120-V ac, to operate probes, control valves, and metering pumps and to monitor pH of effluent; with wiring and electrical-power terminals.
 - 2) Panel: NEMA 250, Type 4X enclosure, unless otherwise indicated; with manufacturer's standard features, control devices, and indicators, including the following:
 - a) Power light and on/off switch.
 - b) pH analyzer with meter and high- and low-pH indicators.
 - c) Low caustic- and acid-solution level indicators.
 - d) Alarm horn with silencer and reset switch.
 - e) Agitator running light with on/off switch.
 - f) Running lights with on/off switches for caustic- and acid-solution pumps.
 - 3) Strip chart recorder with capacity for 30-day record.
 - 4) Piping between Tanks: Same material as chemical-waste piping system unless otherwise indicated.
 - 5) Interceptor Tank: Same material as mixing tank; with removable, gastight cover; and sidewall inlet and outlet piping connections.
 - 6) Neutralization Tank: Same material as mixing tank; with removable, gastight cover; sidewall inlet and outlet piping connections; and vent connection in sidewall or top.
 - a) Limestone: Chips or lumps, with more than 90 percent calcium carbonate content and 1- to 3-inch (25- to 75-mm) diameter.
 - OR**
 - Dolomitic Limestone: Chips or lumps, with more than 90 percent combined magnesium carbonate and calcium carbonate content and 1- to 3-inch (25- to 75-mm) diameter.
 - 7) Mixing Tank: With removable, gastight cover; sidewall inlet and outlet piping connections; vent connection in sidewall or top; neutralizing-solution piping connections; and openings in top for probe and agitator.
 - a) Material: Clay, vitrified into ceramic unit.
 - b) pH Probe: Type and length suitable for mixing tank size.
 - c) Agitator: Electric, with stainless-steel shaft and propeller.
 - 8) Caustic-Solution Storage Tank: PP.
 - a) Caustic Chemical: Sodium hydroxide solution.
 - 9) Acid Storage Tank: PP.
 - a) Acid Chemical: Sulfuric acid solution.
 - 10) Metering Pumps: Types suitable for neutralizing solutions.
 - 11) Sampling Tank: Same material as mixing tank; with removable, gastight cover; sidewall inlet and outlet piping connections; and opening in top for probe.
 - a) pH probe: Type and length suitable for sampling-tank size.

H. Manholes



1. Description: ASTM F 1759, fabricated from PE components. Include bottom, sidewalls, and top sections; corrosion-resistant, manhole frame and cover; fusion or other watertight joints; and design to prohibit flotation.
 - a. Construction: Single wall **OR** Double wall with interstitial space, **as directed**.
 - b. Bottom: Channeled.
 - c. Connections: Inlets and outlet matching or suitable for piping.
 - d. Steps: Manufacturer's standard, fusion welded to sidewall. Omit steps for manholes less than 60 inches (1500 mm) deep.
 - e. Top: Include 24-inch- (610-mm-) nominal-diameter frame and cover.
- I. Leak-Detection Systems
1. Leak-Detection Systems:
 - a. Description: Cable leak-detection system capable of detecting and annunciating fluid leaks; with controls, panel, wiring, cable sensors, probes if required, and piping.
 - 1) Annunciator Panel: Enclosure with visual and audible alarms and leak location indicator.
 - 2) Sensors: Electric cable, suitable for insertion into double-containment piping annular space, with capability of detecting fluid leaks and signaling locations of leaks.
- J. Sleeves
1. Cast-Iron Wall Pipes: Cast or fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
 2. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
 3. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
 4. Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, plain ends.
 5. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with set screws.
- K. Sleeve Seals
1. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - a. Sealing Elements: EPDM **OR** NBR, **as directed**, interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - b. Pressure Plates: Carbon steel **OR** Plastic **OR** Stainless steel, **as directed**.
 - c. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating **OR** Stainless steel, **as directed**, of length required to secure pressure plates to sealing elements.
- L. Escutcheons
1. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to closely fit around pipe and tube and OD that completely covers opening.
 2. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-plated finish.
 3. One-Piece, Stamped-Steel Escutcheons: With set screw **OR** spring clips, **as directed**, and chrome-plated finish.
 4. Split-Plate, Stamped-Steel Escutcheons: With concealed **OR** exposed-rivet, **as directed**, hinge, set screw **OR** spring clips, **as directed**, and chrome-plated finish.
 5. One-Piece, Floor-Plate Escutcheons: Cast iron.
 6. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.
- M. Grout
1. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.



- a. Characteristics: Post-hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
- b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- c. Packaging: Premixed and factory packaged.

1.3 EXECUTION

A. Earthwork

- 1. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

B. Concrete Bases

- 1. Anchor neutralization tanks and neutralization system tanks to concrete bases.
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 19-inch (480-mm) centers around full perimeter of base.
 - b. For installed equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be imbedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - e. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
 - f. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-place Concrete".
 - g. Comply with requirements in Division 31 for cast-in-place concrete materials and placement.

C. Piping Installation

- 1. Chemical-Waste Sewerage Outside the Building:
 - a. Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground chemical-waste sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
 - b. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
 - c. Install manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
 - d. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
 - e. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or combination of both.
 - f. Install drainage piping pitched down in direction of flow, at minimum slope of 1 **OR** 2, **as directed**, percent, unless otherwise indicated.
 - g. Install drainage piping with 36-inch (915-mm) **OR** 48-inch (1220-mm) **OR** 60-inch (1524-mm) **OR** 72-inch (1830-mm), **as directed**, minimum cover.
 - h. Install PE drainage piping according to ASTM D 2321 and ASTM F 1668.
 - i. Install PVC drainage piping according to ASTM D 2321 and ASTM F 1668.
 - j. Install PVDF drainage piping according to ASTM D 2321 and ASTM F 1668.
 - k. Install fiberglass piping according to ASTM D 3839 and ASTM F 1668.
 - l. Install field-fabrication containment piping over new and existing carrier piping. Use containment piping manufacturer's fastening system.

Chemical-Waste Systems for Laboratory and Healthcare



- m. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.
- 2. Chemical-Waste Piping Inside the Building:
 - a. Install piping next to equipment, accessories, and specialties to allow service and maintenance.
 - b. Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used unless otherwise indicated.
 - c. Flanges may be used on aboveground piping unless otherwise indicated.
 - d. Install underground fiberglass piping according to ASTM D 3839.
 - e. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
 - f. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
 - g. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
 - h. Install piping at indicated slopes.
 - i. Install piping free of sags and bends.
 - j. Install fittings for changes in direction and branch connections.
 - k. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1) New Piping:
 - a) Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b) Insulated Piping: One-piece, stamped-steel type with spring clips.
 - c) Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - d) Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type **OR** Split-plate, stamped-steel type with concealed hinge **OR** One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge, **as directed**, and set screw.
 - e) Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with set screw **OR** spring clips, **as directed**.
 - f) Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw **OR** spring clips, **as directed**.
 - g) Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
 - 2) Existing Piping:
 - a) Insulated Piping: Split-plate, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and spring clips.
 - b) Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
 - c) Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
 - d) Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and set screw or spring clips.
 - e) Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
 - f) Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
 - l. Sleeves are not required for core-drilled holes.
 - m. Permanent sleeves are not required for holes formed by removable PE sleeves.
 - n. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

**OR**

Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

- 1) Cut sleeves to length for mounting flush with both surfaces.
 - a) Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
- 2) Install sleeves in new walls and slabs as new walls and slabs are constructed.
- 3) Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a) PVC **OR** Steel, **as directed**, Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
 - b) Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum board partitions.
 - c) Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing And Trim" for flashing.
 - d) Seal space outside of sleeve fittings with grout.
- 4) Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- o. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1) Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
 - 2) Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
 - 3) Sleeve-Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- p. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1) Sleeve-Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- r. Verify final equipment locations for roughing-in.

D. Piping Specialty Installation

1. Embed floor drains in 4-inch (100-mm) minimum depth of concrete around bottom and sides. Comply with requirements in Division 03 Section "Cast-in-place Concrete" for concrete.
2. Fasten grates to drains if indicated.
3. Set floor drains with tops flush with pavement surface.
4. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use fittings of same material as sewer pipe at branches for cleanouts and riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in pipe.

- a. Set cleanout bodies in earth in cast-in-place concrete block, 18 by 18 by 12 inches (450 by 450 by 300 mm) deep. Set with tops 1 inch (25 mm) above surrounding grade. Set cleanout plugs in concrete pavement with tops flush with pavement surface. Comply with requirements in Division 03 Section "Cast-in-place Concrete" for formwork, reinforcement, and concrete requirements.
- 5. Install backwater valves in horizontal position. Include riser to cleanout at grade.

E. Joint Construction

- 1. Chemical-Waste Sewerage Outside the Building:
 - a. Plastic-Piping, Electrofusion Joints: Make polyolefin drainage-piping joints according to ASTM F 1290.
 - b. Make fiberglass-piping bonded joints according to ASTM D 3839.
 - c. Make fiberglass butt-and-wrap joints according to ASTM D 3839.
 - d. Join dissimilar pipe materials with adapters compatible with pipe materials being joined.
 - e. Join high-silicon-iron, hub-and-plain-end piping with calked joints using acid-resistant packing and lead.
 - f. Join high-silicon-iron, mechanical-joint piping with coupled joints using clamps and sleeves.
 - g. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.
- 2. Chemical-Waste Piping Inside the Building:
 - a. Plastic-Piping Electrofusion Joints: Make polyolefin drainage-piping joints according to ASTM F 1290.
 - b. Fiberglass-Piping Joints: Make joints with piping manufacturer's bonded adhesive.
 - c. Dissimilar-Material Piping Joints: Make joints using adapters compatible with both system materials.
 - d. Join high-silicon-iron, hub-and-plain-end piping with calked joints using acid-resistant packing and lead.
 - e. Join high-silicon-iron, mechanical-joint piping with coupled joints using clamps and sleeves.
 - f. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

F. Hanger And Support Installation

- 1. Pipe sizes in this article refer to aboveground, single-wall piping and carrier piping of containment piping, **as directed**.
- 2. Comply with requirements in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment" for seismic-restraint devices.
- 3. Comply with requirements in Division 22 Section "Hangers And Supports For Plumbing Piping And Equipment" for pipe hanger and support devices. Install the following:
 - a. Vertical Piping: MSS Type 8 or MSS Type 42, riser clamps.
 - b. Individual, Straight, Horizontal Piping Runs:
 - 1) 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
 - 2) Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
 - 3) Longer Than 100 Feet (30 m), if Indicated: MSS Type 49, spring cushion rolls.
 - c. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - d. Base of Vertical Piping: MSS Type 52, spring hangers.
- 4. Comply with requirements in Division 22 Section "Hangers And Supports For Plumbing Piping And Equipment" for installation of supports.
- 5. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting and coupling.
- 6. Support vertical piping and tubing at base and at each floor.
- 7. Rod diameter may be reduced 1 size for double-rod hangers, to minimum of 3/8 inch (10 mm).
- 8. Install vinyl-coated hangers for PP piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 2 (DN 50): 33 inches (840 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): 42 inches (1067 mm) with 1/2-inch (13-mm) rod.



- c. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1220 mm) with 5/8-inch (16-mm) rod.
- d. NPS 6 (DN 150): 48 inches (1220 mm) with 3/4-inch (19-mm) rod.
- e. NPS 8 (DN 200): 48 inches (1220 mm) with 7/8-inch (22-mm) rod.
- 9. Install supports for vertical PP piping every 72 inches (1830 mm).
- 10. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1-1/4 (DN 32): 36 inches (910 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 42 inches (1067 mm) with 3/8-inch (10-mm) rod.
 - c. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): 42 inches (1067 mm) with 1/2-inch (13-mm) rod.
 - d. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1220 mm) with 5/8-inch (16-mm) rod.
 - e. NPS 6 (DN 150): 48 inches (1220 mm) with 3/4-inch (19-mm) rod.
 - f. NPS 8 to NPS 12 (DN 200 to DN 300): 48 inches (1220 mm) with 7/8-inch (22-mm) rod.
- 11. Install supports for vertical PVC piping every 48 inches (1220 mm).
- 12. Install vinyl-coated hangers for PVDF piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. All Sizes: Install continuous support for piping with liquid waste at temperatures above 140 deg F (60 deg C).
 - b. NPS 1/2 (DN 15) and Smaller: 30 inches (760 mm) with 3/8-inch (10-mm) rod.
 - c. NPS 3/4 to NPS 1-1/2 (DN 20 to DN 40): 36 inches (910 mm) with 3/8-inch (10-mm) rod.
 - d. NPS 2 (DN 50): 36 inches (910 mm) with 3/8-inch (10-mm) rod.
 - e. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): 42 inches (1067 mm) with 1/2-inch (13-mm) rod.
 - f. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1220 mm) with 5/8-inch (16-mm) rod.
 - g. NPS 6 (DN 150): 48 inches (1220 mm) with 3/4-inch (19-mm) rod.
- 13. Install supports for vertical PVDF piping NPS 1-1/2 (DN 40) every 48 inches (1220 mm) and NPS 2 (DN 50) and larger every 72 inches (1830 mm).
- 14. Install vinyl-coated hangers for fiberglass piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 2 (DN 50) and Smaller: 10 feet (3 m) with 3/8-inch (10-mm) rod.
 - b. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): 10 feet (3 m) with 1/2-inch (13-mm) rod.
 - c. NPS 4 and NPS 5 (DN 100 and DN 125): 10 feet (3 m) with 5/8-inch (16-mm) rod.
 - d. NPS 6 (DN 150): 10 feet (3 m) with 3/4-inch (19-mm) rod.
 - e. NPS 8 to NPS 12 (DN 200 to DN 300): 12 feet (3.6 m) with 7/8-inch (22-mm) rod.
- 15. Install supports for vertical fiberglass piping every 12 feet (3.6 m).
- 16. Install hangers for stainless-steel drainage piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
 - b. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
 - c. NPS 3 (DN 80): 12 feet (3.6 m) with 1/2-inch (13-mm) rod.
 - d. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.6 m) with 5/8-inch (16-mm) rod.
 - e. NPS 6 (DN 150): 12 feet (3.6 m) with 3/4-inch (19-mm) rod.
- 17. Install supports for vertical stainless-steel drainage piping every 15 feet (4.5 m).
- 18. Install hangers for high-silicon-iron piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1520 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 3 (DN 80): 60 inches (1520 mm) with 1/2-inch (13-mm) rod.
 - c. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1520 mm) with 5/8-inch (16-mm) rod.
 - d. NPS 6 (DN 150): 60 inches (1520 mm) with 3/4-inch (19-mm) rod.
 - e. NPS 8 to NPS 12 (DN 200 to DN 300): 60 inches (1520 mm) with 7/8-inch (22-mm) rod.
 - f. NPS 15 (DN 375): 60 inches (1520 mm) with 1-inch (25-mm) rod.
 - g. Spacing for horizontal pipe in 84-inch (2134-mm) lengths may be increased to 84 inches (2134 mm). Spacing for fittings is limited to 60 inches (1520 mm).



19. Install supports for vertical high-silicon-iron piping every 15 feet (4.5 m).
20. Install vinyl-coated hangers for glass piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1830 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2440 mm) with 3/8-inch (10-mm) rod.
 - c. NPS 3 (DN 80): 96 inches (2440 mm) with 1/2-inch (13-mm) rod.
 - d. NPS 4 and NPS 6 (DN 100 and DN 150): 96 inches (2440 mm) with 5/8-inch (16-mm) rod.
21. Install supports for vertical glass piping every 96 inches (2440 mm).
22. Support piping and tubing not listed above according to MSS SP-69.

G. Neutralization Tank Installation

1. Install exterior collection **OR** neutralization, **as directed**, tanks, complete with appurtenances indicated.
 - a. Set tops of tank covers flush with finished surface where covers occur in pavements. Set covers 3 inches (76 mm) above finished surface elsewhere unless otherwise indicated.
 - b. Include initial fill of limestone for neutralization tanks.
2. Install interior neutralization tanks on smooth and level concrete base **OR** floor surface, **as directed**. Include full initial charge of limestone.

H. Neutralization System Installation

1. Install neutralization systems on smooth and level concrete base **OR** floor surface, **as directed**. Include neutralizing solutions and full initial charge of limestone.

I. Manhole Installation

1. General: Install manholes, complete with appurtenances and accessories indicated. Comply with requirements in Division 22 Section "Facility Sanitary Sewers".
2. Set tops of manhole frames and covers flush with finished surface where manholes occur in pavements. Set tops 3 inches (76 mm) above finished surface elsewhere unless otherwise indicated.

J. Leak-Detection System Installation

1. Single-Pipe, Chemical-Waste Sewerage Piping: Install leak-detection system below piping.
2. Double-Containment Piping: Install leak-detection system in piping annular space.
3. Manholes: Install leak-detection system around bottom of exterior.
4. Install panel in location indicated.

K. Concrete Placement

1. Comply with requirements in Division 03 Section "Cast-in-place Concrete" for concrete supports.
2. Place cast-in-place concrete according to ACI 318/318R.

L. Connections

1. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Make connections to existing piping so finished Work complies as nearly as practical with requirements specified for new Work.
3. Use commercially manufactured wye fittings for sewerage piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting plus 6-inch (150-mm) overlap, with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
4. Protect existing piping to prevent concrete or debris from entering while making connections. Remove debris or other extraneous material that may accumulate.
5. Install piping adjacent to equipment to allow service and maintenance.



M. Labeling And Identification

1. Comply with requirements in Division 22 Section "Identification For Plumbing Piping And Equipment" for labeling of equipment and piping.
 - a. Use warning tape **OR** detectable warning tape, **as directed**, over ferrous piping.
 - b. Use detectable warning tape over nonferrous piping and over edges of underground structures.

N. Field Quality Control

1. Inspect interior of sewerage piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place and again at completion of Project.
 - a. Defects requiring correction include the following:
 - 1) Alignment: Less than full diameter of inside of pipe is visible between inspection points.
 - 2) Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - 3) Crushed, broken, cracked, or otherwise damaged piping.
 - 4) Hydrostatic Tests for Drainage Piping:
 - a) Allowable leakage is a maximum of 50 gal./inch of nominal pipe size per mile (4.6 L/mm of nominal pipe size per kilometer) of pipe, during 24-hour period.
 - b) Close openings in system and fill with water.
 - c) Purge air and refill with water.
 - d) Disconnect water supply.
 - e) Test and inspect joints for leaks.
 - 5) Air Tests for Drainage Piping: Comply with UNI-B-6.
 - b. Leaks and loss in test pressure constitute defects that must be repaired.
 - c. Submit separate reports for each test.
2. Replace leaking sewerage piping using new materials, and repeat testing until leakage is within allowances specified.
3. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
4. Tests and Inspections:
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect assembled neutralization systems and leak-detection systems and their installation, including piping and electrical connections, and to assist in testing.
 - b. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - c. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
5. Chemical-waste piping will be considered defective if it does not pass tests and inspections.
6. Prepare test and inspection reports.

O. Startup Service

1. Perform startup service for neutralization systems and leak-detection systems.
 - a. Complete installation and startup checks according to manufacturer's written instructions.
 - b. Neutralization Systems:
 - 1) Verify that neutralization system is installed and connected according to the Contract Documents.
 - 2) Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 22.
 - 3) Install neutralizing solutions and limestone.
 - 4) Energize circuits.
 - 5) Start and run systems through complete sequence of operations.

- 6) Adjust operating controls.
- c. Leak-Detection Systems:
 - 1) Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 22.
 - 2) Energize circuits.
 - 3) Adjust operating controls.
- P. Adjusting
 - 1. Adjust neutralization-system set points.
 - 2. Adjust leak-detection-system control and device settings.
- Q. Cleaning
 - 1. Use procedures prescribed by authorities having jurisdiction or, if not prescribed, use procedures described below:
 - a. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - b. Clean piping by flushing with potable water.
- R. Demonstration
 - 1. Train Owner's maintenance personnel to adjust, operate, and maintain neutralization systems and leak-detection systems.
- S. Piping Schedule
 - 1. Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below unless otherwise indicated.
 - 2. Single-Wall, Chemical-Waste Sewerage Piping: Use any of the following piping materials for each size range:
 - a. NPS 2 to NPS 4 (DN 50 to DN 100): High-silicon-iron, hub-and-plain-end pipe and fittings and calked **OR** High-silicon-iron, mechanical-joint pipe and fittings and coupled, **as directed**, joints.
 - b. NPS 2 to NPS 4 (DN 50 to DN 100): Stainless-steel drainage pipe and fittings and gasketed joints.
 - c. NPS 1-1/2 to NPS 4 (DN 40 to DN 100): PE drainage pipe and fittings and heat-fusion joints.
 - d. NPS 1-1/2 to NPS 4 (DN 40 to DN 100): PP drainage pipe and fittings and electrofusion joints.
 - e. NPS 1-1/2 to NPS 4 (DN 40 to DN 100): PVC drainage pipe and fittings and solvent-cemented joints.
 - f. NPS 1-1/2 to NPS 4 (DN 40 to DN 100): PVDF drainage pipe and fittings and electrofusion joints.
 - g. NPS 2 to NPS 4 (DN 50 to DN 100): Centrifugally cast **OR** Filament-wound, **as directed**, fiberglass pipe and fittings and butt-and-wrap **OR** bonded, **as directed**, joints.
 - h. NPS 1-1/2 to NPS 4 (DN 40 to DN 100): Glass pipe and fittings and coupled joints.
 - i. NPS 6 (DN 150): High-silicon-iron, hub-and-plain-end pipe and fittings and calked **OR** High-silicon-iron, mechanical-joint pipe and fittings and coupled, **as directed**, joints.
 - j. NPS 6 (DN 150): Stainless-steel drainage pipe and fittings and gasketed joints.
 - k. NPS 6 (DN 150): PE drainage pipe and fittings and heat-fusion joints.
 - l. NPS 6 (DN 150): PP drainage pipe and fittings and electrofusion joints.
 - m. NPS 6 (DN 150): PVC drainage pipe and fittings and solvent-cemented joints.
 - n. NPS 6 (DN 150): PVDF drainage pipe and fittings and electrofusion joints.
 - o. NPS 6 (DN 150): Centrifugally cast **OR** Filament-wound, **as directed**, fiberglass pipe and fittings and butt-and-wrap **OR** bonded, **as directed**, joints.
 - p. NPS 6 (DN 150): Glass pipe and fittings and coupled joints.



- q. NPS 8 to NPS 12 (DN 200 to DN 300): High-silicon-iron, hub-and-plain-end pipe and fittings and calked joints.
 - r. NPS 8 to NPS 12 (DN 200 to DN 300): PP drainage pipe and fittings and electrofusion joints.
 - s. NPS 8 to NPS 12 (DN 200 to DN 300): PVC drainage pipe and fittings and solvent-cemented joints.
 - t. NPS 8 to NPS 12 (DN 200 to DN 300): PVDF drainage pipe and fittings and electrofusion joints.
 - u. NPS 8 to NPS 12 (DN 200 to DN 300): Centrifugally cast **OR** Filament-wound, **as directed**, fiberglass pipe and fittings and butt-and-wrap **OR** bonded, **as directed**, joints.
 - v. NPS 15 (DN 375): High-silicon-iron, hub-and-plain-end pipe and fittings and calked joints.
 - w. NPS 15 (DN 375): NPS 16 (DN 400) centrifugally cast **OR** NPS 14 (DN 350) filament-wound, **as directed**, fiberglass pipe and fittings and butt-and-wrap **OR** bonded, **as directed**, joints.
3. Underground, Double-Containment, Chemical-Waste Sewerage Piping: Use any of the following piping materials for each size range:
- a. NPS 2 to NPS 12 (DN 50 to DN 300): PE double-containment drainage pipe and fittings.
 - b. NPS 2 to NPS 12 (DN 50 to DN 300): PP double-containment drainage pipe and fittings.
 - c. NPS 2 to NPS 12 (DN 50 to DN 300): PP/PVC double-containment drainage pipe and fittings.
 - d. NPS 2 to NPS 12 (DN 50 to DN 300): PVDF double-containment drainage pipe and fittings.
 - e. NPS 2 to NPS 12 (DN 50 to DN 300): PVDF/PVC double-containment drainage pipe and fittings.
4. Aboveground Chemical-Waste Piping: Use any of the following piping materials for each size range:
- a. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): PP drainage piping and electrofusion **OR** mechanical, **as directed**, joints.
 - b. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): PVC drainage piping and solvent-cemented joints.
 - c. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): PVDF drainage piping and electrofusion **OR** mechanical, **as directed**, joints.
 - d. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): NPS 2 to NPS 6 (DN 50 to DN 150) high-silicon-iron piping with hub-and-plain ends and calked joints.
 - e. NPS 1-1/2 to NPS 4 (DN 40 to DN 100): High-silicon-iron piping with mechanical-joint ends, mechanical couplings, and coupled joints.
 - f. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): NPS 2 to NPS 4 (DN 50 to DN 100) stainless-steel drainage piping with socket-and-spigot ends and gasketed joints.
 - g. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): Borosilicate glass pipe and fittings, couplings, and coupled joints.
 - h. NPS 8 to NPS 12 (DN 200 to DN 300): PVC drainage pipe and fittings and solvent-cemented joints.
 - i. NPS 8 to NPS 12 (DN 200 to DN 300): High-silicon-iron piping with hub-and-plain ends and calked joints.
5. Under Slab-on-Grade, Indoor, Chemical-Waste Piping: Use any of the following piping materials for each size range:
- a. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): PP drainage piping and electrofusion joints.
 - b. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): PVC drainage piping and solvent-cemented joints.
 - c. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): PVDF drainage piping and electrofusion joints.
 - d. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): NPS 2 to NPS 4 (DN 50 to DN 100) high-silicon-iron piping with hub-and-plain ends and calked joints.
 - e. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): NPS 2 to NPS 4 (DN 50 to DN 100) stainless-steel drainage piping with socket-and-spigot ends and gasketed joints.



- f. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): Borosilicate glass piping with covering, couplings, and coupled joints.
- g. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): PE **OR** PP **OR** PP/PVC **OR** PVDF **OR** PVDF/PVC, **as directed**, double-containment drainage piping and manufacturer's standard joints.
- h. NPS 8 (DN 200): PVC drainage piping and solvent-cemented joints.
- i. NPS 8 (DN 200): High-silicon-iron piping with hub-and-plain ends and calked joints.
- j. NPS 8 (DN 200): PE **OR** PP **OR** PP/PVC **OR** PVDF **OR** PVDF/PVC, **as directed**, double-containment drainage piping and manufacturer's standard joints.
- k. NPS 10 and NPS 12 (DN 250 and DN 300): PVC drainage piping and solvent-cemented joints.
- l. NPS 10 to NPS 15 (DN 250 to DN 375): High-silicon-iron piping with hub-and-plain ends and calked joints.

END OF SECTION 22 66 83 16



Task	Specification	Specification Description
22 67 13 53	21 05 00 00	Common Work Results for Fire Suppression



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SECTION 23 01 30 51 - HVAC AIR-DISTRIBUTION SYSTEM CLEANING**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for HVAC air-distribution system cleaning. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes cleaning HVAC air-distribution equipment, ducts, plenums, and system components.

C. Definitions

1. ASCS: Air systems cleaning specialist.
2. NADCA: National Air Duct Cleaners Association.

D. Submittals

1. Qualification Data: For an ASCS.
2. Strategies and procedures plan.
3. Cleanliness verification report.

E. Quality Assurance

1. ASCS Qualifications: A certified member of NADCA.
 - a. Certification: Employ an ASCS certified by NADCA on a full-time basis.
 - b. Supervisor Qualifications: Certified as an ASCS by NADCA.
2. UL Compliance: Comply with UL 181 and UL 181A for fibrous-glass ducts.
3. Cleaning Conference: Conduct conference at Project site.

1.2 PRODUCTS (Not Used)**1.3 EXECUTION****A. Examination**

1. Examine HVAC air-distribution equipment, ducts, plenums, and system components to determine appropriate methods, tools, and equipment required for performance of the Work.
2. Perform "Project Evaluation and Recommendation" according to NADCA ACR 2006.
3. Prepare written report listing conditions detrimental to performance of the Work.
4. Proceed with work only after unsatisfactory conditions have been corrected.

B. Preparation

1. Prepare a written plan that includes strategies and step-by-step procedures. At a minimum, include the following:
 - a. Supervisor contact information.
 - b. Work schedule including location, times, and impact on occupied areas.
 - c. Methods and materials planned for each HVAC component type.
 - d. Required support from other trades.
 - e. Equipment and material storage requirements.
 - f. Exhaust equipment setup locations.
2. Use the existing service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry and for inspection.

3. Comply with NADCA ACR 2006, "Guidelines for Constructing Service Openings in HVAC Systems" Section.

C. Cleaning

1. Comply with NADCA ACR 2006.
2. Remove visible surface contaminants and deposits from within the HVAC system.
3. Systems and Components to Be Cleaned:
 - a. Air devices for supply and return air.
 - b. Air-terminal units.
 - c. Ductwork:
 - 1) Supply-air ducts, including turning vanes and reheat coils, to the air-handling unit.
 - 2) Return-air ducts to the air-handling unit.
 - 3) Exhaust-air ducts.
 - d. Air-Handling Units:
 - 1) Interior surfaces of the unit casing.
 - 2) Coil surfaces compartment.
 - 3) Condensate drain pans.
 - 4) Fans, fan blades, and fan housings.
 - e. Filters and filter housings.
4. Collect debris removed during cleaning. Ensure that debris is not dispersed outside the HVAC system during the cleaning process.
5. Particulate Collection:
 - a. For particulate collection equipment, include adequate filtration to contain debris removed. Locate equipment downwind and away from all air intakes and other points of entry into the building.
 - b. HEPA filtration with 99.97 percent collection efficiency for particles sized 0.3 micrometer or larger shall be used where the particulate collection equipment is exhausting inside the building.
6. Control odors and mist vapors during the cleaning and restoration process.
7. Mark the position of manual volume dampers and air-directional mechanical devices inside the system prior to cleaning. Restore them to their marked position on completion of cleaning.
8. System components shall be cleaned so that all HVAC system components are visibly clean. On completion, all components must be returned to those settings recorded just prior to cleaning operations.
9. Clean all air-distribution devices, registers, grilles, and diffusers.
10. Clean visible surface contamination deposits according to NADCA ACR 2006 and the following:
 - a. Clean air-handling units, airstream surfaces, components, condensate collectors, and drains.
 - b. Ensure that a suitable operative drainage system is in place prior to beginning wash-down procedures.
 - c. Clean evaporator coils, reheat coils, and other airstream components.
11. Duct Systems:
 - a. Create service openings in the HVAC system as necessary to accommodate cleaning.
 - b. Mechanically clean duct systems specified to remove all visible contaminants so that the systems are capable of passing the HVAC System Cleanliness Tests (see NADCA ACR 2006).
12. Debris removed from the HVAC system shall be disposed of according to applicable Federal, state, and local requirements.
13. Mechanical Cleaning Methodology:
 - a. Source-Removal Cleaning Methods: The HVAC system shall be cleaned using source-removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and to safely remove these contaminants from the facility. No cleaning method, or combination of methods, shall be used that could potentially damage components of the HVAC system or negatively alter the integrity of the system.

- 1) Use continuously operating vacuum-collection devices to keep each section being cleaned under negative pressure.
 - 2) Cleaning methods that require mechanical agitation devices to dislodge debris that is adhered to interior surfaces of HVAC system components shall be equipped to safely remove these devices. Cleaning methods shall not damage the integrity of HVAC system components or damage porous surface materials such as duct and plenum liners.
 - b. Cleaning Mineral-Fiber Insulation Components:
 - 1) Fibrous-glass thermal or acoustical insulation elements present in equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment while the HVAC system is under constant negative pressure and shall not be permitted to get wet according to NADCA ACR 2006.
 - 2) Cleaning methods used shall not cause damage to fibrous-glass components and will render the system capable of passing the HVAC System Cleanliness Tests (see NADCA ACR 2006).
 - 3) Fibrous materials that become wet shall be discarded and replaced.
 14. Coil Cleaning:
 - a. Measure static-pressure differential across each coil.
 - b. See NADCA ACR 2006, "Coil Surface Cleaning" Section. Type 1, or Type 1 and Type 2, cleaning methods shall be used to render the coil visibly clean and capable of passing Coil Cleaning Verification (see applicable NADCA ACR 2006).
 - c. Coil drain pans shall be subject to NADCA ACR 2006, "Non-Porous Surfaces Cleaning Verification." Ensure that condensate drain pans are operational.
 - d. Electric-resistance coils shall be de-energized, locked out, and tagged before cleaning.
 - e. Cleaning methods shall not cause any appreciable damage to, cause displacement of, inhibit heat transfer, or cause erosion of the coil surface or fins, and shall comply with coil manufacturer's written recommendations when available.
 - f. Rinse thoroughly with clean water to remove any latent residues.
 15. Antimicrobial Agents, Coatings, and Sanitizers:
 - a. Apply antimicrobial agents, coatings, and sanitizers if active fungal growth is reasonably suspected or where unacceptable levels of fungal contamination have been verified. Apply antimicrobial agents and coatings according to manufacturer's written recommendations and EPA registration listing after the removal of surface deposits and debris.
 - b. When used, antimicrobial treatments, coatings, and sanitizers shall be applied after the system is rendered clean.
 - c. Apply antimicrobial agents, coatings, and sanitizers directly onto surfaces of interior ductwork. Fogging is prohibited.
 - d. Sanitizing agent products shall be registered by the EPA as specifically intended for use in HVAC systems and ductwork.
- D. Cleanliness Verification
1. Verify cleanliness according to NADCA ACR 2006, "Verification of HVAC System Cleanliness" Section.
 2. Verify HVAC system cleanliness after mechanical cleaning and before applying any treatment or introducing any treatment-related substance to the HVAC system, including biocidal agents, coatings, and sanitizers.
 3. Perform visual inspection for cleanliness. If no contaminants are evident through visual inspection, the HVAC system shall be considered clean. If visible contaminants are evident through visual inspection, those portions of the system where contaminants are visible shall be re-cleaned and subjected to re-inspection for cleanliness.
 4. Additional Verification:
 - a. Perform surface comparison testing or NADCA vacuum test.
 - b. Conduct NADCA vacuum gravimetric test analysis for nonporous surfaces.
 5. Verification of Coil Cleaning:
 - a. Measure static-pressure differential across each coil.



- b. Coil will be considered clean if cleaning restored the coil static-pressure differential within 10 percent of <Insert inches wg (Pa)>, the differential measured when the coil was first installed.

OR

Coil will be considered clean if the coil is free of foreign matter and chemical residue, based on a thorough visual inspection.

- 6. Prepare a written cleanliness verification report. At a minimum, include the following:
 - a. Written documentation of the success of the cleaning.
 - b. Site inspection reports, initialed by supervisor, including notation on areas of inspection, as verified through visual inspection.
 - c. Surface comparison test results if required.
 - d. Gravimetric analysis (nonporous surfaces only).
 - e. System areas found to be damaged.
- 7. Photographic Documentation: Comply with requirements listed in Scope of Work.

E. Restoration

- 1. Restore and repair HVAC air-distribution equipment, ducts, plenums, and components according to NADCA ACR 2006, "Restoration and Repair of Mechanical Systems" Section.
- 2. Restore service openings capable of future reopening. Comply with requirements in Division 23 Section "Metal Ducts". Include location of service openings in Project closeout report.
- 3. Replace fibrous-glass materials that cannot be restored by cleaning or resurfacing. Comply with requirements in Division 23 Section(s) "Metal Ducts" AND "Nonmetal Ducts"
- 4. Replace damaged insulation according to Division 23 Section "Hvac Insulation",
- 5. Ensure that closures do not hinder or alter airflow.
- 6. New closure materials, including insulation, shall match opened materials and shall have removable closure panels fitted with gaskets and fasteners.
- 7. Reseal fibrous-glass ducts. Comply with requirements in Division 23 Section "Nonmetal Ducts".

END OF SECTION 23 01 30 51

SECTION 23 01 50 00 - CAST-IRON BOILERS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for cast-iron boilers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes packaged cast-iron boilers, trim, and accessories for generating hot water or steam with the following configurations and burners:
 - a. Factory and Field assembled.
 - b. Atmospheric gas, Sealed-combustion, gas, Forced-draft, gas, Oil, and Combination gas and oil burner.

C. Submittals

1. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.
2. Shop Drawings: For boilers, boiler trim, and accessories. Include plans, elevations, sections, details, and attachments to other work.
 - a. Design calculations and vibration isolation base details, signed and sealed by a qualified professional engineer.
 - 1) Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - 2) Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails and equipment mounting frames.
 - b. Wiring Diagrams: Power, signal, and control wiring.
3. Manufacturer Seismic Qualification Certification: Submit certification that boiler, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment". Include the following:
4. Source quality-control test reports.
5. Field quality-control test reports.
6. Operation and maintenance data.
7. Warranty: Special warranty specified in this Section.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.
3. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."
4. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, "Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers."
5. I=B=R Compliance: Boilers shall be tested and rated according to HI's "Rating Procedure for Heating Boilers" and "Testing Standard for Commercial Boilers," with I=B=R emblem on a nameplate affixed to boiler.
6. UL Compliance: Test boilers for compliance with UL 726, "Oil-Fired Boiler Assemblies **OR** UL 726, "Oil-Fired Boiler Assemblies," and UL 795, "Commercial-Industrial Gas Heating



Equipment **OR** UL 795, "Commercial-Industrial Gas Heating Equipment", **as directed**. Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

E. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace controls and heat exchangers of boilers that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period for Controls: Two years from date of Final Completion.
 - b. Warranty Period for Heat Exchangers: Five **OR** 10 **OR** 20, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Manufactured Units

1. Description: Factory fabricated and assembled **OR** field assembled, **as directed**.
 - a. Cast-iron sections shall be sealed pressure tight and held together with tie rods set on an insulated steel base, **as directed**; including insulated jacket and flue-gas vent connection.
OR
Ship cast-iron sections disassembled with all materials and equipment, including seals, tie rods, and insulated jacket and flue-gas vent connection for field assembly.
2. Cast-Iron Section Design:
 - a. Configuration: Wet base **OR** back **OR** leg, **as directed**.
 - b. Number of Passes: Single **OR** Multiple, **as directed**.
 - c. Sectional Joints: High-temperature sealant to seal flue-gas passages not in contact with heating medium, tapered cast-iron push nipples, **OR** O-ring gaskets, **OR** fiber roping, **as directed**, and held together with tie rods.
 - d. Drain and blowdown tappings.
 - e. Return injection tube to equalize water flow to all sections.
 - f. Crown inspection tappings with brass plugs.
 - g. Built-in air separator.
3. Combustion Chamber: Equipped with ceramic-fiber target wall **OR** refractory **OR** insulation, **as directed**, and flame observation ports, front and back.
4. Casing:
 - a. Jacket: Sheet metal **OR** Galvanized sheet metal, **as directed**, with snap-in or interlocking closures and baked-enamel **OR** powder-coated, **as directed**, protective finish.
 - b. Insulation: Minimum 1-inch- (25-mm-) **OR** 2-inch- (50-mm-), **as directed**, thick, mineral-fiber insulation surrounding the heat exchanger.
 - c. Combustion Chamber Access: Refractory lined, hinged, front.
 - d. Access: For cleaning between cast-iron sections.
 - e. Draft Hood: Flue canopy and top **OR** rear, **as directed**, flue connection shall be constructed of aluminized **OR** stainless, **as directed**, steel containing adjustable outlet damper assembly.
 - f. Insulated base constructed of aluminized steel to permit boiler to be installed on combustible floor.
 - g. Mounting Frame: Steel rails to mount assembled boiler package on concrete base.
 - 1) Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" when mounting base is anchored to building structure.
 - h. Control Cabinet: Sheet metal casing shall cover all controls, gas train, and burner.
5. Draft Diverter: Steel assembly integral with boiler casing **OR** Separate galvanized-steel assembly, **as directed**.

B. Burner: For Atmospheric Gas Burners.

1. Burner Tubes and Orifices: Stainless steel **OR** Cast iron, **as directed**, for natural **OR** propane, **as directed**, gas.
 2. Gas Train: Control devices and full-modulation **OR** on-off **OR** low-high-low, **as directed**, control sequence shall comply with requirements in ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.
OR
Gas Train: Combination gas valve with manual shutoff, pressure regulator, and pilot adjustment.
 3. Pilot: Standing **OR** Intermittent-electric-spark, **as directed**, pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.
- C. Burner: For Residential-Size Boilers With Sealed-Combustion Burners.
1. Burner Tubes and Orifices: Stainless steel **OR** Cast iron, **as directed**, for natural **OR** propane, **as directed**, gas.
 2. Blower: Forward-curved centrifugal fan integral to burner, directly driven by motor; with adjustable, dual-blade damper assembly and locking quadrant to set air-fuel ratio.
 - a. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 3. Gas Train: Combination gas valve with manual shutoff, pressure regulator, and pilot adjustment.
 4. Pilot: Standing **OR** Intermittent-electric-spark, **as directed**, pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.
- D. Burner: For Forced-Draft Burners.
1. Burner: Welded construction with multivane, stainless-steel, flame-retention diffuser for natural **OR** propane, **as directed**, gas.
 2. Blower: Forward-curved centrifugal fan integral to burner, directly driven by motor; with adjustable, dual-blade damper assembly and locking quadrant to set air-fuel ratio.
 - a. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 3. Gas Train: Control devices and modulating **OR** on-off **OR** low-high-low, **as directed**, control sequence shall comply with requirements in ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.
 4. Pilot: Intermittent **OR** Interrupted, **as directed**, -electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.
 5. Flue-Gas Recirculation: Burner connections shall be equipped for recirculating flue gas.
 - a. Maximum Oxides of Nitrogen Emissions: 20 **OR** 30, **as directed**, ppm.
- E. Burner: For Oil Burners.
1. Burner: Welded construction with multivane, stainless-steel, flame-retention diffuser for fuel oil.
 2. Blower: Forward-curved centrifugal fan integral to burner, directly driven by motor; with adjustable, dual-blade damper assembly and locking quadrant to set air-fuel ratio.
 - a. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 3. Oil Supply: Control devices and modulating **OR** on-off **OR** low-high-low, **as directed**, control sequence shall comply with requirements in ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.
 - a. Oil Pump: Two-stage, gear-type oil pump integral to and directly driven by blower, **as directed**, shall be capable of producing 300-psig (2070-kPa) discharge pressure and 15-inch Hg (50.7-kPa) vacuum.
 - b. Oil Piping Specialties:
 - 1) Suction-line, manual, gate valve.
 - 2) Removable-mesh oil strainer.
 - 3) 0- to 30-inch Hg (0- to 101.3-kPa) vacuum; 0- to 30-psig (0- to 207-kPa) vacuum-pressure gage.

- 4) 0- to 300-psig (0- to 2070-kPa) oil-nozzle pressure gage.
 - 5) Nozzle-line, solenoid-safety-shutoff oil valve.
 4. Pilot: Intermittent **OR** Interrupted, **as directed**, -electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff solenoid using cadmium sulfide **OR** UV scanner, **as directed**, flame-safety control.
 5. Flue-Gas Recirculation: Burner connections shall be equipped for recirculating flue gas.
 - a. Maximum Oxides of Nitrogen Emissions: 30 ppm.
- F. Burner: For Combination Gas And Oil Burners.
 1. Burner: Welded construction with multivane, stainless-steel, flame-retention diffuser for fuel oil and natural **OR** propane, **as directed**, gas.
 2. Blower: Forward-curved centrifugal fan integral to burner, directly driven by motor; with adjustable, dual-blade damper assembly and locking quadrant to set air-fuel ratio.
 - a. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 3. Oil Supply: Control devices and modulating **OR** on-off **OR** low-high-low, **as directed**, control sequence shall comply with requirements in ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.
 - a. Oil Pump: Two-stage, gear-type oil pump integral to and directly driven by blower, **as directed**, shall be capable of producing 300-psig (2070-kPa) discharge pressure and 15-inch Hg (50.7-kPa) vacuum.
 - b. Oil Piping Specialties:
 - 1) Suction-line, manual, gate valve.
 - 2) Removable-mesh oil strainer.
 - 3) 0- to 30-inch Hg (0- to 101.3-kPa) vacuum; 0- to 30-psig (0- to 207-kPa) vacuum-pressure gage.
 - 4) 0- to 300-psig (0- to 2070-kPa) oil-nozzle pressure gage.
 - 5) Nozzle-line, solenoid-safety-shutoff oil valve.
 4. Gas Train: Control devices and modulating **OR** on-off **OR** low-high-low, **as directed**, control sequence shall comply with requirements in ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.
 5. Gas Pilot: Intermittent **OR** Interrupted, **as directed**, -electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.
 6. Oil Pilot: Intermittent **OR** Interrupted, **as directed**, -electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff solenoid with cadmium sulfide **OR** UV scanner, **as directed**, flame-safety control.
 7. Flue-Gas Recirculation: Burner connections shall be equipped for recirculating flue gas.
 - a. Maximum Oxides of Nitrogen Emissions: 20 **OR** 30, **as directed**, ppm.
- G. Trim: For Hot-Water Boilers.
 1. Include devices sized to comply with ANSI B31.9, "Building Services Piping."
 2. Aquastat Controllers: Operating, firing rate, **as directed**, and high limit.
 3. Safety Relief Valve: ASME rated.
 4. Pressure and Temperature Gage: Minimum 3-1/2-inch- (89-mm-) diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.
 5. Boiler Air Vent: Automatic **OR** Manual, **as directed**.
 6. Drain Valve: Minimum NPS 3/4 (DN 20) hose-end gate valve.
 7. Tankless Heater: Carbon-steel header with copper-tube heat exchanger, mounted in an upper port of cast-iron sections and sealed with fiber gasket.
 - a. Tappings NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
 - b. Tappings NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.

- H. Trim: For Steam Boilers.
1. Include devices sized to comply with ANSI B31.9, "Building Services Piping."
 2. Pressure Controllers: Operating, firing rate, **as directed**, and high limit.
 3. Safety Relief Valve:
 - a. Size and Capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code.
 - b. Description: Fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed.
 - 1) Drip-Pan Elbow: Cast iron and having threaded inlet and outlet with threads complying with ASME B1.20.1.
 4. Pressure Gage: Minimum 3-1/2-inch (89-mm) diameter. Gage shall have normal operating pressure about 50 percent of full range.
 5. Water Column: Minimum 12-inch (300-mm) glass gage with shutoff cocks.
 6. Drain Valves: Minimum NPS 3/4 (DN 20) or nozzle size with hose-end connection.
 7. Blowdown Valves: Factory-installed bottom and surface, slow-acting blowdown valves same size as boiler nozzle.
 8. Stop Valves: Boiler inlets and outlets, except safety relief valves or preheater inlet and outlet, shall be equipped with stop valve in an accessible location as near as practical to boiler nozzle and same size as or larger than nozzle. Valves larger than NPS 2 (DN 50) shall have rising stem.
 9. Stop-Check Valves: Factory-installed, stop-check valve and stop valve at boiler outlet with free-blow drain valve factory installed between the two valves and visible when operating stop-check valve.
 10. Tankless Heater: Carbon-steel header with copper-tube heat exchanger, mounted in an upper port of cast-iron sections and sealed with fiber gasket.
 - a. Tappings NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
 - b. Tappings NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
- I. Controls
1. Refer to Division 23 Section "Instrumentation And Control For Hvac".
OR
Boiler operating controls shall include the following devices and features:
 - a. Control transformer.
 - b. Set-Point Adjust: Set points shall be adjustable.
 - c. Operating Pressure Control for Steam Boilers: Factory wired and mounted to cycle burner.
 - d. Low-Water Cutoff and Pump Control for Steam Boilers: Cycle feedwater pump(s) for makeup water control.
 - e. Sequence of Operation for Hot-Water Boilers: Electric, factory-fabricated and field-installed panel to control burner firing rate to maintain space temperature in response to thermostat with heat anticipator located in heated space.
OR
Sequence of Operation for Hot-Water Boilers: Electric, factory-fabricated and field-installed panel to control burner firing rate to reset supply-water temperature inversely with outside-air temperature. At 0 deg F (minus 17 deg C) outside-air temperature, set supply-water temperature at 200 deg F (93 deg C); at 60 deg F (15 deg C) outside-air temperature, set supply-water temperature at 140 deg F (60 deg C).
 - f. Sequence of Operation for Steam Boilers: Electric, factory-fabricated and field-installed panel to control burner firing rate to maintain a constant steam pressure. Maintain pressure set point plus or minus 10 percent.
 - 1) Include automatic, alternating-firing sequence for multiple boilers.
 2. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.
 - a. High Cutoff: Manual **OR** Automatic, **as directed**, reset stops burner if operating conditions rise above maximum boiler design temperature **OR** pressure, **as directed**.

- b. Low-Water Cutoff Switch: Electronic for hot-water boilers or Float and electronic for steam boilers probe shall prevent burner operation on low water. Cutoff switch shall be manual **OR** automatic, **as directed**, -reset type.
- c. Blocked Vent Safety Switch for Atmospheric Burners: Manual-reset switch factory mounted on draft diverter.
- d. Rollout Safety Switch for Atmospheric Burners: Factory mounted on boiler combustion chamber.
- e. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.
- 3. Building Automation System Interface: Factory install hardware and software to enable building automation system to monitor, control, and display boiler status and alarms.
 - a. Hardwired Points:
 - 1) Monitoring: On/off status, common trouble alarm **OR** low water level alarm, **as directed**.
 - 2) Control: On/off operation, hot water supply temperature set-point adjustment **OR** steam pressure adjustment, **as directed**.
 - b. A communication interface with building automation system shall enable building automation system operator to remotely control and monitor the boiler from an operator workstation. Control features available, and monitoring points displayed, locally at boiler control panel shall be available through building automation system.

J. Electrical Power

- 1. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 22..
- 2. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.
 - a. House in NEMA 250, Type 1 enclosure.
 - b. Wiring shall be numbered and color-coded to match wiring diagram.
 - c. Install factory wiring outside of an enclosure in a metal raceway.
 - d. Field power interface shall be to wire lugs **OR** fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**.
 - e. Provide branch power circuit to each motor and to controls with disconnect switch or circuit breaker, **as directed**.
 - f. Provide each motor with overcurrent protection.

K. Source Quality Control

- 1. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.
- 2. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.
- 3. Allow Owner access to source quality-control testing of boilers. Notify the Owner 14 days in advance of testing.

1.3 EXECUTION

A. Boiler Installation

- 1. Install boilers level on concrete base. Concrete base is specified in Division 23 Section "Common Work Results For Hvac" and concrete materials and installation requirements are specified in Division 31..
- 2. Vibration Isolation: Elastomeric isolator pads **OR** mounts, **as directed**, with a minimum static deflection of 0.25 inch (6.35 mm). Vibration isolation devices and installation requirements are

specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".

3. Install gas-fired boilers according to NFPA 54.
4. Install oil-fired boilers according to NFPA 31.
5. Assemble boiler sections in sequence and seal between each section if boiler is not delivered fully assembled.
6. Assemble and install boiler trim.
7. Install electrical devices furnished with boiler but not specified to be factory mounted.
8. Install control wiring to field-mounted electrical devices.

B. Connections

1. Piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install piping adjacent to boiler to allow service and maintenance.
3. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas train connection. Provide a reducer if required.
4. Connect oil piping full size to burner inlet with shutoff valve and union.
5. Connect hot-water piping to supply- and return-boiler tapplings with shutoff valve and union or flange at each connection.
6. Connect steam and condensate piping to supply-, return-, and blowdown-boiler tapplings with shutoff valve and union or flange at each connection.
7. Install piping from safety relief valves to nearest floor drain, for hot-water boilers.
8. Install piping from safety valves to drip-pan elbow and to nearest floor drain, for steam boilers.
9. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.
10. Connect breeching full size to boiler outlet. Comply with requirements in Division 23 Section "Breechings, Chimneys, And Stacks" for venting materials.
11. Install flue-gas recirculation duct from vent to burner. Comply with requirements in Division 23 Section "Breechings, Chimneys, And Stacks" for recirculation duct materials.
12. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
13. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

C. Field Quality Control

1. Perform tests and inspections and prepare test reports.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Tests and Inspections:
 - a. Perform installation and startup checks according to manufacturer's written instructions.
 - b. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
 - c. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
 - d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 1) Burner Test: Adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency.
 - 2) Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature **OR** steam pressure, **as directed**.
 - 3) Set field-adjustable switches and circuit-breaker trip ranges as indicated.
3. Remove and replace malfunctioning units and retest as specified above.
4. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.



5. Performance Tests, **as directed**:
 - a. Engage a factory-authorized service representative to inspect component assemblies and equipment installations, including connections, and to conduct performance testing.
 - b. Boilers shall comply with performance requirements indicated, as determined by field performance tests. Adjust, modify, or replace equipment to comply.
 - c. Perform field performance tests to determine capacity and efficiency of boilers.
 - 1) For dual-fuel boilers, perform tests for each fuel.
 - 2) Test for full capacity.
 - 3) Test for boiler efficiency at low fire 20, 40, 60, 80, 100, 80, 60, 40, and 20 percent of full capacity. Determine efficiency at each test point.
 - d. Repeat tests until results comply with requirements indicated.
 - e. Provide analysis equipment required to determine performance.
 - f. Provide temporary equipment and system modifications necessary to dissipate the heat produced during tests if building systems are not adequate.
 - g. Notify the Owner in advance of test dates.
 - h. Document test results in a report and submit to the Owner.

D. Demonstration

1. Train Owner's maintenance personnel to adjust, operate, and maintain boilers.

END OF SECTION 23 01 50 00

SECTION 23 01 60 00 - CONDENSING UNITS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for condensing units. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes air-cooled and water-cooled condensing units.

C. Submittals

1. Product Data: For each condensing unit, include rated capacities, operating characteristics, furnished specialties, and accessories. Include equipment dimensions, weights and structural loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Shop Drawings: Signed and sealed by a qualified professional engineer.
 - a. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints, **as directed**, and for designing vibration isolation bases.
 - b. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
 - c. Wiring Diagrams: Power, signal, and control wiring.
3. Manufacturer Seismic Qualification Certification: Submit certification that condensing units, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment". Include the following:
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
4. Field quality-control test reports.
5. Operation and maintenance data.
6. Warranty: Special warranty specified in this Section.
7. LEED Submittal:
 - a. Product Data for Credit EA 4: Documentation required by Credit EA 4 indicating that equipment and refrigerants comply.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Fabricate and label refrigeration system according to ASHRAE 15, "Safety Code for Mechanical Refrigeration."
3. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
4. ASME Compliance: Fabricate and label water-cooled condensing units to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

E. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of condensing units that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Compressor failure.
 - 2) Condenser coil leak.



- b. Warranty Period: Four **OR** Five **OR** 10, **as directed**, years from date of Final Completion.
- c. Warranty Period (Compressor Only): Five **OR** 10, **as directed**, years from date of Final Completion.
- d. Warranty Period (Condenser Coil Only): Five years from date of Final Completion.

1.2 PRODUCTS

A. Condensing Units, Air Cooled, 1 To 5 Tons (3.5 TO 17.6 kW)

1. Description: Factory assembled and tested, consisting of compressor, condenser coil, fan, motors, refrigerant reservoir, and operating controls.
2. Compressor: Scroll, hermetically sealed, with rubber vibration isolators.
 - a. Motor: Single **OR** Two, **as directed**, speed, and includes thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - b. Two-Speed Compressor: Include manual-reset, high-pressure switch and automatic-reset, low-pressure switch.
 - c. Accumulator: Suction tube.
 - d. Refrigerant Charge: R-22 **OR** R-407C **OR** R-410A, **as directed**.
3. Condenser Coil: Seamless copper-tube, aluminum-fin coil; circuited for integral liquid subcooler, with removable drain pan and brass service valves with service ports.
4. Condenser Fan: Direct-drive, aluminum propeller fan; with permanently lubricated, totally enclosed fan motor with thermal-overload protection and ball bearings, **as directed**.
5. Accessories:
 - a. Coastal Filter: Mesh screen to protect condenser coil from salt damage.
 - b. Crankcase heater.
 - c. Cycle Protector: Automatic-reset timer to prevent rapid compressor cycling.
 - d. Electronic programmable thermostat **OR** Low-voltage thermostat and subbase, **as directed**, to control condensing unit and evaporator fan.
 - e. Evaporator Freeze Thermostat: Temperature-actuated switch that stops unit when evaporator reaches freezing temperature.
 - f. Filter-dryer.
 - g. High-Pressure Switch: Automatic-reset switch cycles compressor off on high refrigerant pressure.
 - h. Liquid-line solenoid.
 - i. Low Ambient Controller: Cycles condenser fan to permit operation down to 0 deg F (minus 18 deg C) with time-delay relay to bypass low-pressure switch, **as directed**.
OR
Low Ambient Controller: Controls condenser fan speed to permit operation down to minus 20 deg F (minus 29 deg C) with time-delay relay to bypass low-pressure switch, **as directed**.
 - j. Low-Pressure Switch: Automatic-reset switch cycles compressor off on low refrigerant pressure.
 - k. PE mounting base to provide a permanent foundation.
 - l. Precharged and insulated suction and liquid tubing.
 - m. Sound Hood: Wraps around sound attenuation cover for compressor.
 - n. Thermostatic expansion valve.
 - o. Time-Delay Relay: Continues operation of evaporator fan after compressor shuts off.
6. Unit Casing: Galvanized steel, finished with baked enamel; with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Mount service valves, fittings, and gage ports on exterior of casing.

B. Condensing Units, Air Cooled, 6 To 120 Tons (21 TO 422 kW)

1. Description: Factory assembled and tested, air cooled; consisting of casing, compressors, condenser coils, condenser fans and motors, and unit controls.

2. Compressor: Hermetic or semihermetic compressor designed for service with crankcase sight glass, crankcase heater, and backseating service access valves on suction and discharge ports.
 - a. Capacity Control: Cylinder unloading **OR** Hot-gas bypass, **as directed**.
 - b. Refrigerant Charge: R-22 **OR** R-407C **OR** R-410A **OR** HFC-134a, **as directed**.
 3. Condenser Coil: Seamless copper-tube, aluminum-fin coil, including subcooling circuit and backseating liquid-line service access valve. Factory pressure test coils, then dehydrate by drawing a vacuum and fill with a holding charge of nitrogen or refrigerant.
 4. Condenser Fans: Propeller-type vertical discharge; either directly or belt driven. Include the following:
 - a. Permanently lubricated ball-bearing motors.
 - b. Separate motor for each fan.
 - c. Dynamically and statically balanced fan assemblies.
 5. Operating and safety controls include the following:
 - a. Manual-reset, high-pressure cutout switches.
 - b. Automatic-reset, low-pressure cutout switches.
 - c. Low oil pressure cutout switch.
 - d. Compressor-winding thermostat cutout switch.
 - e. Three-leg, compressor-overload protection.
 - f. Control transformer.
 - g. Magnetic contactors for compressor and condenser fan motors.
 - h. Timer to prevent excessive compressor cycling.
 6. Accessories:
 - a. Electronic programmable thermostat **OR** Low-voltage thermostat and subbase, **as directed**, to control condensing unit and evaporator fan.
 - b. Low Ambient Controller: Cycles condenser fan to permit operation down to 0 deg F (minus 18 deg C) with time-delay relay to bypass low-pressure switch, **as directed**.
OR
Low Ambient Controller: Controls condenser fan speed to permit operation down to minus 20 deg F (minus 29 deg C) with time-delay relay to bypass low-pressure switch, **as directed**.
 - c. Gage Panel: Package with refrigerant circuit suction and discharge gages.
 - d. Hot-gas bypass kit.
 - e. Part-winding-start timing relay, circuit breakers, and contactors.
 7. Unit Casings: Designed for outdoor installation with weather protection for components and controls and with removable panels for required access to compressors, controls, condenser fans, motors, and drives. Additional features include the following:
 - a. Steel, galvanized or zinc coated, for exposed casing surfaces; treated and finished with manufacturer's standard paint coating.
 - b. Perimeter base rail with forklift slots and lifting holes to facilitate rigging.
 - c. Gasketed control panel door.
 - d. Nonfused disconnect switch, factory mounted and wired, for single external electrical power connection.
 - e. Condenser coil hail guard **OR** grille, **as directed**, to protect coil from physical damage.
- C. Condensing Units, Water Cooled
1. Description: Factory assembled and tested, water cooled; consisting of compressors, water-cooled condensers, bases, and unit controls.
 2. Compressor: Hermetic or serviceable hermetic type; with oil pump, operating oil charge, and suction and discharge shutoff valves. Factory mounted on base using spring isolators. Include the following:
 - a. Thermally protected compressor motor.
 - b. Crankcase heater.
 - c. Capacity control using cylinder unloading, suction pressure controlled and discharge pressure operated, designed for unloaded start.
 - d. Refrigerant Charge: R-22 **OR** R-407C **OR** R-410A **OR** HFC-134a, **as directed**.

3. Condenser: Single-pass, tube-in-tube coaxial type; with seamless, integral-finned, copper tube and steel outer shell with water-regulating valve.
OR
Condenser: Multipass, shell-and-tube type; with replaceable, seamless, integral-finned copper tubes; positive-liquid subcooling circuit; pressure relief device; liquid-level test cock; purge connection; liquid-line shutoff valve; and angle valve for connection of water-regulating valve.
 - a. Unit Construction: ASME stamped, **as directed**, for refrigerant-side working pressure of 385 psig (2650 kPa) and water-side working pressure of 250 psig (1720 kPa).
4. Accessories include the following:
 - a. Discharge-line muffler.
 - b. Gage panel containing gages for suction, discharge, and oil pressure.
 - c. Electric solenoid cylinder unloaders.
 - d. Pump-down relay package.
 - e. Crankcase cover plates with equalizer connections.
5. Controls: Factory-mounted and -wired panel with the following:
 - a. Timer to prevent short cycling.
 - b. High- and low-refrigerant-pressure safety controls.
 - c. Power- and control-circuit terminal blocks.
 - d. Compressor motor starter.
 - e. Control-circuit on-off switch.
 - f. Control-circuit fuse.

D. Motors

1. General requirements for motors are specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 22.

E. Source Quality Control

1. Verification of Performance: Rate condensing units according to ARI 210/240, ARI 340/360, or ARI 365.
 - a. Energy Efficiency: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
2. Test and inspect shell and tube condensers according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
3. Testing Requirements: Factory test sound-power-level ratings according to ARI 270.

1.3 EXECUTION

A. Installation

1. Install units level and plumb, firmly anchored in locations indicated; maintain manufacturer's recommended clearances.
2. Install condensing units on concrete base. Concrete base is specified in Division 23 Section "Common Work Results For Hvac" and concrete materials and installation requirements are specified in Division 31.
3. Concrete Bases:
 - a. Install dowel rods to connect concrete base to concrete slab. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of the base.
 - b. For equipment supported on structural slab, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

- d. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - e. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 4. Install roof-mounting units on equipment supports specified in Division 07.
 5. Vibration Isolation: Mount condensing units on rubber pads with a minimum deflection of 1/4 inch (6.35 mm). Vibration isolation devices and installation requirements are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
OR
Vibration Isolation: Mount condensing units on restrained spring isolators with a minimum deflection specified by the Owner. Vibration isolation devices and installation requirements are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 6. Maintain manufacturer's recommended clearances for service and maintenance.
 7. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.
- B. Connections**
1. Piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Install piping adjacent to machine to allow service and maintenance.
 3. Connect precharged refrigerant tubing to unit's quick-connect fittings. Install tubing so it does not interfere with access to unit. Install furnished accessories.
 4. Connect refrigerant piping to air-cooled condensing units; maintain required access to unit. Install furnished field-mounted accessories. Refrigerant piping and specialties are specified in Division 23 Section "Refrigerant Piping".
 5. Connect refrigerant and condenser-water piping to water-cooled condensing units. Maintain clear tube removal space. Refrigerant piping and specialties are specified in Division 23 Section "Refrigerant Piping" and condenser-water piping and specialties are specified in Division 22 Section(s) "Domestic Water Piping" OR Division 23 Section(s) "Hydronic Piping", **as directed**.
- C. Field Quality Control**
1. Perform the following field tests and inspections and prepare test reports:
 - a. Perform electrical test and visual and mechanical inspection.
 - b. Leak Test: After installation, charge systems with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
 - c. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.
 - d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - e. Verify proper airflow over coils.
 2. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.
 3. Remove and replace malfunctioning condensing units and retest as specified above.
- D. Startup Service**
1. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
 - a. Inspect for physical damage to unit casing.
 - b. Verify that access doors move freely and are weathertight.
 - c. Clean units and inspect for construction debris.
 - d. Verify that all bolts and screws are tight.
 - e. Adjust vibration isolation and flexible connections.
 - f. Verify that controls are connected and operational.
 2. Lubricate bearings on fans.
 3. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
 4. Adjust fan belts to proper alignment and tension.



5. Start unit according to manufacturer's written instructions and complete manufacturer's startup checklist.
6. Measure and record airflow over coils.
7. Verify proper operation of condenser capacity control device.
8. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.
9. After startup and performance test, lubricate bearings and adjust belt tension, **as directed**.

E. Demonstration

1. Train Owner's maintenance personnel to adjust, operate, and maintain condensing units.

END OF SECTION 23 01 60 00



SECTION 23 05 00 00 - CSF COMMON WORK RESULTS FOR HVAC

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.23 05 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Basic mechanical methods.
 - 2. Supports and anchors.
 - 3. Motors.
 - 4. Mechanical identification.
 - 5. Vibration isolation.
 - 6. Sleeves and seals.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. 078400 - Firestopping: Materials for closure of penetrations at rated assemblies.
 - 2. 079200 - Joint Sealants: Sealants.
 - 3. 099100 - Painting: Field painting.
 - 4. 230915 - Variable Frequency Motor Controllers
 - 5. 019113 General Commissioning Requirements: Requirements related to Division 23 Commissioning

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM F708 - Design and Installation of Rigid Pipe Hangers.
- B. American Society of Mechanical Engineers (ASME):
 - 1. ASME A13.1 - Scheme for the Identification of Piping Systems.
 - 2. ASME B31.5 - Refrigeration Piping
 - 3. ASME B31.9 - Building Services Piping

- C. National Fire Protection Association
 - 1. NFPA 13 - Installation of Sprinkler Systems.
- D. Institute of Electrical and Electronic Engineers
 - 1. IEEE 112 - Test Procedure for Polyphase Induction Motors and Generators.
- E. National Electrical Manufacturers Association
 - 1. NEMA MG 1 - Motors and Generators.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data:
 - a. Pipe Supports and Anchors: Provide manufacturers catalog data including load capacity.
 - b. Motors: Provide wiring diagrams with electrical characteristics and connection requirements.
 - c. Mechanical Identification: Provide manufacturers catalog literature for each product required.
- B. Section 017704 – Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Project Record Documents: Accurately record the following:
 - a. Record actual locations of tagged valves; include valve tag numbers.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Conform to applicable local code for support of plumbing piping.
 - 2. Supports for Fire Suppression Piping: In conformance with NFPA 13.
 - 3. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for the purpose specified and indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering.

1.6 BASIC MECHANICAL METHODS

- A. Comply with manufacturer's published instructions for delivery, storage, protection, installation, and materials.
- B. When equipment is operable, and it is to the advantage of the Contractor to operate the equipment, he may do so provided that he properly supervises the operation, and retains full responsibility for the equipment operated. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, install new filter media, make all required adjustments, and complete all punch list items before final acceptance by the Construction Manager and Contracting Officer.
- C. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required

- access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.
- D. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible.
- E. Items exposed (in areas without ceilings) shall be installed in a neat, orderly manner. Elements shall be perpendicular and parallel to building lines.
- F. In those conditions where ductwork is exposed in finished areas, careful craftsmanship and only the highest standards of installation will be acceptable. All routing of exposed ducts, pipes, conduits, shall be approved in advance by the Contracting Officer prior to installation.
- G. Drawings And Specifications:
1. The Drawings indicate the general arrangement of systems and are to be followed insofar as possible. If deviations from the layout are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted in writing to the Contracting Officer , for approval before proceeding with the work.
 2. This Contractor shall make all his own measurements in the field and shall be responsible for correct fitting. Contractor shall coordinate this work with all other branches in such a manner as to cause a minimum of conflict or delay.
 3. Where any work is so placed as to cause or contribute to a conflict it shall be readjusted at the expense of the Contractor causing the conflict. The decision shall be final in regard to the arrangement of ducts, piping, etc., where conflict arises.
 4. Where offsets in systems are required to complete the installation, or for the proper operation of the system, these shall be deemed to be included in the Contract.
 5. Significant deviations from Drawings must be approved by the.
- H. Locations:
1. Mechanical layouts indicated on drawings are diagrammatic. Exact locations of ducts, pipes, and equipment may vary because of conflicts with work of other trades. Work out conflicts where relocations will not affect operation or appearance of systems.
 2. Locate equipment requiring periodic servicing so that it is readily accessible. Do not back up service sides to walls, nor place it too close to other equipment to make service impractical.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 PIPE HANGERS AND SUPPORTS

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Grinnell, Exeter, NH (603) 778-9200.
 2. Other acceptable manufacturers offering equivalent products.
 - a. Elcen
 - b. Fee and Mason
 - c. Kin-Line
 - d. Michigan
 - e. Unistrut



3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

B. Refrigerant Piping:

1. Conform to [ASME B31.5] [ASTM F708].
2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): [Malleable iron] [Carbon steel,] adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes to 3 Inches (75 mm): Cast iron hook.
6. Wall Support for Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

- C. See Hanger and Support schedule at end of this Section.

2.2 MOTORS

- A. Electric motors shall be new NEMA Standard, sized and designed to operate at full load and full speed continuously, or variable frequency drive duty as required, without causing noise, vibration, and temperature rise in excess of their rating.
- B. Motors on belt driven equipment shall have slide rails with adjusting screws for belt tension adjustment. Motors exposed to the weather shall be weather-protected.
- C. Premium efficiency electric motors shall be installed on air handling units, relief fans, and exhaust fans.
- D. Premium efficiency motors shall have efficiency and losses determined in accordance with the latest revisions of IEEE Standard 112. Polyphase squirrel-cage motors rated 1 through 125 horsepower shall be tested by dynamometer method B. The efficiency will be determined using segregated losses in which stray load loss is obtained from a linear regression analysis to reduce the effect of random errors in the test measurements. Guaranteed minimum load efficiency shall be as follows:

MOTOR HP	FULL LOAD RPM	GUARANTEED FULL LOAD EFF.
1	1800	85.5
1.5	1800	86.5
2	1800	86.5
3	1800	89.5
5	1800	89.5
7-1/2	1800	91.7
10	1800	91.7
15	1800	92.4
20	1800	93.0
25	1800	93.6
30	1800	94.1
40	1800	94.1
50	1800	94.5
60	1800	95.0
75	1800	95.4

- E. Motor sound power levels shall not be greater than recommended in NEMA MG 1-12.49.
- F. Provide motors with drive shafts long enough to extend completely through belt sheaves when sheaves are properly aligned or balanced.
- G. Motor Characteristics:
 - 1. 120V/1/60 Hz: Capacitor start, open drip-proof type, ball bearing, rated 40 C. continuous rise.
 - 2. 460/3/60 Hz: NEMA B, normal starting torque, single speed, squirrel-cage type, open drip-proof, rated 40 C continuous rise, with ball bearings rated for B-10 life of 100,000 hours and fitted with grease fittings and relief ports. Provide motors with aluminum end brackets with steel inserts in bearing cavities.
- H. Manufacturers: Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 - 1. GE
 - 2. Other acceptable manufacturers offering equivalent products.
 - a. Lincoln
 - b. Reliance
 - c. Louis Alis
 - 3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- I. Motor Sentinel Switches:
 - 1. Manufacturers: Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 - a. Square D Class 2510
 - b. Siemens SCN or SCF Series.
 - c. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- J. Combination Starter/Disconnect:
 - 1. Manufacturers: Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 - a. Square D Class 8538 or 8539
 - b. Siemens SCN or SCF Series.
 - c. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- K. Motor/Circuit Disconnects:
 - 1. Manufacturers: Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 - a. Square D Class Type HU.
 - b. Siement/I-T-E Enclosed Switch.
 - c. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.3 MECHANICAL IDENTIFICATION

- A. Nameplates: Laminated three-layer plastic with engraved [black] [] letters on light contrasting background color.
- B. Tags
 - 1. Plastic Tags: Laminated three-layer plastic with engraved [black] [] letters on light contrasting background color. Tag size minimum 1-1/2 inches (38 mm) [diameter] [square] [].



2. Metal Tags: [Brass] [Aluminum] [Stainless Steel] [] with stamped letters; tag size minimum 1-1/2 inches (38 mm) [diameter] [square] [] with smooth edges.
3. Information Tags: Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches (83 x 143 mm) with grommet and self-locking nylon ties.
4. Tag Chart: Typewritten letter size list [in anodized aluminum frame] plastic laminated].

C. Pipe Markers

1. Color and Lettering: Conform to ASME A13.1.
2. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.
3. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
4. Plastic Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches (150 mm) wide by 4 mil (0.10 mm) thick, manufactured for direct burial service.

2.4 VIBRATION ISOLATION

- A. Type 1: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
- B. Type 2: Open spring mount with stiff springs (horizontal stiffness equal to vertical stiffness).
- C. Type 3: Open spring mount with stiff springs, heavy mounting frame, and limit stop.
- D. Type 4: Closed spring mount with stiff springs and limit stop.
- E. Type 5: Closed spring hanger with acoustic washer.
- F. Type 6: Closed spring hanger with one inch (25 mm) thick acoustic isolator.
- G. Type 7: Elastomer mount with threaded insert and hold down holes.
- H. Type 8: Neoprene jacketed pre-compressed molded glass fiber.
- I. Type 9: Rubber waffle pads, 30 durometer, minimum 1/2 inch (13 mm) thick, maximum loading 40 psi (275 kPa). Use neoprene in oily or exterior locations.
- J. Type 10: 1/2 inch (13 mm) thick rubber waffle pads bonded each side of 1/4 inch (6 mm) thick steel plate.

2.5 SLEEVES AND SEALS

- A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage (1.2 mm thick) galvanized steel.
- B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage (1.2 mm thick) galvanized steel.
- C. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed, refer to Section 078400.
- D. Sleeves for Round Ductwork: Galvanized steel.
- E. Sleeves for Rectangular Ductwork: Galvanized steel or wood.

- F. Firestopping Insulation: Glass fiber type, non-combustible; refer to Section 078400.
- G. Sealant: refer to Section 079200.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION - MECHANICAL IDENTIFICATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.3 INSTALLATION - GENERAL

- A. Install in accordance with manufacturer's instructions.
- B. The use of lead-containing solder for plumbing and plumbing fixtures is prohibited in the construction of this project.

3.4 INSTALLATION - PIPE HANGER AND SUPPORTS

- A. Support horizontal piping as scheduled.
- B. Install hangers to provide minimum 1/2 inch (13 mm) space between finished covering and adjacent work.
- C. Place hangers within 12 inches (300 mm) of each horizontal elbow.
- D. Use hangers with 1-1/2 inch (38 mm) minimum vertical adjustment.
- E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet (1.5 m) maximum spacing between hangers.
- F. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- G. Support riser piping independently of connected horizontal piping.
- H. Provide [copper plated hangers and supports for copper piping] [sheet lead packing between hanger or support and piping].

- I. Design hangers for pipe movement without disengagement of supported pipe.
- J. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.5 INSTALLATION - MOTORS

- A. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
- B. Line up motors on direct drive dial type gauges.
- C. Check line voltage and phase and ensure agreement with nameplate.
- D. Make electrical connections and test motor for proper rotation/ phasing under Division 26.
- E. Adjust motors together with driven equipment to insure equipment is dynamically and statically balanced. Correct any excessive vibration or noise from the equipment.

3.6 INSTALLATION - MECHANICAL IDENTIFICATION

- A. Install identifying devices after completion of coverings and painting.
- B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
- C. Install tags using corrosion resistant chain. Number tags consecutively by location.
- D. Install underground plastic pipe markers 6 to 8 inches (150 to 200 mm) below finished grade, directly above buried pipe.
- E. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- F. Identify control panels and major control components outside panels with plastic nameplates.
- G. Identify valves in main and branch piping with tags.
- H. Identify air terminal units and radiator valves with numbered tags.
- I. Tag automatic controls, instruments, and relays. Key to control schematic.
- J. Identify piping, concealed or exposed, with plastic pipe markers and plastic tape pipe markers. Use tags on piping 3/4 inch (20 mm) diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.
- K. Identify ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
- L. Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

3.7 INSTALLATION - VIBRATION ISOLATION

- A. Install vibration isolators for motor driven equipment.
- B. Set steel bases for one inch (25 mm) clearance between housekeeping pad and base. Set concrete inertia bases for 2 inch (50 mm) clearance. Adjust equipment level.
- C. Provide spring isolators on piping connected to isolated equipment as follows: Up to 4 inch (100 mm) diameter, first three points of support; 5 to 8 inch (125 to 200 mm) diameter, first four points of support; 10 inch (250 mm) diameter and over, first six points of support. Static deflection of first point shall be twice deflection of isolated equipment.

3.8 PIPE HANGER AND SUPPORT SCHEDULE

PIPE SIZE Inches (mm)	MAX. HANGER SPACING Feet (m)	HANGER ROD DIAMETER Inches (mm)
1/2 to 1-1/4 (12 to 32)	6.5 (2)	3/8 (9)
1-1/2 to 2 (38 to 50)	10 (3)	3/8 (9)
2-1/2 to 3 (62 to 75)	10 (3)	1/2 (13)
4 to 6 (100 to 150)	10 (3)	5/8 (15)
8 to 12 (200 to 300)	14 (4.25)	7/8 (22)
PVC (All Sizes)	6 (1.8)	3/8 (9)
C.I. Bell and Spigot(or No-Hub) and at Joints	5 (1.5) ([])	[]

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/7/2011

END OF SECTION



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SECTION 23 05 00 00 - MPF COMMON WORK RESULTS FOR HVAC

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.23 05 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Basic mechanical methods.
 - 2. Supports and anchors.
 - 3. Motors.
 - 4. Mechanical identification.
 - 5. Vibration isolation.
 - 6. Sleeves and seals.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. 078400 - Firestopping: Materials for closure of penetrations at rated assemblies.
 - 2. 079200 - Joint Sealants: Sealants.
 - 3. 099100 - Painting: Field painting.
 - 4. Section 019113 – General Commissioning Requirements: Requirements related to Division 23 Commissioning

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM F708 - Design and Installation of Rigid Pipe Hangers.
- B. American Society of Mechanical Engineers (ASME):
 - 1. ASME A13.1 - Scheme for the Identification of Piping Systems.
 - 2. ASME B31.5 - Refrigeration Piping
 - 3. ASME B31.9 - Building Services Piping
- C. National Fire Protection Association
 - 1. NFPA 13 - Installation of Sprinkler Systems.
- D. Institute of Electrical and Electronic Engineers
 - 1. IEEE 112 - Test Procedure for Polyphase Induction Motors and Generators.
- E. National Electrical Manufacturers Association
 - 1. NEMA MG 1 - Motors and Generators.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data:
 - a. Pipe Supports and Anchors: Provide manufacturers catalog data including load capacity.
 - b. Motors: Provide wiring diagrams with electrical characteristics and connection requirements.
 - c. Mechanical Identification: Provide manufacturers catalog literature for each product required.
- B. Section 017704 – Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Project Record Documents: Accurately record the following:
 - a. Record actual locations of tagged valves; include valve tag numbers.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Conform to applicable local code for support of plumbing piping.
 - 2. Supports for Fire Suppression Piping: In conformance with NFPA 13.
 - 3. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for the purpose specified and indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering.

1.6 BASIC MECHANICAL METHODS

- A. Comply with manufacturer's published instructions for delivery, storage, protection, installation, and materials.
- B. When equipment is operable, and it is to the advantage of the Contractor to operate the equipment, he may do so provided that he properly supervises the operation, and retains full responsibility for the equipment operated. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, install new filter media, make all required adjustments, and complete all punch list items before final acceptance by the Construction Manager and Contracting Officer.
- C. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.
- D. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible.
- E. Items exposed (in areas without ceilings) shall be installed in a neat, orderly manner. Elements shall be perpendicular and parallel to building lines.

- F. In those conditions where ductwork is exposed in finished areas, careful craftsmanship and only the highest standards of installation will be acceptable. All routing of exposed ducts, pipes, conduits, shall be approved in advance by the Contracting Officer prior to installation.
- G. Drawings And Specifications:
1. The Drawings indicate the general arrangement of systems and are to be followed insofar as possible. If deviations from the layout are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted in writing to the Contracting Officer , for approval before proceeding with the work.
 2. This Contractor shall make all his own measurements in the field and shall be responsible for correct fitting. Contractor shall coordinate this work with all other branches in such a manner as to cause a minimum of conflict or delay.
 3. Where any work is so placed as to cause or contribute to a conflict it shall be readjusted at the expense of the Contractor causing the conflict. The decision shall be final in regard to the arrangement of ducts, piping, etc., where conflict arises.
 4. Where offsets in systems are required to complete the installation, or for the proper operation of the system, these shall be deemed to be included in the Contract.
 5. Significant deviations from Drawings must be approved by the.
- H. Locations:
1. Mechanical layouts indicated on drawings are diagrammatic. Exact locations of ducts, pipes, and equipment may vary because of conflicts with work of other trades. Work out conflicts where relocations will not affect operation or appearance of systems.
 2. Locate equipment requiring periodic servicing so that it is readily accessible. Do not back up service sides to walls, nor place it too close to other equipment to make service impractical.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 PIPE HANGERS AND SUPPORTS

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Grinnell, Exeter, NH (603) 778-9200.
 2. Other acceptable manufacturers offering equivalent products.
 - a. Elcen
 - b. Fee and Mason
 - c. Kin-Line
 - d. Michigan
 - e. Unistrut
 3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Fire Protection Piping:
1. Conform to NFPA 13.
 2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): [Malleable iron] [Carbon steel], adjustable swivel, split ring.
 3. Hangers for Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
 4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 5. Wall Support for Pipe Sizes to 3 Inches (75 mm): Cast iron hook.



6. Wall Support for Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp.
 7. Vertical Support: Steel riser clamp.
 8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- C. Plumbing Piping - DWV:
1. Conform to [ASME B31.9] [ASTM F708].
 2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Malleable iron or carbon steel, adjustable swivel, split ring.
 3. Hangers for Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
 4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 5. Wall Support for Pipe Sizes to 3 Inches (75 mm): Cast iron hook.
 6. Wall Support for Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp.
 7. Vertical Support: Steel riser clamp.
 8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- D. Plumbing Piping - Water:
1. Conform to [ASME B31.9] [ASTM F708].
 2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Malleable iron or carbon steel, adjustable swivel, split ring.
 3. Hangers for Cold Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
 4. Hangers for Hot Pipe Sizes 2 to 4 Inches (50 to 100 mm): Carbon steel, adjustable, clevis.
 5. Hangers for Hot Pipe Sizes 6 Inches (150 mm) and Over: Adjustable steel yoke, cast iron roll, double hanger.
 6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches (150 mm) and Over: Steel channels with welded spacers and hanger rods, cast iron roll.
 8. Wall Support for Pipe Sizes to 3 Inches (76 mm): Cast iron hook.
 9. Wall Support for Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp.
 10. Wall Support for Hot Pipe Sizes 6 Inches (150 mm) and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
 11. Vertical Support: Steel riser clamp.
 12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 13. Floor Support for Hot Pipe Sizes to 4 Inches (100 mm): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 14. Floor Support for Hot Pipe Sizes 6 Inches (150 mm) and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
 15. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- E. Refrigerant Piping:
1. Conform to [ASME B31.5] [ASTM F708].
 2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Malleable iron or carbon steel adjustable swivel, split ring.
 3. Hangers for Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
 4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 5. Wall Support for Pipe Sizes to 3 Inches (75 mm): Cast iron hook.
 6. Wall Support for Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp.
 7. Vertical Support: Steel riser clamp.

- 8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- 9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- F. See Hanger and Support schedule at end of this Section.

2.2 MOTORS

- A. Electric motors shall be new NEMA Standard, sized and designed to operate at full load and full speed continuously without causing noise, vibration, and temperature rise in excess of their rating.
- B. Motors on belt driven equipment shall have slide rails with adjusting screws for belt tension adjustment. Motors exposed to the weather shall be weather-protected.
- C. Premium efficiency electric motors shall be installed on air handling units, relief fans, exhaust fans, pumps, etc..
- D. High efficiency motors shall have efficiency and losses determined in accordance with the latest revisions of IEEE Standard 112. Polyphase squirrel-cage motors rated 1 through 125 horsepower shall be tested by dynamometer method B. The efficiency will be determined using segregated losses in which stray load loss is obtained from a linear regression analysis to reduce the effect of random errors in the test measurements. Guaranteed minimum load efficiency shall be as follows:

MOTOR HP	FULL LOAD RPM	GUARANTEED MINIMUM FULL LOAD EFF.
3	1750	86.5
5	1750	86.5
7-1/2	1750	88.5
10	1745	90.2
15	1760	90.2
20	1760	91.0
25	1760	91.7
30	1760	92.4

- E. Motor sound power levels shall not be greater than recommended in NEMA MG 1-12.49.
- F. Provide motors with drive shafts long enough to extend completely through belt sheaves when sheaves are properly aligned or balanced.
- G. Motor Characteristics:
 - 1. 120V/1/60 Hz: Capacitor start, open drip-proof type, ball bearing, rated 40 C. continuous rise.
 - 2. 460/3/60 Hz: NEMA B, normal starting torque, single speed, squirrel-cage type, open drip-proof, rated 40 C continuous rise, with ball bearings rated for B-10 life of 100,000 hours and fitted with grease fittings and relief ports. Provide motors with aluminum end brackets with steel inserts in bearing cavities.
- H. Manufacturers: Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 - 1. GE
 - 2. Other acceptable manufacturers offering equivalent products.
 - a. Lincoln
 - b. Reliance
 - c. Louis Alis



3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

I. Motor Sentinel Switches:

1. Manufacturers: Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 - a. Square D Class 2510
 - b. Siemens SCN or SCF Series.
 - c. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

J. Combination Starter/Disconnect:

1. Manufacturers: Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 - a. Square D Class 8538 or 8539
 - b. Siemens SCN or SCF Series.
 - c. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

K. Motor/Circuit Disconnects:

1. Manufacturers: Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 - a. Square D Class Type HU.
 - b. Siement/I-T-E Enclosed Switch.
 - c. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.3 MECHANICAL IDENTIFICATION

- A. Nameplates: Laminated three-layer plastic with engraved [black] [] letters on light contrasting background color.

B. Tags

1. Plastic Tags: Laminated three-layer plastic with engraved [black] [] letters on light contrasting background color. Tag size minimum 1-1/2 inches (38 mm) [diameter] [square] [].
2. Metal Tags: Brass, Aluminum, or Stainless Steel [] with stamped letters; tag size minimum 1-1/2 inches (38 mm) diameter or square with smooth edges.
3. Information Tags: Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches (83 x 143 mm) with grommet and self-locking nylon ties.
4. Tag Chart: Typewritten letter size list in anodized aluminum frame and plastic laminated.

C. Pipe Markers

1. Color and Lettering: Conform to ASME A13.1.
2. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.
3. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
4. Plastic Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches (150 mm) wide by 4 mil (0.10 mm) thick, manufactured for direct burial service.

2.4 VIBRATION ISOLATION

- A. Type 1: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
- B. Type 2: Open spring mount with stiff springs (horizontal stiffness equal to vertical stiffness).
- C. Type 3: Open spring mount with stiff springs, heavy mounting frame, and limit stop.
- D. Type 4: Closed spring mount with stiff springs and limit stop.
- E. Type 5: Closed spring hanger with acoustic washer.
- F. Type 6: Closed spring hanger with one inch (25 mm) thick acoustic isolator.
- G. Type 7: Elastomer mount with threaded insert and hold down holes.
- H. Type 8: Neoprene jacketed pre-compressed molded glass fiber.
- I. Type 9: Rubber waffle pads, 30 durometer, minimum 1/2 inch (13 mm) thick, maximum loading 40 psi (275 kPa). Use neoprene in oily or exterior locations.
- J. Type 10: 1/2 inch (13 mm) thick rubber waffle pads bonded each side of 1/4 inch (6 mm) thick steel plate.

2.5 SLEEVES AND SEALS

- A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage (1.2 mm thick) galvanized steel.
- B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage (1.2 mm thick) galvanized steel.
- C. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed, refer to Section 078400.
- D. Sleeves for Round Ductwork: Galvanized steel.
- E. Sleeves for Rectangular Ductwork: Galvanized steel or wood.
- F. Firestopping Insulation: Glass fiber type, non-combustible; refer to Section 078400.
- G. Sealant: Refer to Section 079200.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.



- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION - MECHANICAL IDENTIFICATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.3 INSTALLATION - GENERAL

- A. Install in accordance with manufacturer's instructions.
- B. The use of lead-containing solder for plumbing and plumbing fixtures is prohibited in the construction of this project.

3.4 INSTALLATION - PIPE HANGER AND SUPPORTS

- A. Support horizontal piping as scheduled.
- B. Install hangers to provide minimum 1/2 inch (13 mm) space between finished covering and adjacent work.
- C. Place hangers within 12 inches (300 mm) of each horizontal elbow.
- D. Use hangers with 1-1/2 inch (38 mm) minimum vertical adjustment.
- E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet (1.5 m) maximum spacing between hangers.
- F. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- G. Support riser piping independently of connected horizontal piping.
- H. Provide [copper plated hangers and supports for copper piping] [sheet lead packing between hanger or support and piping].
- I. Design hangers for pipe movement without disengagement of supported pipe.
- J. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.5 INSTALLATION - MOTORS

- A. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
- B. Line up motors on direct drive dial type gauges.
- C. Check line voltage and phase and ensure agreement with nameplate.
- D. Make electrical connections and test motor for proper rotation/ phasing under Division 26.

- E. Adjust motors together with driven equipment to insure equipment is dynamically and statically balanced. Correct any excessive vibration or noise from the equipment.

3.6 INSTALLATION - MECHANICAL IDENTIFICATION

- A. Install identifying devices after completion of coverings and painting.
- B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
- C. Install tags using corrosion resistant chain. Number tags consecutively by location.
- D. Install underground plastic pipe markers 6 to 8 inches (150 to 200 mm) below finished grade, directly above buried pipe.
- E. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- F. Identify control panels and major control components outside panels with plastic nameplates.
- G. Identify valves in main and branch piping with tags.
- H. Identify air terminal units and radiator valves with numbered tags.
- I. Tag automatic controls, instruments, and relays. Key to control schematic.
- J. Identify piping, concealed or exposed, with plastic pipe markers and plastic tape pipe markers. Use tags on piping 3/4 inch (20 mm) diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.
- K. Identify ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
- L. Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

3.7 INSTALLATION - VIBRATION ISOLATION

- A. Install vibration isolators for motor driven equipment.
- B. Set steel bases for one inch (25 mm) clearance between housekeeping pad and base. Set concrete inertia bases for 2 inch (50 mm) clearance. Adjust equipment level.
- C. Provide spring isolators on piping connected to isolated equipment as follows: Up to 4 inch (100 mm) diameter, first three points of support; 5 to 8 inch (125 to 200 mm) diameter, first four points of support; 10 inch (250 mm) diameter and over, first six points of support. Static deflection of first point shall be twice deflection of isolated equipment.

3.8 PIPE HANGER AND SUPPORT SCHEDULE

HANGER ROD

23 - Heating, Ventilating, And Air-Conditioning
(HVAC)



PIPE SIZE Inches (mm)	MAX. HANGER SPACING Feet (m)	DIAMETER Inches (mm)
1/2 to 1-1/4 (12 to 32)	6.5 (2)	3/8 (9)
1-1/2 to 2 (38 to 50)	10 (3)	3/8 (9)
2-1/2 to 3 (62 to 75)	10 (3)	1/2 (13)
4 to 6 (100 to 150)	10 (3)	5/8 (15)
8 to 12 (200 to 300)	14 (4.25)	7/8 (22)
PVC (All Sizes)	6 (1.8)	3/8 (9)
C.I. Bell and Spigot(or No-Hub) and at Joints	5 (1.5) ([____])	[____]

USPS Mail Processing Facility Specification issued: 10/1/2013
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END OF SECTION



Task	Specification	Specification Description
23 05 13 00	26 05 19 13	Electrical Renovation



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SECTION 23 05 16 00 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for expansion fittings and loops for plumbing piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Flexible-hose packless expansion joints.
 - b. Metal-bellows packless expansion joints.
 - c. Rubber packless expansion joints.
 - d. Grooved-joint expansion joints.
 - e. Pipe loops and swing connections.
 - f. Alignment guides and anchors.

C. Performance Requirements

1. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.
2. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

D. Submittals

1. Product Data: For each type of product indicated.
2. Delegated-Design Submittal: For each anchor and alignment guide indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing connections.
 - b. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
 - c. Alignment Guide Details: Detail field assembly and attachment to building structure.
 - d. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.
3. Welding certificates.
4. Product Certificates: For each type of expansion joint, from manufacturer.
5. Maintenance Data: For expansion joints to include in maintenance manuals.

E. Quality Assurance

1. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. ASME Boiler and Pressure Vessel Code: Section IX.

1.2 PRODUCTS**A. Packless Expansion Joints**

1. Flexible-Hose Packless Expansion Joints:
 - a. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.
 - b. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.

- c. Expansion Joints for Copper Tubing NPS 2 (DN 50) and Smaller: Copper-alloy fittings with solder-joint end connections.
 - 1) Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F (3100 kPa at 21 deg C) and 340 psig at 450 deg F (2340 kPa at 232 deg C) ratings.
 - 2) Bronze hoses and double-braid bronze sheaths with 700 psig at 70 deg F (4830 kPa at 21 deg C) and 500 psig at 450 deg F (3450 kPa at 232 deg C) ratings.
- d. Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Copper-alloy fittings with threaded end connections.
 - 1) Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F (2070 kPa at 21 deg C) and 225 psig at 450 deg F (1550 kPa at 232 deg C) ratings.
 - 2) Stainless-steel hoses and double-braid, stainless-steel sheaths with 420 psig at 70 deg F (2890 kPa at 21 deg C) and 315 psig at 450 deg F (2170 kPa at 232 deg C) ratings.
- e. Expansion Joints for Steel Piping NPS 2 (DN 50) and Smaller: Stainless-steel fittings with threaded end connections.
 - 1) Stainless-steel hoses and single-braid, stainless-steel sheaths with 450 psig at 70 deg F (3100 kPa at 21 deg C) and 325 psig at 600 deg F (2250 kPa at 315 deg C) ratings.
 - 2) Stainless-steel hoses and double-braid, stainless-steel sheaths with 700 psig at 70 deg F (4830 kPa at 21 deg C) and 515 psig at 600 deg F (3550 kPa at 315 deg C) ratings.
- f. Expansion Joints for Steel Piping NPS 2-1/2 to NPS 6 (DN 65 to DN 150): Stainless-steel fittings with flanged end connections.
 - 1) Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70 deg F (1380 kPa at 21 deg C) and 145 psig at 600 deg F (1000 kPa at 315 deg C) ratings.
 - 2) Stainless-steel hoses and double-braid, stainless-steel sheaths with 275 psig at 70 deg F (1900 kPa at 21 deg C) and 200 psig at 600 deg F (1380 kPa at 315 deg C) ratings.
- g. Expansion Joints for Steel Piping NPS 8 to NPS 12 (DN 200 to DN 300): Stainless-steel fittings with flanged end connections.
 - 1) Stainless-steel hoses and single-braid, stainless-steel sheaths with 125 psig at 70 deg F (860 kPa at 21 deg C) and 90 psig at 600 deg F (625 kPa at 315 deg C) ratings.
 - 2) Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 deg F (1130 kPa at 21 deg C) and 120 psig at 600 deg F (830 kPa at 315 deg C) ratings.
- 2. Metal-Bellows Packless Expansion Joints:
 - a. Standards: ASTM F 1120 and EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
 - b. Type: Circular, corrugated bellows with external tie rods.
 - c. Minimum Pressure Rating: 150 psig (1035 kPa) **OR** 175 psig (1200 kPa), **as directed**, unless otherwise indicated.
 - d. Configuration: Single joint **OR** Single joint with base and double joint with base, **as directed**, class(es) unless otherwise indicated.
 - e. Expansion Joints for Copper Tubing: Single **OR** Multi, **as directed**, -ply phosphor-bronze bellows, copper pipe ends, and brass shrouds.
 - 1) End Connections for Copper Tubing NPS 2 (DN 50) and Smaller: Solder joint or threaded.
 - 2) End Connections for Copper Tubing NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Solder joint or threaded.
 - 3) End Connections for Copper Tubing NPS 5 (DN 125) and Larger: Flanged.
- 3. Rubber Packless Expansion Joints:

- a. Standards: ASTM F 1123 and FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."
 - b. Material: Fabric-reinforced rubber complying with FSA-NMEJ-703.
 - c. Arch Type: Single **OR** Multiple, **as directed**, arches with external control rods, **as directed**.
 - d. Spherical Type: Single **OR** Multiple, **as directed** spheres with external control rods, **as directed**.
 - e. Minimum Pressure Rating for NPS 1-1/2 to NPS 4 (DN 40 to DN 100): 150 psig (1035 kPa) at 220 deg F (104 deg C).
 - f. Minimum Pressure Rating for NPS 5 and NPS 6 (DN 125 and DN 150): 140 psig (966 kPa) at 200 deg F (93 deg C).
 - g. Minimum Pressure Rating for NPS 8 to NPS 12 (DN 200 to DN 300): 140 psig (966 kPa) at 180 deg F (82 deg C).
 - h. Material for Fluids Containing Acids, Alkalies, or Chemicals: BR **OR** CSM **OR** EPDM, **as directed**.
 - i. Material for Fluids Containing Gas, Hydrocarbons, or Oil: Buna-N **OR** CR, **as directed**.
 - j. Material for Water: BR **OR** Buna-N **OR** CR **OR** CSM **OR** EPDM **OR** NR, **as directed**.
 - k. End Connections: Full-faced, integral steel flanges with steel retaining rings.
- B. Grooved-Joint Expansion Joints
- 1. Description: Factory-assembled expansion joint made of several grooved-end pipe nipples, couplings, and grooved joints.
 - 2. Standard: AWWA C606, for grooved joints.
 - 3. Nipples: Galvanized, **as directed**, ASTM A 53/A 53M, Schedule 40, Type E or S, steel pipe with grooved ends.
 - 4. Couplings: Five **OR** Seven **OR** 10 **OR** 12, **as directed**, flexible type for steel-pipe dimensions. Include ferrous housing sections, Buna-N gasket suitable for diluted acid, alkaline fluids, and cold and hot water **OR** EPDM gasket suitable for cold and hot water, **as directed**, and bolts and nuts.
- C. Alignment Guides And Anchors
- 1. Alignment Guides:
 - a. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding spider for bolting to pipe.
 - 2. Anchor Materials:
 - a. Steel Shapes and Plates: ASTM A 36/A 36M.
 - b. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
 - c. Washers: ASTM F 844, steel, plain, flat washers.
 - d. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.
 - 1) Stud: Threaded, zinc-coated carbon steel.
 - 2) Expansion Plug: Zinc-coated steel.
 - 3) Washer and Nut: Zinc-coated steel.
 - e. Chemical Fasteners: Insert-type-stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.
 - 1) Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
 - 2) Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud unless otherwise indicated.
 - 3) Washer and Nut: Zinc-coated steel.

1.3 EXECUTION

A. Expansion-Joint Installation

1. Install expansion joints of sizes matching sizes of piping in which they are installed.
2. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
3. Install rubber packless expansion joints according to FSA-NMEJ-702.
4. Install grooved-joint expansion joints to grooved-end steel piping

B. Pipe Loop And Swing Connection Installation

1. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.
2. Connect risers and branch connections to mains with at least five pipe fittings including tee in main.
3. Connect risers and branch connections to terminal units with at least four pipe fittings including tee in riser.
4. Connect mains and branch connections to terminal units with at least four pipe fittings including tee in main.

C. Alignment-Guide And Anchor Installation

1. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.
2. Install one **OR** two, **as directed**, guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.
3. Attach guides to pipe and secure guides to building structure.
4. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
5. Anchor Attachments:
 - a. Anchor Attachment to Black-Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - b. Anchor Attachment to Galvanized-Steel Pipe: Attach with pipe hangers. Use MSS SP-69, Type 42, riser clamp welded to anchor.
 - c. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24, U-bolts bolted to anchor.
6. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.
 - a. Anchor Attachment to Steel Structural Members: Attach by welding.
 - b. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.
7. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION 23 05 16 00

SECTION 23 05 16 00a - EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for expansion fittings and loops for HVAC piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Flexible, ball-joint, packed expansion joints.
 - b. Slip-joint packed expansion joints.
 - c. Expansion-compensator packless expansion joints.
 - d. Flexible-hose packless expansion joints.
 - e. Metal-bellows packless expansion joints.
 - f. Rubber packless expansion joints.
 - g. Grooved-joint expansion joints.
 - h. Pipe loops and swing connections.
 - i. Alignment guides and anchors.

C. Performance Requirements

1. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.
2. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

D. Submittals

1. Product Data: For each type of product indicated.
2. Delegated-Design Submittal: For each anchor and alignment guide indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing connections.
 - b. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
 - c. Alignment Guide Details: Detail field assembly and attachment to building structure.
 - d. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.
3. Welding certificates.
4. Product Certificates: For each type of expansion joint, from manufacturer.
5. Maintenance Data: For expansion joints to include in maintenance manuals.

E. Quality Assurance

1. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. ASME Boiler and Pressure Vessel Code: Section IX.

1.2 PRODUCTS**A. Packed Expansion Joints**

1. Flexible, Ball-Joint, Packed Expansion Joints:



- a. Standards: ASME Boiler and Pressure Vessel Code: Section II, "Materials"; and ASME B31.9, "Building Services Piping," for materials and design of pressure-containing parts and bolting.
- b. Material: Carbon-steel assembly with asbestos-free composition packing.
- c. Design: For 360-degree rotation and angular deflection.
- d. Minimum Pressure Rating: 250 psig at 400 deg F (1725 kPa at 204 deg C).
- e. Angular Deflection for NPS 6 (DN 150) and Smaller: 30 degree minimum.
- f. Angular Deflection for NPS 8 (DN 200) and Larger: 15 degree minimum.
- g. End Connections for NPS 2 (DN 50) and Smaller: Threaded.
- h. End Connections for NPS 2-1/2 (DN 65) and Larger: Flanged.
- 2. Slip-Joint Packed Expansion Joints:
 - a. Standard: ASTM F 1007.
 - b. Material: Carbon steel with asbestos-free PTFE packing.
 - c. Design: With internal guide and injection device for repacking under pressure. Include drip connection if used for steam piping.
 - d. Configuration: Single joint **OR** Single joint with base and double joint with base, **as directed**, class(es) unless otherwise indicated.
 - e. End Connections: Flanged or weld ends to match piping system.
- B. Packless Expansion Joints
 - 1. Metal, Expansion-Compensator Packless Expansion Joints:
 - a. Minimum Pressure Rating: 150 psig (1035 kPa) **OR** 175 psig (1200 kPa), **as directed**, unless otherwise indicated.
 - b. Configuration for Copper Tubing: Two-ply, phosphor-bronze bellows with copper pipe ends.
 - 1) End Connections for Copper Tubing NPS 2 (DN 50) and Smaller: Solder joint or threaded.
 - 2) End Connections for Copper Tubing NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Threaded.
 - c. Configuration for Steel Piping: Two-ply, stainless-steel bellows; steel-pipe end connections; and carbon-steel shroud.
 - 1) End Connections for Steel Pipe NPS 2 (DN 50) and Smaller: Threaded.
 - 2) End Connections for Steel Pipe NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged **OR** Weld, **as directed**.
 - 2. Rubber, Expansion-Compensator Packless Expansion Joints:
 - a. Material: Twin reinforced-rubber spheres with external restraining cables.
 - b. Minimum Pressure Rating: 150 psig at 170 deg F (1035 kPa at 77 deg C) unless otherwise indicated.
 - c. End Connections for NPS 2 (DN 50) and Smaller: Threaded.
 - 3. Flexible-Hose Packless Expansion Joints:
 - a. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.
 - b. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.
 - c. Expansion Joints for Copper Tubing NPS 2 (DN 50) and Smaller: Copper-alloy fittings with solder-joint end connections.
 - 1) Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F (3100 kPa at 21 deg C) and 340 psig at 450 deg F (2340 kPa at 232 deg C) ratings.
 - 2) Bronze hoses and double-braid bronze sheaths with 700 psig at 70 deg F (4830 kPa at 21 deg C) and 500 psig at 450 deg F (3450 kPa at 232 deg C) ratings.
 - d. Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Copper-alloy fittings with threaded end connections.
 - 1) Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F (2070 kPa at 21 deg C) and 225 psig at 450 deg F (1550 kPa at 232 deg C) ratings.

- 2) Stainless-steel hoses and double-braid, stainless-steel sheaths with 420 psig at 70 deg F (2890 kPa at 21 deg C) and 315 psig at 450 deg F (2170 kPa at 232 deg C) ratings.
 - e. Expansion Joints for Steel Piping NPS 2 (DN 50) and Smaller: Carbon-steel fittings with threaded end connections.
 - 1) Stainless-steel hoses and single-braid, stainless-steel sheaths with 450 psig at 70 deg F (3100 kPa at 21 deg C) and 325 psig at 600 deg F (2250 kPa at 315 deg C) ratings.
 - 2) Stainless-steel hoses and double-braid, stainless-steel sheaths with 700 psig at 70 deg F (4830 kPa at 21 deg C) and 515 psig at 600 deg F (3550 kPa at 315 deg C) ratings.
 - f. Expansion Joints for Steel Piping NPS 2-1/2 to NPS 6 (DN 65 to DN 150): Carbon-steel fittings with flanged **OR** weld, **as directed**, end connections.
 - 1) Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70 deg F (1380 kPa at 21 deg C) and 145 psig at 600 deg F (1000 kPa at 315 deg C) ratings.
 - 2) Stainless-steel hoses and double-braid, stainless-steel sheaths with 275 psig at 70 deg F (1900 kPa at 21 deg C) and 200 psig at 600 deg F (1380 kPa at 315 deg C) ratings.
 - g. Expansion Joints for Steel Piping NPS 8 to NPS 12 (DN 200 to DN 300): Carbon-steel fittings with flanged **OR** weld, **as directed**, end connections.
 - 1) Stainless-steel hoses and single-braid, stainless-steel sheaths with 125 psig at 70 deg F (860 kPa at 21 deg C) and 90 psig at 600 deg F (625 kPa at 315 deg C) ratings.
 - 2) Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 deg F (1130 kPa at 21 deg C) and 120 psig at 600 deg F (830 kPa at 315 deg C) ratings.
 - h. Expansion Joints for Steel Piping NPS 14 (DN 350) and Larger: Carbon-steel fittings with flanged **OR** weld, **as directed**, end connections.
 - 1) Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 deg F (1130 kPa at 21 deg C) and 120 psig at 600 deg F (830 kPa at 315 deg C) ratings.
4. Metal-Bellows Packless Expansion Joints:
 - a. Standards: ASTM F 1120 and EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
 - b. Type: Circular, corrugated bellows with external tie rods.
 - c. Minimum Pressure Rating: 150 psig (1035 kPa) **OR** 175 psig (1200 kPa), **as directed**, unless otherwise indicated.
 - d. Configuration: Single joint **OR** Single joint with base and double joint with base, **as directed**, class(es) unless otherwise indicated.
 - e. Expansion Joints for Copper Tubing: Single **OR** Multi, **as directed**,-ply phosphor-bronze bellows, copper pipe ends, and brass shrouds.
 - 1) End Connections for Copper Tubing NPS 2 (DN 50) and Smaller: Solder joint or threaded.
 - 2) End Connections for Copper Tubing NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Solder joint or threaded.
 - 3) End Connections for Copper Tubing NPS 5 (DN 125) and Larger: Flanged.
 - f. Expansion Joints for Steel Piping: Single **OR** Multi, **as directed**,-ply stainless-steel bellows, steel pipe ends, and carbon-steel shroud.
 - 1) End Connections for Steel Pipe NPS 2 (DN 50) and Smaller: Threaded.
 - 2) End Connections for Steel Pipe NPS 2-1/2 (DN 65) and Larger: Flanged **OR** Weld, **as directed**.
5. Rubber Packless Expansion Joints:
 - a. Standards: ASTM F 1123 and FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."
 - b. Material: Fabric-reinforced rubber complying with FSA-NMEJ-703.

- c. Arch Type: Single **OR** Multiple, **as directed**, arches with external control rods, **as directed**.
- d. Spherical Type: Single **OR** Multiple, **as directed**, spheres with external control rods, **as directed**.
- e. Minimum Pressure Rating for NPS 1-1/2 to NPS 4 (DN 40 to DN 100): 150 psig (1035 kPa) at 220 deg F (104 deg C).
- f. Minimum Pressure Rating for NPS 5 and NPS 6 (DN 125 and DN 150): 140 psig (966 kPa) at 200 deg F (93 deg C).
- g. Minimum Pressure Rating for NPS 8 to NPS 12 (DN 200 to DN 300): 140 psig (966 kPa) at 180 deg F (82 deg C).
- h. Material for Fluids Containing Acids, Alkalies, or Chemicals: BR **OR** CSM **OR** EPDM, **as directed**.
- i. Material for Fluids Containing Gas, Hydrocarbons, or Oil: Buna-N **OR** CR, **as directed**.
- j. Material for Water: BR **OR** Buna-N **OR** CR **OR** CSM **OR** EPDM **OR** NR, **as directed**.
- k. End Connections: Full-faced, integral steel flanges with steel retaining rings.

C. Grooved-Joint Expansion Joints

- 1. Description: Factory-assembled expansion joint made of several grooved-end pipe nipples, couplings, and grooved joints.
- 2. Standard: AWWA C606, for grooved joints.
- 3. Nipples: Galvanized, **as directed**, ASTM A 53/A 53M, Schedule 40, Type E or S, steel pipe with grooved ends.
- 4. Couplings: Five **OR** Seven **OR** 10 **OR** 12, **as directed**, flexible type for steel-pipe dimensions. Include ferrous housing sections, Buna-N gasket suitable for diluted acid, alkaline fluids, and cold and hot water **OR** EPDM gasket suitable for cold and hot water, **as directed**, and bolts and nuts.

D. Alignment Guides And Anchors

- 1. Alignment Guides:
 - a. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding spider for bolting to pipe.
- 2. Anchor Materials:
 - a. Steel Shapes and Plates: ASTM A 36/A 36M.
 - b. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
 - c. Washers: ASTM F 844, steel, plain, flat washers.
 - d. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.
 - 1) Stud: Threaded, zinc-coated carbon steel.
 - 2) Expansion Plug: Zinc-coated steel.
 - 3) Washer and Nut: Zinc-coated steel.
 - e. Chemical Fasteners: Insert-type-stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.
 - 1) Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
 - 2) Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud unless otherwise indicated.
 - 3) Washer and Nut: Zinc-coated steel.

1.3 EXECUTION

A. Expansion-Joint Installation

- 1. Install expansion joints of sizes matching sizes of piping in which they are installed.

2. Install packed-type expansion joints with packing suitable for fluid service.
 3. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
 4. Install rubber packless expansion joints according to FSA-NMEJ-702.
 5. Install grooved-joint expansion joints to grooved-end steel piping
- B. Pipe Loop And Swing Connection Installation
1. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.
 2. Connect risers and branch connections to mains with at least five pipe fittings including tee in main.
 3. Connect risers and branch connections to terminal units with at least four pipe fittings including tee in riser.
 4. Connect mains and branch connections to terminal units with at least four pipe fittings including tee in main.
- C. Alignment-Guide And Anchor Installation
1. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.
 2. Install one **OR** two, **as directed**, guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.
 3. Attach guides to pipe and secure guides to building structure.
 4. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
 5. Anchor Attachments:
 - a. Anchor Attachment to Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - b. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24, U-bolts bolted to anchor.
 6. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.
 - a. Anchor Attachment to Steel Structural Members: Attach by welding.
 - b. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.
 7. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION 23 05 16 00a



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Task	Specification	Specification Description
23 05 19 00	22 05 23 00	Piped Utilities Basic Materials And Methods
23 05 19 00	21 05 00 00	Common Work Results for Fire Suppression
23 05 19 00	21 05 19 00	Meters and Gages for Plumbing Piping
23 05 19 00	21 05 19 00a	Meters and Gages for HVAC Piping



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SECTION 23 05 23 00 - MPF GENERAL DUTY VALVES FOR HVAC PIPING

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Ball valves.
 - 2. Gate valves.
 - 3. Globe Valves.
 - 4. Butterfly valves.

1.2 SUBMITTALS

- A. Product Data: Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.
- B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. ASME Compliance: ASME B31.9 for building services piping valves except domestic hot- and cold-water piping.
- B. NSF Compliance: NSF 61 for valve materials for potable-water service.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Valves: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 1. American Valve, Inc.
 - 2. Bray International, Inc.
 - 3. Crane Co.; Crane Valve Group;
 - 4. Grinnell Corporation.
 - 5. Hammond Valve.
 - 6. Metraflex Co.
 - 7. Milwaukee Valve Company.
 - 8. NIBCO INC.
 - 9. Red-White Valve Corp.
 - 10. Tyco International, Ltd.; Tyco Valves & Controls.
 - 11. Watts Industries, Inc.; Water Products Div.
- B. Refer to valve application paragraphs for applications of valves.
- C. Bronze Valves: NPS 2 (DN 50) and smaller with threaded ends, unless otherwise indicated.
- D. Ferrous Valves: NPS 2-1/2 (DN 65) and larger with flanged ends, unless otherwise indicated.
- E. Valve Actuators: Handwheel for valves other than quarter-turn types and lever handle for quarter-turn valves.
- F. Copper-Alloy Ball Valves, General: MSS SP-110.
 - 1. Two-Piece, Copper-Alloy Ball Valves: Brass or bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and [600-psig (4140-kPa)] minimum CWP rating and blowout-proof stem. Valve stem shall be stainless steel construction.
- G. Ferrous-Alloy Butterfly Valves, General: MSS SP-67, Type I, for tight shutoff, with disc and lining suitable for potable water, unless otherwise indicated.
 - 1. Flangeless, 150-psig (1035-kPa) CWP Rating, Ferrous-Alloy Butterfly Valves: Wafer type with one- or two-piece stem with aluminum bronze disc. All stem sections shall be stainless steel.
 - 2. Single-Flange, 150-psig (1035-kPa) CWP Rating, Ferrous-Alloy Butterfly Valves: Wafer-lug type with one- or two-piece stem. All stem sections shall be stainless steel.
- H. Bronze Check Valves, General: MSS SP-80.
 - 1. Class 125, Bronze, Swing Check Valves: Bronze body with aluminum bronze disc and seat.
- I. Spring-Loaded, Lift-Disc Check Valves, General: FCI 74-1, with spring-loaded bronze or alloy disc and bronze or alloy seat.
 - 1. Class 125, Compact-Wafer, Lift-Disc Check Valves: Compact-wafer style with cast-iron shell with diameter made to fit within bolt circle.
- J. Bronze Gate Valves, General: MSS SP-80, with ferrous-alloy handwheel.
 - 1. Class 125, Bronze Gate Valves: Bronze body with nonrising stem and bronze solid wedge .
- K. Cast-Iron Gate Valves, General: MSS SP-70, Type I.

1. Class 125, NRS, Bronze-Mounted, Cast-Iron Gate Valves: Cast-iron body with bronze trim, nonrising stem, and solid-wedge disc.
 2. Class 125, OS&Y, Bronze-Mounted, Cast-Iron Gate Valves: Cast-iron body with bronze trim, rising stem, and solid-wedge disc.
 3. Class 250, NRS, Bronze-Mounted, Cast-Iron Gate Valves: Cast-iron body with bronze trim, nonrising stem, and solid-wedge disc.
 4. Class 250, OS&Y, Bronze-Mounted, Cast-Iron Gate Valves: Cast-iron body with bronze trim, rising stem, and solid-wedge disc.
- L. Bronze Globe Valves, General: MSS SP-80, with ferrous-alloy handwheel.
1. Class 125, Bronze Globe Valves: Bronze body with bronze disc.
- M. Cast-Iron Globe Valves, General: MSS SP-85.
1. Class 125, Cast-Iron Globe Valves: Gray-iron body with bronze seats.

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS:

- A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:
1. Shutoff Service: Ball, butterfly, or gate valves.
 2. Throttling Service: Ball, butterfly, or globe valves.
 3. Pump Discharge: Spring-loaded, lift-disc check valves.
 4. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

3.2 CHILLED-WATER PIPING:

- A. Use the following types of valves:
1. Ball Valves, NPS 2 (DN 50) and Smaller: Two-piece, 400-psig (2760-kPa) CWP rating, copper alloy.
 2. Butterfly Valves, NPS 2-1/2 (DN 65) and Larger: Flangeless or Single-flange, [150-psig (1035-kPa)] CWP rating, ferrous alloy, with EPDM liner.
 3. Swing Check Valves, NPS 2 (DN 50) and Smaller: Class 125, bronze.
 4. Swing Check Valves, NPS 2-1/2 (DN 65) and Larger: Type II, Class 125, gray iron.
 5. Spring-Loaded, Lift-Disc Check Valves, NPS 2 (DN 50) and Smaller: Type IV, Class 125 minimum.
 6. Spring-Loaded, Lift-Disc Check Valves, NPS 2-1/2 (DN 65) and Larger: Class 125, cast iron.
 7. Gate Valves, NPS 2 (DN 50) and Smaller: Class [125, bronze.
 8. Gate Valves, NPS 2-1/2 (DN 65) and Larger: Type I, Class 125, bronze-mounted cast iron.
 9. Globe Valves, NPS 2 (DN 50) and Smaller: Class 125, bronze.
 10. Globe Valves, NPS 2-1/2 (DN 65) and Larger: Class 125, bronze-mounted cast iron.

3.3 DOMESTIC WATER PIPING:

- A. Use the following types of valves:
1. Ball Valves: Two-piece, 400-psig (2760-kPa) CWP rating, copper alloy.
 2. Swing Check Valves, NPS 2 (DN 50) and Smaller: Class 125, bronze.

3. Spring-Loaded, Lift-Disc Check Valves, NPS 2 (DN 50) and Smaller: Class 125 minimum.
4. Gate Valves, NPS 2 (DN 50) and Smaller: Class 125, bronze.
5. Globe Valves, NPS 2 (DN 50) and Smaller: Class 125, bronze.

3.4 SELECT VALVES

- A. Valves with the following end connections:
1. For Copper Tubing: Solder-joint or threaded ends
 2. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
 3. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged or threaded ends.
 4. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.

3.5 VALVE INSTALLATION:

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- C. Locate valves for easy access and provide separate support where necessary.
- D. Install valves in horizontal piping with stem at or above center of pipe.
- E. Install valves in position to allow full stem movement.
- F. Install check valves for proper direction of flow and swing check valves in horizontal position with hinge pin level.
- G. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
1. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

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END OF SECTION 23 05 23 00



SECTION 23 05 23 00 - CSF GENERAL DUTY VALVES FOR HVAC PIPING

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Ball valves.
 - 2. Gate valves.
 - 3. Globe Valves.
 - 4. Butterfly valves.

1.2 SUBMITTALS

- A. Product Data: Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.
- B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. ASME Compliance: ASME B31.9 for building services piping valves except domestic hot- and cold-water piping.
- B. NSF Compliance: NSF 61 for valve materials for potable-water service.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Valves: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 1. American Valve, Inc.
 - 2. Bray International, Inc.
 - 3. Crane Co.; Crane Valve Group;
 - 4. Grinnell Corporation.
 - 5. Hammond Valve.
 - 6. Metraflex Co.
 - 7. Milwaukee Valve Company.
 - 8. NIBCO INC.
 - 9. Red-White Valve Corp.
 - 10. Tyco International, Ltd.; Tyco Valves & Controls.
 - 11. Watts Industries, Inc.; Water Products Div.
- B. Refer to valve application paragraphs for applications of valves.
- C. Bronze Valves: NPS 2 (DN 50) and smaller with threaded ends, unless otherwise indicated.
- D. Ferrous Valves: NPS 2-1/2 (DN 65) and larger with flanged ends, unless otherwise indicated.
- E. Valve Actuators: Handwheel for valves other than quarter-turn types and lever handle for quarter-turn valves.
- F. Copper-Alloy Ball Valves, General: MSS SP-110.
 - 1. Two-Piece, Copper-Alloy Ball Valves: Brass or bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and [600-psig (4140-kPa)] minimum CWP rating and blowout-proof stem. Valve stem shall be stainless steel construction.
- G. Ferrous-Alloy Butterfly Valves, General: MSS SP-67, Type I, for tight shutoff, with disc and lining suitable for potable water, unless otherwise indicated.
 - 1. Flangeless, 150-psig (1035-kPa) CWP Rating, Ferrous-Alloy Butterfly Valves: Wafer type with one- or two-piece stem with aluminum bronze disc. All stem sections shall be stainless steel.
 - 2. Single-Flange, 150-psig (1035-kPa) CWP Rating, Ferrous-Alloy Butterfly Valves: Wafer-lug type with one- or two-piece stem. All stem sections shall be stainless steel.
- H. Bronze Check Valves, General: MSS SP-80.
 - 1. Class 125, Bronze, Swing Check Valves: Bronze body with aluminum bronze disc and seat.
- I. Spring-Loaded, Lift-Disc Check Valves, General: FCI 74-1, with spring-loaded bronze or alloy disc and bronze or alloy seat.
 - 1. Class 125, Compact-Wafer, Lift-Disc Check Valves: Compact-wafer style with cast-iron shell with diameter made to fit within bolt circle.
- J. Bronze Gate Valves, General: MSS SP-80, with ferrous-alloy handwheel.
 - 1. Class 125, Bronze Gate Valves: Bronze body with nonrising stem and bronze solid wedge .
- K. Cast-Iron Gate Valves, General: MSS SP-70, Type I.

1. Class 125, NRS, Bronze-Mounted, Cast-Iron Gate Valves: Cast-iron body with bronze trim, nonrising stem, and solid-wedge disc.
 2. Class 125, OS&Y, Bronze-Mounted, Cast-Iron Gate Valves: Cast-iron body with bronze trim, rising stem, and solid-wedge disc.
 3. Class 250, NRS, Bronze-Mounted, Cast-Iron Gate Valves: Cast-iron body with bronze trim, nonrising stem, and solid-wedge disc.
 4. Class 250, OS&Y, Bronze-Mounted, Cast-Iron Gate Valves: Cast-iron body with bronze trim, rising stem, and solid-wedge disc.
- L. Bronze Globe Valves, General: MSS SP-80, with ferrous-alloy handwheel.
1. Class 125, Bronze Globe Valves: Bronze body with bronze disc.
- M. Cast-Iron Globe Valves, General: MSS SP-85.
1. Class 125, Cast-Iron Globe Valves: Gray-iron body with bronze seats.

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS:

- A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:
1. Shutoff Service: Ball, butterfly, or gate valves.
 2. Throttling Service: Ball, butterfly, or globe valves.
 3. Pump Discharge: Spring-loaded, lift-disc check valves.
 4. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

3.2 CHILLED-WATER PIPING:

- A. Use the following types of valves:
1. Ball Valves, NPS 2 (DN 50) and Smaller: Two-piece, 400-psig (2760-kPa) CWP rating, copper alloy.
 2. Butterfly Valves, NPS 2-1/2 (DN 65) and Larger: Flangeless or Single-flange, [150-psig (1035-kPa)] CWP rating, ferrous alloy, with EPDM liner.
 3. Swing Check Valves, NPS 2 (DN 50) and Smaller: Class 125, bronze.
 4. Swing Check Valves, NPS 2-1/2 (DN 65) and Larger: Type II, Class 125, gray iron.
 5. Spring-Loaded, Lift-Disc Check Valves, NPS 2 (DN 50) and Smaller: Type IV, Class 125 minimum.
 6. Spring-Loaded, Lift-Disc Check Valves, NPS 2-1/2 (DN 65) and Larger: Class 125, cast iron.
 7. Gate Valves, NPS 2 (DN 50) and Smaller: Class [125, bronze.
 8. Gate Valves, NPS 2-1/2 (DN 65) and Larger: Type I, Class 125, bronze-mounted cast iron.
 9. Globe Valves, NPS 2 (DN 50) and Smaller: Class 125, bronze.
 10. Globe Valves, NPS 2-1/2 (DN 65) and Larger: Class 125, bronze-mounted cast iron.

3.3 DOMESTIC WATER PIPING:

- A. Use the following types of valves:
1. Ball Valves: Two-piece, 400-psig (2760-kPa) CWP rating, copper alloy.
 2. Swing Check Valves, NPS 2 (DN 50) and Smaller: Class 125, bronze.

3. Spring-Loaded, Lift-Disc Check Valves, NPS 2 (DN 50) and Smaller: Class 125 minimum.
4. Gate Valves, NPS 2 (DN 50) and Smaller: Class 125, bronze.
5. Globe Valves, NPS 2 (DN 50) and Smaller: Class 125, bronze.

3.4 SELECT VALVES

A. Valves with the following end connections:

1. For Copper Tubing: Solder-joint or threaded ends
2. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
3. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged or threaded ends.
4. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.

3.5 VALVE INSTALLATION:

- A. Piping installation requirements are specified in other Division 22 and 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- C. Locate valves for easy access and provide separate support where necessary.
- D. Install valves in horizontal piping with stem at or above center of pipe.
- E. Install valves in position to allow full stem movement.
- F. Install check valves for proper direction of flow and swing check valves in horizontal position with hinge pin level.
- G. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
 1. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

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END OF SECTION 23 05 23 00



Task	Specification	Specification Description
23 05 23 00	01 22 16 00	No Specification Required
23 05 23 00	22 05 23 00	Piped Utilities Basic Materials And Methods
23 05 23 00	22 05 23 00a	General-Duty Valves for Plumbing Piping
23 05 23 00	22 05 23 00b	General-Duty Valves for HVAC Piping
23 05 23 00	22 05 76 00	Storm Drainage Piping Specialties



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SECTION 23 05 29 00 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for hangers and supports for plumbing piping and equipment. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Metal pipe hangers and supports.
 - b. Trapeze pipe hangers.
 - c. Fiberglass pipe hangers.
 - d. Metal framing systems.
 - e. Fiberglass strut systems.
 - f. Thermal-hanger shield inserts.
 - g. Fastener systems.
 - h. Pipe stands.
 - i. Pipe positioning systems.
 - j. Equipment supports.

C. Definitions

1. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

D. Performance Requirements

1. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - a. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - b. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - c. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

E. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - a. Trapeze pipe hangers.
 - b. Metal framing systems.
 - c. Fiberglass strut systems.
 - d. Pipe stands.
 - e. Equipment supports.
3. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Detail fabrication and assembly of trapeze hangers.

- b. Design Calculations: Calculate requirements for designing trapeze hangers.
- 4. Welding certificates.

F. Quality Assurance

- 1. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- 2. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

1.2 PRODUCTS

A. Metal Pipe Hangers And Supports

- 1. Carbon-Steel Pipe Hangers and Supports:
 - a. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - b. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - c. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - d. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - e. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel **OR** stainless steel, **as directed**.
- 2. Stainless-Steel Pipe Hangers and Supports:
 - a. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - b. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - c. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
- 3. Copper Pipe Hangers:
 - a. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 - b. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel **OR** stainless steel, **as directed**.

B. Trapeze Pipe Hangers

- 1. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

C. Fiberglass Pipe Hangers

- 1. Clevis-Type, Fiberglass Pipe Hangers:
 - a. Description: Similar to MSS SP-58, Type 1, steel pipe hanger except hanger is made of fiberglass or fiberglass-reinforced resin.
 - b. Hanger Rods: Continuous-thread rod, washer, and nuts made of fiberglass, polyurethane or stainless steel.
- 2. Strap-Type, Fiberglass Pipe Hangers:
 - a. Description: Similar to MSS SP-58, Type 9 or Type 10, steel pipe hanger except hanger is made of fiberglass-reinforced resin.
 - b. Hanger Rod and Fittings: Continuous-thread rod, washer, and nuts made of stainless steel.

D. Metal Framing Systems

- 1. MFMA Manufacturer Metal Framing Systems:
 - a. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
 - b. Standard: MFMA-4.

- c. Channels: Continuous slotted steel channel with inturned lips.
- d. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
- e. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel **OR** stainless steel, **as directed**.
- f. Metallic Coating: Electroplated zinc **OR** Hot-dipped galvanized **OR** Mill galvanized **OR** In-line, hot galvanized **OR** Mechanically-deposited zinc, **as directed**.
OR
Paint Coating: Vinyl **OR** Vinyl alkyd **OR** Epoxy **OR** Polyester **OR** Acrylic **OR** Amine **OR** Alkyd, **as directed**.
OR
Plastic Coating: PVC **OR** Polyurethane **OR** Epoxy **OR** Polyester, **as directed**.
OR
Combination Coating: **<Insert coating materials in order of application>**.
- 2. Non-MFMA Manufacturer Metal Framing Systems:
 - a. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
 - b. Standard: Comply with MFMA-4.
 - c. Channels: Continuous slotted steel channel with inturned lips.
 - d. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 - e. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel **OR** stainless steel, **as directed**.
 - f. Coating: Zinc **OR** Paint **OR** PVC, **as directed**.
- E. Fiberglass Strut Systems
 - 1. Description: Shop- or field-fabricated pipe-support assembly similar to MFMA-4 for supporting multiple parallel pipes.
 - a. Channels: Continuous slotted fiberglass or other plastic channel with inturned lips.
 - b. Channel Nuts: Fiberglass nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 - c. Hanger Rods: Continuous-thread rod, nuts, and washer made of fiberglass **OR** stainless steel, **as directed**.
- F. Thermal-Hanger Shield Inserts
 - 1. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.
 - 2. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa), ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength.
 - 3. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
 - 4. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
 - 5. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.
- G. Fastener Systems
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated **OR** stainless-, **as directed**, steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- H. Pipe Stands

1. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
2. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
3. Low-Type, Single-Pipe Stand: One-piece plastic **OR** stainless-steel, **as directed**, base unit with plastic roller, for roof installation without membrane penetration.
4. High-Type, Single-Pipe Stand:
 - a. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 - b. Base: Plastic **OR** Stainless steel, **as directed**.
 - c. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
 - d. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.
5. High-Type, Multiple-Pipe Stand:
 - a. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
 - b. Bases: One or more; plastic.
 - c. Vertical Members: Two or more protective-coated-steel channels.
 - d. Horizontal Member: Protective-coated-steel channel.
 - e. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
6. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

I. Pipe Positioning Systems

1. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

J. Equipment Supports

1. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

K. Miscellaneous Materials

1. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
2. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - a. Properties: Nonstaining, noncorrosive, and nongaseous.
 - b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

1.3 EXECUTION

A. Hanger And Support Installation

1. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
2. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - a. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

- b. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
3. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.
4. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
5. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.
6. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
7. Fastener System Installation:
 - a. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - b. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
8. Pipe Stand Installation:
 - a. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - b. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Division 7 Section "Roof Accessories" for curbs.
9. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. See Division 15 plumbing fixture Sections for requirements for pipe positioning systems for plumbing fixtures.
10. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
11. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
12. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
13. Install lateral bracing with pipe hangers and supports to prevent swaying.
14. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
15. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
16. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
17. Insulated Piping:
 - a. Attach clamps and spacers to piping.
 - 1) Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - 2) Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - 3) Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - b. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - 1) Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
 - c. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

- 1) Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
 - d. Shield Dimensions for Pipe: Not less than the following:
 - 1) NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
 - 2) NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
 - 3) NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
 - 4) NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
 - 5) NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
 - e. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 - f. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.
- B. Equipment Supports
 1. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
 2. Grouting: Place grout under supports for equipment and make bearing surface smooth.
 3. Provide lateral bracing, to prevent swaying, for equipment supports.
- C. Metal Fabrications
 1. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
 2. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
 3. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
 - d. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.
- D. Adjusting
 1. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
 2. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).
- E. Painting
 1. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - a. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

OR

Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 painting Sections **OR** Section "High-Performance Coatings", **as directed**.
 2. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

F. Hanger And Support Schedule

1. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
2. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
3. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
4. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
5. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
6. Use stainless-steel pipe hangers and fiberglass pipe hangers and fiberglass strut systems and stainless-steel or corrosion-resistant attachments for hostile environment applications.
7. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
8. Use padded hangers for piping that is subject to scratching.
9. Use thermal-hanger shield inserts for insulated piping and tubing.
10. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - a. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
 - b. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
 - c. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
 - d. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
 - e. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
 - f. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8 (DN 20 to DN 200).
 - g. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
 - h. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
 - i. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
 - j. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
 - k. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
 - l. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
 - m. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 - n. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 - o. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 - p. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

- q. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
 - r. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24 (DN 65 to DN 600), from single rod if horizontal movement caused by expansion and contraction might occur.
 - s. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 - t. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 (DN 50 to DN 600) if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 - u. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 (DN 50 to DN 750) if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
11. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
- a. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
 - b. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.
12. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
- a. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
 - b. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
 - c. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 - d. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 - e. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.
13. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
- a. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - b. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 - c. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 - d. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - e. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 - f. C-Clamps (MSS Type 23): For structural shapes.
 - g. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 - h. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 - i. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 - j. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 - k. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 - l. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

- 1) Light (MSS Type 31): 750 lb (340 kg).
- 2) Medium (MSS Type 32): 1500 lb (680 kg).
- 3) Heavy (MSS Type 33): 3000 lb (1360 kg).
- m. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- n. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- o. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
14. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - a. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 - b. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 - c. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
15. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - a. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 - b. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
 - c. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 - d. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 - e. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 - f. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 - g. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 - h. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - 1) Horizontal (MSS Type 54): Mounted horizontally.
 - 2) Vertical (MSS Type 55): Mounted vertically.
 - 3) Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
16. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
17. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
18. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
19. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 23 05 29 00



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SECTION 23 05 29 00a - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for hangers and supports for HVAC piping and equipment. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Metal pipe hangers and supports.
 - b. Trapeze pipe hangers.
 - c. Fiberglass pipe hangers.
 - d. Metal framing systems.
 - e. Fiberglass strut systems.
 - f. Thermal-hanger shield inserts.
 - g. Fastener systems.
 - h. Pipe stands.
 - i. Equipment supports.

C. Definitions

1. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

D. Performance Requirements

1. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - a. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - b. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - c. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

E. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - a. Trapeze pipe hangers.
 - b. Metal framing systems.
 - c. Fiberglass strut systems.
 - d. Pipe stands.
 - e. Equipment supports.
3. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Detail fabrication and assembly of trapeze hangers.
 - b. Design Calculations: Calculate requirements for designing trapeze hangers.

4. Welding certificates.

F. Quality Assurance

1. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

1.2 PRODUCTS

A. Metal Pipe Hangers And Supports

1. Carbon-Steel Pipe Hangers and Supports:
 - a. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - b. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - c. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - d. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - e. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel **OR** stainless steel, **as directed**.
2. Stainless-Steel Pipe Hangers and Supports:
 - a. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - b. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - c. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
3. Copper Pipe Hangers:
 - a. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 - b. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel **OR** stainless steel, **as directed**.

B. Trapeze Pipe Hangers

1. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

C. Fiberglass Pipe Hangers

1. Clevis-Type, Fiberglass Pipe Hangers:
 - a. Description: Similar to MSS SP-58, Type 1, steel pipe hanger except hanger is made of fiberglass or fiberglass-reinforced resin.
 - b. Hanger Rods: Continuous-thread rod, washer, and nuts made of fiberglass, polyurethane or stainless steel.
2. Strap-Type, Fiberglass Pipe Hangers:
 - a. Description: Similar to MSS SP-58, Type 9 or Type 10, steel pipe hanger except hanger is made of fiberglass-reinforced resin.
 - b. Hanger Rod and Fittings: Continuous-thread rod, washer, and nuts made of stainless steel.

D. Metal Framing Systems

1. MFMA Manufacturer Metal Framing Systems:
 - a. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
 - b. Standard: MFMA-4.
 - c. Channels: Continuous slotted steel channel with inturned lips.

- d. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
- e. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel **OR** stainless steel, **as directed**.
- f. Metallic Coating: Electroplated zinc **OR** Hot-dipped galvanized **OR** Mill galvanized **OR** In-line, hot galvanized **OR** Mechanically-deposited zinc, **as directed**.
OR
Paint Coating: Vinyl **OR** Vinyl alkyd **OR** Epoxy **OR** Polyester **OR** Acrylic **OR** Amine **OR** Alkyd, **as directed**.
OR
Plastic Coating: PVC **OR** Polyurethane **OR** Epoxy **OR** Polyester, **as directed**.
OR
Combination Coating: as directed by the Owner.
- 2. Non-MFMA Manufacturer Metal Framing Systems:
 - a. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
 - b. Standard: Comply with MFMA-4.
 - c. Channels: Continuous slotted steel channel with inturned lips.
 - d. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 - e. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel **OR** stainless steel, **as directed**.
 - f. Coating: Zinc **OR** Paint **OR** PVC, **as directed**.
- E. Fiberglass Strut Systems
 - 1. Description: Shop- or field-fabricated pipe-support assembly similar to MFMA-4 for supporting multiple parallel pipes.
 - a. Channels: Continuous slotted fiberglass or other plastic channel with inturned lips.
 - b. Channel Nuts: Fiberglass nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 - c. Hanger Rods: Continuous-thread rod, nuts, and washer made of fiberglass **OR** stainless steel, **as directed**.
- F. Thermal-Hanger Shield Inserts
 - 1. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.
 - 2. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa), ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength.
 - 3. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
 - 4. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
 - 5. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.
- G. Fastener Systems
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated **OR** stainless-, **as directed**, steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- H. Pipe Stands

1. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
 2. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
 3. Low-Type, Single-Pipe Stand: One-piece plastic **OR** stainless-steel, **as directed**, base unit with plastic roller, for roof installation without membrane penetration.
 4. High-Type, Single-Pipe Stand:
 - a. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 - b. Base: Plastic **OR** Stainless steel, **as directed**.
 - c. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
 - d. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.
 5. High-Type, Multiple-Pipe Stand:
 - a. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
 - b. Bases: One or more; plastic.
 - c. Vertical Members: Two or more protective-coated-steel channels.
 - d. Horizontal Member: Protective-coated-steel channel.
 - e. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
 6. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.
- I. Equipment Supports
1. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.
- J. Miscellaneous Materials
1. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
 2. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - a. Properties: Nonstaining, noncorrosive, and nongaseous.
 - b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

1.3 EXECUTION

A. Hanger And Support Installation

1. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
2. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - a. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - b. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
3. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.



4. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
5. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.
6. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
7. Fastener System Installation:
 - a. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - b. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
8. Pipe Stand Installation:
 - a. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - b. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Division 07 Section "Roof Accessories" for curbs.
9. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
10. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
11. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
12. Install lateral bracing with pipe hangers and supports to prevent swaying.
13. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
14. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
15. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
16. Insulated Piping:
 - a. Attach clamps and spacers to piping.
 - 1) Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - 2) Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - 3) Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - b. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - 1) Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
 - c. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - 1) Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
 - d. Shield Dimensions for Pipe: Not less than the following:
 - 1) NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
 - 2) NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
 - 3) NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.

- 4) NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
 - 5) NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
 - e. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 - f. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.
- B. Equipment Supports
1. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
 2. Grouting: Place grout under supports for equipment and make bearing surface smooth.
 3. Provide lateral bracing, to prevent swaying, for equipment supports.
- C. Metal Fabrications
1. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
 2. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
 3. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
 - d. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.
- D. Adjusting
1. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
 2. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).
- E. Painting
1. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - a. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

OR

Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 07 OR Division 09 Section(s) "High-performance Coatings", **as directed**.
 2. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.
- F. Hanger And Support Schedule
1. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
 2. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
 3. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

4. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
5. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
6. Use stainless-steel pipe hangers and fiberglass pipe hangers and fiberglass strut systems and stainless-steel or corrosion-resistant attachments for hostile environment applications.
7. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
8. Use padded hangers for piping that is subject to scratching.
9. Use thermal-hanger shield inserts for insulated piping and tubing.
10. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - a. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
 - b. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
 - c. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
 - d. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
 - e. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
 - f. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8 (DN 20 to DN 200).
 - g. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
 - h. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
 - i. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
 - j. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
 - k. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
 - l. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
 - m. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 - n. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 - o. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 - p. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
 - q. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
 - r. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24 (DN 65 to DN 600), from single rod if horizontal movement caused by expansion and contraction might occur.

- s. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 - t. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 (DN 50 to DN 600) if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 - u. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 (DN 50 to DN 750) if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
11. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
- a. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
 - b. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.
12. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
- a. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
 - b. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
 - c. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 - d. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 - e. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.
13. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
- a. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - b. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 - c. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 - d. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - e. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 - f. C-Clamps (MSS Type 23): For structural shapes.
 - g. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 - h. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 - i. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 - j. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 - k. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 - l. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - 1) Light (MSS Type 31): 750 lb (340 kg).
 - 2) Medium (MSS Type 32): 1500 lb (680 kg).
 - 3) Heavy (MSS Type 33): 3000 lb (1360 kg).
 - m. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 - n. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 - o. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

14. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - a. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 - b. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 - c. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
15. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - a. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 - b. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
 - c. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 - d. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 - e. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 - f. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 - g. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 - h. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - 1) Horizontal (MSS Type 54): Mounted horizontally.
 - 2) Vertical (MSS Type 55): Mounted vertically.
 - 3) Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
16. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
17. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
18. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 23 05 29 00a



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Task	Specification	Specification Description
23 05 29 00	22 05 23 00	Piped Utilities Basic Materials And Methods
23 05 29 00	21 05 00 00	Common Work Results for Fire Suppression



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SECTION 23 05 48 00 - VIBRATION AND SEISMIC CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of vibration and seismic controls for fire-suppression piping and equipment. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Isolation pads.
 - b. Isolation mounts.
 - c. Restrained elastomeric isolation mounts.
 - d. Restraining braces.

C. Definitions

1. IBC: International Building Code.
2. ICC-ES: ICC-Evaluation Service.
3. OSHPD: Office of Statewide Health Planning and Development for the State of California.

D. Performance Requirements

1. Seismic-Restraint Loading:
 - a. Site Class as Defined in the IBC: **A OR B OR C OR D OR E OR F, as directed.**
 - b. Assigned Seismic Use Group or Building Category as Defined in the IBC: **I OR II OR III, as directed.**
 - 1) Component Importance Factor: **1.0 OR 1.5, as directed.**
 - 2) Component Response Modification Factor: **1.5 OR 2.5 OR 3.5 OR 5.0, as directed.**
 - 3) Component Amplification Factor: **1.0 OR 2.5, as directed.**
 - c. Design Spectral Response Acceleration at Short Periods (0.2 Second): As required to meet Project requirements.
 - d. Design Spectral Response Acceleration at 1-Second Period: As required to meet Project requirements.

E. Submittals

1. Product Data: For each product indicated.
2. Delegated-Design Submittal: For vibration isolation and seismic-restraint calculations and details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
3. Welding certificates.
4. Qualification Data: For professional engineer.

F. Quality Assurance

1. Comply with seismic-restraint requirements in the IBC and NFPA 13 unless requirements in this Section are more stringent.
2. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
3. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on

Vibration And Seismic Controls For Fire-Suppression Piping And Equipment

calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

1.2 PRODUCTS

A. Vibration Isolators

1. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
 - a. Resilient Material: Oil- and water-resistant neoprene **OR** rubber **OR** hermetically sealed compressed fiberglass, **as directed**.
2. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.
 - a. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - b. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.
3. Restrained Mounts: All-directional mountings with seismic restraint.
 - a. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - b. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

B. Seismic-Restraint Devices

1. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**.
 - a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
2. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
3. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections **OR** Reinforcing steel angle clamped, **as directed**, to hanger rod.
4. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.
5. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.
6. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
7. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

8. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

C. Factory Finishes

1. Finish
 - a. Manufacturer's standard prime-coat finish ready for field painting.
OR
Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
 - 1) Powder coating on springs and housings.
 - 2) All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
 - 3) Baked enamel or powder coat for metal components on isolators for interior use.
 - 4) Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

1.3 EXECUTION

A. Applications

1. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**.
2. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
3. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

B. Vibration-Control And Seismic-Restraint Device Installation

1. Equipment Restraints:
 - a. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
 - b. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**, providing required submittals for component.
2. Piping Restraints:
 - a. Comply with requirements in MSS SP-127 and NFPA 13.
 - b. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
 - c. Brace a change of direction longer than 12 feet (3.7 m).
3. Install cables so they do not bend across edges of adjacent equipment or building structure.
4. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**, providing required submittals for component.
5. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
6. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
7. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
8. Drilled-in Anchors:



- a. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
- b. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
- c. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
- d. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
- e. Set anchors to manufacturer's recommended torque, using a torque wrench.
- f. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

C. Accommodation Of Differential Seismic Motion

1. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 21 Section "Wet-pipe Sprinkler Systems" for piping flexible connections.

END OF SECTION 23 05 48 00

SECTION 23 05 48 00a - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of vibration and seismic controls for plumbing piping and equipment. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Isolation pads.
 - b. Isolation mounts.
 - c. Restrained elastomeric isolation mounts.
 - d. Freestanding and Restrained spring isolators.
 - e. Housed spring mounts.
 - f. Elastomeric hangers.
 - g. Spring hangers.
 - h. Spring hangers with vertical-limit stops.
 - i. Pipe riser resilient supports.
 - j. Resilient pipe guides.
 - k. Seismic snubbers.
 - l. Restraining braces and cables.
 - m. Steel and Inertia, vibration isolation equipment bases.

C. Definitions

1. IBC: International Building Code.
2. ICC-ES: ICC-Evaluation Service.
3. OSHPD: Office of Statewide Health Planning and Development for the State of California.

D. Performance Requirements

1. Seismic-Restraint Loading:
 - a. Site Class as Defined in the IBC: **A OR B OR C OR D OR E OR F, as directed.**
 - b. Assigned Seismic Use Group or Building Category as Defined in the IBC: **I OR II OR III, as directed.**
 - 1) Component Importance Factor: **1.0 OR 1.5, as directed.**
 - 2) Component Response Modification Factor: **1.5 OR 2.5 OR 3.5 OR 5.0, as directed.**
 - 3) Component Amplification Factor: **1.0 OR 2.5, as directed.**
 - c. Design Spectral Response Acceleration at Short Periods (0.2 Second): Percentage as directed.
 - d. Design Spectral Response Acceleration at 1-Second Period: Percentage as directed.

E. Submittals

1. Product Data: For each product indicated.
2. Delegated-Design Submittal: For vibration isolation and seismic-restraint calculations and details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
3. Welding certificates.
4. Qualification Data: For professional engineer.
5. Field quality-control test reports.

F. Quality AssuranceVibration And Seismic Controls For Plumbing Piping And
Equipment

1. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
2. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
3. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproved by ICC-ES, or preapproved by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

1.2 PRODUCTS

A. Vibration Isolators

1. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
 - a. Resilient Material: Oil- and water-resistant neoprene **OR** rubber **OR** hermetically sealed compressed fiberglass, **as directed**.
2. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.
 - a. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - b. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.
3. Restrained Mounts: All-directional mountings with seismic restraint.
 - a. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - b. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.
4. Spring Isolators: Freestanding, laterally stable, open-spring isolators.
 - a. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - b. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - c. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - d. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - e. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- (6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
 - f. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
5. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.
 - a. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.

- b. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.
 - c. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - d. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - e. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - f. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.
- a. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
 - b. Base: Factory drilled for bolting to structure.
 - c. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch (6-mm) travel up or down before contacting a resilient collar.
7. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.
8. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
- a. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 - b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - f. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
 - g. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
9. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.
- a. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 - b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - f. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
 - g. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
 - h. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
10. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig (3.45 MPa) and for equal resistance in all directions.
11. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion



and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

B. Vibration Isolation Equipment Bases

1. Steel Base: Factory-fabricated, welded, structural-steel bases and rails.
 - a. Design Requirements: Lowest possible mounting height with not less than 1-inch (25-mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
 - 1) Include supports for suction and discharge elbows for pumps.
 - b. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
 - c. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
2. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.
 - a. Design Requirements: Lowest possible mounting height with not less than 1-inch (25-mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
 - 1) Include supports for suction and discharge elbows for pumps.
 - b. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
 - c. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
 - d. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

C. Seismic-Restraint Devices

1. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**.
 - a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
2. Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
 - a. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
 - b. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
 - c. Maximum 1/4-inch (6-mm) air gap, and minimum 1/4-inch- (6-mm-) thick resilient cushion.
3. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
4. Restraint Cables: ASTM A 603 galvanized-steel **OR** ASTM A 492 stainless-steel, **as directed**, cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
5. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections **OR** Reinforcing steel angle clamped, **as directed**, to hanger rod.
6. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

7. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.
8. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
9. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.
10. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

D. Factory Finishes

1. Finish:
 - a. Manufacturer's standard prime-coat finish ready for field painting.
OR
Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
 - 1) Powder coating on springs and housings.
 - 2) All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
 - 3) Baked enamel or powder coat for metal components on isolators for interior use.
 - 4) Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

1.3 EXECUTION

A. Applications

1. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**.
2. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
3. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

B. Vibration-Control And Seismic-Restraint Device Installation

1. Equipment Restraints:
 - a. Install seismic snubbers on plumbing equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 - b. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inches (3.2 mm).
 - c. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**, providing required submittals for component.
2. Piping Restraints:
 - a. Comply with requirements in MSS SP-127.
 - b. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.

- c. Brace a change of direction longer than 12 feet (3.7 m).
 3. Install cables so they do not bend across edges of adjacent equipment or building structure.
 4. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**, providing required submittals for component.
 5. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
 6. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
 7. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
 8. Drilled-in Anchors:
 - a. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - b. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - c. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - d. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 - e. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - f. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.
- C. Accommodation Of Differential Seismic Motion
1. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 22 Section "Domestic Water Piping" for piping flexible connections.
- D. Field Quality Control
1. Perform tests and inspections.
 2. Tests and Inspections:
 - a. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - b. Schedule test with Owner before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 - c. Obtain approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - d. Test at least four of each type and size of installed anchors and fasteners selected.
 - e. Test to 90 percent of rated proof load of device.
 - f. Measure isolator restraint clearance.
 - g. Measure isolator deflection.
 - h. Verify snubber minimum clearances.
 - i. Air-Mounting System Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

- j. Air-Mounting System Operational Test: Test the compressed-air leveling system.
 - k. Test and adjust air-mounting system controls and safeties.
 - l. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
 3. Remove and replace malfunctioning units and retest as specified above.
 4. Prepare test and inspection reports.
- E. Adjusting
1. Adjust isolators after piping system is at operating weight.
 2. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
 3. Adjust active height of sprint isolators.
 4. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 23 05 48 00a



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SECTION 23 05 48 00b - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of vibration and seismic controls for HVAC piping and equipment. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Isolation pads.
 - b. Isolation mounts.
 - c. Restrained elastomeric isolation mounts.
 - d. Freestanding and Restrained spring isolators.
 - e. Housed spring mounts.
 - f. Elastomeric hangers.
 - g. Spring hangers.
 - h. Spring hangers with vertical-limit stops.
 - i. Pipe riser resilient supports.
 - j. Resilient pipe guides.
 - k. Freestanding and Restrained air-mounting system.
 - l. Restrained vibration isolation roof-curb rails.
 - m. Seismic snubbers.
 - n. Restraining braces and cables.
 - o. Steel and Inertia, vibration isolation equipment bases.

C. Definitions

1. IBC: International Building Code.
2. ICC-ES: ICC-Evaluation Service.
3. OSHPD: Office of Statewide Health Planning and Development for the State of California.

D. Performance Requirements

1. Wind-Restraint Loading:
 - a. Basic Wind Speed: As required to meet Project requirements.
 - b. Building Classification Category: **I OR II OR III OR IV, as directed.**
 - c. Minimum 10 lb/sq. ft. (48.8 kg/sq. m) multiplied by the maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.
2. Seismic-Restraint Loading:
 - a. Site Class as Defined in the IBC: **A OR B OR C OR D OR E OR F, as directed.**
 - b. Assigned Seismic Use Group or Building Category as Defined in the IBC: **I OR II OR III, as directed.**
 - 1) Component Importance Factor: **1.0 OR 1.5, as directed.**
 - 2) Component Response Modification Factor: **1.5 OR 2.5 OR 3.5 OR 5.0, as directed.**
 - 3) Component Amplification Factor: **1.0 OR 2.5, as directed.**
 - c. Design Spectral Response Acceleration at Short Periods (0.2 Second): Percentage as directed.
 - d. Design Spectral Response Acceleration at 1-Second Period: Percentage as directed.

E. Submittals

1. Product Data: For each product indicated.

2. Delegated-Design Submittal: For vibration isolation and seismic-restraint calculations and details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
3. Welding certificates.
4. Qualification Data: For professional engineer.
5. Field quality-control test reports.

F. Quality Assurance

1. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
2. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
3. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

1.2 PRODUCTS

A. Vibration Isolators

1. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
 - a. Resilient Material: Oil- and water-resistant neoprene **OR** rubber **OR** hermetically sealed compressed fiberglass, **as directed**.
2. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.
 - a. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - b. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.
3. Restrained Mounts: All-directional mountings with seismic restraint.
 - a. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - b. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.
4. Spring Isolators: Freestanding, laterally stable, open-spring isolators.
 - a. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - b. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - c. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - d. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - e. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- (6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).

- f. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
- 5. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.
 - a. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
 - b. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.
 - c. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - d. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - e. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - f. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
- 6. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.
 - a. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
 - b. Base: Factory drilled for bolting to structure.
 - c. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch (6-mm) travel up or down before contacting a resilient collar.
- 7. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.
- 8. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
 - a. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 - b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - f. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
 - g. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
- 9. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.
 - a. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 - b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - f. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
 - g. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
 - h. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

10. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig (3.45 MPa) and for equal resistance in all directions.
11. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

B. Air-Mounting Systems

1. Air Mounts: Freestanding, single or multiple, compressed-air bellows.
 - a. Assembly: Upper and lower steel sections connected by a replaceable, flexible, nylon-reinforced neoprene bellows.
 - b. Maximum Natural Frequency: 3 Hz.
 - c. Operating Pressure Range: 25 to 100 psig (172 to 690 kPa).
 - d. Burst Pressure: At least three times manufacturer's published maximum operating pressure.
 - e. Leveling Valves: Minimum of 3 required to maintain leveling within plus or minus 1/8 inch (3 mm).
2. Restrained Air Mounts: Housed compressed-air bellows.
 - a. Assembly: Upper and lower steel sections connected by a replaceable, flexible, nylon-reinforced neoprene bellows and spring, with angle-iron frame having vertical-limit stops and channel-section top with leveling adjustment and attachment screws.
 - b. Maximum Natural Frequency: 3 Hz.
 - c. Operating Pressure Range: 25 to 100 psig (172 to 690 kPa).
 - d. Burst Pressure: At least three times manufacturer's published maximum operating pressure.
 - e. Leveling Valves: Minimum of 3 required to maintain leveling within plus or minus 1/8 inch (3 mm).

C. Restrained Vibration Isolation Roof-Curb Rails

1. General Requirements for Restrained Vibration Isolation Roof-Curb Rails: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand seismic and wind, **as directed**, forces.
2. Lower Support Assembly: Formed sheet-metal section containing adjustable and removable steel springs that support upper frame. Upper frame shall provide continuous support for equipment and shall be captive to resiliently resist seismic and wind, **as directed**, forces. Lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches (50 mm) of rigid, glass-fiber insulation on inside of assembly.
3. Spring Isolators: Adjustable, restrained spring isolators shall be mounted on 1/4-inch- (6-mm-) thick, elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.
 - a. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or wind, **as directed**, restraint.
 - 1) Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.
 - 2) Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 3) Minimum Additional Travel: 50 percent of the required deflection at rated load.

- 4) Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 5) Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - b. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
 - 1) Resilient Material: Oil- and water-resistant standard neoprene **OR** natural rubber **OR** hermetically sealed compressed fiberglass, **as directed**.
 4. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch (6 mm) thick.
 5. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.
- D. Vibration Isolation Equipment Bases
1. Steel Base: Factory-fabricated, welded, structural-steel bases and rails.
 - a. Design Requirements: Lowest possible mounting height with not less than 1-inch (25-mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
 - 1) Include supports for suction and discharge elbows for pumps.
 - b. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
 - c. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
 2. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.
 - a. Design Requirements: Lowest possible mounting height with not less than 1-inch (25-mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
 - 1) Include supports for suction and discharge elbows for pumps.
 - b. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
 - c. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
 - d. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.
- E. Seismic-Restraint Devices
1. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**.
 - a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
 2. Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
 - a. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
 - b. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
 - c. Maximum 1/4-inch (6-mm) air gap, and minimum 1/4-inch- (6-mm-) thick resilient cushion.
 3. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

4. Restraint Cables: ASTM A 603 galvanized-steel **OR** ASTM A 492 stainless-steel, **as directed**, cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
5. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections **OR** Reinforcing steel angle clamped, **as directed**, to hanger rod.
6. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.
7. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.
8. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
9. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.
10. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

F. Factory Finishes

1. Finish
 - a. Manufacturer's standard prime-coat finish ready for field painting.
OR
Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
 - 1) Powder coating on springs and housings.
 - 2) All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
 - 3) Baked enamel or powder coat for metal components on isolators for interior use.
 - 4) Color-code or otherwise mark vibration isolation and seismic-control and wind-control, **as directed**, devices to indicate capacity range.

1.3 EXECUTION

A. Applications

1. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**.
2. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
3. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

B. Vibration-Control And Seismic-Restraint Device Installation

1. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
2. Equipment Restraints:

- a. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 - b. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
 - c. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**, providing required submittals for component.
 3. Piping Restraints:
 - a. Comply with requirements in MSS SP-127.
 - b. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
 - c. Brace a change of direction longer than 12 feet (3.7 m).
 4. Install cables so they do not bend across edges of adjacent equipment or building structure.
 5. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**, providing required submittals for component.
 6. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
 7. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
 8. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
 9. Drilled-in Anchors:
 - a. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - b. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - c. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - d. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 - e. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - f. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.
- C. Accommodation Of Differential Seismic Motion
 1. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 23 Section "Hydronic Piping" for piping flexible connections.
- D. Field Quality Control
 1. Perform tests and inspections.
 2. Tests and Inspections:
 - a. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.

- b. Schedule test with Owner before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 - c. Obtain approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - d. Test at least four of each type and size of installed anchors and fasteners selected.
 - e. Test to 90 percent of rated proof load of device.
 - f. Measure isolator restraint clearance.
 - g. Measure isolator deflection.
 - h. Verify snubber minimum clearances.
 - i. Air-Mounting System Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - j. Air-Mounting System Operational Test: Test the compressed-air leveling system.
 - k. Test and adjust air-mounting system controls and safeties.
 - l. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
3. Remove and replace malfunctioning units and retest as specified above.
 4. Prepare test and inspection reports.
- E. Adjusting
1. Adjust isolators after piping system is at operating weight.
 2. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
 3. Adjust air-spring leveling mechanism.
 4. Adjust active height of spring isolators.
 5. Adjust restraints to permit free movement of equipment within normal mode of operation.
- F. Demonstration
1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-mounting systems.

END OF SECTION 23 05 48 00b



Task	Specification	Specification Description
23 05 48 00	01 22 16 00	No Specification Required
23 05 48 00	22 05 23 00	Piped Utilities Basic Materials And Methods



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SECTION 23 05 53 00 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for identification for plumbing piping and equipment. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Equipment labels.
 - b. Warning signs and labels.
 - c. Pipe labels.
 - d. Stencils.
 - e. Valve tags.
 - f. Warning tags.

C. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS**A. Equipment Labels**

1. Metal Labels for Equipment:
 - a. Material and Thickness: Brass, 0.032-inch (0.8-mm) **OR** Stainless steel, 0.025-inch (0.64-mm) **OR** Aluminum, 0.032-inch (0.8-mm) **OR** anodized aluminum, 0.032-inch (0.8-mm), **as directed**, minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - b. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
 - c. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - d. Fasteners: Stainless-steel rivets **OR** self-tapping screws, **as directed**.
 - e. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
2. Plastic Labels for Equipment:
 - a. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) **OR** 1/8 inch (3.2 mm), **as directed**, thick, and having predrilled holes for attachment hardware.
 - b. Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - c. Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - d. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
 - e. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
 - f. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - g. Fasteners: Stainless-steel rivets **OR** self-tapping screws, **as directed**.
 - h. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.



3. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
 4. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.
- B. Warning Signs And Labels
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) **OR** 1/8 inch (3.2 mm), **as directed**, thick, and having predrilled holes for attachment hardware.
 2. Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 3. Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
 6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 7. Fasteners: Stainless-steel rivets **OR** self-tapping screws, **as directed**.
 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
 9. Label Content: Include caution and warning information, plus emergency notification instructions.
- C. Pipe Labels
1. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
 2. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover **OR** cover full, **as directed**, circumference of pipe and to attach to pipe without fasteners or adhesive.
 3. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
 4. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - a. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - b. Lettering Size: At least 1-1/2 inches (38 mm) high.
- D. Stencils
1. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch (19 mm) for access panel and door labels, equipment labels, and similar operational instructions.
 - a. Stencil Material: Aluminum **OR** Brass **OR** Fiberboard, **as directed**.
 - b. Stencil Paint: Exterior, gloss, alkyd enamel **OR** acrylic enamel, **as directed**, black unless otherwise indicated. Paint may be in pressurized spray-can form.
 - c. Identification Paint: Exterior, alkyd enamel **OR** acrylic enamel, **as directed**, in colors according to ASME A13.1 unless otherwise indicated.
- E. Valve Tags
1. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.
 - a. Tag Material: Brass, 0.032-inch (0.8-mm) **OR** Stainless steel, 0.025-inch (0.64-mm) **OR** Aluminum, 0.032-inch (0.8-mm) **OR** anodized aluminum, 0.032-inch (0.8-mm), **as directed**, minimum thickness, and having predrilled or stamped holes for attachment hardware.

- b. Fasteners: Brass wire-link chain **OR** beaded chain **OR** S-hook, **as directed**.
 - 2. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - a. Valve-tag schedule shall be included in operation and maintenance data.
- F. Warning Tags
 - 1. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 - a. Size: 3 by 5-1/4 inches (75 by 133 mm) minimum **OR** Approximately 4 by 7 inches (100 by 178 mm), **as directed**.
 - b. Fasteners: Brass grommet and wire **OR** Reinforced grommet and wire or string, **as directed**.
 - c. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 - d. Color: Yellow background with black lettering.

1.3 EXECUTION

- A. Preparation
 - 1. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.
- B. Equipment Label Installation
 - 1. Install or permanently fasten labels on each major item of mechanical equipment.
 - 2. Locate equipment labels where accessible and visible.
- C. Pipe Label Installation
 - 1. Piping Color-Coding: Painting of piping is specified in Division 09 Section(s) "Interior Painting" **OR** "High-performance Coatings", **as directed**.
 - 2. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles **OR** complying with ASME A13.1, **as directed**, on each piping system.
 - a. Identification Paint: Use for contrasting background.
 - b. Stencil Paint: Use for pipe marking.
 - 3. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - a. Near each valve and control device.
 - b. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - c. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - d. At access doors, manholes, and similar access points that permit view of concealed piping.
 - e. Near major equipment items and other points of origination and termination.
 - f. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
 - g. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
 - 4. Pipe Label Color Schedule:
 - a. Low-Pressure, Compressed-Air Piping:
 - 1) Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - 2) Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - b. Medium-Pressure, Compressed-Air Piping:
 - 1) Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.



- 2) Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
- c. Domestic Water Piping:
 - 1) Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - 2) Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
- d. Sanitary Waste and Storm Drainage Piping:
 - 1) Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - 2) Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.

D. Valve-Tag Installation

- 1. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- 2. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - a. Valve-Tag Size and Shape:
 - 1) Cold Water: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, round **OR** square, **as directed**.
 - 2) Hot Water: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, round **OR** square, **as directed**.
 - 3) Low-Pressure Compressed Air: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, round **OR** square, **as directed**.
 - 4) High-Pressure Compressed Air: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, round **OR** square, **as directed**.
 - b. Valve-Tag Color:
 - 1) Cold Water: Natural **OR** Green, **as directed**.
 - 2) Hot Water: Natural **OR** Green, **as directed**.
 - 3) Low-Pressure Compressed Air: Natural **OR** Green, **as directed**.
 - 4) High-Pressure Compressed Air: Natural **OR** Green, **as directed**.
 - c. Letter Color:
 - 1) Cold Water: Black **OR** White, **as directed**.
 - 2) Hot Water: Black **OR** White, **as directed**.
 - 3) Low-Pressure Compressed Air: Black **OR** White, **as directed**.
 - 4) High-Pressure Compressed Air: Black **OR** White, **as directed**.

E. Warning-Tag Installation

- 1. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 23 05 53 00

SECTION 23 05 53 00a - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for identification for HVAC piping and equipment. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Equipment labels.
 - b. Warning signs and labels.
 - c. Pipe labels.
 - d. Duct labels.
 - e. Stencils.
 - f. Valve tags.
 - g. Warning tags.

C. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS**A. Equipment Labels**

1. Metal Labels for Equipment:
 - a. Material and Thickness: Brass, 0.032-inch (0.8-mm) **OR** Stainless steel, 0.025-inch (0.64-mm) **OR** Aluminum, 0.032-inch (0.8-mm) **OR** anodized aluminum, 0.032-inch (0.8-mm), **as directed**, minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - b. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
 - c. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - d. Fasteners: Stainless-steel rivets **OR** self-tapping screws, **as directed**.
 - e. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
2. Plastic Labels for Equipment:
 - a. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) **OR** 1/8 inch (3.2 mm), **as directed**, thick, and having predrilled holes for attachment hardware.
 - b. Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - c. Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - d. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
 - e. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
 - f. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - g. Fasteners: Stainless-steel rivets **OR** self-tapping screws, **as directed**.



- h. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- 3. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- 4. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

B. Warning Signs And Labels

- 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) **OR** 1/8 inch (3.2 mm), **as directed**, thick, and having predrilled holes for attachment hardware.
- 2. Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
- 3. Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
- 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
- 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
- 6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- 7. Fasteners: Stainless-steel rivets **OR** self-tapping screws, **as directed**.
- 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- 9. Label Content: Include caution and warning information, plus emergency notification instructions.

C. Pipe Labels

- 1. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- 2. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover **OR** cover full, **as directed**, circumference of pipe and to attach to pipe without fasteners or adhesive.
- 3. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- 4. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - a. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - b. Lettering Size: At least 1-1/2 inches (38 mm) high.

D. Duct Labels

- 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) **OR** 1/8 inch (3.2 mm), **as directed**, thick, and having predrilled holes for attachment hardware.
- 2. Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
- 3. Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
- 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
- 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
- 6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- 7. Fasteners: Stainless-steel rivets **OR** self-tapping screws, **as directed**.
- 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

9. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.
 - a. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
 - b. Lettering Size: At least 1-1/2 inches (38 mm) high.
 - E. Stencils
 1. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches (32 mm) for ducts; and minimum letter height of 3/4 inch (19 mm) for access panel and door labels, equipment labels, and similar operational instructions.
 - a. Stencil Material: Aluminum **OR** Brass **OR** Fiberboard, **as directed**.
 - b. Stencil Paint: Exterior, gloss, alkyd enamel **OR** acrylic enamel, **as directed**, black unless otherwise indicated. Paint may be in pressurized spray-can form.
 - c. Identification Paint: Exterior, alkyd enamel **OR** acrylic enamel, **as directed**, in colors according to ASME A13.1 unless otherwise indicated.
 - F. Valve Tags
 1. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.
 - a. Tag Material: Brass, 0.032-inch (0.8-mm) **OR** Stainless steel, 0.025-inch (0.64-mm) **OR** Aluminum, 0.032-inch (0.8-mm) **OR** anodized aluminum, 0.032-inch (0.8-mm), **as directed**, minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - b. Fasteners: Brass wire-link chain **OR** beaded chain **OR** S-hook, **as directed**.
 2. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - a. Valve-tag schedule shall be included in operation and maintenance data.
 - G. Warning Tags
 1. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 - a. Size: 3 by 5-1/4 inches (75 by 133 mm) minimum **OR** Approximately 4 by 7 inches (100 by 178 mm), **as directed**.
 - b. Fasteners: Brass grommet and wire **OR** Reinforced grommet and wire or string, **as directed**.
 - c. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 - d. Color: Yellow background with black lettering.
- ### 1.3 EXECUTION
- A. Preparation
 1. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.
 - B. Equipment Label Installation
 1. Install or permanently fasten labels on each major item of mechanical equipment.
 2. Locate equipment labels where accessible and visible.
 - C. Pipe Label Installation
 1. Piping Color-Coding: Painting of piping is specified in Division 09 Section(s) "Interior Painting" **OR** "High-performance Coatings", **as directed**.



2. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles **OR** complying with ASME A13.1, **as directed**, on each piping system.
 - a. Identification Paint: Use for contrasting background.
 - b. Stencil Paint: Use for pipe marking.
3. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - a. Near each valve and control device.
 - b. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - c. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - d. At access doors, manholes, and similar access points that permit view of concealed piping.
 - e. Near major equipment items and other points of origination and termination.
 - f. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
 - g. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
4. Pipe Label Color Schedule:
 - a. Chilled-Water Piping:
 - 1) Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - 2) Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - b. Condenser-Water Piping:
 - 1) Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - 2) Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - c. Heating Water Piping:
 - 1) Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - 2) Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - d. Refrigerant Piping:
 - 1) Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - 2) Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - e. Low-Pressure Steam Piping:
 - 1) Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - 2) Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - f. High-Pressure Steam Piping:
 - 1) Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - 2) Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - g. Steam Condensate Piping:
 - 1) Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - 2) Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.

D. Duct Label Installation

1. Install plastic-laminated **OR** self-adhesive, **as directed**, duct labels with permanent adhesive on air ducts in the following color codes:
 - a. Blue: For cold-air supply ducts.
 - b. Yellow: For hot-air supply ducts.
 - c. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
 - d. ASME A13.1 Colors and Designs: For hazardous material exhaust.
2. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1 inch (25 mm) high is needed for proper identification because of distance from normal location of required identification.
3. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet (15 m) in each space where ducts are exposed or concealed by removable ceiling system.

E. Valve-Tag Installation

1. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
2. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - a. Valve-Tag Size and Shape:
 - 1) Chilled Water: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, round **OR** square, **as directed**.
 - 2) Condenser Water: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, round **OR** square, **as directed**.
 - 3) Refrigerant: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, round **OR** square, **as directed**.
 - 4) Hot Water: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, round **OR** square, **as directed**.
 - 5) Gas: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, round **OR** square, **as directed**.
 - 6) Low-Pressure Steam: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, round **OR** square, **as directed**.
 - 7) High-Pressure Steam: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, round **OR** square, **as directed**.
 - 8) Steam Condensate: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, round **OR** square, **as directed**.
 - b. Valve-Tag Color:
 - 1) Chilled Water: Natural **OR** Green, **as directed**.
 - 2) Condenser Water: Natural **OR** Green, **as directed**.
 - 3) Refrigerant: Natural **OR** Green, **as directed**.
 - 4) Hot Water: Natural **OR** Green, **as directed**.
 - 5) Gas: Natural **OR** Yellow, **as directed**.
 - 6) Low-Pressure Steam: Natural **OR** Yellow, **as directed**.
 - 7) High-Pressure Steam: Natural **OR** Green, **as directed**.
 - 8) Steam Condensate: Natural **OR** Green, **as directed**.
 - c. Letter Color:
 - 1) Chilled Water: Black **OR** White, **as directed**.
 - 2) Condenser Water: Black **OR** White, **as directed**.
 - 3) Refrigerant: Black **OR** White, **as directed**.
 - 4) Hot Water: Black **OR** White, **as directed**.
 - 5) Gas: Black **OR** White, **as directed**.
 - 6) Low-Pressure Steam: Black **OR** White, **as directed**.
 - 7) High-Pressure Steam: Black **OR** White, **as directed**.
 - 8) Steam Condensate: Black **OR** White, **as directed**.

F. Warning-Tag Installation

1. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 23 05 53 00a



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SECTION 23 05 93 00 - CSF TESTING, ADJUSTING AND BALANCING FOR HVAC

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.23 05 93 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Testing, adjustment, and balancing of air systems.
 - 2. Measurement of final operating condition of HVAC systems.
 - 3. Sound measurement of equipment operating conditions.
 - 4. Vibration measurement of equipment operating conditions.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 013543 - Environmental Procedures: Pre-occupancy ventilation
 - 2. Section 014000 - Quality Requirements: Employment of testing agency and payment for services.
 - 3. Section 017300 - Execution: Starting of systems.

1.2 REFERENCES

- A. Associated Air Balance Council (AABC):
 - 1. AABC - National Standards for Total System Balance.
- B. National Environmental Balancing Bureau.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Assurance/Control Submittals:



- a. Test Reports: Submit the following reports directly to Contracting Officer from Testing Laboratory, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
 - 1) Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
 - 2) Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for inclusion in operating and maintenance manuals.
 - 3) Provide reports in binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
 - 4) Indicate data on AABC National Standards for Total System Balance forms.
- b. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
- c. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.

- 1. Project Record Documents: Accurately record the following:
 - a. Actual locations of balancing valves and rough setting.
- 2. Submit written special warranty with forms completed in United States Postal Service name and registered with manufacturer as specified in this Section.

1.4 QUALITY ASSURANCE

A. Qualifications:

- 1. Company specializing in testing, adjusting, and balancing of specified with minimum 5 years documented experience. Company to be certified by one of the following.
 - a. AABC Certified Independent Testing and Balancing Agency.
 - b. National Environmental Balancing Bureau Certified Independent Agency. (NEBB).

B. Certification: Certify the testing, adjusting, and balancing field data reports.

C. Testing, Adjusting, and Balancing Reports: Use testing, adjusting, and balancing Agent's standard forms.

PART 2 - PRODUCTS

(Not Used.)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 - 1. Systems are started and operating in a safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.
 - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 5. Duct systems are clean of debris.

6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.

3.2 PREPARATION

- A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Contracting Officer to facilitate spot checks during testing.
- B. Provide additional balancing instruments as required.

3.3 INSTALLATION TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.4 ADJUSTING

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- E. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Contracting Officer.
- F. Check and adjust systems approximately six months after final acceptance and submit report.

3.5 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities. Perform this work with cooling system energized where applicable to obtain the extra resistance of wet coils.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.



- E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices.
- F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- K. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches (12.5 Pa) positive static pressure near the building entries.

NOTE TO SPECIFIER

"REQUIRED Article (SITE ENVIRONMENTAL PROCEDURES) follows. Do not revise this Article, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer."

3.6 SITE ENVIRONMENTAL PROCEDURES

- A. Indoor Air Quality:
 - 1. Pre-occupancy ventilation: Provide pre-occupancy ventilation as specified in Section 013543 - Environmental Procedures; provide prior to final testing, adjusting, and balancing of HVAC system.

USPS CSF Specifications issued: 10/1/2013
Last revised: 5/11/11

END OF SECTION



SECTION 23 05 93 00 - MPF TESTING, ADJUSTING AND BALANCING FOR HVAC

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Balancing, airflow and water flow within distribution systems, including submains, branches and terminals, to indicated quantities according to specified tolerances.
- B. Adjusting total HVAC systems to provide indicated quantities.
- C. Measuring electrical performance of HVAC equipment.
- D. Setting quantitative performance of HVAC equipment.
- E. Verifying that automatic control devices are functioning properly.
- F. Measuring sound and vibration.
- G. Reporting results of the activities and procedures.

1.2 SUBMITTALS

- A. Certification: Required
- B. Testing and Balancing Reports: Required

1.3 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Company specializing in testing, adjusting, and balancing of the types of systems & equipment specified with minimum 5 years documented experience.
 - 2. Company or agent certified by AABC or NEBB.
 - 3. Testing and Balancing Company shall be submitted for approval prior to commencement of work.
- B. Reference Standards:
 - 1. AABC

2. AMCA
3. ASHRAE
4. CTI
5. NEBB
6. SMACNA

1.4 INSTRUMENTS

- A. All instruments used by this agency shall be accurately calibrated and maintained in good working order. Calibration records must be with the instruments.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that systems are complete and operable before commencing work.
- B. Verify that all required balancing dampers, valves and fittings are provided before commencing work.

3.2 INSTALLATION TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for fans.
- B. Air Outlets and Inlets: Adjust outlets and inlets in the specific space to within plus or minus 10 percent of design.
- C. Pump Flow: Adjust to 110% of design flow rate.
- D. Hydronic Components: Adjust to within plus 5 percent of design.
- E. All rotating equipment such as fans, compressors and pumps shall be balanced and aligned so that vibration severity measured at bearing caps shall not exceed 0.09 inch/second in rms velocity for frequency range from 1 Hz. To 100 Hz.

3.3 GENERAL TESTING AND BALANCING PROCEDURES

- A. Test and balance each system according to the procedures contained in reference standards.



3.4 REPORTS

- A. Provide 4 certified copies of all test data.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 06/30/10

END OF SECTION 23 05 93 00



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Task	Specification	Specification Description
23 05 93 00	01 71 23 16	Cutting and Patching



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SECTION 23 07 13 00 - MPF DUCT INSULATION**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Piping insulation.
- B. Ductwork insulation.
- C. Duct liner.
- D. Insulation jacket.
- E. Equipment insulation.

1.2 SUBMITTALS

- A. Product Data: Required.
- B. Shop Drawings: Required.

1.3 QUALITY ASSURANCE

- A. Flame spread/smoke developed rating of 25/50 or less in accordance with ASTM E84, NFPA 255 and UL 723.
- B. Insulation for duct, pipe and equipment located above grade exposed to weather outside building shall be certified as being self-extinguishing for 1" thickness less than 53 seconds.
- C. Mechanical insulation shall be as per ASHRAE-90.1.

PART 2 - PRODUCTS

2.1 MANUFACTURERS/PRODUCTS

- A. Pipe Insulation:
 - 1. Glass Fiber: Rigid molded, noncombustible with vapor barrier jacket, as manufactured by Certainteed, Manville, Owens-Corning, Knauf.
 - 2. Cellular Foam: Flexible, cellular elastomeric, molded, as manufactured by Armstrong, Halstead, Rubatex.
 - 3. Cellular Glass: Rigid molded cellular glass as manufactured by Pittsburgh Corning.
 - 4. Jackets: PVC Plastic: One piece molded type fitting covers, off white color.
 - 5. Jackets (outdoor): 0.016 inch thick aluminum.
 - 6. Coating:
 - a. Weather-resistant protective finish for cellular foam outside the building.
- B. Ductwork Insulation:
 - 1. Flexible Glass Fiber: Flexible, noncombustible blanket with vapor barrier jacket.
 - 2. Rigid Glass Fiber board with vapor barrier jacket.
 - 3. Duct Liner: Flexible, noncombustible blanket, with facing on air side, 1" thick. Unfaced insulation material shall not be used.
 - 4. Ductwork insulation shall be as manufactured by Certainteed, Owens-Corning, Manville, Knauf.
- C. Equipment Insulation:
 - 1. Rigid Glass Fiber board with resin binder for hot equipment.
 - 2. Foamglas insulation for cold equipment.
 - 3. Insulation shall be as manufactured by Certainteed, Owens-Corning, Manville, Knauf.
 - 4. Insulation shall be removable to provide maintenance access to equipment.

PART 3 - INSTALLATION

3.1 PIPING INSULATION:

- A. Provide cold pipes with vapor barrier jackets. Insulate complete system.
- B. Provide hot pipes with standard jackets. Bevel and seal ends of insulation at equipment, flanges, and unions.
- C. For piping in mechanical rooms, provide PVC jackets.
- D. For piping outdoors, provide aluminum jackets.
- E. For heat traced piping, piping shall be insulated to minimize energy usage.

3.2 DUCTWORK INSULATION:

- A. For ductwork conveying air below ambient temperature provide vapor barrier jacket.

- B. For ductwork exposed and below 10 feet above finished floor, provide aluminum jacket.
- C. Provide insulation for concealed ductwork in non-return air ceiling spaces.

3.3 DUCT LINER:

- 1. Install per SMACNA standards and NAIMA Ductliner Installation Standard.
- 2. All transverse edges to be coated with adhesives to protect against airstream erosion.
- 3. Duct dimensions indicated are net inside dimensions: increase duct size to allow for insulation thickness.

3.4 EQUIPMENT INSULATION:

- A. All hot surfaces to maintain maximum surface temperature of 100°F or more shall be insulated to 7 feet above horizontal passage ways and to 4 feet from stairs or ladders.
- B. Finish with lagging cement with open mesh glass fabric.

3.5 SCHEDULES

A. Piping Insulation:

- 1. Glass Fiber Insulation.

	PIPE SIZE <u>Inch</u>	THICKNESS <u>Inch</u>
Domestic Hot Water Supply	All	1"
Domestic Hot Water Recirc	All	1"
Tempered Domestic Water Supply	All	1/2"
Tempered Domestic Water Recirc	All	1/2"
Domestic Cold Water	All	1/2"
Horizontal Rain Leaders-Above Grade	All	1"
Humidifier Piping	All	1"
Piping Exposed to Freezing with Heat Tracing	All	2"

- 2. Cellular Foam Insulation Schedule

	PIPE SIZE <u>Inch</u>	THICKNESS <u>Inch</u>
Domestic hot water supply	All	1/2"
Domestic hot water recirc	All	1/2"
Tempered Domestic Water Supply	All	1/2"
Tempered Domestic Water Recirc	All	1/2"
Domestic Cold Water	All	1/2"
Moisture Condensate Drains-Above Grade	All	3/4"
Indoor Horizontal Waste Lines from AC Equip.	All	3/4"
HVAC Refrigerant Lines (suction only)	All	3/4"
Piping exposed to freezing with heat tracing	All	1"

- 3. Cellular Glass

Domestic Water-Outdoors	All	2"
Piping with heat tracing	All	2"
Chilled Water Piping	All	2"



B. Ductwork Insulation

1. Flexible Glass Fiber Duct Wrap Insulation

	THICKNESS	FINISH
	<u>Inch</u>	<u></u>
Supply Ducts- Concealed	1- 1/2"	Aluminized Film
Return Ducts- Concealed	1- 1/2"	Aluminized Film
Outdoor Air Intake Ducts- Concealed	1- 1/2"	Aluminized Film

2. Rigid Glass Fiber Board Insulation

Supply Ducts-exposed non-conditioned space	1 1/2"	
Return Ducts- exposed non-conditioned space	1	Fabric

3. Flexible Glass Fiber Duct Liner Insulation

	THICKNESS	FINISH
	<u>Inch</u>	<u></u>
Plenums (Cooling System)	1"	Black
Pigmented, UL		
Supply Ducts	1"	Black
Pigmented, UL		
Return Ducts	1"	Black
Pigmented, UL		
Outdoor Air Intake Ducts	1"	Black
Pigmented, UL		
Ducts Exposed to Outdoors	2"	Black
Pigmented, UL		

C. Equipment Insulation

1. Similar to piping insulation.
2. Follow manufacturer's installation instructions.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 07/27/2010

END OF SECTION 23 07 13 00



SECTION 23 07 13 00 - CSF DUCT INSULATION**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

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Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.23 07 13 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Ductwork insulation.
 - 2. Duct liner.
 - 3. Insulation jackets.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
 - 2. ASTM C177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
 - 3. ASTM C335 - Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.
 - 4. ASTM C518 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - 5. ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
 - 6. ASTM C547 - Mineral Fiber Pipe Insulation.
 - 7. ASTM C553 - Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - 8. ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.
 - 9. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
 - 10. ASTM E84 - Surface Burning Characteristics of Building Materials.
 - 11. ASTM E96 - Water Vapor Transmission of Materials.
- B. National Fire Protection Association (NFPA):

1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

C. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

1. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

D. Underwriters Laboratories, Inc. (UL):

1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

1. Product Data:

- a. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer: Company specializing in manufacturing Products specified with minimum 3 years documented experience.
2. Installer: Company specializing in performing the Work of this Section with minimum 3 years documented experience.

B. Materials:

1. Flame spread/smoke developed rating of 25/50 or less in accordance with ASTM E84, NFPA 255 and UL 723.
2. Insulation for duct, pipe and equipment for above grade exposed to weather outside building shall be certified as being self-extinguishing for 1 inch thickness less than 53 seconds when tested in accordance with ASTM D1692.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

B. Deliver materials to site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Store insulation in original wrapping and protect from weather and construction traffic.

D. Protect insulation against dirt, water, chemical, and mechanical damage.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

A. Jobsite Requirements

1. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
2. Maintain temperature during and after installation for minimum period of 24 hours.

NOTE TO SPECIFIER



"REQUIRED Article (ENVIRONMENTAL REQUIREMENTS) follows. Do not revise this Part, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer."

1.7 ENVIRONMENTAL REQUIREMENTS

A. Energy efficiency:

1. Insulation: Minimum thickness in accordance with ASHRAE 90.1. Provide additional thickness to ensure surface temperatures are below 100 degrees and to prevent condensation on cold surfaces.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 DUCTWORK INSULATION

A. Glass Fiber, Flexible Duct Wrap

1. Manufacturers:
 - a. Owens/Corning, Toledo, OH (800) 438-7465.
 - b. Other acceptable manufacturers offering equivalent products.
 - 1) CertainTeed.
 - 2) Schuller (Manville).
 - 3) Knauf.
2. Insulation: ASTM C553 flexible, noncombustible blanket.
 - a. 'K' ('Ksi') value : ASTM C518, 0.30 at 75 degrees F.
 - b. Maximum service temperature: 250 degrees F.
 - c. Maximum moisture absorption: 0.20 percent by volume.
 - d. Density: 0.75 lb./cu ft .
3. Vapor Barrier Jacket
 - a. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
 - b. Moisture vapor transmission: ASTM E96; 0.02 perm.
 - c. Secure with pressure sensitive tape.
4. Vapor Barrier Tape
 - a. Manufacturers:
 - 1) Owens/Corning.
 - 2) CertainTeed.
 - 3) Schuller (Manville).
 - b. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
5. Tie Wire: Annealed steel, 16 gage.

B. Glass Fiber Duct Liner, Flexible

1. Manufacturers:
 - a. CertainTeed.
 - b. Other acceptable manufacturers offering equivalent products.
 - 1) Knauf.
 - 2) Schuller (Manville).
 - 3) Owens Corning.

2. Insulation: ASTM C553; flexible, noncombustible blanket.
 - a. 'K' ('Ksi') value : ASTM C518, 0.28 at 75 degrees F.
 - b. Maximum service temperature: 250 degrees F.
 - c. Density: 1.5 lb./cu ft.
 - d. Maximum Velocity on Coated Air Side: 4,000 ft./min.
 3. Adhesive
 - a. Waterproof fire-retardant type.
 4. Liner Fasteners: Galvanized steel, impact applied with integral head.
- C. Glass Fiber, Rigid Board
1. Manufacturers:
 - a. CertainTeed.
 - b. Other acceptable manufacturers offering equivalent products.
 - 1) Knauf.
 - 2) Schuller (Manville).
 - 3) Owens Corning.
 2. Insulation: Glass fibers bonded with a thermosetting resin for rigidity. Comply with ASTM C 612, Type IB, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.
 - a. 'K' ('Ksi') value : ASTM C518, 0.28 at 75 degrees F.
 - b. Maximum service temperature: 250 degrees F.
 - c. Density: 1.5 lb./cu ft.
 3. Vapor Barrier Jacket
 - a. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
 - b. Moisture vapor transmission: ASTM E96; 0.02 perm.
 - c. Overlap seams with pressure sensitive tape.
 4. Vapor Barrier Tape
 - a. Manufacturers:
 - 1) Owens/Corning.
 - 2) CertainTeed.
 - 3) Schuller (Manville).
 - b. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
 5. Pin to ductwork below 8 feet and seal all perforations hardcast mastic.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 1. Verify that piping has been tested before applying insulation materials.
 2. Verify that ductwork has been tested before applying insulation materials.
 3. Verify that surfaces are clean, foreign material removed, and dry.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION - DUCTWORK INSULATION

- A. Install materials in accordance with manufacturer's instructions and ASHRAE 90.1.
- B. Insulated ductwork conveying air below ambient temperature:
 - 1. Provide insulation with vapor barrier jackets.
 - 2. Finish with tape and vapor barrier jacket.
 - 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 - 4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- C. Insulated ductwork conveying air above ambient temperature:
 - 1. Provide with or without standard vapor barrier jacket.
 - 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- D. For ductwork exposed in finished spaces below 10 feet above finished floor, finish with aluminum jacket.
- E. For exterior applications, provide insulation with vapor barrier jacket. Cover with caulked aluminum jacket with seams located on bottom side of horizontal duct section.
- F. External Duct Insulation Application:
 - 1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
 - 2. Secure insulation without vapor barrier with staples, tape, or wires.
 - 3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
 - 4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
 - 5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
- G. Duct and Plenum Liner Application:
 - 1. Adhere insulation with adhesive for 100 percent coverage.
 - 2. Secure insulation with mechanical liner fasteners. Refer to SMACNA Standards for spacing.
 - 3. Seal and smooth joints.
 - 4. Seal liner surface penetrations with adhesive.
 - 5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

3.3 CONSTRUCTION

- A. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated.

3.4 DUCTWORK INSULATION SCHEDULE

- A. Flexible Glass Fiber Duct Wrap Insulation Schedule:

DUCTWORK	THICKNESS INCH	FINISH
Round Supply Ducts	1-1/2"	Aluminized Film
Round Return Ducts	1-1/2"	Aluminized Film
Round Outdoor Air Intake Ducts	1-1/2"	Aluminized Film



B. Flexible Glass Fiber Duct Liner Insulation Schedule:

DUCTWORK	THICKNESS INCH	FINISH
Plenums (Cooling System)	1"	Black Pigmented, UL
Supply Ducts	1"	Black Pigmented, UL
Return Ducts	1"	Black Pigmented, UL
Outdoor Air Intake Ducts	1"	Black Pigmented, UL
Ducts Exposed to Outdoors	2"	Black Pigmented, UL

USPS CSF Specifications issued: 10/1/2013
Last revised: 5/11/11

END OF SECTION



SECTION 23 07 19 00 - MPF HVAC PIPING INSULATION**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Piping insulation.
 - 2. Insulation jackets.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
 - 2. ASTM C177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
 - 3. ASTM C335 - Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.
 - 4. ASTM C518 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - 5. ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
 - 6. ASTM C547 - Mineral Fiber Pipe Insulation.
 - 7. ASTM C553 - Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - 8. ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.
 - 9. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
 - 10. ASTM E84 - Surface Burning Characteristics of Building Materials.
 - 11. ASTM E96 - Water Vapor Transmission of Materials.
- B. National Fire Protection Association (NFPA):
 - 1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- C. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
 - 1. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

- D. Underwriters Laboratories, Inc. (UL):
 - 1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data:
 - a. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 3 years documented experience.
 - 2. Installer: Company specializing in performing the Work of this Section with minimum 3 years documented experience.
- B. Materials:
 - 1. Flame spread/smoke developed rating of 25/50 or less in accordance with ASTM E84, NFPA 255 and UL 723.
 - 2. Insulation for pipe and equipment for above grade exposed to weather outside building shall be certified as being self-extinguishing for 1 inch thickness less than 53 seconds when tested in accordance with ASTM D1692.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver materials to site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Store insulation in original wrapping and protect from weather and construction traffic.
- D. Protect insulation against dirt, water, chemical, and mechanical damage.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Jobsite Requirements
 - 1. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
 - 2. Maintain temperature during and after installation for minimum period of 24 hours.

NOTE TO SPECIFIER

"REQUIRED Article (ENVIRONMENTAL REQUIREMENTS) follows. Do not revise this Part, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer."

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Energy efficiency:
1. Insulation: Minimum thickness in accordance with ASHRAE 90.1. Provide additional thickness to ensure surface temperatures are below 100 degrees and to prevent condensation on cold surfaces.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 PIPING INSULATION

- A. Glass Fiber
1. Manufacturers:
 - a. CertainTeed Insulation, Valley Forge, PA (800) 233-8990.
 - b. Other acceptable manufacturers offering equivalent products.
 - 1) Knauf Fiber Glass.
 - 2) Manville Insulation, Inc.
 - 3) Owens-Corning Fiberglass
 2. Insulation: ASTM C547; rigid molded, noncombustible.
 - a. 'K' ('ksi') value : ASTM C335, 0.24 at 75 degrees F.
 - b. Minimum Service Temperature: -20 degrees F.
 - c. Maximum Service Temperature: 300 degrees F.
 - d. Maximum Moisture Absorption: 0.2 percent by volume.
 3. Vapor Barrier Jacket
 - a. ASTM C921, White kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
 - b. Moisture Vapor Transmission: ASTM E96; 0.02 perm inches.
 - c. Secure with self sealing longitudinal laps and butt strips.
 - d. Secure with vapor barrier mastic.
 4. Tie Wire: 18 gage stainless steel with twisted ends on maximum 12 inch centers.
 5. For insulation outdoors, provide stainless steel jacket, bonded, overlapped, screwed with pop rivets or screws, and sealant placed on joints as per manufacturers recommendation for a water-tight joint.
- B. Cellular Foam
1. Manufacturers:
 - a. Armstrong World Industries, Inc, Lancaster, PA (800) 448-1405.
 - b. Other acceptable manufacturers offering equivalent products.
 - 1) Halstead Industries, Inc.
 - 2) Rubatex Corporation, Armaflex II.
 2. Insulation: ASTM C534; flexible, cellular elastomeric, molded or sheet.
 - a. 'K' ('ksi') Value: ASTM C177 or C518; 0.27 at 75 degrees F,
 - b. Minimum Service Temperature: -40 degrees F.
 - c. Maximum Service Temperature: 220 degrees F.
 - d. Maximum Moisture Absorption: ASTM D1056; 1.0 percent (pipe) by volume, 1.0 percent (sheet) by volume.
 - e. Moisture Vapor Transmission: ASTM E96; 0.20 perm inches.
 - f. Maximum Flame Spread: ASTM E84; 25.
 - g. Maximum Smoke Developed: ASTM E84; 50.

- h. Connection: Waterproof vapor barrier adhesive.
- 3. Elastomeric Foam Adhesive
 - a. Manufacturers:
 - 1) Dow U.S.A.
 - 2) H. B. Fuller Co.
 - 3) Rubatex Corporation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify that piping has been tested before applying insulation materials.
 - 2. Verify that surfaces are clean, foreign material removed, and dry.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION - PIPING INSULATION

- A. Install materials in accordance with manufacturer's instructions and ASHRAE 90.1.
- B. On exposed piping, locate insulation and cover seams in least visible locations.
- C. Insulated dual temperature pipes or cold pipes conveying fluids below ambient temperature:
 - 1. Provide vapor barrier jackets, factory applied or field applied.
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe.
 - 3. PVC fitting covers may be used.
 - 4. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations.
 - 5. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- D. For insulated pipes conveying fluids above ambient temperature:
 - 1. Provide standard jackets, with or without vapor barrier, factory applied or field applied.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe.
 - 3. Finish with glass cloth and adhesive.
 - 4. PVC fitting covers may be used.
 - 5. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
 - 6. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.
- E. Inserts and Shields:
 - 1. Application: Piping 3 inches diameter or larger.
 - 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.

3. Insert Location: Between support shield and piping and under the finish jacket.
 4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- F. Finish insulation at supports, protrusions, and interruptions.
- G. For pipe exposed in mechanical equipment rooms or in finished spaces finish with manufacturer's standard all-service jacket for fiberglass pipe. No jacket required for elastomeric foam insulation.
- H. For exterior applications, provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.
- I. For buried piping, use elastomeric foam insulation only.
- J. For heat traced piping, insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.3 CONSTRUCTION

- A. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated.

3.4 PIPING INSULATION SCHEDULE

- A. Glass Fiber Insulation Schedule:

PIPING SYSTEMS	PIPE SIZE Inch	THICKNESS Inch
Plumbing Systems:		
Domestic Hot Water Supply	All	1"
Domestic Hot Water Recirc	All	1"
Tempered Domestic Water Supply	All	1/2"
Tempered Domestic Water Recirc	All	1/2"
Domestic Cold Water	All	1/2"
Horizontal Rain Leaders - Above Grade	All	1"
Other Systems:		
Piping Exposed to Freezing with Heat Tracing	All	2"

- B. Cellular Foam Insulation Schedule

PIPING SYSTEMS	PIPE SIZE Inch	THICKNESS Inch
Plumbing Systems:		
Domestic hot water supply	All	1/2"
Domestic hot water recirc	All	1/2"
Tempered Domestic Water Supply	All	3/8"
Tempered Domestic Water Recirc	All	3/8"
Domestic Cold Water	All	3/8"

23 - Heating, Ventilating, And Air-Conditioning
(HVAC)



Moisture Condensate Drains - Above Grade	All	3/4"
Horizontal Waste Lines from AC Equipment	All	3/4"
HVAC Refrigerant Lines (suction only)	All	3/4"
Other Systems:		
Piping exposed to freezing with heat tracing	All	1"

USPS Mail Processing Facility Specification issued: 10/1/2013
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END OF SECTION 23 07 19 00



SECTION 23 07 19 00 - CSF HVAC PIPING INSULATION**

NOTE TO SPECIFIER

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NOTE TO SPECIFIER

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PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Piping insulation.
 - 2. Insulation jackets.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
 - 2. ASTM C177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
 - 3. ASTM C335 - Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.
 - 4. ASTM C518 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - 5. ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
 - 6. ASTM C547 - Mineral Fiber Pipe Insulation.
 - 7. ASTM C553 - Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - 8. ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.
 - 9. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
 - 10. ASTM E84 - Surface Burning Characteristics of Building Materials.
 - 11. ASTM E96 - Water Vapor Transmission of Materials.
- B. National Fire Protection Association (NFPA):
 - 1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

- C. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
 - 1. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- D. Underwriters Laboratories, Inc. (UL):
 - 1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data:
 - a. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 3 years documented experience.
 - 2. Installer: Company specializing in performing the Work of this Section with minimum 3 years documented experience.
- B. Materials:
 - 1. Flame spread/smoke developed rating of 25/50 or less in accordance with ASTM E84, NFPA 255 and UL 723.
 - 2. Insulation for pipe and equipment for above grade exposed to weather outside building shall be certified as being self-extinguishing for 1 inch thickness less than 53 seconds when tested in accordance with ASTM D1692.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver materials to site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Store insulation in original wrapping and protect from weather and construction traffic.
- D. Protect insulation against dirt, water, chemical, and mechanical damage.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Jobsite Requirements
 - 1. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
 - 2. Maintain temperature during and after installation for minimum period of 24 hours.

NOTE TO SPECIFIER

"REQUIRED Article (ENVIRONMENTAL REQUIREMENTS) follows. Do not revise this Part, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer."



1.7 ENVIRONMENTAL REQUIREMENTS

A. Energy efficiency:

1. Insulation: Minimum thickness in accordance with ASHRAE 90.1. Provide additional thickness to ensure surface temperatures are below 100 degrees and to prevent condensation on cold surfaces.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 PIPING INSULATION

A. Cellular Foam

1. Manufacturers:
 - a. Armstrong World Industries, Inc, Lancaster, PA (800) 448-1405.
 - b. Other acceptable manufacturers offering equivalent products.
 - 1) Halstead Industries, Inc.
 - 2) Rubatex Corporation, Armaflex II.
2. Insulation: ASTM C534; flexible, cellular elastomeric, molded or sheet.
 - a. 'K' ('ksi') Value: ASTM C177 or C518; 0.27 at 75 degrees F,
 - b. Minimum Service Temperature: -40 degrees F.
 - c. Maximum Service Temperature: 220 degrees F.
 - d. Maximum Moisture Absorption: ASTM D1056; 1.0 percent (pipe) by volume, 1.0 percent (sheet) by volume.
 - e. Moisture Vapor Transmission: ASTM E96; 0.20 perm inches.
 - f. Maximum Flame Spread: ASTM E84; 25.
 - g. Maximum Smoke Developed: ASTM E84; 50.
 - h. Connection: Waterproof vapor barrier adhesive.
3. Elastomeric Foam Adhesive
 - a. Manufacturers:
 - 1) Dow U.S.A.
 - 2) H. B. Fuller Co.
 - 3) Rubatex Corporation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 1. Verify that piping has been tested before applying insulation materials.
 2. Verify that surfaces are clean, foreign material removed, and dry.

- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION - PIPING INSULATION

- A. Install materials in accordance with manufacturer's instructions and ASHRAE 90.1.
- B. On exposed piping, locate insulation and cover seams in least visible locations.
- C. Insulated dual temperature pipes or cold pipes conveying fluids below ambient temperature:
 - 1. Provide vapor barrier jackets, factory applied or field applied.
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe.
 - 3. PVC fitting covers may be used.
 - 4. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations.
 - 5. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- D. For insulated pipes conveying fluids above ambient temperature:
 - 1. Provide standard jackets, with or without vapor barrier, factory applied or field applied.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe.
 - 3. Finish with glass cloth and adhesive.
 - 4. PVC fitting covers may be used.
 - 5. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
 - 6. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.
- E. Inserts and Shields:
 - 1. Application: Piping 3 inches diameter or larger.
 - 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 - 3. Insert Location: Between support shield and piping and under the finish jacket.
 - 4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 - 5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- F. Finish insulation at supports, protrusions, and interruptions.
- G. For all insulated piping located 8 feet and below, provide a PVC jacket. For all exposed insulated piping above 8 feet finish with manufacturer's standard all-service jacket for fiberglass pipe. No jacket required for elastomeric foam insulation.
- H. For exterior applications, provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.
- I. For buried piping, use elastomeric foam insulation only.

- J. For heat traced piping, insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.3 CONSTRUCTION

- A. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated.
- B. Cellular Foam Insulation Schedule

PIPING SYSTEMS	PIPE SIZE	THICKNESS
	Inch	Inch
Plumbing Systems:		
Domestic hot water supply	All	1/2"
Domestic hot water recirc	All	1/2"
Tempered Domestic Water Supply	All	3/8"
Tempered Domestic Water Recirc	All	3/8"
Domestic Cold Water	All	3/8"
Moisture Condensate Drains - Above Grade	All	3/4"
Horizontal Waste Lines from AC Equipment	All	3/4"
HVAC Refrigerant Lines (suction only)	All	3/4"
Other Systems:		
Piping exposed to freezing with heat tracing	All	1"

USPS CSF Specifications issued: 10/1/2013
Last revised: 5/11/11

END OF SECTION



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SECTION 23 08 00 00 - CSF COMMISSIONING OF HVAC**

NOTE TO SPECIFIER

This section is intended for CSF Medium facilities. For CSF Small facilities, this section is not applicable.

NOTE TO SPECIFIER

*REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT AN APPROVED WRITTEN DEVIATION FROM USPS HEADQUARTERS SUBMITTED THROUGH THE CONTRACTING OFFICER.***

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.23 08 00 00

PART 1 - GENERAL

WORK INCLUDED

- A. Systems and equipment testing and start-up.
- B. Validation of proper and thorough installation of Division 23 systems and equipment.
- C. Systems balancing verification.
- D. Pre-functional performance testing of equipment and systems.
- E. Documentation of tests, procedures, and installations.
- F. Coordination of Training Events.
- G. Generic Start-Up Procedures for mechanical systems and equipment.

GENERAL DESCRIPTION

- H. Commissioning (Cx) is the process of ensuring that all building systems are installed and perform interactively according to the design intent; that systems are efficient and cost effective and meet the Owner's operational needs; that the installation is adequately documented; and that the Operators are adequately trained. It serves as a tool to minimize post-occupancy operational problems. It establishes testing and communication protocols in an effort to advance the building systems from installation to full dynamic operation and optimization.
- I. The USPS shall retain an independent Commissioning Authority (CxA) to provide Commissioning Services through their preapproved vendors or have Solicitation A/E for Design-Build Project or Design A/E for Design-Bid-Build Project hire the CxA directly from the same list of preapproved vendors.
- J. This Section outlines the Cx procedures specific to the Division 23 Contractors. Requirements common to all work are described in Specifications 019113.

SCOPE

NOTE TO SPECIFIER

THE FOLLOWING SYSTEMS NEED TO BE CUSTOMIZED OR SELECTED FOR EACH PROJECT



REFER TO "NOTE TO SPECIFIER" IN SPECIFICATION PART 3 FOR SPECIFIC GUIDELINES ON WHAT EQUIPMENT AND SYSTEMS MAY BE COMMISSIONED. EDIT THE LIST ACCORDINGLY.

- K. The following equipment and/or systems may be commissioned if in compliance with the guidelines provided in Specifications 019113, or with Contracting Officer approval:

Roof Top Units

Air Handling or Furnace Units

Air Terminal Units

RELATED WORK AND DOCUMENTS

- L. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section
- M. Commissioning Plan: The Cx Plan shall be available for reference as it outlines responsibilities outside of the Construction Contract. It provides the Contractor and the Owner an understanding of the planned commissioning activities for that project.
- N. Section 013300 - Submittal Procedures: Stipulates additional copies of submittals to be submitted and refers to other sections for additional submittal requirements related to Cx.
- O. Section 017704 - Closeout Procedures and Training: Defines the milestones in completion incorporating the Cx process.
- P. Section 019113 – General Commissioning Requirements: Specifies the general facility commissioning procedures common across all Divisions and the Contractor's responsibilities for the commissioning process.
- Q. Individual Specification Sections: Individual sections stipulate installation, start-up, warranty, O&M documentation, and training requirements for the system or device specified in the Section.
- R. Section 250804 – Building Automation System Commissioning: Details the commissioning procedures specific to the BAS.
- S. Section 220800 – Commissioning of Plumbing: Details the commissioning procedures specific to the Plumbing Systems.
- T. Section 260800 – Commissioning of Electrical Systems: Details the commissioning procedures specific to Division 26 work.

REFERENCE STANDARDS

- U. ASHRAE Guideline 0-2005, "Guideline for Commissioning HVAC Systems"
- V. National Environmental Balancing Bureau (NEBB)
- W. AABC Commissioning Group (ACG)
- X. National Fire Protection Association (NFPA)

DOCUMENTATION

- Y. In addition to the documentation required in Section 019113, Contractor shall provide to the CxA the following per the procedures specified herein and in other Sections of the specification:

HVAC Balancing Plan

All referenced charts such as vibration severity chart and room noise criteria (NC) curves.

Vibration Severity Charts

Factory Test Reports: Contractor shall provide any factory testing documentation or certified test reports required by the specifications. These shall be provided prior to Acceptance Phase. Factory Test Reports should be provided in PDF electronic format. These may include but are not limited to:

- a. Air Handling Units
- b. Variable Frequency Drives
- c. Fans Capacity
- d. Fan Sound Power Levels
- e. Pump Capacity

Field Testing Agency Reports (other than TAB): Provide all documentation of work of independent testing agencies required by the specification. These shall be provided prior to Acceptance Phase. Field Testing Agency Reports should be provided in PDF electronic format. These may include but are not limited to:

- f. Pipe Pressure Testing
- g. Duct Leakage Testing
- h. Vibration Testing
- i. Generated Noise and Resultant Noise Level
- j. Corrosion Protection

Completed Test and Balance Reports.

CONTRACTOR RESPONSIBILITIES

- Z. Refer to Section 019113: Detailed Contractor responsibilities common to all Divisions are specified in this Section. The following are additional responsibilities or notable responsibilities specific to Division 23.

AA. Acceptance Phase

Assist CxA in functional performance testing. Assistance will generally include the following:

- a. Manipulate systems and equipment to facilitate testing (as dictated in the Commissioning Plan; in some cases this will entail only an initial sample);
- b. Provide any specialized instrumentation necessary for functional performance testing;
- c. Manipulate BAS and other control systems to facilitate functional performance testing (as dictated Specification 250804; in some cases this will entail only an initial sample).

NOTE TO SPECIFIER

THE FOLLOWING TAB ASSISTANCE TIME NEEDS TO BE CUSTOMIZED OR SELECTED TO MATCH THE PARTICULAR NEEDS OF EACH PROJECT.

Provide a TAB technician to work at the direction of CxA for up to [24] [____] hours beyond assistance specified above.

Provide a BAS technician to work at the direction of CxA for additional hours as specified in Section 250804.

Maintain trends and monitor the facility throughout the Endurance Period as specified in Section 250804.

Respond to all Action Items which are assigned to the respective Division 23 Contractors. Response shall be via the Project Portal or by response to the original Action Item E-mail.

Resolve all deficiencies which are determined to be within the Division 23 scope of work.

BB. Warranty Phase

Maintain record documentation of any configurations, set ups, parameters etc, that change throughout the period.

Provide representative for off season testing as required by CxA.

Respond to Warranty issues as required by Division 1 and the General Conditions.

EQUIPMENT SUPPLIER RESPONSIBILITIES

CC. Refer to Section 019113.

CONTRACTOR NOTIFICATION AND SCHEDULING

DD. Refer to Section 019113.

START-UP PROCEDURES AND DOCUMENTATION

EE. Refer to Section 019113 and as detailed in Section 3 below.

EQUIPMENT NAMEPLATE DATA

FF. Refer to Division 1.

BAS TRENDING REQUIREMENTS

GG. Trending requirements are specified in Section 250804.

FUNCTIONAL PERFORMANCE TESTING

HH. Contractor shall participate in the initial samples of Functional Performance Testing as stipulated in Section 019113 and the Commissioning Plan.

FPT ACCEPTANCE CRITERIA

II. Acceptance criteria for tests are indicated in the specifications applicable to the systems being tested. Generally, unless indicated otherwise, the criteria for acceptance will be that specified with the individual system, equipment, component, or device.

TRAINING

JJ. Contractors, Subcontractor, Vendors, and other applicable Parties shall prepare and conduct training sessions on the installed systems and equipment they are responsible for the requirements of Section 019113 and the individual Specifications.

O&M MANUAL

KK. Refer to Division 1 and 019113 and the individual Specifications.



PART 2 - PRODUCTS

INSTRUMENTATION

- A. General: All testing equipment used by any Party shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:
- B. Standard Testing Instrumentation: Standard instrumentation used for testing air flows, temperatures, humidity, noise levels, amperage, voltage, and pressure differential in air systems shall be provided by CxA.
- C. Special Tools: Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and turned over to the Owner upon project completion.

TEST KITS FOR METERS AND GAGES

- D. Test kits for meters and gages shall be provided to the Owner new and in good condition. Previously used kits will be unacceptable. Kits shall be submitted prior to the Acceptance Phase. Kits included shall be as a minimum:

Digital indication of temperature and pressure with associated sensors to work with the P/T test ports
Companion readout kit (with fittings) for calibrated balancing valve with ranges as required by all devices on this project

PART 3 - EXECUTION

NOTE TO SPECIFIER

THE FOLLOWING SYSTEMS NEED TO BE CUSTOMIZED AND/OR SELECTED FOR EACH PROJECT. SELECT THE APPLICABLE SYSTEM AND SUBMIT TO USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.

START-UP PROCEDURES - GENERAL

- A. This Section outlines 'generic' or minimally acceptable Start-Up Procedures and individual systems. These items shall provide a minimum or guideline for the Contractor to determine the level of care required for start-up of the systems. The CxA will provide draft start-up sheets and the Contractor shall synthesize their own internal quality control practices, those of the manufacturer, and any applicable codes and standards to supplement the draft sheets for project-specific application. These supplemented procedures will be turned over to the CxA for development of the project-specific start-up procedures.
- B. The following start up verifications/procedures are common to all systems
Checkout shall proceed from devices to the components to the systems.
Verify labeling is affixed per spec and visible
Verify prerequisite procedures are done.
Inspect for damage and ensure none is present.
Verify system is applied per the manufacturer's recommendations
Verify system has been start up per the manufacturer's recommendations
Verify that access is provided for inspection, operation and repair
Verify that access is provided for replacement of the equipment
Verify the record drawings, submittal data and O&M documentation accurately reflect the installed systems



Verify all gages and test ports are provided as required by contract documents and manufacturer's recommendations
Verify all recorded nameplate data is accurate
Installation is done to ensure safe operation and maintenance.
Verify specified replacement material/attic stock has been provided as required by the Construction Documents
Verify all rotating parts are properly lubricated
Verify all monitoring and ensure all alarms are active and set per Owner's requirements

OBSERVATION AND TESTING REQUIREMENTS

<u>Equipment or Systems</u>	<u>Sampling Rate</u>
<u>HVAC Systems</u>	
Air Handling Units	25%
Exhaust Fan Systems	25%
Ventilation Fans	25%
VFDs	25%
Air Terminal Units	25%
Ductwork	20%
Temperature Control	25%
Ventilation Control	25%
<u>Building Automation Systems</u>	
Temperature/Humidity Sensors	25%
Pressure Sensors and Controllers	25%
Sequence of Operation (all different sequences)	100%
Airflow Stations	25%
Damper/Valve Actuators	25%
<u>Plumbing and Fire Protection Systems</u>	
Plumbing Equipment	25%
Plumbing Fixtures	25%
Plumbing Piping Systems	25%
Effluent Decontamination System	25%
Fire Pump	100%
<u>Electrical Systems</u>	
Medium Voltage Switchgear and Unit Substations	50%
Normal Power Electrical Systems	25%
Emergency Power Systems	100%
Fire Alarm System	100%
Lighting Systems and Control	100%
Sub-metering	100%

USPS CSF Specification issued: 10/1/2013
Last revised: 3/23/2012

END OF SECTION



SECTION 23 08 00 00 - MPF COMMISSIONING OF HVAC**

NOTE TO SPECIFIER

REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT AN APPROVED WRITTEN DEVIATION FROM USPS HEADQUARTERS SUBMITTED THROUGH THE CONTRACTING OFFICER. **

Text in [brackets] indicates a choice must be made. Brackets with [] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.23 08 00 00

PART 1 - GENERAL

WORK INCLUDED

- A. Systems and equipment testing and start-up.
- B. Validation of proper and thorough installation of Division 23 systems and equipment.
- C. Systems balancing verification.
- D. Pre-functional performance testing of equipment and systems.
- E. Documentation of tests, procedures, and installations.
- F. Coordination of Training Events.
- G. Generic Start-Up Procedures for mechanical systems and equipment.

GENERAL DESCRIPTION

- H. Commissioning (Cx) is the process of ensuring that all building systems are installed and perform interactively according to the design intent; that systems are efficient and cost effective and meet the Owner's operational needs; that the installation is adequately documented; and that the Operators are adequately trained. It serves as a tool to minimize post-occupancy operational problems. It establishes testing and communication protocols in an effort to advance the building systems from installation to full dynamic operation and optimization.
- I. The USPS shall retain an independent Commissioning Authority (CxA) to provide Commissioning Services through their preapproved vendors or have Solicitation A/E for Design-Build Project or Design A/E for Design-Bid-Build Project hire the CxA directly from the same list of preapproved vendors.
- J. This Section outlines the Cx procedures specific to the Division 23 Contractors. Requirements common to all work are described in Specifications 019113.

SCOPE

NOTE TO SPECIFIER

THE FOLLOWING SYSTEMS NEED TO BE CUSTOMIZED OR SELECTED FOR EACH PROJECT

REFER TO "NOTE TO SPECIFIER" IN SPECIFICATION PART 3 FOR SPECIFIC GUIDELINES ON WHAT EQUIPMENT AND SYSTEMS MAY BE COMMISSIONED. EDIT THE LIST ACCORDINGLY.

- K. The following equipment and/or systems may be commissioned if in compliance with the guidelines provided in Specifications 019113, or with Contracting Officer approval:

Roof Top Units
Air Handling Units
Air Terminal Units
Fan Coil Units
Chillers
Cooling Towers
Boilers

RELATED WORK AND DOCUMENTS

- L. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section
- M. Commissioning Plan: The Cx Plan shall be available for reference as it outlines responsibilities outside of the Construction Contract. It provides the Contractor and the Owner an understanding of the planned commissioning activities for that project.
- N. Section 013300 - Submittal Procedures: Stipulates additional copies of submittals to be submitted and refers to other sections for additional submittal requirements related to Cx.
- O. Section 017704 - Closeout Procedures and Training: Defines the milestones in completion incorporating the Cx process.
- P. Section 019113 – General Commissioning Requirements: Specifies the general facility commissioning procedures common across all Divisions and the Contractor's responsibilities for the commissioning process.
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- R. Section 250804 – Building Automation System Commissioning: Details the commissioning procedures specific to the BAS.
- S. Section 220800 – Commissioning of Plumbing: Details the commissioning procedures specific to the Plumbing Systems.
- T. Section 260800 – Commissioning of Electrical Systems: Details the commissioning procedures specific to Division 26 work.

REFERENCE STANDARDS

- U. ASHRAE Guideline 0-2005, "Guideline for Commissioning HVAC Systems"
- V. National Environmental Balancing Bureau (NEBB)
- W. AABC Commissioning Group (ACG)
- X. National Fire Protection Association (NFPA)

DOCUMENTATION

- Y. In addition to the documentation required in Section 019113, Contractor shall provide to the CxA the following per the procedures specified herein and in other Sections of the specification:

HVAC Balancing Plan

All referenced charts such as vibration severity chart and room noise criteria (NC) curves.

Vibration Severity Charts

Factory Test Reports: Contractor shall provide any factory testing documentation or certified test reports required by the specifications. These shall be provided prior to Acceptance Phase. Factory Test Reports should be provided in PDF electronic format. These may include but are not limited to:

- a. Air Handling Units
- b. Variable Frequency Drives
- c. Fans Capacity
- d. Fan Sound Power Levels
- e. Pump Capacity

Field Testing Agency Reports (other than TAB): Provide all documentation of work of independent testing agencies required by the specification. These shall be provided prior to Acceptance Phase. Field Testing Agency Reports should be provided in PDF electronic format. These may include but are not limited to:

- f. Pipe Pressure Testing
- g. Duct Leakage Testing
- h. Vibration Testing
- i. Generated Noise and Resultant Noise Level
- j. Corrosion Protection
- k. Water Treatment

Completed Test and Balance Reports.

CONTRACTOR RESPONSIBILITIES

- Z. Refer to Section 019113: Detailed Contractor responsibilities common to all Divisions are specified in this Section. The following are additional responsibilities or notable responsibilities specific to Division 23.

AA. Acceptance Phase

Assist CxA in functional performance testing. Assistance will generally include the following:

- a. Manipulate systems and equipment to facilitate testing (as dictated in the Commissioning Plan; in some cases this will entail only an initial sample);
- b. Provide any specialized instrumentation necessary for functional performance testing;
- c. Manipulate BAS and other control systems to facilitate functional performance testing (as dictated Specification 250804; in some cases this will entail only an initial sample).

NOTE TO SPECIFIER

THE FOLLOWING TAB ASSISTANCE TIME NEEDS TO BE CUSTOMIZED OR SELECTED TO MATCH THE PARTICULAR NEEDS OF EACH PROJECT.

Provide a TAB technician to work at the direction of CxA for up to [24] [___] hours beyond assistance specified above.

Provide a BAS technician to work at the direction of CxA for additional hours as specified in Section 250804.

Maintain trends and monitor the facility throughout the Endurance Period as specified in Section 250804.

Respond to all Action Items which are assigned to the respective Division 23 Contractors. Response shall be via the Project Portal or by response to the original Action Item E-mail.

Resolve all deficiencies which are determined to be within the Division 23 scope of work.

BB. Warranty Phase

Maintain record documentation of any configurations, set ups, parameters etc, that change throughout the period.

Provide representative for off season testing as required by CxA.

Respond to Warranty issues as required by Division 1 and the General Conditions.

EQUIPMENT SUPPLIER RESPONSIBILITIES

CC. Refer to Section 019113.

CONTRACTOR NOTIFICATION AND SCHEDULING

DD. Refer to Section 019113.

START-UP PROCEDURES AND DOCUMENTATION

EE. Refer to Section 019113 and as detailed in Section 3 below.

EQUIPMENT NAMEPLATE DATA

FF. Refer to Division 1.

BAS TRENDING REQUIREMENTS

GG. Trending requirements are specified in Section 250804.

FUNCTIONAL PERFORMANCE TESTING

HH. Contractor shall participate in the initial samples of Functional Performance Testing as stipulated in Section 019113 and the Commissioning Plan.

FPT ACCEPTANCE CRITERIA

II. Acceptance criteria for tests are indicated in the specifications applicable to the systems being tested. Generally, unless indicated otherwise, the criteria for acceptance will be that specified with the individual system, equipment, component, or device.

TRAINING

JJ. Contractors, Subcontractor, Vendors, and other applicable Parties shall prepare and conduct training sessions on the installed systems and equipment they are responsible for the requirements of Section 019113 and the individual Specifications.

O&M MANUAL

KK. Refer to Division 1 and 019113 and the individual Specifications.



PART 2 - PRODUCTS

INSTRUMENTATION

- A. General: All testing equipment used by any Party shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:
- B. Standard Testing Instrumentation: Standard instrumentation used for testing air and water flows, temperatures, humidity, noise levels, amperage, voltage, and pressure differential in air and water systems shall be provided by CxA.
- C. Special Tools: Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and turned over to the Owner upon project completion.

TEST KITS FOR METERS AND GAGES

- D. Test kits for meters and gages shall be provided to the Owner new and in good condition. Previously used kits will be unacceptable. Kits shall be submitted prior to the Acceptance Phase. Kits included shall be as a minimum:

Digital indication of temperature and pressure with associated sensors to work with the P/T test ports
Companion readout kit (with fittings) for calibrated balancing valve with ranges as required by all devices on this project

PART 3 - EXECUTION

NOTE TO SPECIFIER

THE FOLLOWING SYSTEMS NEED TO BE CUSTOMIZED AND/OR SELECTED FOR EACH PROJECT. SELECT THE APPLICABLE SYSTEM AND SUBMIT TO USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.

START-UP PROCEDURES - GENERAL

- A. This Section outlines 'generic' or minimally acceptable Start-Up Procedures and individual systems. These items shall provide a minimum or guideline for the Contractor to determine the level of care required for start-up of the systems. The CxA will provide draft start-up sheets and the Contractor shall synthesize their own internal quality control practices, those of the manufacturer, and any applicable codes and standards to supplement the draft sheets for project-specific application. These supplemented procedures will be turned over to the CxA for development of the project-specific start-up procedures.

- B. The following start up verifications/procedures are common to all systems

Checkout shall proceed from devices to the components to the systems.

Verify labeling is affixed per spec and visible

Verify prerequisite procedures are done.

Inspect for damage and ensure none is present.

Verify system is applied per the manufacturer's recommendations

Verify system has been start up per the manufacturer's recommendations

Verify that access is provided for inspection, operation and repair

Verify that access is provided for replacement of the equipment

Verify the record drawings, submittal data and O&M documentation accurately reflect the installed systems



Verify all gages and test ports are provided as required by contract documents and manufacturer's recommendations

Verify all recorded nameplate data is accurate

Installation is done to ensure safe operation and maintenance.

Verify specified replacement material/attic stock has been provided as required by the Construction Documents

Verify all rotating parts are properly lubricated

Verify all monitoring and ensure all alarms are active and set per Owner's requirements

USPS Mail Processing Facility Specification issued: 10/1/2013

Last revised: 3/23/2012

END OF SECTION



SECTION 23 09 04 00 - CSF INSTRUMENTATION AND CONTROL FOR HVAC (CSF MEDIUM)

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

This section is intended for CSF Medium facilities that will have an Enterprise Energy Management System (EEMS). See the Standard Design Criteria (SDC) for information on EEMS requirements. For CSF Medium facilities without an EEMS use section 230905.

NOTE TO SPECIFIER

Use this section where HVAC Instrumentation and Controls are part of the Work. This section is not intended for larger facilities with multiple air handlers, pumps, chillers and boilers. See Standard Design Criteria for information on Central Energy and Monitoring Systems.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.23 09 04 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. HVAC system thermostats.
2. HVAC system remote monitoring.
3. Electric Time Clocks.
4. Electric Thermostats.

B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:

1. Section 283100 – Fire Detection and Alarm
2. Section 238100 – Decentralized Unitary HVAC Equipment.
3. Section 019113 - General Commissioning Requirements
4. Section 230800 – Commissioning of HVAC
5. Section 230904 - Instrumentation and Control For HVAC (CSF Medium)
6. Section 251304 - Facility System Integration Into Enterprise Energy Management System (EEMS)
7. Section 260500 – Common Work Results for Communications
8. Section 260533 – Raceway and Boxes for Electrical Systems
9. Section 260623 – Lighting Controls

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module
 - 2. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system. Submittals shall be furnished as a complete package prior to installation.
 - 3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
 - 4. Operating Instruction: Document training by furnishing a sign-in sheet with a description of the training provided, instructors name and organization, and those who received training. Refer to 017704 1.3, 1.4, and 1.5 for more specific training requirements.
- B. Section 017704 - Closeout Procedures and Training: Procedures for close-out submittals.
 - 1. Project Record Documents: Accurately record the following:
 - a. Actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.
 - 2. Submit written special warranty with forms completed in United States Postal Service name and registered with manufacturer as specified in this Section.

1.3 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 - 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.
- B. Regulatory Requirements:
 - 1. Conform to requirements of NFPA 70 (National Electrical Code).
 - 2. Products: Listed and classified by Underwriters Laboratories, Incorporated and suitable for the purpose specified and indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:

1. Grid Point, Inc., Roanoke, VA 866-800-8906.
2. Carrier Corp., Miami, FL (305) 590-1000.
3. Lennox, Dallas, TX (214) 497-5000.
4. Trane Co., Lacrosse, WI (608) 787-2000.
5. York, York, PA (717) 771-6225.
6. Honeywell, Minneapolis, MN (800) 328-5111.
7. White Rodgers, St. Louis, MO (314) 577-1300.

- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted, unless noted otherwise.
- C. Provide heavy duty, locking, ventilated, hinged all - metal enclosure locking guards for all thermostats located in workroom and customer accessible areas. Provide two keys.

2.2 REMOTE MONITORING SYSTEM

- A. Manufacturer
1. Supplier: Grid Point, Inc., Roanoke, VA 866-800-8906
 2. Substitutions: Not permitted.
- B. Thermostats used shall be low voltage, digital, two-way communicating thermostats configurable for monitoring electric systems, heat pump systems, gas packs, packaged units, air handlers, etc.
- a. Microprocessor based
 - b. Temporary manual override of space temperature
 - c. Battery backup
- C. Sensors/meters used shall be low voltage, digital, with battery backup and capable of measuring the following parameters, either individually or collectively (see drawings for specific application):
- a. Supply air temperature (-20°C to +70°C)
 - b. Runtime by stage
 - c. Differential Pressure (air filter condition)
 - d. Electrical load
 - e. Space temperature (-20°C to +70°C)
 - f. Relative humidity (0-95% RH non-condensing)
 - g. CO² sensing
 - h. Building pressure
 - i. Light intensity
 - j. Outside air temperature
- D. Controller shall be a centralized device that networks thermostats, sensors, advanced meters and submeters for remote access via (1) 56K RJ-11 phone line and (1) 10/100 RJ-45 Ethernet port in native BACnet protocol. Monitoring of the building HVAC performance parameters shall be accessible via the web. The controller shall have the following features and capabilities:
- a. Touch screen interface for local access.
 - b. Revenue grade accuracy in accordance with ANSI C12.1.
 - c. Lockout of local override capabilities
 - d. Remote control of schedule and set points.
 - e. Collect, analyze and report, per phase when applicable, voltage, current, reactive power, real power, apparent power, power factor, frequency, and total harmonic distortion (THD) via analog and/or digital inputs.
 - f. Collect and automatically analyze trends and perform demand limiting functions.
 - g. Integrated submetering of standard HVAC performance metrics, such as kWh, kW, Amperage, Voltage, Power Factor, etc.



- h. Data collected and analyzed shall be viewable via a web based graphical interface (charting/graphing/dashboard) without the need to download any software.
- i. Operational parameters shall be capable of being remotely changed.
- j. Provide alarm notification by email when kW thresholds are exceeded.

2.3 ELECTRONIC TIME CLOCKS:

- A. Timeclock for headbolt heater control shall be a single channel SPDT 7 day electronic programmable controller with up to minimum 2 on and 2 off times for each day of the week. Timeclock shall have COPY DAY function to speed programming, manual override of programming through single override button. Timeclock shall have at least 48 hour battery backup of memory retention in the event of power interruption. Timeclock abbreviated operating instructions shall be printed on inside of timeclock cover

2.4 ELECTRIC THERMOSTATS:

- A. Electric Thermostats for headbolt heater control shall be low voltage 24 volt, with a 0 degrees F. to 100 degrees F. range, 3 degrees F. to 10 degrees F. adjustable differential, remote non-mercury bulb type with 5 foot copper capillary. Spdt switch that makes on fall. Mounted in heavy metal case.
- B. Electric Thermostats for Dock Unit heater control shall be low voltage, 24 volt, rated and suitable for the application, coiled bimetal element, with adjustable heat anticipator that is non-mercury based, setting lever (55 degrees F to 95 degrees F. range) Mounted in heavy ventilated metal enclosure at 78 inches above floor.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. At contract award, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the USPS.

3.2 INSTALLATION:

- A. Provide new control wiring as required for proper operation. All control wires installed under this contract shall be color coded, numbered or otherwise labeled for easy identification. All control wiring exposed to damage in workrooms shall be installed in conduit painted to match the mounting surface. All control wiring exposed in offices or other public spaces shall be installed in wiremold painted to match the mounting surface. All concealed control wiring shall be plenum rated. Provide and install batteries as required for proper operation. New installation shall be in accordance with manufacturer's recommendations.

- B. Provide all necessary transformers, relays, contactors and other options as required for proper operation.
- C. Mount new thermostats at 78 inches above the floor in workroom spaces subject to damage from operations. Mount new thermostats at 54 inches above the floor in office and public areas.

3.3 SYSTEM PERFORMANCE

- A. Thermostats including batteries, temperature controllers, relays, switches, and 24 volt wiring to be furnished and installed by the Heating Contractor, unless furnished with the equipment.
- B. The temperature control system is to maintain space temperature settings, within plus or minus 1 degree F. of space thermostat settings.

3.4 TEMPERATURE CONTROL SYSTEM OPERATION

- A. The temperature control system for split system air conditioning systems and packaged rooftop air conditioning systems shall control the operation of the heating and ventilating and air conditioning system as follows:
- B. Where economizers are provided in air handlers without integral economizers, thermostat shall enable the economizer on a call for cooling when the outside air temperature is below 65 degrees F. Where economizers are integral with unit (package rooftop units), economizer shall be enabled on a call for cooling when enthalpy of outside air is lower than enthalpy of inside air.
- C. At completion of the project, the Contractor shall program and completely adjust the entire temperature control system. Provide all necessary training to building personnel to include demonstration of all functions and programming capabilities of electronic thermostats and time clocks. Provide Owner's manuals and installation manuals. Provide wiring schematic (control diagrams) showing wiring identification system. Contractor shall obtain a signed receipt that the Owner has received the instruction manuals and complete instruction on the operation of the system.
- D. Operation Instructions
 - 1. Provide on-site instruction to review the operation of the system and detail any common troubleshooting or maintenance required to ensure normal operation.
 - 2. Provide one complete set of equipment operating, installation, and programming manuals that will remain at the installed location.

USPS CSF Specifications issued: 5/1/2014
Last revised: 4/16/2014

END OF SECTION



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Task	Specification	Specification Description
23 09 04 00	23 09 05 00	CSF INSTRUMENTATION AND CONTROL FOR HVAC (CSF SMALL)



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SECTION 23 09 05 00 - CSF INSTRUMENTATION AND CONTROL FOR HVAC (CSF SMALL)

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

This section is intended for all CSF Small facility and for CSF Medium facilities that will NOT have an Enterprise Energy Management System (EEMS). See the Standard Design Criteria (SDC) for information on EEMS requirements. For CSF Medium facilities with an EEMS use section 230904.

NOTE TO SPECIFIER

Use this section where HVAC Instrumentation and Controls are part of the Work. This section is not intended for larger facilities with multiple air handlers, pumps, chillers and boilers. See Standard Design Criteria for information on Central Energy and Monitoring Systems.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.23 09 05 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. HVAC system thermostats.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module
 - 2. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system. Submittals shall be furnished as a complete package prior to installation.
- B. Section 017704 - Closeout Procedures and Training: Procedures for close-out submittals.
 - 1. Project Record Documents: Accurately record the following:

CSF INSTRUMENTATION AND CONTROL FOR HVAC (CSF
SMALL)



- a. Actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.
2. Submit written special warranty with forms completed in United States Postal Service name and registered with manufacturer as specified in this Section.

1.3 QUALITY ASSURANCE

- A. Qualifications:
 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 1. Carrier Corp., Miami, FL (305) 590-1000.
 2. Lennox, Dallas, TX (214) 497-5000.
 3. Trane Co., Lacrosse, WI (608) 787-2000.
 4. York, York, PA (717) 771-6225.
 5. Honeywell, Minneapolis, MN (800) 328-5111.
 6. White Rodgers, St. Louis, MO (314) 577-1300.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 ROOM THERMOSTATS

- A. Thermostats for controlled HVAC equipment shall be low voltage digital electronic type. See drawings for HVAC equipment type and number of stages.
- B. Performance Requirements:
 1. LCD Touch-Screen Display
 2. Energy Star approved
 3. Seven-day programmable schedule: Minimum of four separate scheduling periods per day (with separate heating and cooling setpoints for each period). Each time period and temperature setpoint shall be individually programmable.
 4. Automatic changeover between heating and cooling modes
 5. Built in time delay between compressor starts
 6. Fan operation: Fan operation shall be programmable by time period to either operate continuously or automatically on a call for heating or cooling.
 7. Adaptive Recovery Control: Thermostat shall have an adaptive recovery feature that adjusts the start time, based on learned system performance, to reach setpoint at the desired occupancy time.
 8. Battery Back-up to retain program and time through minimum 24 hour power outage.
 9. Keypad Lock: Keypad shall be partially lockable (via programming) to allow only temporary adjustment of temperature setpoints. Keypad shall also be fully lockable (via programming).

- C. Model Selection: Provide the manufacturer's recommended model for the HVAC equipment to be controlled (type and number of stages).
- D. Provide heavy duty, locking, ventilated, hinged all - metal enclosure with locking guards for all thermostats located in workroom and customer accessible areas. Provide two keys.

2.3 ELECTRONIC TIME CLOCKS:

- A. Timeclock for headbolt heater control shall be a single channel SPDT 7 day electronic programmable controller with up to minimum 2 on and 2 off times for each day of the week. Timeclock shall have COPY DAY function to speed programming, manual override of programming through single override button. Timeclock shall have at least 48 hour battery backup of memory retention in the event of power interruption. Timeclock abbreviated operating instructions shall be printed on inside of timeclock cover

2.4 ELECTRIC THERMOSTATS:

- A. Electric Thermostats for headbolt heater control shall be low voltage 24 volt, with a 0 degrees F. to 100 degrees F. range, 3 degrees F. to 10 degrees F. adjustable differential, remote non-mercury bulb type with 5 foot copper capillary. Spdt switch that makes on fall. Mounted in heavy metal case.
- B. Electric Thermostats for Dock Unit heater control shall be low voltage, 24 volt, rated and suitable for the application, coiled bimetal element, switch with adjustable heat anticipator, that is non-mercury based, setting lever (55 degrees F to 95 degrees F. range), . Mounted in heavy ventilated metal enclosure at 78 inches above floor.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Provide new control wiring as required for proper operation. All control wires installed under this contract shall be color coded, numbered or otherwise labeled for easy identification. All control wiring exposed to damage in workrooms shall be installed in conduit painted to match the mounting surface. All control wiring exposed in offices or other public spaces shall be installed in wiremold painted to match the mounting surface. All concealed control wiring shall be plenum rated. Provide and install batteries as required for proper operation. New installation shall be in accordance with manufacturer's recommendations.
- B. Provide all necessary transformers, relays, contactors and other options as required for proper operation.
- C. Mount new thermostats at 78 inches above the floor in workroom spaces subject to damage from operations. Mount new thermostats at 54 inches above the floor in office and public areas.

3.2 SYSTEM PERFORMANCE

- A. Thermostats including batteries, temperature controllers, relays, switches, and 24 volt wiring to be furnished and installed by the Heating Contractor, unless furnished with the equipment.



- B. The temperature control system is to maintain space temperature settings, within plus or minus 1 degree F. of space thermostat settings.

3.3 TEMPERATURE CONTROL SYSTEM OPERATION

- A. The temperature control system for split system air conditioning systems and package rooftop air conditioning systems shall control the operation of the heating and ventilating and air conditioning system as follows:
 - B. Air handling fans shall run continuously in the "Occupied" position when the thermostat fan is in the "ON" position.. Fans shall cycle as required to maintain setpoint when the thermostat fan is in the "Auto" position and during the "Unoccupied" cycle. Set blower speed at highest speed for cooling and next highest speed for heating. Where economizers are provided in air handlers without integral economizers, thermostat shall enable the economizer on a call for cooling when the outside air temperature is below 65 degrees F. Where economizers are integral with unit (package rooftop units), economizer shall be enabled on a call for cooling when enthalpy of outside air is lower than enthalpy of inside air. Where outside air capability is provided, set minimum position to be at 5 percent when fan is ON.

USPS CSF Specifications issued: 10/1/2013
Last revised: 5/11/11

END OF SECTION



SECTION 23 09 15 00 - CSF VARIABLE FREQUENCY MOTOR CONTROLLERS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.23 09 15 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Variable Speed Drive System
 - 2. High efficiency electric motors
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 260500 - Common Work Results for Electrical: Basic electrical methods.

1.2 REFERENCES

- A. Institute of Electrical and Electronics Engineers (IEEE):
 - 1. IEEE 519-1992 - Harmonic Distortion Standard.
- B. National Electrical Contractors Association (NECA):
 - 1. NECA SI - Standard of Installation.
- C. National Electrical Manufacturers Association (NEMA):
- D. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data:
 - a. Product Specifications.



- b. Descriptive Bulletins
- 2. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Project Record Documents: Record actual locations, ratings and sizes of variable speed drives.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with Manufacturer's recommendations and as specified herein.
- B. Manufacturer Qualifications: Company specializing in manufacturing Products specified in this Section with minimum five years documented experience.
- C. Regulatory Requirements:
 - 1. Conform to requirements of NFPA 70.
 - 2. Products: Listed and classified by Underwriters Laboratories, Incorporated as suitable for purpose specified and indicated.

1.5 MAINTENANCE

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Extra Products: At completion of installation, deliver to Contracting Officer.
 - 1. Three of each size and type fuse installed.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Variable Speed Drives and Motors: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. ABB, New Berlin WI, (414) 785-8605.
 - 2. Allen-Bradley, Milwaukee WI, (414) 382-2000.
 - 3. Cutler-Hammer Eaton Corp., Milwaukee WI, (800) 833-3927.
 - 4. Graham, Milwaukee WI, (414) 355-8800.
 - 5. MagneTek, La Vergne TN, (800) 624-6383.
 - 6. Reliance Electric, Rockwell Automation, Cleveland OH, (800) 241-2886.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Not Permitted.

2.2 VARIABLE SPEED DRIVE EQUIPMENT (VSD):

- A. Drive System shall be compatible with electrical characteristics of motors furnished and rated for operation with equipment furnished. **IMPORTANT NOTE:** Shaft grounding rings shall be incorporated into motors 10HP and higher to prevent electrically induced bearing damage (EIBD) when VFDs are utilized on larger pump and fan motors. Coordinate work with drive and equipment manufacturers.
- B. System shall feature the following minimum operating characteristics:
1. Input ac voltage tolerance of 480V, plus or minus 10 percent.
 2. Input frequency tolerance of 50/60 Hz, plus or minus 6 percent.
 3. Minimum Efficiency: 96 percent at 60 Hz, full load.
 4. Minimum Displacement Primary-Side Power Factor: 96 percent.
 5. Overload Capability: 1.1 times the base load current for 60 seconds; 2.0 times the base load current for 3 seconds.
 6. Starting Torque: 100 percent of rated torque or as indicated.
 7. Speed Regulation: Plus or minus 1 percent.
 8. Isolated control interface to allow controller to follow control signal over an 11:1 speed range.
 9. Electrical Signal: 4 to 20 mA at 24 V.
 10. Internal Adjustability Capabilities:
 11. Minimum Speed: 5 to 25 percent of maximum rpm.
 12. Maximum Speed: 80 to 100 percent of maximum rpm.
 13. Acceleration: 2 to a minimum of 22 seconds.
 14. Deceleration: 2 to a minimum of 22 seconds.
 15. Current Limit: 50 to a minimum of 110 percent of maximum rating.
 16. Self-Protection and Reliability Features:
 - a. Input transient protection by means of surge suppressors.
 - b. Under- and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.
 - c. Motor Overload Relay: Adjustable and capable of NEMA 250, Class 10 performance.
 - d. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
 - e. Instantaneous line-to-line and line-to-ground overcurrent trips.
 - f. Loss-of-phase protection.
 - g. Reverse-phase protection.
 - h. Short-circuit protection.
 17. Motor overtemperature fault.
 18. Provide with function loss input for interface of a freeze stat to shut down the drive system upon detection of a freeze condition. Manual restart shall be required.
 19. Automatic Reset/Restart: Attempts three restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Bidirectional autospeed search shall be capable of starting into rotating loads spinning in either direction and returning motor to set speed in proper direction, without damage to controller, motor, or load.
 20. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped.
 21. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.
 22. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
 23. Minimum 3% line reactor. Supplier to calculate harmonic study and provide appropriate line reactor.
 24. The VSD must meet the requirements for Radio Frequency Interference (RFI) above 7 MHz as specified by FCC regulations, part 15, subpart J, Class A devices.
 25. Status Lights: Door-mounted LED indicators shall indicate the following conditions:
 - a. Power on.
 - b. Run.
 - c. Overvoltage.
 - d. Line fault.
 - e. Overcurrent.

- f. External fault.
- C. Panel-Mounted Operator Station: Start-stop and auto-manual selector switches with manual speed control potentiometer and elapsed time meter.
- D. Indicating Devices: Digital display and selector switch, mounted flush in controller door and connected to indicate the following controller parameters:
 - 1. Output frequency (Hz).
 - 2. Motor speed (rpm).
 - 3. Motor status (running, stop, fault).
 - 4. Motor current (amperes).
 - 5. Motor torque (percent).
 - 6. Fault or alarming status (code).
 - 7. PID feedback signal (percent).
 - 8. DC-link voltage (VDC).
 - 9. Set-point frequency (Hz).
 - 10. Motor output voltage (V).
- E. Control Signal Interface:
 - 1. Electric Input Signal Interface: A minimum of 2 analog inputs (0 to 10 V or 0/4-20 mA) and 6 programmable digital inputs.
- F. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BMS or other control systems:
 - 1. 0 to 10-V dc.
 - 2. 0-20 or 4-20 mA.
 - 3. Potentiometer using up/down digital inputs.
 - 4. Fixed frequencies using digital inputs.
 - 5. RS485.
- G. Keypad display for local hand operation
- H. Output Signal Interface:
 - 1. A minimum of 1 analog output signal (0/4-20 mA), which can be programmed to any of the following:
 - a. Output frequency (Hz).
 - b. Output current (load).
 - c. DC-link voltage (VDC).
 - d. Motor torque (percent).
 - e. Motor speed (rpm).
 - f. Set-point frequency (Hz).
- I. Remote Indication Interface: A minimum of 2 dry circuit relay outputs (120-V ac, 1 A) for remote indication of the following:
 - 1. Motor running.
 - 2. Set-point speed reached.
 - 3. Fault and warning indication (overtemperature or overcurrent).
 - 4. PID high- or low-speed limits reached.
- J. A. Communications Interface: Provide BACnet compliant MS/TCP interface to be used with an external system within a multidrop LAN configuration. Communication capabilities shall include, but not be limited to; run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, acceleration/deceleration time adjustments, and lock and unlock the keypad. The interface shall allow monitoring of process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature, VSD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the communications interface.
- K. Manual bypass shall be provided for each VSD. VSD and bypass components shall be mounted inside a common NEMA 1 enclosure, fully pre-wired and ready for installation as a single UL listed device. Bypass shall include the following:
 - 1. Input, output, and bypass contactors, to disconnect power to the VSD, when the motor is running in the bypass mode.

2. 115 V.A.C. control transformer, with fused primary.
 3. Thermal overload relay, to protect the motor while operating in the bypass mode.
 4. Circuit breaker/disconnect switch, with a "through-the-door" handle mechanism.
 5. Control and safety circuit terminal strip.
 6. "Drive-Off-Bypass" selector switch.
 7. Pilot lights for "Power On" and "Fault".
 8. "Normal/Test" selector switch, to allow testing and adjustment of the VSD while the motor is running in the bypass mode.
 9. Integral Disconnecting Means: NEMA KS 1, nonfusible switch.
 10. Isolating Switch: Non-load-break switch arranged to isolate VSD and permit safe troubleshooting and testing, both energized and de-energized, while motor is operating in bypass mode.
 11. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.
 12. Provide human machine interface (HMI) backlit LCD display with key pad mounted on door for control and indication.
- L. Programmable settings shall be held in non-volatile flash memory, not affected by power interruption or loss, or be backed up by a battery capable maintaining the program for a minimum of 72 hours.

2.3 ENCLOSURES

A. NEMA 1 enclosure

B. ACCESSORIES

1. Devices shall be factory installed in controller enclosure, unless otherwise indicated.
2. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.
3. Control Relays: Auxiliary and adjustable time-delay relays.
4. Standard Displays:
 - a. Output frequency (Hz).
 - b. Set-point frequency (Hz).
 - c. Motor current (amperes).
 - d. DC-link voltage (VDC).
 - e. Motor torque (percent).
 - f. Motor speed (rpm).
 - g. Motor output voltage (V).
5. Historical Logging Information and Displays:
 - a. Real-time clock with current time and date.
 - b. Running log of total power versus time.
 - c. Total run time.
 - d. Fault log, maintaining last four faults with time and date stamp for each.
6. 1.1 Current-Sensing, Phase-Failure Relays for Bypass Controller: Solid-state sensing circuit with isolated output contacts for hard-wired connection; arranged to operate on phase failure, phase reversal, current unbalance of from 30 to 40 percent, or loss of supply voltage; with adjustable response delay.

2.4 HIGH EFFICIENCY DRIVE EQUIPMENT:

- A. Motors shall conform to the latest applicable requirements of NEMA, IEEE, ANSI, NEC and be U.L. listed. Motors shall be designed for continuous duty. Motors shall feature an engraved, stainless steel nameplate listing horsepower, volts, phase, rated and full load amps, model and serial numbers.
- B. All new motors furnished on this project shall be premium efficiency type rated for [____] volt, [____] phase.
- C. All new motors furnished on this project shall be furnished with motor starters and fused disconnects with fuses sized as recommended by the motor manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Variable Speed Drives:
 - 1. Provide a digital, electronic variable speed drive system that is compatible with the equipment to be controlled and suitable for the application.
 - 2. Provide the services of a factory trained technician to assist in installation, startup and training of Postal Service personnel. Provide filters or other accessories as required to minimize harmonic noise in controlled motors.
 - 3. Connect new VSD's to operate equipment and be controlled by BAS or other method as specified. BAS Controller shall operate all VSD's according to the sequence of operations. VSD control systems requiring operator to make changes at drive unit are not acceptable.
 - 4. Connect VSD to BAS using either twisted pair or shielded cable as required for system furnished. Check that RPM/HERTZ and other readings at BAS are equal to readings at VSD panel. Insure that system is properly grounded and all connections are properly torqued to manufacturer's recommendations.
 - 5. Set minimum speed to allow proper motor cooling and lubrication (normally 20 percent).
 - 6. Mount VSD (normally on wall) to allow for less than 25 feet of lead length between the drive and motor to prevent voltage reflection. Allow for proper air flow around VSD for cooling and service access. Check for over-voltage by measuring the phase-phase voltage at the motor terminals.
 - 7. Provide line reactors with 3 to 5 percent impedance or use filter device between drive and motor where required to compensate for power fluctuations (surges and drops).
 - 8. Mount drive in location to provide adequate ventilation for heat dissipation. Provide dust free enclosures with exterior heat sink where required by environment.
 - 9. Coordinate startup and testing with controls contractor. All controls shall be installed and ready to function in accordance with the sequence of operations prior to final testing and training. Adjust controller to update minimum of twice per second.
 - 10. Where multiple pump or fan systems are designed to operate in parallel, adjust VSD to maintain speeds within 20 revolutions per minute of each other when multiple motors are operating.
- B. High Efficiency Motors:
 - 1. Provide premium efficiency drive motors that are compatible with digital electronic variable speed drive systems and suitable for the application.
 - 2. Securely mount and connect new motors to new VSD in accordance with manufacturer's recommendations, the National Electrical Code and as noted above. Size wiring as specified and per the NEC. All wiring shall be run in conduit suitable for the application.
 - 3. For three phase motors, verify direction of rotation. Verify proper grounding. Check phase to phase voltage and phase to ground voltage. Report results to the Contracting Officer.
 - 4. Torque all connections per manufacturer's recommendations.



5. Provide thermal overloads in starter sized for the application.
6. Check operation of system complies with the sequence of operations.

3.3 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.

USPS CSF Specifications issued: 10/1/2013
Last revised: 9/4/2013

END OF SECTION



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SECTION 23 09 15 00 - MPF VARIABLE SPEED DRIVES

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Variable Speed Drive System
 - 2. High efficiency electric motors
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 250504 – Building Automation System (BAS) General: BAS integration methods.
 - 2. Section 260500 – Common Work Results for Electrical: Basic electrical methods.

1.2 REFERENCES

- A. Institute of Electrical and Electronics Engineers (IEEE):
 - 1. IEEE 519-1992 - Harmonic Distortion Standard.
- B. National Electrical Contractors Association (NECA):
 - 1. NECA SI - Standard of Installation.
- C. National Electrical Manufacturers Association (NEMA):
- D. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data:
 - a. Product Specifications.
 - b. Descriptive Bulletins



2. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

- B. Section 017704 – Closeout Procedures and Training: Procedures for closeout submittals.
 1. Project Record Documents: Record actual locations, ratings and sizes of variable speed drives.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with Manufacturer's recommendations and as specified herein.
- B. Manufacturer Qualifications: Company specializing in manufacturing Products specified in this Section with minimum five years documented experience.
- C. Regulatory Requirements:
 1. Conform to requirements of NFPA 70.
 2. Products: Listed and classified by Underwriters Laboratories, Incorporated as suitable for purpose specified and indicated.

1.5 MAINTENANCE

- A. Section 017704 – Closeout Procedures and Training: Procedures for closeout submittals.
- B. Extra Products: At completion of installation, deliver to Contracting Officer.
 1. Three of each size and type fuse installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Variable Speed Drives and Motors: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. ABB, New Berlin WI, (414) 785-8605.
 2. Allen-Bradley, Milwaukee WI, (414) 382-2000.
 3. Cutler-Hammer Eaton Corp., Milwaukee WI, (800) 833-3927.
 4. Square D Company, Schneider Electric; (888) 778-2733.
 5. MagneTek, La Vergne TN, (800) 624-6383.
 6. Reliance Electric, Rockwell Automation, Cleveland OH, (800) 241-2886.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 VARIABLE SPEED DRIVE EQUIPMENT (VSD):

- A. Drive System shall be compatible with electrical characteristics of motors furnished and rated for operation with equipment furnished. **IMPORTANT NOTE:** Shaft grounding rings shall be incorporated into motors 10HP and higher to prevent electrically induced bearing damage (EIBD) when VFDs are utilized on larger pump and fan motors. Coordinate work with drive and equipment manufacturers.

- B. System shall feature the following minimum operating characteristics:
 - 1. Input ac voltage tolerance of 480V, plus or minus 10 percent.
 - 2. Input frequency tolerance of 50/60 Hz, plus or minus 6 percent.
 - 3. Minimum Efficiency: 96 percent at 60 Hz, full load.
 - 4. Minimum Displacement Primary-Side Power Factor: 96 percent.
 - 5. Overload Capability: 1.1 times the base load current for 60 seconds; 2.0 times the base load current for 3 seconds.
 - 6. Starting Torque: 100 percent of rated torque or as indicated.
 - 7. Speed Regulation: Plus or minus 1 percent.
- C. Isolated control interface to allow controller to follow control signal over an 11:1 speed range.
 - 1. Electrical Signal: 4 to 20 mA at 24 V.
- D. Internal Adjustability Capabilities:
 - 1. Minimum Speed: 5 to 25 percent of maximum rpm.
 - 2. Maximum Speed: 80 to 100 percent of maximum rpm.
 - 3. Acceleration: 2 to a minimum of 22 seconds.
 - 4. Deceleration: 2 to a minimum of 22 seconds.
 - 5. Current Limit: 50 to a minimum of 110 percent of maximum rating.
- E. Self-Protection and Reliability Features:
 - 1. Input transient protection by means of surge suppressors.
 - 2. Under- and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.
 - 3. Motor Overload Relay: Adjustable and capable of NEMA 250, Class 10 performance.
 - 4. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
 - 5. Instantaneous line-to-line and line-to-ground overcurrent trips.
 - 6. Loss-of-phase protection.
 - 7. Reverse-phase protection.
 - 8. Short-circuit protection.
 - 9. Motor overtemperature fault.
 - 10. Provide with function loss input for interface of a freeze stat to shut down the drive system upon detection of a freeze condition. Manual restart shall be required.
- F. Automatic Reset/Restart: Attempts three restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Bidirectional autospeed search shall be capable of starting into rotating loads spinning in either direction and returning motor to set speed in proper direction, without damage to controller, motor, or load.
- G. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped.
- H. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.
- I. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
- J. Minimum 5% line reactor.
- K. The VSD must meet the requirements for Radio Frequency Interference (RFI) above 7 MHz as specified by FCC regulations, part 15, subpart J, Class A devices.
- L. Status Lights: Door-mounted LED indicators shall indicate the following conditions:
 - 1. Power on.
 - 2. Run.
 - 3. Overvoltage.

4. Line fault.
 5. Overcurrent.
 6. External fault.
- M. Panel-Mounted Operator Station: Start-stop and auto-manual selector switches with manual speed control potentiometer and elapsed time meter.
- N. Indicating Devices: Digital display and selector switch, mounted flush in controller door and connected to indicate the following controller parameters:
1. Output frequency (Hz).
 2. Motor speed (rpm).
 3. Motor status (running, stop, fault).
 4. Motor current (amperes).
 5. Motor torque (percent).
 6. Fault or alarming status (code).
 7. PID feedback signal (percent).
 8. DC-link voltage (VDC).
 9. Set-point frequency (Hz).
 10. Motor output voltage (V).
- O. Control Signal Interface:
1. Electric Input Signal Interface: A minimum of 2 analog inputs (0 to 10 V or 0/4-20 mA) and 6 programmable digital inputs.
 2. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BMS or other control systems:
 - a. 0 to 10-V dc.
 - b. 0-20 or 4-20 mA.
 - c. Potentiometer using up/down digital inputs.
 - d. Fixed frequencies using digital inputs.
 - e. RS485.
 - f. Keypad display for local hand operation.
 3. Output Signal Interface:
 - a. A minimum of 2 analog output signal (0/4-20 mA), which can be programmed to any of the following:
 - 1) Output frequency (Hz).
 - 2) Output current (load).
 - 3) DC-link voltage (VDC).
 - 4) Motor torque (percent).
 - 5) Motor speed (rpm).
 - 6) Set-point frequency (Hz).
 4. Remote Indication Interface: A minimum of 2 dry circuit relay outputs (120-V ac, 1 A) for remote indication of the following:
 - a. Motor running.
 - b. Set-point speed reached.
 - c. Fault and warning indication (overtemperature or overcurrent).
 - d. PID high- or low-speed limits reached.
- P. Communications Interface: Provide BACnet compliant MS/TCP interface to be used with an external system within a multidrop LAN configuration. Communication capabilities shall include, but not be limited to; run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, acceleration/deceleration time adjustments, and lock and unlock the keypad. The interface shall allow monitoring of process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature,

VSD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the communications interface

- Q. Manual bypass shall be provided for each VFD. VFD and bypass components shall be mounted inside a common NEMA 1 enclosure, fully pre-wired and ready for installation as a single UL listed device. Bypass shall include the following:
1. Input, output, and bypass contactors, to disconnect power to the VFD, when the motor is running in the bypass mode.
 2. 115 V.A.C. control transformer, with fused primary.
 3. Thermal overload relay, to protect the motor while operating in the bypass mode.
 4. Circuit breaker/disconnect switch, with a "through-the-door" handle mechanism.
 5. Control and safety circuit terminal strip.
 6. "Drive-Off-Bypass" selector switch.
 7. Pilot lights for "Power On" and "Fault".
 8. "Normal/Test" selector switch, to allow testing and adjustment of the VSD while the motor is running in the bypass mode.

2.3 ENCLOSURES

- A. NEMA 1 enclosure

2.4 ACCESSORIES

- A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.
- B. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.
- C. Control Relays: Auxiliary and adjustable time-delay relays.
- D. Historical Logging Information and Displays:
1. Real-time clock with current time and date.
 2. Running log of total power versus time.
 3. Total run time.
 4. Fault log, maintaining last four faults with time and date stamp for each.
- E. Current-Sensing, Phase-Failure Relays for Bypass Controller: Solid-state sensing circuit with isolated output contacts for hard-wired connection; arranged to operate on phase failure, phase reversal, current unbalance of from 30 to 40 percent, or loss of supply voltage; with adjustable response delay.

2.5 HIGH EFFICIENCY DRIVE EQUIPMENT:

- A. Motors shall conform to the latest applicable requirements of NEMA, IEEE, ANSI, NEC and be U.L. listed. Motors shall be designed for continuous duty. Motors shall feature an engraved, stainless steel nameplate listing horsepower, volts, phase, rated and full load amps, model and serial numbers.
- B. All new motors furnished on this project shall be premium efficiency type rated for [____] volt, [____] phase.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Variable Speed Drives:
 - 1. Provide a digital, electronic variable speed drive system that is compatible with the equipment to be controlled and suitable for the application.
 - 2. Provide the services of a factory trained technician to assist in installation, startup and training of Postal Service personnel. Provide filters or other accessories as required to minimize harmonic noise in controlled motors.
 - 3. Connect new VSD's to operate equipment and be controlled by BAS or other method as specified. BAS Controller shall operate all VSD's according to the sequence of operations. VSD control systems requiring operator to make changes at drive unit are not acceptable.
 - 4. Connect VSD to BAS using either twisted pair or shielded cable as required for system furnished. Check that RPM/HERTZ and other readings at BAS are equal to readings at VSD panel. Insure that system is properly grounded and all connections are properly torqued to manufacturer's recommendations.
 - 5. Set minimum speed to allow proper motor cooling and lubrication (normally 20 percent).
 - 6. Mount VSD (normally on wall) to allow for less than 25 feet of lead length between the drive and motor to prevent voltage reflection. Allow for proper air flow around VSD for cooling and service access. Check for over-voltage by measuring the phase-phase voltage at the motor terminals.
 - 7. Provide line reactors with 3 to 5 percent impedance or use filter device between drive and motor where required to compensate for power fluctuations (surges and drops).
 - 8. Mount drive in location to provide adequate ventilation for heat dissipation. Mount drive in interior locations only and provide adequate ventilation.
 - 9. Coordinate startup and testing with controls contractor. All controls shall be installed and ready to function in accordance with the sequence of operations prior to final testing and training. Adjust controller to update minimum of twice per second.
 - 10. Where multiple pump or fan systems are designed to operate in parallel, adjust VSD to maintain speeds within 20 revolutions per minute of each other when multiple motors are operating.
- B. High Efficiency Motors:
 - 1. Provide premium efficiency drive motors that are compatible with digital electronic variable speed drive systems and suitable for the application.
 - 2. Securely mount and connect new motors to new VSD in accordance with manufacturer's recommendations, the National Electrical Code and as noted above. Size wiring as specified and per the NEC. All wiring shall be run in conduit suitable for the application.
 - 3. For three phase motors, verify direction of rotation. Verify proper grounding. Check phase to phase voltage and phase to ground voltage. Report results to the Contracting Officer.
 - 4. Torque all connections per manufacturer's recommendations.



5. Provide thermal overloads in starter sized for the application.
6. Check operation of system complies with the sequence of operations.

3.3 FIELD QUALITY CONTROL

- A. Section 014000 – Quality Requirements: Field testing and inspection.

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Last revised: 9/4/2013

END OF SECTION 23 09 15 00



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SECTION 23 11 23 00 - FACILITY LIQUEFIED-PETROLEUM GAS PIPING**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for facility liquid-petroleum gas piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Pipes, tubes, and fittings.
 - b. Piping specialties.
 - c. Piping and tubing joining materials.
 - d. Valves.
 - e. Pressure regulators.
 - f. Service meters.
 - g. Storage containers.
 - h. Transport truck unloading facility specialties.
 - i. Pumps.
 - j. Vaporizers.
 - k. Air mixers.
 - l. Mechanical sleeve seals.
 - m. Grout.
 - n. Concrete bases.

C. Definitions

1. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
2. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
3. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
4. LPG: Liquefied-petroleum gas.

D. Performance Requirements

1. Minimum Operating-Pressure Ratings:
 - a. For Piping Containing Only Vapor:
 - 1) Piping and Valves: 125 psig (862 kPa) unless otherwise indicated.
 - b. For Piping Containing Liquid:
 - 1) Piping between Shutoff Valves: 350 psig (2413 kPa) unless otherwise indicated.
 - 2) Piping Other Than Above: 250 psig (1723 kPa) unless otherwise indicated.
 - 3) Valves and Fittings: 250 psig (1723 kPa) unless otherwise indicated.
 - c. Minimum Operating Pressure of Service Meter: 5 psig (34.5 kPa) **OR** 10 psig (69 kPa) **OR** 20 psig (138 kPa) **OR** 65 psig (450 kPa), **as directed**.
2. LPG System Pressure within Buildings: One pressure range. 0.5 psig (3.45 kPa) or less **OR** More than 0.5 psig (3.45 kPa) but not more than 2 psig (13.8 kPa) **OR** More than 2 psig (13.8 kPa) but not more than 5 psig (34.5 kPa), **as directed**.
OR
LPG System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig (3.45 kPa) but not more than 2 psig (13.8 kPa) and is reduced to secondary pressure of 0.5 psig (3.45 kPa) or less.

OR

LPG System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 2 psig (13.8 kPa) but not more than 5 psig (34.5 kPa) and is reduced to secondary pressure of more than 0.5 psig (3.45 kPa) but not more than 2 psig (13.8 kPa).

OR

LPG System Pressures within Buildings: Three pressure ranges. Primary pressure is more than 2 psig (13.8 kPa) but not more than 5 psig (34.5 kPa) and is reduced to secondary pressures of more than 0.5 psig (3.45 kPa) but not more than 2 psig (13.8 kPa) and is reduced again to pressures of 0.5 psig (3.45 kPa) or less.

3. Delegated Design: Design restraints and anchors for LPG piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
4. Seismic Performance: Vaporizers and storage container supports shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

E. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For facility LPG piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
3. Delegated-Design Submittal: For LPG piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Detail fabrication and assembly of seismic restraints.
 - b. Design Calculations: Calculate requirements for selecting seismic restraints.
4. Seismic Qualification Certificates: Submit certification that vaporizer, air mixer, storage container supports, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment". Include the following:
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
5. Welding certificates.
6. Field quality-control reports.
7. Operation and maintenance data.

F. Quality Assurance

1. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Delivery, Storage, And Handling

1. Handling Flammable Liquids: Remove and dispose of liquids from existing LPG piping according to requirements of authorities having jurisdiction.
2. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

3. Store pipes and tubes with protective PE coating to avoid damaging coating and protect from direct sunlight.
4. Protect stored PE pipes and valves from direct sunlight.

H. Project Conditions

1. Interruption of Existing LPG Service: Do not interrupt LPG service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of LPG supply according to requirements indicated:
 - a. Notify Owner no fewer than two days in advance of proposed interruption of LPG service.
 - b. Do not proceed with interruption of LPG service without Owner's written permission.

1.2 PRODUCTS

A. Pipes, Tubes, And Fittings

1. Steel Pipe: ASTM A 53/A 53M, black steel, Schedules 40 and 80, Type E or S, Grade B.
 - a. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - b. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 - c. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 - d. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - 1) Material Group: 1.1.
 - 2) End Connections: Threaded or butt welding to match pipe.
 - 3) Lapped Face: Not permitted underground.
 - 4) Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - 5) Bolts and Nuts: ASME B18.2.1, carbon steel aboveground, and stainless steel underground.
 - e. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
 - 1) Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
 - f. Mechanical Couplings:
 - 1) Stainless-steel **OR** Steel, **as directed**, flanges and tube with epoxy finish.
 - 2) Buna-nitrile seals.
 - 3) Stainless-steel **OR** Steel, **as directed**, bolts, washers, and nuts.
 - 4) Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
 - 5) Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.
2. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.
 - a. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
 - b. Coating: PE with flame retardant.
 - 1) Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a) Flame-Spread Index: 25 or less.
 - b) Smoke-Developed Index: 50 **OR** 450, **as directed**, or less.
 - c. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
 - d. Striker Plates: Steel, designed to protect tubing from penetrations.
 - e. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
 - f. Operating-Pressure Rating: 5 psig (34.5 kPa).
3. Aluminum Tubing: Comply with ASTM B 210 and ASTM B 241/B 241M.

- a. Aluminum Alloy: Alloy 5456 is prohibited.
- b. Protective Coating: Factory-applied coating capable of resisting corrosion on tubing in contact with masonry, plaster, insulation, water, detergents, and sewerage.
- c. Flare Fittings: Comply with ASME B16.26 and SAE J513.
 - 1) Copper-alloy fittings.
 - 2) Metal-to-metal compression seal without gasket.
 - 3) Dryseal threads shall comply with ASME B1.20.3.
- 4. Drawn-Temper Copper Tube: Comply with ASTM B 88, Type K (ASTM B 88M, Type A) **OR** ASTM B 88, Type L (ASTM B 88M, Type B) **OR** ASTM B 837, Type G, **as directed**.
 - a. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.
 - b. Bronze Flanges and Flanged Fittings: ASME B16.24, Class 150.
 - 1) Gasket Material: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - 2) Bolts and Nuts: ASME B18.2.1, carbon steel or stainless steel.
 - c. Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch (0.56 mm) thick.
- 5. Annealed-Temper Copper Tube: Comply with ASTM B 88, Type K (ASTM B 88M, Type A) **OR** ASTM B 88, Type L (ASTM B 88M, Type B) **OR** ASTM B 837, Type G, **as directed**.
 - a. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.
 - b. Flare Fittings: Comply with ASME B16.26 and SAE J513.
 - 1) Copper fittings with long nuts.
 - 2) Metal-to-metal compression seal without gasket.
 - 3) Dryseal threads complying with ASME B1.20.3.
 - c. Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch (0.56 mm) thick.
- 6. Tin-Lined Copper Tube: ASTM B 280, seamless, annealed, with interior tin-plated lining.
 - a. Flare Fittings: Comply with ASME B16.26 and SAE J513.
 - 1) Copper fittings with long nuts.
 - 2) Metal-to-metal compression seal without gasket.
 - 3) Dryseal threads complying with ASME B1.20.3.
- 7. PE Pipe: ASTM D 2513, SDR 11.
 - a. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
 - b. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - c. Anodeless Service-Line Risers: Factory fabricated and leak tested.
 - 1) Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
 - 2) Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B with corrosion-protective coating covering. Vent casing aboveground, **as directed**.
 - 3) Aboveground Portion: PE transition fitting.
 - 4) Outlet shall be threaded or flanged or suitable for welded connection.
 - 5) Tracer wire connection.
 - 6) Ultraviolet shield.
 - 7) Stake supports with factory finish to match steel pipe casing or carrier pipe.
 - d. Transition Service-Line Risers: Factory fabricated and leak tested.
 - 1) Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
 - 2) Outlet shall be threaded or flanged or suitable for welded connection.
 - 3) Bridging sleeve over mechanical coupling.
 - 4) Factory-connected anode.
 - 5) Tracer wire connection.
 - 6) Ultraviolet shield.

- 7) Stake supports with factory finish to match steel pipe casing or carrier pipe.
 - e. Plastic Mechanical Couplings, NPS 1-1/2 (DN 40) and Smaller: Capable of joining PE pipe to PE pipe.
 - 1) PE body with molded-in, stainless-steel support ring.
 - 2) Buna-nitrile seals.
 - 3) Acetal collets.
 - 4) Electro-zinc-plated steel stiffener.
 - f. Plastic Mechanical Couplings, NPS 2 (DN 50) and Larger: Capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
 - 1) Fiber-reinforced plastic body.
 - 2) PE body tube.
 - 3) Buna-nitrile seals.
 - 4) Acetal collets.
 - 5) Stainless-steel bolts, nuts, and washers.
 - 8. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
 - 1) Stainless-steel **OR** Steel, **as directed**, flanges and tube with epoxy finish.
 - 2) Buna-nitrile seals.
 - 3) Stainless-steel **OR** Steel, **as directed**, bolts, washers, and nuts.
 - 4) Factory-installed anode for steel-body couplings installed underground.
- B. Piping Specialties
- 1. Flexible Piping Joints:
 - a. Approved for LPG service.
 - b. Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
 - c. Minimum working pressure of 250 psig (1723 kPa) and 250 deg F (121 deg C) operating temperature.
 - d. Flanged- or threaded-end connections to match equipment connected and shall be capable of minimum 3/4-inch (20-mm) misalignment.
 - e. Maximum 36-inch (914-mm) length for liquid LPG lines.
 - 2. Appliance Flexible Connectors:
 - a. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
 - b. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
 - c. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
 - d. Corrugated stainless-steel tubing with polymer coating.
 - e. Operating-Pressure Rating: 0.5 psig (3.45 kPa).
 - f. End Fittings: Zinc-coated steel.
 - g. Threaded Ends: Comply with ASME B1.20.1.
 - h. Maximum Length: 72 inches (1830 mm).
 - 3. Quick-Disconnect Devices: Comply with ANSI Z21.41.
 - a. Copper-alloy convenience outlet and matching plug connector.
 - b. Nitrile seals.
 - c. Hand operated with automatic shutoff when disconnected.
 - d. For indoor or outdoor applications.
 - e. Adjustable, retractable restraining cable.
 - 4. Y-Pattern Strainers:
 - a. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
 - b. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
 - c. Strainer Screen: 40 **OR** 60, **as directed**, -mesh startup strainer and perforated stainless-steel basket with 50 percent free area.
 - d. CWP Rating: 125 psig (862 kPa).
 - 5. Basket Strainers:
 - a. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.

- b. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
 - c. Strainer Screen: 40 **OR** 60, **as directed**, -mesh startup strainer and perforated stainless-steel basket with 50 percent free area.
 - d. CWP Rating: 125 psig (862 kPa).
 - 6. T-Pattern Strainers:
 - a. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
 - b. End Connections: Grooved ends.
 - c. Strainer Screen: 40 **OR** 60, **as directed**, -mesh startup strainer and perforated stainless-steel basket with 57 percent free area.
 - d. CWP Rating: 750 psig (5170 kPa).
 - 7. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.
- C. Joining Materials
 - 1. Joint Compound and Tape: Suitable for LPG.
 - 2. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
 - 3. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F (540 deg C) complying with AWS A5.8/A5.8M.
- D. Manual Gas Shutoff Valves
 - 1. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
 - 2. Metallic Valves, NPS 2 (DN 50) and Smaller for Liquid Service: Comply with ASME B16.33 and UL 842.
 - a. CWP Rating: 250 psig (1723 kPa).
 - b. Threaded Ends: Comply with ASME B1.20.1.
 - c. Socket ends for brazed joints.
 - d. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - e. Listing by CSA or agency acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.
 - f. Valves 1-1/4 inch (32 mm) and larger shall be suitable for LPG service, with "WOG" indicated on valve body.
 - 3. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller for Vapor Service: Comply with ASME B16.33.
 - a. CWP Rating: 125 psig (862 kPa).
 - b. Threaded Ends: Comply with ASME B1.20.1.
 - c. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
 - d. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - e. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.
 - f. Service Mark: Valves 1-1/4 inch (32 mm) to NPS 2 (DN 50) shall have initials "WOG" permanently marked on valve body.
 - 4. General Requirements for Metallic Valves, NPS 2-1/2 (DN 65) and Larger: Comply with ASME B16.38.
 - a. CWP Rating: 125 psig (862 kPa).
 - b. Flanged Ends: Comply with ASME B16.5 for steel flanges.
 - c. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - d. Service Mark: Initials "WOG" shall be permanently marked on valve body.

5. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.
 - a. Body: Bronze, complying with ASTM B 584.
 - b. Ball: Chrome-plated brass.
 - c. Stem: Bronze; blowout proof.
 - d. Seats: Reinforced TFE; blowout proof.
 - e. Packing: Separate packnut with adjustable-stem packing threaded ends.
 - f. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - g. CWP Rating: 600 psig (4143 kPa).
 - h. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - i. Service: Suitable for LPG service with "WOG" indicated on valve body.
6. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
 - a. Body: Bronze, complying with ASTM B 584.
 - b. Ball: Chrome-plated bronze.
 - c. Stem: Bronze; blowout proof.
 - d. Seats: Reinforced TFE; blowout proof.
 - e. Packing: Threaded-body packnut design with adjustable-stem packing.
 - f. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - g. CWP Rating: 600 psig (4143 kPa).
 - h. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - i. Service: Suitable for LPG service with "WOG" indicated on valve body.
7. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.
 - a. Body: Bronze, complying with ASTM B 584.
 - b. Ball: Chrome-plated bronze
 - c. Stem: Bronze; blowout proof.
 - d. Seats: Reinforced TFE.
 - e. Packing: Threaded-body packnut design with adjustable-stem packing.
 - f. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - g. CWP Rating: 600 psig (4140 kPa).
 - h. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - i. Service: Suitable for LPG service with "WOG" indicated on valve body.
8. Bronze Plug Valves: MSS SP-78.
 - a. Body: Bronze, complying with ASTM B 584.
 - b. Plug: Bronze.
 - c. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - d. Operator: Square head or lug type with tamperproof feature where indicated.
 - e. Pressure Class: 125 psig (862 kPa).
 - f. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - g. Service: Suitable for LPG service with "WOG" indicated on valve body.
9. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.
 - a. Body: Cast iron, complying with ASTM A 126, Class B.
 - b. Plug: Bronze or nickel-plated cast iron.
 - c. Seat: Coated with thermoplastic.
 - d. Stem Seal: Compatible with LPG.
 - e. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - f. Operator: Square head or lug type with tamperproof feature where indicated.
 - g. Pressure Class: 125 psig (862 kPa).

- h. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - i. Service: Suitable for LPG service with "WOG" indicated on valve body.
 - 10. Cast-Iron, Lubricated Plug Valves: MSS SP-78.
 - a. Body: Cast iron, complying with ASTM A 126 Class B.
 - b. Plug: Bronze or nickel-plated cast iron.
 - c. Seat: Coated with thermoplastic.
 - d. Stem Seal: Compatible with LPG.
 - e. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - f. Operator: Square head or lug type with tamperproof feature where indicated.
 - g. Pressure Class: 125 psig (862 kPa).
 - h. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - i. Service: Suitable for LPG service with "WOG" indicated on valve body.
 - 11. PE Ball Valves: Comply with ASME B16.40.
 - a. Body: PE.
 - b. Ball: PE.
 - c. Stem: Acetal.
 - d. Seats and Seals: Nitrile.
 - e. Ends: Plain or fusible to match piping.
 - f. CWP Rating: 80 psig (552 kPa).
 - g. Operating Temperature: Minus 20 to plus 140 deg F (Minus 29 to plus 60 deg C).
 - h. Operator: Nut or flat head for key operation.
 - i. Include plastic valve extension.
 - j. Include tamperproof locking feature for valves where indicated on Drawings.
 - 12. Valve Boxes:
 - a. Cast-iron, two-section box.
 - b. Top section with cover with "GAS" lettering.
 - c. Bottom section with base to fit over valve and barrel a minimum of 5 inches (125 mm) in diameter.
 - d. Adjustable cast-iron extensions of length required for depth of bury.
 - e. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head and with stem of length required to operate valve.
- E. Motorized Gas Valves
 - 1. Hydrostatic Relief Valves: Comply with NFPA 58.
 - a. Operating Pressure: 350 psig (2413 kPa).
 - b. Body: Brass.
 - c. Spring: Stainless steel.
 - d. Disc and Seat: Nitrile.
 - e. Brass body and stainless-steel, spring-operated valve with resilient rubber disc seat and protective cap.
 - f. Factory set and tested.
 - g. Listing: Valves listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - h. Valve shall reseal after relieving pressure.
 - 2. Automatic Gas Valves: Comply with ANSI Z21.21.
 - a. Body: Brass or aluminum.
 - b. Seats and Disc: Nitrile rubber.
 - c. Springs and Valve Trim: Stainless steel.
 - d. Normally closed.
 - e. Visual position indicator.
 - f. Electrical **OR** Mechanical, **as directed**, operator for actuation by appliance automatic shutoff device.
 - 3. Electrically Operated Valves: Comply with UL 429.

- a. Pilot operated.
 - b. Body: Brass or aluminum.
 - c. Seats and Disc: Nitrile rubber.
 - d. Springs and Valve Trim: Stainless steel.
 - e. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, replaceable.
 - f. NEMA ICS 6, Type 4, coil enclosure.
 - g. Normally closed.
 - h. Visual position indicator.
- F. Earthquake Valves
- 1. Earthquake Valves: Comply with ASCE 25.
 - a. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - b. Maximum Operating Pressure: 5 psig (34.5 kPa).
 - c. Cast-aluminum body with nickel-plated chrome steel internal parts.
 - d. Nitrile-rubber valve washer.
 - e. Sight windows for visual indication of valve position.
 - f. Threaded-end connections complying with ASME B1.20.1.
 - 2. Earthquake Valves: Comply with ASCE 25.
 - a. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - b. Maximum Operating Pressure: 0.5 psig (3.45 kPa) **OR** 7 psig (48 kPa) **OR** 60 psig (414 kPa), **as directed**.
 - c. Cast-aluminum body with stainless-steel internal parts.
 - d. Nitrile-rubber, reset-stem o-ring seal.
 - e. Valve position, open or closed, indicator.
 - f. Composition valve seat with clapper held by spring or magnet locking mechanism.
 - g. Level indicator.
 - h. End Connections: Threaded for valves NPS 2 (DN 50) and smaller; flanged for valves NPS 2-1/2 (DN 65) and larger.
- G. Pressure Regulators
- 1. General Requirements:
 - a. Single stage and suitable for LPG.
 - b. Steel jacket and corrosion-resistant components.
 - c. Elevation compensator.
 - d. End Connections: Threaded for regulators NPS 2 (DN 50) and smaller; flanged for regulators NPS 2-1/2 (DN 65) and larger.
 - 2. Service Pressure Regulators: Comply with ANSI Z21.80.
 - a. Body and Diaphragm Case: Cast iron or die-cast aluminum.
 - b. Springs: Zinc-plated steel; interchangeable.
 - c. Diaphragm Plate: Zinc-plated steel.
 - d. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
 - e. Orifice: Aluminum; interchangeable.
 - f. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 - g. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet and no pressure sensing piping external to the regulator.
 - h. Pressure regulator shall maintain discharge pressure setting downstream and not exceed 150 percent of design discharge pressure at shutoff.
 - i. Overpressure Protection Device: Factory mounted on pressure regulator.
 - j. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
 - k. Maximum Inlet Pressure: 100 psig (690 kPa).
 - 3. Line Pressure Regulators: Comply with ANSI Z21.80.
 - a. Body and Diaphragm Case: Cast iron or die-cast aluminum.
 - b. Springs: Zinc-plated steel; interchangeable.
 - c. Diaphragm Plate: Zinc-plated steel.

- d. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
 - e. Orifice: Aluminum; interchangeable.
 - f. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 - g. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet and no pressure sensing piping external to the regulator.
 - h. Pressure regulator shall maintain discharge pressure setting downstream and not exceed 150 percent of design discharge pressure at shutoff.
 - i. Overpressure Protection Device: Factory mounted on pressure regulator.
 - j. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
 - k. Maximum Inlet Pressure: 2 psig (13.8 kPa) **OR** 5 psig (34.5 kPa) **OR** 10 psig (69 kPa), **as directed**.
4. Appliance Pressure Regulators: Comply with ANSI Z21.18.
- a. Body and Diaphragm Case: Die-cast aluminum.
 - b. Springs: Zinc-plated steel; interchangeable.
 - c. Diaphragm Plate: Zinc-plated steel.
 - d. Seat Disc: Nitrile rubber.
 - e. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 - f. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
 - g. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
 - h. Maximum Inlet Pressure: 1 psig (6.9 kPa) **OR** 2 psig (13.8 kPa) **OR** 5 psig (34.5 kPa-), **as directed**.

H. Service Meters

1. Diaphragm-Type Service Meters: Comply with ANSI B109.1 **OR** ANSI B109.2, **as directed**.
- a. Case: Die-cast aluminum.
 - b. Connections: Steel threads.
 - c. Diaphragm: Synthetic fabric.
 - d. Diaphragm Support Bearings: Self-lubricating.
 - e. Compensation: Continuous temperature and pressure, **as directed**.
 - f. Meter Index: Cubic feet **OR** Liters **OR** Cubic feet and liters, **as directed**.
 - g. Meter Case and Index: Tamper resistant.
 - h. Remote meter reader compatible.
 - i. Maximum Inlet Pressure: 100 psig (690 kPa).
 - j. Pressure Loss: Maximum 0.5-inch wg (124 Pa) **OR** 2.0-inch wg (498 Pa), **as directed**.
 - k. Accuracy: Maximum plus or minus 1.0 percent.
2. Rotary-Type Service Meters: Comply with ANSI B109.3.
- a. Case: Extruded aluminum.
 - b. Connection: Flange.
 - c. Impellers: Polished aluminum.
 - d. Rotor Bearings: Self-lubricating.
 - e. Compensation: Continuous temperature and pressure, **as directed**.
 - f. Meter Index: Cubic feet **OR** Liters **OR** Cubic feet and liters, **as directed**.
 - g. Tamper resistant.
 - h. Remote meter reader compatible.
 - i. Maximum Inlet Pressure: 100 psig (690 kPa).
 - j. Accuracy: Maximum plus or minus 2.0 percent.
3. Turbine Meters: Comply with ASME MFC-4M.
- a. Housing: Cast iron or welded steel.
 - b. Connection Threads or Flanges: Steel.
 - c. Turbine: Aluminum or plastic.
 - d. Turbine Bearings: Self-lubricating.
 - e. Compensation: Continuous temperature and pressure, **as directed**.

- f. Meter Index: Cubic feet **OR** Liters **OR** Cubic feet and liters, **as directed**.
 - g. Tamper resistant.
 - h. Remote meter reader compatible.
 - i. Maximum Inlet Pressure: 100 psig (690 kPa).
 - j. Accuracy: Maximum plus or minus 2.0 percent.
 - 4. Service-Meter Bars:
 - a. Malleable- or cast-iron frame for supporting service meter.
 - b. Include offset swivel pipes, meter nuts with o-ring seal, and factory- or field-installed dielectric unions.
 - c. Omit meter offset swivel pipes if service-meter bar dimensions match service-meter connections.
 - 5. Service-Meter Bypass Fittings:
 - a. Ferrous, tee, pipe fitting with capped side inlet for temporary LPG supply.
 - b. Integral ball-check bypass valve.
- I. Dielectric Fittings
 - 1. Dielectric Unions:
 - a. Minimum Operating-Pressure Rating: 150 psig (1034 kPa).
 - b. Combination fitting of copper alloy and ferrous materials.
 - c. Insulating materials suitable for LPG.
 - d. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.
 - 2. Dielectric Flanges:
 - a. Minimum Operating-Pressure Rating: 150 psig (1034 kPa).
 - b. Combination fitting of copper alloy and ferrous materials.
 - c. Insulating materials suitable for LPG.
 - d. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.
 - 3. Dielectric-Flange Kits:
 - a. Minimum Operating-Pressure Rating: 150 psig (1034 kPa).
 - b. Companion-flange assembly for field assembly.
 - c. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or PE bolt sleeves, phenolic washers, and steel backing washers.
 - d. Insulating materials suitable for LPG.
 - e. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.
- J. Storage Containers
 - 1. Description: Factory fabricated, complying with requirements in NFPA 58 and ASME Boiler and Pressure Vessel Code and bearing the ASME label. Tanks shall be rated for 250-psig (1723-kPa) minimum working pressure.
 - a. Liquid outlet and vapor inlet and outlet connections shall have shutoff valves with excess-flow safety shutoff valves and bypass and back-pressure check valves with smaller than 0.039-inch (1-mm) drill-size hole to equalize pressure. Liquid-fill connection shall have backflow check valve.
 - 1) Connections: Color-code and tag valves to indicate type.
 - a) Liquid fill and outlet, red.
 - b) Vapor inlet and outlet, yellow.
 - b. Level gage shall indicate current level of liquid in the container. Gages shall also indicate storage container contents; e.g., "Butane," "50-50 LPG Mix," or "Propane."
 - c. Pressure relief valves, type and number as required by NFPA 58, connected to vapor space and having discharge piping same size as relief-valve outlet and long enough to extend at least 84 inches (2130 mm) directly overhead. Identify relief valves as follows:
 - 1) Discharge pressure in psig (kPa).
 - 2) Rate of discharge for standard air in cfm (L/s).
 - 3) Manufacturer's name.

- 4) Catalog or model number.
- d. Container pressure gage.
- e. For outdoor installation, exposed metal surfaces mechanically cleaned, primed, and painted for resistance to corrosion.
- f. Ladders for access to valves more than 72 inches (1830 mm) aboveground.
- g. Stainless-Steel Nameplate: Attach to aboveground storage container or to adjacent structure for underground storage container.
 - 1) Name and address of supplier or trade name of container.
 - 2) Water capacity in gallons and liters.
 - 3) Design pressure in psig (kPa).
 - 4) Statement, "This container shall not contain a product having a vapor pressure in excess of **<Insert maximum pressure in psig (kPa) at 100 deg F (37.8 deg C)>**."
 - 5) Outside surface area in sq. ft. (sq. m).
 - 6) Year of manufacture.
 - 7) Shell thickness in inches (mm).
 - 8) Overall length in feet (m).
 - 9) OD in feet (m).
 - 10) Manufacturer's serial number.
 - 11) ASME Code label.
- h. Felt support pads and two concrete or painted-steel saddles per storage container. Corrosion protection required at container-to-felt contact.
- i. Tie straps for each saddle.
- j. Straps and anchors for tie-down slab.
- k. Asphalt-based coating for corrosion protection.
- l. Container connections and valves protected in manway at top of storage container.
- m. Manway equipped with ventilation louvers.

K. Transport Truck Unloading Facility

- 1. Description: Comply with requirements in NFPA 58.
 - a. Support structure consisting of a minimum 6-inch (150-mm) steel channel or 6-by-4-inch (150-by-100-mm) rectangular steel tubing, a minimum of 36 inches (914 mm) above and below grade.
 - b. Liquid-fill and vapor-return, quick-disconnect fittings.
 - c. Liquid and vapor shutoff valves with hydrostatic relief valves mounted between the quick-disconnect fittings and shutoff valves.
 - d. Excess-flow safety shutoff valve in vapor-return line.
 - e. Backflow check valve in liquid-fill line.
 - f. Remote emergency shutoff valve station with underground cable to the vapor emergency shutoff valve.

L. Pumps

- 1. Description: Factory-assembled and -tested, duplex, positive-displacement, belt drive.
- 2. Pump Construction:
 - a. Casing: Ductile-iron casing with threaded gage tappings at inlet and outlet.
 - b. Internal Pressure Relief Valve: For pump protection in addition to the external pressure relief valves.
 - c. Impeller: Carbon or composite vane in cast-iron rotor.
 - d. Pump Shaft: Carbon steel.
 - e. Seal: Mechanical with Buna-N o-ring.
 - f. Pump Bearings: Ball bearings with grease fittings.
 - g. Baseplate: Bent carbon-steel channel or structural channel.
- 3. Motor: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".

- a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 22.
 - c. Motor Speeds: Single.
 - d. Bearings: Permanently lubricated **OR** Grease-lubricated, **as directed**, ball bearings.
 - e. Class I, Division 1, Group D requirements per NFPA 70.
 - 4. Factory-Installed Piping and Specialties:
 - a. Pipe: ASTM A 53/A 53M, Type E or S, Grade B; Schedule 40 black steel with welded fittings and joints or Schedule 80 for threaded malleable-iron fittings and joints.
 - b. Piping Specialties for Each Pump:
 - 1) Bypass valve.
 - 2) Isolation valves.
 - 3) Unions for each connection.
 - 4) Check valve.
 - 5) Basket strainer.
 - 6) Pressure gages for suction and discharge connections.
 - 7) Hydrostatic relief valve.
 - 8) Pilot-operated, pressure-regulating valve.
 - 5. Braided-jacket flexible connectors for suction and discharge connections.
 - 6. Pump and Piping Finish: For outdoor installation, exposed metal surfaces mechanically cleaned, primed, and painted for resistance to corrosion.
 - 7. Controls:
 - a. Explosion-proof controls enclosure.
 - b. Magnetic starter package with automatic alternator.
 - c. Pressure-activated start and stop.
 - d. Lag pump starts if lead pump fails.
 - e. Audible and visual indication of pump failure.
- M. Vaporizers
- 1. Description: Factory-fabricated, -assembled, and -tested vaporizer with heat exchanger sealed pressure-tight, built on a steel base; including insulated jacket, flue-gas vent, liquid fuel supply and vapor connections, and controls. Assembly shall be FMG labeled and comply with NFPA 58 and NFPA 70.
 - 2. Fabricate base and attachment to vaporizers with reinforcement strong enough to resist vaporizer movement during a seismic event when steel base is anchored to a concrete base.
 - 3. Casing:
 - a. Mineral-fiber insulation, a minimum of 2 inches (50 mm) thick, surrounding the heat exchanger.
 - b. Integral one-piece skid with forklift access holes.
 - c. Lifting lugs on top of vaporizer.
 - d. Flue rain cap and bird screen.
 - e. Sheet metal jacket with screw-fastened closures and baked-enamel **OR** powder-coat, **as directed**, protective finish.
 - f. Mounting base to secure boiler to concrete base.
 - g. Control Compartment Enclosure: NEMA 250, Type 4, enclosure housing control panels for LPG-fired vaporizers. Explosion-proof control compartment construction required for electric vaporizers.
 - 4. LPG Liquid and Vapor Circuit Specialties:
 - a. Y-type strainer with drain valve at inlet.
 - b. Vaporizer coil safety pressure relief valve.
 - c. Vaporizer coil blowdown valve.
 - d. Vapor outlet isolation valve.
 - e. Pressure gages, a minimum of 2-1/2 inches (63 mm) in diameter, at liquid inlet and vapor discharge. Gages shall have operating-temperature ranges so normal operating range is at approximately 50 percent of full range.

- f. Inlet safety solenoid valve to close with off-normal operation alarm.
 - g. Backflow check valve in bypass around inlet safety solenoid valve.
 - h. Liquid carryover or float-type safety shutoff switch.
 - i. LPG Vapor Filter: Steel shell designed and manufactured per ASME Boiler and Pressure Vessel Code, Section VIII, Division 1; factory mounted on vaporizer discharge. Shells larger than 5 inches (125 mm) shall be ASME "U" stamped. Fill with stainless-steel, woven-mesh coalescing element to remove 99 percent of particles larger than 10 microns. 250-psig (1723-kPa) minimum working pressure. Finish with corrosion-resistant coating for an exterior application. Include factory-mounted and -piped, differential pressure gage with gage cocks in and out, and minimum NPS 3/4 (DN 20) full-port, ball-type drain valve.
5. Direct-Type, Direct-Fired Heat Exchanger:
- a. Description: ASME-rated and -stamped, LPG, vaporizer coil contained in an enclosure insulated with at least 2-inch- (50-mm-) thick, mineral-fiber board enclosure with a burner.
 - b. Burner Tubes and Orifices: Stainless steel.
 - 1) Gas Train: Control devices and burner control sequence shall be FMG labeled. Include shutoff valve, high- and low-pressure safety switches, pressure regulator, and main- and pilot-control valves.
 - 2) Pilot: Standing pilot with 100 percent main-valve and pilot safety shutoff.
 - c. Burner Operating Controls:
 - 1) Controls shall maintain safe operating conditions. Mechanical burner safety controls limit operation of the burner.
 - 2) High-Pressure Cutoff: Manual reset stops burner if operating conditions rise above maximum design pressure.
 - 3) Operating Vapor-Pressure Control: Factory piped and mounted to control burner.
6. Indirect-Type, Direct-Fired Heat Exchanger:
- a. Description: ASME-rated and -stamped, LPG, vaporizer vessel with a replaceable, immersion-type, electric heating element.
 - b. Heating Element Operating Controls:
 - 1) Operating controls shall maintain safe operating conditions. Safety controls limit operation of the element. Microprocessor-based control system integrates safety and operating controls, **as directed**.
 - 2) Operating Vapor-Pressure Control: Factory wired and mounted to control heating element.
 - 3) High-Pressure Cutoff: Manual reset stops burner if operating conditions rise above maximum design pressure.
 - 4) Alarm Bell and Rotary Beacon: Factory mounted on control panel with silence switch; shall sound alarm for out-of-normal conditions.
 - 5) Control Transformer: 115-V maximum control voltage.
7. Direct-Type, Water-Bath Heat Exchanger:
- a. Description: Straight, steel fire tubes welded into steel headers with ASME-rated and -stamped, helical, LPG, vaporizer coil submerged in water bath. Include the following:
 - 1) Water bath filled with water/glycol solution designed to prevent freezing at minus 30 deg F (minus 34 deg C).
 - 2) Water-bath, high- and low-level sight glasses.
 - 3) Low-water cutoff to stop burner and annunciate alarm.
 - 4) Water/glycol fill and vent fitting.
 - 5) Minimum NPS 3/4 (DN 20) hose-end drain valves.
 - 6) Operating high- and low-limit aquastat controllers.
 - 7) Water-bath temperature gage; a minimum of 2-1/2 inches (63 mm) in diameter. Gages shall have operating-temperature ranges so normal operating range is at approximately 50 percent of full range.
 - b. Burner Tubes and Orifices: Stainless steel.
 - 1) Gas Train: Control devices and burner modulation control sequence shall be FMG labeled. Include shutoff valve, high- and low-pressure safety switches, pressure regulator, and main- and pilot-control valves.

- 2) Pilot: Intermittent-electric-spark **OR** Hot-surface, **as directed**, pilot ignition with 100 percent main-valve and pilot safety shutoff with electronic supervision of burner flame.
 - c. Burner Operating Controls:
 - 1) Operating controls shall maintain safe operating conditions. Safety controls limit operation of the burner. Microprocessor-based control system integrates safety and operating controls, **as directed**.
 - 2) Operating Water-Bath Temperature Control: Factory wired and mounted to control burner.
 - 3) High-Temperature and High-Pressure Cutoff: Manual reset stops burner if operating conditions rise above maximum design temperature or vapor pressure.
 - 4) Alarm Bell and Rotary Beacon: Factory mounted on control panel with silence switch; shall sound alarm for out-of-normal conditions.
 - 5) Control Transformer: 115-V maximum control voltage.
 8. Indirect-Type, Water-Bath Heat Exchanger:
 - a. Description: Immersion-type, electric heating element with ASME-rated and -stamped, helical, LPG, vaporizer coil submerged in water bath. Include the following:
 - 1) Water bath filled with water/glycol solution designed to prevent freezing at minus 30 deg F (minus 34 deg C).
 - 2) Water-bath, high- and low-level sight glasses.
 - 3) Low-water cutoff to stop electric heater and annunciate alarm.
 - 4) Water/glycol fill and vent fitting.
 - 5) Minimum NPS 3/4 (DN 20) hose-end drain valves.
 - 6) Operating high- and low-limit aquastat controllers.
 - 7) Water-bath temperature gage; a minimum of 2-1/2 inches (63 mm) in diameter. Gages shall have operating-temperature ranges so normal operating range is at approximately 50 percent of full range.
 - b. Electric Heater Operating Controls:
 - 1) Controls shall maintain safe operating conditions. Safety controls limit operation of the electric element. Microprocessor-based control system integrates safety and operating controls, **as directed**.
 - 2) Operating Water-Bath Temperature Control: Factory wired and mounted to control burner.
 - 3) High-Temperature and High-Pressure Cutoff: Manual reset stops burner if operating conditions rise above maximum design temperature or pressure.
 - 4) Alarm Bell and Rotary Beacon: Factory mounted on control panel with silence switch; shall sound alarm for out-of-normal conditions.
 - 5) Control Transformer: 115-V maximum control voltage.
 9. Building Management System Interface: Factory-installed hardware and software to enable building management system to monitor and control set points and display vaporizer status and alarms.
- N. Air Mixers
1. Description: Factory-fabricated, -assembled, -calibrated, and -tested, blower-assisted, **as directed**, air mixer with surge tank, built on a steel base; including vapor supply and discharge connections, and controls. Assembly shall be FMG labeled and comply with NFPA 58 and NFPA 70.
 2. Fabricate base and attachment to mixers with reinforcement strong enough to resist air mixer movement during a seismic event when steel base is anchored to a concrete base.
 3. Mounting Skid, Panels, and Surge Tank:
 - a. Integral one-piece skid with forklift access holes.
 - b. Lifting lugs on top of air mixer.
 - c. Baked-enamel **OR** Powder-coat, **as directed**, protective finish.
 - d. Mounting base to secure boiler to concrete base.
 - e. Control Compartment Enclosure: NEMA 250, Type 4, enclosure housing control panels.

- f. ASME-stamped surge tank with venturi, isolation valves, excess-flow safeties, and safety relief valves.
 - 4. Blower: Positive-displacement, rotary-lobe type.
 - a. Motor: Single speed, with permanently lubricated **OR** grease-lubricated, **as directed**, ball bearings. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 5. LPG Circuit Specialties:
 - a. Venturi solenoid valves.
 - b. Venturi nozzles, minimum of 3, for minimum of 10:1 turndown capacity.
 - c. Venturi silencers.
 - d. Mist filter and strainer with pressure differential gage, and blowdown ball valve.
 - e. Inlet and outlet isolation valves.
 - f. Pressure gages, a minimum of 2-1/2 inches (63 mm) in diameter, at inlet and discharge. Gages shall have operating-temperature ranges so normal operating range is at approximately 50 percent of full range.
 - 6. Air-Mixer Controls:
 - a. Controls shall maintain safe operating conditions. The following safety controls limit the operation of the air mixer. All safety controls are manual reset.
 - 1) Low-inlet-vapor pressure.
 - 2) High- or low-discharge pressure.
 - b. Alarm Bell and Rotary Beacon: Factory mounted on control panel with silence switch; shall sound alarm for out-of-normal conditions.
 - c. Control Transformer: 115-V maximum control voltage.
 - 7. Mount on common skid with vaporizer.
- O. Sleeves
 - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
 - 2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- P. Mechanical Sleeve Seals
 - 1. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - a. Sealing Elements: EPDM **OR** NBR, **as directed**, interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe and sleeve.
 - b. Pressure Plates: Plastic **OR** Carbon steel **OR** Stainless steel, **as directed**.
 - c. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating **OR** Stainless steel, **as directed**, of length required to secure pressure plates to sealing elements. Include one nut and bolt for each sealing element.
- Q. Escutcheons
 - 1. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to fit around pipe or tube, and OD that completely covers opening.
 - 2. One-Piece, Deep-Pattern Escutcheons: Deep-drawn brass with polished chrome-plated finish.
 - 3. One-Piece, Cast-Brass Escutcheons: With set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass, **as directed**.
 - 4. Split-Casting, Cast-Brass Escutcheons: With concealed hinge and set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass, **as directed**.
 - 5. One-Piece, Stamped-Steel Escutcheons: With set screw **OR** spring clips, **as directed**, and chrome-plated finish.
 - 6. Split-Plate, Stamped-Steel Escutcheons: With concealed **OR** exposed-rivet, **as directed**, hinge, set screw **OR** spring clips, **as directed**, and chrome-plated finish.
 - 7. One-Piece, Floor-Plate Escutcheons: Cast-iron floor plate.
 - 8. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.

- R. Grout
 - 1. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - a. Characteristics: Post-hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - c. Packaging: Premixed and factory packaged.
- S. Labeling And Identifying
 - 1. Detectable Warning Tape: Acid- and alkali-resistant PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored yellow.

1.3 EXECUTION

- A. Earthwork
 - 1. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.
- B. Preparation
 - 1. Close equipment shutoff valves before turning off LPG to premises or piping section.
 - 2. Inspect LPG piping according to NFPA 58 and NFPA 54 **OR** the International Fuel Gas Code, **as directed**, to determine that LPG utilization devices are turned off in piping section affected.
 - 3. Comply with NFPA 58 and NFPA 54 **OR** the International Fuel Gas Code, **as directed**, requirements for prevention of accidental ignition.
- C. Outdoor Piping Installation
 - 1. Comply with NFPA 58 and NFPA 54 **OR** the International Fuel Gas Code, **as directed**, requirements for installation and purging of LPG piping.
 - 2. Install underground, LPG piping buried at least 36 inches (900 mm) below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.
 - a. If LPG piping is installed less than 36 inches (914 mm) below finished grade, install it in containment conduit.
 - 3. Install underground, PE, LPG piping according to ASTM D 2774.
 - 4. Steel Piping with Protective Coating:
 - a. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
 - b. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.**OR**
 - Replace pipe having damaged PE coating with new pipe.
 - 5. Copper Tubing with Protective Coating:
 - a. Apply joint cover kits over tubing to cover, seal, and protect joints.
 - b. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
 - 6. Install fittings for changes in direction and branch connections.
 - 7. Joints for connection to inlets and outlets on vaporizers, air mixers, regulators, and valves may be flanged or threaded to match the equipment.
 - 8. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - a. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
 - b. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.

9. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
10. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
11. Install pressure gage downstream **OR** upstream and downstream, **as directed**, from each service regulator. Pressure gages are specified in Division 23 Section "Meters And Gages For Hvac Piping".

D. Indoor Piping Installation

1. Comply with NFPA 54 **OR** the International Fuel Gas Code, **as directed**, for installation and purging of LPG piping.
2. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
3. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
4. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
5. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
6. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
7. Locate valves for easy access.
8. Install LPG piping at uniform grade of 2 percent down toward drip and sediment traps.
9. Install piping free of sags and bends.
10. Install fittings for changes in direction and branch connections.
11. Install escutcheons for penetrations of interior walls, ceilings, and floors.
 - a. New Piping:
 - 1) Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - 2) Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
OR
Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - 3) Piping at Ceiling Penetrations in Finished Spaces: One-piece **OR** Split-casting, **as directed**, cast-brass type with polished chrome-plated finish.
OR
Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type **OR** Split-plate, stamped-steel type with concealed hinge, **as directed**, and set screw.
 - 4) Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated **OR** rough-brass, **as directed**, finish.
OR
Piping in Unfinished Service Spaces: One-piece, stamped-steel type with set screw **OR** spring clips, **as directed**.
 - 5) Piping in Equipment Rooms: One-piece, cast-brass type.
OR
Piping in Equipment Rooms: One-piece, stamped-steel type with set screw **OR** spring clips, **as directed**.
 - 6) Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
 - b. Existing Piping:

- 1) Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
OR
Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
 - 2) Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
OR
Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
 - 3) Piping in Unfinished Service Spaces: Split-casting, cast-brass type with polished chrome-plated **OR** rough-brass, **as directed**, finish.
OR
Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and set screw or spring clips.
 - 4) Piping in Equipment Rooms: Split-casting, cast-brass type.
OR
Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
 - 5) Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
12. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping" for materials.
 13. Verify final equipment locations for roughing-in.
 14. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
 15. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where readily accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - a. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches (75 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
 16. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
 17. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
 18. Concealed Location Installations: Except as specified below, install concealed LPG piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.
 - a. Above Accessible Ceilings: LPG piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
 - b. In Floors: Install LPG piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches (38 mm) of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
 - c. In Floor Channels: Install LPG piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
 - d. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
 - 1) Exception: Tubing passing through partitions or walls does not require striker barriers.
 - e. Prohibited Locations:

- 1) Do not install LPG piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
- 2) Do not install LPG piping in solid walls or partitions.
19. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
20. Connect branch piping from top or side of horizontal piping.
21. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
22. Do not use LPG piping as grounding electrode.
23. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
24. Install pressure gage downstream **OR** upstream and downstream, **as directed**, from each line regulator. Pressure gages are specified in Division 23 Section "Meters And Gages For Hvac Piping".

E. Service-Meter Assembly Installation

1. Install service-meter assemblies aboveground, on concrete bases, **as directed**.
2. Install metal shutoff valves upstream from service regulators. Shutoff valves are not required at second regulators if two regulators are installed in series.
3. Install strainer on inlet of service-pressure regulator and meter set.
4. Install service regulators mounted outside with vent outlet horizontal or facing down. Install screen in vent outlet if not integral with service regulator.
5. Install metal shutoff valves upstream from service meters. Install dielectric fittings downstream from service meters.
6. Install service meters downstream from pressure regulators.
7. Install metal bollards to protect meter assemblies. Comply with requirements in Division 05 Section "Metal Fabrications" for pipe bollards.

F. Valve Installation

1. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.
2. Install underground valves with valve boxes.
3. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
4. Install earthquake valves aboveground outside buildings according to listing.
5. Install anode for metallic valves in underground PE piping.

G. Piping Joint Construction

1. Ream ends of pipes and tubes and remove burrs.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Threaded Joints:
 - a. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - b. Cut threads full and clean using sharp dies.
 - c. Ream threaded pipe ends to remove burrs and restore full ID of pipe.
 - d. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 - e. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
4. Welded Joints:
 - a. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
 - b. Bevel plain ends of steel pipe.
 - c. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

5. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Ch. 22, "Pipe and Tube."
 6. Flanged Joints: Install gasket material, size, type, and thickness appropriate for LPG service. Install gasket concentrically positioned.
 7. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.
 8. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - a. Plain-End Pipe and Fittings: Use butt fusion.
 - b. Plain-End Pipe and Socket Fittings: Use socket fusion.
- H. Hanger And Support Installation
1. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 2. Comply with requirements for pipe hangers and supports specified in Division 23 Section "Hangers And Supports For Hvac Piping And Equipment".
 3. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - a. NPS 1 (DN 25) and Smaller: Maximum span, 96 inches (2438 mm); minimum rod size, 3/8 inch (10 mm).
 - b. NPS 1-1/4 (DN 32): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
 - c. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
 - d. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Maximum span, 10 feet (3 m); minimum rod size, 1/2 inch (13 mm).
 - e. NPS 4 (DN 100) and Larger: Maximum span, 10 feet (3 m); minimum rod size, 5/8 inch (16 mm).
 4. Install hangers for horizontal, drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:
 - a. NPS 3/8 (DN 10): Maximum span, 48 inches (1220 mm); minimum rod size, 3/8 inch (10 mm).
 - b. NPS 1/2 and NPS 5/8 (DN 15 and DN 18): Maximum span, 72 inches (1830 mm); minimum rod size, 3/8 inch (10 mm).
 - c. NPS 3/4 and NPS 7/8 (DN 20 and DN 22): Maximum span, 84 inches (2134 mm); minimum rod size, 3/8 inch (10 mm).
 - d. NPS 1 (DN 25): Maximum span, 96 inches (2440 mm); minimum rod size, 3/8 inch (10 mm).
 5. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:
 - a. NPS 3/8 (DN 10): Maximum span, 48 inches (1220 mm); minimum rod size, 3/8 inch (10 mm).
 - b. NPS 1/2 (DN 15): Maximum span, 72 inches (1830 mm); minimum rod size, 3/8 inch (10 mm).
 - c. NPS 3/4 (DN 20) and Larger: Maximum span, 96 inches (2440 mm); minimum rod, 3/8 inch (10 mm).
- I. Connections
1. Connect to utility's gas main according to utility's procedures and requirements.
 2. Install LPG piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
 3. Install piping adjacent to appliances to allow service and maintenance of appliances.
 4. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches (1830 mm) of each gas-fired appliances and equipment. Install union between valve and appliances or equipment.

5. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.
- J. Transport Truck Unloading Facility
1. Install transport truck unloading in a cast-in-place concrete base, 48 inches (1220 mm) square by 36 inches (914 mm) deep. Set top of concrete base at least 6 inches (150 mm) above finished grade.
 2. Install remote emergency shutoff station with cable release in an accessible location, a minimum of 25 feet (7.6 m) and a maximum of 100 feet (30 m) away from transport truck unloading.
 3. Install at least two 6-inch- (150-mm-) diameter metal bollards set in and filled with concrete on both sides of transport truck unloading. Bollard length shall be at least 48 inches (1220 mm) above and below grade, with concrete encasement a minimum of 12 inches (305 mm) in diameter.
- K. Storage Container Installation
1. Fill storage container to at least 80 percent capacity with butane **OR** propane, **as directed**.
 2. Install piping connections with swing joints or flexible connectors to allow for storage container settlement and for thermal expansion and contraction.
 3. Ground containers according to NFPA 780. Grounding is specified in Division 26 Section "Lightning Protection For Structures".
 4. Set storage containers in felt pads on concrete or steel saddles. Install corrosion protection at container-to-felt contact.
 5. Install tie-downs over storage containers on saddles with proper tension.
 6. Set concrete saddles on dowels set in concrete base. Anchor steel saddles to concrete base.
 7. Set storage container on concrete ballast base large enough to offset buoyancy of empty storage container immersed in water.
 8. Install tie-down straps over container anchored in ballast base and repair damaged coating.
 9. Backfill with a minimum coverage for underground or mounded storage containers according to NFPA 58.
 10. Backfill with pea gravel as required in Division 31 Section "Earth Moving".
 11. Install cathodic protection for storage container. Cathodic protection is specified in Division 26 Section "Cathodic Protection".
- L. Pump Installation
1. Install pumps with access space for periodic maintenance including removal of motors, impellers, and accessories.
 2. Set pumps on and anchored to concrete base.
 3. Install suction piping with minimum fittings and change of direction.
 4. Connect liquid suction to container, supply to vaporizer, and return line to container.
- M. Vaporizer Installation
1. Install vaporizer with access space for periodic maintenance.
 2. Set vaporizers on and anchor to concrete base.
 3. Connect liquid line from pump set, and vapor supply to distribution piping.
 4. Install backup connection from vapor space of container to inlet of pressure-regulating valve at vaporizer discharge to bypass the vaporizer during maintenance. Install shutoff valves to change source from vaporizer to storage container.
- N. Air Mixer With Vaporizer Installation
1. Install air mixer with vaporizer with access space for periodic maintenance.
 2. Set air mixer with vaporizer on and anchor to concrete base.
 3. Connect liquid line from pump set, and mixed gas supply to distribution piping.
 4. Install backup connection from vapor space of container to inlet of pressure-regulating valve at vaporizer discharge to bypass vaporizer during maintenance. Install shutoff valves to change source from vaporizer to storage container.

5. Replace filters at Final Completion if air mixer was operated during construction.
- O. Labeling And Identifying
1. Comply with requirements in Division 23 Section "Identification For Hvac Piping And Equipment" for piping and valve identification.
OR
Install detectable warning tape directly above gas piping, 12 inches (305 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.
- P. Painting
1. Comply with requirements in Division 07 for painting interior and exterior LPG piping.
 2. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components with factory-applied paint or protective coating.
 - a. Alkyd System: MPI EXT 5.1D.
 - 1) Prime Coat: Alkyd anticorrosive metal primer.
 - 2) Intermediate Coat (for a Premium Grade system): Exterior alkyd enamel matching topcoat.
 - 3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - 4) Color: Gray, **unless directed otherwise**.
 3. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components with factory-applied paint or protective coating.
 - a. Latex Over Alkyd Primer System: MPI INT 5.1Q.
 - 1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
 - 2) Intermediate Coat (for a Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - 4) Color: Gray, **unless directed otherwise**.
 - b. Alkyd System: MPI INT 5.1E.
 - 1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
 - 2) Intermediate Coat (for a Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - 4) Color: Gray, **unless directed otherwise**.
 4. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.
- Q. Concrete Bases
1. Concrete Bases: Anchor equipment to concrete base according to seismic codes at Project.
 - a. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (451-mm) centers around the full perimeter of the base.
 - c. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - f. Use 3000-psig (20.7-MPa), **unless directed otherwise**, 28-day, compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-place Concrete".
- R. Field Quality Control
1. Perform tests and inspections.
 2. Tests and Inspections:

- a. Test, inspect, and purge LPG according to NFPA 58 and NFPA 54 **OR** the International Fuel Gas Code, **as directed**, and requirements of authorities having jurisdiction.
3. LPG piping will be considered defective if it does not pass tests and inspections.
4. Prepare test and inspection reports.

S. Outdoor Piping Schedule

1. Underground LPG liquid piping shall be one of the following:
 - a. Schedule 40 steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.
 - b. Annealed **OR** Drawn, **as directed**,-temper copper tube, Type K (Type A) **OR** Type L (Type B), **as directed**, with wrought-copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.
2. Aboveground LPG liquid piping shall be one of the following:
 - a. NPS 2 (DN 50) and Smaller: Schedule 40 **OR** Schedule 80, **as directed**, steel pipe, malleable-iron threaded fittings and threaded and seal welded, **as directed**, joints. Coat pipe and fittings with protective coating for steel piping.
 - b. NPS 2-1/2 (DN 65) and Larger: Schedule 40, steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.
 - c. Annealed **OR** Drawn, **as directed**,-temper copper tube, Type L (Type B), with wrought-copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.
3. Underground LPG vapor piping shall be one of the following:
 - a. PE pipe and fittings joined by heat-fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.
 - b. Schedule 40, steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.
 - c. Annealed **OR** Drawn, **as directed**,-temper copper tube, Type L (Type B) with wrought-copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.
4. Aboveground LPG vapor piping shall be one of the following:
 - a. Schedule 40, steel pipe with malleable-iron fittings and threaded joints.
 - b. Schedule 40, steel pipe with wrought-steel fittings and welded joints, or mechanical couplings.
 - c. Annealed **OR** Drawn, **as directed**,-temper copper tube, Type L (Type B), with wrought-copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.
5. Branch Piping in Cast-in-Place Concrete to Single Appliance: Annealed-temper copper, with wrought-copper fittings and brazed **OR** flared, **as directed**, joints. Install piping embedded in concrete with no joints in concrete.
6. Containment Conduit: Schedule 40, steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

T. Indoor Piping Schedule For System Pressures Less Than 0.5 psig (3.45 kPa)

1. Aboveground, branch piping NPS 1 (DN 25) and smaller shall be one of the following:
 - a. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
 - b. Annealed-temper, tin-lined copper tube with flared joints and fittings.
 - c. Annealed-temper copper tube with wrought-copper fittings and brazed **OR** flared, **as directed**, joints.
 - d. Aluminum tube with flared fittings and joints.
 - e. Schedule 40, steel pipe with malleable-iron fittings and threaded joints.
2. Aboveground, distribution piping shall be one of the following:
 - a. Schedule 40, steel pipe with malleable-iron fittings and threaded joints.
 - b. Schedule 40, steel pipe with wrought-steel fittings and welded joints.

- c. Drawn-temper copper tube, Type L (Type B) with wrought-copper fittings and brazed joints.
 - 3. Underground, below building, piping shall be one of the following:
 - a. Schedule 40, steel pipe with malleable-iron fittings and threaded joints.
 - b. Schedule 40, steel pipe with wrought-steel fittings and welded joints.
 - 4. Containment Conduit: Schedule 40, steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
 - 5. Containment Conduit Vent Piping: Schedule 40, steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.
- U. Indoor Piping Schedule For System Pressures More Than 0.5 psig (3.45 kPa) And Less Than 5 psig (34.5 kPa)
 - 1. Aboveground, branch piping NPS 1 (DN 25) and smaller shall be one of the following:
 - a. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
 - b. Annealed-temper, tin-lined copper tube with flared joints and fittings.
 - c. Annealed-temper copper tube, Type L (Type B) with wrought-copper fittings and brazed **OR** flared, **as directed**, joints.
 - d. Aluminum tube with flared fittings and joints.
 - e. Schedule 40, steel pipe with malleable-iron fittings and threaded joints.
 - 2. Aboveground, distribution piping shall be one of the following:
 - a. Schedule 40, steel pipe with malleable-iron fittings and threaded joints.
 - b. Schedule 40, steel pipe with steel welding fittings and welded joints.
 - c. Drawn-temper copper tube, Type L (Type B) **OR** Type G, **as directed**, with wrought-copper fittings and brazed joints.
 - 3. Underground, below building, piping shall be one of the following:
 - a. Schedule 40, steel pipe with malleable-iron fittings and threaded joints.
 - b. Schedule 40, steel pipe with wrought-steel fittings and welded joints.
 - 4. Containment Conduit: Schedule 40, steel pipe with wrought-steel fittings and welded joints. Coat underground pipe and fittings with protective coating for steel piping.
 - 5. Containment Conduit Vent Piping: Schedule 40, steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.
- V. Indoor Piping Schedule For System Pressures More Than 5 psig (34.5 kPa)
 - 1. Aboveground Piping: Maximum operating pressure more than 5 psig (34.5 kPa).
 - 2. Aboveground, Branch Piping: Schedule 40, steel pipe with steel welding fittings and welded joints.
 - 3. Aboveground, distribution piping shall be one of the following:
 - a. Schedule 40, steel pipe with steel welding fittings and welded joints.
 - b. Drawn-temper copper tube, Type L (Type B) **OR** Type G, **as directed**, with wrought-copper fittings and brazed joints.
 - 4. Underground, below building, piping shall be one of the following:
 - a. Schedule 40, steel pipe with malleable-iron fittings and threaded joints.
 - b. Schedule 40, steel pipe with wrought-steel fittings and welded joints.
 - 5. Containment Conduit: Schedule 40, steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
 - 6. Containment Conduit Vent Piping: Schedule 40, steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.
- W. Underground Manual Gas Shutoff Valve Schedule
 - 1. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.
 - 2. Underground Vapor Piping:
 - a. PE valves.



- b. NPS 2 (DN 50) and Smaller: Bronze, lubricated **OR** nonlubricated, **as directed**, plug valves.
- c. NPS 2-1/2 (DN 65) and Larger: Cast-iron, lubricated **OR** nonlubricated, **as directed**, plug valves.

X. Aboveground Manual Gas Shutoff Valve Schedule

- 1. Aboveground Liquid Piping:
 - a. Two-piece, full **OR** regular, **as directed**, -port, bronze ball valves with bronze trim.
- 2. Valves for pipe NPS 2 (DN 50) and smaller at service meter shall be one of the following:
 - a. One-piece, bronze ball valve with bronze trim.
 - b. Two-piece, full **OR** regular, **as directed**, -port, bronze ball valves with bronze trim.
 - c. Bronze plug valve.
- 3. Valves for pipe NPS 2-1/2 (DN 65) and larger at service meter shall be one of the following:
 - a. Two-piece, full **OR** regular, **as directed**, -port, bronze ball valves with bronze trim.
 - b. Bronze plug valve.
 - c. Cast-iron, nonlubricated plug valve.
- 4. Distribution piping valves for pipe NPS 2 (DN 50) and smaller shall be one of the following:
 - a. One-piece, bronze ball valve with bronze trim.
 - b. Two-piece, full **OR** regular, **as directed**, -port, bronze ball valves with bronze trim.
 - c. Bronze plug valve.
- 5. Distribution piping valves for pipe NPS 2-1/2 (DN 65) and larger shall be one of the following:
 - a. Two-piece, full **OR** regular, **as directed**, -port, bronze ball valves with bronze trim.
 - b. Bronze plug valve.
 - c. Cast-iron, nonlubricated **OR** lubricated, **as directed**, plug valve.
- 6. Valves in branch piping for single appliance shall be one of the following:
 - a. One-piece, bronze ball valve with bronze trim.
 - b. Two-piece, full **OR** regular, **as directed**, -port, bronze ball valves with bronze trim.
 - c. Bronze plug valve.

END OF SECTION 23 11 23 00



SECTION 23 11 23 00A - CSF FACILITY NATURAL-GAS PIPING

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.23 11 23 00a

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Pipes, tubes, and fittings.
 2. Piping specialties.
 3. Piping and tubing joining materials.
 4. Valves.
 5. Pressure regulators.

1.2 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
1. Piping and Valves: 100 psig minimum unless otherwise indicated.
 2. Service Regulators: 100 psig minimum unless otherwise indicated.
- B. Natural-Gas System Pressure within Buildings: More than 0.5 psig but not more than 5 psig.
- C. Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig but not more than 5 psig, and is reduced to secondary pressure of 0.5 psig or less.
- D. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides,

expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

- C. Delegated-Design Submittal: For natural-gas piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail fabrication and assembly of seismic restraints.
 - 2. Design Calculations: Calculate requirements for selecting seismic restraints.
- D. Welding certificates.
- E. Field quality-control reports.
- F. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 - 4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
 - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
- B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. OmegaFlex, Inc.
 - b. Parker Hannifin Corporation; Parflex Division.
 - c. Titeflex.
 - d. Tru-Flex Metal Hose Corp.
 - e. <Insert manufacturer's name>.
 - 2. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
 - 3. Coating: PE with flame retardant.
 - a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

- 1) Flame-Spread Index: 25 or less.
 - 2) Smoke-Developed Index: 50 or less.
 4. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
 5. Striker Plates: Steel, designed to protect tubing from penetrations.
 6. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
- C. PE Pipe: ASTM D 2513, SDR 11.
1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
 2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
 - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
 - b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.
 - c. Aboveground Portion: PE transition fitting.
 - d. Outlet shall be threaded or suitable for welded connection.
 - e. Tracer wire connection.
 - f. Ultraviolet shield.
 - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
 4. Transition Service-Line Risers: Factory fabricated and leak tested.
 - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
 - b. Outlet shall be threaded or suitable for welded connection.
 - c. Bridging sleeve over mechanical coupling.
 - d. Factory-connected anode.
 - e. Tracer wire connection.
 - f. Ultraviolet shield.
 - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

2.2 PIPING SPECIALTIES

- A. Appliance Flexible Connectors:
1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
 2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
 3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
 4. Corrugated stainless-steel tubing with polymer coating.
 5. Operating-Pressure Rating: 0.5 psig.
 6. End Fittings: Zinc-coated steel.
 7. Threaded Ends: Comply with ASME B1.20.1.
 8. Maximum Length: 72 inches
- B. Quick-Disconnect Devices: Comply with ANSI Z21.41.
1. Copper-alloy convenience outlet and matching plug connector.
 2. Nitrile seals.
 3. Hand operated with automatic shutoff when disconnected.
 4. For indoor or outdoor applications.
 5. Adjustable, retractable restraining cable.
- C. Y-Pattern Strainers:
1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.

2. End Connections: Threaded ends for NPS 2 and smaller.
 3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
 4. CWP Rating: 125 psig.
- D. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES

- A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
- B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
1. CWP Rating: 125 psig.
 2. Threaded Ends: Comply with ASME B1.20.1.
 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
 4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
 6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
- C. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Lyall, R. W. & Company, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Perfection Corporation; a subsidiary of American Meter Company.
 2. Body: Bronze, complying with ASTM B 584.
 3. Ball: Chrome-plated brass.
 4. Stem: Bronze; blowout proof.
 5. Seats: Reinforced TFE; blowout proof.
 6. Packing: Separate packnut with adjustable-stem packing threaded ends.
 7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 8. CWP Rating: 600 psig.
 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

- D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Lyall, R. W. & Company, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Perfection Corporation; a subsidiary of American Meter Company.
 - f. <Insert manufacturer's name>.
 2. Body: Bronze, complying with ASTM B 584.
 3. Ball: Chrome-plated bronze.
 4. Stem: Bronze; blowout proof.
 5. Seats: Reinforced TFE; blowout proof.
 6. Packing: Threaded-body packnut design with adjustable-stem packing.
 7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 8. CWP Rating: 600 psig.
 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- E. PE Ball Valves: Comply with ASME B16.40.
1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Kerotest Manufacturing Corp.
 - b. Lyall, R. W. & Company, Inc.
 - c. Perfection Corporation; a subsidiary of American Meter Company.
 - d. <Insert manufacturer's name>.
 2. Body: PE.
 3. Ball: PE.
 4. Stem: Acetal.
 5. Seats and Seals: Nitrile.
 6. Ends: Plain or fusible to match piping.
 7. CWP Rating: 80 psig.
 8. Operating Temperature: Minus 20 to plus 140 deg F.
 9. Operator: Nut or flat head for key operation.
 10. Include plastic valve extension.
 11. Include tamperproof locking feature for valves where indicated on Drawings.
- F. Valve Boxes:
1. Cast-iron, two-section box.
 2. Top section with cover with "GAS" lettering.
 3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
 4. Adjustable cast-iron extensions of length required for depth of bury.
 5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.5 EARTHQUAKE VALVES

- A. Earthquake Valves: Comply with ASCE 25, where required by local codes or ordinance.
1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Vanguard Valves, Inc.

- b. Pacific Seismic Products, Inc.
- 2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
- 3. Maximum Operating Pressure: 5 psig.
- 4. Cast-aluminum body with nickel-plated chrome steel internal parts.
- 5. Nitrile-rubber valve washer.
- 6. Sight windows for visual indication of valve position.
- 7. Threaded end connections complying with ASME B1.20.1.
- 8. Wall mounting bracket with bubble level indicator.

2.6 PRESSURE REGULATORS

A. General Requirements:

- 1. Single stage and suitable for natural gas.
- 2. Steel jacket and corrosion-resistant components.
- 3. Elevation compensator.
- 4. End Connections: Threaded for regulators NPS 2 and smaller.

B. Line Pressure Regulators: Comply with ANSI Z21.80.

- 1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Actaris.
 - b. American Meter Company.
 - c. Eclipse Combustion, Inc.
 - d. Fisher Control Valves and Regulators; Division of Emerson Process Management.
 - e. Invensys.
 - f. Maxitrol Company.
 - g. Richards Industries; Jordan Valve Div.
- 2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
- 3. Springs: Zinc-plated steel; interchangeable.
- 4. Diaphragm Plate: Zinc-plated steel.
- 5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
- 6. Orifice: Aluminum; interchangeable.
- 7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
- 8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
- 9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
- 10. Overpressure Protection Device: Factory mounted on pressure regulator.
- 11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
- 12. Maximum Inlet Pressure: As designed.

C. Appliance Pressure Regulators: Comply with ANSI Z21.18.

- 1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Canadian Meter Company Inc.
 - b. Eaton Corporation; Controls Div.
 - c. Harper Wyman Co.
 - d. Maxitrol Company.
 - e. SCP, Inc.
- 2. Body and Diaphragm Case: Die-cast aluminum.
- 3. Springs: Zinc-plated steel; interchangeable.

4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
9. Maximum Inlet Pressure: As designed.

2.7 DIELECTRIC UNIONS

- A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 1. Capitol Manufacturing Company.
 2. Central Plastics Company.
 3. Hart Industries International, Inc.
 4. McDonald, A. Y. Mfg. Co.
 5. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
 6. Wilkins; Zurn Plumbing Products Group.
 7. <Insert manufacturer's name>.
- B. Minimum Operating-Pressure Rating: 150 psig.
- C. Combination fitting of copper alloy and ferrous materials.
- D. Insulating materials suitable for natural gas.
- E. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.8 SLEEVES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.9 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.
 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe and sleeve.
 3. Pressure Plates: Stainless steel.
 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one nut and bolt for each sealing element.

2.10 LABELING AND IDENTIFYING

- A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 OUTDOOR PIPING INSTALLATION

- A. Comply with NFPA 54, the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.
 - 1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.
- C. Install underground, PE, natural-gas piping according to ASTM D 2774.
- D. Steel Piping with Protective Coating:
 - 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
 - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
 - 3. Replace pipe having damaged PE coating with new pipe.
- E. Copper Tubing with Protective Coating:
 - 1. Apply joint cover kits over tubing to cover, seal, and protect joints.
 - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
- F. Install fittings for changes in direction and branch connections.
- G. Exterior-Wall Pipe Penetrations: Seal penetrations using steel or cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- H. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.2 INDOOR PIPING INSTALLATION

- A. Comply with NFPA 54, the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- L. Verify final equipment locations for roughing-in.
- M. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- N. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- O. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- P. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- R. Connect branch piping from top or side of horizontal piping.
- S. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment.
- T. Do not use natural-gas piping as grounding electrode.
- U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

3.3 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing or copper connector.
- B. Install underground valves with valve boxes.

- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install earthquake valves aboveground outside buildings according to listing.
- E. Install anode for metallic valves in underground PE piping.

3.4 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
 - 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
 - 2. Bevel plain ends of steel pipe.
 - 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- F. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.
- G. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
- B. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:
 - 1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
 - 2. NPS 1/2: Maximum span, 72 inches; minimum rod size, 3/8 inch.
 - 3. NPS 3/4 and Larger: Maximum span, 96 inches; minimum rod size, 3/8 inch.

3.6 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.7 LABELING AND IDENTIFYING

- A. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for piping and valve identification. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.8 FIELD QUALITY CONTROL

- A. Test, inspect, and purge natural gas according to NFPA 54, the International Fuel Gas Code and authorities having jurisdiction.
- B. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.9 OUTDOOR PIPING SCHEDULE

- A. Underground natural-gas piping shall be **[one of]** the following:
 - 1. PE pipe and fittings joined by heat fusion; service-line risers with tracer wire terminated in an accessible location.
 - 2. Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- B. Aboveground natural-gas piping shall be **[one of]** the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with wrought-steel fittings and welded joints.
- C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.10 INDOOR PIPING SCHEDULE

- A. Aboveground, distribution piping shall be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with wrought-steel fittings and welded joints.
- B. Underground, below building, piping shall be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with wrought-steel fittings and welded joints.



- C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- D. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.11 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2 and smaller at service meter shall be[one of] the following:
 - 1. One-piece, bronze ball valve with bronze trim.
 - 2. Two-piece, full-port, bronze ball valves with bronze trim.
 - 3. Bronze plug valve.
- B. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:
 - 1. One-piece, bronze ball valve with bronze trim.
 - 2. Two-piece, full-port, bronze ball valves with bronze trim.
 - 3. Bronze plug valve.
- C. Valves in branch piping for single appliance shall be one of the following:
 - 1. One-piece, bronze ball valve with bronze trim.
 - 2. Two-piece, full-port, bronze ball valves with bronze trim.
 - 3. Bronze plug valve.

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END OF SECTION



SECTION 23 11 23 00A - MPF FACILITY NATURAL-GAS PIPING

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipes, tubes, and fittings.
 - 2. Piping specialties.
 - 3. Piping and tubing joining materials.
 - 4. Valves.
 - 5. Pressure regulators.

1.2 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
 - 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
 - 2. Service Regulators: 100 psig minimum unless otherwise indicated.
- B. Natural-Gas System Pressure within Buildings: More than 0.5 psig but not more than 5 psig.
- C. Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig but not more than 5 psig, and is reduced to secondary pressure of 0.5 psig or less.
- D. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

- C. Delegated-Design Submittal: For natural-gas piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail fabrication and assembly of seismic restraints.
 - 2. Design Calculations: Calculate requirements for selecting seismic restraints.
- D. Welding certificates.
- E. Field quality-control reports.
- F. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 - 4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
 - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
- B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. OmegaFlex, Inc.
 - b. Parker Hannifin Corporation; Parflex Division.
 - c. Titeflex.
 - d. Tru-Flex Metal Hose Corp.
 - e. <Insert manufacturer's name>.
 - 2. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
 - 3. Coating: PE with flame retardant.
 - a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1) Flame-Spread Index: 25 or less.
 - 2) Smoke-Developed Index: 50 or less.

4. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
 5. Striker Plates: Steel, designed to protect tubing from penetrations.
 6. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
- C. PE Pipe: ASTM D 2513, SDR 11.
1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
 2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
 - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
 - b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.
 - c. Aboveground Portion: PE transition fitting.
 - d. Outlet shall be threaded or suitable for welded connection.
 - e. Tracer wire connection.
 - f. Ultraviolet shield.
 - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
 4. Transition Service-Line Risers: Factory fabricated and leak tested.
 - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
 - b. Outlet shall be threaded or suitable for welded connection.
 - c. Bridging sleeve over mechanical coupling.
 - d. Factory-connected anode.
 - e. Tracer wire connection.
 - f. Ultraviolet shield.
 - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

2.2 PIPING SPECIALTIES

- A. Appliance Flexible Connectors:
1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
 2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
 3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
 4. Corrugated stainless-steel tubing with polymer coating.
 5. Operating-Pressure Rating: 0.5 psig.
 6. End Fittings: Zinc-coated steel.
 7. Threaded Ends: Comply with ASME B1.20.1.
 8. Maximum Length: 72 inches
- B. Quick-Disconnect Devices: Comply with ANSI Z21.41.
1. Copper-alloy convenience outlet and matching plug connector.
 2. Nitrile seals.
 3. Hand operated with automatic shutoff when disconnected.
 4. For indoor or outdoor applications.
 5. Adjustable, retractable restraining cable.
- C. Y-Pattern Strainers:
1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
 2. End Connections: Threaded ends for NPS 2 and smaller.



3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
 4. CWP Rating: 125 psig.
- D. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES

- A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
- B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
 1. CWP Rating: 125 psig.
 2. Threaded Ends: Comply with ASME B1.20.1.
 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
 4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
 6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
- C. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.
 1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Lyall, R. W. & Company, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Perfection Corporation; a subsidiary of American Meter Company.
 2. Body: Bronze, complying with ASTM B 584.
 3. Ball: Chrome-plated brass.
 4. Stem: Bronze; blowout proof.
 5. Seats: Reinforced TFE; blowout proof.
 6. Packing: Separate packnut with adjustable-stem packing threaded ends.
 7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 8. CWP Rating: 600 psig.
 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

- D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Lyall, R. W. & Company, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Perfection Corporation; a subsidiary of American Meter Company.
 - f. <Insert manufacturer's name>.
 2. Body: Bronze, complying with ASTM B 584.
 3. Ball: Chrome-plated bronze.
 4. Stem: Bronze; blowout proof.
 5. Seats: Reinforced TFE; blowout proof.
 6. Packing: Threaded-body packnut design with adjustable-stem packing.
 7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 8. CWP Rating: 600 psig.
 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- E. PE Ball Valves: Comply with ASME B16.40.
1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Kerotest Manufacturing Corp.
 - b. Lyall, R. W. & Company, Inc.
 - c. Perfection Corporation; a subsidiary of American Meter Company.
 - d. <Insert manufacturer's name>.
 2. Body: PE.
 3. Ball: PE.
 4. Stem: Acetal.
 5. Seats and Seals: Nitrile.
 6. Ends: Plain or fusible to match piping.
 7. CWP Rating: 80 psig.
 8. Operating Temperature: Minus 20 to plus 140 deg F.
 9. Operator: Nut or flat head for key operation.
 10. Include plastic valve extension.
 11. Include tamperproof locking feature for valves where indicated on Drawings.
- F. Valve Boxes:
1. Cast-iron, two-section box.
 2. Top section with cover with "GAS" lettering.
 3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
 4. Adjustable cast-iron extensions of length required for depth of bury.
 5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.5 EARTHQUAKE VALVES

- A. Earthquake Valves: Comply with ASCE 25, where required by local codes or ordinance.
1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Vanguard Valves, Inc.

- b. Pacific Seismic Products, Inc.
- 2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
- 3. Maximum Operating Pressure: 5 psig.
- 4. Cast-aluminum body with nickel-plated chrome steel internal parts.
- 5. Nitrile-rubber valve washer.
- 6. Sight windows for visual indication of valve position.
- 7. Threaded end connections complying with ASME B1.20.1.
- 8. Wall mounting bracket with bubble level indicator.

2.6 PRESSURE REGULATORS

A. General Requirements:

- 1. Single stage and suitable for natural gas.
- 2. Steel jacket and corrosion-resistant components.
- 3. Elevation compensator.
- 4. End Connections: Threaded for regulators NPS 2 and smaller.

B. Line Pressure Regulators: Comply with ANSI Z21.80.

- 1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Actaris.
 - b. American Meter Company.
 - c. Eclipse Combustion, Inc.
 - d. Fisher Control Valves and Regulators; Division of Emerson Process Management.
 - e. Invensys.
 - f. Maxitrol Company.
 - g. Richards Industries; Jordan Valve Div.
- 2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
- 3. Springs: Zinc-plated steel; interchangeable.
- 4. Diaphragm Plate: Zinc-plated steel.
- 5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
- 6. Orifice: Aluminum; interchangeable.
- 7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
- 8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
- 9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
- 10. Overpressure Protection Device: Factory mounted on pressure regulator.
- 11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
- 12. Maximum Inlet Pressure: As designed.

C. Appliance Pressure Regulators: Comply with ANSI Z21.18.

- 1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Canadian Meter Company Inc.
 - b. Eaton Corporation; Controls Div.
 - c. Harper Wyman Co.
 - d. Maxitrol Company.
 - e. SCP, Inc.
- 2. Body and Diaphragm Case: Die-cast aluminum.
- 3. Springs: Zinc-plated steel; interchangeable.

4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
9. Maximum Inlet Pressure: As designed.

2.7 DIELECTRIC UNIONS

- A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 1. Capitol Manufacturing Company.
 2. Central Plastics Company.
 3. Hart Industries International, Inc.
 4. McDonald, A. Y. Mfg. Co.
 5. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
 6. Wilkins; Zurn Plumbing Products Group.
 7. <Insert manufacturer's name>.
- B. Minimum Operating-Pressure Rating: 150 psig.
- C. Combination fitting of copper alloy and ferrous materials.
- D. Insulating materials suitable for natural gas.
- E. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.8 SLEEVES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.9 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.
 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe and sleeve.
 3. Pressure Plates: Stainless steel.
 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one nut and bolt for each sealing element.

2.10 LABELING AND IDENTIFYING

- A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 OUTDOOR PIPING INSTALLATION

- A. Comply with NFPA 54, the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.
 - 1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.
- C. Install underground, PE, natural-gas piping according to ASTM D 2774.
- D. Steel Piping with Protective Coating:
 - 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
 - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
 - 3. Replace pipe having damaged PE coating with new pipe.
- E. Copper Tubing with Protective Coating:
 - 1. Apply joint cover kits over tubing to cover, seal, and protect joints.
 - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
- F. Install fittings for changes in direction and branch connections.
- G. Exterior-Wall Pipe Penetrations: Seal penetrations using steel or cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- H. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.2 INDOOR PIPING INSTALLATION

- A. Comply with NFPA 54, the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- L. Verify final equipment locations for roughing-in.
- M. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- N. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- O. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- P. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- R. Connect branch piping from top or side of horizontal piping.
- S. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment.
- T. Do not use natural-gas piping as grounding electrode.
- U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

3.3 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing or copper connector.
- B. Install underground valves with valve boxes.

- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install earthquake valves aboveground outside buildings according to listing.
- E. Install anode for metallic valves in underground PE piping.

3.4 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
 - 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
 - 2. Bevel plain ends of steel pipe.
 - 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- F. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.
- G. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
- B. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:
 - 1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
 - 2. NPS 1/2: Maximum span, 72 inches; minimum rod size, 3/8 inch.
 - 3. NPS 3/4 and Larger: Maximum span, 96 inches; minimum rod size, 3/8 inch.

3.6 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.7 LABELING AND IDENTIFYING

- A. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for piping and valve identification. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.8 FIELD QUALITY CONTROL

- A. Test, inspect, and purge natural gas according to NFPA 54, the International Fuel Gas Code and authorities having jurisdiction.
- B. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.9 OUTDOOR PIPING SCHEDULE

- A. Underground natural-gas piping shall be **[one of]** the following:
 - 1. PE pipe and fittings joined by heat fusion; service-line risers with tracer wire terminated in an accessible location.
 - 2. Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- B. Aboveground natural-gas piping shall be **[one of]** the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with wrought-steel fittings and welded joints.
- C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.10 INDOOR PIPING SCHEDULE

- A. Aboveground, distribution piping shall be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with wrought-steel fittings and welded joints.
- B. Underground, below building, piping shall be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with wrought-steel fittings and welded joints.



- C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- D. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.11 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2 and smaller at service meter shall be[one of] the following:
 - 1. One-piece, bronze ball valve with bronze trim.
 - 2. Two-piece, full-port, bronze ball valves with bronze trim.
 - 3. Bronze plug valve.
- B. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:
 - 1. One-piece, bronze ball valve with bronze trim.
 - 2. Two-piece, full-port, bronze ball valves with bronze trim.
 - 3. Bronze plug valve.
- C. Valves in branch piping for single appliance shall be one of the following:
 - 1. One-piece, bronze ball valve with bronze trim.
 - 2. Two-piece, full-port, bronze ball valves with bronze trim.
 - 3. Bronze plug valve.

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END OF SECTION 23 11 23 00A

Task	Specification	Specification Description
23 11 23 00	22 05 23 00	Piped Utilities Basic Materials And Methods
23 11 23 00	22 11 23 39	Water Supply Wells
23 11 23 00	21 05 00 00	Common Work Results for Fire Suppression
23 11 33 00	21 05 00 00	Common Work Results for Fire Suppression
23 12 13 00	22 05 23 00	Piped Utilities Basic Materials And Methods
23 12 16 00	01 22 16 00	No Specification Required
23 12 23 00	22 05 23 00	Piped Utilities Basic Materials And Methods
23 13 13 13	22 05 23 00	Piped Utilities Basic Materials And Methods
23 13 13 13	22 12 23 26	Facility Fuel-Oil Piping
23 13 13 13	23 11 23 00	Facility Liquefied-Petroleum Gas Piping
23 13 13 23	22 05 23 00	Piped Utilities Basic Materials And Methods
23 13 13 23	22 12 23 26	Facility Fuel-Oil Piping
23 13 23 16	01 22 16 00	No Specification Required
23 13 23 16	22 05 23 00	Piped Utilities Basic Materials And Methods
23 13 23 16	22 12 23 26	Facility Fuel-Oil Piping
23 13 23 16	23 11 23 00	Facility Liquefied-Petroleum Gas Piping
23 13 23 19	22 05 23 00	Piped Utilities Basic Materials And Methods
23 13 23 19	22 12 23 26	Facility Fuel-Oil Piping
23 13 23 19	23 11 23 00	Facility Liquefied-Petroleum Gas Piping
23 13 23 26	22 05 23 00	Piped Utilities Basic Materials And Methods
23 13 23 26	22 12 23 26	Facility Fuel-Oil Piping
23 13 33 00	22 05 23 00	Piped Utilities Basic Materials And Methods



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SECTION 23 21 13 23 - RADIANT HEATING PIPING**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for radiant heating piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes radiant heating piping, including pipes, fittings, and piping specialties.

C. Definitions

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. PEX: Crosslinked polyethylene.
3. PEX/AL/PEX: Crosslinked polyethylene/aluminum/crosslinked polyethylene.

D. Submittals

1. Product Data: For each type of radiant heating pipe, fitting, manifold, specialty, and control.
 - a. For radiant heating piping and manifolds, include pressure and temperature rating, oxygen-barrier performance, fire-performance characteristics, and water flow and pressure drop characteristics.
2. Shop Drawings: Show piping layout and details drawn to scale, including valves, manifolds, controls, and support assemblies, and their attachments to building structure.
3. Operation and Maintenance Data.

1.2 PRODUCTS**A. PEX Pipe And Fittings**

1. Pipe Material: PEX plastic according to ASTM F 876.
2. Oxygen Barrier: Limit oxygen diffusion through the tube to maximum 0.10 mg per cu. m/day at 104 deg F (40 deg C) according to DIN 4726.
3. Fittings: ASTM F 1807, metal insert and copper crimp rings.
4. Pressure/Temperature Rating: Minimum 100 psig (690 kPa) and 180 deg F (82 deg C).

B. PEX/AL/PEX Pipe And Fittings

1. Pipe Material: PEX plastic bonded to the inside and outside of a welded aluminum tube according to ASTM F 1281.
2. Oxygen Barrier: Limit oxygen diffusion through the pipe to maximum 0.10 mg per cu. m/day at 104 deg F (40 deg C) according to DIN 4726.
3. Fittings: ASTM F 1974, metal insert fittings with split ring and compression nut (compression joint) or metal insert fittings with copper crimp rings (crimp joint).
4. Flame-Spread and Smoke-Developed Indexes: 25 and 50 or less, respectively, tested according to ASTM E 84.
5. Pressure/Temperature Rating: Minimum 100 psig (690 kPa) and 210 deg F (99 deg C).

C. EPDM Pipe And Fittings

1. Pipe Material: Crosslinked EPDM inner and outer tubes.
2. Wall Thickness: Minimum 0.125 inch (3.2 mm).
3. Oxygen Barrier: Ductile aluminum foil layer applied to the inner tube to limit oxygen diffusion through the pipe to maximum 0.10 mg per cu. m/day at 104 deg F (40 deg C) according to DIN 4726.

4. Reinforcing Braid: Braided-aluminum wire between the inner and outer tube.
5. Fittings: ASTM F 1807, copper with stainless-steel crimps or clamps.
6. Pressure/Temperature Rating: Minimum 100 psig (690 kPa) and 210 deg F (99 deg C).

D. Distribution Manifolds

1. Manifold: Minimum NPS 1 (DN 25), brass **OR** copper **OR** modular plastic **OR** stainless steel, **as directed**.
2. Main Shutoff Valves:
 - a. Factory installed on supply and return connections.
 - b. Two **OR** Three, **as directed**, -piece body.
 - c. Body: Brass or bronze.
 - d. Ball: Chrome-plated bronze.
 - e. Seals: PTFE.
 - f. CWP Rating: 150 psig (1035 kPa).
 - g. Maximum Operating Temperature: 225 deg F (107 deg C).
3. Manual Air Vents:
 - a. Body: Bronze.
 - b. Internal Parts: Nonferrous.
 - c. Operator: Key furnished with valve, or screwdriver bit.
 - d. Inlet Connection: NPS 1/2 (DN 15).
 - e. Discharge Connection: NPS 1/8 (DN 6).
 - f. CWP Rating: 150 psig (1035 kPa).
 - g. Maximum Operating Temperature: 225 deg F (107 deg C).
4. Balancing Valves:
 - a. Body: Plastic or bronze, ball or plug, or globe cartridge type.
 - b. Ball or Plug: Brass or stainless steel.
 - c. Globe Cartridge and Washer: Brass with EPDM composition washer.
 - d. Seat: PTFE.
 - e. Visual Flow Indicator: Flowmeter with visible indication in a clear plastic cap at top of valve.
OR
Differential Pressure Gage Connections: Integral seals for portable meter to measure loss across calibrated orifice.
 - f. Handle Style: Lever or knob, with memory stop to retain set position if used for shutoff.
 - g. CWP Rating: Minimum 125 psig (860 kPa).
 - h. Maximum Operating Temperature: 250 deg F (121 deg C).
5. Zone Control Valves:
 - a. Body: Plastic or bronze, ball or plug, or globe cartridge type.
 - b. Ball or Plug: Brass or stainless steel.
 - c. Globe Cartridge and Washer: Brass with EPDM composition washer.
 - d. Seat: PTFE.
 - e. Actuator: Replaceable electric motor.
 - f. CWP Rating: Minimum 125 psig (860 kPa).
 - g. Maximum Operating Temperature: 250 deg F (121 deg C).
6. Thermometers:
 - a. Mount on supply and return connections.
 - b. Case: Dry type, metal or plastic, 2-inch (50-mm) diameter.
 - c. Element: Bourdon tube or other type of pressure element.
 - d. Movement: Mechanical, connecting element and pointer.
 - e. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
 - f. Pointer: Black metal.
 - g. Window: Plastic.
 - h. Connector: Rigid, back type.
 - i. Thermal System: Liquid- or mercury-filled bulb in copper-plated steel, aluminum, or brass stem.

- j. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.
 - 7. Mounting Brackets: Copper, or plastic or copper-clad steel, where in contact with manifold.
- E. Piping Specialties
- 1. Cable Ties:
 - a. Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
 - b. Minimum Width: 1/8 inch (3 mm).
 - c. Tensile Strength: 20 lb (9 kg), minimum.
 - d. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - 2. Floor-Mounting Staples:
 - a. Steel, with corrosion-resistant coating and smooth finish without sharp edges.
 - b. Minimum Thickness: 3/32 inch (2.4 mm).
 - c. Width: Minimum, wider than tubing.
 - 3. Floor-Mounting Clamps:
 - a. Two bolt, steel, with corrosion-resistant coating and smooth finish without sharp edges.
 - b. Minimum Thickness: 3/32 inch (2.4 mm).
 - c. Width: Minimum, wider than tubing.
 - 4. Floor Mounting Tracks:
 - a. Aluminum or plastic channel track with smooth finish, no sharp edges.
 - b. Minimum Thickness: 1/16 inch (1.6 mm).
 - c. Slot Width: Snap fit to hold tubing.
 - d. Slot Spacing: 2-inch (50-mm) **OR** 3-inch (75-mm), **as directed**, intervals.
 - 5. Channeled Subfloor:
 - a. Plywood, APA-rated subfloor panel, composed of premium, tongue-and-groove, 7-layer, Douglas fir structural subfloor panels.
 - b. Particleboard manufactured to meet Federal Housing Authority standards of less than 0.3-ppm formaldehyde.
 - c. Clad panel with minimum 0.025-inch- (0.635-mm-) thick aluminum recessed in the grooves sized to maintain contact with radiant piping.
 - 6. Modular Interlocking Blocks:
 - a. Polypropylene snap-together blocks with grooves to support piping.
 - b. Galvanized sheet metal or aluminum emission plates.
 - c. Natural mineralboard cover panel.
 - 7. Heat-Emission Plates:
 - a. Formed aluminum suitable for radiant heating piping.
 - b. Minimum Thickness: 1/16 inch (1.6 mm).
 - c. Slot Width: Snap fit to maintain pressure fit on tubing.
- F. Controls
- 1. Temperature-control devices and sequence of operations are specified in Division 23 Section(s) "Instrumentation And Control For Hvac" AND "Sequence Of Operations For Hvac Controls".
 - 2. Wall-Mounting Thermostat:
 - a. Minimum temperature range from 50 to 90 deg F (10 to 32 deg C).
 - b. Manually operated with on-off switch.
 - c. Day and night setback and clock program with minimum four periods per day.
 - d. Operate pumps or open zone control valves if room temperature falls below the thermostat setting, and stop pumps or close zone control valves when room temperature rises above the thermostat setting.
 - 3. Heated-Panel Thermostat:
 - a. Remote bulb unit with adjustable temperature range from 50 to 90 deg F (10 to 32 deg C).
 - b. Snap action; open-on-rise, single-pole switch with minimum current rating adequate for connected pump or zone control valve.
 - c. Remote bulb on capillary tube, resistance temperature device, or thermistor for directly sensing radiant panel temperature.
 - d. Stop pump or close zone control valves if heated-panel thermostat setting is exceeded.

- e. Corrosion-resistant, waterproof control enclosure.
- 4. Heated-Panel Thermostat with Outdoor Temperature Reset:
 - a. Remote bulb unit with adjustable temperature range from 50 to 90 deg F (10 to 32 deg C).
 - b. Snap action; open-on-rise, single-pole switch with minimum current rating adequate for connected pump and zone control valve.
 - c. Remote bulb on capillary tube, resistance temperature device, or thermistor for directly sensing radiant panel temperature.
 - d. Remote bulb on capillary tube, resistance temperature device, or thermistor for directly sensing outdoor-air temperature.
 - e. Operate zone control valves to reset supply-water temperature inversely with outdoor-air temperature as follows:
 - 1) Low outdoor-air temperature, zero deg F (minus 18 deg C) with high supply-water temperature 110 deg F (43 deg C).
 - 2) High outdoor-air temperature, 60 deg F (16 deg C) with low supply-water temperature 70 deg F (21 deg C).
 - f. Corrosion-resistant, waterproof control enclosure.
- 5. Precipitation and Temperature Sensor:
 - a. Microprocessor-based **OR** Automatic, **as directed**, control with manual on, automatic, and standby/reset switch.
 - b. Precipitation and temperature sensors shall sense the surface conditions of pavement and shall be programmed to operate pump and zone control valves as follows:
 - 1) Temperature Span: 34 to 44 deg F (1 to 7 deg C).
 - 2) Adjustable Delay Off Span: 30 to 90 minutes.
 - 3) Start Pump or Open Zone Control Valves: Following two-minute delay if ambient temperature is below set point and precipitation is detected.
 - 4) Stop Pump or Close Zone Control Valves: On detection of a dry surface plus time delay.
 - c. Corrosion-proof and waterproof enclosure suitable for outdoor mounting, for controls and precipitation and temperature sensors.
 - d. Minimum 30-A contactor to start pump and open valves.
 - e. Precipitation sensor shall be mounted in pavement.
 - f. Provide relay with contacts to indicate operational status, on or off, for interface with central HVAC control system workstation.

1.3 EXECUTION

A. Applications

- 1. Install the following types of radiant heating piping for the applications described:
 - a. Piping in Exterior Pavement: EPDM **OR** PEX **OR** PEX/AL/PEX, **as directed**.
 - b. Piping in Interior Reinforced-Concrete Floors: EPDM **OR** PEX **OR** PEX/AL/PEX, **as directed**.
 - c. Piping in Level Fill Concrete Floors (Not Reinforced): EPDM **OR** PEX **OR** PEX/AL/PEX, **as directed**.
 - d. Piping in Ceilings: EPDM **OR** PEX **OR** PEX/AL/PEX, **as directed**.
 - e. Piping in Subfloors: EPDM **OR** PEX **OR** PEX/AL/PEX, **as directed**.
 - f. Piping below Wood Floors: EPDM **OR** PEX **OR** PEX/AL/PEX, **as directed**.

B. Installation

- 1. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop or Coordination Drawings.
- 2. Install radiant heating piping continuous from the manifold through the heated panel and back to the manifold without piping joints in heated panels.

3. Connect radiant piping to manifold in a reverse-return arrangement.
4. Do not bend pipes in radii smaller than manufacturer's minimum bend radius dimensions.
5. Install manifolds in accessible locations, or install access panels to provide maintenance access as required in Division 08 Section "Access Doors And Frames".
6. Refer to Division 23 Section "Hydronic Piping" for pipes and connections to hydronic systems and for glycol-solution fill requirements.
7. Fire- and Smoke-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials according to Division 07 Section "Penetration Firestopping".
8. Piping in Exterior Pavement:
 - a. Secure piping in concrete floors by attaching pipes to reinforcement using cable ties.
 - b. Space cable ties a maximum of 18 inches (457 mm) o.c., and at center of turns or bends.
 - c. Maintain 3-inch (75-mm) minimum cover.
 - d. Install a sleeve of 3/8-inch- (9.5-mm-) thick, foam-type insulation or PE pipe around tubing and extending for a minimum of 10 inches (250 mm) on each side of slab joints to protect the tubing passing through expansion or control joints. Anchor sleeve to slab form at control joints to provide maximum clearance for saw cut.
 - e. Maintain minimum 40-psig (275-kPa) pressure in piping during concrete placement and continue for 24 hours after placement.
9. Piping in Interior Reinforced-Concrete Floors:
 - a. Secure piping in concrete floors by attaching pipes to reinforcement using cable ties.
 - b. Space cable ties a maximum of 18 inches (457 mm) o.c., and at center of turns or bends.
 - c. Maintain 2-inch (50-mm) minimum cover.
 - d. Install a sleeve of 3/8-inch- (9.5-mm-) thick, foam-type insulation or PE pipe around tubing and extending for a minimum of 10 inches (250 mm) on each side of slab joints to protect the tubing passing through expansion or control joints. Anchor sleeve to slab form at control joints to provide maximum clearance for saw cut.
 - e. Maintain minimum 40-psig (275-kPa) pressure in piping during concrete placement and continue for 24 hours after placement.
10. Piping in Level Fill Concrete Floors (Not Reinforced):
 - a. Secure piping in concrete floors by attaching pipes to subfloor using tracks, clamps, or staples.
 - b. Space tracks, clamps, or staples a maximum of 18 inches (457 mm) o.c., and at center of turns or bends.
 - c. Maintain 3/4-inch (19-mm) minimum cover.
 - d. Install a sleeve of 3/8-inch- (9.5-mm-) thick, foam-type insulation or PE pipe around tubing and extending for a minimum of 10 inches (250 mm) on each side of slab joints to protect the tubing passing through expansion or control joints. Anchor sleeve to slab form at control joints to provide maximum clearance for saw cut.
 - e. Maintain minimum 40-psig (275-kPa) pressure in piping during the concrete pour and continue for 24 hours during curing.
11. Piping in Ceiling:
 - a. Secure piping by attaching pipes to ceiling substrate using clamps or staples.
 - b. Space clamps or staples a maximum of 18 inches (457 mm) o.c., and at center of turns or bends.
 - c. Maintain 1-1/2-inch (38-mm) minimum plaster cover.
 - d. Maintain minimum 40-psig (275-kPa) pressure in piping during the plaster application and continue for 24 hours during curing.
12. Piping in Subfloor:
 - a. Secure piping by laying piping in subfloor channels or modular interlocking blocks.
 - b. Use straight channel panels or blocks in the center, and curved channel panels or blocks at the ends.
 - c. Finish floor with mineralboard panel cover or finished floor surface.
13. Piping below Wood Floor:
 - a. Secure piping by attaching pipes to subfloor using heat-emission plates, clamps, or staples.

- b. Space heat-emission plates, clamps, or staples a maximum of 4 inches (100 mm) o.c., and at center of turns or bends.
 - c. Install heat-emission plates on underside of wood subfloor with maximum space between plates, as noted above, to maintain pipe contact with floor.
 - 14. Revise locations and elevations from those indicated as required to suit field conditions and ensure integrity of piping and as approved.
 - 15. After system balancing has been completed, mark balancing valves to permanently indicate final position.
 - 16. Perform the following adjustments before operating the system:
 - a. Open valves to fully open position.
 - b. Check operation of automatic valves.
 - c. Set temperature controls so all zones call for full flow.
 - d. Purge air from piping.
 - 17. After the concrete or plaster heating panel has cured as recommended by concrete or plaster supplier, operate radiant heating system as follows:
 - a. Start system heating at a maximum of 10 deg F (6 deg C) above the ambient radiant panel temperature, and increase 10 deg F (6 deg C) each following day until design temperature is achieved.
 - b. For freeze protection, operate at a maximum of 60 deg F (16 deg C) supply-water temperature.
- C. Field Quality Control
- 1. Prepare radiant heating piping for testing as follows:
 - a. Open all isolation valves and close bypass valves.
 - b. Open and verify operation of zone control valves.
 - c. Flush with clean water, and clean strainers.
 - 2. Tests and Inspections:
 - a. Leak Test: After installation, charge system and test for leaks. Subject piping to hydrostatic test pressure that is not less than 1.5 times the design pressure but not more than 100 psig (690 kPa). Repair leaks and retest until no leaks exist.
 - b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Remove and replace malfunctioning radiant heating piping components that do not pass tests, and retest as specified above.
 - 4. Prepare a written report of testing.

END OF SECTION 23 21 13 23



Task	Specification	Specification Description
23 21 13 23	22 05 23 00	Piped Utilities Basic Materials And Methods
23 21 13 23	22 11 23 39	Water Supply Wells
23 21 13 23	21 05 00 00	Common Work Results for Fire Suppression
23 21 13 23	22 12 23 26	Facility Fuel-Oil Piping
23 21 13 23	23 11 23 00	Facility Liquefied-Petroleum Gas Piping
23 21 13 23	22 11 16 00	Compressed-Air Piping For Laboratory And Healthcare Facilities
23 21 13 23	22 11 16 00a	Vacuum Piping For Laboratory And Healthcare Facilities
23 21 13 23	22 11 16 00b	Gas Piping For Laboratory And Healthcare Facilities
23 21 16 00	01 22 16 00	No Specification Required
23 21 16 00	22 05 23 00	Piped Utilities Basic Materials And Methods
23 21 16 00	21 05 00 00	Common Work Results for Fire Suppression
23 21 16 00	22 12 23 26	Facility Fuel-Oil Piping
23 21 16 00	23 11 23 00	Facility Liquefied-Petroleum Gas Piping



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SECTION 23 21 23 00 - MPF HYDRONIC PUMPS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:

NOTE TO SPECIFIER

Adjust list below to suit Project.

1. Close-coupled, in-line centrifugal pumps.
2. Close-coupled, end-suction centrifugal pumps.
3. Separately coupled, horizontal, in-line centrifugal pumps.
4. Separately coupled, vertical, in-line centrifugal pumps.
5. Separately coupled, base-mounted, end-suction centrifugal pumps.

1.2 SUBMITTALS

- A. Product Data: Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.
- B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 CENTRIFUGAL PUMPS

- A. Manufacturers:
1. Armstrong Pumps Inc.
 2. Aurora Pump; Division of Pentair Pump Group.
 3. Bell & Gossett; Div. of ITT Industries.
 4. PACO Pumps.
 5. Taco, Inc.
 6. Weinman; Div. of Crane Pumps & Systems.
- B. Description: Factory-assembled and -tested, centrifugal, pump as defined in HI 1.1-1.2 and HI 1.3; designed for base mounting, with pump and motor shafts horizontal. Rate pump for [125-psig (860-kPa)] [175-psig (1204-kPa)] [250-psig (1720-kPa)] minimum working pressure and a continuous water temperature of [200 deg F (93 deg C)] [225 deg F (107 deg C)] [250 deg F (121 deg C)].
- C. Pump Construction:
1. Casing:
 2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
 3. Pump Shaft: Steel, with copper-alloy shaft sleeve.
 4. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N or EPT bellows and gasket.
 5. Select subparagraph above or first subparagraph below. Packing seal is rated for 200 deg F (93 deg C).
 6. Packing Seal: Stuffing box, with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
 7. Pump Bearings: Grease-lubricated ball bearings contained in cast-iron housing with grease fittings.
- D. Shaft Coupling: Molded rubber insert and interlocking spider capable of absorbing vibration. EPDM coupling sleeve for variable-speed applications.
- E. Coupling Guard: Dual rated; ANSI B15.1, Section 8; OSHA 1910.219 approved; steel; removable; attached to mounting frame.
- F. Mounting Frame: Welded-steel frame and cross members, factory fabricated from ASTM A 36/A 36M channels and angles. Fabricate to mount pump casing, coupling guard, and motor.
- G. Permanently lubricated ball bearings are available up through 5 hp. Larger motors have grease-lubricated ball bearings.
- H. Motor: Premium efficiency single speed.

2.3 PUMP SPECIALTY FITTINGS

- A. Suction Diffuser: Angle pattern, [175-psig (1204-kPa)] [300-psig (2060-kPa)] pressure rating, cast-iron body and end cap, pump-inlet fitting; with bronze startup and bronze or stainless-steel permanent strainers; bronze or stainless-steel straightening vanes; drain plug; and factory-fabricated support.
- B. Triple-Duty Valve: Angle or straight pattern, [175-psig (1204-kPa)] [300-psig (2060-kPa)] pressure rating, cast-iron body, pump-discharge fitting; with drain plug and bronze-fitted shutoff, balancing, and check valve features. Brass gage ports with integral check valve, and orifice for flow measurement.

PART 3 - EXECUTION

3.1 PUMP INSTALLATION

- A. Comply with HI 1.4.
- B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.
- C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
- D. Install continuous-thread hanger rods and spring hangers with vertical-limit stop of sufficient size to support pump weight. Vibration isolation devices are specified in Division 23 Section "Mechanical Vibration and Seismic Controls." Fabricate brackets or supports as required. Hanger and support materials are specified in Division 23 Section "Hangers and Supports."
- E. Suspend vertically mounted, in-line centrifugal pumps independent of piping. Install pumps with motor and pump shafts vertical. Use continuous-thread hanger rods and spring hangers with vertical-limit stop of sufficient size to support pump weight. Vibration isolation devices are specified in Division 23 Section "Mechanical Vibration and Seismic Controls." Hanger and support materials are specified in Division 23 Section "Hangers and Supports."
- F. Set base-mounted pumps on concrete foundation. Disconnect coupling before setting. Do not reconnect couplings until alignment procedure is complete.
 - 1. Support pump baseplate on rectangular metal blocks and shims, or on metal wedges with small taper, at points near foundation bolts to provide a gap of 3/4 to 1-1/2 inches (19 to 38 mm) between pump base and foundation for grouting.
 - 2. Adjust metal supports or wedges until pump and driver shafts are level. Check coupling faces and suction and discharge flanges of pump to verify that they are level and plumb.

3.2 ALIGNMENT

- A. Align pump and motor shafts and piping connections after setting on foundation, grout has been set and foundation bolts have been tightened, and piping connections have been made.
- B. Comply with pump and coupling manufacturers' written instructions.
- C. Adjust pump and motor shafts for angular and offset alignment by methods specified in HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation."
- D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 and 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.
- C. Connect piping to pumps. Install valves that are same size as piping connected to pumps.
- D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.
- E. Install check valve and throttling or triple-duty valve on discharge side of pumps.
- F. Install Y-type strainer or suction diffuser and shutoff valve on suction side of pumps.
- G. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.
- H. Install pressure gages on pump suction and discharge, at integral pressure-gage tapping, or install single gage with multiple input selector valve.
- I. Ground equipment according to Division 26 Section "Grounding and Bonding."
- J. Connect wiring according to Division 26 Section "Conductors and Cables."

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Last revised: 3/23/2012

END OF SECTION 23 21 23 00



Task	Specification	Specification Description
23 21 23 13	22 05 23 00	Piped Utilities Basic Materials And Methods
23 21 23 13	22 11 23 39	Water Supply Wells
23 21 23 16	22 05 23 00	Piped Utilities Basic Materials And Methods
23 21 23 16	22 11 23 39	Water Supply Wells
23 21 23 23	22 05 23 00	Piped Utilities Basic Materials And Methods
23 21 23 23	22 11 23 39	Water Supply Wells
23 21 29 00	22 05 23 00	Piped Utilities Basic Materials And Methods



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SECTION 23 22 13 00 - MPF STEAM AND CONDENSATE HEATING PIPING

NOTE TO SPECIFIER

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NOTE TO SPECIFIER

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PART 1 - GENERAL**1.1 SUMMARY**

- A. This Section includes the following for LP steam (less than 30 psig) and condensate piping:
1. Pipe and fittings.
 2. Strainers.
 3. Safety valves.
 4. Pressure-reducing valves.
 5. Steam traps.
 6. Thermostatic air vents and vacuum breakers.

1.2 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressures and temperatures:
1. LP Steam Piping:
 2. Condensate Piping: 100 psig at 250 deg F.
 3. Makeup-Water Piping: 100 psig at 150 deg F.
 4. Blowdown-Drain Piping: Equal to pressure of the piping system to which it is attached.
 5. Air-Vent and Vacuum-Breaker Piping: Equal to pressure of the piping system to which it is attached.
 6. Safety-Valve-Inlet and -Outlet Piping: Equal to pressure of the piping system to which it is attached.

1.3 SUBMITTALS

- A. Product Data: For each type of the following:
1. Pressure-reducing and safety valve.
 2. Steam trap.
 3. Air vent and vacuum breaker.

- B. Shop Drawings: Detail, 1/4 inch equals 1 foot scale, fabrication of pipe anchors, hangers, pipe, multiple pipes, alignment guides, and expansion joints and loops and their attachment to the building structure. Detail locations of anchors, alignment guides, and expansion joints and loops.
- C. Field quality-control test reports.
- D. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping" for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Delete any piping products not used.

2.1 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.
- B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.
- C. Wrought-Copper Fittings and Unions: ASME B16.22.

2.2 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, plain ends, Type, Grade, and Schedule as indicated in Part 3 piping applications articles.
- B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125, 150, and 300 as indicated in Part 3 piping applications articles.
- C. Malleable-Iron Threaded Fittings: ASME B16.3; Classes 150 and 300 as indicated in Part 3 piping applications articles.
- D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 piping applications articles.

NOTE TO SPECIFIER

Coordinate flange class in first paragraph below with products in other parts of this Section and in related. Sections to match face size and bolt patterns.

- E. Cast-Iron Threaded Flanges and Flanged Fittings: ASME B16.1, Classes 125 and 250 as indicated in Part 3 piping applications articles; raised ground face, and bolt holes spot faced.
- F. Stainless-Steel Bellows, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforced, protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

2.3 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

2.4 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions:
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. Hart Industries, International Inc.
 - d. Watts Water Technologies, Inc.
 - e. Zurn Plumbing Products Group.
 - f. <Insert manufacturer's name.>
 2. Factory-fabricated union assembly, for 250-psig minimum working pressure at 180 deg F.

2.5 VALVES

- A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."
- B. Stop-Check Valves:
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.
 - b. Jenkins Valves; a Crane Company.
 - c. Lunkenheimer Valves.
 - d. A.Y. McDonald Mfg. Co.



- e. <Insert manufacturer's name.>
2. Body and Bonnet: Malleable iron.
3. End Connections: Flanged.
4. Disc: Cylindrical with removable liner and machined seat.
5. Stem: Brass alloy.
6. Operator: Outside screw and yoke with cast-iron handwheel.
7. Packing: Polytetrafluoroethylene-impregnated packing with two-piece packing gland assembly.
8. Pressure Class: 250.

2.6 STRAINERS

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B cast iron, with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for strainers NPS 2 and smaller; flanged ends for strainers NPS 2-1/2 and larger.
3. Strainer Screen: Stainless-steel, 20 mesh strainer, and perforated stainless-steel basket with 50 percent free area.
4. Tapped blowoff plug.
5. CWP Rating: 250-psig working steam pressure.

2.7 SAFETY VALVES

NOTE TO SPECIFIER

Valves in paragraph and subparagraphs below are available in NPS 1/2 through NPS 2-1/2 (DN 15 through DN 65).

A. Bronze Safety Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armstrong International, Inc.
 - b. Kunkle Valve; a Tyco International Ltd. Company.
 - c. Spirax Sarco, Inc.
 - d. Watts Water Technologies, Inc.
 - e. <Insert manufacturer's name.>
2. Disc Material: Forged copper alloy.
3. End Connections: Threaded inlet and outlet.
4. Spring: Fully enclosed steel spring with adjustable pressure range and positive shutoff, factory set and sealed.
5. Pressure Class: 250.
6. Drip-Pan Elbow: Cast iron and having threaded inlet and outlet with threads complying with ASME B1.20.1.
7. Size and Capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code.

NOTE TO SPECIFIER

Valves in paragraph and subparagraphs below are available in NPS 1-1/2 through NPS 6 (DN 40 through DN 150).

B. Cast-Iron Safety Valves:



1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armstrong International, Inc.
 - b. Kunkle Valve; a Tyco International Ltd. Company.
 - c. Spirax Sarco, Inc.
 - d. Watts Water Technologies, Inc.
 - e. <Insert manufacturer's name.>
2. Disc Material: Forged copper alloy with bronze nozzle.
3. End Connections: Raised-face flanged inlet and threaded or flanged outlet connections.
4. Spring: Fully enclosed cadmium-plated steel spring with adjustable pressure range and positive shutoff, factory set and sealed.
5. Pressure Class: 250.
6. Drip-Pan Elbow: Cast iron and having threaded inlet, outlet, and drain, with threads complying with ASME B1.20.1.
7. Exhaust Head: Cast iron and having threaded inlet and drain, with threads complying with ASME B1.20.1.
8. Size and Capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code.

2.8 PRESSURE-REDUCING VALVES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Armstrong International, Inc.
 2. Hoffman Specialty; Division of ITT Industries.
 3. Leslie Controls, Inc.
 4. Spence Engineering Company, Inc.
 5. Spirax Sarco, Inc.
 6. <Insert manufacturer's name.>

NOTE TO SPECIFIER

Schedule pressure-reducing valves and include size, capacity, minimum length of straight pipe on both sides of valve, and inlet and outlet pressures. Select pressure-reducing valves to develop no more than 85 dBA at an elevation of 3 feet (1 m) above adjacent floor and at 3 feet (1 m) in any direction. Use Schedule 80 minimum for piping inlet and outlet connections to pressure-reducing valves, to achieve the required sound level, or use sound attenuators.

- B. Size, Capacity, and Pressure Rating: Factory set for inlet and outlet pressures indicated.
- C. Description: Pilot-actuated, diaphragm type, with adjustable pressure range and positive shutoff.
- D. Body: Cast iron.
- E. End Connections: Threaded connections for valves NPS 2 and smaller and flanged connections for valves NPS 2-1/2 and larger.
- F. Trim: Hardened stainless steel.
- G. Head and Seat: Replaceable, main head stem guide fitted with flushing and pressure-arresting device cover over pilot diaphragm.
- H. Gaskets: Non-asbestos materials.

2.9 STEAM TRAPS

A. Thermostatic Traps:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armstrong International, Inc.
 - b. Barnes & Jones, Inc.
 - c. Dunham-Bush, Inc.
 - d. Hoffman Specialty; Division of ITT Industries.
 - e. Spirax Sarco, Inc.
 - f. Sterling.
 - g. <Insert manufacturer's name.>
2. Body: Bronze angle-pattern body with integral union tailpiece and screw-in cap.
3. Trap Type: Balanced-pressure.
4. Bellows: Stainless steel or monel.
5. Head and Seat: Replaceable, hardened stainless steel.
6. Pressure Class: 125.

B. Float and Thermostatic Traps:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armstrong International, Inc.
 - b. Barnes & Jones, Inc.
 - c. Dunham-Bush, Inc.
 - d. Hoffman Specialty; Division of ITT Industries.
 - e. Spirax Sarco, Inc.
 - f. Sterling.
 - g. <Insert manufacturer's name.>
2. Body and Bolted Cap: ASTM A 126, cast iron.
3. End Connections: Threaded.
4. Float Mechanism: Replaceable, stainless steel.
5. Head and Seat: Hardened stainless steel.
6. Trap Type: Balanced pressure.
7. Thermostatic Bellows: Stainless steel or monel.
8. Thermostatic air vent capable of withstanding 45 deg F of superheat and resisting water hammer without sustaining damage.

NOTE TO SPECIFIER

Retain first subparagraph below for optional vacuum breaker.

9. Vacuum Breaker: Thermostatic with phosphor bronze bellows, and stainless steel cage, valve, and seat.
10. Maximum Operating Pressure: 125 psig.

2.10 THERMOSTATIC AIR VENTS AND VACUUM BREAKERS

A. Thermostatic Air Vents:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armstrong International, Inc.
 - b. Barnes & Jones, Inc.

- c. Dunham-Bush, Inc.
 - d. Hoffman Specialty; Division of ITT Industries.
 - e. Spirax Sarco, Inc.
 - f. Sterling.
 - g. <Insert manufacturer's name.>
 2. Body: Cast iron, bronze, or stainless steel.
 3. End Connections: Threaded.
 4. Float, Valve, and Seat: Stainless steel.
 5. Thermostatic Element: Phosphor bronze bellows in a stainless-steel cage.
 6. Pressure Rating: 125 psig.
 7. Maximum Temperature Rating: 350 deg F.
- B. Vacuum Breakers:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armstrong International, Inc.
 - b. Dunham-Bush, Inc.
 - c. Hoffman Specialty; Division of ITT Industries.
 - d. Johnson Corporation (The).
 - e. Spirax Sarco, Inc.
 - f. <Insert manufacturer's name.>
 2. Body: Cast iron, bronze, or stainless steel.
 3. End Connections: Threaded.
 4. Sealing Ball, Retainer, Spring, and Screen: Stainless steel.
 5. O-ring Seal: EPR.
 6. Pressure Rating: 125 psig.
 7. Maximum Temperature Rating: 350 deg F.

PART 3 - EXECUTION

3.1 LP STEAM PIPING APPLICATIONS

NOTE TO SPECIFIER

Retain at least one pipe material in paragraphs below for each service required for Project. See "Writing Guide"

- A. LP Steam Piping: Schedule 80, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.
- B. Condensate Piping above Grade: Schedule 80, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.
- C. Condensate Piping below Grade: Schedule 80, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.

3.2 ANCILLARY PIPING APPLICATIONS

- A. Makeup-water piping installed above grade shall be the following:
 1. Drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
- B. Makeup-Water Piping Installed below Grade and within Slabs: Annealed-temper copper tubing, wrought-copper fittings, and soldered joints. Use the fewest possible joints.



- C. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.
- D. Air-Vent Piping:
 - 1. Inlet: Same as service where installed.
 - 2. Outlet: Type K annealed-temper copper tubing with soldered or flared joints.
- E. Vacuum-Breaker Piping: Outlet, same as service where installed.
- F. Safety-Valve-Inlet and -Outlet Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed.

3.3 VALVE APPLICATIONS

- A. Install shutoff duty valves at branch connections to steam supply mains, at steam supply connections to equipment, and at the outlet of steam traps.
- B. Install safety valves on pressure-reducing stations and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install safety-valve discharge piping, without valves, to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

3.4 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Use indicated piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Install piping to allow application of insulation.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- K. Install drains, consisting of a tee fitting, NPS 3/4 full port-ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- L. Install steam supply piping at a minimum uniform grade of 0.2 percent downward in direction of steam flow.

- M. Install condensate return piping at a minimum uniform grade of 0.4 percent downward in direction of condensate flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side down.
- O. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to top of main pipe.
- P. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."
- Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- S. Install strainers on supply side of control valves, pressure-reducing valves, traps, and elsewhere as indicated. Install NPS 3/4 nipple and full port ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.
- T. Install expansion loops, expansion joints, anchors, and pipe alignment guides as specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."
- U. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."
- V. Install drip legs at low points and natural drainage points such as ends of mains, bottoms of risers, and ahead of pressure regulators, and control valves.
 - 1. On straight runs with no natural drainage points, install drip legs at intervals not exceeding 300 feet.
 - 2. Size drip legs same size as main. In steam mains NPS 6 and larger, drip leg size can be reduced, but to no less than NPS 4.

3.5 STEAM-TRAP INSTALLATION

- A. Install steam traps in accessible locations as close as possible to connected equipment.
- B. Install full-port ball valve, strainer, and union upstream from trap; install union, check valve, and full-port ball valve downstream from trap unless otherwise indicated.

3.6 PRESSURE-REDUCING VALVE INSTALLATION

NOTE TO SPECIFIER

Consult manufacturers for proper installation of piping to and from pressure-reducing valves.

- A. Install pressure-reducing valves in accessible location for maintenance and inspection.
- B. Install bypass piping around pressure-reducing valves, with globe valve equal in size to area of pressure-reducing valve seat ring, unless otherwise indicated.
- C. Install gate valves on both sides of pressure-reducing valves.
- D. Install unions or flanges on both sides of pressure-reducing valves having threaded- or flanged-end connections respectively.

- E. Install pressure gages on low-pressure side of pressure-reducing valves after the bypass connection according to Division 23 Section "Meters and Gages for HVAC Piping."
- F. Install strainers upstream for pressure-reducing valve.
- G. Install safety valve downstream from pressure-reducing valve station.

3.7 SAFETY VALVE INSTALLATION

- A. Install safety valves according to ASME B31.9, "Building Services Piping."
- B. Pipe safety-valve discharge without valves to atmosphere outside the building.
- C. Install drip-pan elbow fitting adjacent to safety valve and pipe drain connection to nearest floor drain.
- D. Install exhaust head with drain to waste, on vents equal to or larger than NPS 2-1/2.

3.8 HANGERS AND SUPPORTS

NOTE TO SPECIFIER

Piping support must account for expansion and contraction, vibration, dead load of piping and its contents.

- A. Install hangers and supports according to Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with requirements below for maximum spacing.

NOTE TO SPECIFIER

Retain first paragraph below for projects in areas that require seismic restraints.

- B. Seismic restraints are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
- C. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
 - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
 - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
 - 4. Spring hangers to support vertical runs.
- D. Install hangers with the following maximum spacing and minimum rod sizes:
 - 1. NPS 3/4: Maximum span, 9 feet; minimum rod size, 1/4 inch.
 - 2. NPS 1: Maximum span, 9 feet; minimum rod size, 1/4 inch.
 - 3. NPS 1-1/2: Maximum span, 12 feet; minimum rod size, 3/8 inch.
 - 4. NPS 2: Maximum span, 13 feet; minimum rod size, 3/8 inch.
 - 5. NPS 2-1/2: Maximum span, 14 feet; minimum rod size, 3/8 inch.
 - 6. NPS 3: Maximum span, 15 feet; minimum rod size, 3/8 inch.
 - 7. NPS 4: Maximum span, 17 feet; minimum rod size, 1/2 inch.
- E. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1/2: Maximum span, 4 feet; minimum rod size, 1/4 inch.

2. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
3. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
7. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.

- F. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.9 PIPE JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube ends. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube," using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.10 TERMINAL EQUIPMENT CONNECTIONS

- A. Size for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install traps and control valves in accessible locations close to connected equipment.
- C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.
- D. Install vacuum breakers downstream from control valve, close to coil inlet connection.
- E. Install a drip leg at coil outlet.

3.11 FIELD QUALITY CONTROL

- A. Prepare steam and condensate piping according to ASME B31.9, "Building Services Piping," and as follows:
1. Leave joints, including welds, uninsulated and exposed for examination during test.



2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
 3. Flush system with clean water. Clean strainers.
 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
- B. Perform the following tests on steam and condensate piping:
1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
 2. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength.
 3. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
- C. Prepare written report of testing.

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END OF SECTION 23 22 13 00



Task	Specification	Specification Description
23 22 16 00	22 05 23 00	Piped Utilities Basic Materials And Methods
23 22 16 00	21 05 19 00	Meters and Gages for Plumbing Piping
23 22 16 00	21 05 19 00a	Meters and Gages for HVAC Piping



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SECTION 23 23 00 00 - CSF REFRIGERANT PIPING

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.23 23 00 00

PART 1 - GENERAL

1.1 SUBMITTALS:

- A. Product Data: Include pressure drop, based on manufacturer's test data, for thermostatic expansion valves, solenoid valves, and pressure-regulating valves.
- B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationship between piping and equipment.
 - 1. Size piping and design the actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes, to ensure proper operation and compliance with warranties of connected equipment.
 - 2.

1.2 QUALITY ASSURANCE:

- A. ASHRAE Standard: Comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."
- B. ASME Standard: Comply with ASME B31.5, "Refrigeration Piping."
- C. UL Standard: Provide products complying with UL 207, "Refrigerant-Containing Components and Accessories, Nonelectrical"; or UL 429, "Electrically Operated Valves."

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS:

- A. Drawn-Temper Copper Tube: ASTM B 280, Type ACR.
- B. Wrought-Copper Fittings: ASME B16.22.

- C. Wrought-Copper Unions: ASME B16.22.
- D. Bronze Filler Metals: AWS A5.8, Classification BAg-1 (silver)

2.2 REFRIGERANT PIPING SPECIALITIES:

- A. Replaceable-Core Filter-Dryers: 500-psig maximum working pressure; heavy gage protected with corrosion-resistant-painted steel shell, flanged ring and spring, ductile-iron cover plate with steel cap screws; wrought-copper fittings for solder-end connections; with replaceable-core kit, including gaskets and the following:
 - 1. Filter-Dryer Cartridge: Pleated media with solid-core sieve with activated alumina, ARI 730 rated for capacity.
 - 2. Service Valves: 500-psig (3450-kPa) pressure rating; forged-brass body with copper stubs, brass caps, removable valve core, integral ball check valve, and with solder-end connections.
 - 3. Pressure-Regulating Valves: Comply with ARI 770; direct acting, brass; with pilot operator, stainless-steel diaphragm, standard coil, and solder-end connection; suitable for refrigerant specified.
 - 4. Pressure Relief Valves: Straight-through or angle pattern, brass body and disc, neoprene seat, and factory sealed and ASME labeled for standard pressure setting.
 - 5. Thermostatic Expansion Valves: Comply with ARI 750; brass body with stainless-steel parts; thermostatic-adjustable, modulating type; size and operating characteristics as recommended by manufacturer of evaporator, and factory set for superheat requirements; solder-end connections; with sensing bulb, distributor having side connection for hot-gas bypass line, and external equalizer line.
 - 6. Hot-Gas Bypass Valve: Pulsating-dampening design, stainless-steel bellows and polytetrafluoroethylene valve seat; adjustable; sized for capacity equal to last step of compressor unloading; with solder-end connections.
 - 7. Moisture/Liquid Indicators: 500-psig (3450-kPa) maximum working pressure and 200 deg F (93 deg C) operating temperature; all-brass body with replaceable, polished, optical viewing window with color-coded moisture indicator; with solder-end connections.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS:

- A. Aboveground, within Building: Type ACR drawn-copper tubing or Type L (Type B) drawn-copper tubing.
- B. Belowground for NPS 2 (DN 50) and Smaller: Type K (Type A) annealed-copper tubing.

3.2 PIPING INSTALLATION:

- A. Install refrigerant piping according to ASHRAE 15. Equipment manufacturer shall size refrigerant lines for Contractor.
- B. Basic piping installation requirements are specified in Division 23 Section "Common Work for HVAC."
- C. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- D. Arrange piping to allow inspection and service of compressor and other equipment. Install valves and specialties in accessible locations to allow for service and inspection.



- E. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.
- F. Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanical injury.
- G. Slope refrigerant piping as follows:
 - 1. Install horizontal suction lines with a uniform slope downward to compressor.
 - 2. Install traps and double risers to entrain oil in vertical runs.
 - 3. Liquid lines may be installed level.
- H. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports."
- I. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
- J. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 - 2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 - 3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
 - 4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
- K. Support vertical runs at each floor.
- L. Pipe Joint Construction:
 - 1. Braze joints according to Division 23 Section "Common Work for HVAC."
 - 2. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide) during brazing to prevent scale formation.
- M. Refrigerant Pipe Insulation:
 - 1. Insulate refrigerant piping according to Division 23 Section "Pipe Insulation."
- N. Test and inspect refrigerant piping according to ASME B31.5, Chapter VI.
 - 1. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure.
 - 2. Test high- and low-pressure side piping of each system at not less than the lower of the design pressure or the setting of pressure relief device protecting high and low side of system.
 - a. System shall maintain test pressure at the manifold gage throughout duration of test.
 - b. Test joints and fittings by brushing a small amount of soap and glycerine solution over joint.
 - c. Fill system with nitrogen to raise a test pressure of 150 psig or higher as required by authorities having jurisdiction.
 - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.
- O. Adjust set-point temperature of the conditioned air controllers to the system design temperature.
- P. Before installing copper tubing other than Type ACR, clean tubing and fittings with trichloroethylene.
- Q. Replace core of filter-dryer after system has been adjusted and design flow rates and pressures are established.
- R. Charge system using the following procedures:
 - 1. Install core in filter-dryer after leak test but before evacuation.
 - 2. Evacuate entire refrigerant system with a vacuum pump to a vacuum of 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
 - 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.



4. Charge system with a new filter-dryer core in charging line. Provide full-operating charge.

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END OF SECTION



SECTION 23 23 00 00 - MPF REFRIGERANT PIPING

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUBMITTALS:

- A. Product Data: Include pressure drop, based on manufacturer's test data, for thermostatic expansion valves, solenoid valves, and pressure-regulating valves.
- B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationship between piping and equipment.
 - 1. Size piping and design the actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes, to ensure proper operation and compliance with warranties of connected equipment.
 - 2.

1.2 QUALITY ASSURANCE:

- A. ASHRAE Standard: Comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."
- B. ASME Standard: Comply with ASME B31.5, "Refrigeration Piping."
- C. UL Standard: Provide products complying with UL 207, "Refrigerant-Containing Components and Accessories, Nonelectrical"; or UL 429, "Electrically Operated Valves."

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS:

- A. Drawn-Temper Copper Tube: ASTM B 280, Type ACR.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.

- D. Bronze Filler Metals: AWS A5.8, Classification BAg-1 (silver)

2.2 REFRIGERANT PIPING SPECIALITIES:

- A. Replaceable-Core Filter-Dryers: 500-psig maximum working pressure; heavy gage protected with corrosion-resistant-painted steel shell, flanged ring and spring, ductile-iron cover plate with steel cap screws; wrought-copper fittings for solder-end connections; with replaceable-core kit, including gaskets and the following:
1. Filter-Dryer Cartridge: Pleated media with solid-core sieve with activated alumina, ARI 730 rated for capacity.
 2. Service Valves: 500-psig (3450-kPa) pressure rating; forged-brass body with copper stubs, brass caps, removable valve core, integral ball check valve, and with solder-end connections.
 3. Pressure-Regulating Valves: Comply with ARI 770; direct acting, brass; with pilot operator, stainless-steel diaphragm, standard coil, and solder-end connection; suitable for refrigerant specified.
 4. Pressure Relief Valves: Straight-through or angle pattern, brass body and disc, neoprene seat, and factory sealed and ASME labeled for standard pressure setting.
 5. Thermostatic Expansion Valves: Comply with ARI 750; brass body with stainless-steel parts; thermostatic-adjustable, modulating type; size and operating characteristics as recommended by manufacturer of evaporator, and factory set for superheat requirements; solder-end connections; with sensing bulb, distributor having side connection for hot-gas bypass line, and external equalizer line.
 6. Hot-Gas Bypass Valve: Pulsating-dampening design, stainless-steel bellows and polytetrafluoroethylene valve seat; adjustable; sized for capacity equal to last step of compressor unloading; with solder-end connections.
 7. Moisture/Liquid Indicators: 500-psig (3450-kPa) maximum working pressure and 200 deg F (93 deg C) operating temperature; all-brass body with replaceable, polished, optical viewing window with color-coded moisture indicator; with solder-end connections.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS:

- A. Aboveground, within Building: Type ACR drawn-copper tubing or Type L (Type B) drawn-copper tubing.
- B. Belowground for NPS 2 (DN 50) and Smaller: Type K (Type A) annealed-copper tubing.

3.2 PIPING INSTALLATION:

- A. Install refrigerant piping according to ASHRAE 15. Equipment manufacturer shall size refrigerant lines for Contractor.
- B. Basic piping installation requirements are specified in Division 23 Section "Common Work for HVAC."
- C. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- D. Arrange piping to allow inspection and service of compressor and other equipment. Install valves and specialties in accessible locations to allow for service and inspection.
- E. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.

- F. Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanical injury.
- G. Slope refrigerant piping as follows:
 - 1. Install horizontal suction lines with a uniform slope downward to compressor.
 - 2. Install traps and double risers to entrain oil in vertical runs.
 - 3. Liquid lines may be installed level.
- H. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports."
- I. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
- J. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 - 2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 - 3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
 - 4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
- K. Support vertical runs at each floor.
- L. Pipe Joint Construction:
 - 1. Braze joints according to Division 23 Section "Common Work for HVAC."
 - 2. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide) during brazing to prevent scale formation.
- M. Refrigerant Pipe Insulation:
 - 1. Insulate refrigerant piping according to Division 23 Section "Pipe Insulation."
- N. Test and inspect refrigerant piping according to ASME B31.5, Chapter VI.
 - 1. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure.
 - 2. Test high- and low-pressure side piping of each system at not less than the lower of the design pressure or the setting of pressure relief device protecting high and low side of system.
 - a. System shall maintain test pressure at the manifold gage throughout duration of test.
 - b. Test joints and fittings by brushing a small amount of soap and glycerine solution over joint.
 - c. Fill system with nitrogen to raise a test pressure of 150 psig or higher as required by authorities having jurisdiction.
 - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.
- O. Adjust set-point temperature of the conditioned air controllers to the system design temperature.
- P. Before installing copper tubing other than Type ACR, clean tubing and fittings with trichloroethylene.
- Q. Replace core of filter-dryer after system has been adjusted and design flow rates and pressures are established.
- R. Charge system using the following procedures:
 - 1. Install core in filter-dryer after leak test but before evacuation.
 - 2. Evacuate entire refrigerant system with a vacuum pump to a vacuum of 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
 - 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
 - 4. Charge system with a new filter-dryer core in charging line. Provide full-operating charge.



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END OF SECTION 23 23 00 00



Task	Specification	Specification Description
23 23 13 00	22 05 23 00	Piped Utilities Basic Materials And Methods



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SECTION 23 23 16 00 - REFRIGERANT DETECTION AND ALARM**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for refrigerant detection and alarm. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes refrigerant monitors, notification appliances, and SCBA.

C. Definitions

1. CMOS: Complementary metal-oxide semiconductor.
2. LCD: Liquid-crystal display.
3. LED: Light-emitting diode.
4. MOS: Metal-oxide semiconductor.
5. NDIR: Non-dispersive infrared.
6. PIR: Photoacoustic infrared.
7. SCBA: Self-contained breathing apparatus.

D. Submittals

1. Product Data:
 - a. For each type of refrigerant monitor, include refrigerant sensing range in ppm, temperature and humidity range, alarm outputs, display range, furnished specialties, installation requirements, and electric power requirement.
 - b. For SCBA, include mounting details, service requirements, and compliance with authorized Federal agency.
2. Shop Drawings:
 - a. Air-Sampling Tubing: Size, routing, and termination including elevation above finished floor.
 - b. Wiring Diagrams: Power, signal, and control wiring.
3. Product Certificates: For monitoring devices and SCBA, signed by product manufacturer.
4. Field quality-control test reports.
5. Operation and maintenance data.

1.2 PRODUCTS**A. CMOS OR MOS, as directed, Refrigerant Monitor**

1. Description: Sensor shall be factory tested, calibrated, and certified to continuously measure and display the specific gas concentration and shall be capable of indicating, alarming, shutting down fuel-fired equipment, **as directed**, and automatically activating ventilation system.
2. ASHRAE: Monitoring system shall comply with ASHRAE 15.
3. Performance:
 - a. Refrigerant to Be Monitored: R-22 **OR** R-134a **OR** R-407C **OR** R-410A, **as directed**.
 - b. Range: 0 to 1000 ppm.
 - c. Minimum Detectability: 50 ppm, **as directed**.
 - d. Accuracy: Maximum 10 percent of full scale.
 - e. Repeatability: Maximum plus or minus 2 percent of full scale.
 - f. Response: Maximum 150 seconds for 90 percent of full scale, and 20-second step change.
 - g. Detection Level Set Points:

- 1) Detection Level 1: 50 ppm, **as directed**.
- 2) Detection Level 2: 250 ppm, **as directed**.
- h. Operating Temperature: 32 to 104 deg F (0 to 40 deg C).
- i. Relative Humidity: 20 to 95 percent, noncondensing over the operating temperature range.
- j. Site Elevation: Maximum 6560 feet (2000 m), **as directed**.
4. Input/Output Features:
 - a. Maximum Power Input: 120-V ac, 60 Hz, 75 W.
 - b. Number of Sensor/Transmitter Points: One **OR** Four, **as directed**.
 - c. Alarm Relays: Minimum 3 relays at a minimum of 5-A resistive load each.
 - d. Alarm Set Points: Displayed and adjustable through keypad on front of meter.
 - e. Alarm Silence Switch: Mount in the front panel of the monitor to stop audible and visual notification appliances, but alarm LED remains illuminated.
 - f. Alarm Manual Reset: Momentary-contact push button in the front panel of the monitor stops audible and visual notification appliances, extinguishes alarm LED, and returns monitor to detection mode at current detection levels.
 - g. Display: Alphanumeric LCD, LED indicating lights for each detection level; acknowledge switch and test switch mounted on front panel; alarm status LEDs and service fault/trouble LEDs.
 - h. Audible Output: Minimum 75 dB at 10 feet (3 m).
 - i. Visible Output: Strobe light.
 - j. Analog Output: 0- to 10-V dc into 2k ohms, or 4- to 20-mA into 1k ohms.
 - k. Serial Output: RS-232 or RS-485 compatible with HVAC controls, **as directed**.
 - l. Enclosure: NEMA 250, Type 1 **OR** Type 12, **as directed**, with locking quarter-turn latch and key.

B. NDIR Refrigerant Monitor

1. Description: Sensor shall be factory tested, calibrated, and certified to continuously measure and display the specific gas concentration and shall be capable of indicating, alarming, shutting down fuel-fired equipment, **as directed**, and automatically activating ventilation system.
2. ASHRAE: Monitoring system shall comply with ASHRAE 15.
3. Performance:
 - a. Refrigerant to Be Monitored: R-22 **OR** R-123 **OR** R-134a **OR** R-407C **OR** R-410A, **as directed**.
 - b. Range: 0 to 1000 ppm.
 - c. Sensitivity:
 - 1) Minimum Detectability: 10 ppm, **as directed**.
 - 2) Accuracy: 0 to 100 ppm; plus or minus 10 ppm. 100 to 1000 ppm; plus or minus 10 percent of reading.
 - 3) Repeatability: Plus or minus 1 percent of full scale.
 - 4) Response: Maximum 10, **as directed**, seconds per sample.
 - 5) Detection Level Set Points:
 - a) Detection Level 1: 1 ppm, **as directed**.
 - b) Detection Level 2 **OR** Level 1, **as directed**: 10 **OR** 50, **as directed**, ppm.
 - c) Detection Level 3 **OR** Level 2, **as directed**: 50 **OR** 250, **as directed**, ppm.
 - d. Sensitivity:
 - 1) Minimum Detectability: 20 ppm, **as directed**.
 - 2) Accuracy: 0 to 100 ppm; plus or minus 20 ppm, 100 to 1000 ppm; plus or minus 5 percent of reading.
 - 3) Repeatability: Plus or minus 1 percent of full scale.
 - 4) Response: 50 percent of a step change in 60 seconds.
 - 5) Detection Level Set Points:
 - a) Detection Level 1: 20 ppm, **as directed**.
 - b) Detection Level 2 **OR** Level 1, **as directed**: 50 ppm, **as directed**.
 - c) Detection Level 3 **OR** Level 2, **as directed**: 250 ppm, **as directed**.
 - e. Operating Temperature: 32 to 104 deg F (0 to 40 deg C).

- f. Relative Humidity: 20 to 95 percent, noncondensing over the operating temperature range. Compensate sensor for relative humidity, **as directed**.
- g. Site Elevation: Maximum 6560 feet (2000 m), **as directed**.
- 4. Input/Output Features:
 - a. Maximum Power Input: 120-V ac, 60 Hz, 75 W.
 - b. Number of Air-Sampling Points: One **OR** Four **OR** Eight **OR** 16, **as directed**.
 - c. Air-Sampling Point Inlet Filter: 0.10-micron filter element for each sampling point.
 - d. Air-Sampling Point Analog Output: 0- to 10-V dc into 2k ohms, or 4- to 20-mA into 1k ohms matched to sensor output.
 - e. Alarm Relays: Minimum 3 **OR** 4, **as directed**, relays at a minimum of 5-A resistive load each.
 - f. Alarm Set Points: Displayed on front of meter and adjustable through keypad on front of meter.
 - g. Alarm Acknowledge Switch: Mount in the front panel of the monitor to stop audible and visual notification appliances, but alarm LED remains illuminated.
 - h. Alarm Manual Reset: Momentary-contact push button in the front panel of the monitor stops audible and visual notification appliances, extinguishes alarm LED, and returns monitor to detection mode at current detection levels.
 - i. Display: Alphanumeric LCD, LED indicating lights for each detection level; acknowledge switch and test switch mounted on front panel; alarm status LEDs and service fault LEDs.
 - j. Audible Output: Minimum 75 dB at 10 feet (3 m).
 - k. Visible Output: Strobe light.
 - l. Sensor Analog Output: 0- to 10-V dc into 2k ohms, or 4- to 20-mA into 1k ohms.
 - m. Serial Output: RS-232 or RS-485 compatible with HVAC controls, **as directed**.
 - n. Enclosure: NEMA 250, Type 1 **OR** Type 12, **as directed**, with locking quarter-turn latch and key.

C. PIR Refrigerant Monitor

- 1. Description: Sensor shall be factory tested, calibrated, and certified to continuously measure and display the specific gas concentration and shall be capable of indicating, alarming, shutting down fuel-fired equipment, **as directed**, and automatically activating ventilation system.
- 2. ASHRAE: Monitoring system shall comply with ASHRAE 15 and ASHRAE 147, **as directed**.
- 3. Performance:
 - a. Refrigerant to Be Monitored: R-22 **OR** R-123 **OR** R-134a **OR** R-407C **OR** R-410A, **as directed**.
 - b. Range: 0 to 1000 ppm.
 - c. Sensitivity:
 - 1) Minimum Detectability: 1 ppm, **as directed**.
 - 2) Accuracy: 0 to 50 ppm; plus or minus 1 ppm. 51 to 1000 ppm; plus or minus 10 percent of reading.
 - 3) Repeatability: Plus or minus 1 percent of full scale.
 - 4) Response: Maximum 10, **as directed**, seconds per sample.
 - 5) Detection Level Set Points:
 - a) Detection Level 1: 1 ppm, **as directed**.
 - b) Detection Level 2 **OR** Level 1, **as directed**: 10 **OR** 50, **as directed**, ppm.
 - c) Detection Level 3 **OR** Level 2, **as directed**: 50 **OR** 250, **as directed**, ppm.
 - d. Sensitivity:
 - 1) Minimum Detectability: 20 ppm, **as directed**.
 - 2) Accuracy: 0 to 100 ppm; plus or minus 20 ppm, 100 to 1000 ppm; plus or minus 5 percent of reading.
 - 3) Repeatability: Plus or minus 1 percent of full scale.
 - 4) Response: 50 percent of a step change in 60 seconds.
 - 5) Detection Level Set Points:
 - a) Detection Level 1: 20 ppm, **as directed**.
 - b) Detection Level 2 **OR** Level 1, **as directed**: 50 ppm, **as directed**.
 - c) Detection Level 3 **OR** Level 2, **as directed**: 250 ppm, **as directed**.

- e. Operating Temperature: 32 to 104 deg F (0 to 40 deg C).
- f. Relative Humidity: 20 to 95 percent, noncondensing over the operating temperature range. Compensate sensor for relative humidity.
- g. Site Elevation: Maximum 6560 feet (2000 m), **as directed**.
- 4. Input/Output Features:
 - a. Maximum Power Input: 120-V ac, 60 Hz, 75 W.
 - b. Number of Air-Sampling Points: One **OR** Four **OR** Eight **OR** 16, **as directed**.
 - c. Air-Sampling Point Inlet Filter: 0.10-micron filter element for each sampling point.
 - d. Air-Sampling Point Analog Output: 0- to 10-V dc into 2k ohms, or 4- to 20-mA into 1k ohms matched to sensor output.
 - e. Alarm Relays: Minimum 3 **OR** 4, **as directed**, relays at a minimum of 5-A resistive load each.
 - f. Alarm Set Points: Displayed and adjustable through keypad on front of meter.
 - g. Alarm Silence Switch: Mount in the front panel of the monitor to stop audible and visual notification appliances, but alarm LED remains illuminated.
 - h. Alarm Manual Reset: Momentary-contact push button in the front panel of the monitor stops audible and visual notification appliances, extinguishes alarm LED, and returns monitor to detection mode at current detection levels.
 - i. Display: Alphanumeric LCD, LED indicating lights for each detection level; acknowledge switch and test switch mounted on front panel; alarm status LEDs and service fault/trouble LEDs.
 - j. Audible Output: Minimum 75 dB at 10 feet (3 m).
 - k. Visible Output: Strobe light.
 - l. Sensor Analog Output: 0- to 10-V dc into 2k ohms, or 4- to 20-mA into 1k ohms.
 - m. Serial Output: RS-232 or RS-485 compatible with HVAC controls, **as directed**.
 - n. Enclosure: NEMA 250, Type 1 **OR** Type 12, **as directed**, with locking quarter-turn latch and key.

D. Monitor Alarm Sequence

- 1. Detection Level 1: Notify HVAC control workstation of detection in the refrigeration equipment room on a rise or fall of refrigerant concentration to this level. Start ventilation system at low speed to allow occupancy by maintenance technicians to identify leaks. Cycle blue strobe lights.
- 2. Detection Level 2 **OR** Level 1, **as directed**: Notify the HVAC control workstation of the detection in the refrigeration equipment room on a rise or fall of refrigerant concentration to this level. Run ventilation system at high speed on a rise in concentration to this level, and change to low speed on a reduction in concentration below this level. Operate the ventilation system at high speed for a minimum of five minutes. Cycle amber strobe lights.
- 3. Detection Level 3 **OR** Level 2, **as directed**: Notify the HVAC control workstation of the detection in the refrigeration equipment room on a rise or fall of refrigerant concentration to this level. Sound alarm horns and cycle red strobe lights inside and outside refrigeration equipment room. Terminate operation of any combustion-process equipment located in the refrigeration equipment room. Provide manual reset for this detection level.
- 4. Sensor Fault/Trouble: Notify HVAC control workstation of fault/trouble detection in monitor.

E. Notification Appliances

- 1. Horns: Comply with UL 464; electric-vibrating-polarized type, listed by a qualified testing agency with provision for housing the operating mechanism behind a grille. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn.
- 2. Visible Alarm Devices: Comply with UL 1971; three color xenon strobe lights, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The words "REFRIGERANT DETECTION" printed in minimum 1/2-inch- (13-mm-) high letters on the lens. Rated light output is 75 **OR** 110, **as directed**, candela.

F. Air-Sampling Tubing

- 1. Annealed-Temper Copper Tubing: ASTM B 88, Type L (ASTM B 88M, Type B).

2. Polyethylene Tubing: ASTM D 2737, flame-retardant, nonmetallic tubing rated for ambient temperature range of 10 to 150 deg F (minus 13 to plus 65 deg C).

G. SCBA

1. Description: Open-circuit, pressure-demand, compressed-air SCBA; includes completely assembled, portable, self-contained devices designed for application in hazardous breathing environment. Tested and certified by the National Institute for Occupational Safety and Health and the Mine Safety and Health Administration according to 42 CFR 84, Subpart H.
2. Face Piece: Silicon, EPDM, or nitrile rubber], one-size-fits-all with double-sealing edge, stainless-steel speaking diaphragm and lens retainer, five adjustable straps to hold face piece to head (two straps on each side and one on top), exhalation valve in mask, close-fitting nose piece to ensure no CO₂ buildup, and perspiration drain to avoid skin irritation and prevent lens fogging.
3. Backplate: Ergonomically designed of glass fiber, aluminum, or thermoset plastic.
4. Harness and Carrier Assembly: Large triangular back pad, with backplate and adjustable waist and shoulders straps. Modular design, detachable components, easy to clean and maintain. Shoulder straps are padded with flame-resistant material, reinforced with stainless-steel cable, and attached with T-nuts, washers, and screws.
5. Air Cylinder, Regulator, and Pressure Gages: 30 **OR** 45 **OR** 60, **as directed**, -minute, low-pressure 2216-psig (15.3-MPa), carbon-fiber composite, fiberglass composite, or all-aluminum cylinders fitted with quick-fill assembly for refilling and air transfer. Two-stage regulator, and gage with end of service time whistle signal.
6. Wall-Mounted Case: Watertight, high visibility orange or yellow, **as directed**, corrosion-resistant, tough, lockable plastic case.

1.3 EXECUTION

A. Installation

1. Comply with ASHRAE 15 and ASHRAE 147, **as directed**.
2. Install air-sampling inlets, or diffusion type monitors in pits, tunnels, or trenches in machinery room that are accessible to personnel.
3. Floor mount diffusion-type monitor, sensor/transmitters, or air-sampling inlets on slotted channel frame 12 to 18 inches (300 to 450 mm) above the floor in a location near the refrigerant source or between the refrigerant source and the ventilation duct inlet.
4. Wall mount air-sampling multiple-point monitors with top of unit 60 inches (1525 mm) above finished floor.
5. Run air-sampling tubing from monitor to air-sampling point, in size as required by monitor manufacturer. Install tubing with maximum unsupported length of 36 inches (915 mm), for tubing exposed to view. Terminate air-sampling tubing at sampling point with filter recommended by monitor manufacturer.
6. Install air-sampling tubing with sufficient slack and flexible connections to allow for vibration of tubing and movement of equipment.
7. Purge air-sampling tubing with dry, oil-free compressed air before connecting to monitor.
8. Number-code or color-code air-sampling tubing for future identification and service of air-sampling multiple-point monitors.
9. Extend air-sampling tubing from exhaust part of multiple-point monitors to outside.
10. Extend air-sampling tubing from outdoors to outdoor inlet connection of NDIR monitors. Terminate air-sampling tubing at outdoor inlet location with filter recommended by monitor manufacturer.
11. Install warning signs, labels, and nameplates to identify detection devices according to Division 23 Section "Identification For Hvac Piping And Equipment".
12. Place warning signs inside and outside each door to the refrigeration equipment room. Sample wording: "AUDIBLE AND VISUAL ALARM SOUNDING INDICATES REFRIGERANT DETECTION - ENTRY REQUIRES SELF-CONTAINED BREATHING APPARATUS."



13. Audible Alarm-Indicating Devices: Install at each entry door to refrigeration equipment room, and position not less than 6 inches (150 mm) below the ceiling. Install horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
14. Visible Alarm-Indicating Devices: Install adjacent to each alarm horn at each entry door to refrigeration equipment room, and position at least 6 inches (150 mm) below the ceiling.
15. Mount primary and secondary backup, **as directed**, SCBA on wall outside each, **as directed**, interior door to refrigeration equipment room.

B. Field Quality Control

1. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
2. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
3. Perform tests and inspections and prepare test reports.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
4. Tests and Inspections:
 - a. Inspect field-assembled components, equipment installation, and electrical connections for compliance with requirements.
 - b. Test and adjust controls and safeties.
 - c. Test Reports: Prepare a written report to record the following:
 - 1) Test procedures used.
 - 2) Test results that comply with requirements.
 - 3) Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
5. Repair or replace malfunctioning units and retest as specified above.

C. Demonstration

1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain refrigerant detection devices and SCBA equipment.
2. SCBA Training: Provide an instructional video that details operating procedures of equipment.

END OF SECTION 23 23 16 00



23 - Heating, Ventilating, And Air-Conditioning
(HVAC)

Task	Specification	Specification Description
23 23 16 00	21 05 00 00	Common Work Results for Fire Suppression
23 23 16 00	23 01 60 00	Condensing Units
23 23 23 00	23 01 60 00	Condensing Units



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SECTION 23 25 13 00 - HVAC WATER TREATMENT

- A. Description Of Work
1. This specification covers the furnishing and installation of materials for HVAC water treatment. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work
- B. Summary
1. This Section includes the following HVAC water-treatment systems:
 - a. Bypass chemical-feed equipment and controls.
 - b. Biocide chemical-feed equipment and controls.
 - c. Ozone-generator biocide equipment and controls.
 - d. UV-irradiation unit, biocide equipment, and controls.
 - e. Chemical treatment test equipment.
 - f. HVAC water-treatment chemicals.
 - g. Makeup water softeners.
 - h. RO equipment for HVAC makeup water.
 - i. Water filtration units for HVAC makeup water.
- C. Definitions
1. EEPROM: Electrically erasable, programmable read-only memory.
 2. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
 3. RO: Reverse osmosis.
 4. TDS: Total dissolved solids.
 5. UV: Ultraviolet.
- D. Performance Requirements
1. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment.
 2. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.
 3. Closed hydronic systems, including hot-water heating, chilled water, dual-temperature water, and glycol cooling, shall have the following water qualities:
 - a. pH: Maintain a value within 9.0 to 10.5.
 - b. "P" Alkalinity: Maintain a value within 100 to 500 ppm.
 - c. Boron: Maintain a value within 100 to 200 ppm.
 - d. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.
 - e. Soluble Copper: Maintain a maximum value of 0.20 ppm.
 - f. TDS: Maintain a maximum value of 10 ppm.
 - g. Ammonia: Maintain a maximum value of 20 ppm.
 - h. Free Caustic Alkalinity: Maintain a maximum value of 20 ppm.
 - i. Microbiological Limits:
 - 1) Total Aerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.
 - 2) Total Anaerobic Plate Count: Maintain a maximum value of 100 organisms/ml.
 - 3) Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.
 - 4) Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.
 - 5) Iron Bacteria: Maintain a maximum value of 0 organisms/ml.
 4. Steam Boiler and Steam Condensate:
 - a. Steam Condensate:
 - 1) pH: Maintain a value within 7.8 to 8.4.
 - 2) Total Alkalinity: Maintain a value within 5 to 50 ppm.

- 3) Chemical Oxygen Demand: Maintain a maximum value of 15 ppm.
 - 4) Soluble Copper: Maintain a maximum value of 0.20 ppm.
 - 5) TDS: Maintain a maximum value of 10 ppm.
 - 6) Ammonia: Maintain a maximum value of 20 ppm.
 - 7) Total Hardness: Maintain a maximum value of 2 ppm.
 - b. Steam boiler operating at 15 psig (104 kPa) and less shall have the following water qualities:
 - 1) "OH" Alkalinity: Maintain a value within 200 to 400 ppm.
 - 2) TDS: Maintain a value within 600 to 3000 ppm.
 - c. Steam boiler operating at more than 15 psig (104 kPa) shall have the following water qualities:
 - 1) "OH" Alkalinity: 200 to 400 ppm.
 - 2) TDS: Maintain a value within 600 to 1200 ppm to maximum 30 times RO water TDS.
5. Open hydronic systems, including condenser **OR** fluid-cooler spray, **as directed**, water, shall have the following water qualities:
 - a. pH: Maintain a value within 8.0 to 9.1.
 - b. "P" Alkalinity: Maintain a maximum value of 100 ppm.
 - c. Chemical Oxygen Demand: Maintain a maximum value of 100ppm.
 - d. Soluble Copper: Maintain a maximum value of 0.20 ppm.
 - e. TDS: Maintain a maximum value of 10 ppm.
 - f. Ammonia: Maintain a maximum value of 20 ppm.
 - g. Free "OH" Alkalinity: Maintain a maximum value of 0 ppm.
 - h. Microbiological Limits:
 - 1) Total Aerobic Plate Count: Maintain a maximum value of 10,000 organisms/ml.
 - 2) Total Anaerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.
 - 3) Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.
 - 4) Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.
 - 5) Iron Bacteria: Maintain a maximum value of 0 organisms/ml.
 - i. Polymer Testable: Maintain a minimum value within 10 to 40.
6. Passivation for Galvanized Steel: For the first 60 days of operation.
 - a. pH: Maintain a value within 7 to 8.
 - b. Calcium Carbonate Hardness: Maintain a value within 100 to 300 ppm.
 - c. Calcium Carbonate Alkalinity: Maintain a value within 100 to 300 ppm.

E. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Pretreatment and chemical treatment equipment showing tanks, maintenance space required, and piping connections to HVAC systems. Include plans, elevations, sections, details, and attachments to other work.
 - a. Wiring Diagrams: Power and control wiring.
3. Field quality-control test reports.
4. Manufacturer Seismic Qualification Certification
5. Other Informational Submittals:
 - a. Water-Treatment Program: Written sequence of operation on an annual basis for the application equipment required to achieve water quality defined in the "Performance Requirements" Article above.
 - b. Water Analysis: Illustrate water quality available at Project site.
 - c. Passivation Confirmation Report: Verify passivation of galvanized-steel surfaces, and confirm this observation in a letter to the Owner.

F. Quality Assurance

1. HVAC Water-Treatment Service Provider Qualifications: An experienced HVAC water-treatment service provider capable of analyzing water qualities, installing water-treatment equipment, and applying water treatment as specified in this Section.

2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.2 PRODUCTS

A. Manual Chemical-Feed Equipment

1. Bypass Feeders: Steel, with corrosion-resistant exterior coating, minimum 3-1/2-inch (89-mm) fill opening in the top, and NPS 3/4 (DN 20) bottom inlet and top side outlet. Quarter turn or threaded fill cap with gasket seal and diaphragm to lock the top on the feeder when exposed to system pressure in the vessel.
 - a. Capacity: 2 gal. (7.6 L) **OR** 5 gal. (19 L), **as directed**.
 - b. Minimum Working Pressure: 125 psig (860 kPa) **OR** 175 psig (1210 kPa), **as directed**.

B. Automatic Chemical-Feed Equipment

1. Water Meter:
 - a. AWWA C700, oscillating-piston, magnetic-drive, totalization meter.
 - b. Body: Bronze.
 - c. Maximum Pressure Loss at Design Flow: 3 psig (20 kPa).
 - d. Registration: Gallons (Liters) or cubic feet (cubic meters).
 - e. Controls: Flow-control switch with normally open contacts; rated for maximum 10 A, 250-V ac; and that will close at adjustable increments of total flow.
2. Water Meter:
 - a. AWWA C701, turbine-type, totalization meter.
 - b. Body: Bronze.
 - c. Minimum Working-Pressure Rating: 100 psig (690 kPa).
 - d. Maximum Pressure Loss at Design Flow: 3 psig (20 kPa).
 - e. Registration: Gallons (Liters) or cubic feet (cubic meters).
 - f. End Connections: Threaded.
 - g. Control: Low-voltage signal capable of transmitting 1000 feet (305 m).
3. Water Meter:
4. AWWA C701, turbine-type, totalization meter.
 - a. Body: Bronze **OR** Epoxy-coated cast iron, **as directed**.
 - b. Minimum Working-Pressure Rating: 150 psig (1035 kPa).
 - c. Maximum Pressure Loss at Design Flow: 3 psig (20 kPa).
 - d. Registration: Gallons (Liters) or cubic feet (cubic meters).
 - e. End Connections: Flanged.
 - f. Controls: Flow-control switch with normally open contacts; rated for maximum 10 A, 250-V ac; and that will close at adjustable increments of total flow.
5. Inhibitor Injection Timers:
 - a. Microprocessor-based controller with LCD display in NEMA 250, Type 12 enclosure with gasketed and lockable door. Interface for start/stop and status indication at central workstation as described in Division 23 Section "Instrumentation And Control For Hvac".
 - b. Programmable timers with infinite adjustment over full range, and mounted in cabinet with hand-off-auto switches and status lights.
 - c. Test switch.
 - d. Hand-off-auto switch for chemical pump.
 - e. Illuminated legend to indicate feed when pump is activated.
 - f. Programmable lockout timer with indicator light. Lockout timer to deactivate the pump and activate alarm circuits.
 - g. LCD makeup totalizer to measure amount of makeup and bleed-off water from two water meter inputs.
6. pH Controller:

- a. Microprocessor-based controller, 1 percent accuracy in a range from zero to 14 units. Incorporate solid-state integrated circuits and digital LCD display in NEMA 250, Type 12 enclosure with gasketed and lockable door. Interface for start/stop and status indication at central workstation as described in Division 23 Section "Instrumentation And Control For Hvac".
- b. Digital display and touch pad for input.
- c. Sensor probe adaptable to sample stream manifold.
- d. High, low, and normal pH indication.
- e. High or low pH alarm light, trip points field adjustable; with silence switch.
- f. Hand-off-auto switch for acid pump.
- g. Internal adjustable hysteresis or deadband.
- 7. TDS Controller:
 - a. Microprocessor-based controller, 1 percent accuracy in a range from zero to 5000 micromhos. Incorporate solid-state integrated circuits and digital LCD display in NEMA 250, Type 12 enclosure with gasketed and lockable door. Interface for start/stop and status indication at central workstation as described in Division 23 Section "Instrumentation And Control For Hvac".
 - b. Digital display and touch pad for input.
 - c. Sensor probe adaptable to sample stream manifold.
 - d. High, low, and normal conductance indication.
 - e. High or low conductance alarm light, trip points field adjustable; with silence switch.
 - f. Hand-off-auto switch for solenoid bleed-off valve.
 - g. Bleed-off valve activated indication.
 - h. Internal adjustable hysteresis or deadband.
 - i. Bleed Valves:
 - 1) Cooling Systems: Forged-brass body, globe pattern, general-purpose solenoid with continuous-duty coil, or motorized valve.
 - 2) Steam Boilers: Motorized ball valve, steel body, and TFE seats and seals.
- 8. Biocide Feeder Timer:
 - a. Microprocessor-based controller with digital LCD display in NEMA 250, Type 12 enclosure with gasketed and lockable door. Interface for start/stop and status indication at central workstation as described in Division 23 Section "Instrumentation And Control For Hvac".
 - b. 24-hour timer with 14-day skip feature to permit activation any hour of day.
 - c. Precision, solid-state, bleed-off lockout timer and clock-controlled biocide pump timer. Prebleed and bleed lockout timers.
 - d. Solid-state alternator to enable use of two different formulations.
 - e. 24-hour display of time of day.
 - f. 14-day display of day of week.
 - g. Battery backup so clock is not disturbed by power outages.
 - h. Hand-off-auto switches for biocide pumps.
 - i. Biocide A and Biocide B pump running indication.
- 9. Chemical Solution Tanks:
 - a. Chemical-resistant reservoirs fabricated from high-density opaque polyethylene with minimum 110 percent containment vessel.
 - b. Molded cover with recess for mounting pump.
 - c. Capacity: 30 gal. (114 L) **OR** 50 gal. (189 L) **OR** 120 gal. (454 L), **as directed**.
- 10. Chemical Solution Injection Pumps:
 - a. Self-priming, positive-displacement; rated for intended chemical with minimum 25 percent safety factor for design pressure and temperature.
 - b. Adjustable flow rate.
 - c. Metal and thermoplastic construction.
 - d. Built-in relief valve.
 - e. Fully enclosed, continuous-duty, single-phase motor. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".

11. Chemical Solution Tubing: Polyethylene tubing with compression fittings and joints except ASTM A 269, Type 304, stainless steel for steam boiler injection assemblies.
 12. Injection Assembly:
 - a. Quill: Minimum NPS 1/2 (DN 15) with insertion length sufficient to discharge into at least 25 percent of pipe diameter.
 - b. Ball Valve: Three **OR** Two, **as directed**, -piece, stainless steel; selected to fit quill.
 - c. Packing Gland: Mechanical seal on quill of sufficient length to allow quill removal during system operation.
 - d. Assembly Pressure/Temperature Rating: Minimum 600 psig (4137 kPa) at 200 deg F (93 deg C).
- C. Ozone-Generator Biocide Equipment
1. Corona discharge generator with stainless-steel generating cells, and transformer housed in a NEMA 250, Type 4 enclosure. Assembly shall be suitable for continuous duty. Provide site glasses to verify proper operation of generator.
 2. Water-cooled generators shall be provided with cooling water at maximum 70 deg F (21 deg C) and 35 psig (241 kPa).
 3. Generator vessels exposed to system pressure shall be constructed according to ASME Boiler and Pressure Vessel Code and be equipped with pressure relief valve.
 4. External air compressor or induced airflow through a cleanable prefilter supplies concentrated oxygen through a molecular sieve with minus 62 deg F (minus 52 deg C) dew point to avoid the formation of nitric acid.
 5. Microprocessor-based control with software in EEPROM, surge protection, high-temperature cutout, and operational status lights. Interface for start/stop and status indication at central workstation as described in Division 23 Section "Instrumentation And Control For Hvac".
 6. Ozone Contactors:
 - a. Bubble diffusers.
 - b. Induction injection nozzle.
 - c. Injectors with static mixers.
 7. Ozone Detector and Alarm Devices:
 - a. Detector:
 - 1) Sensor: Metal dioxide semiconductor.
 - 2) Concentration Range: 0.01 to 0.14 ppm.
 - 3) Accuracy: Plus or minus 20 percent of range.
 - 4) Sensitivity: 0.01 ppm.
 - 5) Response Time: Maximum 10 seconds.
 - 6) Operating Temperature: 50 to 100 deg F (10 to 38 deg C).
 - 7) Relatively Humidity: 20 to 95 percent, noncondensing over the operating temperature range.
 - b. Horns:
 - 1) Electric-vibrating-polarized type.
 - 2) 24-V dc; with provision for housing the operating mechanism behind a grille.
 - 3) Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn.
 - c. Visible Alarm Devices:
 - 1) Xenon strobe lights listed in UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate.
 - 2) Rated Light Output: 75 **OR** 110, **as directed**, candela.
 - 3) Strobe Leads: Factory connected to screw terminals.
 8. Self-Contained Breathing Apparatus: Open-circuit, pressure-demand, compressed air includes completely assembled, portable, self-contained devices designed for hazardous breathing environment application.
 - a. Face Piece: EPDM or silicone rubber construction material, one-size-fits-all with double-sealing edge, stainless-steel speaking diaphragm and lens retainer, five adjustable straps to hold face piece to head (two straps on each side and one on top), exhalation valve in

mask, close-fitting nose piece to ensure no CO₂ buildup, and perspiration drain to avoid skin irritation and to prevent eyepiece, spectacle, and lens fogging.

- b. Backplate: Orthopedically designed of chemical and impact-resistant, glass-fiber composite **OR** aluminum, **as directed**.
- c. Harness and Carrier Assembly: Large triangular back pad, backplate, and adjustable waist and shoulder straps. Modular in design, detachable components, and easy to clean and maintain. Shoulder straps padded with flame-resistant material, reinforced with stainless-steel cable, and attached with T-nuts, washers, and screws.
- d. Air Cylinder: 30 **OR** 45 **OR** 60, **as directed**, -minute, low-pressure, air-supply-loaded fiberglass **OR** aluminum **OR** steel, **as directed**, cylinders fitted with quick-fill assembly for refilling and air transfer.
- e. Wall-Mounting Cabinet: Leakproof, corrosion-resistant, clear, plastic case.
- f. Tested and Certified: By the National Institute for Occupational Safety and Health and by the Mine Safety and Health Administration, according to 42 CFR 84, Subpart H.

D. Stainless-Steel Pipes And Fittings

- 1. Stainless-Steel Tubing: Comply with ASTM A 269, Type 316.
- 2. Stainless-Steel Fittings: Complying with ASTM A 815/A 815M, Type 316, Grade WP-S.
- 3. Two-Piece, Full-Port, Stainless-Steel Ball Valves: ASTM A 351, Type 316 stainless-steel body; ASTM A 276, Type 316 stainless-steel stem and vented ball, carbon-filled TFE seats, threaded body design with adjustable stem packing, threaded ends, and 250-psig (1725-kPa) SWP and 600-psig (4140-kPa) CWP ratings.
- 4. Three-Piece, Full-Port, Stainless-Steel Ball Valves: ASTM A 351, Type 316 stainless-steel body; ASTM A 276, Type 316 stainless-steel stem and vented ball, threaded body design with adjustable stem packing, threaded ends, and 150-psig (1035-kPa) SWP and 600-psig (4140-kPa) CWP rating.

E. UV Biocide Equipment

- 1. Target Irradiation: Minimum 30,000 microwatts x s/sq. cm.
- 2. Light Source Vessels:
 - a. ASTM A 666, Type 304 stainless steel.
 - b. Construct for minimum 150 psig (1035 kPa) at 150 deg F (65 deg C) according to ASME Boiler and Pressure Vessel Code, and equipped with pressure relief valve.
 - c. Light Source Sleeve: Quartz, with EPDM O-ring seals.
 - d. Light Source: Replaceable UV lamp producing minimum target irradiation of 254-nm wavelength light.
- 3. Controls: Interlock with pumps to operate when water is circulating.

F. Chemical Treatment Test Equipment

- 1. Test Kit: Manufacturer-recommended equipment and chemicals in a wall-mounting cabinet for testing pH, TDS, inhibitor, chloride, alkalinity, and hardness; sulfite and testable polymer tests for high-pressure boilers, and oxidizing biocide test for open cooling systems.
- 2. Sample Cooler:
 - a. Tube: Sample.
 - 1) Size: NPS 1/4 (DN 8) tubing.
 - 2) Material: ASTM A 666, Type 316 stainless steel.
 - 3) Pressure Rating: Minimum 2000 psig (13 790 kPa).
 - 4) Temperature Rating: Minimum 850 deg F (454 deg C).
 - b. Shell: Cooling water.
 - 1) Material: ASTM A 666, Type 304 stainless steel.
 - 2) Pressure Rating: Minimum 250 psig (1725 kPa).
 - 3) Temperature Rating: Minimum 450 deg F (232 deg C).
 - c. Capacities and Characteristics:
 - 1) Tube: Sample.
 - a) Flow Rate: 0.25 gpm (0.016 L/s).

- b) Entering Temperature: 400 deg F (204 deg C).
 - c) Leaving Temperature: 88 deg F (31 deg C).
 - d) Pressure Loss: 6.5 psig (44.8 kPa).
 - 2) Shell: Cooling water.
 - a) Flow Rate: 3 gpm (0.19 L/s).
 - b) Entering Temperature: 70 deg F (21 deg C).
 - c) Pressure Loss: 1.0 psig (6.89 kPa).
 - 3. Corrosion Test-Coupon Assembly: Constructed of corrosive-resistant material, complete with piping, valves, and mild steel and copper coupons. Locate copper coupon downstream from mild steel coupon in the test-coupon assembly.
 - a. Two-station rack for closed-loop systems.
 - b. Four-station rack for open systems.
- G. Chemicals
- 1. Chemicals shall be as recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment, and that can attain water quality specified in Part 1.1 "Performance Requirements" Article.
 - 2. Water Softener Chemicals:
 - a. Mineral: High-capacity, sulfonated-polystyrene ion-exchange resin that is stable over entire pH range with good resistance to bead fracture from attrition or shock. Resin exchange capacity minimum 30,000 grains/cu. ft. (69 kg/cu. m) of calcium carbonate of resin when regenerated with 15 lb (6.8 kg) of salt.
 - b. Salt for Brine Tanks: High-purity sodium chloride, free of dirt and foreign material. Rock and granulated forms are not acceptable.
- H. HVAC Makeup Water Softener
- 1. Description: Twin mineral tanks and one brine tank, factory mounted on skid.
 - 2. Fabricate supports and attachments to tanks with reinforcement strong enough to resist tank movement during seismic event when tank supports are anchored to building structure as recommended in writing by manufacturer.
 - 3. Mineral Tanks:
 - a. Fabricate and label steel filter tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - b. Fabricate and label FRP filter tanks to comply with ASME Boiler and Pressure Vessel Code: Section X, if indicated.
 - c. Pressure Rating: 100 psig (690 kPa) **OR** 125 psig (860 kPa) **OR** 150 psig (1035 kPa), **as directed**, minimum.
 - d. Wetted Components: Suitable for water temperatures from 40 to at least 100 deg F (5 to at least 38 deg C).
 - e. Freeboard: 50 percent, minimum, for backwash expansion above the normal resin bed level.
 - f. Support Legs or Skirt: Constructed of structural steel, welded or bonded to tank before testing and labeling.
 - g. Finish: Hot-dip galvanized on exterior and interior of tank after fabrication.
 - h. Upper Distribution System: Single-point type, fabricated from galvanized-steel pipe and fittings.
 - i. Lower Distribution System: Hub and radial-arm or header-lateral type; fabricated from PVC pipe and fittings with individual, fine-slotted, nonclogging PE strainers; arranged for even-flow distribution through resin bed.
 - 4. Controls: Automatic; factory mounted on mineral tanks and factory wired.
 - a. Adjustable duration of regeneration steps.
 - b. Push-button start and complete manual operation override.
 - c. Pointer on pilot-control valve shall indicate cycle of operation.
 - d. Means of manual operation of pilot-control valve if power fails.
 - e. Main Operating Valves: Industrial, automatic, multiport, diaphragm type with the following features:

- 1) Slow opening and closing, nonslam operation.
 - 2) Diaphragm guiding on full perimeter from fully open to fully closed.
 - 3) Isolated dissimilar metals within valve.
 - 4) Self-adjusting, internal, automatic brine injector that draws brine and rinses at constant rate independent of pressure.
 - 5) Float-operated brine valve to automatically measure the correct amount of brine to the softener and refill with fresh water.
 - 6) Sampling cocks for soft water.
 - f. Flow Control: Automatic control of backwash and flush rates over variations in operating pressures that do not require field adjustments. Equip mineral tanks with automatic-reset-head water meter that electrically activates cycle controller to initiate regeneration at preset total in gallons (liters), and automatically resets after regeneration to preset total in gallons (liters) for next service run. Include alternator to regenerate one mineral tank with the other in service.
 5. Brine Tank: Combination measuring and wet-salt storing system.
 - a. Tank and Cover Material: Fiberglass a minimum of 3/16 inch (4.8 mm) thick; or molded PE a minimum of 3/8 inch (9.5 mm) thick.
 - b. Brine Valve: Float operated and plastic fitted for automatic control of brine withdrawn and freshwater refill.
 - c. Size: Large enough for at least four regenerations at full salting.
 6. Factory-Installed Accessories:
 - a. Piping, valves, tubing, and drains.
 - b. Sampling cocks.
 - c. Main-operating-valve position indicators.
 - d. Water meters.
 7. Water Test Kit: Include water test kit in wall-mounting enclosure for water softener.
- I. RO Equipment For HVAC Makeup Water
1. Description: Factory fabricated and tested with RO membrane elements in housings, high-pressure pumps and motors, controls, valves, and prefilter; mounted on skid.
 2. Fabricate supports and attachments to tanks with reinforcement strong enough to resist tank movement during seismic event when tank supports are anchored to building structure as recommended in writing by manufacturer.
 3. Skid Assembly: Welded-steel frame coated with epoxy protective finish.
 4. RO Membrane and Housing:
 - a. Element: Thin-film composite with U-cup brine seal with minimum 98 percent salt rejection based on 2000-ppm water supplied at 225 psig (1551 kPa) and 77 deg F (25 deg C).
 - b. Housing: ASTM A 666, Type 304 stainless steel with PVC end caps held in place with stainless-steel straps.
 5. High-Pressure Pumps and Motors:
 - a. Pump:
 - 1) Vertical, multistage centrifugal operating at 3500 rpm with ASTM A 666, Type 304 stainless-steel casing, shaft, impellers, and inlet and discharge casting.
 - 2) Bearings shall be tungsten carbide and ceramic.
 - 3) Cast-iron frame and flanged suction and discharge connections.
 - b. Motor: NEMA-standard, C-faced TEFC motor supported on the pump-bearing frame. General requirements for motors are specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 6. Controls:
 - a. Microprocessor-based controller with LCD display.
 - b. Interlock for remote start/stop control.
 - c. Membrane flush sequence when pumps shut down.
 - d. Run time indicator.
 - e. Low-pressure safety cutoff.
 - f. Panel-mounted gages as follows:

- 1) Product and concentrate.
 - 2) Inlet, cartridge filter outlet, RO feed, RO concentrate, and RO product pressures.
 - 3) Product conductivity monitor.
 7. Valves:
 - a. Stainless-steel pump, concentrate, and recycle throttling valves rated for minimum 300 psig (2068 kPa).
 - b. Automatic inlet shutoff valve, diaphragm type; solenoid actuated, normally closed, and constructed of glass-reinforced noryl thermoplastic.
 - c. PVC valves with EPDM seats and seals for isolation at inlet, and check and sample valves at product and concentrate. Sample valves at cartridge filter outlet, concentrate, and product outlet.
 8. Prefilter:
 - a. Housing: Polypropylene with built-in relief or vent valve.
 - b. Element: Spun-wound polypropylene.
 9. Inlet Water Tempering Valve: Thermostatic water-tempering valve to maintain 77 deg F (25 deg C), **as directed**, inlet water temperature to RO unit.
 10. Activated Carbon Filter:
 - a. Media Tank: Fiberglass-reinforced polyester rated for minimum 150 psig (1035 kPa) with internal backwash distributor and filtered water collector.
 - b. Media: 12 x 40-mesh, bituminous coal-based activated carbon.
 - c. Backwash Valve: Piston-operated control valve with drain-line, flow-control orifice.
 - d. Backwash Control: Seven-day time clock.
 11. Atmospheric Storage Tank:
 - a. Tank: Polyethylene single piece with closed top and flat bottom with manway in top, 0.2-micron filter vent, inlet, discharge, and drain piping connections, and bulkhead fittings for level controls.
 - b. Control: Level switches start and stop RO unit. Low-level limit shall stop repressurization pumps, and signal an alarm.
 12. Repressurization Pumps:
 - a. Pumps: Two close-coupled, single-stage centrifugal pumps, with mechanical seals. Wetted components ASTM A 666, Type 316 stainless steel.
 - b. Controls: NEMA-4X pump control panel constructed of fiberglass to control pumps, one operating, one standby, with automatic alternator and fail-over control.
 - c. Motor: ODP motor supported on the pump-bearing frame. General requirements for motors are specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 13. Water Test Kit: Include water test kit in wall-mounting cabinet for RO unit.
- J. Filtration Equipment
1. Multimedia Filters:
 - a. Description: Factory-fabricated and -tested, simplex, multimedia filter system of filter tank, media, strainer, circulating pump, piping, and controls for removing particles from water.
 - 1) Filter Tank: Corrosion resistant with distribution system and media.
 - a) Fabricate and label steel filter tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - b) Fabricate and label FRP filter tanks to comply with ASME Boiler and Pressure Vessel Code: Section X, if indicated.
 - c) Pipe Connections NPS 2 (DN 50) and Smaller: Threaded according to ASME B1.20.1.
 - d) Steel Tank Pipe Connections NPS 2-1/2 (DN 65) and Larger: Steel, Class 150 flanges according to ASME B16.5 or grooved according to AWWA C606.
 - e) FRP Tank Pipe Connections NPS 2-1/2 (DN 65) and Larger: Type A, integral; Designation E, 125-psig (0.862-MPa) or F, 150-psig (1.034-MPa) pressure category flanges of grade same as tank material according to ASTM D 5421.

- 2) Motorized Valves: Flanged or grooved-end, ductile-iron butterfly type with EPDM valve seat and stem seal; with ASTM B 148 aluminum bronze disc.
 - 3) Strainer: Basket type mounted on pump suction.
 - 4) Piping: ASTM A 53/A 53M, Type S, F, or E; Grade B, Schedule 40 black steel, with flanged, grooved, or threaded joints and malleable, steel welding, or ductile-iron fittings.
 - 5) Piping: ASTM B 88, Type L (ASTM B 88M, Type B) copper water tube, copper-alloy solder-joint fittings, and brazed, flanged, or grooved joints.
 - 6) Safety Valves: Automatic pressure relief.
 - 7) Circulating Pump: Overhung impeller, close coupled, single stage, end suction, centrifugal. Comply with UL 778 and with HI 1.1-1.2 and HI 1.3.
 - a) Casing: Radially split, cast iron.
 - b) Pressure Rating: 125 psig (860 kPa) **OR** 150 psig (1035 kPa), **as directed**, minimum.
 - c) Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, closed, and keyed to shaft.
 - d) Shaft and Shaft Sleeve: Steel shaft, with copper-alloy shaft sleeve.
 - e) Seal: Mechanical.
 - f) Motor: ODP motor supported on the pump-bearing frame. General requirements for motors are specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 8) Controls: Automatic control of circulating pump and tank backwash; factory wired for single electrical connection.
 - a) Panel: NEMA 250, Type 4 enclosure with time clock and pressure gages.
 - b) Pump: Automatic and manual switching; manual switch position bypasses safeties and controls.
 - c) Backwash: Automatic; with time clock and differential pressure switch.
 - d) Backwash Valve: Tank mounted with valves interlocked to single actuator.
 - 9) Support: Skid mounting. Fabricate supports and base and attachment to tank with reinforcement strong enough to resist filter movement during a seismic event when filter base is anchored to building structure.
2. Self-Cleaning Strainers:
- a. Description: Factory-fabricated and -tested, ASTM A 126, Class B, cast-iron or steel, self-cleaning strainer system of tank, strainer, backwash arm or cleaning spiral, drive and motor, piping, and controls for removing particles from water.
 - 1) Fabricate and label ASTM A 126, Class B, cast-iron or steel strainer tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 2) Pipe Connections:
 - a) NPS 2 (DN 50) and Smaller: Threaded according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Steel, Class 150 flanges according to ASME B16.5 or grooved according to AWWA C606.
 - b. Motorized Valves: Flanged or grooved-end, ductile-iron angle type with EPDM valve seat and stem seal; with ASTM B 148 aluminum bronze disc.
 - c. Strainer: ASTM A 666, Type 316 stainless steel.
 - d. Piping: ASTM A 53/A 53M, Type S, F, or E; Grade B, Schedule 40 black steel, with flanged, grooved, or threaded joints and malleable, steel welding, or ductile-iron fittings.
 - e. Safety Valves: Automatic pressure relief.
 - f. Backwash Arm Drive:
 - 1) Drive Casing: Cast iron.
 - 2) Worm Gears: Immersed in oil.
 - 3) Motor: ODP motor supported on the strainer-bearing frame. General requirements for motors are specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - g. Controls: Automatic control of backwash; factory wired for single electrical connection.
 - 1) Panel: NEMA 250, Type 4 enclosure with time clock and pressure gages.

- 2) Backwash Arm Drive: Automatic and manual switching; manual switch position bypasses safeties and controls.
 - 3) Backwash: Automatic; with time clock and differential pressure switch.
 - 4) Backwash Valve: Electric actuator.
 - h. Support: Skid mounting. Fabricate supports and base and attachment to tank with reinforcement strong enough to resist strainer movement during a seismic event when strainer base is anchored to building structure.
- 3. Bag **OR** Cartridge, **as directed**, -Type Filters:
 - a. Description: Floor-mounting housing with filter bags **OR** cartridges, **as directed**, for removing particles from water.
 - 1) Housing: Corrosion resistant; designed to separate inlet from outlet and to direct inlet through bag **OR** cartridge, **as directed**, -type water filter; with bag support and base, feet, or skirt.
 - a) Pipe Connections NPS 2 (DN 50) and Smaller: Threaded according to ASME B1.20.1.
 - b) Steel Housing Pipe Connections NPS 2-1/2 (DN 65) and Larger: Steel, Class 150 flanges according to ASME B16.5 or grooved according to AWWA C606.
 - c) Plastic Housing Pipe Connections NPS 2-1/2 (DN 65) and Larger: 150-psig (1035-kPa) plastic flanges.
 - 2) Bag **OR** Cartridge, **as directed**: Replaceable; of shape to fit housing.
- 4. Centrifugal Separators:
 - a. Description: Simplex separator housing with baffles and chambers for removing particles from water by centrifugal action and gravity.
 - b. Housing: With manufacturer's proprietary system of baffles and chambers.
 - 1) Construction: Fabricate and label steel separator housing to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 2) Inlet: Designed with tangential entry to produce centrifugal flow of feedwater.
 - 3) Vortex Chamber: Designed for downward vortex flow and gravity separation of particles.
 - 4) Collection Chamber: Designed to hold separated particles.
 - 5) Outlet: Near top of unit.
 - 6) Purge: At bottom of collection chamber.
 - 7) Pipe Connections NPS 2 (DN 50) and Smaller: Threaded according to ASME B1.20.1.
 - 8) Pipe Connections NPS 2-1/2 (DN 65) and Larger: Steel, Class 150 flanges according to ASME B16.5 or grooved according to AWWA C606. Provide stainless-steel flanges if tank is stainless steel.
 - c. Motorized Purge Valve: Gate or plug pattern valve.
 - 1) Motorized Valves: Butterfly-type, flanged or grooved-end, ductile-iron body, with EPDM valve seat and stem seal; with ASTM B 148 aluminum bronze disc.
 - d. Strainer: Stainless-steel basket type mounted on pump suction.
 - e. Piping: ASTM A 53/A 53M, Type S, F, or E; Grade B, Schedule 40 black steel, with flanged, grooved, or threaded joints and malleable, steel welding, or ductile-iron fittings.
 - f. Piping: ASTM B 88, Type L (ASTM B 88M, Type B) copper water tube, copper-alloy solder-joint fittings, and brazed, flanged, or grooved joints.
 - g. Circulating Pump: Overhung impeller, close coupled, single stage, end suction, centrifugal. Comply with UL 778 and with HI 1.1-1.2 and HI 1.3.
 - 1) Casing: Radially split, cast iron.
 - 2) Pressure Rating: 125 psig (860 kPa) **OR** 150 psig (1035 kPa), **as directed**, minimum.
 - 3) Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, closed, and keyed to shaft.
 - 4) Shaft and Shaft Sleeve: Steel shaft, with copper-alloy shaft sleeve.
 - 5) Seal: Mechanical.

- 6) Motor: ODP motor supported on the pump-bearing frame. General requirements for motors are specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
- h. Controls: Automatic control of circulating pump and separator purge; factory wired for single electrical connection.
 - 1) Panel: NEMA 250, Type 4 enclosure.
 - 2) Pump: Automatic and manual switching; manual switch position bypasses safeties and controls.
 - 3) Separator Purge: Automatic and manual.
 - 4) TDS Controller Interlock: Open separator purge valve with bleed-off control.
- i. Support: Skid mounting. Fabricate supports and base and attachment to separator housing with reinforcement strong enough to resist separator movement during a seismic event when separator base is anchored to building structure.

1.3 EXECUTION

A. Water Analysis

- 1. Perform an analysis of supply water to determine quality of water available at Project site.

B. Installation

- 1. Install chemical application equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor chemical tanks and floor-mounting accessories to substrate.
- 2. Install seismic restraints for equipment and floor-mounting accessories and anchor to building structure. Refer to Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" for seismic restraints.
- 3. Install water testing equipment on wall near water chemical application equipment.
- 4. Install interconnecting control wiring for chemical treatment controls and sensors.
- 5. Mount sensors and injectors in piping circuits.
- 6. Bypass Feeders: Install in closed hydronic systems, including hot-water heating, chilled water, dual-temperature water, and glycol cooling, and equipped with the following:
 - a. Install bypass feeder in a bypass circuit around circulating pumps, unless otherwise indicated on Drawings.
 - b. Install water meter in makeup water supply.
 - c. Install test-coupon assembly in bypass circuit around circulating pumps, unless otherwise indicated on Drawings.
 - d. Install a gate or full-port ball isolation valves on inlet, outlet, and drain below feeder inlet.
 - e. Install a swing check on inlet after the isolation valve.
- 7. Install automatic chemical-feed equipment for steam boiler and steam condensate systems and include the following:
 - a. Install makeup water softener.
 - b. Install water meter in makeup water supply.
 - c. Install inhibitor injection pumps and solution tanks with injection timer sensing contacts in water meter.
 - 1) Pumps shall operate for timed interval when contacts close at water meter in makeup water supply connection. Injection pump shall discharge into boiler feedwater tank or feedwater supply connection at boiler.
 - d. Install test equipment and furnish test-kit to Owner.
 - e. Install RO unit for makeup water.
 - f. Install TDS controller with sensor and bleed valves.
 - 1) Bleed valves shall cycle to maintain maximum TDS concentration.
 - g. Install inhibitor injection timer with injection pumps and solution tanks.

- 1) Pumps shall operate for timed interval on contact closure at water meter in makeup water supply connection. Injection pump shall discharge into main steam supply header.
 8. Install automatic chemical-feed equipment for condenser **OR** fluid-cooler spray, **as directed**, water and include the following:
 - a. Install makeup water softener.
 - b. Install water meter in makeup water supply.
 - c. Install inhibitor injection pumps and solution tanks with injection timer sensing contacts in water meter.
 - 1) Pumps shall operate for timed interval on contact closure at water meter in makeup water supply connection. Injection pump shall discharge into boiler feedwater tank or feedwater supply connection at boiler.
 - d. Install test equipment and provide test-kit to Owner. Install test-coupon assembly in bypass circuit around circulating pumps, unless otherwise indicated on Drawings.
 - e. Install TDS controller with sensor and bleed valves.
 - 1) Bleed valves shall cycle to maintain maximum TDS concentration.
 - f. Install pH sensor and controller with injection pumps and solution tanks.
 - 1) Injector pumps shall operate to maintain required pH.
 - g. Install biocide feeder alternating timer with two sets of injection pumps and solution tanks.
 - 1) Injection pumps shall operate to feed biocide on an alternating basis.
 - h. Install ozone generator with diffusers in condenser-water piping.
 - i. Ozone generator shall operate continuously with condenser-water flow.
 - j. Install UV-irradiation lamps in condenser-water piping.
 - 1) UV lights shall operate continuously with condenser-water flow.
- C. Ozone-Generator Installation
 1. Install ozone generator and equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor mineral and brine tanks and floor-mounting accessories to substrate.
 2. Install seismic restraints for equipment and floor-mounting accessories and anchor to building structure. Refer to Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" for seismic restraints.
 3. Pipe ozone from ozone generator to condenser water with stainless-steel pipe and fittings with welded joints.
 4. Install two **OR** three, **as directed**,-piece, stainless-steel ball valve in ozone supply to condenser water.
 5. Pipe cooling water to ozone generator, and to air-gap drain fitting with stainless-steel pipe and fittings with welded joints where enclosed in ozone-generator room.
 6. Install two **OR** three, **as directed**,-piece, stainless-steel ball valve in cooling water supply to ozone generator.
 7. Mounting supports for ozone generator shall be ASTM A 666, Type 316 stainless steel.
 8. Mount breathing apparatus outside ozone-generator room.
 9. Mount and install ozone detector, warning lights, and audible alarm inside ozone-generator room. Mount another set of warning lights and audible alarm just outside the main entrance to ozone-generator room.
- D. UV-Irradiation Unit Installation
 1. Install UV-irradiation units on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor mineral and brine tanks and floor-mounting accessories to substrate.
 2. Install seismic restraints for UV-irradiation units and floor-mounting accessories and anchor to building structure. Refer to Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" for seismic restraints.
- E. Water Softener Installation

1. Install water softener equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor mineral and brine tanks and floor-mounting accessories to substrate.
2. Install seismic restraints for tanks and floor-mounting accessories and anchor to building structure. Refer to Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" for seismic restraints.
3. Install brine lines and fittings furnished by equipment manufacturer but not factory installed.
4. Prepare mineral-tank distribution system and underbed for minerals and place specified mineral into mineral tanks.
5. Install water-testing sets on wall adjacent to water softeners.

F. RO Unit Installation

1. Install RO unit and storage tank on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor RO unit and storage tank with pumps to substrate.
2. Install seismic restraints for tanks and floor-mounting accessories and anchor to building structure. Refer to Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" for seismic restraints.
3. Install interconnecting piping and controls furnished by equipment manufacturer but not factory installed.
4. Install water testing sets on wall adjacent to RO unit.

G. Connections

1. Piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install piping adjacent to equipment to allow service and maintenance.
3. Make piping connections between HVAC water-treatment equipment and dissimilar-metal piping with dielectric fittings. Dielectric fittings are specified in Division 23 Section "Common Work Results For Hvac".
4. Install shutoff valves on HVAC water-treatment equipment inlet and outlet. Metal general-duty valves are specified in Division 23 Section "General-duty Valves For Hvac Piping".
5. Refer to Division 22 Section "Domestic Water Piping Specialties" for backflow preventers required in makeup water connections to potable-water systems.
6. Confirm applicable electrical requirements in Division 22 for connecting electrical equipment.
7. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
8. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

H. Field Quality Control

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
2. Perform tests and inspections and prepare test reports.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
3. Tests and Inspections:
 - a. Inspect field-assembled components and equipment installation, including piping and electrical connections.
 - b. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
 - c. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC systems' startup procedures.

- d. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
- e. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
- f. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
- g. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
- h. Repair leaks and defects with new materials and retest piping until no leaks exist.
4. Remove and replace malfunctioning units and retest as specified above.
5. Sample boiler water at one-week intervals after boiler startup for a period of five weeks, and prepare test report advising Owner of changes necessary to adhere to Part 1 "Performance Requirements" Article for each required characteristic. Sample boiler water at four **OR** six **OR** eight, **as directed**, -week intervals following the testing noted above to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section.
6. At four **OR** six **OR** eight, **as directed**, -week intervals following Final Completion, perform separate water analyses on hydronic systems to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section. Submit written reports of water analysis advising Owner of changes necessary to adhere to Part 1.1 "Performance Requirements" Article.
7. Comply with ASTM D 3370 and with the following standards:
 - a. Silica: ASTM D 859.
 - b. Steam System: ASTM D 1066.
 - c. Acidity and Alkalinity: ASTM D 1067.
 - d. Iron: ASTM D 1068.
 - e. Water Hardness: ASTM D 1126.
- I. Demonstration
 1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment.

END OF SECTION 23 25 13 00



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Task	Specification	Specification Description
23 25 13 00	22 05 23 00	Piped Utilities Basic Materials And Methods
23 25 13 00	22 12 23 26	Facility Fuel-Oil Piping



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SECTION 23 31 00 00 - CSF HVAC DUCTS AND CASINGS**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.23 31 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal ductwork.
 - 2. Nonmetal ductwork.
 - 3. Air turning devices.
 - 4. Duct access doors.
 - 5. Duct test holes.
 - 6. Fire dampers.
 - 7. Flexible duct connections.
 - 8. Volume control dampers.
 - 9. Duct cleaning.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 230500 - Common Work Results for HVAC:
 - 2. Section 230719 - Duct Insulation: Duct Insulation.
 - 3. Section 233713 - Diffusers Registers and Grilles:
 - 4. Section 230593 - Testing, Adjusting and Balancing for HVAC:

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A 36 - Structural Steel.
 - 2. ASTM A 90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
 - 3. ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
 - 4. ASTM A 480 - General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.



5. ASTM A 653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvanealed) by the Hot-Dip Process.
 6. ASTM A 568 Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.
- B. American Welding Society (AWS):
1. AWS D9.1 - Welding of Sheet Metal.
- C. National Fire Protection Association (NFPA):
1. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
 2. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems.
 3. NFPA 91 - Installation of Blower and Exhaust Systems for Dust, Stock and Vapor Removal or Conveying.
 4. NFPA 96 - Installing of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment.
- D. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
1. SMACNA - HVAC Air Duct Leakage Test Manual.
 2. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- E. Underwriters Laboratories, Inc. (UL):
1. UL 181 - Factory-Made Air Ducts and Connectors.

1.3 SYSTEM DESCRIPTION

- A. Performance Requirements: No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
1. Product Data:
 - a. Duct materials, duct liner, duct connectors, and flexible duct.
 - b. Factory or shop manufactured assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
1. Project Record Documents: Accurately record the following:
 - a. Actual locations of ducts and duct fittings.
 - b. Record changes in fitting location and type.
 - c. Show additional fittings used.
 - d. Actual locations of access doors, test holes, and fire dampers.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- B. Qualifications:
1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.



2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

- C. Regulatory Requirements: Construct ductwork to NFPA 90A, NFPA 90B, and NFPA 96 standards.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Protect dampers from damage to operating linkages and blades.

1.7 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Jobsite Requirements:
 1. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
 2. Maintain temperatures during and after installation of duct sealants.

NOTE TO SPECIFIER

"REQUIRED Article (ENVIRONMENTAL REQUIREMENTS) follows. Do not revise this Article, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer."

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Environmental Impact:
 1. Indoor Air Quality: Install insulation so that unfaced fiberglass and mineral fiber insulation are not in the interior of the ductwork.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

- A. Galvanized Steel Ducts: ASTM A653 having zinc coating in conformance with ASTM A90.
- B. Steel Ducts: ASTM A569 and A568..
- C. Flexible Ducts:
 1. Manufacturers:
 - a. Anco Products Inc.
 - b. Hart & Cooley.
 - c. Tuttle & Bailey.
 - d. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
 2. UL Labeled, black polymer film supported by helically wound spring steel wire.
 3. Pressure Rating: 4 inches WG positive and 0.5 inches WG negative.
 4. Maximum Velocity: 4000 fpm.
 5. Temperature Range: -20 degrees F to 175 degrees.

- D. Insulated Flexible Ducts:
 - 1. Manufacturers:
 - a. Anco Products Inc.
 - b. Hart & Cooley.
 - c. Tuttle & Bailey
 - d. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
 - 2. Black polymer film supported by helically wound spring steel wire; fiberglass insulation; aluminized vapor barrier film.
 - 3. Pressure Rating: 4 inches WG positive and 0.5 inches WG negative.
 - 4. Maximum Velocity: 4000 fpm.
 - 5. Temperature Range: -20 degrees F to 175 degrees F.
- E. Stainless Steel Ducts: ASTM A 167, Type 304.
- F. Fasteners: Rivets, bolts, or sheet metal screws.
- G. Sealant:
 - 1. Manufacturers:
 - a. Duro Dyne Corporation, Farmingdale, NY (800) 899-3876.
 - b. H.B. Fuller Co, St. Paul, MN (888) 423-8553.
 - c. Hardcast, Inc, Wylie, TX (800) 527-7092.
 - d. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
 - 2. Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.
- H. Hanger Rod: ASTM A36; steel threaded both ends, threaded one end, or continuously threaded.

2.2 AIR TURNING DEVICES/EXTRACTORS

- A. Manufacturers:
 - 1. Semco, Inc, Columbia, MO (888) 473-6264.
 - 2. Metal-Fab, Inc, Wichita, KS (800) 835-2830.
 - 3. United McGill Corp, Groveport, OH (614) 836-9981.
 - 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Multi-blade device with blades aligned in short dimension; steel or aluminum construction; with individually adjustable blades, mounting straps.

2.3 DUCT ACCESS DOORS

- A. Manufacturers:
 - 1. Ductmate Industries, Inc, East Monongahela, PA (800) 245-3188.
 - 2. Ruskin Manufacturing, Kansas City, MO (816) 761-7476.
 - 3. Semco Inc, Columbia, MO (888) 473-6264.
 - 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

- C. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum one inch thick insulation with sheet metal cover.
 - 1. Less Than 12 Inches Square: Secure with sash locks.
 - 2. Up to 18 Inches Square: Provide two hinges and two sash locks.
 - 3. Up to 24 x 48 Inches: Three hinges and two compression latches with outside and inside handles.
 - 4. Larger Sizes: Provide an additional hinge.
- D. Access doors with sheet metal screw fasteners are not acceptable.

2.4 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.5 FIRE DAMPERS

- A. Manufacturers:
 - 1. Prefco Products, Inc, Buckingham, PA (800) 437-6653.
 - 2. Ruskin Manufacturing, Kansas City, MO (816) 761-7476.
 - 3. Vent Products Co., Inc.
 - 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.
- C. Ceiling Dampers: Galvanized steel, 22 gage frame and 16 gage flap, two layers 0.125 inch ceramic fiber on top side, and one layer on bottom side for round flaps, with locking clip.
- D. Horizontal Dampers: Galvanized steel, 22 gage frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.
- E. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1.0 inch pressure class ducts up to 12 inches in height.
- F. Multiple Blade Dampers: 16 gage galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.
- G. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

2.6 FLEXIBLE DUCT CONNECTIONS

- A. Manufacturers:
 - 1. Ductmate Industries, Inc, East Monongahela, PA (800) 245-3188.
 - 2. Ruskin Manufacturing, Kansas City, MO (816) 761-7476.
 - 3. Semco Inc, Columbia, MO (888) 473-6264.



4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

C. Connector: Fabric crimped into metal edging strip.

1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30oz per sq yd.
2. Net Fabric Width: Approximately 3 inches wide.
3. Metal: 3 inches wide, 24 gage thick galvanized steel.

2.7 VOLUME CONTROL DAMPERS.

A. Manufacturers:

1. Louvers and Dampers, Inc, Florence, KY (606) 647-2299.
2. Prefco Products, Inc, Buckingham, PA (800) 437-6653.
3. Ruskin Manufacturing, Kansas City, MO (816) 761-7476.
4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

C. Splitter Dampers:

1. Material: Same gage as duct to 24 inches size in either direction, and two gages heavier for sizes over 24 inches.
2. Blade: Fabricate of double thickness sheet metal to streamline shape, secured with continuous hinge or rod.
3. Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw.

D. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.

E. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

F. End Bearings: Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

G. Quadrants:

1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
3. Where rod lengths exceed 30 inches provide regulator at both ends.

2.8 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

- B. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide turning vanes.
- C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify that electric power is available and of the correct characteristics.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION - DUCTWORK

- A. Install in accordance with manufacturer's instructions.
- B. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- C. Duct Sizes are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- D. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- F. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.
- G. Use double nuts and lock washers on threaded rod supports.
- H. Connect diffusers or light troffer boots to low pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp and tape.
- I. Connect flexible ducts to metal ducts with draw bands plus tape.
- J. Provide residue traps in kitchen hood exhaust ducts at base of vertical risers with provisions for clean out. Use stainless steel for ductwork exposed to view and stainless steel or carbon steel for ducts where concealed.

- K. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- L. Install so that unfaced fiberglass and mineral fiber insulation are not in the interior of the ductwork.

3.3 INSTALLATION - DUCTWORK ACCESSORIES

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ductwork in accordance with NFPA 96. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Review locations prior to fabrication.
- D. Provide duct test holes where indicated and required for testing and balancing purposes.
- E. Provide fire dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
- F. Demonstrate re-setting of fire dampers to Owner.
- G. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment.
- H. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
- I. Use splitter dampers only where indicated.
- J. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

3.4 CLEANING

- A. Clean work under provisions of 017300.
- B. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.

USPS CSF Specifications issued: 10/1/2013
Last revised: 5/11/11

END OF SECTION



SECTION 23 31 00 00 - MPF HVAC DUCTS AND CASINGS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. THIS SECTION IS A "PERFORMANCE" SPECIFICATION. The Section describes the design requirements for the Fire Alarm System. The Fire Alarm Contractor will design the system and prepare detailed Fire Alarm Drawings to be used for the installation of the Fire Alarm System.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.23 31 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal ductwork.
 - 2. Nonmetal ductwork.
 - 3. Air turning devices.
 - 4. Duct access doors.
 - 5. Duct test holes.
 - 6. Fire dampers.
 - 7. Flexible duct connections.
 - 8. Volume control dampers.
 - 9. Duct cleaning.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 230500 - Common Work Results for HVAC:
 - 2. Section 230713 - Duct Insulation.
 - 3. Section 233713 - Diffusers Registers and Grilles:
 - 4. Section 230593 - Testing, Adjusting, and Balancing for HVAC:

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A 36 - Structural Steel.
 - 2. ASTM A 90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
 - 3. ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
 - 4. ASTM A 480 - General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
 - 5. ASTM A 653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvanealed) by the Hot-Dip Process.
 - 6. ASTM A 568 Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.
- B. American Welding Society (AWS):
 - 1. AWS D9.1 - Welding of Sheet Metal.
- C. National Fire Protection Association (NFPA):

1. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
2. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems.
3. NFPA 91 - Installation of Blower and Exhaust Systems for Dust, Stock and Vapor Removal or Conveying.
4. NFPA 96 - Installing of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment.

D. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

1. SMACNA - HVAC Air Duct Leakage Test Manual.
2. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

E. Underwriters Laboratories, Inc. (UL):

1. UL 181 - Factory-Made Air Ducts and Connectors.

1.3 SYSTEM DESCRIPTION

- A. Performance Requirements: No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

1. Product Data:
 - a. Duct materials, duct liner, duct connectors, and flexible duct.
 - b. Factory or shop manufactured assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.

B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.

1. Project Record Documents: Accurately record the following:
 - a. Actual locations of ducts and duct fittings.
 - b. Record changes in fitting location and type.
 - c. Show additional fittings used.
 - d. Actual locations of access doors, test holes, and fire dampers.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

B. Qualifications:

1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

- C. Regulatory Requirements: Construct ductwork to NFPA 90A, NFPA 90B, and NFPA 96 standards.

1.6 DELIVERY, STORAGE, AND HANDLING



- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Protect dampers from damage to operating linkages and blades.

1.7 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Jobsite Requirements:
 - 1. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
 - 2. Maintain temperatures during and after installation of duct sealants.

NOTE TO SPECIFIER

"REQUIRED Article (ENVIRONMENTAL REQUIREMENTS) follows. Do not revise this Article, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer."

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Environmental Impact:
 - 1. Indoor Air Quality: Install insulation so that unfaced fiberglass and mineral fiber insulation are not in the interior of the ductwork.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

- A. Galvanized Steel Ducts: ASTM A653 having zinc coating in conformance with ASTM A90.
- B. Steel Ducts: ASTM A569 and A568..
- C. Flexible Ducts:
 - 1. Manufacturers:
 - a. Anco Products Inc.
 - b. Hart & Cooley.
 - c. Tuttle & Bailey.
 - d. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
 - 2. UL Labeled, black polymer film supported by helically wound spring steel wire.
 - 3. Pressure Rating: 4 inches WG positive and 0.5 inches WG negative.
 - 4. Maximum Velocity: 4000 fpm.
 - 5. Temperature Range: -20 degrees F to 175 degrees.
- D. Insulated Flexible Ducts:
 - 1. Manufacturers:
 - a. Anco Products Inc.
 - b. Hart & Cooley.
 - c. Tuttle & Bailey
 - d. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2. Black polymer film supported by helically wound spring steel wire; fiberglass insulation; aluminized vapor barrier film.
3. Pressure Rating: 4 inches WG positive and 0.5 inches WG negative.
4. Maximum Velocity: 4000 fpm.
5. Temperature Range: -20 degrees F to 175 degrees F.

E. Stainless Steel Ducts: ASTM A 167, Type 304.

F. Fasteners: Rivets, bolts, or sheet metal screws.

G. Sealant:

1. Manufacturers:
 - a. Duro Dyne Corporation, Farmingdale, NY (800) 899-3876.
 - b. H.B. Fuller Co, St. Paul, MN (888) 423-8553.
 - c. Hardcast, Inc, Wylie, TX (800) 527-7092.
 - d. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
2. Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.

H. Hanger Rod: ASTM A36; steel threaded both ends, threaded one end, or continuously threaded.

2.2 AIR TURNING DEVICES/EXTRACTORS

A. Manufacturers:

1. Semco, Inc, Columbia, MO (888) 473-6264.
2. Metal-Fab, Inc, Wichita, KS (800) 835-2830.
3. United McGill Corp, Groveport, OH (614) 836-9981.
4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

B. Multi-blade device with blades aligned in short dimension; steel or aluminum construction; with individually adjustable blades, mounting straps.

2.3 DUCT ACCESS DOORS

A. Manufacturers:

1. Ductmate Industries, Inc, East Monongahela, PA (800) 245-3188.
2. Ruskin Manufacturing, Kansas City, MO (816) 761-7476.
3. Semco Inc, Columbia, MO (888) 473-6264.
4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

C. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum one inch thick insulation with sheet metal cover.

1. Less Than 12 Inches Square: Secure with sash locks.
2. Up to 18 Inches Square: Provide two hinges and two sash locks.
3. Up to 24 x 48 Inches: Three hinges and two compression latches with outside and inside handles.
4. Larger Sizes: Provide an additional hinge.

- D. Access doors with sheet metal screw fasteners are not acceptable.

2.4 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.5 FIRE DAMPERS

- A. Manufacturers:
 - 1. Prefco Products, Inc, Buckingham, PA (800) 437-6653.
 - 2. Ruskin Manufacturing, Kansas City, MO (816) 761-7476.
 - 3. Vent Products Co., Inc.
 - 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.
- C. Ceiling Dampers: Galvanized steel, 22 gage frame and 16 gage flap, two layers 0.125 inch ceramic fiber on top side, and one layer on bottom side for round flaps, with locking clip.
- D. Horizontal Dampers: Galvanized steel, 22 gage frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.
- E. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1.0 inch pressure class ducts up to 12 inches in height.
- F. Multiple Blade Dampers: 16 gage galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.
- G. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

2.6 FLEXIBLE DUCT CONNECTIONS

- A. Manufacturers:
 - 1. Ductmate Industries, Inc, East Monongahela, PA (800) 245-3188.
 - 2. Ruskin Manufacturing, Kansas City, MO (816) 761-7476.
 - 3. Semco Inc, Columbia, MO (888) 473-6264.
 - 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- C. Connector: Fabric crimped into metal edging strip.



1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30oz per sq yd.
2. Net Fabric Width: Approximately 3 inches wide.
3. Metal: 3 inches wide, 24 gage thick galvanized steel.

2.7 VOLUME CONTROL DAMPERS.

A. Manufacturers:

1. Louvers and Dampers, Inc, Florence, KY (606) 647-2299.
2. Prefco Products, Inc, Buckingham, PA (800) 437-6653.
3. Ruskin Manufacturing, Kansas City, MO (816) 761-7476.
4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

C. Splitter Dampers:

1. Material: Same gage as duct to 24 inches size in either direction, and two gages heavier for sizes over 24 inches.
2. Blade: Fabricate of double thickness sheet metal to streamline shape, secured with continuous hinge or rod.
3. Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw.

D. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.

E. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

F. End Bearings: Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

G. Quadrants:

1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
3. Where rod lengths exceed 30 inches provide regulator at both ends.

2.8 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide turning vanes.

C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify that electric power is available and of the correct characteristics.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION - DUCTWORK

- A. Install in accordance with manufacturer's instructions.
- B. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- C. Duct Sizes are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- D. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- F. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.
- G. Use double nuts and lock washers on threaded rod supports.
- H. Connect diffusers or light troffer boots to low pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp and tape.
- I. Connect flexible ducts to metal ducts with draw bands plus tape.
- J. Provide residue traps in kitchen hood exhaust ducts at base of vertical risers with provisions for clean out. Use stainless steel for ductwork exposed to view and stainless steel or carbon steel for ducts where concealed.
- K. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- L. Install so that unfaced fiberglass and mineral fiber insulation are not in the interior of the ductwork.



3.3 INSTALLATION - DUCTWORK ACCESSORIES

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ductwork in accordance with NFPA 96. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Review locations prior to fabrication.
- D. Provide duct test holes where indicated and required for testing and balancing purposes.
- E. Provide fire dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
- F. Demonstrate re-setting of fire dampers to Owner.
- G. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment.
- H. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
- I. Use splitter dampers only where indicated.
- J. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

3.4 CLEANING

- A. Clean work under provisions of 017300.
- B. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.

USPS Major Facility Specifications issued: 10/1/2013
Last revised: 03/31/10

END OF SECTION



SECTION 23 33 00 00 - MPF AIR DUCT ACCESSORIES

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Backdraft and pressure relief dampers.
 - 2. Manual volume dampers.
 - 3. Control dampers.
 - 4. Fire dampers.
 - 5. Smoke dampers.
 - 6. Flange connectors.
 - 7. Turning vanes.
 - 8. Duct-mounted access doors.
 - 9. Flexible connectors.
 - 10. Flexible ducts.
 - 11. Duct accessory hardware.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
 - 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control damper installations.
 - d. Fire-damper and smoke-damper installations, including sleeves; and duct-mounted access doors.
 - e. Wiring Diagrams: For power, signal, and control wiring.
- C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.
 - 2. Exposed-Surface Finish: Mill phosphatized.
- C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and finish for exposed ducts.
- D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.
- F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

NOTE TO SPECIFIER

Delete section if backdraft and pressure relief dampers are not required.

- A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - 1. Air Balance Inc.; a division of Mestek, Inc.
 - 2. American Warming and Ventilating; a division of Mestek, Inc.
 - 3. Cesco Products; a division of Mestek, Inc.
 - 4. Duro Dyne Inc.
 - 5. Greenheck Fan Corporation.
 - 6. Lloyd Industries, Inc.
 - 7. Nailor Industries Inc.
 - 8. NCA Manufacturing, Inc.
 - 9. Pottorff; a division of PCI Industries, Inc.
 - 10. Ruskin Company.
 - 11. SEMCO Incorporated.



12. Vent Products Company, Inc.
13. <Insert manufacturer's name>.
- B. Description: Gravity balanced.
- C. Frame: 0.052-inch- thick, galvanized sheet steel.
- D. Blades: Multiple single-piece blades, [center-pivoted,] maximum 6-inch width, 0.025-inch- thick, roll-formed aluminum with sealed edges.
- E. Blade Action: Parallel.
- F. Blade Seals: Neoprene, mechanically locked.
- G. Blade Axles:
 1. Material: Stainless steel
 2. Diameter: 0.20 inch.
- H. Tie Bars and Brackets: Galvanized steel.
- I. Return Spring: Adjustable tension.
- J. Bearings: [Steel ball] [Synthetic pivot bushings] [Steel ball or synthetic pivot bushings].
- K. Accessories:
 1. Adjustment device to permit setting for varying differential static pressure.
 2. Counterweights and spring-assist kits for vertical airflow installations.
 3. Electric actuators.
 4. Chain pulls.
 5. Screen Mounting: Front mounted in sleeve.
 - a. Sleeve Thickness: 20-gage minimum.
 - b. Sleeve Length: 6 inches minimum.
 6. Screen Mounting: Rear mounted.
 7. Screen Material: Aluminum.
 8. Screen Type: Bird.
 9. 90-degree stops.

2.3 MANUAL VOLUME DAMPERS

NOTE TO SPECIFIER

Show dampers on Drawings.

- A. Standard, Steel, Manual Volume Dampers:
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Air Balance Inc.; a division of Mestek, Inc.
 - b. American Warming and Ventilating; a division of Mestek, Inc.
 - c. Flexmaster U.S.A., Inc.
 - d. McGill AirFlow LLC.
 - e. METALAIR, Inc.
 - f. Nailor Industries Inc.
 - g. Ruskin Company.
 - h. Vent Products Company, Inc.
 - i. <Insert manufacturer's name>.
 2. Standard leakage rating, with linkage outside airstream.
 3. Suitable for horizontal or vertical applications.

4. Frames:
 - a. Hat-shaped, galvanized-steel channels, 0.064-inch minimum thickness.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized-steel, 0.064 inch thick.
6. Blade Axles: Stainless steel.
7. Bearings:
 - a. Molded synthetic.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Tie Bars and Brackets: Galvanized steel.

B. Standard, Aluminum, Manual Volume Dampers:

NOTE TO SPECIFIER

Specify aluminum dampers only when the excessive corrosion is expected.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Air Balance Inc.; a division of Mestek, Inc.
 - b. American Warming and Ventilating; a division of Mestek, Inc.
 - c. Flexmaster U.S.A., Inc.
 - d. McGill AirFlow LLC.
 - e. METALAIRE, Inc.
 - f. Nailor Industries Inc.
 - g. Ruskin Company.
 - h. Trox USA Inc.
 - i. Vent Products Company, Inc.
 - j. <Insert manufacturer's name>.
2. Standard leakage rating[, with linkage outside airstream].
3. Suitable for horizontal or vertical applications.
4. Frames: Hat-shaped, 0.10-inch- thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet.
6. Blade Axles: Stainless steel.
7. Bearings:
 - a. Molded synthetic.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Tie Bars and Brackets: Aluminum.

C. Jackshaft:

1. Size: 1-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.



- D. Damper Hardware:
1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
 2. Include center hole to suit damper operating-rod size.
 3. Include elevated platform for insulated duct mounting.

2.4 CONTROL DAMPERS

NOTE TO SPECIFIER

If multiple control damper types are required, copy this article and re-edit for each type; assign each type a drawing designation; and indicate each type on Drawings. Delete if not used or if control dampers are specified elsewhere within the specifications.

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. American Warming and Ventilating; a division of Mestek, Inc.
 2. Arrow United Industries; a division of Mestek, Inc.
 3. Flexmaster U.S.A., Inc.
 4. Greenheck Fan Corporation.
 5. Lloyd Industries, Inc.
 6. McGill AirFlow LLC.
 7. METALAIR, Inc.
 8. Nailor Industries Inc.
 9. Ruskin Company.
 10. Vent Products Company, Inc.
 11. Young Regulator Company.
 12. <Insert manufacturer's name>.

NOTE TO SPECIFIER

Specify all stainless construction for corrosive environments.

- B. Frames:
1. Hat or U shaped.
 2. Galvanized-steel channels, 0.064 inch thick.
 3. Mitered and welded corners.
- C. Blades:
1. Multiple blade with maximum blade width of 8 inches.
 2. Parallel- and opposed-blade design.
 3. Galvanized steel.
 4. 0.064 inch thick.
 5. Blade Edging: Closed-cell neoprene edging.
- D. Blade Axles: 1/2-inch- diameter; stainless steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
1. Operating Temperature Range: From minus 40 to plus 200 deg F.
- E. Bearings:
1. Molded synthetic.
 2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 3. Thrust bearings at each end of every blade.

2.5 FIRE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Air Balance Inc.; a division of Mestek, Inc.
 2. Arrow United Industries; a division of Mestek, Inc.
 3. Greenheck Fan Corporation.
 4. McGill AirFlow LLC.
 5. METALAIRE, Inc.
 6. Nailor Industries Inc.
 7. Prefco; Perfect Air Control, Inc.
 8. Ruskin Company.
 9. Vent Products Company, Inc.
 10. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
 11. <Insert manufacturer's name>.

NOTE TO SPECIFIER

Edit for the types of dampers required and indicate each damper on Drawings.

- *****
- B. Type: Static and dynamic; rated and labeled according to UL 555 by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 4000-fpm velocity.
- D. Fire Rating: 1-1/2 and 3 hours, as indicated.

NOTE TO SPECIFIER

Type 304, stainless-steel dampers are available for corrosive atmospheres.

- *****
- E. Frame: [Curtain type with blades inside airstream] [Curtain type with blades outside airstream] [Multiple-blade type] [Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream]; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.
- F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
1. Minimum Thickness: 0.052 or 0.138 inch thick, as indicated, and of length to suit application.
 2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- J. Heat-Responsive Device: Replaceable, temperature rated, fusible links.

2.6 SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Air Balance Inc.; a division of Mestek, Inc.
 2. Greenheck Fan Corporation.

3. Nailor Industries Inc.
 4. Ruskin Company.
 5. <Insert manufacturer's name>.
- B. General Requirements: Label according to UL 555S by an NRTL.
- C. Smoke Detector: Integral, factory wired for single-point connection.
- D. Frame: Fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.
- E. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- F. Rated pressure and velocity to exceed design airflow conditions.
- G. Mounting Sleeve: Factory-installed, 0.052-inch- thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone caulking.
- H. Damper Motors: two-position action.
- I. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
 5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
 6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
 7. Electrical Connection: 115 V, single phase, 60 Hz.
- J. Accessories:
1. Auxiliary switches for required signaling, controlling and monitoring.

2.7 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Ductmate Industries, Inc.
 2. Nexus PDQ; Division of Shilco Holdings Inc.
 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
 4. <Insert manufacturer's name>.
- B. Material: Galvanized steel.
- C. Gage and Shape: Match connecting ductwork.

2.8 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Ductmate Industries, Inc.
 2. Duro Dyne Inc.
 3. METALAIRE, Inc.
 4. SEMCO Incorporated.
 5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
 6. <Insert manufacturer's name>.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."
- D. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.9 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. American Warming and Ventilating; a division of Mestek, Inc.
 2. Ductmate Industries, Inc.
 3. Flexmaster U.S.A., Inc.
 4. Greenheck Fan Corporation.
 5. McGill AirFlow LLC.
 6. Nailor Industries Inc.
 7. Ventfabrics, Inc.
 8. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
 9. <Insert manufacturer's name>.
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."
1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches.
 - d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

2.10 DUCT ACCESS PANEL ASSEMBLIES

NOTE TO SPECIFIER*Retain this for access panels in fire-rated duct systems, such as exhaust ducts for commercial kitchen hoods.*

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Ductmate Industries, Inc.
 - 2. Flame Gard, Inc.
 - 3. 3M.
 - 4. <Insert manufacturer's name>.
- B. Labeled according to UL 1978 by an NRTL.
- C. Panel and Frame: Minimum thickness 0.0428-inch stainless steel.
- D. Fasteners: Stainless steel. Panel fasteners shall not penetrate duct wall.
- E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.
- F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.11 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. Ventfabrics, Inc.
 - 4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
 - 5. <Insert manufacturer's name>.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd..
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F.
- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - 1. Minimum Weight: 24 oz./sq. yd..
 - 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
 - 3. Service Temperature: Minus 50 to plus 250 deg F.

2.12 FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Flexmaster U.S.A., Inc.
 - 2. McGill AirFlow LLC.
 - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
 - 4. <Insert manufacturer's name>.
- B. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
 - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 10 to plus 160 deg F.
- C. Flexible Duct Connectors:
 - 1. Clamps: [Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action] [Nylon strap] in sizes 3 through 18 inches, to suit duct size.
 - 2. Non-Clamp Connectors: [Adhesive] [Liquid adhesive plus tape] [Adhesive plus sheet metal screws].

2.13 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft and control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

NOTE TO SPECIFIER

To minimize duct noise generated by volume dampers, SMACNA recommends locating dampers at least two duct diameters from fittings and as far away as possible from outlets.

- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
 2. Install aluminum volume dampers in aluminum ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire and smoke dampers according to UL listing.
- H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
1. On both sides of duct coils.
 2. Upstream from duct filters.
 3. At outdoor-air intakes and mixed-air plenums.
 4. At drain pans and seals.
 5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors; and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
- I. Install access doors with swing against duct static pressure.
- J. Access Door Sizes:
1. One-Hand or Inspection Access: 8 by 5 inches.
 2. Two-Hand Access: 12 by 6 inches.
 3. Head and Hand Access: 18 by 10 inches.
 4. Head and Shoulders Access: 21 by 14 inches.
 5. Body Access: 25 by 14 inches.
 6. Body plus Ladder Access: 25 by 17 inches.
- K. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- L. Install flexible connectors to connect ducts to equipment.
- M. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- N. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.
- O. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
1. Operate dampers to verify full range of movement.
 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 3. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
 4. Inspect turning vanes for proper and secure installation.



Last revised: 6/25/13

END OF SECTION 23 33 00 00



SECTION 23 33 00 00 - CSF AIR DUCT ACCESSORIES

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Packaged Rooftop Units are part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.23 33 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Backdraft and pressure relief dampers.
 - 2. Manual volume dampers.
 - 3. Control dampers.
 - 4. Fire dampers.
 - 5. Smoke dampers.
 - 6. Flange connectors.
 - 7. Turning vanes.
 - 8. Duct-mounted access doors.
 - 9. Flexible connectors.
 - 10. Flexible ducts.
 - 11. Duct accessory hardware.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
 - 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control damper installations.
 - d. Fire-damper and smoke-damper installations, including sleeves; and duct-mounted access doors.
 - e. Wiring Diagrams: For power, signal, and control wiring.

- C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.
 - 2. Exposed-Surface Finish: Mill phosphatized.
- C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and finish for exposed ducts.
- D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.
- F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

NOTE TO SPECIFIER

Delete section if backdraft and pressure relief dampers are not required.

- A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - 1. Air Balance Inc.; a division of Mestek, Inc.
 - 2. American Warming and Ventilating; a division of Mestek, Inc.
 - 3. Cesco Products; a division of Mestek, Inc.
 - 4. Duro Dyne Inc.
 - 5. Greenheck Fan Corporation.
 - 6. Lloyd Industries, Inc.
 - 7. Nailor Industries Inc.
 - 8. NCA Manufacturing, Inc.



9. Pottorff; a division of PCI Industries, Inc.
 10. Ruskin Company.
 11. SEMCO Incorporated.
 12. Vent Products Company, Inc.
 13. <Insert manufacturer's name>.
- B. Description: Gravity balanced.
- C. Frame: 0.052-inch- thick, galvanized sheet steel.
- D. Blades: Multiple single-piece blades, [center-pivoted,] maximum 6-inch width, 0.025-inch- thick, roll-formed aluminum with sealed edges.
- E. Blade Action: Parallel.
- F. Blade Seals: Neoprene, mechanically locked.
- G. Blade Axles:
1. Material: Stainless steel
 2. Diameter: 0.20 inch.
- H. Tie Bars and Brackets: Galvanized steel.
- I. Return Spring: Adjustable tension.
- J. Bearings: [Steel ball] [Synthetic pivot bushings] [Steel ball or synthetic pivot bushings].
- K. Accessories:
1. Adjustment device to permit setting for varying differential static pressure.
 2. Counterweights and spring-assist kits for vertical airflow installations.
 3. Electric actuators.
 4. Chain pulls.
 5. Screen Mounting: Front mounted in sleeve.
 - a. Sleeve Thickness: 20-gage minimum.
 - b. Sleeve Length: 6 inches minimum.
 6. Screen Mounting: Rear mounted.
 7. Screen Material: Aluminum.
 8. Screen Type: Bird.
 9. 90-degree stops.

2.3 MANUAL VOLUME DAMPERS

NOTE TO SPECIFIER

Show dampers on Drawings.

- A. Standard, Steel, Manual Volume Dampers:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Air Balance Inc.; a division of Mestek, Inc.
 - b. American Warming and Ventilating; a division of Mestek, Inc.
 - c. Flexmaster U.S.A., Inc.
 - d. McGill AirFlow LLC.
 - e. METALAIR, Inc.
 - f. Nailor Industries Inc.
 - g. Ruskin Company.
 - h. Vent Products Company, Inc.

- i. <Insert manufacturer's name>.
2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames:
 - a. Hat-shaped, galvanized-steel channels, 0.064-inch minimum thickness.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized-steel, 0.064 inch thick.
6. Blade Axles: Stainless steel.
7. Bearings:
 - a. Molded synthetic.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Tie Bars and Brackets: Galvanized steel.

B. Standard, Aluminum, Manual Volume Dampers:

NOTE TO SPECIFIER

Specify aluminum dampers only when the excessive corrosion is expected.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Air Balance Inc.; a division of Mestek, Inc.
 - b. American Warming and Ventilating; a division of Mestek, Inc.
 - c. Flexmaster U.S.A., Inc.
 - d. McGill AirFlow LLC.
 - e. METALAIRE, Inc.
 - f. Nailor Industries Inc.
 - g. Ruskin Company.
 - h. Trox USA Inc.
 - i. Vent Products Company, Inc.
 - j. <Insert manufacturer's name>.
2. Standard leakage rating[, with linkage outside airstream].
3. Suitable for horizontal or vertical applications.
4. Frames: Hat-shaped, 0.10-inch- thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet.
6. Blade Axles: Stainless steel.
7. Bearings:
 - a. Molded synthetic.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Tie Bars and Brackets: Aluminum.

C. Jackshaft:

1. Size: 1-inch diameter.



2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.
- D. Damper Hardware:
1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
 2. Include center hole to suit damper operating-rod size.
 3. Include elevated platform for insulated duct mounting.

2.4 CONTROL DAMPERS

NOTE TO SPECIFIER

If multiple control damper types are required, copy this article and re-edit for each type; assign each type a drawing designation; and indicate each type on Drawings. Delete if not used or if control dampers are specified elsewhere within the specifications.

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. American Warming and Ventilating; a division of Mestek, Inc.
 2. Arrow United Industries; a division of Mestek, Inc.
 3. Flexmaster U.S.A., Inc.
 4. Greenheck Fan Corporation.
 5. Lloyd Industries, Inc.
 6. McGill AirFlow LLC.
 7. METALAIR, Inc.
 8. Nailor Industries Inc.
 9. Ruskin Company.
 10. Vent Products Company, Inc.
 11. Young Regulator Company.
 12. <Insert manufacturer's name>.

NOTE TO SPECIFIER

Specify all stainless construction for corrosive environments.

- B. Frames:
1. Hat or U shaped.
 2. Galvanized-steel channels, 0.064 inch thick.
 3. Mitered and welded corners.
- C. Blades:
1. Multiple blade with maximum blade width of 8 inches.
 2. Parallel- and opposed-blade design.
 3. Galvanized steel.
 4. 0.064 inch thick.
 5. Blade Edging: Closed-cell neoprene edging.
- D. Blade Axles: 1/2-inch- diameter; stainless steel; blade-linkage hardware of zinc-plated steel and brass;
1. Operating Temperature Range: From minus 40 to plus 200 deg F.
- E. Bearings:



1. Molded synthetic.
2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.5 FIRE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Greenheck Fan Corporation.
4. McGill AirFlow LLC.
5. METALAIRE, Inc.
6. Nailor Industries Inc.
7. Prefco; Perfect Air Control, Inc.
8. Ruskin Company.
9. Vent Products Company, Inc.
10. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
11. <Insert manufacturer's name>.

NOTE TO SPECIFIER

Edit for the types of dampers required and indicate each damper on Drawings.

- B. Type: Static and dynamic; rated and labeled according to UL 555 by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 4000-fpm velocity.
- D. Fire Rating: 1-1/2 and 3 hours, as indicated.

NOTE TO SPECIFIER

Type 304, stainless-steel dampers are available for corrosive atmospheres.

- E. Frame: [Curtain type with blades inside airstream] [Curtain type with blades outside airstream] [Multiple-blade type] [Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream]; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.
- F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
1. Minimum Thickness: 0.052 or 0.138 inch thick, as indicated, and of length to suit application.
 2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- J. Heat-Responsive Device: Replaceable, temperature rated, fusible links.

2.6 SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Air Balance Inc.; a division of Mestek, Inc.
 - 2. Greenheck Fan Corporation.
 - 3. Nailor Industries Inc.
 - 4. Ruskin Company.
 - 5. <Insert manufacturer's name>.
- B. General Requirements: Label according to UL 555S by an NRTL.
- C. Smoke Detector: Integral, factory wired for single-point connection.
- D. Frame: Fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.
- E. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- F. Rated pressure and velocity to exceed design airflow conditions.
- G. Mounting Sleeve: Factory-installed, 0.052-inch- thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.
- H. Damper Motors: two-position action.
- I. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
 - 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 - 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
 - 5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
 - 6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
 - 7. Electrical Connection: 115 V, single phase, 60 Hz.
- J. Accessories:
 - 1. Auxiliary switches for required signaling, controlling and monitoring.

2.7 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Ductmate Industries, Inc.
 - 2. Nexus PDQ; Division of Shilco Holdings Inc.
 - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
 - 4. <Insert manufacturer's name>.

- B. Material: Galvanized steel.
- C. Gage and Shape: Match connecting ductwork.

2.8 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. METALAIRE, Inc.
 - 4. SEMCO Incorporated.
 - 5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
 - 6. <Insert manufacturer's name>.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
 - 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."
- D. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.9 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. American Warming and Ventilating; a division of Mestek, Inc.
 - 2. Ductmate Industries, Inc.
 - 3. Flexmaster U.S.A., Inc.
 - 4. Greenheck Fan Corporation.
 - 5. McGill AirFlow LLC.
 - 6. Nailor Industries Inc.
 - 7. Ventfabrics, Inc.
 - 8. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
 - 9. <Insert manufacturer's name>.
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."
 - 1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
 - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 - 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.



- c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches.
- d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

2.10 DUCT ACCESS PANEL ASSEMBLIES

NOTE TO SPECIFIER

Retain this for access panels in fire-rated duct systems, such as exhaust ducts for commercial kitchen hoods.

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Ductmate Industries, Inc.
 - 2. Flame Gard, Inc.
 - 3. 3M.
 - 4. <Insert manufacturer's name>.
- B. Labeled according to UL 1978 by an NRTL.
- C. Panel and Frame: Minimum thickness 0.0428-inch stainless steel.
- D. Fasteners: Stainless steel. Panel fasteners shall not penetrate duct wall.
- E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.
- F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.11 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. Ventfabrics, Inc.
 - 4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
 - 5. <Insert manufacturer's name>.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd..
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F.
- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - 1. Minimum Weight: 24 oz./sq. yd..
 - 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.

3. Service Temperature: Minus 50 to plus 250 deg F.

2.12 FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Flexmaster U.S.A., Inc.
 2. McGill AirFlow LLC.
 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
 4. <Insert manufacturer's name>.
- B. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 2. Maximum Air Velocity: 4000 fpm.
 3. Temperature Range: Minus 10 to plus 160 deg F.
- C. Flexible Duct Connectors:
 1. Clamps: [Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action] [Nylon strap] in sizes 3 through 18 inches, to suit duct size.
 2. Non-Clamp Connectors: [Adhesive] [Liquid adhesive plus tape] [Adhesive plus sheet metal screws].

2.13 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft and control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

NOTE TO SPECIFIER

To minimize duct noise generated by volume dampers, SMACNA recommends locating dampers at least two duct diameters from fittings and as far away as possible from outlets.

- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
 - 2. Install aluminum volume dampers in aluminum ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire and smoke dampers according to UL listing.
- H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils.
 - 2. Upstream from duct filters.
 - 3. At outdoor-air intakes and mixed-air plenums.
 - 4. At drain pans and seals.
 - 5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 - 6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors; and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
- I. Install access doors with swing against duct static pressure.
- J. Access Door Sizes:
 - 1. One-Hand or Inspection Access: 8 by 5 inches.
 - 2. Two-Hand Access: 12 by 6 inches.
 - 3. Head and Hand Access: 18 by 10 inches.
 - 4. Head and Shoulders Access: 21 by 14 inches.
 - 5. Body Access: 25 by 14 inches.
 - 6. Body plus Ladder Access: 25 by 17 inches.
- K. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- L. Install flexible connectors to connect ducts to equipment.
- M. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- N. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.
- O. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Operate dampers to verify full range of movement.
 - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 - 3. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
 - 4. Inspect turning vanes for proper and secure installation.



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END OF SECTION

SECTION 23 33 13 13 - DRAFT CONTROL DEVICES**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for draft control devices. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Draft inducer fans.
 - b. Venturi-draft inducer fans.
 - c. Mechanical-draft vent fans.
 - d. Vent exhaust fans.
 - e. Barometric dampers.
 - f. Vent dampers.
 - g. Combustion-air fans.

C. Submittals

1. Product Data: For each type of product indicated.
2. Wiring Diagrams: Power, signal, and control wiring.
3. Operation and Maintenance Data.
4. Warranty: Warranty specified in this Section.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Warranty

1. Manufacturer's standard form in which manufacturer agrees to repair or replace components of draft inducer fans, venturi-draft inducer fans, mechanical-draft vent fans, vent exhaust fans, barometric dampers, vent dampers, and/or combustion-air fans that fail in materials or workmanship within two **OR 10, as directed**, years from date of Final Completion.
 - a. Failures include failure of the fan due to corrosion.

1.2 PRODUCTS**A. Draft Inducer Fans**

1. Fan Construction: Galvanized **OR** Aluminized, **as directed**,-steel housing and radial-blade centrifugal fan.
 - a. Fan Motor: Permanent split-capacitor type.
2. Controls:
 - a. Draft proving switch.
 - b. Control kit to cycle fan with gas flow to a single burner.

B. Venturi-Draft Inducer Fans

1. Fan Construction: Enameled-steel venturi tube for vents 20 inches (508 mm) in diameter and smaller, and ASTM A 666, Type 304, stainless-steel venturi tube for vents 22 to 48 inches (559 to 1219 mm) in diameter. Galvanized **OR** Enameled, **as directed**,-steel fan housing with radial-blade centrifugal wheel.

- a. Fan Motor: Permanent split-capacitor type.
 - 2. Controls:
 - a. Draft proving switch.
 - b. Control kit to cycle fan with gas flow to a single burner.
- C. Mechanical-Draft Vent Fans
- 1. Fan Construction: Forward-curved centrifugal fan and scroll fabricated of aluminized **OR** galvanized, **as directed**, steel; direct-drive, ball-bearing motor lubricated with synthetic oil; internal cooling fan; stainless-steel shaft; and integral pressure-sensing switch.
 - a. Fan Motor: Permanent split-capacitor type.
 - 2. Controls:
 - a. Draft proving switch.
 - b. Control kit to cycle fan with gas flow to single **OR** multiple, **as directed**, burner(s).
 - 3. Accessories:
 - a. Aluminized **OR** Stainless, **as directed**, -steel, wall-vent hood.
- D. Vent Exhaust Fans
- 1. General: Centrifugal fan with variable **OR** constant, **as directed**, -speed control mounted at end of sidewall **OR** vertical, **as directed**, vent.
 - 2. Test Standard: UL 378, for fans exposed to flue gases up to 640 deg F (337 deg C).
 - 3. Fan Construction: Cast-aluminum **OR** Galvanized-steel **OR** Stainless-steel, **as directed**, housing painted manufacturer's standard color of baked enamel, **as directed**. Galvanized **OR** Stainless, **as directed**, -steel vent. Cast-aluminum **OR** Stainless-steel, **as directed**, wheel. Backward-inclined centrifugal or axial fan wheel statically and dynamically balanced. Provide access to clean the discharge area. Concentric makeup air inlet duct surrounding the vent to allow zero clearance to combustibles, **as directed**.
 - 4. Motor: Fully enclosed, variable-speed duty, **as directed**, permanent split capacitor, out of the airstream, with prelubricated and sealed ball bearings.
 - 5. Constant-Speed Controls: Boiler interlock relay starts fan when burner control cycles on. Pressure switch permits burner operation via interlock with boiler. Fan proving switch is adjustable between minus 0.07- and minus 0.15-inch wg (minus 17 and minus 37 Pa).
 - 6. Variable-Speed Controls: Boiler interlock relay starts fan when burner control cycles on. Pressure controller, control transformer, and miscellaneous controls for automatic modulation of fan speed to maintain preset negative pressure between 0- and minus 1.0-inch wg (0 and minus 249 Pa). Include controller with indicator lights, pressure differential transmitter, chimney pressure sensor probe, and fan proving switch adjustable between minus 0.07- and minus 0.15-inch wg (minus 17 and minus 37 Pa). Include tubing.
- E. Barometric Dampers
- 1. Damper Construction: High-temperature-enamel-painted steel damper and housing with galvanized-steel breeching connection. Adjustable counterweight with lock. Include knife-edge bearings that do not require lubrication.
- F. Vent Dampers
- 1. Damper Construction: Stainless-steel damper blade, shaft, and vent pipe with metal, prelubricated bearings.
 - a. Electric motor sized to power damper open and closed in approximately 15 seconds in each direction. Power is off when damper is at rest.
 - b. Comply with ANSI Z21.66.
 - 2. Controls:
 - a. Control transformer.
 - b. Keyed wiring harness.
 - c. Damper end-switch to prove damper is open.
 - d. Interlock with boiler to permit burner operation when damper is open.
 - e. Hold-open switch for troubleshooting boiler controls.

G. Combustion-Air Fans

1. Fan Construction: Galvanized **OR** Aluminized, **as directed**, -steel housing; steel forward-curved fan and scroll; direct-drive, totally enclosed, fan-cooled motor with ball bearings; stainless-steel shaft; and integral pressure-sensing switch.
 - a. Internal bypass to temper supply-air temperature to room.
2. Controls:
 - a. Fan proving switch to permit burner operation when combustion-air fan is operating.
 - b. Multiple appliance control starts fan with operation of any one of three **OR** four, **as directed**, appliances.
 - c. Modulating combustion-air fan speed to control pressure differential in room with respect to outdoors.
 - d. Manual-reset, high-limit switch stops operation with 160 deg F (71 deg C) room temperature.
 - e. Optional Controls:
 - 1) Alarm circuit.
 - 2) Excessive negative pressure limit.
 - 3) Interface relay for vent exhaust fan, draft inducer fan, or mechanical-draft vent fan.
 - 4) Galvanized-steel **OR** Aluminum, **as directed**, intake hood.

H. Motors

1. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".

1.3 EXECUTION**A. Installation**

1. Install listed components in a manner complying with the listing.
2. Secure barometric dampers to breechings with hardware compatible with connected materials.
3. Locate barometric and motorized vent dampers as close to draft hood collar as possible.
4. Secure barometric and motorized vent dampers to appliances, breechings, or chimneys with hardware compatible with connected materials.
5. Install draft inducer fans in single-wall vent section that is designed to couple with other vent materials.
6. Secure draft inducer fans to appliances, breechings, or stacks with hardware compatible with connected materials.
7. Install draft inducer fans with clearances for service and maintenance.
8. Install PVC, **as directed**, intake duct that is sized according to manufacturer's written instructions.

B. Connections

1. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
2. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

C. Startup Service

1. Engage a factory-authorized service representative to perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.
2. Remove and replace malfunctioning components and recheck.

D. Adjusting

1. Set field-adjustable switches and controls as indicated.

E. Demonstration

1. Engage a factory-authorized service representative to train **OR** Train, **as directed**, Owner's maintenance personnel to adjust, operate, and maintain draft control devices.



END OF SECTION 23 33 13 13



Task	Specification	Specification Description
23 33 13 29	23 33 13 13	Draft Control Devices
23 33 53 00	01 22 16 00	No Specification Required



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SECTION 23 34 14 00 - CSF CIRCULATING FANS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where ceiling fans are part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.23 34 14 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Ceiling fans.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Electrical service and connections.

1.2 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 - 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

PART 2 - PRODUCTS

NOTE TO SPECIFIER



Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Emerson Air Comfort Products, Hazelwood, MO (800) 237-6511.
 - 2. Hunter Fan Company, Memphis, TN (901) 743-1360.
 - 3. Leading Edge, Inc., Miami, FL (800) 327-4328.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

- A. Ceiling fans
 - 1. Emerson: #HF956W.
 - 2. Hunter: Summer Breeze #25516.
 - 3. Leading Edge: #5630-1RDP.
- B. Description
 - 1. Blade material: Contoured metal or solid wood.
 - 2. Blade size: Minimum 4 foot 6 inches diameter.
 - 3. Operation: Forward and reverse.
 - 4. Speed: [Variable] [3 speed].
 - 5. Air movement: Minimum 25,000 cubic feet per minute.
 - 6. Electrical: 120 volts, maximum 110 watts, 1.0 amps.
 - 7. Color: White.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.



3.3 ADJUSTING

- A. Adjust assembly for smooth and noiseless operation.

3.4 CLEANING

- A. Section 017704 - Closeout Procedures and Training: Cleaning installed work.
- B. Remove labels and visible markings.

3.5 WARRANTIES

- A. Two year warranty on motor.

NOTE TO SPECIFIER

Include items that require coordination with Contract Drawings. Retain for reference purposes and delete prior to issuance of Project Manual.

DRAWING COORDINATION ITEMS

Drawings should indicate the following information related to this Section.

1. *Fans must be mounted a minimum 10 feet above the floor.*
2. *Fan direction selector switch to be wall mounted.*
3. *Fan speed switch to be wall mounted.*

USPS CSF Specifications issued: 10/1/2013

Last revised: 5/11/11

END OF SECTION



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SECTION 23 34 16 00 - CSF CENTRIFUGAL HVAC FANS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Exhaust Fans are part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.23 34 16 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Roof exhausters.
 - 2. Wall exhausters.
 - 3. Cabinet [exhaust] fans.
 - 4. Ceiling exhaust fans.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 077213 – Manufactured Curbs: Roof curbs for roof exhauster installation.
 - 2. Section 230500 – Common Work results for HVAC: Basic mechanical methods.
 - 3. Section 233100 – HVAC Ducts and Casings: Connections to ductwork and backdraft dampers.
 - 4. Section 260500 – Common Work Results for Electrical: Electrical connections.

1.2 REFERENCES

- A. Air Movement and Control Association (AMCA):
 - 1. AMCA 99 - Standards Handbook.
 - 2. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.
 - 3. AMCA 261 - Directory of Products Licensed to Bear the AMCA Certified Ratings Seal.
 - 4. AMCA 300 - Test Code for Sound Rating Air Moving Devices.
 - 5. AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.
- B. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA MG1 - Motors and Generators.
- C. National Fire Protection Association (NFPA):



1. NFPA 70 - National Electrical Code.

- D. Underwriters Laboratories, Inc. (UL):
1. UL 705 - Power Ventilators.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
1. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, sound power levels at rated capacity, and electrical characteristics and connection requirements.
 2. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
1. Operation and Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.4 QUALITY ASSURANCE

- A. Qualifications:
1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

NOTE TO SPECIFIER

Use ROOF EXHAUSTERS where required for specific Project.

2.1 ROOF EXHAUSTER

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. ACME Engineering & Manufacturing, Muskogee, OK (918) 682-7791.
 2. Greenheck Fan Corp., Schofield, WI (715) 359-6171.
 3. Penn Ventilator, Philadelphia, PA (215) 464-8900.
 4. Cook, Loren Co., Springfield, MO (417) 869-6474.
 5. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Product Requirements:



1. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.
 2. Sound Ratings: AMCA 301, tested to AMCA 300 ,and bear AMCA Certified Sound Rating Seal.
 3. Fabrication: Conform to AMCA 99.
 4. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
- C. Performance: Refer to schedule on Drawings.
- D. Fan Unit: V-belt or direct driven as indicated, with [spun aluminum] [galvanized steel with baked on enamel] [fiberglass reinforced plastic] [upblast spun aluminum with grease tray] housing; resilient mounted motor; 1/2 inch mesh, 16 gage aluminum birdscreen; square base to suit roof curb with continuous curb gaskets.
- E. Roof Curb: Specified in Section 077213. Curbs to be supplied and installed by General Contractor.
- F. Electrical Characteristics and Components
1. Electrical Characteristics: Refer to schedule on Drawings.
 2. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.
 3. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor [and wall mounted [multiple speed switch] [or] [solid state speed controller]]..
- G. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with nylon bearings.
- H. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self aligning pre-lubricated ball bearings.

NOTE TO SPECIFIER

Use WALL EXHAUSTERS where required for specific Project. List minimum 3 manufacturers.

2.2 WALL EXHAUSTERS

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. ACME Engineering & Manufacturing, Muskogee, OK (918) 682-7791.
 2. Greenheck Fan Corp., Schofield, WI (715) 359-6171.
 3. Penn Ventilator, Philadelphia, PA (215) 464-8900.
 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Performance: Refer to schedule on Drawings.
- C. Fan Unit: V-belt or direct driven with spun aluminum housing; resiliently mounted motor; 1/2 inch mesh, 16 gage aluminum bird screen.
- D. Electrical Characteristics and Components.
1. Electrical Characteristics: Refer to schedule on Drawings.
 2. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.
 3. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor [and wall mounted [multiple speed switch] [or] [solid state speed controller]]..



- E. Backdraft Damper: Gravity activated, aluminum multiple blade construction, felt edged with nylon bearings.
- F. Sheaves: For V-belt drives, provide cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self aligning pre-lubricated ball bearings.

NOTE TO SPECIFIER

Use CABINET AND CEILING FANS where required for specific Project. List minimum 3 manufacturers.

2.3 CABINET AND CEILING EXHAUST FANS

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. ACME Engineering & Manufacturing, Muskogee, OK (918) 682-7791.
 - 2. Cook, Loren Co., Springfield, MO (417) 869-6474.
 - 3. Greenheck Fan Corp., Schofield, WI (715) 359-6171.
 - 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Performance: Refer to schedule on Drawings.
- C. Centrifugal Fan Unit: V-belt driven with galvanized steel housing lined with 1/2 inch acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.
- D. Electrical Characteristics and Components.
 - 1. Electrical Characteristics: Refer to schedule on Drawings.
 - 2. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.
 - 3. Disconnect Switch: Cord and plug in housing for thermal overload protected motor [and wall mounted [switch] [multiple speed switch] [solid state speed controller]].
- E. Grille: Molded white plastic or aluminum with baked white enamel finish.
- F. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution Requirements: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure [roof] [wall] exhausters with [cadmium plated steel] [aluminum] [stainless steel] lag screws to [roof curb] [structure].
- C. Extend ducts to [roof] [wall] exhausters into [roof curb] [structure]. Counterflash duct to [roof] [wall] opening.
- D. Install flexible connections between fan inlet and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.
- E. Provide sheaves required for final air balance.
- F. Install backdraft dampers on inlet to roof exhausters.
- G. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.
- H. Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

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END OF SECTION



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Task	Specification	Specification Description
23 34 16 00	01 22 16 00	No Specification Required



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SECTION 23 34 23 00 - MPF VAC POWER VENTILATORS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:

NOTE TO SPECIFIER

Adjust list below to suit Project.

1. Centrifugal roof ventilators.
2. Centrifugal wall ventilators.
3. Ceiling-mounting ventilators.
4. In-line centrifugal fans.

1.2 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
- B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- C. UL Standard: Power ventilators shall comply with UL 705.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 CENTRIFUGAL ROOF VENTILATORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Carnes Company HVAC.
 - 2. Central Blower Co.
 - 3. Greenheck.
 - 4. Loren Cook Company.
 - 5. Penn Ventilation.
- B. Description: Direct- or belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.
- C. Painted galvanized-steel and fiberglass housings are also available from some manufacturers.
- D. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.
- E. Drive Assembly: Belt drive or direct drive, as required.
 - 1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
 - 2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
 - 3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
 - 4. Fan and motor isolated from exhaust airstream.
- F. Accessories:
 - 1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted [inside] [outside] fan housing, factory wired through an internal aluminum conduit.
 - 2. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.
 - 3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
 - 4. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.
- G. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to suit roof opening and fan base.
 - 1. Overall Height: High enough to allow proper roof flashing to prevent leaks.
 - 2. Pitch Mounting: Manufacture curb for roof slope.
 - 3. Burglar Bars: Provide where required for security.

2.2 CENTRIFUGAL WALL VENTILATORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Carnes Company HVAC.
 - 2. Central Blower Co.
 - 3. Greenheck.
 - 4. Loren Cook Company.
 - 5. Penn Ventilation.



- B. Description: Direct- or belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and accessories.
- C. Housing: Heavy-gage, removable, spun-aluminum, dome top and outlet baffle; venturi inlet cone.
- D. Fan Wheel: Aluminum hub and wheel with backward-inclined blades.
- E. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:
 - 1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
 - 2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
 - 3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
 - 4. Fan and motor isolated from exhaust airstream.

F. Accessories:

NOTE TO SPECIFIER

Edit list of accessories below that may be in subparagraphs below required for Project.

Edit list of accessories below that may be required for Project.

- 1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through internal aluminum conduit.
- 2. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.
- 3. Wall Grille: Ring type for flush mounting.
- 4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in wall sleeve; factory set to close when fan stops.
- 5. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

2.3 CEILING-MOUNTING VENTILATORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Broan Mfg. Co., Inc.
 - 2. Carnes Company HVAC.
 - 3. Greenheck.
 - 4. Loren Cook Company.
 - 5. NuTone Inc.
 - 6. Penn Ventilation.
- B. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.
- C. Housing: Steel, lined with acoustical insulation.
- D. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.
- E. Grille: Louvered grille with flange on intake and thumbscrew attachment to fan housing.
- F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

2.4 IN-LINE CENTRIFUGAL FANS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Carnes Company HVAC.
 - 2. Central Blower Co.
 - 3. Greenheck.
 - 4. Loren Cook Company.
 - 5. Penn Ventilation.
- B. Description: In-line, centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.
- C. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

NOTE TO SPECIFIER

Adjust two subparagraphs below to suit Project.

- D. Direct-Driven Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.
- E. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.
- F. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

2.5 MOTORS

- A. Comply with requirements in Division 15 Section "Motors."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Support units using elastomeric mounts or spring isolators based upon size.
 - 1. Secure vibration and seismic controls to concrete bases using anchor bolts cast in concrete base.
- C. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 7 Section "Roof Accessories" for installation of roof curbs.
- D. Ceiling Units: Suspend units from structure; use metal straps.
- E. Support suspended units from structure using threaded steel rods and elastomeric hangers or spring hangers.
- F. Install units with clearances for service and maintenance.
- G. Label units according to requirements specified in Division 15.

- H. Coordinate duct installation and specialty arrangements with schematics on Drawings and with requirements specified in duct systems. If Drawings are explicit enough, these requirements may be reduced or omitted.
- I. Duct installation and connection requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 15 Section "Duct and Duct Accessories."
- J. Install ducts adjacent to power ventilators to allow service and maintenance.
- K. Ground equipment according to Division 16 Section "Grounding and Bonding."
- L. Connect wiring according to Division 16 Section "Conductors and Cables."

3.2 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 5. Adjust belt tension.
 - 6. Adjust damper linkages for proper damper operation.
 - 7. Verify lubrication for bearings and other moving parts.
 - 8. Remove and replace malfunctioning units and retest as specified above.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 6/30/2010

END OF SECTION 23 34 23 00



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Task	Specification	Specification Description
23 35 13 00	01 22 16 00	No Specification Required



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SECTION 23 36 00 00 - MPF AIR TERMINAL UNITS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fan-powered air terminal units.
 - 2. Shutoff, single-duct air terminal units.

1.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Hangers and supports and seismic restraints (if required by location) shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems".

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For air terminal units. Include plans, elevations, sections, details, and attachments to other work.
- C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 FAN-POWERED AIR TERMINAL UNITS

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Carnes.
 2. Environmental Technologies, Inc.
 3. Krueger.
 4. METALAIR, Inc.
 5. Nailor Industries Inc.
 6. Price Industries.
 7. Titus.
 8. Trane; a business of American Standard Companies.
- B. Configuration: Volume-damper assembly and fan in parallel arrangement inside unit casing with control components inside a protective metal shroud.
- C. Casing: 0.034-inch (0.85-mm) steel, single wall.
1. Casing Lining: Adhesive attached, 1/2-inch- (13-mm-) thick, coated, fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
 - a. Cover liner with nonporous foil.
 2. Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.
 3. Air Outlet: S-slip and drive connections.
 4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.
 5. Fan: Forward-curved centrifugal, located at plenum air inlet.
 6. Retain subparagraph below to comply with LEED-NC Prerequisite EQ 1.
 7. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
- D. Volume Damper: Galvanized steel with flow-sensing ring and peripheral gasket and self-lubricating bearings.
1. Maximum Damper Leakage: ARI 880 rated, 2 percent of nominal airflow at 3-inch wg (750-Pa) inlet static pressure.
- E. Velocity Sensors: Multipoint array with velocity sensors in cold- and hot-deck air inlets and air outlets.
- F. Motor:
1. Fan-Motor Assembly Isolation: Rubber isolators.
 2. Verify availability of enclosure types with manufacturer of specified equipment. Delete "Enclosure" Subparagraph below if information is included in schedule on Drawings.
 3. Efficiency: Premium efficient ECM

NOTE TO SPECIFIER

Edit the two paragraphs below based on actual heating coils for Project.

- G. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), and rated for a minimum working pressure of 200 psig (1380 kPa) and a maximum entering-water temperature of 220 deg F (104 deg C). Include manual air vent and drain valve.
 - 1. Location: Plenum air inlet.
- H. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware.
 - 1. Location: Plenum air inlet.
 - 2. Access door interlocked disconnect switch.
 - 3. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable.)
 - 4. Nickel chrome 80/20 heating elements.
 - 5. Airflow switch for proof of airflow.
 - 6. Fan interlock contacts.
 - 7. Fuses in terminal box for overcurrent protection (for coils more than 48 A).
 - 8. Magnetic contactor for each step of control (for three-phase coils).
- I. Direct Digital Controls: Single-package unitary controller and actuator specified in Division 25 Section ""Building Automation System (BAS) General".

2.2 SHUTOFF, SINGLE-DUCT AIR TERMINAL UNITS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Carnes.
 - 2. Environmental Technologies, Inc.
 - 3. Krueger.
 - 4. METALAIR, Inc.
 - 5. Nailor Industries Inc.
 - 6. Price Industries.
 - 7. Titus.
 - 8. Trane; a business of American Standard Companies.
- B. Casing: 0.034-inch (0.85-mm) steel, single wall.
 - 1. Casing Lining: Adhesive attached, 1/2-inch- (13-mm-) thick, coated, fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
 - a. Cover liner with nonporous foil.
 - 2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
 - 3. Air Outlet: S-slip and drive connections, size matching inlet size.
 - 4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.
 - 5. Retain subparagraph below to comply with LEED-NC Prerequisite EQ 1.
 - 6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
- C. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
 - 1. Maximum Damper Leakage: ARI 880 rated, 2 percent of nominal airflow at 3-inch wg (750-Pa) inlet static pressure.

NOTE TO SPECIFIER

Edit the two paragraphs below based on actual heating coils for Project.

- D. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), and rated for a minimum working pressure of 200 psig (1380 kPa) and a maximum entering-water temperature of 220 deg F (104 deg C). Include manual air vent and drain valve.
- E. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware.
 - 1. Access door interlocked disconnect switch.
 - 2. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable.)
 - 3. Nickel chrome 80/20 heating elements.
 - 4. Airflow switch for proof of airflow.
 - 5. Fuses in terminal box for overcurrent protection (for coils more than 48 A).
 - 6. Magnetic contactor for each step of control (for three-phase coils).
- F. Direct Digital Controls: Single-package unitary controller and actuator specified in Division 25 Section ""Building Automation System (BAS) General".

2.3 SOURCE QUALITY CONTROL

- A. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
- B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Hangers Exposed to View: Threaded rod and angle or channel supports.
- C. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.3 CONNECTIONS

- A. Install piping adjacent to air terminal unit to allow service and maintenance.
- B. Hot-Water Piping: In addition to requirements in Division 23 Section "Hydronic Piping," connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.

- C. Connect ducts to air terminal units according to Division 23 Section "Metal Ducts."
- D. Coordinate duct installations and specialty arrangements with Drawings.
- E. Make connections to air terminal units with flexible connectors complying with requirements in Division 23 Section "Duct Accessories."

3.4 IDENTIFICATION

- A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.5 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
 - 2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Air terminal unit will be considered defective if it does not pass tests and inspections.

3.6 STARTUP SERVICE

- A. Perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
 - 3. Verify that controls and control enclosure are accessible.
 - 4. Verify that control connections are complete.
 - 5. Verify that nameplate and identification tag are visible.
 - 6. Verify that controls respond to inputs as specified.

3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.



END OF SECTION 23 36 00 00



SECTION 23 36 00 00 - CSF AIR TERMINAL UNITS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fan-powered air terminal units.
 - 2. Shutoff, single-duct air terminal units.

1.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Hangers and supports and seismic restraints (if required by location) shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems".

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For air terminal units. Include plans, elevations, sections, details, and attachments to other work.
- C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 FAN-POWERED AIR TERMINAL UNITS

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Carnes.
 2. Environmental Technologies, Inc.
 3. Krueger.
 4. METALAIRE, Inc.
 5. Nailor Industries Inc.
 6. Price Industries.
 7. Titus.
 8. Trane; a business of American Standard Companies.
- B. Configuration: Volume-damper assembly and fan in parallel arrangement inside unit casing with control components inside a protective metal shroud.
- C. Casing: 0.034-inch (0.85-mm) steel, single wall.
1. Casing Lining: Adhesive attached, 1/2-inch- (13-mm-) thick, coated, fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
 - a. Cover liner with nonporous foil.
 2. Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.
 3. Air Outlet: S-slip and drive connections.
 4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.
 5. Fan: Forward-curved centrifugal, located at plenum air inlet.
 6. Retain subparagraph below to comply with LEED-NC Prerequisite EQ 1.
 7. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
- D. Volume Damper: Galvanized steel with flow-sensing ring and peripheral gasket and self-lubricating bearings.
1. Maximum Damper Leakage: ARI 880 rated, 2 percent of nominal airflow at 3-inch wg (750-Pa) inlet static pressure.
- E. Velocity Sensors: Multipoint array with velocity sensors in cold- and hot-deck air inlets and air outlets.
- F. Motor:
1. Fan-Motor Assembly Isolation: Rubber isolators.
 2. Verify availability of enclosure types with manufacturer of specified equipment. Delete "Enclosure" Subparagraph below if information is included in schedule on Drawings.
 3. Efficiency: Premium efficient ECM
- G. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware.

1. Location: Plenum air inlet.
2. Access door interlocked disconnect switch.
3. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable.)
4. Nickel chrome 80/20 heating elements.
5. Airflow switch for proof of airflow.
6. Fan interlock contacts.
7. Fuses in terminal box for overcurrent protection (for coils more than 48 A).
8. Magnetic contactor for each step of control (for three-phase coils).

- H. Electronic Controls: Single-package unitary controller and actuator configured to work with limited BAS systems in CSF facilities.

2.2 SHUTOFF, SINGLE-DUCT AIR TERMINAL UNITS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Carnes.
 2. Environmental Technologies, Inc.
 3. Krueger.
 4. METALAIR, Inc.
 5. Nailor Industries Inc.
 6. Price Industries.
 7. Titus.
 8. Trane; a business of American Standard Companies.
- B. Casing: 0.034-inch (0.85-mm) steel, single wall.
1. Casing Lining: Adhesive attached, 1/2-inch- (13-mm-) thick, coated, fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
 - a. Cover liner with nonporous foil.
 2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
 3. Air Outlet: S-slip and drive connections, size matching inlet size.
 4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.
 5. Retain subparagraph below to comply with LEED-NC Prerequisite EQ 1.
 6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
- C. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
1. Maximum Damper Leakage: ARI 880 rated, 2 percent of nominal airflow at 3-inch wg (750-Pa) inlet static pressure.
- D. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware.
1. Access door interlocked disconnect switch.
 2. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable.)
 3. Nickel chrome 80/20 heating elements.
 4. Airflow switch for proof of airflow.
 5. Fuses in terminal box for overcurrent protection (for coils more than 48 A).
 6. Magnetic contactor for each step of control (for three-phase coils).

- E. Electronic Controls: Single-package unitary controller and actuator configured to work with limited BAS systems in CSF facilities.

2.3 SOURCE QUALITY CONTROL

- A. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
- B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Hangers Exposed to View: Threaded rod and angle or channel supports.
- C. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.3 CONNECTIONS

- A. Install piping adjacent to air terminal unit to allow service and maintenance.
- B. Hot-Water Piping: In addition to requirements in Division 23 Section "Hydronic Piping," connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.
- C. Connect ducts to air terminal units according to Division 23 Section "Metal Ducts."
- D. Coordinate duct installations and specialty arrangements with Drawings.
- E. Make connections to air terminal units with flexible connectors complying with requirements in Division 23 Section "Duct Accessories."

3.4 IDENTIFICATION

- A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.5 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
 - 2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Air terminal unit will be considered defective if it does not pass tests and inspections.

3.6 STARTUP SERVICE

- A. Perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
 - 3. Verify that controls and control enclosure are accessible.
 - 4. Verify that control connections are complete.
 - 5. Verify that nameplate and identification tag are visible.
 - 6. Verify that controls respond to inputs as specified.

3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

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Last revised: 5/11/11

END OF SECTION 23 36 00 00



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SECTION 23 37 13 00 - MPF DIFFUSERS, REGISTERS, AND GRILLES

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Rectangular and square ceiling diffusers.
 - 2. Perforated diffusers.
 - 3. Louver face diffusers.
 - 4. Adjustable bar registers and grilles.
 - 5. Fixed face registers and grilles.
- B. Related Sections:
 - 1. Division 10 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
 - 2. Division 15 Section "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

- A. Rectangular and Square Ceiling Diffusers:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carnes.

- b. Hart & Cooley Inc.
- c. Krueger.
- d. METALAIR, Inc.
- e. Nailor Industries Inc.
- f. Price Industries.
- g. Titus.
- h. Tuttle & Bailey.
- 2. Devices shall be specifically designed for variable-air-volume flows, where required.
- 3. Material: Steel or Aluminum, as specified. Aluminum shall be used in humid climates.
- 4. Finish: Baked enamel, white or anodized aluminum, per requirements.
- 5. Face Size: 24 by 24 inches (600 by 600 mm) for lay-in ceilings or as otherwise required.
- 6. Mounting: Surface or T-bar, as required.
- 7. Pattern: Fixed or adjustable, as required.
- 8. Dampers: Radial opposed blade.
- 9. Insulation: Back plate covered with glass fiber insulation with an aluminum foil vapor barrier to prevent harmful effects of condensation.

2.2 REGISTERS AND GRILLES

- A. Fixed Face Grille or Register:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carnes.
 - b. Hart & Cooley Inc.
 - c. Krueger.
 - d. METALAIR, Inc.
 - e. Nailor Industries Inc.
 - f. Price Industries.
 - g. Titus.
 - h. Tuttle & Bailey.
 - 2. Devices shall be specifically designed for variable-air-volume flows, where required.
 - 3. Material: Steel or Aluminum, as specified. Aluminum shall be used in humid climates.
 - 4. Finish: Baked enamel, white or anodized aluminum, per requirements.
 - 5. Face Size: 24 by 24 inches (600 by 600 mm) for lay-in ceilings or as otherwise required.
 - 6. Mounting: Surface or T-bar, as required.
 - 7. Pattern: Fixed or adjustable, as required.
 - 8. Dampers: Radial opposed blade.
 - 9. Insulation: Back plate covered with glass fiber insulation with an aluminum foil vapor barrier to prevent harmful effects of condensation.

2.3 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.

- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.2 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

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Last revised: 4/24/2012

END OF SECTION 23 37 13 00



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SECTION 23 37 13 00 - CSF DIFFUSERS, REGISTERS AND GRILLES

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.23 37 13 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Diffusers.
 - 2. Registers/grilles.
 - 3. Door grilles.
- B. Related Sections:
 - 1. Section 099100 - Painting: Painting of ductwork visible behind outlets and inlets.

1.2 REFERENCES

- A. Air Diffusion Council (ADC):
 - 1. ADC 1062 - Certification, Rating and Test Manual.
- B. Air Movement and Control Association (AMCA):
 - 1. AMCA 500 - Test Method for Louvers, Dampers and Shutters.
- C. Air Conditioning and Refrigeration Institute (ARI):
 - 1. ARI 650 - Air Outlets and Inlets.
- D. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
 - 1. ASHRAE 70 - Method of Testing for Rating the Air Flow Performance of Outlets and Inlets.
- E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
 - 1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.
- F. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code.
 - 2. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.



1.3 SUBMITTALS

- A. Section 013300 - Submittals: Procedures for submittals.
 - 1. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.4 QUALITY ASSURANCE

- A. Test and rate air outlet and inlet performance in accordance with ADC Equipment Test Code 1062 and ASHRAE 70.
- B. Test and rate louver performance in accordance with AMCA 500.
- C. Qualifications
 - 1. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Titus, Richardson, TX (214) 899-1030.
 - 2. Ruskin, Kansas City, MO (816) 761-7476.
 - 3. Tuttle & Bailey, Holland, MI (800) 270-5686.

2.2 .ROUND CEILING DIFFUSERS

- A. Type: Round, stamped or spun, multi-core diffuser to discharge air in 360 degree pattern, with sectorizing baffles where indicated. Diffuser collar shall project not more than one inch above ceiling.
- B. Fabrication: Steel with baked enamel, "off-white" finish.
- C. Accessories: Radial opposed blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face.
- D. Insulation: Back plate covered with glass fiber insulation with an aluminum foil vapor barrier to prevent harmful effects of condensation.

2.3 RECTANGULAR CEILING DIFFUSERS

- A. Type: Square, stamped, multi-core diffuser to discharge air in four way pattern.
- B. Frame: Surface mount, Snap-in, Inverted T-bar, or Spline type as scheduled on plans.
- C. Fabrication: Steel or Aluminum with baked enamel, "off-white" finish.

- D. Accessories: Radial opposed blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face.
- E. Insulation: Back plate covered with glass fiber insulation with an aluminum foil vapor barrier to prevent harmful effects of condensation.

2.4 PERFORATED FACE CEILING DIFFUSERS

- A. Type: Perforated face with fully adjustable pattern and removable face.
- B. Frame: Surface mount, Snap-in, Inverted T-bar, or Spline type as scheduled on plans.
- C. Fabrication: Steel with steel or aluminum frame and baked enamel, "off-white" finish.
- D. Accessories: Radial opposed blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face.
- E. Insulation: Back plate covered with glass fiber insulation with an aluminum foil vapor barrier to prevent harmful effects of condensation.

2.5 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

- A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with blades set at 45 degrees, vertical or horizontal face as scheduled on Drawings.
- B. Frame: 1-1/4 inch margin with concealed mounting.
- C. Fabrication: Steel with 20 gage minimum frames and 22 gage minimum blades, steel and aluminum with 20 gage minimum frame, or aluminum extrusions, with factory baked enamel, "off-white" finish.
- D. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans.
- E. Insulation: Back plate covered with glass fiber insulation with an aluminum foil vapor barrier to prevent harmful effects of condensation.

2.6 CEILING GRID CORE EXHAUST AND RETURN REGISTERS/GRILLES

- A. Type: Fixed grilles of 1/2 x 1/2 x 1/2 inch louvers.
- B. Fabrication: Aluminum or steel grid with factory baked enamel, "off-white" finish.
- C. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.
- D. Insulation: Back plate covered with glass fiber insulation with an aluminum foil vapor barrier to prevent harmful effects of condensation.

2.7 WALL SUPPLY REGISTERS/GRILLES

- A. Type: Streamlined and individually adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing with spring or other device to set blades, vertical or horizontal face, single or double deflection as scheduled on plans.

- B. Frame: 1-1/4 inch margin with countersunk screw or concealed mounting and gasket.
- C. Fabrication: Steel with 20 gage minimum frames and 22 gage minimum blades, steel and aluminum with 20 gage minimum frame, or aluminum extrusions, with factory baked enamel "off-white" finish.
- D. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.
- E. Insulation: Back plate covered with glass fiber insulation with an aluminum foil vapor barrier to prevent harmful effects of condensation.

2.8 WALL EXHAUST AND RETURN REGISTERS/GRILLES

- A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with spring or other device to set blades, vertical or horizontal face as scheduled on plans.
- B. Frame: 1-1/4 inch margin with countersunk screw or concealed mounting.
- C. Fabrication: Steel with 20 gage minimum frames and 22 gage minimum blades, or Steel and aluminum with 20 gage minimum frame, with factory baked enamel, "off-white" finish.
- D. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.9 DOOR GRILLES

- A. Type: V-shaped louvers of 20 gage thick steel, one inch deep on 1/2 inch centers.
- B. Frame: 20 gage steel with auxiliary frame to give finished appearance on both sides of door, with factory prime coat finish, final color finish to be determined by Architect.
- C. Coordinate with Section 081100.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Coordinate location of outlets and inlets with Architectural reflected ceiling plan and make necessary adjustments in position to conform with architectural features, symmetry, and electrical lighting arrangement.
- C. Install diffusers to ductwork with air tight connection.
- D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- E. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 099100.



USPS CSF Specifications issued: 10/1/2013
Last revised: 4/24/12

END OF SECTION



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Task	Specification	Specification Description
23 38 13 16	01 22 16 00	No Specification Required



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SECTION 23 41 00 00 - MPF PARTICULATE AIR FILTRATION

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes factory-fabricated air-filter devices and media used to remove particulate matter from air for HVAC applications.

1.2 SUBMITTALS

- A. Product Data: Include dimensions; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each unit indicated.
- B. Shop Drawings: Details to illustrate component assemblies and attachments.
 - 1. Show filter rack assembly, dimensions, materials, and methods of assembly of components.
- C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Comply with ARI 850.
- B. Comply with ASHRAE 52.1 and ASHRAE 52.2.
- C. Comply with NFPA 90A and NFPA 90B.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AAF International.
 2. Air Filter International.
 3. Airguard Industries, Inc.
 4. Farr Co.
 5. Flanders/CSC Corp.
 6. Flanders Filters, Inc.
 7. General Filters Inc.
 8. International Air Filtration Corporation.
 9. NiCon Filter Corp.; Continental Air Filter Div.
 10. Purafil, Inc.
- B. Extended-Surface, Disposable Panel Filters: Factory-fabricated, dry, extended-surface filters with hold-
ing frames.
1. Media: Fibrous material formed into deep-V-shaped pleats and held by self-supporting wire grid.
 2. Media and Media-Grid Frame: Nonflammable cardboard with gaskets.
 3. Duct-Mounting Frames: Welded, galvanized steel with gaskets and fasteners, and suitable for
bolting together into built-up filter banks.
 4. Provide new filters at project completion plus one new set of spare filters for each system.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames
to substrate.
- B. Install filters in position to prevent passage of unfiltered air.
- C. Coordinate filter installations with duct and air-handling unit installations.
- D. Electrical wiring and connections are specified in Division 26 Sections.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 6/30/2010

END OF SECTION 23 41 00 00



Task	Specification	Specification Description
23 41 13 00	22 11 19 00	Electronic Air Cleaners
23 41 16 00	22 11 19 00	Electronic Air Cleaners
23 41 19 00	22 11 19 00	Electronic Air Cleaners
23 41 33 00	22 13 19 13	High-Efficiency Particulate Filtration



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SECTION 23 42 13 00 - GAS-PHASE AIR FILTRATION**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for gas-phase air infiltration. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Activated-carbon panel filters.
 - b. Activated-carbon, deep-V filters.
 - c. Activated carbon, V-cell filters.
 - d. Cylindrical-canister filters.
 - e. Permanganate filters.
 - f. Supported adsorber bag filters.
 - g. Front-access filter housings.
 - h. Side-service housings.
 - i. Filter gages.

C. Submittals

1. Product Data: For each type of product indicated. Include dimensions; operating characteristics; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.
2. LEED Submittal:
 - a. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with applicable requirements in ASHRAE 62.1, Section 5, "Systems and Equipment."
3. Shop Drawings: For air filters. Include plans, elevations, sections, details, and attachments to other work.
 - a. Show filter rack assembly, dimensions, materials, and methods of assembly of components.
 - b. Include setting drawings, templates, and requirements for installing anchor bolts and anchorages.
4. Field quality-control reports.
5. Operation and Maintenance Data: For each type of filter and rack to include in emergency, operation, and maintenance manuals.

D. Quality Assurance

1. ASHRAE Compliance:
 - a. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
2. Comply with NFPA 90A and NFPA 90B.

1.2 PRODUCTS**A. Activated-Carbon Panel Filters**

1. Description: Factory-fabricated unit with activated-carbon media.
2. Media: Flat-panel, disposable multilayer filter with an inlet layer of polyester fibers, a layer of activated-carbon granules bonded to fibers, and a layer of polyurethane foam; housed in a cardboard frame.



3. Media: Flat-panel, disposable honeycombed cellulose with cells filled with activated-carbon granules and a perforated mesh grid; housed in a cardboard frame.
4. Media: Pleated, multilayer filter with an inlet layer of cotton and synthetic fibers and a layer of activated-carbon granules bonded to synthetic fibers; media formed into deep-V-shaped pleats, held by self-wire grid, and housed in a cardboard frame.
5. Mounting Frames: Welded, galvanized, sheet-steel frame and galvanized-steel fasteners with polyurethane, **as directed**, gaskets; capable of bolting together into built-up filter banks.

B. Activated-Carbon, Deep-V Filters

1. Description: Factory-fabricated unit with activated-carbon trays in deep-V arrangement with disposable panel prefilter, **as directed**, and final filter, **as directed**.
2. Module Housing: 0.064-inch- (1.6-mm-) thick, galvanized steel **OR** stainless steel **OR** double-wall casing with 1-inch- (25-mm-) thick insulation, **as directed**, to hold media-filled panels; with side servicing through gasketed access doors on both sides and able to connect to other housings. Equip housings with metal slide channel tracks to hold activated-carbon trays and particulate prefilter, **as directed**, and final filter, **as directed**.
 - a. Finish: Factory primed **OR** primed and painted, **as directed**, outside **OR** inside and outside **OR** inside, **as directed**.
 - b. Pressure tap and fitting.
3. Media-Holding Panels: 1-inch- (25-mm-) thick, perforated polystyrene to allow airflow through contained loose-fill media; with removable service cap for recharging.
OR
Media-Holding Panels: 1 inch (25 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, deep and containing granular carbon bonded into a briquette form with a galvanized **OR** stainless, **as directed**, -steel frame.
4. Media: 45 lb (20.3 kg) per 1000 cfm (470 L/s) of loose-fill **OR** loose-fill or bonded-briquette **OR** bonded-briquette, **as directed**, coconut-shell activated carbon.
 - a. Ash Content: 2 to 3 percent.
 - b. Percent Carbon Tetrachloride Activity: 35 to 70 percent when tested according to ASTM D 3467.
 - c. Bulk Density: 32 lb/cu. ft. (510 kg/cu. m).
 - d. Mesh Size: 4 by 6 inches (100 by 150 mm), 90 percent minimum.
 - e. Hardness Factor: 95 when tested according to ASTM D 3802.
5. Media: loose-fill **OR** loose-fill or bonded-briquette **OR** bonded-briquette, **as directed**, activated alumina impregnated with potassium permanganate.
 - a. Ash Content: 2 to 3 percent.
 - b. Percent Carbon Tetrachloride Activity: 35 to 70 percent when tested according to ASTM D 3467.
 - c. Bulk Density: 32 lb/cu. ft. (510 kg/cu. m).
 - d. Mesh Size: 4 by 6 inches (100 by 150 mm), 90 percent minimum.
 - e. Hardness Factor: 95 when tested according to ASTM D 3802.
6. Media: loose-fill **OR** loose-fill or bonded-briquette **OR** bonded-briquette, **as directed**, impregnated carbon.
 - a. Ash Content: 2 to 3 percent.
 - b. Percent Carbon Tetrachloride Activity: 35 to 70 percent when tested according to ASTM D 3467.
 - c. Bulk Density: 32 lb/cu. ft. (510 kg/cu. m).
 - d. Mesh Size: 4 by 6 inches (100 by 150 mm), 90 percent minimum.
 - e. Hardness Factor: 95 when tested according to ASTM D 3802.
7. Media: loose-fill **OR** loose-fill or bonded-briquette **OR** bonded-briquette, **as directed**, blended carbon and alumina impregnated with potassium permanganate.
 - a. Ash Content: 2 to 3 percent.
 - b. Percent Carbon Tetrachloride Activity: 35 to 70 percent when tested according to ASTM D 3467.
 - c. Bulk Density: 32 lb/cu. ft. (510 kg/cu. m).

- d. Mesh Size: 4 by 6 inches (100 by 150 mm), 90 percent minimum.
 - e. Hardness Factor: 95 when tested according to ASTM D 3802.
- C. Activated-Carbon, V-Cell Filters
- 1. Description: Factory-fabricated, dry, V-shaped cartridges containing loose-fill media with holding frames.
 - 2. Cartridges: V-cell configuration, plastic enclosure caps, galvanized-steel frame with vertical galvanized-steel channel supports. Integral, 1-inch- (25-mm-) deep panels constructed of honeycombed paper and nylon mesh.
 - 3. Fill Media: Coconut-shell activated carbon; 45 lb (20.3 kg) of activated carbon per 1000 cfm (470 L/s) of airflow.
 - a. Ash Content: 2 to 3 percent.
 - b. Percent Carbon Tetrachloride Activity: 35 to 70 percent when tested according to ASTM D 3467.
 - c. Bulk Density: 32 lb/cu. ft. (510 kg/cu. m).
 - d. Mesh Size: 4 by 6 inches (100 by 150 mm), 90 percent minimum.
 - e. Hardness Factor: 95 when tested according to ASTM D 3802.
 - 4. Fill Media: Activated alumina impregnated with potassium permanganate; 10.5 lb (4.8 kg) of adsorbent per 500 cfm (236 L/s) of airflow.
 - a. Ash Content: 2 to 3 percent.
 - b. Percent Carbon Tetrachloride Activity: 35 to 70 percent when tested according to ASTM D 3467.
 - c. Bulk Density: 32 lb/cu. ft. (510 kg/cu. m).
 - d. Mesh Size: 4 by 6 inches (100 by 150 mm), 90 percent minimum.
 - e. Hardness Factor: 95 when tested according to ASTM D 3802.
 - 5. Fill Media: Impregnated carbon; 8.0 lb (3.6 kg) of adsorbent per 500 cfm (236 L/s) of airflow.
 - a. Ash Content: 2 to 3 percent.
 - b. Percent Carbon Tetrachloride Activity: 35 to 70 percent when tested according to ASTM D 3467.
 - c. Bulk Density: 32 lb/cu. ft. (510 kg/cu. m).
 - d. Mesh Size: 4 by 6 inches (100 by 150 mm), 90 percent minimum.
 - e. Hardness Factor: 95 when tested according to ASTM D 3802.
 - 6. Fill Media: Blended carbon and alumina impregnated with potassium permanganate; 7.0 lb (3.1 kg) of adsorbent per 500 cfm (236 L/s) of airflow.
 - a. Ash Content: 2 to 3 percent.
 - b. Percent Carbon Tetrachloride Activity: 35 to 70 percent when tested according to ASTM D 3467.
 - c. Bulk Density: 32 lb/cu. ft. (510 kg/cu. m).
 - d. Mesh Size: 4 by 6 inches (100 by 150 mm), 90 percent minimum.
 - e. Hardness Factor: 95 when tested according to ASTM D 3802.
 - 7. Mounting Frames: Welded, galvanized, sheet-steel frame and galvanized-steel fasteners with gaskets; capable of bolting together into built-up filter banks.
- D. Cylindrical-Canister Filters
- 1. Description: Factory-fabricated, dry, cylindrical canisters containing loose-fill adsorbent with holding frames.
 - 2. Cylinders: 0.0455-inch- (1.2-mm-) thick, perforated, electroplated **OR** stainless, **as directed**, steel, with end plate.
 - 3. Fill Media: 5.0 lb (2.3 kg) **OR** 6.7 lb (3.0 kg), **as directed**, of coconut-shell activated carbon **OR** activated alumina impregnated with potassium permanganate **OR** impregnated carbon **OR** blended carbon and alumina impregnated with potassium permanganate, **as directed**, per canister.
 - a. Ash Content: 2 to 3 percent.
 - b. Percent Carbon Tetrachloride Activity: 35 to 70 percent when tested according to ASTM D 3467.
 - c. Bulk Density: 32 lb/cu. ft. (510 kg/cu. m).



- d. Mesh Size: 4 by 6 inches (100 by 150 mm), 90 percent minimum.
- e. Hardness Factor: 95 when tested according to ASTM D 3802.
- 4. Mounting Frames: Welded galvanized, sheet steel with galvanized-steel fasteners **OR** stainless steel with stainless-steel fasteners, **as directed**, with gaskets; designed for bolting together into built-up filter banks.

E. Permanganate Filters

- 1. Description: Factory-fabricated modules containing loose-fill adsorbent with holding frames.
- 2. Modules: Permanent type, 24 inches wide by 24 inches high by 24 inches deep (600 mm wide by 600 mm high by 600 mm deep); shall hold both potassium permanganate and activated carbon. Manufactured in two pieces, each 12 inches (300 mm) wide for ease of installation.
- 3. Media: Porous spherical pellets formed from a combination of powdered, activated carbon and other binders, impregnated with potassium permanganate.
 - a. Leach Test: 180 minutes.
 - b. Potassium Permanganate Content: 4 percent minimum.
 - c. Moisture Content: 20 percent maximum.
 - d. Bulk Density: 34 lb/cu. ft. (0.54 g/mL) **OR** 50 lb/cu. ft. (0.8 g/mL), **as directed**.
 - e. Crush Strength: 40 **OR** 50 **OR** 60, **as directed**, percent maximum.
 - f. Abrasion: 4 percent maximum.
 - g. Nominal Pellet Diameter: 0.125 inch (3.175 mm).
 - h. Percent of Pellet Sizes: 80 to 85 percent after screening.
- 4. Media: High-grade carbon, manufactured from coconut shells, bituminous coal, or a combination of both.
 - a. Ash Content: 2 to 3 percent.
 - b. Percent Carbon Tetrachloride Activity: 35 to 70 percent when tested according to ASTM D 3467.
 - c. Bulk Density: 32 lb/cu. ft. (510 kg/cu. m).
 - d. Mesh Size: 4 by 6 inches (100 by 150 mm), 90 percent minimum.
 - e. Hardness Factor: 95 when tested according to ASTM D 3802.
- 5. Frame: Galvanized steel **OR** Hot-dip galvanized steel **OR** Aluminum **OR** Stainless steel, **as directed**, hinged, and with pull and retaining handles fastened to the media.

F. Supported Adsorber Bag Filters

- 1. Description: Factory-fabricated, dry, extended-surface, self-supporting filters with holding frames.
- 2. Media: Carbon-filled fibrous material constructed so individual pleats are maintained under rated-airflow conditions in tapered form by flexible internal supports.
- 3. Filter-Media Frame: Galvanized steel.
- 4. Mounting Frames: Welded, galvanized, sheet-steel frame and galvanized-steel fasteners with gaskets; capable of bolting together into built-up filter banks.

G. Front-Access Filter Frames

- 1. Framing System: Galvanized-steel **OR** Aluminum, **as directed**, framing members with access for upstream (front) filter servicing, cut to size and prepunched for assembly into modules. Vertically support filters to prevent deflection of horizontal members without interfering with either filter installation or operation.
- 2. Prefilters: Incorporate a separate track with spring clips, **as directed**, removable from front or back, **as directed**.
- 3. Sealing: Factory-installed, positive-sealing device for each row of filters to ensure seal between gasketed filter elements to prevent bypass of unfiltered air.

H. Side-Service Housings

- 1. Description: Factory-assembled, side-service housings constructed of galvanized steel **OR** aluminum, **as directed**, with flanges to connect to duct or casing system.
- 2. Prefilters: Integral tracks to accommodate 2-inch- (50-mm-) thick, disposable or washable, **as directed**, filters.

3. Access Doors: Hinged with continuous **OR** Continuous, **as directed**, gaskets on perimeter and with positive-locking devices. Arrange so filter cartridges can be loaded from either access door.
4. Sealing: Incorporate positive-sealing gasket material on channels to seal top and bottom of filter cartridge frames to prevent bypass of unfiltered air.

I. Filter Gages

1. Diaphragm type, with dial and pointer in metal case, vent valves, black figures on white background, and front recalibration adjustment.
 - a. Diameter: 4-1/2 inches (115 mm) **OR** 2 inches (50 mm), **as directed**.
 - b. Scale Range for Filter Media Having a Recommended Final Resistance of 0.5-Inch wg (125 Pa) or Less: 0- to 0.5-inch wg (0 to 125 Pa).
 - c. Scale Range for Filter Media Having a Recommended Final Resistance of 0.5- to 1.0-Inch wg (125 to 250 Pa) or Less: 0- to 1.0-inch wg (0 to 250 Pa).
 - d. Scale Range for Filter Media Having a Recommended Final Resistance of 1.0- to 2.0-Inch wg (250 to 500 Pa) or Less: 0- to 2.0-inch wg (0 to 500 Pa).
 - e. Scale Range for Filter Media Having a Recommended Final Resistance of 2.0- to 3.0-Inch wg (500 to 750 Pa) or Less: 0- to 3.0-inch wg (0 to 750 Pa).
 - f. Scale Range for Filter Media Having a Recommended Final Resistance of 3.0- to 4.0-Inch wg (750 to 1000 Pa) or Less: 0- to 4.0-inch wg (0 to 1000 Pa).
2. Manometer-Type Filter Gage: Molded plastic, with epoxy-coated aluminum scale, logarithmic-curve tube gage with integral leveling gage; graduated to read from 0- to 3.0-inch wg (0 to 750 Pa) and accurate within 3 percent of full-scale range.
3. Accessories: Static-pressure tips, tubing, gage connections, and mounting bracket.

1.3 EXECUTION

A. Installation

1. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.
2. Install filters in position to prevent passage of unfiltered air.
3. Install filter gage for each filter bank.
4. Do not operate fan system until particulate filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.
5. Do not install gas-phase filters until fan system is clean and there is no risk of construction debris loading the filter.
6. Install filter-gage, static-pressure taps upstream and downstream from filters. Install filter gages on filter banks with separate static-pressure taps upstream and downstream of filters. Mount filter gages on outside of filter housing or filter plenum in an accessible position. Adjust and level inclined gages.
7. Coordinate filter installations with duct and air-handling unit installations.

B. Field Quality Control

1. Perform tests and inspections.
2. Tests and Inspections:
 - a. Test for leakage of unfiltered air while system is operating.
3. Air filter will be considered defective if it does not pass tests and inspections.
4. Prepare test and inspection reports.

C. Cleaning

1. After completing system installation and testing, adjusting, and balancing air-handling and air-distribution systems, clean filter housings and install new particulate filter media.

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SECTION 23 51 00 00 - MPF BREECHINGS, CHIMNEYS, AND STACKS

NOTE TO SPECIFIER

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NOTE TO SPECIFIER

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PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:

NOTE TO SPECIFIER

Adjust list below to suit Project.

1. Listed chimney liners.
2. Listed single and/or double-wall vents/chimneys.
3. Listed grease and dishwasher ducts.

- B. See Division 23 Section "Draft Control Devices" for induced-draft and mechanical fans and for motorized and barometric dampers.

1.2 SUBMITTALS

- A. Product Data: For the following:

1. Chimney liners.
2. Type B and BW vents.
3. Type L vents.
4. Special gas vents.
5. Building-heating-appliance chimneys.
6. Grease ducts.

- B. Shop Drawings: For vents, breechings, chimneys, and stacks. Include plans, elevations, sections, details, and attachments to other work.

PART 2 - PRODUCTS

2.1 LISTED CHIMNEY LINERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Metal Products; MASCO Corporation.
2. Deflect-O Corp.
3. Heat-Fab, Inc.
4. Industrial Chimney Company.
5. Metal-Fab, Inc.
6. Selkirk Inc.; Selkirk Metalbestos and Air Mate.
7. Shook Manufactured Products, Inc.
8. Simpson Dura-Vent Co., Inc.; Subsidiary of Simpson Manufacturing Co.
9. Tru-Flex Metal Hose Corp.
10. <Insert manufacturer's name.>

NOTE TO SPECIFIER

Straight, stainless-steel chimney liners can be used for dishwasher exhaust ducts and Type II, commercial kitchen hood exhaust ducts.

- B. Description: Straight or corrugated single-wall chimney liner tested according to UL 1777 and rated for 1000 deg F continuously, or 2100 deg F for 10 minutes; with negative or positive flue pressure complying with NFPA 211.
- C. Straight Liner Materials: ASTM A 666, Type 304 stainless steel.
- D. Corrugated Liner Materials: ASTM A 240/A 240M, Type 321, ASTM A 240/A 240M, Type 430, or ASTM A 959, Type 29-4C stainless steel.
- E. Accessories:
1. Fittings: Tees, elbows, increasers, draft-hood connectors, metal caps with bird barriers, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar or compatible materials and designs.

NOTE TO SPECIFIER

Retain first subparagraph below for positive-pressure applications.

2. Sealant: Manufacturer's standard high-temperature sealant.
3. Insulating Fill: Manufacturer's standard high-temperature insulation fill material in annular space surrounding chimney liner including high-temperature, ceramic-fiber insulation required to seal chimney at top and bottom.

2.2 LISTED TYPE B AND BW VENTS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. American Metal Products; MASCO Corporation.
 2. Cleaver-Brooks; Div. of Aqua-Chem Inc.
 3. FAMCO.



4. Hart & Cooley, Inc.
5. Heat-Fab, Inc.
6. Industrial Chimney Company.
7. Metal-Fab, Inc.
8. Selkirk Inc.; Selkirk Metalbestos and Air Mate.
9. Simpson Dura-Vent Co., Inc.; Subsidiary of Simpson Manufacturing Co.
10. Tru-Flex Metal Hose Corp.
11. Van-Packer Company, Inc.
12. <Insert manufacturer's name.>

B. Description: Double-wall metal vents tested according to UL 441 and rated for 480 deg F continuously for Type B, or 550 deg F continuously for Type BW; with neutral or negative flue pressure complying with NFPA 211.

C. Construction: Inner shell and outer jacket separated by at least a 1/4-inch airspace.

NOTE TO SPECIFIER

Edit inner shell type as required for service.

- D. Inner Shell: [ASTM B 209, Type 1100 aluminum] [ASTM B 209, Type 3003 aluminum] [ASTM B 209, Type 3105 aluminum] [ASTM A 666, Type 430 stainless steel].
- E. Outer Jacket: Aluminized steel.
- F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.
1. Termination: Round chimney top designed to exclude minimum 98 percent of rainfall.
 2. Termination: <Insert termination.>

2.3 LISTED TYPE L VENTS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. American Metal Products; MASCO Corporation.
 2. FAMCO.
 3. Heat-Fab, Inc.
 4. Industrial Chimney Company.
 5. Metal-Fab, Inc.
 6. Selkirk Inc.; Selkirk Metalbestos and Air Mate.
 7. Simpson Dura-Vent Co., Inc.; Subsidiary of Simpson Manufacturing Co.
 8. Tru-Flex Metal Hose Corp.
 9. Van-Packer Company, Inc.
 10. <Insert manufacturer's name.>

B. Description: Double-wall metal vents tested according to UL 641 and rated for 570 deg F continuously, or 1700 deg F for 10 minutes; with neutral or negative flue pressure complying with NFPA 211.

NOTE TO SPECIFIER

Edit air space requirements based upon service and project requirements.

C. Construction: Inner shell and outer jacket separated by at least a [1-inch] [2-inch] [4-inch] airspace filled with high-temperature insulation.



- D. Inner Shell: ASTM A 666, Type 304 stainless steel.
- E. Outer Jacket: Aluminized steel (provide stainless steel in corrosive environments).
- F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

NOTE TO SPECIFIER

Edit termination based upon service and project requirements.

- 1. Termination: Round chimney top designed to exclude 98 percent of rainfall.
- 2. Termination: Exit cone with drain section incorporated into riser.
- 3. Termination: <Insert termination.>

2.4 LISTED SPECIAL GAS VENTS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Heat-Fab, Inc.
 - 2. Metal-Fab, Inc.
 - 3. Selkirk Inc.; Selkirk Metalbestos and Air Mate.
 - 4. Z-Flex; Flexmaster Canada Limited.
 - 5. <Insert manufacturer's name.>
- B. Description: Double-wall metal vents tested according to UL 1738 and rated for 480 deg F continuously, with positive or negative flue pressure complying with NFPA 211.
- C. Construction: Inner shell and outer jacket separated by at least a 1/2-inch airspace.
- D. Inner Shell: ASTM A 959, Type 29-4C stainless steel.
- E. Outer Jacket: Aluminized steel (provide stainless steel in corrosive environments).
- F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.
 - 1. Termination: Stack cap designed to exclude minimum 90 percent of rainfall.
 - 2. Termination: Round chimney top designed to exclude minimum 98 percent of rainfall.
 - 3. Termination: Exit cone with drain section incorporated into riser.
 - 4. Termination: <Insert termination.>

2.5 LISTED BUILDING-HEATING-APPLIANCE CHIMNEYS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. American Metal Products; MASCO Corporation.
 - 2. Cleaver-Brooks; Div. of Aqua-Chem Inc.
 - 3. FAMCO.
 - 4. Hart & Cooley, Inc.
 - 5. Heat-Fab, Inc.
 - 6. Industrial Chimney Company.
 - 7. Metal-Fab, Inc.
 - 8. Selkirk Inc.; Selkirk Metalbestos and Air Mate.



9. Simpson Dura-Vent Co., Inc.; Subsidiary of Simpson Manufacturing Co.
10. Tru-Flex Metal Hose Corp.
11. Van-Packer Company, Inc.
12. <Insert manufacturer's name.>

NOTE TO SPECIFIER

Retain three paragraphs below for building-heating-appliance chimneys suitable for dual-fuel boilers, oven vents, water heaters, or exhaust for engines.

- B. Description: Double-wall metal vents tested according to UL 103 and rated for 1000 deg F continuously, or 1700 deg F for 10 minutes; with neutral or negative flue pressure complying with NFPA 211.

NOTE TO SPECIFIER

Edit air space requirements based upon service and project requirements.

- C. Construction: Inner shell and outer jacket separated by at least a [1-inch] [2-inch] [3-inch] [4-inch] annular space [filled with high-temperature, ceramic-fiber insulation].

- D. Inner Shell: ASTM A 666, Type 304 stainless steel.

NOTE TO SPECIFIER

Retain three paragraphs below for 1400 deg F (760 deg C) chimneys suitable for dual-fuel boilers, oven vents, water heaters, or exhaust for engines.

- E. Description: Double-wall metal vents tested according to UL 103 and UL 959 and rated for 1400 deg F continuously, or 1800 deg F for 10 minutes; with positive or negative flue pressure complying with NFPA 211.

NOTE TO SPECIFIER

Edit air space requirements based upon service and project requirements.

- F. Construction: Inner shell and outer jacket separated by at least a [1-inch] [2-inch] [3-inch] [4-inch] annular space filled with high-temperature, ceramic-fiber insulation.

- G. Inner Shell: ASTM A 666, Type 304 stainless steel.

NOTE TO SPECIFIER

Retain first three paragraphs below for Type HT chimneys suitable for fireplaces and other solid-fuel-burning appliances.

- H. Description: Double-wall metal vents tested according to UL 103 and rated for 1000 deg F continuously, or 2100 deg F for 10 minutes; with neutral or negative flue pressure complying with NFPA 211.

- I. Construction: Inner shell and outer jacket separated by at least a [1-inch] [1-1/2-inch] [2-inch] [4-inch] annular space filled with high-temperature, ceramic-fiber insulation.

- J. Inner Shell: [ASTM A 666, Type 304] [ASTM A 666, Type 316] [ASTM A 240/A 240M, Type 430] stainless steel.

- K. Outer Jacket: Aluminized steel (provide stainless steel in corrosive environments).



- L. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

NOTE TO SPECIFIER

Edit termination based upon service and project requirements.

1. Termination: Round chimney top designed to exclude minimum 98 percent of rainfall.
2. Termination: Exit cone with drain section incorporated into riser.
3. Termination: <Insert termination.>

2.6 LISTED GREASE DUCTS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Metal Products; MASCO Corporation.
2. Heat-Fab, Inc.
3. Industrial Chimney Company.
4. Metal-Fab, Inc.
5. Selkirk Inc.; Selkirk Metalbestos and Air Mate.
6. Simpson Dura-Vent Co., Inc.; Subsidiary of Simpson Manufacturing Co.
7. Tru-Flex Metal Hose Corp.
8. Van-Packer Company, Inc.
9. <Insert manufacturer's name.>

- B. Description: Double-wall metal vents tested according to UL 1978 and rated for 500 deg F continuously, or 2000 deg F for 30 minutes; with positive or negative duct pressure and complying with NFPA 211.

NOTE TO SPECIFIER

Edit air space requirements based upon service and project requirements.

- C. Construction: Inner shell and outer jacket separated by at least a [1-inch] [2-inch] [3-inch] annular space filled with high-temperature, ceramic-fiber insulation.
- D. Inner Shell: ASTM A 666, Type 304 stainless steel.
- E. Outer Jacket: Aluminized steel where concealed. Stainless steel where exposed.
- F. Accessories: Tees, elbows, increasers, hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly. Include unique components required to comply with NFPA 96 including cleanouts, transitions, adapters and drain fittings.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Listed Chimney Liners: High-efficiency boiler or furnace vents in masonry chimney, dishwasher exhaust, or Type II commercial kitchen hood.
- B. Listed Type B and BW Vents: Vents for certified gas appliances.



- C. Listed Type L Vents: Vents for low-heat appliances.
- D. Listed Special Gas Vents: Condensing gas appliances. Positive pressure AL29-4C, double wall venting.
- E. Listed Building-Heating-Appliance Chimneys: Dual-fuel boilers, oven vents, water heaters, and exhaust for engines. Fireplaces and other solid-fuel-burning appliances.
- F. Listed Grease Ducts: Type I commercial kitchen grease duct.

3.2 INSTALLATION OF LISTED VENTS AND CHIMNEYS

- A. Locate to comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.

NOTE TO SPECIFIER

Retain first subparagraph below for positive-pressure applications.

- B. Seal between sections of positive-pressure vents and grease exhaust ducts according to manufacturer's written installation instructions, using sealants recommended by manufacturer.
- C. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.

NOTE TO SPECIFIER

Retain first paragraph below for appliances more than 83 percent efficient.

- D. Slope breechings down in direction of appliance, with condensate drain connection at lowest point piped to nearest drain.
- E. Lap joints in direction of flow.
- F. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.
- G. Clean breechings internally, during and after installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth and apply touchup finish to match factory or shop finish.
- H. Provide temporary closures at ends of breechings, chimneys, and stacks that are not completed or connected to equipment.

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END OF SECTION 23 51 00 00



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SECTION 23 51 00 00 - CSF BREECHINGS, CHIMNEYS, AND STACKS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Packaged Rooftop Units are part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.23 51 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:

NOTE TO SPECIFIER

Adjust list below to suit Project.

1. Listed chimney liners.
2. Listed single and/or double-wall vents/chimneys.
3. Listed grease and dishwasher ducts.

- B. See Division 23 Section "Draft Control Devices" for induced-draft and mechanical fans and for motorized and barometric dampers.

1.2 SUBMITTALS

- A. Product Data: For the following:

1. Chimney liners.
2. Type B and BW vents.
3. Type L vents.
4. Special gas vents.
5. Building-heating-appliance chimneys.
6. Grease ducts.

- B. Shop Drawings: For vents, breechings, chimneys, and stacks. Include plans, elevations, sections, details, and attachments to other work.

PART 2 - PRODUCTS

2.1 LISTED CHIMNEY LINERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Metal Products; MASCO Corporation.
2. Deflect-O Corp.
3. Heat-Fab, Inc.
4. Industrial Chimney Company.
5. Metal-Fab, Inc.
6. Selkirk Inc.; Selkirk Metalbestos and Air Mate.
7. Shook Manufactured Products, Inc.
8. Simpson Dura-Vent Co., Inc.; Subsidiary of Simpson Manufacturing Co.
9. Tru-Flex Metal Hose Corp.
10. <Insert manufacturer's name.>

NOTE TO SPECIFIER

Straight, stainless-steel chimney liners can be used for dishwasher exhaust ducts and Type II, commercial kitchen hood exhaust ducts.

- B. Description: Straight or corrugated single-wall chimney liner tested according to UL 1777 and rated for 1000 deg F continuously, or 2100 deg F for 10 minutes; with negative or positive flue pressure complying with NFPA 211.
- C. Straight Liner Materials: ASTM A 666, Type 304 stainless steel.
- D. Corrugated Liner Materials: ASTM A 240/A 240M, Type 321, ASTM A 240/A 240M, Type 430, or ASTM A 959, Type 29-4C stainless steel.
- E. Accessories:
1. Fittings: Tees, elbows, increasers, draft-hood connectors, metal caps with bird barriers, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar or compatible materials and designs.

NOTE TO SPECIFIER

Retain first subparagraph below for positive-pressure applications.

2. Sealant: Manufacturer's standard high-temperature sealant.
3. Insulating Fill: Manufacturer's standard high-temperature insulation fill material in annular space surrounding chimney liner including high-temperature, ceramic-fiber insulation required to seal chimney at top and bottom.

2.2 LISTED TYPE B AND BW VENTS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. American Metal Products; MASCO Corporation.
 2. Cleaver-Brooks; Div. of Aqua-Chem Inc.
 3. FAMCO.



4. Hart & Cooley, Inc.
5. Heat-Fab, Inc.
6. Industrial Chimney Company.
7. Metal-Fab, Inc.
8. Selkirk Inc.; Selkirk Metalbestos and Air Mate.
9. Simpson Dura-Vent Co., Inc.; Subsidiary of Simpson Manufacturing Co.
10. Tru-Flex Metal Hose Corp.
11. Van-Packer Company, Inc.
12. <Insert manufacturer's name.>

B. Description: Double-wall metal vents tested according to UL 441 and rated for 480 deg F continuously for Type B, or 550 deg F continuously for Type BW; with neutral or negative flue pressure complying with NFPA 211.

C. Construction: Inner shell and outer jacket separated by at least a 1/4-inch airspace.

NOTE TO SPECIFIER

Edit inner shell type as required for service.

D. Inner Shell: [ASTM B 209, Type 1100 aluminum] [ASTM B 209, Type 3003 aluminum] [ASTM B 209, Type 3105 aluminum] [ASTM A 666, Type 430 stainless steel].

E. Outer Jacket: Aluminized steel.

F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

1. Termination: Round chimney top designed to exclude minimum 98 percent of rainfall.
2. Termination: <Insert termination.>

2.3 LISTED TYPE L VENTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Metal Products; MASCO Corporation.
2. FAMCO.
3. Heat-Fab, Inc.
4. Industrial Chimney Company.
5. Metal-Fab, Inc.
6. Selkirk Inc.; Selkirk Metalbestos and Air Mate.
7. Simpson Dura-Vent Co., Inc.; Subsidiary of Simpson Manufacturing Co.
8. Tru-Flex Metal Hose Corp.
9. Van-Packer Company, Inc.
10. <Insert manufacturer's name.>

B. Description: Double-wall metal vents tested according to UL 641 and rated for 570 deg F continuously, or 1700 deg F for 10 minutes; with neutral or negative flue pressure complying with NFPA 211.

NOTE TO SPECIFIER

Edit air space requirements based upon service and project requirements.

C. Construction: Inner shell and outer jacket separated by at least a [1-inch] [2-inch] [4-inch] airspace filled with high-temperature insulation.

- D. Inner Shell: ASTM A 666, Type 304 stainless steel.
- E. Outer Jacket: Aluminized steel (provide stainless steel in corrosive environments).
- F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

NOTE TO SPECIFIER

Edit termination based upon service and project requirements.

- 1. Termination: Round chimney top designed to exclude 98 percent of rainfall.
- 2. Termination: Exit cone with drain section incorporated into riser.
- 3. Termination: <Insert termination.>

2.4 LISTED SPECIAL GAS VENTS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Heat-Fab, Inc.
 - 2. Metal-Fab, Inc.
 - 3. Selkirk Inc.; Selkirk Metalbestos and Air Mate.
 - 4. Z-Flex; Flexmaster Canada Limited.
 - 5. <Insert manufacturer's name.>
- B. Description: Double-wall metal vents tested according to UL 1738 and rated for 480 deg F continuously, with positive or negative flue pressure complying with NFPA 211.
- C. Construction: Inner shell and outer jacket separated by at least a 1/2-inch airspace.
- D. Inner Shell: ASTM A 959, Type 29-4C stainless steel.
- E. Outer Jacket: Aluminized steel (provide stainless steel in corrosive environments).
- F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.
 - 1. Termination: Stack cap designed to exclude minimum 90 percent of rainfall.
 - 2. Termination: Round chimney top designed to exclude minimum 98 percent of rainfall.
 - 3. Termination: Exit cone with drain section incorporated into riser.
 - 4. Termination: <Insert termination.>

2.5 LISTED BUILDING-HEATING-APPLIANCE CHIMNEYS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. American Metal Products; MASCO Corporation.
 - 2. Cleaver-Brooks; Div. of Aqua-Chem Inc.
 - 3. FAMCO.
 - 4. Hart & Cooley, Inc.
 - 5. Heat-Fab, Inc.
 - 6. Industrial Chimney Company.
 - 7. Metal-Fab, Inc.
 - 8. Selkirk Inc.; Selkirk Metalbestos and Air Mate.



9. Simpson Dura-Vent Co., Inc.; Subsidiary of Simpson Manufacturing Co.
10. Tru-Flex Metal Hose Corp.
11. Van-Packer Company, Inc.
12. <Insert manufacturer's name.>

NOTE TO SPECIFIER

Retain three paragraphs below for building-heating-appliance chimneys suitable for dual-fuel boilers, oven vents, water heaters, or exhaust for engines.

- B. Description: Double-wall metal vents tested according to UL 103 and rated for 1000 deg F continuously, or 1700 deg F for 10 minutes; with neutral or negative flue pressure complying with NFPA 211.

NOTE TO SPECIFIER

Edit air space requirements based upon service and project requirements.

- C. Construction: Inner shell and outer jacket separated by at least a [1-inch] [2-inch] [3-inch] [4-inch] annular space [filled with high-temperature, ceramic-fiber insulation].

- D. Inner Shell: ASTM A 666, Type 304 stainless steel.

NOTE TO SPECIFIER

Retain three paragraphs below for 1400 deg F (760 deg C) chimneys suitable for dual-fuel boilers, oven vents, water heaters, or exhaust for engines.

- E. Description: Double-wall metal vents tested according to UL 103 and UL 959 and rated for 1400 deg F continuously, or 1800 deg F for 10 minutes; with positive or negative flue pressure complying with NFPA 211.

NOTE TO SPECIFIER

Edit air space requirements based upon service and project requirements.

- F. Construction: Inner shell and outer jacket separated by at least a [1-inch] [2-inch] [3-inch] [4-inch] annular space filled with high-temperature, ceramic-fiber insulation.

- G. Inner Shell: ASTM A 666, Type 304 stainless steel.

NOTE TO SPECIFIER

Retain first three paragraphs below for Type HT chimneys suitable for fireplaces and other solid-fuel-burning appliances.

- H. Description: Double-wall metal vents tested according to UL 103 and rated for 1000 deg F continuously, or 2100 deg F for 10 minutes; with neutral or negative flue pressure complying with NFPA 211.

- I. Construction: Inner shell and outer jacket separated by at least a [1-inch] [1-1/2-inch] [2-inch] [4-inch] annular space filled with high-temperature, ceramic-fiber insulation.

- J. Inner Shell: [ASTM A 666, Type 304] [ASTM A 666, Type 316] [ASTM A 240/A 240M, Type 430] stainless steel.

- K. Outer Jacket: Aluminized steel (provide stainless steel in corrosive environments).



- L. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

NOTE TO SPECIFIER

Edit termination based upon service and project requirements.

1. Termination: Round chimney top designed to exclude minimum 98 percent of rainfall.
2. Termination: Exit cone with drain section incorporated into riser.
3. Termination: <Insert termination.>

2.6 LISTED GREASE DUCTS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Metal Products; MASCO Corporation.
2. Heat-Fab, Inc.
3. Industrial Chimney Company.
4. Metal-Fab, Inc.
5. Selkirk Inc.; Selkirk Metalbestos and Air Mate.
6. Simpson Dura-Vent Co., Inc.; Subsidiary of Simpson Manufacturing Co.
7. Tru-Flex Metal Hose Corp.
8. Van-Packer Company, Inc.
9. <Insert manufacturer's name.>

- B. Description: Double-wall metal vents tested according to UL 1978 and rated for 500 deg F continuously, or 2000 deg F for 30 minutes; with positive or negative duct pressure and complying with NFPA 211.

NOTE TO SPECIFIER

Edit air space requirements based upon service and project requirements.

- C. Construction: Inner shell and outer jacket separated by at least a [1-inch] [2-inch] [3-inch] annular space filled with high-temperature, ceramic-fiber insulation.
- D. Inner Shell: ASTM A 666, Type 304 stainless steel.
- E. Outer Jacket: Aluminized steel where concealed. Stainless steel where exposed.
- F. Accessories: Tees, elbows, increasers, hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly. Include unique components required to comply with NFPA 96 including cleanouts, transitions, adapters and drain fittings.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Listed Chimney Liners: High-efficiency boiler or furnace vents in masonry chimney, dishwasher exhaust, or Type II commercial kitchen hood.
- B. Listed Type B and BW Vents: Vents for certified gas appliances.



- C. Listed Type L Vents: Vents for low-heat appliances.
- D. Listed Special Gas Vents: Condensing gas appliances. Positive pressure AL29-4C, double wall venting.
- E. Listed Building-Heating-Appliance Chimneys: Dual-fuel boilers, oven vents, water heaters, and exhaust for engines. Fireplaces and other solid-fuel-burning appliances.
- F. Listed Grease Ducts: Type I commercial kitchen grease duct.

3.2 INSTALLATION OF LISTED VENTS AND CHIMNEYS

- A. Locate to comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.

NOTE TO SPECIFIER

Retain first subparagraph below for positive-pressure applications.

- B. Seal between sections of positive-pressure vents and grease exhaust ducts according to manufacturer's written installation instructions, using sealants recommended by manufacturer.
- C. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.

NOTE TO SPECIFIER

Retain first paragraph below for appliances more than 83 percent efficient.

- D. Slope breechings down in direction of appliance, with condensate drain connection at lowest point piped to nearest drain.
- E. Lap joints in direction of flow.
- F. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.
- G. Clean breechings internally, during and after installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth and apply touchup finish to match factory or shop finish.
- H. Provide temporary closures at ends of breechings, chimneys, and stacks that are not completed or connected to equipment.

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END OF SECTION



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SECTION 23 52 13 00 - ELECTRIC BOILERS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for electric boilers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes packaged, factory-fabricated and -assembled electric boilers, trim, and accessories for generating hot water or steam.

C. Submittals

1. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.
2. Shop Drawings: For boilers, boiler trim, and accessories. Include plans, elevations, sections, details, and attachments to other work.
 - a. Design calculations and vibration isolation base details, signed and sealed by a qualified professional engineer.
 - 1) Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - b. Wiring Diagrams: Power, signal, and control wiring.
3. Manufacturer Seismic Qualification Certification: Submit certification that boiler, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
4. Source quality-control test reports.
5. Field quality-control test reports.
6. Operation and maintenance data.
7. Warranty: Special warranty specified in this Section.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.
3. NFPA Compliance: Design and fabricate boilers to comply with NFPA 70, "National Electrical Code," Article 424, Paragraphs G and H.
4. UL Compliance: Test boilers for compliance with UL 834, "Heating, Water Supply, and Power Boilers--Electric." Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

E. Warranty

1. Manufacturer's standard form in which manufacturer agrees to repair or replace pressure vessels of boilers that fail in materials or workmanship within five years from date of Final Completion.

1.2 PRODUCTS**A. Manufactured Units**

1. Description: Factory-fabricated, -assembled, and -tested electric boilers with trim and controls necessary to generate hot water **OR** steam, **as directed**.

2. Pressure Vessel: Carbon-steel **OR** Cast-iron, **as directed**, pressure vessel mounted on structural-steel base.
3. Nozzles: Flanges for water inlet and **OR** steam, **as directed**, outlet and heating element inserts; threaded connections for trim and controls.
4. Insulation: One layer **OR** Two layers, **as directed**, of minimum 1-inch- (25-mm-) **OR** 2-inch- (50-mm-), **as directed**, thick, glass-fiber insulation.
5. Jacket: Galvanized, **as directed**, sheet metal casing with baked-enamel **OR** powder-coated, **as directed**, protective finish and removable panels with snap-in or interlocking closures for access to pressure vessel.
6. Lifting Lugs: Welded to pressure vessel, extending above jacket.
7. Heating Elements: Copper **OR** Incoloy, **as directed**, sheathed, replaceable electric-resistance element, rated 20 kW maximum, with maximum 50 W/sq. in. (7.7 W/sq. cm) **OR** 75 W/sq. in. (11.5 W/sq. cm), **as directed**, over heat-transfer length.
8. Mounting base to secure boiler to concrete base.
 - a. Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" when mounting base is anchored to building structure.

B. Trim For Hot-Water Boilers

1. Include devices sized to comply with ANSI B31.1, "Power Piping" **OR** ANSI B31.9, Building Services Piping," **as directed**.
2. Aquastat Controllers: Operating auto-reset high limit.
3. Safety Relief Valve: ASME rated.
4. Pressure and Temperature Gage: Minimum 3-1/2-inch- (89-mm-) diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.
5. Boiler Air Vent: Automatic **OR** Manual, **as directed**.
6. Dip-tube in water outlet.
7. Drain Valve: Minimum NPS 3/4 (DN 20) hose-end ball valve sized per requirements of authorities having jurisdiction.
8. Tankless Heater: Carbon-steel header with copper-tube heat exchanger, mounted in an upper port of pressure vessel and sealed with fiber gasket.
 - a. Tappings NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
 - b. Tappings NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.

C. Trim For Steam Boilers

1. Include devices sized to comply with ANSI B31.1, "Power Piping" **OR** ANSI B31.9, "Building Services Piping," **as directed**.
2. Pressure Controllers: Operating auto-reset high limit.
3. Safety Relief Valve:
 - a. Size and Capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code.
 - b. Description: Fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed.
 - 1) Drip-Pan Elbow: Cast iron and having threaded inlet and outlet with threads complying with ASME B1.20.1.
4. Pressure Gage: Minimum 3-1/2-inch (89-mm) diameter. Gage shall have normal operating pressure about 50 percent of full range.
5. Water Column: Minimum 12-inch (300-mm) glass gage with shutoff cocks.
6. Drain Valves: Minimum NPS 3/4 (DN 20) or nozzle size with hose-end connection.

7. Blowdown Valves: Factory-installed bottom and surface, slow-acting blowdown valves same size as boiler nozzle. Blowdown valves shall be combination of slow and quick acting as required by ANSI B31.1, **as directed**.
8. Stop Valves: Boiler inlets and outlets, except safety relief valves or preheater inlet and outlet, shall be equipped with stop valve in an accessible location as near as practical to boiler nozzle and same size or larger than nozzle. Valves larger than NPS 2 (DN 50) shall have rising stem.
9. Stop-Check Valves: Factory-installed, stop-check valve and stop valve at boiler outlet with free-blow drain valve factory installed between the two valves and visible when operating stop-check valve.
10. Tankless Heater: Carbon-steel header with copper-tube heat exchanger, mounted in an upper port of pressure vessel and sealed with fiber gasket.
 - a. Tappings NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
 - b. Tappings NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.

D. Controls

1. Boiler operating controls shall include the following devices and features:
 - a. Control transformer.
 - b. Step controller.
 - c. Recycling relay returns controller to off position after power failure.
 - d. Multistage thermostat.
 - e. Control circuit switch.
 - f. Visual indication for each step.
 - g. Supply-voltage indicator.
 - h. Set-Point Adjust: Set points shall be adjustable.
 - i. Operating Level Control: Factory wired and mounted to cycle feedwater pump(s) for makeup water control.
 - j. Sequence of Operation for hot-water boilers: Electric, factory-fabricated and field-installed panel to control element sequence controller to maintain space temperature in response to thermostat with heat anticipator located in heated space.
 - k. Sequence of Operation: Electric, factory-fabricated and field-installed panel to control element sequence controller to reset supply-water temperature inversely with outside-air temperature. At 0 deg F (minus 17 deg C) outside-air temperature, set supply-water temperature at 200 deg F (93 deg C); at 60 deg F (15 deg C) outside-air temperature, set supply-water temperature at 140 deg F (60 deg C).
 - l. Sequence of Operation for steam boilers: Electric, factory-fabricated and field-installed panel to control element sequence controller to maintain a constant steam pressure. Maintain pressure set point plus or minus 10 percent.
 - 1) Include automatic, alternating-operation sequence for multiple boilers to provide equal runtime for boilers.
2. Safety Controls: To maintain safe operating conditions, safety controls limit boiler operation.
 - a. High Cutoff: Manual **OR** Automatic, **as directed**, reset stops boiler if operating conditions rise above set point or maximum boiler design temperature **OR** pressure, **as directed**.
 - b. Low-Water Cutoff Switch: Electronic **OR** Float and electronic, **as directed**, probe shall prevent boiler operation on low water. Cutoff switch shall be manual **OR** automatic, **as directed**, -reset type.
 - c. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.
3. Building Management System Interface: Factory install hardware and software to enable building management system to monitor, control, and display boiler status and alarms.
 - a. Hardwired Points:
 - 1) Monitoring: On/off status, common trouble alarm **OR** low water level alarm, **as directed**.

- 2) Control: On/off operation, hot water supply temperature set-point adjustment **OR** steam pressure adjustment, **as directed**.
- b. A communication interface with building management system shall enable building management system operator to remotely control and monitor the boiler from an operator workstation. Control features available, and monitoring points displayed, locally at boiler control panel shall be available through building management system.

E. Electrical Power

1. Single-Point Field Power Connection: Factory-installed and -wired switches, transformers, and electrical devices necessary shall provide a single-point field power connection to boiler.
 - a. Field power interface shall be to fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**.
 - b. Interlock with door to de-energize power with door open.
2. Electrical Enclosures: NEMA 250, Type 1, **as directed**, enclosure with hinged door and key-locking handle.
3. Install factory wiring outside of an enclosure in a metal, **as directed**, raceway.
4. Comply with NFPA 70.
 - a. Electrical Circuits: 48 A, maximum.
5. Connectors: Mechanical lugs bolted to copper bus bars or distribution blocks with pressure connectors.
6. Fuses: NEMA FU 1, Class J or K5; 60 A, maximum.
7. Contactors: 3-pole magnetic contactors, listed for 500,000 cycles at full load.
8. Factory-wired internal control devices and heating elements.
 - a. Wiring shall be numbered and color coded to match the wiring diagram.

F. Source Quality Control

1. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.
2. Hydrostatic Test: Factory test assembled boiler including hydrostatic test.

1.3 EXECUTION

A. Boiler Installation

1. Install boilers level on concrete base. Concrete base is specified in Division 23 Section "Common Work Results For Hvac", and concrete materials and installation requirements are specified in Division 31..
2. Vibration Isolation: Elastomeric isolator pads **OR** mounts, **as directed**, with a minimum static deflection of 0.25 inch (6.35 mm), **as directed**. Vibration isolation devices and installation requirements are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
3. Install electrical devices furnished with boiler but not specified to be factory mounted.

B. Connections

1. Piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install piping adjacent to boiler to allow service and maintenance.
3. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve and union or flange at each connection.
4. Connect steam and condensate piping to supply-, return-, and blowdown-boiler tappings with shutoff valve and union or flange at each connection.
5. Install piping from safety relief valves to nearest floor drain.
6. Install piping from safety valves to drip-pan elbow and to nearest floor drain.
7. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.

8. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 9. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
- C. Field Quality Control
1. Perform tests and inspections and prepare test reports.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 2. Tests and Inspections:
 - a. Perform installation and startup checks according to manufacturer's written instructions.
 - b. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
 - c. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 1) Check and adjust initial operating set points and high- and low-limit safety set points of water level and water temperature **OR** steam pressure, **as directed**.
 - 2) Set field-adjustable switches and circuit-breaker trip ranges as indicated.
 3. Remove and replace malfunctioning units and retest as specified above.
 4. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.
- D. Demonstration
1. Train Owner's maintenance personnel to adjust, operate, and maintain boilers. Video training sessions, **as directed**.

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SECTION 23 52 16 00 - CSF CONDENSING BOILERS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 - GENERAL**1.1 SUMMARY**

- A. This Section includes packaged, factory-fabricated and -assembled, gas-fired, **pulse-combustion** condensing boilers, trim, and accessories for generating hot water.
- B. Specification of Condensing Boilers requires that heating hot water system is able to operate at lower temperatures during significant operational hours to allow the unit(s) to go into condensing mode and provide the necessary efficiency improvements that will justify the additional first costs.
- C. Boiler plants shall be sized to meet the heating load requirement of building as defined by computerized load calculations. Redundant boilers shall be avoided and the quantity should be limited to three or four maximum at the boiler plant. Loss of a single boiler should be able to still provide up to 65% of the peak heating load for typical USPS facilities. Plant redundancy is provided by the number of boilers and not excess capacity.

1.2 SUBMITTALS

- A. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: For boilers, boiler trim, and accessories. Include plans, elevations, sections, details, and attachments to other work.

NOTE TO SPECIFIER

** Retain paragraph below if required by seismic criteria applicable to Project.

- A. Manufacturer Seismic Qualification Certification: Submit certification that boiler, accessories, and components will withstand seismic forces defined in Division 23 Section "Mechanical Vibration and Seismic Controls."
- B. Operation and maintenance data.
- C. Warranty: Special warranty specified in this Section.



1.2 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.
- C. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."

NOTE TO SPECIFIER

** Delete first paragraph below if boiler rating exceeds 300,000 Btu/h (87.9 kW).

- D. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, "Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers."
- E. UL Compliance: Test boilers for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

1.3 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Pulse-Combustion Boilers:
 - a. Heat Exchanger Damaged by Thermal Shock: 10 years from date of Substantial Completion.
 - b. Heat-Exchanger Corrosion: Prorated for five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AERCO International.
 - 2. Fulton Boiler Works, Inc.
 - 3. Gasmaster Industries Incorporated.
 - 4. Hydrotherm, Inc.; a division of Mestek, Inc.

2.2 MANUFACTURED UNITS

- A. Description: Factory-fabricated, -assembled, and -tested, pulse-combustion condensing boiler with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket; flue-gas vent;

combustion-air intake connections; water supply, return, and condensate drain connections; and controls.

- B. Heat Exchanger: Type 316L, stainless-steel primary and secondary combustion chamber.
- C. Pressure Vessel: Carbon steel with welded heads and tube connections.
- D. Exhaust Decoupler: Fiberglass composite material in a corrosion-resistant steel box.
- E. Burner: [Natural Gas] [Propane] gas, self-aspirating and self-venting after initial start.
- F. Blower: Centrifugal fan to operate only during start of each burner sequence.
 - 1. Motors: Comply with requirements specified in Division 23 Section "Motors."
 - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- G. Gas Train: Combination gas valve with manual shutoff and pressure regulator.
- H. Ignition: Spark ignition with 100 percent main-valve shutoff with electronic flame supervision.
- I. Casing:
 - 1. Jacket: Sheet metal, with snap-in or interlocking closures.
 - 2. Control Compartment Enclosure: NEMA 250, Type 1A.
 - 3. Finish: Baked-enamel or powder-coated protective finish.
 - 4. Insulation: Minimum 2-inch- (50-mm-) thick, mineral-fiber insulation surrounding the heat exchanger.
 - 5. Combustion-Air Connection: Inlet duct collar and sheet metal closure over burner compartment.
 - 6. Mounting base to secure boiler to concrete base.

NOTE TO SPECIFIER

** Retain subparagraph below for projects in seismic areas.

- a. Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler pressure vessel, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Mechanical Vibration and Seismic Controls" when mounting base is anchored to building structure.
- J. Mufflers: Carbon-steel intake muffler and stainless-steel exhaust.
- K. Condensate Trap: Cast-iron body with stainless-steel internal parts.

2.3 TRIM

- A. Aquastat Controllers: Operating and high limit.
- B. Safety Relief Valve: ASME rated.
- C. Pressure and Temperature Gage: Minimum 3-1/2-inch- (89-mm-) diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.

D. Boiler Air Vent: Automatic.

E. Drain Valve: Minimum NPS 3/4 (DN 20) hose-end gate valve.

NOTE TO SPECIFIER

** Retain paragraph below if pump is a component of boiler. Coordinate with Division 23 Section "Hydronic Pumps."

F. Circulation Pump: Non-overloading, in-line pump with split-capacitor motor having thermal-overload protection and lubricated bearings; designed to operate at specified boiler pressures and temperatures.

2.4 CONTROLS

A. Refer to specification Section 250504 Building Automation System (BAS) General."

B. Boiler operating controls shall include the following devices and features:

1. Control transformer.
2. Set-Point Adjust: Set points shall be adjustable.
3. Sequence of Operation: Refer to Section 259004 – Sequence of Operation for coordination.

- a. Include automatic, alternating-firing sequence for multiple boilers to ensure maximum system efficiency throughout the load range and to provide equal runtime for boilers.

C. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.

1. High Cutoff: Automatic reset stops burner if operating conditions rise above maximum boiler design temperature.
2. Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be automatic-reset type.
3. Blocked Inlet Safety Switch: Manual-reset pressure switch field mounted on boiler combustion-air inlet.
4. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.

D. Building Automation System Interface: Factory install hardware and software to enable building automation system to monitor, control, and display boiler status and alarms. Refer to specification Section 250504 Building Automation System (BAS) General.

2.5 ELECTRICAL POWER

A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.

B. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.

1. House in NEMA 250, Type 1 enclosure.
2. Wiring shall be numbered and color-coded to match wiring diagram.



3. Provide branch power circuit to each motor and to controls with a disconnect switch or circuit breaker.
4. Provide each motor with overcurrent protection.

2.6 VENTING

NOTE TO SPECIFIER

** Edit venting and intake requirements below to suit project specifics.

- A. Combustion Vent: Complete system, ASTM A 959, Type 29-4C stainless steel, pipe or Sch 40 CPVC piping pipe, vent terminal, thimble, indoor plate, vent adapter, condensate trap and dilution tank, and sealant.
- B. Combustion-Air Intake: Complete system, stainless steel or Sch 40 CPVC, pipe, vent terminal with screen, inlet air coupling, and sealant.

2.7 SOURCE QUALITY CONTROL

- A. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.

PART 3 - EXECUTION

3.1 BOILER INSTALLATION

- A. Install boilers level on concrete base. Concrete base is specified in Division 23 Section "Common Work for HVAC," and concrete materials and installation requirements are specified in Division 3.
- B. Vibration Isolation: Elastomeric isolation pads with a minimum static deflection of 0.25 inch (6.35 mm).
- C. Install gas-fired boilers according to NFPA 54.
- D. Assemble and install boiler trim.
- E. Install electrical devices furnished with boiler but not specified to be factory mounted.
- F. Install control wiring to field-mounted electrical devices.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to boiler to allow service and maintenance.
- C. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.

- D. Connect piping to boilers, except safety relief valve connections, with flexible connectors of materials suitable for service. Flexible connectors and their installation are specified in Division 22 Section "Common Work for Plumbing."
- E. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas train connection. Provide a reducer if required.
- F. Connect hot-water piping to supply- and return-boiler tapings with shutoff valve and union or flange at each connection.
- G. Install piping from safety relief valves to nearest floor drain.
- H. Boiler Venting:
 - 1. Install flue venting kit and combustion-air intake.
- I. Ground equipment according to Division 26 Section "Grounding and Bonding."
- J. Connect wiring according to Division 26 Section "Conductors and Cables."
- K. Stack drain piping shall be routed through an acid neutralizing tank to prevent damage to piping, floors and floor drains and to prevent highly acidic waste from entering the sanitary drain system.

3.3 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Perform installation and startup checks according to manufacturer's written instructions.
 - 2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and water temperature.
 - b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- B. Remove and replace malfunctioning units and retest as specified above.
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain boilers. Video training sessions. Refer to Division 1 Section "Demonstration and Training."



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SECTION 23 52 16 00 - MPF CONDENSING BOILERS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes packaged, factory-fabricated and -assembled, gas-fired, **pulse-combustion** condensing boilers, trim, and accessories for generating hot water.
- B. Specification of Condensing Boilers requires that heating hot water system is able to operate at lower temperatures during significant operational hours to allow the unit(s) to go into condensing mode and provide the necessary efficiency improvements that will justify the additional first costs.
- C. Boiler plants shall be sized to meet the heating load requirement of building as defined by computerized load calculations. Redundant boilers shall be avoided and the quantity should be limited to three or four maximum at the boiler plant. Loss of a single boiler should be able to still provide up to 65% of the peak heating load for typical USPS facilities. Plant redundancy is provided by the number of boilers and not excess capacity.

1.2 SUBMITTALS

- A. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: For boilers, boiler trim, and accessories. Include plans, elevations, sections, details, and attachments to other work.

NOTE TO SPECIFIER

** Retain paragraph below if required by seismic criteria applicable to Project.

- A. Manufacturer Seismic Qualification Certification: Submit certification that boiler, accessories, and components will withstand seismic forces defined in Division 23 Section "Mechanical Vibration and Seismic Controls."
- B. Operation and maintenance data.
- C. Warranty: Special warranty specified in this Section.



1.2 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.
- C. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."

NOTE TO SPECIFIER

** Delete first paragraph below if boiler rating exceeds 300,000 Btu/h (87.9 kW).

- D. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, "Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers."
- E. UL Compliance: Test boilers for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

1.3 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Pulse-Combustion Boilers:
 - a. Heat Exchanger Damaged by Thermal Shock: 10 years from date of Substantial Completion.
 - b. Heat-Exchanger Corrosion: Prorated for five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AERCO International.
 - 2. Fulton Boiler Works, Inc.
 - 3. Gasmaster Industries Incorporated.
 - 4. Hydrotherm, Inc.; a division of Mestek, Inc.

2.2 MANUFACTURED UNITS

- A. Description: Factory-fabricated, -assembled, and -tested, pulse-combustion condensing boiler with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket; flue-gas vent;

combustion-air intake connections; water supply, return, and condensate drain connections; and controls.

- B. Heat Exchanger: Type 316L, stainless-steel primary and secondary combustion chamber.
- C. Pressure Vessel: Carbon steel with welded heads and tube connections.
- D. Exhaust Decoupler: Fiberglass composite material in a corrosion-resistant steel box.
- E. Burner: [Natural Gas] [Propane] gas, self-aspirating and self-venting after initial start.
- F. Blower: Centrifugal fan to operate only during start of each burner sequence.
 - 1. Motors: Comply with requirements specified in Division 23 Section "Motors."
 - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- G. Gas Train: Combination gas valve with manual shutoff and pressure regulator.
- H. Ignition: Spark ignition with 100 percent main-valve shutoff with electronic flame supervision.
- I. Casing:
 - 1. Jacket: Sheet metal, with snap-in or interlocking closures.
 - 2. Control Compartment Enclosure: NEMA 250, Type 1A.
 - 3. Finish: Baked-enamel or powder-coated protective finish.
 - 4. Insulation: Minimum 2-inch- (50-mm-) thick, mineral-fiber insulation surrounding the heat exchanger.
 - 5. Combustion-Air Connection: Inlet duct collar and sheet metal closure over burner compartment.
 - 6. Mounting base to secure boiler to concrete base.

NOTE TO SPECIFIER

** Retain subparagraph below for projects in seismic areas.

- a. Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler pressure vessel, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Mechanical Vibration and Seismic Controls" when mounting base is anchored to building structure.
- J. Mufflers: Carbon-steel intake muffler and stainless-steel exhaust.
- K. Condensate Trap: Cast-iron body with stainless-steel internal parts.

2.3 TRIM

- A. Aquastat Controllers: Operating and high limit.
- B. Safety Relief Valve: ASME rated.
- C. Pressure and Temperature Gage: Minimum 3-1/2-inch- (89-mm-) diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.

D. Boiler Air Vent: Automatic.

E. Drain Valve: Minimum NPS 3/4 (DN 20) hose-end gate valve.

NOTE TO SPECIFIER

** Retain paragraph below if pump is a component of boiler. Coordinate with Division 23 Section "Hydronic Pumps."

F. Circulation Pump: Non-overloading, in-line pump with split-capacitor motor having thermal-overload protection and lubricated bearings; designed to operate at specified boiler pressures and temperatures.

2.4 CONTROLS

A. Refer to specification Section 250504 Building Automation System (BAS) General."

B. Boiler operating controls shall include the following devices and features:

1. Control transformer.
2. Set-Point Adjust: Set points shall be adjustable.
3. Sequence of Operation: Refer to Section 259004 – Sequence of Operation for coordination.
 - a. Include automatic, alternating-firing sequence for multiple boilers to ensure maximum system efficiency throughout the load range and to provide equal runtime for boilers.

C. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.

1. High Cutoff: Automatic reset stops burner if operating conditions rise above maximum boiler design temperature.
2. Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be automatic-reset type.
3. Blocked Inlet Safety Switch: Manual-reset pressure switch field mounted on boiler combustion-air inlet.
4. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.

D. Building Automation System Interface: Factory install hardware and software to enable building automation system to monitor, control, and display boiler status and alarms. Refer to specification Section 250504 Building Automation System (BAS) General.

2.5 ELECTRICAL POWER

A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.

B. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.

1. House in NEMA 250, Type 1 enclosure.
2. Wiring shall be numbered and color-coded to match wiring diagram.



3. Provide branch power circuit to each motor and to controls with a disconnect switch or circuit breaker.
4. Provide each motor with overcurrent protection.

2.6 VENTING

NOTE TO SPECIFIER

** Edit venting and intake requirements below to suit project specifics.

- A. Combustion Vent: Complete system, ASTM A 959, Type 29-4C stainless steel, pipe or Sch 40 CPVC piping pipe, vent terminal, thimble, indoor plate, vent adapter, condensate trap and dilution tank, and sealant.
- B. Combustion-Air Intake: Complete system, stainless steel or Sch 40 CPVC, pipe, vent terminal with screen, inlet air coupling, and sealant.

2.7 SOURCE QUALITY CONTROL

- A. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.

PART 3 - EXECUTION

3.1 BOILER INSTALLATION

- A. Install boilers level on concrete base. Concrete base is specified in Division 23 Section "Common Work for HVAC," and concrete materials and installation requirements are specified in Division 3.
- B. Vibration Isolation: Elastomeric isolation pads with a minimum static deflection of 0.25 inch (6.35 mm).
- C. Install gas-fired boilers according to NFPA 54.
- D. Assemble and install boiler trim.
- E. Install electrical devices furnished with boiler but not specified to be factory mounted.
- F. Install control wiring to field-mounted electrical devices.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to boiler to allow service and maintenance.
- C. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.

- D. Connect piping to boilers, except safety relief valve connections, with flexible connectors of materials suitable for service. Flexible connectors and their installation are specified in Division 22 Section "Common Work for Plumbing."
- E. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas train connection. Provide a reducer if required.
- F. Connect hot-water piping to supply- and return-boiler tapings with shutoff valve and union or flange at each connection.
- G. Install piping from safety relief valves to nearest floor drain.
- H. Boiler Venting:
 - 1. Install flue venting kit and combustion-air intake.
- I. Ground equipment according to Division 26 Section "Grounding and Bonding."
- J. Connect wiring according to Division 26 Section "Conductors and Cables."
- K. Stack drain piping shall be routed through an acid neutralizing tank to prevent damage to piping, floors and floor drains and to prevent highly acidic waste from entering the sanitary drain system.

3.3 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Perform installation and startup checks according to manufacturer's written instructions.
 - 2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and water temperature.
 - b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- B. Remove and replace malfunctioning units and retest as specified above.
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain boilers. Video training sessions. Refer to Division 1 Section "Demonstration and Training."



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Task	Specification	Specification Description
23 52 23 00	23 01 50 00	Cast-Iron Boilers



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SECTION 23 52 33 16 - WATER-TUBE BOILERS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for water-tube boilers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes packaged, factory-fabricated and -assembled, gas-fired, finned water-tube boilers, trim, and accessories for generating hot water.
2. This Section includes packaged, water-tube boilers, trim, and accessories for generating hot water or steam with the following configurations, burners, and outputs:
 - a. Factory and Field assembled.
 - b. Atmospheric gas, Forced-draft gas, Oil, and Combination gas and oil burner.

C. Submittals

1. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.
2. Shop Drawings: For boilers, boiler trim, and accessories. Include plans, elevations, sections, details, and attachments to other work.
 - a. Design calculations and vibration isolation base details, signed and sealed by a qualified professional engineer.
 - 1) Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - 2) Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails and equipment mounting frames.
 - b. Wiring Diagrams: Power, signal, and control wiring.
3. Manufacturer Seismic Qualification Certification: Submit certification that boiler, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment". Include the following:
 4. Source quality-control test reports.
 5. Field quality-control test reports.
 6. Operation and maintenance data.
 7. Warranty: Special warranty specified in this Section.
8. Other Informational Submittals:
 - a. ASME "A" Stamp Certification and Report: Submit "A" stamp certificate of authorization as required by authorities having jurisdiction, and document hydrostatic testing of piping external to boiler.
 - b. Startup service reports.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.
3. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."
4. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, "Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers."



5. I=B=R Compliance: Boilers shall be tested and rated according to HI's "Rating Procedure for Heating Boilers" and "Testing Standard for Commercial Boilers," with I=B=R emblem on a nameplate affixed to boiler.
6. UL Compliance: Test boilers for compliance with UL 726, "Oil-Fired Boiler Assemblies" **OR** UL 726, "Oil-Fired Boiler Assemblies" and UL 795, "Commercial-Industrial Gas Heating Equipment" **OR** UL 795, "Commercial-Industrial Gas Heating Equipment", **as directed**. Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

E. Warranty

1. Special Warranty for Finned Water-Tube Boilers: Manufacturer's standard form in which manufacturer agrees to repair or replace heat exchangers damaged by thermal shock and vent dampers of boilers that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period for Heat Exchangers: 20 years from date of Final Completion.
 - b. Warranty Period for Vent Dampers: Five years from date of Final Completion.
2. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace drums, tubes, headers, cabinets, atmospheric gas burners, and pressure vessels of boilers that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period for Drums, Tubes, Headers, Cabinets, and Atmospheric Gas Burner: Five years from date of Final Completion, pro rata.
 - b. Warranty Period for Pressure Vessel: 20 years from date of Final Completion, for thermal shock.

1.2 PRODUCTS

A. Finned Water-Tube Boilers

1. Description: Factory-fabricated, -assembled, and -tested boiler with tubes sealed into headers pressure tight, and set on a steel base; including insulated jacket, flue-gas vent, combustion-air intake connections, water supply and return connections, and controls.
2. Heat Exchanger:
 - a. Finned copper **OR** steel **OR** copper-nickel, **as directed**, tubing with stainless-steel baffles.
 - b. Bronze **OR** Cast-iron **OR** Steel, **as directed**, headers.
 - c. Single-pass **OR** Two-pass, **as directed**, horizontal **OR** vertical **OR** coil, **as directed**, configuration.
 - d. Tubes shall be sealed in header with silicone O-ring gaskets **OR** by welding **OR** by mechanically rolling tubes in header, **as directed**.
3. Combustion Chamber Internal Insulation: Interlocking panels of refractory insulation, high-temperature cements, mineral fiber, and ceramic refractory tile for service temperatures to 2000 deg F (1100 deg C).
4. Casing:
 - a. Jacket: Sheet metal **OR** Stainless steel, **as directed**, with snap-in or interlocking closures.
 - b. Control Compartment Enclosure: NEMA 250, Type 1A.
 - c. Finish: Baked enamel over primer **OR** Baked enamel over galvanizing **OR** Powder coated, **as directed**.
 - d. Insulation: Minimum 1-inch- (25-mm-) **OR** 2-inch- (50-mm-), **as directed**, thick, mineral-fiber insulation surrounding the heat exchanger.
 - e. Draft Hood: Integral **OR** External, **as directed**.
 - f. Combustion-Air Connection: Inlet duct collar and sheet metal closure over burner compartment.
 - g. Mounting base to secure boiler with accessory for mounting on combustible surface, **as directed**.
 - 1) Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler pressure vessel, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration And

Seismic Controls For Hvac Piping And Equipment" when mounting base is anchored to building structure.

5. Burner:
 - a. Burner Tubes and Orifices: Stainless steel, for natural **OR** propane, **as directed**, gas. Mount burner tubes in a slide-out burner drawer for ease of inspection, **as directed**.
 - 1) Sealed Combustion: Factory-mounted centrifugal fan to draw outside air into boiler and discharge into burner compartment.
 - 2) Direct Vent: Factory-mounted centrifugal fan to draw flue gas out of boiler and discharge into boiler vent.
 - b. Vertical Burner:
 - 1) High-temperature stainless steel **OR** Ceramic, **as directed**, to fire in a 360-degree pattern.
 - 2) Burner shall have a viewing port for observation of burner operation and a factory-mounted centrifugal fan to supply room **OR** outside, **as directed**, air through a replaceable 99 percent efficient (1-micrometer particles) filter, **as directed**, to boiler burner.
 - 3) Fan shall be controlled to prepurge and postpurge the combustion chamber before firing.
 - c. Gas Train for Commercial Boilers: Control devices and full-modulation **OR** on-off **OR** low-high-low **OR** proportional, **as directed**, control sequence shall comply with requirements in AGA **OR** ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**. In addition to these requirements, include shutoff cock, pressure regulator, and control valve.
 - d. Gas Train for Residential Boilers: Combination gas valve with manual shutoff, pressure regulator, and pilot adjustment.
 - e. Pilot: Standing **OR** Intermittent-electric-spark **OR** Hot-surface, **as directed**, pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.
 - f. Flue-Gas Recirculation Fans: Centrifugal fans on burner assembly to recirculate flue gas to decrease oxides of nitrogen emissions to less than 30 ppm.
 - g. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
6. Trim:
 - a. Aquastat Controllers: Operating, firing rate, **as directed**, and high limit.
 - b. Safety Relief Valve: ASME rated.
 - c. Pressure and Temperature Gage: Minimum 3-1/2-inch- (89-mm-) diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.
 - d. Boiler Air Vent: Automatic **OR** Manual, **as directed**.
 - e. Drain Valve: Minimum NPS 3/4 (DN 20) hose-end gate valve.
 - f. Circulation Pump: Non-overloading, in-line pump with split-capacitor motor having thermal-overload protection and lubricated bearings; designed to operate at specified boiler pressures and temperatures.
7. Controls:
 - a. Refer to Division 23 Section "Instrumentation And Control For Hvac".
OR
Boiler operating controls shall include the following devices and features:
 - 1) Control transformer.
 - 2) Motorized Vent Damper: Interlocked with burner to open before burner starts. If damper fails to open, stop burner operation.
 - 3) Set-Point Adjust: Set points shall be adjustable.
 - 4) Sequence of Operation: Electric, factory-fabricated and field-installed panel to control burner firing rate to maintain space temperature in response to thermostat with heat anticipator located in heated space.**OR**

Sequence of Operation: Electric, factory-fabricated and field-installed panel to control burner firing rate to reset supply-water temperature inversely with outside-air temperature. At 0 deg F (minus 17 deg C) outside-air temperature, set supply-water temperature at 200 deg F (93 deg C); at 60 deg F (15 deg C) outside-air temperature, set supply-water temperature at 140 deg F (60 deg C).

- 5) Include automatic, alternating-firing sequence for multiple boilers to ensure maximum system efficiency throughout the load range and to provide equal runtime for boilers.
- b. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.
 - 1) High Cutoff: Manual **OR** Automatic, **as directed**, reset stops burner if operating conditions rise above maximum boiler design temperature.
 - 2) Water Flow Switch: Automatic-reset paddle-switch shall prevent burner operation on low water flow.
 - 3) Blocked Vent Safety Switch: Manual-reset switch factory mounted on draft diverter.
 - 4) Rollout Safety Switch: Factory mounted on boiler combustion chamber.
 - 5) Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.
- c. Building Automation System Interface: Factory install hardware and software to enable building automation system to monitor, control, and display boiler status and alarms.
 - 1) Monitoring: On/off status, common trouble alarm **OR** low water level alarm, **as directed**.
 - 2) Control: On/off operation, hot water supply temperature set-point adjustment, **as directed**.
 - 3) A communication interface with building automation system shall enable building automation system operator to remotely control and monitor the boiler from an operator workstation. Control features available, and monitoring points displayed, locally at boiler control panel shall be available through building automation system.

B. Steel **OR Flexible, **as directed**, Water-Tube Boilers**

1. Description: Factory-fabricated and assembled **OR** Field-assembled, **as directed**, water-tube boiler with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket, flue-gas vent, supply and return connections, and controls.
2. Heat-Exchanger Design: Straight steel tubes rolled into steel headers.
 - a. Accessible head plates at both ends.
 - b. Handholes or couplings, **as directed**, in headers for water-side inspections.
 - c. Accessible drain and blowdown tappings, both high and low, for surface and mud removal.
 - d. Lifting lugs on top of boiler.
 - e. Built-in air separator.
3. Heat-Exchanger Design: Bent steel tubes swaged **OR** welded, **as directed**, into steel headers with membrane waterwall design, **as directed**.
 - a. Limit tube configurations to two **OR** four, **as directed**.
 - b. Accessible drain and blowdown tappings, both high and low, for surface and mud removal.
 - c. Accessible inspection ports in drum, mud legs, and tube manifolds.
 - d. Lifting lugs on top of boiler.
 - e. Built-in air separator.
4. Combustion Chamber: Equipped with minimum 2-1/2-inch (64-mm) **OR** 3-inch (75-mm) **OR** 4-inch (100-mm), **as directed**, 2700 deg F (1482 deg C) poured refractory on floor and minimum 2-inch (50-mm) **OR** 3-1/2-inch (89-mm), **as directed**, lap-jointed cast refractory with fiber-blanket joint seals on side walls. Combustion chamber shall have flame observation ports in front and back **OR** back, **as directed**.
5. Casing:
 - a. Insulation: Minimum 2-inch (50-mm) thick, lightweight refractory; 1-inch (25-mm) thick insulating board; galvanized-steel membrane, and 2-inch (50-mm) thick, mineral-fiber insulation surrounding the heat exchanger and combustion chamber **OR** 2-inch (50-mm)

- thick, mineral-fiber insulation surrounding the heat exchanger and combustion chamber, **as directed**.
- b. Top Flue Connection: Constructed of aluminized steel **OR** stainless steel, **as directed**.
 - c. Jacket: Mirror-finish stainless steel, with screw-fastened closures.
OR
Jacket: Sheet metal **OR** Galvanized sheet metal, **as directed**, with screw-fastened closures and baked-enamel **OR** powder-coated, **as directed**, protective finish.
 - d. Mounting base to secure boiler to concrete base.
 - 1) Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" when mounting base is anchored to building structure.
 - e. Control Compartment Enclosure: NEMA 250, Type 1A.
6. Draft Diverter **OR** Barometric Damper, **as directed**: Galvanized-steel assembly with flue-gas thermometer.
7. Burner - Atmospheric Gas Burners:
- a. Burner and Orifices: Stainless steel **OR** Cast iron, **as directed**, for natural **OR** propane, **as directed**, gas.
 - b. Gas Train for Commercial Boilers: Control devices and full-modulation **OR** on-off **OR** low-high-low, **as directed**, control sequence shall comply with requirements in AGA **OR** ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.
 - c. Gas Train for Residential Boilers: Combination gas valve with manual shutoff, pressure regulator, and pilot adjustment.
 - d. Pilot: Standing **OR** Intermittent-electric-spark, **as directed**, pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.
8. Burner - Forced-Draft Gas Burners:
- a. Burner: Welded construction with multivane, stainless-steel, flame-retention diffuser for natural **OR** propane, **as directed**, gas. Mount burner on hinged access door to permit access to combustion chamber, **as directed**.
 - b. Blower: Forward-curved centrifugal fan integral to burner, directly driven by motor; with adjustable, dual-blade damper assembly and locking quadrant to set air-fuel ratio.
 - 1) Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - c. Gas Train: Control devices and modulating **OR** on-off **OR** low-high-low, **as directed**, control sequence shall comply with requirements in AGA **OR** ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.
 - d. Pilot: Intermittent **OR** Interrupted, **as directed**, -electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.
 - e. Flue-Gas Recirculation: Burner connections shall be equipped for recirculating flue gas.
 - 1) Maximum Oxides of Nitrogen Emissions: 20 **OR** 30, **as directed**, ppm.
9. Burner - Oil Burners:
- a. Burner: Welded construction with multivane, stainless-steel, flame-retention diffuser for fuel oil. Mount burner on hinged access door to permit access to combustion chamber, **as directed**.
 - b. Blower: Forward-curved centrifugal fan integral to burner, directly driven by motor; with adjustable, dual-blade damper assembly and locking quadrant to set air-fuel ratio.
 - 1) Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - c. Oil Supply: Control devices and modulating **OR** on-off **OR** low-high-low, **as directed**, control sequence shall comply with requirements in ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.

- 1) Oil Pump: Two-stage, gear-type oil pump integral to and directly driven by blower, **as directed**, shall be capable of producing 300-psig (2070-kPa) discharge pressure and 15-inch Hg (50.7-kPa) vacuum.
 - 2) Oil Piping Specialties:
 - a) Suction-line, manual, gate valve.
 - b) Removable-mesh oil strainer.
 - c) 0- to 30-inch Hg (0- to 101.3-kPa) vacuum; 0- to 30-psig (0- to 207-kPa) vacuum-pressure gage.
 - d) 0- to 300-psig (0- to 2070-kPa) oil-nozzle pressure gage.
 - e) Nozzle-line, solenoid-safety-shutoff oil valve.
 - d. Pilot: Intermittent **OR** Interrupted, **as directed**, -electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff solenoid using cadmium sulfide **OR** UV scanner, **as directed**, flame-safety control.
 - e. Flue-Gas Recirculation: Burner connections shall be equipped for recirculating flue gas.
 - 1) Maximum Oxides of Nitrogen Emissions: 30 ppm.
10. Burner - Combination Gas and Oil Burners:
- a. Burner: Welded construction with multivane, stainless-steel, flame-retention diffuser for fuel oil and natural **OR** propane, **as directed** gas. Mount burner on hinged access door to permit access to combustion chamber, **as directed**.
 - b. Blower: Forward-curved centrifugal fan integral to burner, directly driven by motor; with adjustable, dual-blade damper assembly and locking quadrant to set air-fuel ratio.
 - 1) Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - c. Oil Supply: Control devices and modulating **OR** on-off **OR** low-high-low, **as directed**, control sequence shall comply with requirements in ASME CSD-1 **OR** FMG **OR** IRI, **as directed**.
 - 1) Oil Pump: Two-stage, gear-type oil pump integral to and directly driven by blower, **as directed**, shall be capable of producing 300-psig (2070-kPa) discharge pressure and 15-inch Hg (50.7-kPa) vacuum.
 - 2) Oil Piping Specialties:
 - a) Suction-line, manual, gate valve.
 - b) Removable-mesh oil strainer.
 - c) 0- to 30-inch Hg (0- to 101.3-kPa) vacuum; 0- to 30-psig (0- to 207-kPa) vacuum-pressure gage.
 - d) 0- to 300-psig (0- to 2070-kPa) oil-nozzle pressure gage.
 - e) Nozzle-line, solenoid-safety-shutoff oil valve.
 - d. Gas Train: Control devices and modulating **OR** on-off **OR** low-high-low, **as directed**, control sequence shall comply with requirements in ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.
 - e. Gas Pilot: Intermittent **OR** Interrupted, **as directed**, -electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.
 - f. Oil Pilot: Intermittent **OR** Interrupted, **as directed**, -electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff solenoid with cadmium sulfide **OR** UV scanner, **as directed**, flame-safety control.
 - g. Flue-Gas Recirculation: Burner connections shall be equipped for recirculating flue gas.
 - 1) Maximum Oxides of Nitrogen Emissions: 20 **OR** 30, **as directed**, ppm.
11. Trim for Hot-Water Boilers:
- a. Include devices sized to comply with ANSI B31.1, "Power Piping **OR** ANSI B31.9, "Building Services Piping", **as directed**.
 - b. Aquastat Controllers: Operating, firing rate, **as directed**, and high limit.
 - c. Safety Relief Valve: ASME rated.



- d. Pressure and Temperature Gage: Minimum 3-1/2-inch- (89-mm-) diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.
 - e. Boiler Air Vent: Automatic **OR** Manual, **as directed**.
 - f. Drain Valve: Minimum NPS 3/4 (DN 20) hose-end gate valve.
 - g. Tankless Heater: Carbon-steel **OR** Bronze, **as directed**, header with copper-tube heat exchanger, mounted in a port of upper drum and sealed with fiber gasket.
 - 1) Tappings NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
 - 2) Tappings NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
12. Trim for Steam Boilers:
- a. Include devices sized to comply with ANSI B31.1, "Power Piping **OR** ANSI B31.9, "Building Services Piping", **as directed**.
 - b. Pressure Controllers: Operating, firing rate, **as directed**, and high limit.
 - c. Safety Relief Valve:
 - 1) Size and Capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code.
 - 2) Description: Fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed.
 - a) Drip-Pan Elbow: Cast iron and having threaded inlet and outlet with threads complying with ASME B1.20.1.
 - d. Pressure Gage: Minimum 3-1/2-inch (89-mm) diameter. Gage shall have normal operating pressure about 50 percent of full range.
 - e. Water Column: Minimum 12-inch (300-mm) glass gage with shutoff cocks.
 - f. Drain Valves: Minimum NPS 3/4 (DN 20) or nozzle size with hose-end connection.
 - g. Blowdown Valves: Factory-installed bottom and surface, slow-acting blowdown valves same size as boiler nozzle. Blowdown valves shall be combination of slow and quick acting as required by ANSI B31.1, **as directed**.
 - h. Stop Valves: Boiler inlets and outlets, except safety relief valves or preheater inlet and outlet, shall be equipped with stop valve in an accessible location as near as practical to boiler nozzle and same size or larger than nozzle. Valves larger than NPS 2 (DN 50) shall have rising stem.
 - i. Stop-Check Valves: Factory-installed, stop-check valve and stop valve at boiler outlet with free-blow drain valve factory installed between the two valves and visible when operating stop-check valve.
 - j. Tankless Heater: Carbon-steel header with copper-tube heat exchanger, mounted in a port of upper manifold and sealed with fiber gasket.
 - 1) Tappings NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
 - 2) Tappings NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
13. Controls:
- a. Refer to Division 23 Section "Instrumentation And Control For Hvac".
OR
Boiler operating controls shall include the following devices and features:
 - 1) Control transformer.
 - 2) Set-Point Adjust: Set points shall be adjustable.
 - 3) Operating Pressure Control for Steam Boilers: Factory wired and mounted to cycle burner.
 - 4) Low-Water Cutoff and Pump Control for Steam Boilers: Cycle feedwater pump(s) for makeup water control.

- 5) Sequence of Operation for Hot-Water Boilers: Electric, factory-fabricated and field-installed panel to control burner firing rate to maintain space temperature in response to thermostat with heat anticipator located in heated space.
OR
Sequence of Operation for Hot-Water Boilers: Electric, factory-fabricated and field-installed panel to control burner firing rate to reset supply-water temperature inversely with outside-air temperature. At 0 deg F (minus 17 deg C) outside-air temperature, set supply-water temperature at 200 deg F (93 deg C); at 60 deg F (15 deg C) outside-air temperature, set supply-water temperature at 140 deg F (60 deg C).
 - 6) Sequence of Operation for Steam Boilers: Electric, factory-fabricated and field-installed panel to control burner firing rate to maintain a constant steam pressure. Maintain pressure set point plus or minus 10 percent.
 - 7) Include automatic, alternating-firing sequence for multiple boilers to ensure maximum system efficiency throughout the load range and to provide equal runtime for boilers.
 - b. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.
 - 1) High Cutoff: Manual **OR** Automatic, **as directed**, reset stops burner if operating conditions rise above maximum boiler design temperature for hot-water boiler or design pressure for steam boiler.
 - 2) Low-Water Cutoff Switch: Electronic (for hot-water boilers) or Float and electronic (for steam boilers) probe shall prevent burner operation on low water. Cutoff switch shall be manual **OR** automatic, **as directed**, -reset type.
 - 3) Blocked Vent Safety Switch (Atmospheric Boilers): Manual-reset switch factory mounted on draft diverter.
 - 4) Rollout Safety Switch (Atmospheric Boilers): Factory mounted on boiler combustion chamber.
 - 5) Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.
 - c. Building Automation System Interface: Factory install hardware and software to enable building automation system to monitor, control, and display boiler status and alarms.
 - 1) Monitoring: On/off status, common trouble alarm **OR** low water level alarm, **as directed**.
 - 2) Control: On/off operation, hot water supply temperature set-point adjustment **OR** steam pressure adjustment, **as directed**.
 - 3) A communication interface with building automation system shall enable building automation system operator to remotely control and monitor the boiler from an operator workstation. Control features available, and monitoring points displayed, locally at boiler control panel shall be available through building automation system.
- C. Electrical Power
1. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 22.
OR
Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.
 - a. House in NEMA 250, Type 1 enclosure.
 - b. Wiring shall be numbered and color-coded to match wiring diagram.
 - c. Install factory wiring outside of an enclosure in a metal, **as directed**, raceway.
 - d. Field power interface shall be to wire lugs **OR** fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**.
 - e. Provide branch power circuit to each motor and to controls with disconnect switch or circuit breaker, **as directed**.

- f. Provide each motor with overcurrent protection.

D. Venting Kits

1. Vent Damper (for Finned Water-Tube Boilers): Motorized, UL listed for use on atmospheric burner boiler equipped with draft hood; motor to open and close damper; stainless-steel vent coupling and damper blade; keyed wiring harness connector plug; and dual-position switches to permit burner operation.
2. Kit: Complete system, ASTM A 959, Type 29-4C, **as directed**, stainless steel, pipe, vent terminal, thimble, indoor plate, vent adapter, condensate trap, and sealant.
3. Combustion-Air Intake: Stainless steel, pipe, vent terminal with screen, inlet air coupling, and sealant.

E. Source Quality Control

1. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.
2. Burner and Hydrostatic Test (for Factory-Assembled Boilers): Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.
3. Allow Owner access to source quality-control testing of boilers. Notify the Owner 14 days in advance of testing.

1.3 EXECUTION

A. Boiler Installation

1. Install boilers level on concrete base. Concrete base is specified in Division 23 Section "Common Work Results For Hvac", and concrete materials and installation requirements are specified in Division 31.
2. Vibration Isolation: Elastomeric isolator pads **OR** mounts, **as directed**, with a minimum static deflection of 0.25 inch (6.35 mm). Vibration isolation devices and installation requirements are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
3. Install gas-fired boilers according to NFPA 54.
4. Install oil-fired boilers according to NFPA 31.
5. Assemble boiler tubes in sequence and seal each tube joint.
6. Assemble and install boiler trim.
7. Install electrical devices furnished with boiler but not specified to be factory mounted.
8. Install control wiring to field-mounted electrical devices.

B. Connections

1. Piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install piping adjacent to boiler to allow service and maintenance.
3. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas train connection. Provide a reducer if required.
4. Connect oil piping full size to burner inlet with shutoff valve and union.
5. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve and union or flange at each connection.
6. Connect steam and condensate piping to supply-, return-, and blowdown-boiler tappings with shutoff valve and union or flange at each connection.
7. Install piping from safety relief valves to nearest floor drain (for hot-water boilers).
8. Install piping from safety valves to drip-pan elbow and to nearest floor drain (for steam boilers).
9. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.
10. Boiler Flue Venting (for Finned Water-Tube Boilers):
 - a. Install venting kit and combustion-air intake.

- b. Connect full size to boiler connections. Comply with requirements in Division 23 Section "Breechings, Chimneys, And Stacks".
- 11. Connect breeching to full size of boiler outlet. Comply with requirements in Division 23 Section "Breechings, Chimneys, And Stacks" for venting materials.
- 12. Install flue-gas recirculation duct from vent to burner. Comply with requirements in Division 23 Section "Breechings, Chimneys, And Stacks" for recirculation duct materials.
- 13. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
- 14. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

C. Field Quality Control

- 1. Perform tests and inspections and prepare test reports.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- 2. Tests and Inspections:
 - a. Perform installation and startup checks according to manufacturer's written instructions.
 - b. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
 - c. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
 - d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 1) Burner Test (for Field-Assembled Boilers): Adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency.
 - 2) Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and water temperature **OR** steam pressure, **as directed**.
 - 3) Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- 3. Remove and replace malfunctioning units and retest as specified above.
- 4. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.
- 5. Performance Tests, as directed:
 - a. Engage a factory-authorized service representative to inspect component assemblies and equipment installations, including connections, and to conduct performance testing.
 - b. Boilers shall comply with performance requirements indicated, as determined by field performance tests. Adjust, modify, or replace equipment in order to comply.
 - c. Perform field performance tests to determine the capacity and efficiency of the boilers.
 - 1) For dual-fuel boilers, perform tests for each fuel.
 - 2) Test for full capacity.
 - 3) Test for boiler efficiency at low fire 20, 40, 60, 80, 100, 80, 60, 40 and 20, **as directed**, percent of full capacity. Determine efficiency at each test point.
 - d. Repeat tests until results comply with requirements indicated.
 - e. Provide analysis equipment required to determine performance.
 - f. Provide temporary equipment and system modifications necessary to dissipate the heat produced during tests if building systems are not adequate.
 - g. Notify the Owner in advance of test dates.
 - h. Document test results in a report and submit to the Owner.

D. Demonstration

- 1. Train Owner's maintenance personnel to adjust, operate, and maintain boilers.

END OF SECTION 23 52 33 16

SECTION 23 52 36 00 - FIRE-TUBE BOILERS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for fire-tube boilers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes packaged, factory-fabricated and -assembled boilers, trim, and accessories for generating hot water **OR** steam, **as directed**, with the following configurations and burners:
 - a. Horizontal, fire-tube, Vertical, fire-tube, and Fire-box boiler.
 - b. Gas, Oil, and Combination gas and oil burner.

C. Submittals

1. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.
2. Shop Drawings: For boilers, boiler trim, and accessories. Include plans, elevations, sections, details, and attachments to other work.
 - a. Design calculations and vibration isolation base details, signed and sealed by a qualified professional engineer.
 - 1) Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - 2) Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails and equipment mounting frames.
 - b. Wiring Diagrams: Power, signal, and control wiring.
3. Manufacturer Seismic Qualification Certification: Submit certification that boiler, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment". Include the following:
4. Source quality-control test reports.
5. Field quality-control test reports.
6. Operation and maintenance data.
7. Warranty: Special warranty specified in this Section.
8. Other Informational Submittals:
 - a. ASME Stamp Certification and Report: Submit "A," "S," or "PP" stamp certificate of authorization, as required by authorities having jurisdiction, and document hydrostatic testing of piping external to boiler.
 - b. Startup service reports.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.
3. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."
4. UL Compliance: Test Boilers for compliance with UL 726, "Oil-Fired Boiler Assemblies" **OR** UL 726, "Oil-Fired Boiler Assemblies" and UL 795, "Commercial-Industrial Gas Heating Equipment" **OR** UL 795, "Commercial-Industrial Gas Heating Equipment", **as directed**. Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

E. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace front- and rear-door refractories and heat exchangers of boilers that fail in materials or workmanship within specified warranty period.
 - a. Horizontal, Fire-Tube and Fire-Box Boilers: Refractory in front and rear doors, 10 years from date of startup by factory-authorized personnel.
 - b. Vertical, Fire-Tube Boilers and Heat Exchanger: Five years from date of Final Completion, if following water-treatment program recommended by manufacturer.

1.2 PRODUCTS

A. Manufactured Units - Horizontal, Fire-Tube Boilers

1. Description: Factory-fabricated, -assembled, and -tested, horizontal, fire-tube boilers with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket, flue-gas vent, water supply and return connections, and controls.
2. Pressure Vessel Design: Straight, steel tubes rolled **OR** welded, **as directed**, into steel headers. Three **OR** Four, **as directed**, passes with dry-back **OR** wet-back, **as directed**, design. Minimum heat-exchanger surface of 5 sq. ft./bhp (2.1 sq. m/10 kW). Include the following accessories:
 - a. Handholes for water-side inspections.
 - b. Lifting lugs on top of boiler.
 - c. Minimum NPS 1 (DN 25) hose-end drain valves at shell low point.
 - d. For hot-water boilers only:
 - 1) Tappings or flanges for supply- and return-water piping.
 - 2) Built-in air separator.
 - e. For steam boilers only:
 - 1) Accessible drain and blowdown tappings, both high and low, for surface and mud removal.
 - 2) Tappings for steam supply, makeup, level controls, and chemical treatment.
3. Front and Rear Doors:
 - a. Bolted **OR** Hinged **OR** Davited, **as directed**, sealed with heat-resistant gaskets and fastened with lugs and cap screws.
 - b. Designed so tube sheets and flues are fully accessible for inspection or cleaning when doors are open.
 - c. Include observation ports in doors at both ends of boiler for inspection of flame conditions.
 - d. Door refractory **OR** insulation, **as directed**, shall be accessible for inspection and maintenance.
4. Casing:
 - a. Insulation: Minimum 2-inch- (50-mm-) thick, mineral-fiber insulation surrounding the boiler shell.
 - b. Flue Connection: Flange at top of boiler.
 - c. Jacket: Galvanized sheet **OR** Sheet, **as directed**, metal, with screw-fastened closures and baked-enamel **OR** powder-coated, **as directed**, protective finish.
 - d. Mounting base to secure boiler to concrete base.
 - 1) Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" when mounting base is anchored to building structure.
 - e. Control Compartment Enclosure: NEMA 250, Type 1 **OR** 4 **OR** 4X **OR** 12, **as directed**.
5. Barometric Damper: Galvanized-steel assembly with flue-gas thermometer having a minimum 3-1/2-inch- (89-mm-) diameter dial.

B. Manufactured Units - Vertical, Fire-Tube Boilers



1. Description: Factory-fabricated, -assembled, and -tested, vertical, fire-tube boilers with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket, flue-gas vent, water supply and return connections, and controls.
 2. Pressure Vessel Design: Straight, steel pipe welded in a concentric pattern to separate flue-gas and heating media to form two **OR** four, **as directed**, passes with welded fins to improve heat transfer in secondary flue-gas passages. Include the following accessories:
 - a. Handholes for water-side inspections.
 - b. Lifting lugs on top of boiler.
 - c. Minimum NPS 1 (DN 25) hose-end drain valves at water passage low point.
 - d. For hot-water boilers only:
 - 1) Tappings or flanges for supply- and return-water piping.
 - 2) Built-in air separator.
 - e. For steam boilers only:
 - 1) Accessible drain and blowdown tappings, both high and low, for surface and mud removal.
 - 2) Tappings for steam supply, makeup, level controls, and chemical treatment.
 3. Combustion Chamber: Equipped with flame retainer to lengthen flame-residence time.
 4. Casing:
 - a. Insulation: Minimum 4-inch- (100-mm-) thick, mineral-fiber insulation surrounding the heat exchanger and combustion chamber.
 - b. Flue Connection: Top connection, constructed of aluminized **OR** stainless, **as directed**, steel.
 - c. Jacket: Mirror-finish stainless steel with screw-fastened closures.
OR
Jacket: Galvanized sheet **OR** Sheet, **as directed**, metal, with screw-fastened closures and baked-enamel **OR** powder-coated, **as directed**, protective finish.
 - d. Mounting base to secure boiler to concrete base.
 - 1) Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 22 Section "Identification For Plumbing Piping And Equipment" when mounting base is anchored to building structure.
 - e. Control Compartment Enclosure: NEMA 250, Type 1 **OR** 4 **OR** 4X **OR** 12, **as directed**.
 5. Barometric Damper: Galvanized-steel assembly with flue-gas thermometer having a minimum 3-1/2-inch- (89-mm-) diameter dial.
- C. Manufactured Units - Fire-Box Boilers
1. Description: Factory-fabricated, -assembled, and -tested, fire-box boilers with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket, flue-gas vent, water supply and return connections, and controls.
 2. Pressure Vessel Design: Straight, steel tubes rolled **OR** welded, **as directed**, into steel headers. Three passes with wet-back design. Minimum heat-exchanger surface of 5 sq. ft./bhp (2.1 sq. m/10 kW). Include the following features and accessories:
 - a. Tube Size and Thickness: Minimum NPS 2 (DN 50), minimum 0.105 inch (2.667 mm) thick.
 - b. Brass washout plugs.
 - c. Steel turbulators.
 - d. Lifting lugs on top of boiler.
 - e. Minimum NPS 1 (DN 25) hose-end drain valves at shell low point.
 - f. For hot-water boilers only:
 - 1) Tappings or flanges for supply- and return-water piping.
 - 2) Built-in air separator.
 - g. For steam boilers only:
 - 1) Accessible drain and blowdown tappings, both high and low, for surface and mud removal.
 - 2) Tappings for steam supply, makeup, level controls, and chemical treatment.

3. Combustion Chamber: Welded steel, waterwall and -floor design **OR** water-leg design with refractory insulation poured in the floor, **as directed**. Flame observation port.
4. Casing:
 - a. Insulation: Minimum 2-inch- (50-mm-) thick, foil-backed, **as directed**, mineral-fiber insulation surrounding the boiler shell.
 - b. Insulated removable smoke boxes and reversing chamber cover.
 - c. Flue Connection: Steel top **OR** rear, **as directed**.
 - d. Jacket: Sheet metal, with screw-fastened closures and baked-enamel **OR** powder-coated, **as directed**, protective finish.
 - e. Control Compartment Enclosure: NEMA 250, Type 1 **OR** 1A **OR** 4 **OR** 4X **OR** 12, **as directed**.
 - f. Mounting base to secure boiler to concrete base.
 - 1) Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" when mounting base is anchored to building structure.
5. Barometric Damper: Galvanized-steel assembly with flue-gas thermometer having a minimum 3-1/2-inch- (89-mm-) diameter dial.

D. Burner For Forced-Draft Gas Burners

1. Burner: Welded construction with multivane, stainless-steel, flame-retention diffuser for natural **OR** propane, **as directed**, gas. Mount burner on hinged access door to permit access to combustion chamber, **as directed**.
2. Blower: Forward-curved centrifugal fan integral to burner, directly driven by motor; with adjustable, dual-blade damper assembly and locking quadrant to set air-fuel ratio.
 - a. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
3. Gas Train: Control devices and modulating **OR** on-off **OR** low-high-low, **as directed**, control sequence shall comply with requirements in ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.
4. Pilot: Intermittent **OR** Interrupted, **as directed**, -electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.
5. Flue-Gas Recirculation: Burner connections shall be equipped for recirculating flue gas.
 - a. Maximum Oxides of Nitrogen Emissions: 20 **OR** 30, **as directed**, ppm.

E. Burner For Oil Burners

1. Burner: Welded construction with multivane, stainless-steel, flame-retention diffuser for fuel oil. Mount burner on hinged access door to permit access to combustion chamber, **as directed**.
2. Blower: Forward-curved centrifugal fan integral to burner, directly driven by motor; with adjustable, dual-blade damper assembly and locking quadrant to set air-fuel ratio.
 - a. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
3. Oil Supply: Control devices and modulating **OR** on-off **OR** low-high-low, **as directed**, control sequence shall comply with requirements in ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.
 - a. Oil Pump: Two-stage, gear-type oil pump integral to and directly driven by blower, **as directed**, shall be capable of producing 300-psig (2070-kPa) discharge pressure and 15-inch Hg (50.7-kPa) vacuum.
 - b. Oil Piping Specialties:
 - 1) Suction-line, manual, gate valve.
 - 2) Removable-mesh oil strainer.
 - 3) 0- to 30-inch Hg (0- to 101.3-kPa) vacuum; 0- to 30-psig (0- to 207-kPa) vacuum-pressure gage.

- 4) 0- to 300-psig (0- to 2070-kPa) oil-nozzle pressure gage.
 - 5) Nozzle-line, solenoid-safety-shutoff oil valve.
 4. Pilot: Intermittent **OR** Interrupted, **as directed**, -electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff solenoid with cadmium sulfide **OR** UV scanner, **as directed**, flame-safety control.
 5. Flue-Gas Recirculation: Burner connections shall be equipped for recirculating flue gas.
 - a. Maximum Oxides of Nitrogen Emissions: 30 ppm.
- F. Burner For Combination Gas And Oil Burners
 1. Burner: Welded construction with multivane, stainless-steel, flame-retention diffuser for fuel oil and natural **OR** propane, **as directed**, gas. Mount burner on hinged access door to permit access to combustion chamber, **as directed**.
 2. Blower: Forward-curved centrifugal fan integral to burner, directly driven by motor; with adjustable, dual-blade damper assembly and locking quadrant to set air-fuel ratio.
 - a. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 3. Oil Supply: Control devices and modulating **OR** on-off **OR** low-high-low, **as directed**, control sequence shall comply with requirements in ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.
 - a. Oil Pump: Two-stage, gear-type oil pump integral to and directly driven by blower, **as directed**, shall be capable of producing 300-psig (2070-kPa) discharge pressure and 15-inch Hg (50.7-kPa) vacuum.
 - b. Oil Piping Specialties:
 - 1) Suction-line, manual, gate valve.
 - 2) Removable-mesh oil strainer.
 - 3) 0- to 30-inch Hg (0- to 101.3-kPa) vacuum; 0- to 30-psig (0- to 207-kPa) vacuum-pressure gage.
 - 4) 0- to 300-psig (0- to 2070-kPa) oil-nozzle pressure gage.
 - 5) Nozzle-line, solenoid-safety-shutoff oil valve.
 4. Gas Train: Control devices and modulating **OR** on-off **OR** low-high-low, **as directed**, control sequence shall comply with requirements in ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.
 5. Gas Pilot: Intermittent **OR** Interrupted, **as directed**, -electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.
 6. Oil Pilot: Intermittent **OR** Interrupted, **as directed**, -electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff solenoid with cadmium sulfide **OR** UV scanner, **as directed**, flame-safety control.
 7. Flue-Gas Recirculation: Burner connections shall be equipped for recirculating flue gas.
 - a. Maximum Oxides of Nitrogen Emissions: 20 **OR** 30, **as directed**, ppm.
- G. Trim For Hot-Water Boilers
 1. Include devices sized to comply with ANSI B31.1, "Power Piping **OR** ANSI B31.9, "Building Services Piping", **as directed**.
 2. Aquastat Controllers: Operating, firing rate, **as directed**, and high limit.
 3. Safety Relief Valve: ASME rated.
 4. Pressure and Temperature Gage: Minimum 3-1/2-inch- (89-mm-) diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.
 5. Boiler Air Vent: Automatic **OR** Manual, **as directed**.
 6. Drain Valve: Minimum NPS 3/4 (DN 20) hose-end gate valve.
 7. Tankless Heater: Carbon-steel **OR** Bronze, **as directed**, header with copper-tube heat exchanger, mounted in a port of upper drum and sealed with fiber gasket.
 - a. Tappings NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.

- b. Tappings NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.

H. Trim For Steam Boilers

1. Include devices sized to comply with ANSI B31.1, "Power Piping **OR** ANSI B31.9, "Building Services Piping", **as directed**.
2. Pressure Controllers: Operating, firing rate, **as directed**, and high limit.
3. Safety Relief Valve:
 - a. Size and Capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code.
 - b. Description: Fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed.
 - 1) Drip-Pan Elbow: Cast iron and having threaded inlet and outlet with threads complying with ASME B1.20.1.
4. Pressure Gage: Minimum 3-1/2-inch (89-mm) diameter. Gage shall have normal operating pressure about 50 percent of full range.
5. Water Column: Minimum 12-inch (300-mm) glass gage with shutoff cocks.
6. Drain Valves: Minimum NPS 3/4 (DN 20) or nozzle size with hose-end connection.
7. Blowdown Valves: Factory-installed bottom and surface, slow-acting blowdown valves same size as boiler nozzle. Blowdown valves shall be combination of slow and quick acting as required by ANSI B31.1, **as directed**.
8. Stop Valves: Boiler inlets and outlets, except safety relief valves or preheater inlet and outlet, shall be equipped with stop valve in an accessible location as near as practical to boiler nozzle and same size or larger than nozzle. Valves larger than NPS 2 (DN 50) shall have rising stem.
9. Stop-Check Valves: Factory-installed, stop-check valve and stop valve for field installation at boiler outlet with free-blow drain valve for field installation between the two valves and visible when operating stop-check valve.
10. Tankless Heater: Carbon-steel header with copper-tube heat exchanger, mounted in a port of upper manifold and sealed with fiber gasket.
 - a. Tappings NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
 - b. Tappings NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.

I. Controls

1. Refer to Division 23 Section "Instrumentation And Control For Hvac".
OR
Boiler operating controls shall include the following devices and features:
 - a. Control transformer.
 - b. Set-Point Adjust: Set points shall be adjustable.
 - c. Operating Pressure Control for steam boilers: Factory wired and mounted to cycle burner.
 - d. Low-Water Cutoff and Pump Control for steam boilers: Cycle feedwater pump(s) **OR** Operate feedwater pump(s) continuously and modulate valve, **as directed**, for makeup water control.
 - e. Sequence Of Operation For Hot-Water Boilers: Electric, factory-fabricated and field-installed panel to control burner firing rate to maintain space temperature in response to thermostat with heat anticipator located in heated space.**OR**
Sequence Of Operation For Hot-Water Boilers: Electric, factory-fabricated and field-installed panel to control burner firing rate to reset supply-water temperature inversely with outside-air temperature. At 0 deg F (minus 17 deg C) outside-air temperature, set supply-water temperature at 200 deg F (93 deg C); at 60 deg F (15 deg C) outside-air temperature, set supply-water temperature at 140 deg F (60 deg C).

- f. Sequence Of Operation For Steam Boilers: Electric, factory-fabricated and field-installed panel to control burner firing rate to maintain a constant steam pressure. Maintain pressure set point plus or minus 10 percent.
 - 1) Include automatic, alternating-firing sequence for multiple boilers to ensure maximum system efficiency throughout the load range and to provide equal runtime for boilers.
 - 2. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.
 - a. High Cutoff: Manual **OR** Automatic, **as directed**, reset stops burner if operating conditions rise above maximum boiler design temperature for hot-water boiler **OR** design pressure for steam boiler, **as directed**.
 - b. Low-Water Cutoff Switch: Electronic for hot-water boilers **OR** Float and electronic for steam boilers, **as directed**, probe shall prevent burner operation on low water. Cutoff switch shall be manual **OR** automatic, **as directed**, -reset type.
 - c. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.
 - 3. Building Automation System Interface: Factory-install hardware and software to enable building automation system to monitor, control, and display boiler status and alarms.
 - a. Hardwired Points:
 - 1) Monitoring: On/off status, common trouble alarm **OR** low water level alarm, **as directed**.
 - 2) Control: On/off operation, hot water supply temperature set-point adjustment **OR** steam pressure adjustment, **as directed**.
 - b. A communication interface with building automation system shall enable building automation system operator to remotely control and monitor the boiler from an operator workstation. Control features available, and monitoring points displayed, locally at boiler control panel shall be available through building automation system.
- J. Electrical Power
 - 1. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 22..
OR
Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.
 - a. House in NEMA 250, Type 1 **OR** 4 **OR** 4X **OR** 12, **as directed**, enclosure.
 - b. Wiring shall be numbered and color-coded to match wiring diagram.
 - c. Install wiring outside of an enclosure in a metal, **as directed**, raceway.
 - d. Field power interface shall be to wire lugs **OR** fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**.
 - e. Provide branch power circuit to each motor and to controls with a disconnect switch or circuit breaker, **as directed**.
 - f. Provide each motor with overcurrent protection.
- K. Source Quality Control
 - 1. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.
 - 2. Burner and Hydrostatic Test for factory-assembled boilers: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.
 - 3. Allow Owner access to source quality-control testing of boilers. Notify the Owner 14 days in advance of testing.

1.3 EXECUTION

A. Boiler Installation

1. Install boilers level on concrete base. Concrete base is specified in Division 23 Section "Common Work Results For Hvac", and concrete materials and installation requirements are specified in Division 31.
2. Vibration Isolation: Elastomeric isolator pads **OR** mounts, **as directed**, with a minimum static deflection of 0.25 inch (6.35 mm). Vibration isolation devices and installation requirements are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
3. Install gas-fired boilers according to NFPA 54.
4. Install oil-fired boilers according to NFPA 31.
5. Assemble and install boiler trim.
6. Install electrical devices furnished with boiler but not specified to be factory mounted.
7. Install control wiring to field-mounted electrical devices.

B. Connections

1. Piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install piping adjacent to boiler to allow service and maintenance.
3. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas train connection. Provide a reducer if required.
4. Connect oil piping full size to burner inlet with shutoff valve and union.
5. Connect hot-water piping to supply- and return-boiler tapplings with shutoff valve and union or flange at each connection.
6. Connect steam and condensate piping to supply-, return-, and blowdown-boiler tapplings with shutoff valve and union or flange at each connection.
7. Install piping from safety relief valves to nearest floor drain, for hot-water boilers.
8. Install piping from safety valves to drip-pan elbow and to nearest floor drain, for steam boilers.
9. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.
10. Connect breeching full size to boiler outlet. Comply with requirements in Division 23 Section "Breechings, Chimneys, And Stacks" for venting materials.
11. Install flue-gas recirculation duct from vent to burner. Comply with requirements in Division 23 Section "Breechings, Chimneys, And Stacks" for recirculation duct materials.
12. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
13. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

C. Field Quality Control

1. Perform tests and inspections and prepare test reports.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Tests and Inspections:
 - a. Perform installation and startup checks according to manufacturer's written instructions.
 - b. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
 - c. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
 - d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 1) Burner Test for field-assembled boilers: Adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency.

- 2) Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and water temperature **OR** steam pressure, **as directed**.
 - 3) Set field-adjustable switches and circuit-breaker trip ranges as indicated.
 3. Remove and replace malfunctioning units and retest as specified above.
 4. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.
 5. Performance Tests, **as directed**:
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect component assemblies and equipment installations, including connections, and to conduct performance testing.
 - b. Boilers shall comply with performance requirements indicated, as determined by field performance tests. Adjust, modify, or replace equipment in order to comply.
 - c. Perform field performance tests to determine the capacity and efficiency of boilers.
 - 1) For dual-fuel boilers, perform tests for each fuel.
 - 2) Test for full capacity.
 - 3) Test for boiler efficiency at low fire, 20, 40, 60, 80, 100, 80, 60, 40 and 20, **as directed**, percent of full capacity. Determine efficiency at each test point.
 - d. Repeat tests until results comply with requirements indicated.
 - e. Provide analysis equipment required to determine performance.
 - f. Provide temporary equipment and system modifications necessary to dissipate the heat produced during tests if building systems are not adequate.
 - g. Notify the Owner in advance of test dates.
 - h. Document test results in a report and submit to the Owner.
- D. Demonstration
 1. Train Owner's maintenance personnel to adjust, operate, and maintain boilers.

END OF SECTION 23 52 36 00



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Task	Specification	Specification Description
23 52 39 13	23 52 36 00	Fire-Tube Boilers



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SECTION 23 55 23 00 - CSF GAS-FIRED RADIANT HEATERS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Unit Heaters are part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.23 55 23 00

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes gas-fired, tubular infrared radiant heaters.

1.2 SUBMITTALS

- A. Product Data: For each type of gas-fired radiant heater indicated. Include rated capacities, operating characteristics, and accessories.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of gas-fired radiant heater that fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TUBULAR INFRARED HEATERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Combustion Research Corporation.
 - 2. Gas-Fired Products Inc.; Space-Ray Div.
 - 3. Reznor/Thomas & Betts Corporation.
 - 4. Roberts-Gordon, Inc.
 - 5. Schwank Inc.
 - 6. Solaronics, Inc.
 - 7. Sterling HVAC Products; Div. of Mestek Technology Inc.
- B. Description: Factory assembled, piped, and wired, and complying with ANSI Z83.20/CSA 2.34.
- C. Fuel Type: Design burner for gas having characteristics same as those of gas available at Project site.
- D. Combustion Tubing: 4-inch- (100-mm-) diameter steel with high-emissivity, high-temperature, corrosion-resistant external finish.
- E. Tubing Connections: Stainless-steel couplings or flared joints with stainless-steel draw bolts.
- F. Reflector: Polished aluminum, 97 percent minimum reflectivity, with end caps. Shape to control radiation from tubing for uniform intensity at floor level with 100 percent cutoff above centerline of tubing. Provide for rotating reflector or heater around a horizontal axis for minimum 30-degree (0.52-radian) tilt from vertical.
 - 1. Reflector Extension Shields: Same material as reflectors, arranged for fixed connection to lower reflector lip and rigid support to provide 100 percent cutoff of direct radiation from tubing at angles greater than 30 degrees (0.52 radians) from vertical.
 - 2. Include hanger kit.
- G. Burner Safety Controls:
 - 1. Gas Control Valve: Single-stage, regulated redundant 24-V ac gas valve containing pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.
 - 2. Blocked Vent Safety: Differential pressure switch in burner safety circuit to stop burner operation with high discharge or suction pressure.
 - 3. Control Panel Interlock: Stops burner if panel is open.
 - 4. Indicator Lights: Burner-on indicator light.
- H. Burner and Emitter Type: Gravity-vented power burner, with the following features:
 - 1. Emitter Tube: 4-inch- (100-mm-) diameter, aluminized-steel tubing with sight glass for burner and pilot flame observation.
 - 2. Venting: Connector at exit end of emitter tubing for vent-pipe connection with rain cap for both].
 - 3. Burner/Ignition: Power gas burner with electronic spark and electronic flame safety.
 - 4. Burner/Ignition: Stainless-steel burner cup and head with balanced-rotor draft fan and spark ignition with electronic flame supervision.
 - 5. Combustion-Air Connection: Duct connection for combustion air to be drawn directly from outdoors by burner fan.
- I. CONTROLS



2.2

NOTE TO SPECIFIER

**** Retain one of two paragraphs below or revise to suit selected equipment. Delete if thermostat is specified in Division 23 BAS sections."**

- A. Thermostat: Devices and wiring are specified in Section [230904] or [230905] "Instrumentation and Control for HVAC."
 - 1. Control Transformer: Integrally mounted.
- B. Thermostat: Single-stage, wall-mounting type with 50 to 90 deg F operating range and fan on switch.
 - 1. Control Transformer: Integrally mounted.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install and connect gas-fired radiant heaters and associated fuel and vent features and systems according to NFPA 54, applicable local codes and regulations, and manufacturer's written installation instructions.
- B. Suspended Units: Suspend from substrate using chain hanger kits and building attachments.
- C. Maintain manufacturers' recommended clearances to combustibles.
- D. Install piping adjacent to gas-fired radiant heaters to allow service and maintenance.
- E. Gas Piping: Comply with Section 221000 "Fuel Gas Piping." Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.
- F. Electrical Connections: Comply with applicable requirements in Division 26 Sections.
 - 1. Install electrical devices furnished with heaters but not specified to be factory mounted.
- G. Adjust initial temperature set points.
- H. Adjust burner and other unit components for optimum heating performance and efficiency.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections: Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.3 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain boilers. Video training sessions. Refer to Division 1 Section "Demonstration and Training."



USPS CSF Specification issued: 10/1/2013
Last revised: 5/11/11

END OF SECTION



SECTION 23 55 23 00 - MPF GAS-FIRED RADIANT HEATERS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes gas-fired, tubular infrared radiant heaters.

1.2 SUBMITTALS

- A. Product Data: For each type of gas-fired radiant heater indicated. Include rated capacities, operating characteristics, and accessories.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of gas-fired radiant heater that fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TUBULAR INFRARED HEATERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Combustion Research Corporation.



2. Gas-Fired Products Inc.; Space-Ray Div.
 3. Reznor/Thomas & Betts Corporation.
 4. Roberts-Gordon, Inc.
 5. Schwank Inc.
 6. Solaronics, Inc.
 7. Sterling HVAC Products; Div. of Mestek Technology Inc.
- B. Description: Factory assembled, piped, and wired, and complying with ANSI Z83.20/CSA 2.34.
- C. Fuel Type: Design burner for gas having characteristics same as those of gas available at Project site.
- D. Combustion Tubing: 4-inch- (100-mm-) diameter steel with high-emissivity, high-temperature, corrosion-resistant external finish.
- E. Tubing Connections: Stainless-steel couplings or flared joints with stainless-steel draw bolts.
- F. Reflector: Polished aluminum, 97 percent minimum reflectivity, with end caps. Shape to control radiation from tubing for uniform intensity at floor level with 100 percent cutoff above centerline of tubing. Provide for rotating reflector or heater around a horizontal axis for minimum 30-degree (0.52-radian) tilt from vertical.
1. Reflector Extension Shields: Same material as reflectors, arranged for fixed connection to lower reflector lip and rigid support to provide 100 percent cutoff of direct radiation from tubing at angles greater than 30 degrees (0.52 radians) from vertical.
 2. Include hanger kit.
- G. Burner Safety Controls:
1. Gas Control Valve: Single-stage, regulated redundant 24-V ac gas valve containing pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.
 2. Blocked Vent Safety: Differential pressure switch in burner safety circuit to stop burner operation with high discharge or suction pressure.
 3. Control Panel Interlock: Stops burner if panel is open.
 4. Indicator Lights: Burner-on indicator light.
- H. Burner and Emitter Type: Gravity-vented power burner, with the following features:
1. Emitter Tube: 4-inch- (100-mm-) diameter, aluminized-steel tubing with sight glass for burner and pilot flame observation.
 2. Venting: Connector at exit end of emitter tubing for vent-pipe connection with rain cap for both].
 3. Burner/Ignition: Power gas burner with electronic spark and electronic flame safety.
 4. Burner/Ignition: Stainless-steel burner cup and head with balanced-rotor draft fan and spark ignition with electronic flame supervision.
 5. Combustion-Air Connection: Duct connection for combustion air to be drawn directly from outdoors by burner fan.
- I. CONTROLS

2.2

NOTE TO SPECIFIER

**** Retain one of two paragraphs below or revise to suit selected equipment. Delete if thermostat is specified in Division 15 BAS sections."**

- A. Thermostat: Devices and wiring are specified in Division 15 Section 250504 Building Automation System (BAS) General."

1. Control Transformer: Integrally mounted.
- B. Thermostat: Single-stage, wall-mounting type with 50 to 90 deg F (10 to 32 deg C) operating range and fan on switch.
 1. Control Transformer: Integrally mounted.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install and connect gas-fired radiant heaters and associated fuel and vent features and systems according to NFPA 54, applicable local codes and regulations, and manufacturer's written installation instructions.
- B. Suspended Units: Suspend from substrate using chain hanger kits and building attachments.
- C. Maintain manufacturers' recommended clearances to combustibles.
- D. Install piping adjacent to gas-fired radiant heaters to allow service and maintenance.
- E. Gas Piping: Comply with Division 15 Section "Fuel Gas Piping." Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.
- F. Vent Connections: Comply with Division 15 Section "Breechings, Chimneys, and Stacks."
- G. Electrical Connections: Comply with applicable requirements in Division 16 Sections.
 1. Install electrical devices furnished with heaters but not specified to be factory mounted.
- H. Adjust initial temperature set points.
- I. Adjust burner and other unit components for optimum heating performance and efficiency.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections: Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.3 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain boilers. Video training sessions. Refer to Division 1 Section "Demonstration and Training."

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END OF SECTION 23 55 23 00

SECTION 23 55 23 13 - RADIANT HEATING AND COOLING UNITS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for radiant heating and cooling units. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Electric radiant heaters.
 - b. Prefabricated electric radiant heating panels.
 - c. Hydronic heating and cooling panels.

C. Definitions

1. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling and power-limited circuits.

D. Submittals

1. Product Data: Include rated capacities, specialties, and accessories for each product indicated.
2. Manufacturer Seismic Qualification Certification.
3. Field quality-control test reports.
4. Operation and maintenance data.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.2 PRODUCTS**A. Electric Radiant Heaters**

1. Quartz Lamp Heating Elements: Coiled tungsten-wire heating element enclosed in clear quartz tube.
2. Quartz Tube Heating Elements: Nickel-chromium-wire heating element enclosed in quartz tube.
3. Metal-Sheathed Heating Elements: Nickel-chromium-wire heating element embedded in magnesium oxide powder and enclosed in metal sheath. Comply with UL 1030.
4. Comply with UL 499 and UL 2021, **as directed**.
5. Enclosures: Aluminized **OR** Stainless **OR** Painted, **as directed**, steel housing with anodized-aluminum reflector.
 - a. Finish: Baked-enamel finish in manufacturer's standard **OR** custom, **as directed**, paint color as selected.
6. Unit Controls:
 - a. Line-voltage thermostat.
 - b. Enclosed contactor for remote thermostat.
 - c. Snow and ice detector with moisture sensor and integral temperature sensor.

B. Prefabricated Electric Radiant Heating Panels

1. Description: Sheet-metal-enclosed panel with heating element suitable for lay-in installation flush with T-bar ceiling grid **OR** surface mounting **OR** recessed mounting, **as directed**. Comply with UL 2021.



- a. Panel: Minimum 0.0276-inch- (0.7-mm-) thick, galvanized-steel sheet back panel riveted to minimum 0.0396-inch- (1.0-mm-) thick, galvanized-steel sheet front panel with fused-on crystalline surface.
 - b. Heating Element: Powdered graphite sandwiched between sheets of electric insulation **OR** Insulated resistive wires, **as directed**.
 - c. Electrical Connections: Nonheating, high-temperature, insulated-copper leads, factory connected to heating element.
 - d. Exposed-Side Panel Finish:
 - 1) Apply silk-screened finish to match appearance of Architect-selected acoustical ceiling tiles.
OR
Factory prime coated, ready for field painting.
OR
Baked-enamel finish in manufacturer's standard **OR** custom, **as directed**, paint color as selected.
 - e. Surface-Mounting Trim: Sheet metal with baked-enamel finish in manufacturer's standard **OR** custom, **as directed**, paint color as selected.
2. Wall Thermostat: Bimetal, sensing elements calibrated from 55 to 90 deg F (13 to 32 deg C); with contacts suitable for low **OR** line, **as directed**, -voltage circuit, and manually operated on-off switch with contactors, relays, and control transformers.
3. Capacities and Characteristics:
- a. Nominal Panel Size: 24 by 24 inches (600 by 600 mm) **OR** 24 by 36 inches (600 by 900 mm) **OR** 24 by 48 inches (600 by 1200 mm) **OR** 24 by 60 inches (600 by 1500 mm), **as directed**.
 - b. Heating Capacity: 250 **OR** 375 **OR** 500 **OR** 570 **OR** 625 **OR** 750 **OR** 950, **as directed**, kW.

C. Hydronic Heating And Cooling, **as directed**, Panels

1. Description: Modular **OR** Linear, **as directed**, sheet metal panel with serpentine water piping, suitable for lay-in installation flush with T-bar ceiling grid **OR** surface mounting **OR** recessed mounting, **as directed**.
- a. Panels: Minimum 0.0336-inch- (0.86-mm-) thick, galvanized-steel **OR** 0.0396-inch- (1.0-mm-) thick, aluminum, **as directed**, sheet.
 - b. Backing Insulation: Minimum 1-inch- (25-mm-) **OR** 2-inch- (50-mm-), **as directed**, thick, mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB with factory-applied jacket.
 - c. Exposed-Side Panel Finish:
 - 1) Apply silk-screened finish to match appearance of selected acoustical ceiling tiles.
OR
Factory prime coated, ready for field painting.
OR
Baked-enamel finish in manufacturer's standard **OR** custom, **as directed**, paint color as selected.
 - d. Factory Piping: ASTM B 88, Type L (ASTM B 88M, Type B) **OR** ASTM B 88, Type M (ASTM B 88M, Type C), **as directed**, copper tube with ASME B16.22 wrought-copper fittings and brazed joints. Piping shall be mechanically bonded to panel.
 - e. Surface-Mounting Trim: Sheet metal with baked-enamel finish in manufacturer's standard **OR** custom, **as directed**, paint color as selected.
 - f. Accessories:
 - 1) 5-inch (127-mm) **OR** 6-inch (152-mm) **OR** 8-inch (203-mm), **as directed**, panel with drape track recess.
 - 2) 5-inch (127-mm) male bullnose panel.
 - 3) 5-inch (127-mm) female bullnose panel.
 - 4) 4-inch (102-mm) male corner panel.
 - 5) 4-inch (102-mm) female corner panel.

- 6) Inside corner panel.
 - 7) 1/2-inch (13-mm) filler panel.
2. Capacities and Characteristics:
 - a. Nominal Panel Size: 24 by 24 inches (600 by 600 mm) **OR** 24 by 36 inches (600 by 900 mm) **OR** 24 by 48 inches (600 by 1200 mm) **OR** 24 by 60 inches (600 by 1500 mm), **as directed**.
 - b. Piping Inlet and Outlet: NPS 1/2 (DN 15).

1.3 EXECUTION

A. Installation

1. Install radiant heating and cooling units level and plumb.
2. Suspend radiant heaters from structure.
3. Support for Radiant Heating and Cooling Panels in or on Grid-Type Suspended Ceilings: Use grid as a support element.
 - a. Install a minimum of four ceiling support system rods or wires for each panel. Locate not more than 6 inches (150 mm) from panel corners.
 - b. Support Clips: Fasten to panel and to ceiling grid members at or near each panel corner with clips designed for the application.
 - c. Panels of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support panels independently with at least two 3/4-inch (19-mm) metal channels spanning and secured to ceiling tees.
 - d. Install at least one independent support rod or wire from structure to a tab on panel. Wire or rod shall have breaking strength of the weight of panel at a safety factor of 3.
4. Verify locations of thermostats with Drawings and room details before installation. Install devices 48 inches (1220 mm) **OR** 60 inches (1525 mm), **as directed**, above finished floor.
5. Piping installation requirements are specified in Division 23 Section "Hydronic Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
6. Unless otherwise indicated, install shutoff valve and union or flange at each connection.
7. Install piping adjacent to unit to allow service and maintenance.
8. Ground electric units according to Division 26 Section "Grounding And Bonding For Electrical Systems".
9. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

B. Field Quality Control

1. Testing: Perform the following field tests and inspections and prepare test reports:
 - a. Operate electric heating elements through each stage to verify proper operation and electrical connections.
 - b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and units.
2. Remove and replace malfunctioning units and retest as specified above.
3. After installing panels, inspect unit cabinet for damage to finish. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

END OF SECTION 23 55 23 13



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SECTION 23 55 23 13a - RADIANT-HEATING ELECTRIC PANELS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for radiant-heating electric panels. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes prefabricated radiant-heating electric panels.

C. Submittals

1. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each type of product indicated.
2. Shop Drawings: For electric heating panels. Include plans, sections, details, and attachments to other work.
 - a. Wiring Diagrams: Power, signal, and control wiring.
3. Field quality-control test reports.
4. Operation and Maintenance Data: For electric heating panels to include in operation and maintenance manuals.
5. Warranty: Special warranty specified in this Section.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.2 PRODUCTS**A. Prefabricated Radiant-Heating Electric Panels**

1. Description: Sheet-metal-enclosed panel with heating element suitable for lay-in installation flush with T-bar ceiling grid **OR** surface mounting **OR** recessed mounting, **as directed**. Comply with UL 2021.
 - a. Panel: Minimum 0.0276-inch- (0.7-mm-) thick, galvanized-steel sheet back panel riveted to minimum 0.0396-inch- (1.0-mm-) thick, galvanized-steel sheet front panel with fused-on crystalline surface.
 - b. Heating Element:
 - 1) Powdered graphite sandwiched between sheets of electric insulation.
OR
Insulated resistive wires.
 - c. Electrical Connections: Nonheating, high-temperature, insulated-copper leads, factory connected to heating element.
 - d. Exposed-Side Panel Finish:
 - 1) Apply silk-screened finish to match appearance of selected acoustical ceiling tiles.
 - 2) Factory prime coated, ready for field painting.
 - 3) Baked-enamel finish in manufacturer's standard **OR** custom, **as directed**, paint color as selected.
 - e. Surface-Mounting Trim: Sheet metal with baked-enamel finish in manufacturer's standard **OR** custom, **as directed**, paint color as selected.



2. Wall Thermostat: Bimetal, sensing elements calibrated from 55 to 90 deg F (13 to 32 deg C); with contacts suitable for low **OR** line, **as directed**, -voltage circuit, and manually operated on-off switch with contactors, relays, and control transformers.

1.3 EXECUTION

A. Installation

1. Install radiant-heating panels level and plumb.
2. Support for Radiant-Heating Panels in or on Grid-Type Suspended Ceilings: Use grid as a support element.
 - a. Install a minimum of four ceiling support system rods or wires for each panel. Locate not more than 6 inches (150 mm) from panel corners.
 - b. Support Clips: Fasten to panel and to ceiling grid members at or near each panel corner with clips designed for the application.
 - c. Panels of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support panels independently with at least two 3/4-inch (19-mm) metal channels spanning and secured to ceiling tees.
 - d. Install at least one independent support rod or wire from structure to a tab on panel. Wire or rod shall have breaking strength of the weight of panel at a safety factor of 3.
3. Verify locations of thermostats with Drawings and room details before installation. Install devices 48 inches (1220 mm) **OR** 60 inches (1525 mm), **as directed**, above finished floor.

B. Connections

1. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
2. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

C. Field Quality Control

1. Testing: Perform the following field tests and inspections and prepare test reports:
 - a. Operate electric heating elements through each stage to verify proper operation and electrical connections.
 - b. Test and adjust controls and safeties.
2. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 23 55 23 13a



Task	Specification	Specification Description
23 55 33 00	01 22 16 00	No Specification Required



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SECTION 23 57 13 00 - HEAT EXCHANGERS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for hydronic and steam heat exchangers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes shell-and-tube and plate heat exchangers.

C. Submittals

1. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.
2. Coordination Drawings: Equipment room, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - a. Tube-removal space.
 - b. Structural members to which heat exchangers will be attached.
3. Manufacturer Seismic Qualification Certification: Submit certification that heat exchanger, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".

D. Quality Assurance

1. ASME Compliance: Fabricate and label heat exchangers to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.

1.2 PRODUCTS**A. Shell-And-Tube Heat Exchangers**

1. Configuration: U-tube with removable bundle.
2. Shell Materials: Steel.
3. Head:
 - a. Materials: Cast iron **OR** Cast stainless steel **OR** Fabricated steel **OR** Fabricated steel with removable cover **OR** Fabricated stainless steel **OR** Fabricated stainless steel with removable cover, **as directed**.
 - b. Flanged and bolted to shell.
4. Tube:
 - a. Seamless copper **OR** Steel **OR** Stainless-steel **OR** Cupronickel **OR** Admiralty-metal, **as directed**, tubes.
 - b. Tube diameter is determined by manufacturer based on service.
5. Tubesheet Materials: Steel **OR** Stainless-steel, **as directed**, tubesheets.
6. Baffles: Steel **OR** Stainless steel, **as directed**.
7. Piping Connections:
 - a. Shell: Flanged inlet and threaded **OR** Threaded inlet and **OR** Flanged inlet and, **as directed**, outlet fluid connections, threaded drain, and vent connections.
 - b. Head: Threaded **OR** Flanged, **as directed**, inlet and outlet fluid connections.
8. Support Saddles:
 - a. Fabricated of material similar to shell.
 - b. Foot mount with provision for anchoring to support.

- c. Fabricate attachment of saddle supports to pressure vessel with reinforcement strong enough to resist heat-exchanger movement during a seismic event when heat-exchanger saddles are anchored to building structure.

B. Gasketed Plate Heat Exchangers

1. Configuration: Freestanding assembly consisting of frame support, top and bottom carrying and guide bars, fixed and movable end plates, tie rods, individually removable plates, and one-piece gaskets.
2. Frame:
 - a. Capacity to accommodate 20 percent additional plates.
 - b. Painted carbon steel with provisions for anchoring to support.
3. Top and Bottom Carrying and Guide Bars: Painted carbon steel, aluminum, or stainless steel.
 - a. Fabricate attachment of heat-exchanger carrying and guide bars with reinforcement strong enough to resist heat-exchanger movement during a seismic event when heat-exchanger carrying and guide bars are anchored to building structure.
4. End-Plate Material: Painted carbon steel.
5. Tie Rods and Nuts: Steel or stainless steel.
6. Plate Material: 0.024 inch (0.6 mm) **OR** 0.031 inch (0.8 mm) **OR** 0.039 inch (1 mm), **as directed**, thick before stamping; Type 304 **OR** 304L **OR** 316 **OR** 316L, **as directed**, stainless steel.
7. Gasket Material: Nitrile rubber **OR** EPDM, **as directed**.
8. Piping Connections:
 - a. Threaded port for NPS 2 (DN 50) and smaller. For larger sizes, furnish end-plate port with threaded studs suitable for flanged connection.
 - b. End plate with welded carbon-steel nozzles. Threaded pipe connection for NPS 2 (DN 50) and smaller; carbon-steel flanged pipe connection for larger sizes.
 - c. Line wetted surfaces with same material as plates.
9. Enclose plates in a solid aluminum **OR** stainless-steel, **as directed**, removable shroud.

C. Brazed Plate Heat Exchangers

1. Configuration: Brazed assembly consisting of two end plates, one with threaded nozzles and pattern-embossed plates.
2. End-Plate Material: Type 316 stainless steel.
3. Threaded Nozzles: Type 316 stainless steel.
4. Plate Material: Type 316 stainless steel.
5. Brazing Material: Copper or nickel.

1.3 EXECUTION

A. Heat-Exchanger Installation

1. Install shell-and-tube heat exchangers on saddle supports.
2. Install shell-and-tube heat exchangers on, and anchor to, concrete base.

B. Connections

1. Install shutoff valves at heat-exchanger inlet and outlet connections.
2. Install relief valves on heat-exchanger heated-fluid connection and install pipe relief valves, full size of valve connection, to floor drain.
3. Install vacuum breaker at heat-exchanger steam inlet connection.
4. Install hose end valve to drain shell.

END OF SECTION 23 57 13 00



Task	Specification	Specification Description
23 57 16 00	23 57 13 00	Heat Exchangers
23 57 19 13	23 57 13 00	Heat Exchangers
23 57 19 19	23 57 13 00	Heat Exchangers
23 57 19 23	23 57 13 00	Heat Exchangers



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SECTION 23 61 16 00 - ROTARY-SCREW WATER CHILLERS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for rotary screw water chillers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Packaged, water-cooled, single-compressor chillers.
 - b. Packaged, water-cooled, multiple-compressor chillers.
 - c. Packaged, air-cooled chillers.
 - d. Packaged, portable refrigerant recovery units.
 - e. Heat-exchanger, brush-cleaning system.

C. Definitions

1. BAS: Building automation system.
2. COP: Coefficient of performance. The ratio of the rate of heat removal to the rate of energy input using consistent units for any given set of rating conditions.
3. EER: Energy-efficiency ratio. The ratio of the cooling capacity given in terms of Btu/h to the total power input given in terms of watts at any given set of rating conditions.
4. IPLV: Integrated part-load value. A single-number part-load efficiency figure of merit calculated per the method defined by ARI 550/590 and referenced to ARI standard rating conditions.
5. kW/Ton (kW/kW): The ratio of total power input of the chiller in kilowatts to the net refrigerating capacity in tons (kW) at any given set of rating conditions.
6. NPLV: Nonstandard part-load value. A single-number part-load efficiency figure of merit calculated per the method defined by ARI 550/590 and intended for operating conditions other than ARI standard rating conditions.

D. Performance Requirements

1. Seismic Performance: Chillers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Condenser-Fluid Temperature Performance:
 - a. Startup Condenser-Fluid Temperature: Chiller shall be capable of starting with an entering condenser-fluid temperature of 60 deg F (16 deg C) **OR** 55 deg F (13 deg C) **OR** 40 deg F (4 deg C), **as directed**, and providing stable operation until the system temperature is elevated to the minimum operating entering condenser-fluid temperature.
 - b. Minimum Operating Condenser-Fluid Temperature: Chiller shall be capable of continuous operation over the entire capacity range indicated with an entering condenser-fluid temperature of 65 deg F (18 deg C) **OR** 60 deg F (16 deg C) **OR** 55 deg F (13 deg C), **as directed**.
 - c. Make factory modifications to standard chiller design if necessary to comply with performance indicated.
3. Site Altitude: Chiller shall be suitable for altitude in which installed without affecting performance indicated. Make adjustments to affected chiller components to account for site altitude.
4. Performance Tolerance: Comply with the following in lieu of ARI 550/590, **as directed**:
 - a. Allowable Capacity Tolerance: Zero percent.
 - b. Allowable IPLV/NPLV Performance Tolerance: Zero percent.

E. Submittals

1. Product Data: For each type of product indicated. Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.
2. LEED Submittal:
 - a. Product Data for Credit EA 4: Documentation required by Credit EA 4 indicating that equipment and refrigerants comply.
3. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, load distribution, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
4. Certificates: For certification required in "Quality Assurance" Article.
5. Seismic Qualification Certificates: For chillers, accessories, and components, from manufacturer.
6. Startup service reports.
7. Operation and maintenance data.
8. Warranty: Sample of special warranty.

F. Quality Assurance

1. ARI Certification: Certify chiller according to ARI 550 and ARI 590, **as directed**, certification program(s).
2. ARI Rating: Rate chiller performance according to requirements in ARI 550/590.
3. ASHRAE Compliance:
 - a. ASHRAE 15 for safety code for mechanical refrigeration.
 - b. ASHRAE 147 for refrigerant leaks, recovery, and handling and storage requirements.
4. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.
5. ASME Compliance: Fabricate and label chiller to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, and include an ASME U-stamp and nameplate certifying compliance.
6. Comply with NFPA 70.
7. Comply with requirements of UL and UL Canada and include label by a qualified testing agency showing compliance.

G. Delivery, Storage, And Handling

1. Ship chillers from the factory fully charged with refrigerant.
OR
Ship each chiller with a full charge of refrigerant. Charge each chiller with nitrogen if refrigerant is shipped in containers separate from chiller.
2. Ship each oil-lubricated chiller with a full charge of oil.
 - a. Ship oil factory installed in chiller **OR** in containers separate from chiller, **as directed**.
3. Package chiller for export shipping in totally enclosed crate and bagging, **as directed**.

H. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of chillers that fail in materials or workmanship within specified warranty period.
 - a. Extended warranties include, but are not limited to, the following:
 - 1) Complete chiller including refrigerant and oil charge.
OR
Complete compressor and drive assembly including refrigerant and oil charge.
OR
Refrigerant **OR** Refrigerant and oil charge, **as directed**.
 - 2) Parts only **OR** Parts and labor, **as directed**.
 - 3) Loss of refrigerant charge for any reason.
 - b. Warranty Period: Two **OR** Three **OR** Four **OR** Five, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Packaged, Water-Cooled, Single-Compressor Chillers

1. Description: Factory-assembled and factory-tested **OR** run-tested, **as directed**, chiller with compressor, compressor motor, compressor motor controller, lubrication system, evaporator, condenser, heat-reclaim condenser as indicated, controls, interconnecting unit piping and wiring, and indicated accessories.
 - a. Disassemble chiller into major assemblies as required by the installation after factory testing and before packaging for shipment.
2. Fabricate chiller mounting base with reinforcement strong enough to resist chiller movement during a seismic event when chiller is anchored to field support structure.
3. Compressor:
 - a. Description: Hermetic **OR** Open, **as directed**, positive displacement, and oil lubricated.
 - b. Casing: Cast iron, precision machined for minimum clearance about periphery of rotors.
 - c. Rotors: Manufacturer's standard one-, two-, or three-rotor design.
 - d. Drive Coupling: For chillers with open drives, provide flexible disc with all-metal construction and no wearing parts to ensure long life without the need for lubrication.
 - e. Seals: Seal drive assembly to prevent refrigerant leakage.
4. Compressor Motor:
 - a. Continuous-duty, squirrel-cage, induction-type motor with energy efficiency required to suit chiller energy efficiency indicated.
 - b. Factory mounted, aligned, and balanced as part of compressor assembly before shipping.
 - c. Motor shall be of sufficient capacity to drive compressor throughout entire operating range without overload and with sufficient capacity to start and accelerate compressor without damage.
 - d. For chillers with open drives, provide motor with open-dripproof **OR** weather-protected, Type I **OR** weather-protected, Type II **OR** totally enclosed, **as directed**, enclosure.
 - e. Provide motor with thermistor or RTD in single motor winding **OR** each of three-phase motor windings, **as directed**, to monitor temperature and report information to chiller control panel.
 - f. Provide motor with thermistor or RTD to monitor bearing temperature and report information to chiller control panel.
 - g. Provide open-drive motor with internal electric heater, internally powered from chiller power supply.
5. Vibration Balance: Balance chiller compressor and drive assembly to provide a precision balance that is free of noticeable vibration over the entire operating range.
 - a. Overspeed Test: 25 percent above design operating speed.
6. Service: Easily accessible for inspection and service.
 - a. Compressor's internal components shall be accessible without having to remove compressor-drive assembly from chiller.
 - b. Provide lifting lugs or eyebolts attached to casing.
7. Capacity Control: Modulating slide-valve assembly or port unloaders combined with a variable frequency controller, if applicable, and hot-gas bypass, if necessary, to achieve performance indicated.
 - a. Maintain stable operation throughout range of operation. Configure to achieve most energy-efficient operation possible.
 - b. Operating Range: From 100 to 20 **OR** 15 **OR** 10 **OR** 5 **OR** zero, **as directed**, percent of design capacity.
 - c. Condenser-Fluid Unloading Requirements over Operating Range: Constant-design entering condenser-fluid temperature **OR** Drop-in entering condenser-fluid temperature of 2.5 deg F 1.4 deg C drop for each 10 percent in capacity reduction, **as directed**.
8. Oil Lubrication System: Consisting of pump if required, filtration, heater, cooler, factory-wired power connection, and controls.
 - a. Provide lubrication to bearings, gears, and other rotating surfaces at all operating, startup, shutdown, and standby conditions including power failure.
 - b. Thermostatically controlled oil heater properly sized to remove refrigerant from oil.

- c. Oil filter **OR** Dual oil filters, one redundant, **as directed**, shall be the easily replaceable cartridge type, minimum 0.5-micron efficiency, with means of positive isolation while servicing.
- d. Refrigerant **OR** Water, **as directed**, -cooled oil cooler.
- e. Factory-installed and pressure-tested piping with isolation valves and accessories.
- f. Oil compatible with refrigerant and chiller components.
- g. Positive visual indication of oil level.
- 9. Refrigerant Circuit:
 - a. Refrigerant: Type as indicated on Drawings.
OR
Refrigerant Type: R-22 **OR** R-134a **OR** HFC, **as directed**. Classified as Safety Group A1 according to ASHRAE 34.
 - b. Refrigerant Compatibility: Chiller parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
 - c. Refrigerant Flow Control: Manufacturer's standard refrigerant flow-control device satisfying performance requirements indicated.
 - d. Pressure Relief Device:
 - 1) Comply with requirements in ASHRAE 15 and in applicable portions of ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 2) ASME-rated, spring-loaded pressure relief valve; single- or multiple-reseating type. Pressure relief valve(s) shall be provided for each heat exchanger. Condenser shall have dual valves with one being redundant and configured to allow either valve to be replaced without loss of refrigerant.
 - e. Refrigeration Transfer: Provide service valves and other factory-installed accessories required to facilitate transfer of refrigerant from chiller to a remote refrigerant storage and recycling system. Comply with requirements in ASHRAE 15 and ASHRAE 147.
 - f. Refrigerant Isolation: Factory install positive shutoff isolation valves in the compressor discharge line to the condenser and the refrigerant liquid line leaving the condenser to allow for isolation and storage of full refrigerant charge in the chiller condenser shell. In addition, provide isolation valve on suction side of compressor from evaporator to allow for isolation and storage of full refrigerant charge in the chiller evaporator shell, **as directed**.
- 10. Evaporator:
 - a. Description: Shell-and-tube design with water in tubes and refrigerant surrounding tubes within shell. Shell is separate from condenser.
 - b. Shell Material: Carbon-steel rolled plates with continuously welded seams or seamless pipe.
 - c. Designed to prevent liquid refrigerant carryover from entering compressor.
 - d. Provide evaporator with sight glass or other form of positive visual verification of liquid-refrigerant level.
 - e. Tubes:
 - 1) Individually replaceable from either end and without damage to tube sheets and other tubes.
 - 2) Mechanically expanded into end sheets and physically attached to intermediate tube sheets.
 - 3) Material: Copper **OR** Copper-nickel alloy, **as directed**.
 - 4) Nominal OD: Manufacturer's choice **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**.
 - 5) Minimum Wall Thickness: Manufacturer's choice **OR** 0.025 inch (0.6 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.
 - 6) External Finish: Manufacturer's standard.
 - 7) Internal Finish: Enhanced **OR** Smooth, **as directed**.
 - f. End Tube Sheets: Continuously welded to each end of shell; drilled and reamed to accommodate tubes with positive seal between fluid in tubes and refrigerant in shell.
 - g. Intermediate Tube Sheets: Installed in shell and spaced along length of tube at intervals required to eliminate vibration and to avoid contact of tubes resulting in abrasion and wear.

- h. Water Box:
 - 1) Cast-iron or carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - 2) Standard **OR** Marine, **as directed**, type for water box with piping connections. Standard type for water box without piping connections.
 - 3) Provide water boxes and marine water-box covers, **as directed**, with lifting lugs or eyebolts.
 - 4) Hinged **OR** Davited, **as directed**, water boxes.
OR
Hinged **OR** Davited, **as directed**, marine water-box covers.
 - 5) Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - 6) Thermistor or RTD temperature sensor factory installed in each nozzle.
 - 7) Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
 - i. Additional Corrosion Protection:
 - 1) Electrolytic corrosion-inhibitor anode.
 - 2) Coat wetted surfaces with a corrosion-resistant finish.
11. Condenser:
- a. Description: Shell-and-tube design with water in tubes and refrigerant surrounding tubes within shell. Shell is separate from evaporator.
 - b. Shell Material: Carbon-steel rolled plates with continuously welded seams or seamless pipe.
 - c. Designed to prevent direct impingement of high-velocity hot gas from compressor discharge on tubes.
 - d. Provide condenser with sight glass or other form of positive visual verification of refrigerant charge and condition.
 - e. Tubes:
 - 1) Individually replaceable from either end and without damage to tube sheets and other tubes.
 - 2) Mechanically expanded into end sheets and physically attached to intermediate tube sheets.
 - 3) Material: Copper **OR** Copper-nickel alloy, **as directed**.
 - 4) Nominal OD: Manufacturer's choice **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**.
 - 5) Minimum Wall Thickness: Manufacturer's choice **OR** 0.025 inch (0.6 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.
 - 6) External Finish: Manufacturer's standard.
 - 7) Internal Finish: Enhanced **OR** Smooth, **as directed**.
 - f. End Tube Sheets: Continuously welded to each end of shell; drilled and reamed to accommodate tubes with positive seal between fluid in tubes and refrigerant in shell.
 - g. Intermediate Tube Sheets: Installed in shell and spaced along length of tube at intervals required to eliminate vibration and to avoid contact of tubes resulting in abrasion and wear.
 - h. Water Box:
 - 1) Cast-iron or carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - 2) Standard **OR** Marine, **as directed**, type for water box with piping connections. Standard type for water box without piping connections.
 - 3) Provide water boxes and marine water-box covers, **as directed**, with lifting lugs or eyebolts.
 - 4) Hinged **OR** Davited, **as directed**, water boxes.
OR
Hinged **OR** Davited, **as directed**, marine water-box covers.

- 5) Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
- 6) Thermistor or RTD temperature sensor factory installed in each nozzle.
- 7) Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
- i. Additional Corrosion Protection:
 - 1) Electrolytic corrosion-inhibitor anode.
 - 2) Coat wetted surfaces with a corrosion-resistant finish.
- 12. Heat-Reclaim Condenser:
 - a. Description: Shell-and-tube design with water in tubes and refrigerant surrounding tubes within shell. Shell is separate from evaporator and condenser.
 - b. Shell Material: Carbon-steel rolled plates with continuously welded seams or seamless pipe.
 - c. Designed to prevent direct impingement of high-velocity hot gas from compressor discharge on tubes.
 - d. Tubes:
 - 1) Individually replaceable from either end and without damage to tube sheets and other tubes.
 - 2) Mechanically expanded into end sheets and physically attached to intermediate tube sheets.
 - 3) Material: Copper **OR** Copper-nickel alloy, **as directed**.
 - 4) Nominal OD: Manufacturer's choice **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**.
 - 5) Minimum Wall Thickness: Manufacturer's choice **OR** 0.025 inch (0.6 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.
 - 6) External Finish: Manufacturer's standard.
 - 7) Internal Finish: Enhanced **OR** Smooth, **as directed**.
 - e. End Tube Sheets: Continuously welded to each end of shell; drilled and reamed to accommodate tubes with positive seal between fluid in tubes and refrigerant in shell.
 - f. Intermediate Tube Sheets: Installed in shell and spaced along length of tube at intervals required to eliminate vibration and to avoid contact of tubes resulting in abrasion and wear.
 - g. Water Box:
 - 1) Cast-iron or carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - 2) Standard **OR** Marine, **as directed**, type for water box with piping connections. Standard type for water box without piping connections.
 - 3) Provide water boxes and marine water-box covers, **as directed**, with lifting lugs or eyebolts.
 - 4) Hinged **OR** Davited, **as directed**, water boxes.
OR
Hinged **OR** Davited, **as directed**, marine water-box covers.
 - 5) Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - 6) Thermistor or RTD temperature sensor factory installed in each nozzle.
 - 7) Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
 - h. Additional Corrosion Protection:
 - 1) Electrolytic corrosion-inhibitor anode.
 - 2) Coat wetted surfaces with a corrosion-resistant finish.
- 13. Electrical Power:
 - a. Factory installed and wired, and functionally tested at factory before shipment.

- b. Single-point, field-power connection to fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**. Minimum withstand rating shall be as required by electrical power distribution system, but not less than 42,000 **OR** 65,000, **as directed**, A.
 - 1) Provide branch power circuit to each motor, electric heater, dedicated electrical load, and controls with disconnect switch or circuit breaker, **as directed**.
 - 2) NEMA- and ICS 2-rated motor controller for auxiliary motors, hand-off-auto switch, and overcurrent protection for each motor. Provide variable frequency controller for each variable-speed motor furnished.
 - 3) Control-circuit transformer with primary and secondary side fuses.
- c. Terminal blocks with numbered and color-coded, **as directed**, wiring to match wiring diagram. Spare wiring terminal block for connection to external controls or equipment.
- d. Factory-installed wiring outside of enclosures shall be in metal raceway except make connections to each motor and heater with not more than a 24-inch (610-mm) length of liquidtight conduit.
- e. Factory install and wire capacitor bank for the purpose of power factor correction to 0.95 at all operating conditions.
 - 1) If capacitors are mounted in a dedicated enclosure, use same NEMA enclosure type as motor controller. Provide enclosure with service entrance knockouts and bushings for conduit.
 - 2) Capacitors shall be non-PCB dielectric fluid, metallized electrode design, low loss with low-temperature rise. The kVAR ratings shall be indicated and shall not exceed the maximum limitations set by NFPA 70. Provide individual cells as required.
 - 3) Provide each cell with current-limiting replaceable fuses and carbon-film discharge resistors to reduce residual voltage to less than 50 V within 1 minute after de-energizing.
 - 4) Provide a ground terminal and a terminal block or individual connectors for phase connection.
- 14. Motor Controller:
 - a. Enclosure: Factory installed, unit mounted **OR** Factory furnished, field mounted, **as directed**, NEMA 250 **OR** NEMA ICS 6, **as directed**, Type 1 **OR** Type 4 **OR** Type 4X **OR** Type 12, **as directed**, with hinged full-front access door with lock and key or padlock and key, **as directed**.
 - b. Control Circuit: Obtained from integral control power transformer, **as directed**, with a control power transformer **OR** source, **as directed**, of enough capacity to operate connected control devices.
 - c. Overload Relay: Shall be sized according to UL 1995 or shall be an integral component of chiller control microprocessor.
 - d. Across-the-Line Controller: NEMA ICS 2, Class A, full voltage, nonreversing; include isolation switch and current-limiting fuses.
 - e. Star-Delta, Reduced-Voltage Controller: NEMA ICS 2, closed transition.
 - f. Autotransformer Reduced-Voltage Controller: NEMA ICS 2, closed transition; include isolation switch and current-limiting fuses.
 - g. Solid-State, Reduced-Voltage Controller: NEMA ICS 2.
 - 1) Surge suppressor in solid-state power circuits providing three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
 - 2) Visual indication of motor and control status, including the following conditions:
 - a) Controller on.
 - b) Overload trip.
 - c) Loss of phase.
 - d) Starter fault.
 - h. Accessories: Devices shall be factory installed in controller enclosure unless otherwise indicated.
 - 1) Externally Operated, Door-Interlocked, **as directed**, Disconnect: Fused disconnect switch **OR** Nonfused disconnect switch **OR** Circuit breaker, **as directed**. Minimum



withstand rating shall be as required by electrical power distribution system, but not less than 42,000 **OR** 65,000, **as directed**, A.

- 2) Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.
- 3) Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.
- 4) Control Relays: Time-delay relays.
- 5) Elapsed-Time Meters: Numerical readout in hours on face of enclosure.
- 6) Number-of-Starts Counter: Numerical readout on face of enclosure.
- 7) Meters: Panel type, 2-1/2 inches (64 mm) **OR** 4-1/4 inches (108 mm), **as directed**, with 90 **OR** 120 **OR** 270, **as directed**,-degree scale and 1 **OR** 2, **as directed**, percent accuracy. Where indicated, provide transfer device with an off position. Meters shall indicate the following:
 - a) Ammeter: Output current for each phase, with current sensors rated to suit application.
 - b) Voltmeter: Output voltage for each phase.
 - c) Frequency Meter: Output frequency.
 - d) Real-time clock with current time and date.
 - e) Total run time.

OR

Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:

- a) Selectable, digital display of the following:
 - i. Phase Currents, Each Phase: Plus or minus 1 percent.
 - ii. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
 - iii. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
 - iv. Three-Phase Real Power: Plus or minus 2 percent.
 - v. Three-Phase Reactive Power: Plus or minus 2 percent.
 - vi. Power Factor: Plus or minus 2 percent.
 - vii. Frequency: Plus or minus 0.5 percent.
 - viii. Integrated Demand with Demand Interval Selectable from 5 to 60 Minutes: Plus or minus 2 percent.
 - ix. Accumulated energy, in megawatt hours (joules), plus or minus 2 percent; stored values unaffected by power outages for up to 72 hours.
 - b) Mounting: Display and control unit flush or semirecessed in instrument compartment door.
 - 8) Phase-Failure, Phase-Reversal, Undervoltage Relays: Solid-state sensing circuit with adjustable undervoltage setting and isolated output contacts for hardwired connection.
 - 9) Power Protection: Chiller shall shut down within six cycles of power interruption.
15. Variable Frequency Controller:
- a. Motor controller shall be factory mounted and wired on the chiller to provide a single-point, field-power termination to the chiller and its auxiliaries.
 - b. Description: NEMA ICS 2; listed and labeled as a complete unit and arranged to provide variable speed by adjusting output voltage and frequency.
 - c. Enclosure: Unit mounted, NEMA 250, Type 1, **as directed**, with hinged full-front access door with lock and key.
 - d. Integral Disconnecting Means: Door-interlocked, **as directed**, NEMA AB 1, instantaneous-trip circuit breaker with lockable handle. Minimum withstand rating shall be as required by electrical power distribution system, but not less than 42,000 **OR** 65,000 **OR** 100,000, **as directed**, A.
 - e. Technology: Pulse width modulated (PWM) output suitable for constant or variable torque loads.

- f. Output Rating: Three phase; with voltage proportional to frequency throughout voltage range.
- g. Operating Requirements:
 - 1) Input AC Voltage Tolerance: 460-V ac, plus 10 percent or 506 V maximum, **as directed**.
 - 2) Input frequency tolerance of 60 Hz, plus or minus 2 Hz.
 - 3) Capable of driving full load, without derating, under the following conditions:
 - a) Ambient Temperature: 0 to 40 deg C.
 - b) Relative Humidity: Up to 90 **OR** 95, **as directed**, percent (noncondensing).
 - c) Altitude: 3300 feet (1005 m) **OR** 6600 feet (2010 m), **as directed**.
 - 4) Minimum Efficiency: 96 percent at 60 Hz, full load.
 - 5) Minimum Displacement Primary-Side Power Factor: 98 percent.
 - 6) Overload Capability: 1.05 times the full-load current for 7 seconds.
 - 7) Starting Torque: As required by compressor-drive assembly.
 - 8) Speed Regulation: Plus or minus 1 percent.
 - 9) Isolated control interface to allow controller to follow control signal over a 10:1 speed range.
 - 10) To avoid equipment resonant vibrations, provide critical speed lockout circuitry to allow bands of operating frequency at which controller shall not operate continuously.
 - 11) Capable of being restarted into a motor coasting in either the forward or reverse direction without tripping.
- h. Internal Adjustability Capabilities:
 - 1) Minimum Output Frequency: 6 Hz.
 - 2) Maximum Output Frequency: 60 Hz.
 - 3) Acceleration: 2 seconds to 60 seconds.
 - 4) Deceleration: Zero seconds to 60 seconds.
 - 5) Current Limit: 30 to a minimum of 100 percent of maximum rating.
- i. Self-Protection and Reliability Features: Subjecting the controller to any of the following conditions shall not result in component failure or the need for replacement:
 - 1) Overtemperature.
 - 2) Short circuit at controller output.
 - 3) Ground fault at controller output. Variable frequency controller shall be able to start a grounded motor.
 - 4) Open circuit at controller output.
 - 5) Input undervoltage.
 - 6) Input overvoltage.
 - 7) Loss of input-phase.
 - 8) Reverse phase.
 - 9) AC line switching transients.
 - 10) Instantaneous overload, line to line or line to ground.
 - 11) Sustained overload exceeding 100 percent of controller rated current.
 - 12) Starting a rotating motor.
- j. Motor Protection: Controller shall protect motor against overvoltage and undervoltage, phase loss, reverse phase, overcurrent, overtemperature, and ground fault.
- k. Automatic Reset and Restart: Capable of three restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Controller shall be capable of automatic restart on phase-loss, and overvoltage and undervoltage trips.
- l. Visual Indication: On face of controller enclosure or chiller control enclosure; indicating the following conditions:
 - 1) Power on.
 - 2) Run.
 - 3) Overvoltage.
 - 4) Line fault.
 - 5) Overcurrent.

- 6) External fault.
 - 7) Motor speed (percent).
 - 8) Fault or alarm status (code).
 - 9) Motor output voltage.
 - 10) Input kilovolt amperes.
 - 11) Total power factor.
 - 12) Input kilowatts.
 - 13) Input kilowatt-hours.
 - 14) Three-phase input voltage.
 - 15) Three-phase output voltage.
 - 16) Three-phase input current.
 - 17) Three-phase output current.
 - 18) Output frequency (Hertz).
 - 19) Elapsed operating time (hours).
 - 20) Diagnostic and service parameters.
 - m. Operator Interface: At controller or chiller control panel; with start-stop and auto-manual selector with manual-speed-control potentiometer.
 - n. Harmonic Distortion Filter: Factory mounted and wired to limit total voltage and current distortion to 5 percent.
16. Controls:
- a. Standalone and microprocessor based with all memory stored in nonvolatile memory so that reprogramming is not required on loss of electrical power.
 - b. Enclosure: Unit mounted, NEMA 250, Type 1 **OR** Type 4 **OR** Type 4x **OR** Type 12, **as directed**, hinged or lockable; factory wired with a single-point, field-power connection and a separate control circuit.
 - c. Operator Interface: Multiple-character digital or graphic display with dynamic update of information and with keypad or touch-sensitive display located on front of control enclosure. In either imperial or metric units, display the following information:
 - 1) Date and time.
 - 2) Operating or alarm status.
 - 3) Fault history with not less than last 10 faults displayed.
 - 4) Set points of controllable parameters.
 - 5) Trend data.
 - 6) Operating hours.
 - 7) Number of chiller starts.
 - 8) Outdoor-air temperature or space temperature if required for chilled-water reset.
 - 9) Temperature and pressure of operating set points.
 - 10) Entering- and leaving-fluid temperatures of evaporator and condenser.
 - 11) Difference in fluid temperatures of evaporator and condenser.
 - 12) Fluid flow of evaporator and condenser.
 - 13) Fluid pressure drop of evaporator and condenser.
 - 14) Refrigerant pressures in evaporator and condenser.
 - 15) Refrigerant saturation temperature in evaporator and condenser.
 - 16) Pump status.
 - 17) Antirecycling timer status.
 - 18) Percent of maximum motor amperage.
 - 19) Current-limit set point.
 - 20) Compressor bearing temperature.
 - 21) Motor bearing temperature.
 - 22) Motor winding temperature.
 - 23) Oil temperature.
 - 24) Oil discharge pressure.
 - 25) Phase current.
 - 26) Percent of motor rated load amperes.
 - 27) Phase voltage.

- 28) Demand power (kilowatts).
- 29) Energy use (kilowatt-hours).
- 30) Power factor.
- d. Control Functions:
 - 1) Manual or automatic startup and shutdown time schedule.
 - 2) Entering and leaving chilled-water temperatures, control set points, and motor load limits. Evaporator fluid temperature shall be reset based on return-water **OR** outdoor-air **OR** space, **as directed**, temperature.
 - 3) Current limit and demand limit.
 - 4) Condenser-fluid temperature.
 - 5) External chiller emergency stop.
 - 6) Antirecycling timer.
 - 7) Variable evaporator flow.
 - 8) Thermal storage.
 - 9) Heat reclaim.
- e. Manually Reset Safety Controls: The following conditions shall shut down chiller and require manual reset:
 - 1) Low evaporator pressure or temperature; high condenser pressure.
 - 2) Low evaporator fluid temperature.
 - 3) Low oil differential pressure.
 - 4) High or low oil pressure.
 - 5) High oil temperature.
 - 6) High compressor-discharge temperature.
 - 7) Loss of condenser-fluid flow.
 - 8) Loss of evaporator-fluid flow.
 - 9) Motor overcurrent.
 - 10) Motor overvoltage.
 - 11) Motor undervoltage.
 - 12) Motor phase reversal.
 - 13) Motor phase failure.
 - 14) Sensor- or detection-circuit fault.
 - 15) Processor communication loss.
 - 16) Motor controller fault.
 - 17) Extended compressor surge.
- f. Trending: Capability to trend analog data of up to five parameters simultaneously over an adjustable period and frequency of polling.
- g. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: view only; view and operate; and view, operate, and service.
- h. Control Authority: At least four conditions: Off, local manual control at chiller, local automatic control at chiller, and automatic control through a remote source.
- i. Communication Port: RS-232 port or equivalent connection capable of connecting a printer and a notebook computer, **as directed**.
- j. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display chiller status and alarms.
 - 1) Hardwired Points:
 - a) Monitoring: On-off status, common trouble alarm **OR** electrical power demand (kilowatts) **OR** electrical power consumption (kilowatt-hours) **OR** power factor, **as directed**.
 - b) Control: On-off operation, chilled-water, discharge temperature set-point adjustment **OR** electrical power demand limit, **as directed**.
 - 2) ASHRAE 135 (BACnet) **OR** LonTalk **OR** Modbus **OR** Industry-accepted, open-protocol, **as directed**, communication interface with the BAS shall enable the BAS operator to remotely control and monitor the chiller from an operator workstation. Control features and monitoring points displayed locally at chiller control panel shall be available through the BAS.

17. Insulation:
 - a. Material: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - b. Thickness: 3/4 inch (19 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
 - c. Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface. Seal seams and joints.
 - d. Factory-applied insulation over cold surfaces of chiller capable of forming condensation. Components shall include, but not be limited to, evaporator shell and end tube sheets, evaporator water boxes including nozzles, refrigerant suction pipe from evaporator to compressor, cold surfaces of compressor, refrigerant-cooled motor, and auxiliary piping.
 - 1) Before insulating steel surfaces, prepare surfaces for paint, and prime and paint as indicated for other painted components. Do not insulate unpainted steel surfaces.
 - 2) Seal seams and joints to provide a vapor barrier.
 - 3) After adhesive has fully cured, paint exposed surfaces of insulation to match other painted parts.
18. Finish:
 - a. Paint chiller, using manufacturer's standard procedures, except comply with the following minimum requirements:
 - 1) Provide at least one coat of primer with a total dry film thickness of at least 2 mils (0.05 mm).
 - 2) Provide at least two coats of alkyd-modified, vinyl enamel **OR** epoxy **OR** polyurethane, **as directed**, finish with a total dry film thickness of at least 4 mils (0.10 mm).
 - 3) Paint surfaces that are to be insulated before applying the insulation.
 - 4) Paint installed insulation to match adjacent uninsulated surfaces.
 - 5) Color of finish coat to be manufacturer's standard **OR** custom color selected by the Owner, **as directed**.
 - b. Provide Owner with quart container of paint used in application of topcoat to use in touchup applications after Project Closeout.
19. Accessories:
 - a. Flow Switches:
 - 1) If required and not factory installed, chiller manufacturer shall furnish a switch for each condenser **OR** evaporator and condenser, **as directed**, and verify field-mounting location before installation.
 - 2) Paddle Flow Switches:
 - a) Vane operated to actuate a double-pole, double-throw switch with one pole field wired to the chiller control panel and the other pole field wired to the BAS.
 - b) Contacts: Platinum alloy, silver alloy, or gold-plated switch contacts with a rating of 10 A at 120-V ac.
 - c) Pressure rating equal to pressure rating of heat exchanger.
 - d) Construct body and wetted parts of Type 316 stainless steel.
 - e) House switch in a NEMA 250, Type 4, **as directed**, enclosure constructed of die-cast aluminum.
 - f) Vane length to suit installation.

OR

Pressure Differential Switches:

 - g) Construction: Wetted parts of body and trim constructed of Type 316 stainless steel.
 - h) Performance: Switch shall withstand, without damage, the full-pressure rating of the heat exchanger applied to either port and exhibit zero set-point shift due to variation in working pressure.
 - i) Set Point: Screw type, field adjustable.
 - j) Electrical Connections: Internally mounted screw-type terminal blocks.
 - k) Switch Enclosure: NEMA 250, Type 4, **as directed**.

- l) Switch Action: Double-pole, double-throw switch with one pole field wired to the chiller control panel and the other pole field wired to the BAS.
 - b. Vibration Isolation:
 - c. Chiller manufacturer shall furnish vibration isolation for each chiller.
 - 1) Neoprene Pad:
 - a) Two layers of 0.375-inch- (10-mm-) thick, ribbed- or waffle-pattern neoprene pads separated by a 16-gage, stainless-steel plate.
 - b) Fabricate pads from 40- to 50-durometer neoprene.
 - c) Provide stainless-steel square bearing plate to load the pad uniformly between 20 and 40 psig (138 and 276 kPa) with a 0.12- to 0.16-inch (3- to 4-mm) deflection.
 - OR**
 - Spring Isolator:
 - d) Stable in operation and designed for not less than 30 percent reserve deflection beyond actual operating conditions. Isolators shall be designed such that the Kx/Ky ratio shall be 1.0 or more for stability.
 - e) Provide PVC or neoprene-coated springs and hot-dip, galvanized-steel components. Aluminum components shall be etched and painted. Nuts, bolts, and washers shall be zinc electroplated.
 - f) Isolators shall be adjustable and with an open spring, having one or more coil springs attached to a top compression plate and a baseplate. An elastomeric pad with a minimum thickness of 0.25 inch (6 mm) shall be bonded to the baseplate.
 - g) Spring assembly shall be removable and shall fit within a welded steel enclosure consisting of a top plate and rigid lower housing, which serves as a blocking device during installation. Isolated restraining bolts shall not be engaged during normal operation and shall connect the top plate and lower housing to prevent the isolated equipment from rising when drained of fluid.
 - h) Isolators shall be selected for a nominal 1-inch (25-mm) **OR** 2-inch (50-mm), **as directed**, deflection.
 - d. Sound Barrier:
 - 1) Furnish removable and reusable sound-barrier covers over the compressor housing, hermetic motor, compressor suction and discharge piping, and condenser shell.
 - 2) Provide for repeated installation and removal without use of tape or caulk.
 - 3) Inner and outer cover shall consist of a PTFE-impregnated fiberglass cloth enclosing heavy-density, needled fiberglass insulation material with a mass-loaded vinyl acoustic barrier.
 - 4) Covers shall be double sewn and lock stitched with edges folded and sewn so no raw cut edges are exposed.
 - 5) Form covers around control devices, gages, conduit, piping, and supports without degrading sound-barrier performance.
 - 6) Continuously lap all exposed seams at least 2 inches (50 mm) for better sound containment.
 - 7) Permanently label each section of cover to indicate its location, description, size, and number sequence.
 - 8) Randomly place stainless-steel quilting pins to prevent covers from shifting and sagging.
- B. Packaged, Water-Cooled, Multiple-Compressor Chillers
 - 1. Description: Factory-assembled and -tested **OR** run-tested, **as directed**, chiller with compressor(s), compressor motors and motor controllers, evaporator, condenser where indicated, electrical power, controls, and indicated accessories.
 - a. Disassemble chiller into major assemblies as required by the installation after factory testing and before packaging for shipment.

2. Fabricate chiller mounting base with reinforcement strong enough to resist chiller movement during a seismic event when chiller is anchored to field support structure.
3. Compressors:
 - a. Description: Positive displacement, hermetically sealed.
 - b. Casing: Cast iron, precision machined for minimum clearance about periphery of rotors.
 - c. Rotors: Manufacturer's standard one- or two-rotor design.
4. Service: Easily accessible for inspection and service.
 - a. Compressor's internal components shall be accessible without having to remove compressor-drive assembly from chiller.
 - b. Provide lifting lugs or eyebolts attached to casing.
5. Capacity Control: On-off compressor cycling and modulating slide-valve assembly or port unloaders combined with hot-gas bypass, if necessary, to achieve performance indicated.
 - a. Maintain stable operation throughout range of operation. Configure to achieve most energy-efficient operation possible.
 - b. Operating Range: From 100 to 20 **OR** 15 **OR** 10 **OR** 5 **OR** zero, **as directed**, percent of design capacity.
 - c. Condenser-Fluid Unloading Requirements over Operating Range: Constant-design entering condenser-fluid temperature **OR** Drop-in entering condenser-fluid temperature of 2.5 deg F (1.4 deg C) drop for each 10 percent in capacity reduction, **as directed**.
6. Oil Lubrication System: Consisting of pump if required, filtration, heater, cooler, factory-wired power connection, and controls.
 - a. Provide lubrication to bearings, gears, and other rotating surfaces at all operating, startup, shutdown, and standby conditions including power failure.
 - b. Thermostatically controlled oil heater properly sized to remove refrigerant from oil.
 - c. Factory-installed and pressure-tested piping with isolation valves and accessories.
 - d. Oil compatible with refrigerant and chiller components.
 - e. Positive visual indication of oil level.
7. Vibration Control:
 - a. Vibration Balance: Balance chiller compressor and drive assembly to provide a precision balance that is free of noticeable vibration over the entire operating range.
 - 1) Overspeed Test: 25 percent above design operating speed.
 - b. Isolation: Mount individual compressors on vibration isolators.
8. Sound Control: Sound-reduction package shall consist of removable acoustic enclosures around the compressors and drive assemblies that are designed to reduce sound levels without affecting performance.
9. Compressor Motors:
 - a. Hermetically sealed and cooled by refrigerant suction gas.
 - b. High-torque, induction type with inherent thermal-overload protection on each phase.
10. Refrigerant Circuits:
 - a. Refrigerant: Type as indicated on Drawings.
OR
Refrigerant Type: R-22 **OR** R-134a **OR** HFC, **as directed**. Classified as Safety Group A1 according to ASHRAE 34.
 - b. Refrigerant Compatibility: Chiller parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
 - c. Refrigerant Circuit: Each shall include a thermal- or electronic-expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction, **as directed**, and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core, **as directed**, filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.
 - d. Pressure Relief Device:
 - 1) Comply with requirements in ASHRAE 15 and in applicable portions of ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 2) ASME-rated, spring-loaded pressure relief valve; single- or multiple-reseating type.

- e. Refrigerant Isolation: Factory install positive shutoff isolation valves in the compressor discharge line to the condenser and the refrigerant liquid-line leaving the condenser to allow for isolation and storage of full refrigerant charge in the chiller condenser shell.
- 11. Evaporator:
 - a. Description: Shell-and-tube design.
 - 1) Direct-expansion (DX) type with fluid flowing through the shell, and refrigerant flowing through the tubes within the shell.
 - 2) Flooded type with fluid flowing through tubes and refrigerant flowing around tubes within the shell.
 - b. Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - c. Shell Material: Carbon steel.
 - d. Shell Heads: Removable carbon-steel heads with multipass baffles, and located at each end of the tube bundle.
 - e. Fluid Nozzles: Terminated with mechanical-coupling or flanged end connections for connection to field piping.
 - f. Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.
- 12. Condenser:
 - a. Shell and tube, or without integral condenser; as indicated.
OR
Shell and Tube:
 - 1) Description: Shell-and-tube design with refrigerant flowing through shell, and fluid flowing through tubes within shell.
 - 2) Provides positive subcooling of liquid refrigerant.
 - 3) Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 4) Shell Material: Carbon steel.
 - 5) Water Boxes: Removable, of carbon-steel construction, located at each end of the tube bundle with fluid nozzles terminated with mechanical-coupling end connections for connection to field piping.
 - 6) Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.
 - 7) Provide each condenser with a pressure relief device, purge cock, and liquid-line shutoff valve.
 - b. Provide chiller without an integral condenser and design chiller for field connection to remote condenser. Coordinate requirements with Division 23 Section "Air-cooled Refrigerant Condensers".
- 13. Electrical Power:
 - a. Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a multipoint **OR** single-point, **as directed**, field-power connection to chiller.
 - b. House in a unit-mounted, NEMA 250, Type 1, **as directed**, enclosure with hinged access door with lock and key or padlock and key, **as directed**.
 - c. Wiring shall be numbered and color-coded, **as directed**, to match wiring diagram.
 - d. Install factory wiring outside of an enclosure in a raceway.
 - e. Field-power interface shall be to wire lugs **OR** NEMA KS 1, heavy-duty, nonfused disconnect switch **OR** NEMA AB 1, instantaneous-trip circuit breaker with lockable handle, **as directed**.
 - 1) Disconnect means shall be interlocked with door operation.
 - 2) Minimum withstand rating shall be as required by electrical power distribution system, but not less than 42,000 **OR** 65,000 **OR** 100,000, **as directed**, A.
 - f. Provide branch power circuit to each motor and to controls with one of the following disconnecting means:
 - 1) NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.

- 2) NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit-trip set point.
- g. Provide each motor with overcurrent protection.
- h. Overload relay sized according to UL 1995 or an integral component of chiller control microprocessor.
- i. Phase-Failure and Undervoltage Relays: Solid-state sensing with adjustable settings.
- j. Control Transformer: Unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.
- k. Control Relays: Auxiliary and adjustable time-delay relays.
- l. For chiller electrical power supply, indicate the following:
 - 1) Current and phase to phase for all three phases.
 - 2) Voltage, phase to phase, and phase to neutral for all three phases.
 - 3) Three-phase real power (kilowatts).
 - 4) Three-phase reactive power (kilovolt amperes reactive).
 - 5) Power factor.
 - 6) Running log of total power versus time (kilowatt-hours).
 - 7) Fault log, with time and date of each.
14. Compressor Motor Controllers:
 - a. Across the Line: NEMA ICS 2, Class A, full voltage, nonreversing, or solid state, **as directed**.
 - b. Star-Delta, Reduced-Voltage Controller: NEMA ICS 2, closed or open transition, or solid state, **as directed**.
15. Controls:
 - a. Standalone and microprocessor based.
 - b. Enclosure: Share enclosure with electrical-power devices or provide a separate enclosure of matching construction.
 - c. Operator Interface: Multiple-character digital or graphic display with dynamic update of information and with keypad or touch-sensitive display located on front of control enclosure. In either imperial or metric units, display the following information:
 - 1) Date and time.
 - 2) Operating or alarm status.
 - 3) Fault history with not less than last 10 faults displayed.
 - 4) Set points of controllable parameters.
 - 5) Trend data.
 - 6) Operating hours.
 - 7) Number of chiller starts.
 - 8) Outdoor-air temperature or space temperature if required for chilled-water reset.
 - 9) Temperature and pressure of operating set points.
 - 10) Entering- and leaving-fluid temperatures of evaporator and condenser.
 - 11) Difference in fluid temperatures of evaporator and condenser.
 - 12) Refrigerant pressures in evaporator and condenser.
 - 13) Refrigerant saturation temperature in evaporator and condenser.
 - 14) No cooling load condition.
 - 15) Elapsed time meter (compressor run status).
 - 16) Pump status.
 - 17) Antirecycling timer status.
 - 18) Percent of maximum motor amperage.
 - 19) Current-limit set point.
 - 20) Number of compressor starts.
 - 21) Compressor refrigerant suction and discharge temperature.
 - 22) Oil temperature.
 - 23) Oil discharge pressure.
 - 24) Phase current.
 - 25) Percent of motor rated load amperes.
 - 26) Phase voltage.

- d. Control Functions:
 - 1) Manual or automatic startup and shutdown time schedule.
 - 2) Entering and leaving chilled-water temperatures, control set points, and motor load limits. Chilled-water leaving temperature shall be reset based on return-water **OR** outdoor-air **OR** space, **as directed**, temperature.
 - 3) Current limit and demand limit.
 - 4) Condenser-fluid temperature.
 - 5) External chiller emergency stop.
 - 6) Antirecycling timer.
 - 7) Automatic lead-lag switching.
 - 8) Variable evaporator flow.
 - 9) Thermal storage.
 - e. Manually Reset Safety Controls: The following conditions shall shut down chiller and require manual reset:
 - 1) Low evaporator pressure, or high condenser pressure.
 - 2) Low chilled-water temperature.
 - 3) Refrigerant high pressure.
 - 4) High or low oil pressure.
 - 5) High oil temperature.
 - 6) Loss of chilled-water flow.
 - 7) Loss of condenser-fluid flow.
 - 8) Control device failure.
 - f. Trending: Capability to trend analog data of up to five parameters simultaneously over an adjustable period and frequency of polling.
 - g. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: view only; view and operate; and view, operate, and service.
 - h. Control Authority: At least four conditions: Off, local manual control at chiller, local automatic control at chiller, and automatic control through a remote source.
 - i. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display chiller status and alarms.
 - 1) Hardwired Points:
 - a) Monitoring: On-off status, common trouble alarm **OR** electrical power demand (kilowatts) **OR** electrical power consumption (kilowatt-hours), **as directed**.
 - b) Control: On-off operation, chilled-water, discharge temperature set-point adjustment **OR** electrical power demand limit, **as directed**.
 - 2) ASHRAE 135 (BACnet) **OR** LonTalk **OR** Modbus **OR** Industry-accepted, open-protocol, **as directed**, communication interface with the BAS shall enable the BAS operator to remotely control and monitor the chiller from an operator workstation. Control features and monitoring points displayed locally at chiller control panel shall be available through the BAS.
16. Insulation:
- a. Material: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - b. Thickness: 3/4 inch (19 mm).
 - c. Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface. Seal seams and joints.
 - d. Factory-applied insulation over cold surfaces of chiller capable of forming condensation. Components shall include, but not be limited to, evaporator shell and end tube sheets, evaporator water boxes including nozzles, refrigerant suction pipe from evaporator to compressor, cold surfaces of compressor, refrigerant-cooled motor, and auxiliary piping.
 - 1) Before insulating steel surfaces, prepare surfaces for paint, prime and paint as indicated for other painted components. Do not insulate unpainted steel surfaces.
 - 2) Seal seams and joints to provide a vapor barrier.

- 3) After adhesive has fully cured, paint exposed surfaces of insulation to match other painted parts.
 17. Finish:
 - a. Paint chiller, using manufacturer's standard procedures, except comply with the following minimum requirements:
 - 1) Provide at least one coat of primer.
 - 2) Provide finish coat of alkyd-modified, vinyl enamel, **as directed**.
 - 3) Paint surfaces that are to be insulated before applying the insulation.
 - 4) Paint installed insulation to match adjacent uninsulated surfaces.
 18. Accessories:
 - a. Factory-furnished, chilled- and condenser-, **as directed**, water flow switches for field installation.
 - b. Individual compressor suction and discharge pressure gages with shutoff valves for each refrigerant circuit.
 - c. Factory-furnished neoprene **OR** spring, **as directed**, isolators for field installation.
- C. Packaged, Air-Cooled Chillers
1. Description: Factory-assembled and run-tested chiller complete with base and frame, condenser casing, compressors, compressor motors and motor controllers, evaporator, condenser coils, condenser fans and motors, electrical power, controls, and accessories.
 2. Fabricate base, frame, and attachment to chiller components strong enough to resist chiller movement during a seismic event when chiller base is anchored to field support structure.
 3. Cabinet:
 - a. Base: Galvanized-steel base extending the perimeter of chiller. Secure frame, compressors, and evaporator to base to provide a single-piece unit.
 - b. Frame: Rigid galvanized-steel frame secured to base and designed to support cabinet, condenser, control panel, and other chiller components not directly supported by base.
 - c. Casing: Galvanized steel.
 - d. Finish: Coat base, frame, and casing with a corrosion-resistant coating capable of withstanding a 500 **OR** 1000, **as directed**, -hour salt-spray test according to ASTM B 117.
 - e. Sound-reduction package designed to reduce sound level without affecting performance and consisting of the following:
 - 1) Acoustic enclosure around compressors.
 - 2) Reduced-speed fans with acoustic treatment.
 - f. Security Package: Provide removable grilles **OR** louvered panels, **as directed**, with fasteners for additional protection of compressors, evaporator, and condenser coils without inhibiting service access. Finish to match cabinet.
 4. Compressors:
 - a. Description: Positive displacement, hermetically sealed.
 - b. Casing: Cast iron, precision machined for minimum clearance about periphery of rotors.
 - c. Rotors: Manufacturer's standard one- or two-rotor design.
 - d. Each compressor provided with suction and, **as directed**, discharge shutoff valves, crankcase oil heater, and suction strainer.
 5. Service: Easily accessible for inspection and service.
 6. Capacity Control: On-off compressor cycling and modulating slide-valve assembly or port unloaders combined with hot-gas bypass, if necessary, to achieve performance indicated.
 7. Maintain stable operation throughout range of operation. Configure to achieve most energy-efficient operation possible.
 - a. Operating Range: From 100 to 20 **OR** 15 **OR** 10 **OR** 5 **OR** zero, **as directed**, percent of design capacity.
 - b. Condenser-Air Unloading Requirements over Operating Range: Constant-design entering condenser-air temperature **OR** Drop-in entering condenser-air temperature of 5 deg F (3 deg C) drop for each 10 percent in capacity reduction, **as directed**.

- c. For units equipped with a variable frequency controller, capacity control shall be both "valveless" and "stepless," requiring no slide valve or capacity-control valve(s) to operate at reduced capacity.
- 8. Oil Lubrication System: Consisting of pump if required, filtration, heater, cooler, factory-wired power connection, and controls.
 - a. Provide lubrication to bearings, gears, and other rotating surfaces at all operating, startup, shutdown, and standby conditions including power failure.
 - b. Thermostatically controlled oil heater properly sized to remove refrigerant from oil.
 - c. Factory-installed and pressure-tested piping with isolation valves and accessories.
 - d. Oil compatible with refrigerant and chiller components.
 - e. Positive visual indication of oil level.
- 9. Vibration Control:
 - a. Vibration Balance: Balance chiller compressors and drive assemblies to provide a precision balance that is free of noticeable vibration over the entire operating range.
 - 1) Overspeed Test: 25 percent above design operating speed.
 - b. Isolation: Mount individual compressors on vibration isolators.
- 10. Compressor Motors:
 - a. Hermetically sealed and cooled by refrigerant suction gas.
 - b. High-torque, induction type with inherent thermal-overload protection on each phase.
- 11. Compressor Motor Controllers:
 - a. Across the Line: NEMA ICS 2, Class A, full voltage, nonreversing, or solid state, **as directed**.
 - b. Star-Delta, Reduced-Voltage Controller: NEMA ICS 2, closed transition, or solid state, **as directed**.
 - c. Variable Frequency Controller:
 - 1) Motor controller shall be factory mounted and wired on the chiller to provide a single-point, field-power termination to the chiller and its auxiliaries.
 - 2) Description: NEMA ICS 2; listed and labeled as a complete unit and arranged to provide variable speed by adjusting output voltage and frequency.
 - 3) Enclosure: Unit mounted, NEMA 250, Type 3R, **as directed**, with hinged full-front access door with lock and key.
 - 4) Integral Disconnecting Means: Door-interlocked, **as directed**, NEMA AB 1, instantaneous-trip circuit breaker with lockable handle. Minimum withstand rating shall be as required by electrical power distribution system, but not less than 42,000 **OR** 65,000 **OR** 100,000, **as directed**, A.
 - 5) Technology: Pulse width modulated (PWM) output suitable for constant or variable torque loads.
 - 6) Motor current at start shall not exceed the rated load amperes, providing no electrical inrush.
- 12. Refrigerant Circuits:
 - a. Refrigerant: Type as indicated on Drawings.
OR
Refrigerant Type: R-22 **OR** R-134a **OR** R-407c **OR** HFC, **as directed**: Classified as Safety Group A1 according to ASHRAE 34.
 - b. Refrigerant Compatibility: Chiller parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
 - c. Refrigerant Circuit: Each shall include a thermal- or electronic-expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction, **as directed**, and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core, **as directed**, filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.
 - d. Pressure Relief Device:
 - 1) Comply with requirements in ASHRAE 15 and in applicable portions of ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 2) ASME-rated, spring-loaded pressure relief valve; single- or multiple-reseating type.
- 13. Evaporator:

- a. Description: Shell-and-tube design.
 - 1) Direct-expansion (DX) type with fluid flowing through the shell, and refrigerant flowing through the tubes within the shell.
 - 2) Flooded type with fluid flowing through tubes and refrigerant flowing around tubes within the shell.
 - b. Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - c. Shell Material: Carbon steel.
 - d. Shell Heads: Removable carbon-steel heads located at each end of the tube bundle.
 - e. Fluid Nozzles: Terminated with mechanical-coupling **OR** flanged, **as directed**, end connections for connection to field piping.
 - f. Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.
 - g. Heater: Factory-installed and -wired electric heater with integral controls designed to protect the evaporator to minus 20 deg F (minus 29 deg C).
 - h. Remote Mounting: Designed for remote field mounting where indicated. Provide kit for field installation.
14. Air-Cooled Condenser:
- a. Plate-fin coil with integral subcooling on each circuit, rated at 450 psig (3103 kPa).
 - 1) Construct coil casing of galvanized **OR** stainless, **as directed**, steel.
 - 2) Construct coils of copper tubes mechanically bonded to aluminum **OR** aluminum with precoated epoxy-phenolic **OR** copper, **as directed**, fins.
 - 3) Coat coils with a baked-epoxy, corrosion-resistant coating after fabrication.
 - 4) Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.
 - b. Fans: Direct-drive propeller type with statically and dynamically balanced fan blades, arranged for vertical air discharge.
 - c. Fan Motors: Totally enclosed nonventilating (TENV) or totally enclosed air over (TEAO) enclosure, with permanently lubricated bearings. Equip each motor with overload protection integral to either the motor or chiller controls.
 - d. Fan Guards: Steel safety guards with corrosion-resistant coating.
15. Electrical Power:
- a. Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a multipoint **OR** single-point, **as directed**, field-power connection to chiller.
 - b. House in a unit-mounted, NEMA 250, Type 3R, **as directed**, enclosure with hinged access door with lock and key or padlock and key, **as directed**.
 - c. Wiring shall be numbered and color-coded, **as directed**, to match wiring diagram.
 - d. Install factory wiring outside of an enclosure in a raceway.
 - e. Field-power interface shall be to wire lugs **OR** NEMA KS 1, heavy-duty, nonfused disconnect switch **OR** NEMA AB 1, instantaneous-trip circuit breaker with lockable handle, **as directed**.
 - 1) Disconnect means shall be interlocked with door operation.
 - 2) Minimum withstand rating shall be as required by electrical power distribution system, but not less than 42,000 **OR** 65,000 **OR** 100,000, **as directed**, A.
 - f. Provide branch power circuit to each motor and to controls with one of the following disconnecting means:
 - 1) NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
 - 2) NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit-trip set point.
 - g. Provide each motor with overcurrent protection.
 - h. Overload relay sized according to UL 1995 or an integral component of chiller control microprocessor.
 - i. Phase-Failure and Undervoltage Relays: Solid-state sensing with adjustable settings.

- j. Provide power factor correction capacitors to correct power factor to 0.90 **OR** 0.95, **as directed**, at full load.
 - k. Control Transformer: Unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.
 - 1) Power unit-mounted controls where indicated.
 - 2) Power unit-mounted, ground fault interrupt (GFI) duplex receptacle.
 - l. Control Relays: Auxiliary and adjustable time-delay relays.
 - m. For chiller electrical power supply, indicate the following:
 - 1) Current and phase to phase for all three phases.
 - 2) Voltage, phase to phase, and phase to neutral for all three phases.
 - 3) Three-phase real power (kilowatts).
 - 4) Three-phase reactive power (kilovolt amperes reactive).
 - 5) Power factor.
 - 6) Running log of total power versus time (kilowatt-hours).
 - 7) Fault log, with time and date of each.
16. Controls:
- a. Standalone and microprocessor based.
 - b. Enclosure: Share enclosure with electrical power devices or provide a separate enclosure for remote mounting in the field, **as directed**.
 - c. Operator Interface: Multiple-character digital or graphic display with dynamic update of information and with keypad or touch-sensitive display located on front of control enclosure. In either imperial or metric units, display the following information:
 - 1) Date and time.
 - 2) Operating or alarm status.
 - 3) Operating hours.
 - 4) Outdoor-air temperature if required for chilled-water reset.
 - 5) Temperature and pressure of operating set points.
 - 6) Entering and leaving temperatures of chilled water.
 - 7) Refrigerant pressures in evaporator and condenser.
 - 8) Saturation temperature in evaporator and condenser.
 - 9) No cooling load condition.
 - 10) Elapsed time meter (compressor run status).
 - 11) Pump status.
 - 12) Antirecycling timer status.
 - 13) Percent of maximum motor amperage.
 - 14) Current-limit set point.
 - 15) Number of compressor starts.
 - d. Control Functions:
 - 1) Manual or automatic startup and shutdown time schedule.
 - 2) Entering and leaving chilled-water temperatures, control set points, and motor load limits. Chilled-water leaving temperature shall be reset based on return-water **OR** outdoor-air **OR** space, **as directed**, temperature.
 - 3) Current limit and demand limit.
 - 4) External chiller emergency stop.
 - 5) Antirecycling timer.
 - 6) Automatic lead-lag switching.
 - 7) Variable evaporator flow.
 - 8) Thermal storage.
 - e. Manually Reset Safety Controls: The following conditions shall shut down chiller and require manual reset:
 - 1) Low evaporator pressure or high condenser pressure.
 - 2) Low chilled-water temperature.
 - 3) Refrigerant high pressure.
 - 4) High or low oil pressure.
 - 5) High oil temperature.
 - 6) Loss of chilled-water flow.

- 7) Control device failure.
 - f. Trending: Capability to trend analog data of up to five parameters simultaneously over an adjustable period and frequency of polling.
 - g. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: view only; view and operate; and view, operate, and service.
 - h. Control Authority: At least four conditions: Off, local manual control at chiller, local automatic control at chiller, and automatic control through a remote source.
 - i. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display chiller status and alarms.
 - 1) Hardwired Points:
 - a) Monitoring: On-off status, common trouble alarm **OR** electrical power demand (kilowatts) **OR** electrical power consumption (kilowatt-hours), **as directed**.
 - b) Control: On-off operation, chilled-water, discharge temperature set-point adjustment **OR** electrical power demand limit, **as directed**.
 - 2) ASHRAE 135 (BACnet) **OR** LonTalk **OR** Modbus **OR** Industry-accepted, open-protocol, **as directed**, communication interface with the BAS shall enable the BAS operator to remotely control and monitor the chiller from an operator workstation. Control features and monitoring points displayed locally at chiller control panel shall be available through the BAS.
 - 17. Insulation:
 - a. Material: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - b. Thickness: 3/4 inch (19 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
 - c. Factory-applied insulation over cold surfaces of chiller components.
 - 1) Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface. Seal seams and joints.
 - d. Apply protective coating to exposed surfaces of insulation to protect insulation from weather.
 - 18. Accessories:
 - a. Factory-furnished, chilled-water flow switches for field installation.
 - b. Individual compressor suction and discharge pressure gages with shutoff valves for each refrigerant circuit.
 - c. Factory-furnished neoprene **OR** spring, **as directed**, isolators for field installation.
- D. Packaged Refrigerant Recovery Units
- 1. Packaged portable unit consisting of compressor, air-cooled condenser, recovery system, tank pressure gages, filter-dryer, and valving that allows for switching between liquid and vapor recovery mode. Refrigerant recovery unit shall be factory mounted on an ASME-constructed and -stamped refrigerant storage vessel that is sized to hold the full refrigerant charge of the largest chiller furnished.
- E. Heat-Exchanger, Brush-Cleaning System
- 1. Furnish for field installation a brush-cleaning system on each chiller condenser, **as directed**, for tube cleaning and improved heat transfer.
 - 2. System shall maintain tube fouling at or below design conditions without interrupting normal equipment operation.
 - 3. System shall consist of a brush inserted in each tube and a catch basket attached to each end of the tube. A four-way valve shall operate to reverse the direction of water flow to push the brush through the tube while removing tube deposits. Four-way reversing valve's actuator shall be controlled by a preset time cycle that provides regular tube brushing during equipment operation. Frequency of the brushing cycle shall be set up to match Project requirements.
 - 4. Components:

- a. Brush: Each brush shall have nylon bristles, titanium wires, and polypropylene tips. Brush interference fit with the ID of the tube shall not exceed 0.025 inch (0.6 mm).
- b. Basket: Single-piece polypropylene basket with neck OD to press fit ID of tube. Design shall provide for insertion of eddy current probe or removal of brushes without removing baskets from the valve.
- c. Four-Way Valve:
 - 1) Construct valve body of carbon steel with internal sealing parts of hard rubber and Type 304 stainless steel.
 - 2) Configure valve with parallel flow connections to minimize field installation piping.
 - 3) Construct to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, at a system working pressure equal to condenser.
 - 4) Pipe connections shall be flanged.
 - 5) Valve manufacturer to test and certify a maximum leakage rate of less than 0.05 percent of the design flow rate at operation conditions of maximum differential pressure.
 - 6) Hydrostatically test to 1.5 times the design working pressure.
 - 7) Design the valve to cause no more than 0.5-psig (3-kPa) pressure drop at design flow conditions.
 - 8) Provide valve with valve-mounted indicating/warning light, which shall light before valve begins rotation.
 - 9) Valve Actuator: Mount electric actuator to operate valve.
OR
Valve Actuator: Mount pneumatic piston-type actuator to operate valve. Actuator shall be suitable for operation using field-supplied air pressure.
 - 10) Position Switches: Factory mount microswitches on valve to indicate the complete turn of valve in both normal and reverse flow.
- d. Control Panel: Factory or field mount a control panel on chiller. Control panel shall include the following features:
 - 1) NEMA 250, Type 1 **OR** Type 4 **OR** Type 4x **OR** Type 12, **as directed**, enclosure.
 - 2) Timer to automatically initiate the cleaning cycle over a 24-hour period.
 - 3) Manual override of preset cleaning cycle.
 - 4) Visual indication of "Power On," "Diverter Position," "Normal Flow," "Reverse Flow," and "Valve Malfunction" indicating a slow turn or incomplete valve turn.
 - 5) For pneumatic actuators, mount four-way solenoid valve for actuator operation in the control panel.
 - 6) Flow switch bypass.
 - 7) Unloading signal to chiller.

F. Source Quality Control

- 1. Perform functional tests of chillers before shipping.
- 2. Factory run test each air-cooled chiller with water flowing through evaporator.
- 3. Factory performance test water-cooled chillers, before shipping, according to ARI 550/590.
 - a. Test the following conditions:
 - 1) Design conditions indicated.
 - 2) Reduction in capacity from design to minimum load in steps of 10 **OR** 25 **OR** 33, **as directed**, with condenser fluid at design conditions.
OR
Reduction in capacity from design to minimum load in steps of 10 **OR** 25 **OR** 33, **as directed**, with varying entering condenser-fluid temperature from design to minimum conditions in 5 deg F (3 deg C) increments.
OR
At one **OR** two **OR** three **OR** four **OR** five **OR** 10, **as directed**, point(s) of varying part-load performance to be selected by Owner at time of test.
 - b. Allow Owner access to place where chillers are being tested. Notify the Owner 14 days in advance of testing.

- c. Prepare test report indicating test procedures, instrumentation, test conditions, and results. Submit copy of results within one week of test date.
4. Factory performance test air-cooled chillers, **as directed**, before shipping, according to ARI 550/590.
 - a. Test the following conditions:
 - 1) Design conditions indicated.
 - 2) Reduction in capacity from design to minimum load in steps of 10 **OR** 25 **OR** 33, **as directed**, with condenser air at design conditions.**OR**
At one **OR** two **OR** three **OR** four **OR** five, **as directed**, point(s) of varying part-load performance to be selected by Owner at time of test.
 - b. Allow Owner access to place where chillers are being tested. Notify the Owner 14 days in advance of testing.
 - c. Prepare test report indicating test procedures, instrumentation, test conditions, and results. Submit copy of results within one week of test date.
5. Factory sound test water-cooled chillers, **as directed**, before shipping, according to ARI 575 **OR** air-cooled chillers, before shipping, according to ARI 370, **as directed**.
 - a. Test the following conditions:
 - 1) Design conditions indicated.
 - 2) Chiller operating at calculated worst-case sound condition.**OR**
At one **OR** two **OR** three **OR** four **OR** five, **as directed**, point(s) of varying part-load performance to be selected by Owner at time of test.
 - b. Allow Owner access to place where chillers are being tested. Notify the Owner 14 days in advance of testing.
 - c. Prepare test report indicating test procedures, instrumentation, test conditions, and results. Submit copy of results within one week of test date.
6. Factory test and inspect evaporator and condenser **OR** condenser, and heat-reclaim condenser, **as directed**, according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
7. For chillers located indoors, rate sound power level according to ARI 575.
8. For chillers located outdoors, rate sound power level according to ARI 370.

1.3 EXECUTION

A. Chiller Installation

1. Install chillers on support structure indicated.
2. Equipment Mounting: Install chiller on concrete bases using elastomeric pads **OR** restrained spring isolators, **as directed**. Comply with requirements for concrete bases specified in Division 03 Section "Cast-in-place Concrete". Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**.
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - c. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Equipment Mounting: Install chiller using elastomeric pads **OR** restrained spring isolators, **as directed**. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".

- a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**.
 4. Equipment Mounting: Install chiller on concrete bases. Comply with requirements for concrete bases specified in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
 5. Maintain manufacturer's recommended clearances for service and maintenance.
 6. Charge chiller with refrigerant and fill with oil if not factory installed.
 7. Install separate devices furnished by manufacturer and not factory installed.
- B. Heat-Exchanger, Brush-Cleaning System Installation
 1. Install brush-cleaning system control panel adjacent to chiller control panel.
 2. Arrange piping to provide service access to four-way valve assembly without affecting access to chiller. Secure valve to prevent lateral movement and vibration during operation.
 3. Provide field electric power, as required, to each system control panel and electric actuated valve.
 4. Provide pneumatic piping with pressure regulator and isolation valve to each pneumatic supply connection. Coordinate field source of air with manufacturer to ensure that requirements are satisfied for proper valve operation.
 5. Interconnect brush-cleaning system controls with chiller controls. Coordinate requirements to ensure safe, trouble-free operation.
 6. Functionally test the entire brush-cleaning system, including the valve, actuator, position indicator, and control panel, with chiller in operation.
- C. Connections
 1. Comply with requirements for piping specified in Division 23 Section(s) "Hydronic Piping" AND "Refrigerant Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Install piping adjacent to chiller to allow service and maintenance.
 3. Evaporator Fluid Connections: Connect to evaporator inlet with shutoff valve, strainer, **as directed**, flexible connector, **as directed**, thermometer, and plugged tee with pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, **as directed**, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, flow meter, **as directed**, and drain connection with valve. Make connections to chiller with a flange **OR** mechanical coupling, **as directed**.
 4. Condenser Fluid Connections: Connect to condenser inlet with shutoff valve, strainer, **as directed**, flexible connector, **as directed**, thermometer, and plugged tee with pressure gage. Connect to condenser outlet with shutoff valve, balancing valve, flexible connector, **as directed**, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, flow meter, **as directed**, and drain connection with valve. Make connections to chiller with a flange **OR** mechanical coupling, **as directed**.
 5. Heat-Reclaim Condenser Fluid Connections: Connect to condenser inlet with shutoff valve, strainer, **as directed**, flexible connector, **as directed**, thermometer, and plugged tee with pressure gage. Connect to condenser outlet with shutoff valve, balancing valve, flexible connector, **as directed**, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, flow meter, **as directed**, and drain connection with valve. Make connections to chiller with a flange **OR** mechanical coupling, **as directed**.
 6. Refrigerant Pressure Relief Device Connections: For chillers installed indoors, extend vent piping **OR** separate vent piping for each chiller, **as directed**, to the outdoors without valves or restrictions. Comply with ASHRAE 15. Connect vent to chiller pressure relief device with flexible connector and dirt leg with drain valve.
 7. Connect each chiller drain connection with a union and drain pipe, and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection.



D. Startup Service

1. Engage a factory-authorized service representative to perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.
 - b. Verify that refrigerant charge is sufficient and chiller has been leak tested.
 - c. Verify that pumps are installed and functional.
 - d. Verify that thermometers and gages are installed.
 - e. Operate chiller for run-in period.
 - f. Check bearing lubrication and oil levels.
 - g. For chillers installed indoors, verify that refrigerant pressure relief device is vented outdoors.
 - h. Verify proper motor rotation.
 - i. Verify static deflection of vibration isolators, including deflection during chiller startup and shutdown.
 - j. Verify and record performance of fluid flow and low-temperature interlocks for evaporator and condenser **OR** condenser, and heat-reclaim condenser, **as directed**.
 - k. Verify and record performance of chiller protection devices.
 - l. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
2. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assembly, installation, and connection.
3. Prepare test and inspection startup reports.

END OF SECTION 23 61 16 00



Task	Specification	Specification Description
23 61 23 00	23 61 16 00	Rotary-Screw Water Chillers



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SECTION 23 62 13 00 - INDIRECT-FIRED ABSORPTION WATER CHILLERS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for indirect-fired absorption water chillers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Packaged, water-cooled, single-effect and double-effect absorption chillers.
 - b. Heat-exchanger, brush-cleaning system.

C. Definitions

1. BAS: Building automation system.
2. COP: Coefficient of performance. The ratio of the rate of heat removal to the rate of energy input using consistent units for any given set of rating conditions.
3. IPLV: Integrated part-load value. A single-number part-load efficiency figure of merit calculated per the method defined by ARI 560 and referenced to ARI standard rating conditions.
4. NPLV: Nonstandard part-load value. A single-number part-load efficiency figure of merit calculated per the method defined by ARI 560 and intended for operating conditions other than the ARI standard rating conditions.

D. Performance Requirements

1. Seismic Performance: Indirect-fired absorption chillers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Condenser-Fluid Temperature Performance:
 - a. Startup Condenser-Fluid Temperature: Chiller shall be capable of starting with an entering condenser-fluid temperature of 60 deg F (16 deg C) **OR** 55 deg F (13 deg C) **OR** 40 deg F (4.4 deg C), **as directed**, and providing stable operation until the system temperature is elevated to the minimum operating entering condenser-fluid temperature.
 - b. Minimum Operating Condenser-Fluid Temperature: Chiller shall be capable of continuous operation over the entire capacity range indicated with an entering condenser-fluid temperature of 65 deg F (18 deg C) **OR** 60 deg F (16 deg C) **OR** 55 deg F (13 deg C), **as directed**.
 - c. Make factory modifications to standard chiller design if necessary to comply with performance indicated.
3. Site Altitude: Chiller shall be suitable for altitude at which installed without affecting performance indicated. Make adjustments to affected chiller components to account for site altitude.
4. Performance Tolerance: Comply with the following in lieu of ARI 560, **as directed**:
 - a. Allowable Capacity Tolerance: Zero percent.
 - b. Allowable IPLV/NPLV Performance Tolerance: Zero percent.

E. Submittals

1. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, furnished specialties and accessories.
2. LEED Submittals:
 - a. Product Data for LEED-NC Prerequisite EA 2: Documentation indicating that units comply with ASHRAE 90.1.



- b. Product Data for LEED-NC Prerequisite EA 3: Documentation indicating that refrigerants comply.
- c. Product Data for LEED-NC Credit EA 4: Documentation indicating that equipment and refrigerants comply.
- 3. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- 4. Certificates: For certification required in "Quality Assurance" Article.
- 5. Seismic Qualification Certificates: For chillers, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- 6. Startup service reports.
- 7. Operation and maintenance data.
- 8. Warranty: Sample of special warranty.

F. Quality Assurance

- 1. ARI Rating: Rate chiller performance according to requirements in ARI 560.
- 2. ASHRAE Compliance:
 - a. ASHRAE 15 for safety code for mechanical refrigeration.
 - b. ASHRAE/IESNA 90.1.
- 3. ASME Compliance: Fabricate and label chiller pressure vessels to comply with applicable portions of ASME Boiler and Pressure Vessel Code.
- 4. Comply with NFPA 70.
- 5. Comply with requirements of UL and UL Canada, and include label by a qualified testing agency showing compliance.

G. Delivery, Storage, And Handling

- 1. Ship chillers factory charged with nitrogen.
- 2. Ship absorbent and refrigerant in chillers or in containers separate from chillers.
OR
Ship absorbent and refrigerant, **as directed**, in containers separate from chillers.
- 3. Package chiller for export shipping in totally enclosed bagging **OR** crate **OR** crate with bagging, **as directed**.

H. Warranty

- 1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of chillers that fail in materials or workmanship within specified warranty period.
 - a. Extended warranties include, but are not limited to, the following:
 - 1) Complete chiller.
OR
Pumps and motors **OR** Purge unit, **as directed**.
OR
Absorbent **OR** Absorbent and refrigerant, **as directed**, only.
 - 2) Parts only **OR** Parts and labor, **as directed**.
 - 3) Loss of absorbent and refrigerant for any reason.
- 2. Warranty Period: Two **OR** Three **OR** Four **OR** Five, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Manufactured Unit

1. Description: Factory-assembled and -tested, hermetic-design chiller complete with absorber, evaporator, condenser, generator, solution heat exchanger, controls, absorbent solution pump with motor, refrigerant pump with motor, purge unit with motor, motor controllers, rupture disk, interconnecting unit piping and wiring, indicated accessories, and mounting frame.
 - a. Disassemble chiller into major assemblies as required by the installation after factory testing and before packaging for shipment.
 2. Absorbent and Refrigerant:
 - a. Absorbent: Lithium bromide solution with corrosion inhibitor.
 - b. Refrigerant: Deionized or distilled, **as directed**, water.
 - c. Performance Enhancer: Heat and mass transfer enhancer to improve performance.
 3. Seismic Fabrication Requirements: Fabricate mounting base and attachment to chiller, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" when mounting base is anchored to building structure.
- B. Pumps
1. Hermetically sealed, self-lubricating, and fitted with self-adjusting, spring-loaded, wear-compensating tapered carbon bearings.
 2. Pump motor assembly shall be designed to operate for not less than 25,000 **OR** 50,000, **as directed**, hours between inspections.
 3. Pump motors cooled, and bearings lubricated, either by fluid being pumped or by a filtered supply of liquid refrigerant.
 4. Pump suction and discharge equipped with isolation valves.
 5. Separate and dedicated pumps for absorbent solution and refrigerant.
 - a. Absorbent solution and refrigerant flow-control method shall be manufacturer's choice to comply with operating requirements indicated.
 6. Purge System: Unit mounted and factory wired, equipped with controls and a pump to automatically remove noncondensable vapors.
 - a. Purge Pump Motor: Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Enclosure: Open dripproof **OR** Totally enclosed, **as directed**.
- C. Heat-Exchanger Shells
1. Configuration for Single-Effect Chillers: Two shells; one shell consists of the absorber/evaporator and the other shell consists of the condenser/generator.
 2. Configuration for Double-Effect Chillers: Two shells; one shell consists of the absorber/evaporator, low-stage generator/condenser and the other shell consists of the high-stage generator.
 3. Construction: Fabricated from continuously welded carbon-steel sheet or plate, or from seamless pipe.
 4. Design Pressure and Temperature Rating: Comply with applicable requirements in ASME Boiler and Pressure Vessel Code.
 5. End Tube Sheets: Carbon-steel plates continuously welded to each end of shell; drilled and reamed to accommodate tubes with positive seal between fluid in tubes and refrigerant in shell.
 6. Intermediate Tube Sheets: Carbon-steel plates installed in shell and spaced along length of tube at intervals required to eliminate vibration and to avoid contact of tubes resulting in abrasion and wear.
 7. Generator/Condenser Shell Pressure Relief Device: Manufacturers standard rupture disk complying with requirements in ASHRAE 15 and in applicable portions of ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- D. Absorber
1. Nozzle or Dispersion Trays: Designed to evenly distribute absorbent solution over tubes. Constructed of brass, stainless steel, or another material that will not corrode.
 2. Tubes:



- a. Individually replaceable, straight tubes expanded into tube sheets. Replaceable from either end and without damage to tube sheets and other tubes.
 - b. Material: Copper **OR** Copper-nickel alloy **OR** Stainless steel **OR** Titanium, **as directed**.
 - c. Minimum Wall Thickness: Manufacturer's choice **OR** 0.025 inch (0.6 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.
 - d. External Finish: Manufacturer's standard.
 - e. Internal Finish: Enhanced **OR** Smooth, **as directed**.
 3. Water Boxes:
 - a. Carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - b. Standard **OR** Marine, **as directed**, type for water box with piping connections.
 - 1) Water boxes and marine water-box covers, **as directed**, shall have lifting lugs or eyebolts.
 - 2) Hinged **OR** davited, **as directed**, water boxes.
OR
Hinged **OR** davited, **as directed**, marine water-box covers.
 - c. **OR**
Standard type for water box without piping connections.
 - 1) Water boxes shall have lifting lugs or eyebolts.
 - 2) Hinged **OR** davited, **as directed**, water boxes.
OR
Hinged **OR** davited, **as directed**, marine water-box covers.
 - c. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - d. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - e. Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm) **OR** 3/4- or 1-inch (19- or 25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
 4. Additional Corrosion Protection:
 - a. Electrolytic corrosion-inhibitor anode.
 - b. Coat wetted surfaces with a corrosion-resistant finish.
OR
Using same material as tubes, clad surfaces of end tube sheets in contact with fluid. Coat other wetted surfaces, including water boxes, with a corrosion-resistant finish.
 5. Absorber/Condenser Crossover Piping: Factory furnished **OR** installed, **as directed**, piping connecting fluid connection of absorber discharge to condenser inlet.
- E. Evaporator
1. Nozzle or Dispersion Trays: Designed to evenly distribute refrigerant over tubes. Constructed of brass, stainless steel, or another material that will not corrode.
 2. Refrigerant Holding Pan: Steel **OR** Stainless steel, **as directed**.
 3. Tubes:
 - a. Individually replaceable, straight tubes expanded into tube sheets. Replaceable from either end and without damage to tube sheets and other tubes.
 - b. Material: Copper **OR** Copper-nickel alloy **OR** Stainless steel **OR** Titanium, **as directed**.
 - c. Minimum Wall Thickness: Manufacturer's choice **OR** 0.025 inch (0.6 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.
 - d. External Finish: Manufacturer's standard.
 - e. Internal Finish: Enhanced **OR** Smooth, **as directed**.
 4. Water Boxes:
 - a. Carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - b. Standard **OR** Marine, **as directed**, type for water box with piping connections.

- 1) Water boxes and marine water-box covers, **as directed**, shall have lifting lugs or eyebolts.
 - 2) Hinged **OR** davited, **as directed**, water boxes.
OR
Hinged **OR** davited, **as directed**, marine water-box covers.
- OR**
Standard type for water box without piping connections.
- 1) Water boxes shall have lifting lugs or eyebolts.
 - 2) Hinged **OR** davited, **as directed**, water boxes.
OR
Hinged **OR** davited, **as directed**, marine water-box covers.
- c. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - d. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - e. Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm) **OR** 3/4- or 1-inch (19- or 25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
- F. Condenser
1. Refrigerant Holding Pan: Steel **OR** Stainless steel, **as directed**.
 2. Tubes:
 - a. Individually replaceable, straight tubes expanded into tube sheets. Replaceable from either end and without damage to tube sheets and other tubes.
 - b. Material: Copper **OR** Copper-nickel alloy **OR** Stainless steel **OR** Titanium, **as directed**.
 - c. Minimum Wall Thickness: Manufacturer's choice **OR** 0.025 inch (0.6 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.
 - d. External Finish: Manufacturer's standard.
 - e. Internal Finish: Enhanced **OR** Smooth, **as directed**.
 3. Water Boxes:
 - a. Carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - b. Standard **OR** Marine, **as directed**, type for water box with piping connections.
 - 1) Water boxes and marine water-box covers, **as directed**, shall have lifting lugs or eyebolts.
 - 2) Hinged **OR** davited, **as directed**, water boxes.
OR
Hinged **OR** davited, **as directed**, marine water-box covers.

OR
Standard type for water box without piping connections.

 - 1) Water boxes shall have lifting lugs or eyebolts.
 - 2) Hinged **OR** davited, **as directed**, water boxes.
OR
Hinged **OR** davited, **as directed**, marine water-box covers.
 - c. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - d. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - e. Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug. - 4. Additional Corrosion Protection:
 - a. Electrolytic corrosion-inhibitor anode.
 - b. Coat wetted surfaces with a corrosion-resistant finish.
OR
Using same material as tubes, clad surfaces of end tube sheets in contact with fluid. Coat other wetted surfaces, including water boxes, with a corrosion-resistant finish.

G. Generator For Single-Effect Chillers

1. Tubes:
 - a. Individually replaceable, straight tubes expanded into tube sheets. Replaceable from either end and without damage to tube sheets and other tubes.
 - b. Material: 90/10 copper-nickel alloy **OR** Stainless steel **OR** Titanium, as directed.
 - c. Minimum Wall Thickness: Manufacturer's choice **OR** 0.035 inch (0.9 mm), **as directed**.
 - d. External Finish: Manufacturer's standard.
 - e. Internal Finish: Smooth **OR** Enhanced, **as directed**
2. Water Boxes:
 - a. Carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - b. Standard type water box.
 - c. Water boxes shall have lifting lugs or eyebolts.
 - d. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - e. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - f. Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
3. Additional Corrosion Protection:
 - a. Electrolytic corrosion-inhibitor anode.
 - b. Coat wetted surfaces with a corrosion-resistant finish.
OR
Using same material as tubes, clad surfaces of end tube sheets in contact with fluid. Coat other wetted surfaces, including water boxes, with a corrosion-resistant finish.

H. First-Stage Generator For Double-Effect Chillers

1. Tubes:
 - a. Replaceable, straight, or U tubes expanded into tube sheets.
 - b. Material: Manufacturer's standard **OR** 70/30 copper-nickel alloy **OR** Type 409 stainless steel **OR** Titanium, **as directed**.
 - c. Minimum Wall Thickness: Manufacturer's choice **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.
 - d. External Finish: Manufacturer's standard.
 - e. Internal Finish: Smooth **OR** Enhanced, **as directed**.
2. Water Boxes:
 - a. Carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - b. Standard type water box.
 - c. Water boxes shall have lifting lugs or eyebolts.
 - d. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - e. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - f. Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
3. Additional Corrosion Protection:
 - a. Electrolytic corrosion-inhibitor anode.
 - b. Coat wetted surfaces with a corrosion-resistant finish.
OR
Using same material as tubes, clad surfaces of end tube sheets in contact with fluid. Coat other wetted surfaces, including water boxes, with a corrosion-resistant finish.

I. Second-Stage Generator For Double-Effect Chillers

1. Tubes:

- a. Individually replaceable, straight tubes expanded into tube sheets. Replaceable from either end and without damage to tube sheets and other tubes.
 - b. Material: Copper **OR** Copper-nickel alloy **OR** Stainless steel **OR** Titanium, **as directed**.
 - c. Minimum Wall Thickness: Manufacturer's choice **OR** 0.025 inch (0.6 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.
 - d. External Finish: Manufacturer's standard.
 - e. Internal Finish: Smooth **OR** Enhanced, **as directed**.
 2. Water Boxes:
 - a. Carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - b. Standard type water box.
 - c. Water boxes shall have lifting lugs or eyebolts.
 - d. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - e. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - f. Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
 3. Additional Corrosion Protection:
 - a. Electrolytic corrosion-inhibitor anode.
 - b. Coat wetted surfaces with a corrosion-resistant finish.
OR
Using same material as tubes, clad surfaces of end tube sheets in contact with fluid. Coat other wetted surfaces, including water boxes, with a corrosion-resistant finish.
- J. Solution Heat Exchanger
 1. Description: Shell-and-tube or brazed-plate heat exchanger; integral part of chiller to increase cycle efficiency by preheating the weak solution on its way to the generator while precooling the strong solution returning from the generator.
- K. Steam Condensate Drain Cooler
 1. Description: Shell-and-tube heat exchanger constructed of carbon-steel shell and copper-nickel-alloy or stainless-steel tubes.
- L. Factory-Applied Insulation
 1. Factory-Applied Insulation on Cold Surfaces:
 - a. Closed-cell, flexible elastomeric thermal insulation complying with ASTM C 534, Type I for tube and Type II for sheet materials.
 - 1) Thickness: 3/4 inch (19 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
 - b. Adhesive: As recommended by insulation manufacturer.
 - c. Factory apply insulation over all cold surfaces of chiller capable of forming condensation. Components shall include, but not be limited to, evaporator shell and end tube sheets; evaporator water boxes including nozzles; refrigerant pump; cold surfaces of motor; and cold piping.
 - 1) Apply adhesive to 100 percent of insulation contact surface.
 - 2) Before insulating steel surfaces, prepare surfaces for paint, and prime and paint as indicated for other painted components. Do not insulate unpainted steel surfaces.
 - 3) Seal seams and joints to provide a vapor barrier.
 - 4) After adhesive has fully cured, paint exposed surfaces of insulation to match other painted parts.
 2. Factory-Applied Insulation on Hot Surfaces:
 - a. Mineral-fiber board, pipe or tank insulation complying with one of following:
 - 1) ASTM C 547, Type I or Type II, Grade A.
 - 2) ASTM C 612, Type IB.
 - 3) ASTM C 1393, Type II or Type IIIA, Category 2.
 - 4) Thickness: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**.



- b. Adhesive: As recommended by insulation manufacturer.
- c. Factory apply materials over all hot surfaces to provide smooth, straight, and even surfaces; free of voids.
 - 1) Apply adhesive to insulation contact surface as recommended by insulation manufacturer.
 - 2) Install insulation anchor pins and washers if required by insulation manufacturer to secure insulation to surfaces to be insulated.
 - 3) Completely encapsulate insulation with metal jacket, leaving no exposed insulation. Provide removable jacket on components requiring access for service and inspection.
 - 4) Paint exposed surfaces of metal jacket to match other painted parts unless jacket material is aluminum or stainless steel.

M. Electrical

- 1. Factory installed and wired, and functionally tested at factory before shipment.
- 2. Single-point, field-power connection to fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**. Minimum withstand rating shall be as required by electrical power distribution system, but not less than 42,000 **OR** 65,000, **as directed**, A.
 - a. Branch power circuit to each motor, dedicated electrical load, and controls with disconnect switch or circuit breaker, **as directed**.
 - 1) NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
 - 2) NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit-trip set point.
 - b. NEMA ICS 2, Class A, full-voltage, nonreversing motor controller, hand-off-auto switch, and overcurrent protection for each motor.
 - c. Control-circuit transformer with primary and secondary side fuses.
- 3. Terminal blocks with numbered and color-coded, **as directed**, wiring to match wiring diagram. Spare wiring terminal block for connection to external controls or equipment.
- 4. Wiring Outside of Enclosures: Factory installed in metal raceway except make terminal connections with not more than a 24-inch (610-mm) length of liquidtight **OR** flexible metallic, **as directed**, conduit.

N. Controls

- 1. Control: Standalone and microprocessor based, with all memory stored in nonvolatile memory so that reprogramming is not required on loss of electrical power.
- 2. Enclosure: Unit mounted, NEMA 250, Type 1 **OR** Type 4 **OR** Type 4x, **as directed**, hinged or lockable.
- 3. Operator Interface: Multiple-character digital or graphic display with dynamic update of information and with keypad or touch-sensitive display located on front of control enclosure. In either imperial or metric units selectable through the interface, display the following information:
 - a. Date and time.
 - b. Operating or alarm status.
 - c. Operating hours.
 - d. Outdoor-air temperature if required for chilled-water reset.
 - e. Temperature and pressure of operating set points.
 - f. Entering and leaving temperatures of chilled and condenser water.
 - g. Refrigerant temperature.
 - h. Solution concentration and temperature.
 - i. Indication of solution and purge-pump operation.
 - j. Generator shell pressure.
 - k. Number of starts.
 - l. Number of purge cycles.
 - m. Hot-water valve actuator potentiometer position (percentage).
 - n. Entering and leaving hot-water temperatures.

- o. Steam demand limit.
- p. Inlet steam pressure and temperature.
- q. Steam valve actuator potentiometer position (percentage).
- r. First-stage generator pressure and temperature.
- 4. Control Functions:
 - a. Manual or automatic startup and shutdown time schedule.
 - b. Automatic cycle to prevent crystallization.
 - c. Entering and leaving chilled-water temperatures and control set points. Chilled-water temperature shall be reset based on return-water **OR** outdoor-air **OR** space, **as directed**, temperature.
 - d. Condenser-fluid temperature.
 - e. Cooling provided and heating energy used within programmable time periods, minimum monthly.
- 5. Capacity Control: Automatically controls input flow rate of heat source to maintain chilled-water temperature set point for cooling loads ranging from 10 to 100 percent.
- 6. Control Valve Package: Factory-furnished, for field installation, **OR** Factory-installed, **as directed**, control valve package suitable for energy source indicated.
 - a. Body: Cast-iron, carbon-steel, or stainless-steel body with flanged connections.
 - b. Type: Manufacturer's choice **OR** V-notch ball **OR** Butterfly **OR** Globe style with cage-guide plug, **as directed**, constructed of stainless steel.
 - c. Rating: Pressure and temperature rating to match heat exchanger.
 - d. Shutoff: Capable of bubble-tight shutoff against maximum system pressure.
 - e. Size: Determined by chiller manufacturer.
 - f. Modulation: Two-way **OR** Three-way, **as directed**.
 - g. Turndown: As required to achieve stable control through the indicated operating range.
 - h. Actuator: Electric powered from chiller control panel and installed on valve.
- 7. Safety Shutdowns:
 - a. Crystallization.
 - b. Low refrigerant temperature.
 - c. Loss of chilled- or condenser-water flow.
 - d. Low leaving chilled-water temperature, 2 deg F (1 deg C) below set point, **as directed**.
 - e. First-stage generator low-solution level.
 - f. First-stage generator high temperature or pressure.
 - g. Power failure.
 - h. Solution pump overloads.
 - i. External auxiliary safety shutdown.
 - j. High solution concentration.
 - k. Incomplete dilution cycle.
 - l. High entering-water temperature.
 - m. High inlet steam pressure and temperature.
- 8. Warning Conditions: Control panel shall close warning contacts and generate a message when one of the following operating conditions is detected:
 - a. Low refrigerant temperature.
 - b. High generator temperature or pressure.
 - c. High entering generator-water temperature (single-stage generator only).
 - d. High or low entering condenser-water temperature.
 - e. Solution temperature sensor failure.
 - f. Low chilled-water flow.
- 9. Trending: Capability to trend analog data of up to five parameters simultaneously over an adjustable period and frequency of polling.
- 10. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: view only; view and operate; and view, operate, and service.
- 11. Control Authority: At least four conditions: Off, local manual control at chiller, local automatic control at chiller, and automatic control through a remote source.

12. Communication Port: RS-232 port, USB 2.0 port, or equivalent connection capable of connecting a printer and a notebook computer, **as directed**.
13. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display chiller status and alarms.
 - a. Hardwired Points:
 - 1) Monitoring: On-off status, common trouble alarm.
 - 2) Control: On-off operation, chilled-water, discharge temperature set-point adjustment **OR** generator heat source capacity limiting, **as directed**.
 - b. ASHRAE 135 (BACnet) **OR** LonTalk **OR** Modbus **OR** Industry-accepted, open-protocol, **as directed**, communication interface with the BAS shall enable the BAS operator to remotely control and monitor the chiller from an operator workstation. Control features and monitoring points displayed locally at chiller control panel shall be available through the BAS.

O. Finish

1. Paint chiller, using manufacturer's standard procedures, except comply with the following minimum requirements:
 - a. Provide at least one coat of primer with a total dry film thickness of at least 2 mils (0.05 mm).
 - b. Provide at least two coats of alkyd-modified, vinyl enamel **OR** epoxy **OR** polyurethane, **as directed**, finish with a total dry film thickness of at least 4 mils (0.10 mm).
 - c. Paint surfaces that are to be insulated before applying the insulation.
 - d. Paint installed insulation to match adjacent uninsulated surfaces.
 - e. Color of finish coat to be manufacturer's standard **OR** custom color selected by the Owner.
2. Provide Owner with quart container of paint used in application of topcoat to use in touchup applications after Project Closeout.

P. Accessories

1. Sight Glasses: Equip unit with sight glasses for visual inspection of absorbent solution and refrigerant levels. Provide at least one sight glass in absorber and evaporator sections.
2. Flow Switches:
 - a. Chiller manufacturer shall furnish a switch for each condenser **OR** evaporator and condenser, **as directed**, and verify field-mounting location before installation.
 - b. Paddle Flow Switches:
 - 1) Vane operated to actuate a double-pole, double-throw switch with one pole field wired to the chiller control panel and the other pole field wired to the BAS.
 - 2) Contacts: Platinum alloy, silver alloy, or gold-plated switch contacts with a rating of 10 A at 120-V ac.
 - 3) Pressure rating equal to pressure rating of heat exchanger.
 - 4) Construct body and wetted parts of Type 316 stainless steel.
 - 5) House switch in a NEMA 250, Type 4 enclosure constructed of die-cast aluminum.
 - 6) Vane length to suit installation.

OR

Pressure Differential Switches:

 - 1) Construction: Wetted parts of body and trim constructed of Type 316 stainless steel.
 - 2) Performance: Switch shall withstand, without damage, the full-pressure rating of the heat exchanger applied to either port and exhibit zero set-point shift due to variation in working pressure.
 - 3) Set Point: Screw type, field adjustable.
 - 4) Electrical Connections: Internally mounted screw-type terminal blocks.
 - 5) Switch Enclosure: NEMA 250, Type 4.
 - 6) Switch Action: Double-pole, double-throw switch with one pole field wired to the chiller control panel and the other pole field wired to the BAS.
3. Vibration Isolation:
 - a. Chiller manufacturer shall furnish neoprene-pad vibration isolation for each chiller.

- 1) Two layers of 0.375-inch- (10-mm-) thick, ribbed- or waffle-pattern neoprene pads separated by a 16-gage, stainless-steel plate.
 - 2) Fabricate pads from 40- to 50-durometer neoprene.
 - 3) Provide stainless-steel square bearing plate to load the pad uniformly between 20 and 40 psig (138 and 276 kPa) with a 0.12- to 0.16-inch (3- to 4-mm) deflection.
4. Lithium Bromide Filter, **as directed**:
- a. Factory install a filter, isolation valves, and associated piping.
 - b. Filter shall consist of a stainless-steel body, with removable and cleanable 150-micron, stainless-steel element.
 - c. Isolation valves shall provide isolation for filter servicing without disturbing operation of chiller.
- Q. Heat-Exchanger, Brush-Cleaning System
1. Furnish for field installation a brush-cleaning system on each chiller condenser, **as directed**, for tube cleaning and improved heat transfer.
 2. System shall maintain tube fouling at or below design conditions without interrupting normal equipment operation.
 3. System shall consist of a brush inserted in each tube and a catch basket attached to each end of the tube. A four-way valve shall operate to reverse the direction of water flow to push the brush through the tube while removing tube deposits. Four-way reversing valve's actuator shall be controlled by a preset time cycle that provides regular tube brushing during equipment operation. Frequency of the brushing cycle shall be set up to match Project requirements.
 4. Components:
 - a. Brush: Each brush shall have nylon bristles, titanium wires, and polypropylene tips. Brush interference fit with the ID of the tube shall not exceed 0.025 inch (0.6 mm).
 - b. Basket: Single-piece polypropylene basket with neck OD to press fit inner diameter of tube. Design shall provide for insertion of eddy current probe or removal of brushes without removing baskets from the valve.
 - c. Four-Way Valve:
 - 1) Construct valve body of carbon steel with internal sealing parts of hard rubber and Type 304 stainless steel.
 - 2) Configure valve with parallel flow connections to minimize field installation piping.
 - 3) Construct to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, at a system working pressure equal to condenser.
 - 4) Pipe connections shall be flanged.
 - 5) Valve manufacturer to test and certify a maximum leakage rate of less than 0.05 percent of the design flow rate at operation conditions of maximum differential pressure.
 - 6) Hydrostatically test to 1.5 times the design working pressure.
 - 7) Design the valve to cause no more than 0.5-psig (3-kPa) pressure drop at design flow conditions.
 - 8) Provide valve with valve-mounted indicating/warning light, which shall light before the valve begins rotation.
 - 9) Valve Actuator: Mount electric actuator to operate valve.
OR
Valve Actuator: Mount pneumatic piston-type actuator to operate valve. Actuator shall be suitable for operation using field-supplied air pressure.
 - 10) Position Switches: Factory mount microswitches on the valve to indicate the complete turn of valve in both normal and reverse flow.
 - d. Control Panel: Factory or field mount a control panel on chiller. Control panel shall include the following features:
 - 1) NEMA 250, Type 1 **OR** Type 4 **OR** Type 4x **OR** Type 12, **as directed**, enclosure.
 - 2) Timer to automatically initiate the cleaning cycle over a 24-hour period.
 - 3) Manual override of preset cleaning cycle.
 - 4) Visual indication of "Power On," "Diverter Position," "Normal Flow," "Reverse Flow," and "Valve Malfunction" indicating a slow turn or incomplete valve turn.

- 5) For pneumatic actuators, mount four-way solenoid valve for actuator operation in the control panel.
- 6) Flow-switch bypass.
- 7) Unloading signal to chiller.

R. Source Quality Control

1. Perform functional tests **OR** run tests, **as directed**, of chillers before shipping.
2. Factory test and inspect absorber, generator, evaporator and condenser according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1. Pressure test tube-side of heat exchangers, including water boxes, to 1.5 times the rated pressure. Vacuum and pressure test shells for leaks.
3. Rate sound power level according to ARI 575.
4. Factory performance test chillers, before shipping, according to ARI 560, **as directed**.
 - a. Test the following conditions:
 - 1) Design conditions indicated.
 - 2) Reduction in capacity from design to minimum load in steps of 10 **OR** 25 **OR** 33, **as directed**, with condenser fluid at design conditions.
OR
Reduction in capacity from design to minimum load in steps of 10 **OR** 25 **OR** 33, **as directed**, with varying entering condenser-fluid temperature from design to minimum conditions in 5 deg F (3 deg C) increments.
OR
At one **OR** two **OR** three **OR** four **OR** five **OR** 10, **as directed**, point(s) of varying part-load performance to be selected by Owner at time of test.
5. Factory sound test chillers, before shipping, according to ARI 575, **as directed**.
 - a. Test the following conditions:
 - 1) Design conditions indicated.
 - 2) Chiller operating at calculated worst-case sound condition.
 - 3) At one **OR** two **OR** three **OR** four **OR** five, **as directed**, point(s) of varying part-load performance to be selected by Owner at time of test.
6. Allow Owner access to place where chillers are being tested. Notify the Owner 14 days in advance of testing.
7. Prepare test report indicating test procedures, instrumentation, test conditions, and results. Submit copy of results within one week of test date.

1.3 EXECUTION

A. Chiller Installation

1. Install chillers on support structure indicated.
2. Equipment Mounting: Install chiller on concrete bases using elastomeric pads. Comply with requirements for concrete bases specified in Division 03 Section "Cast-in-place Concrete". Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1/2 inch (13 mm), **as directed**.
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - c. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Equipment Mounting: Install chiller using elastomeric pads. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".

- a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1/2 inch (13 mm), **as directed**.
 4. Equipment Mounting: Install chiller on concrete bases. Comply with requirements for concrete bases specified in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
 5. Install chillers with seismic-restraint device. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 6. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 7. Maintain manufacturer's recommended clearances for service and maintenance.
 8. Charge chiller with absorbent and refrigerant if not factory charged.
 9. Install separate devices furnished by manufacturer and not factory installed.
 10. Insulate hot and cold chiller surfaces that are recommended by chiller manufacturer to be insulated, and are not factory insulated. Comply with requirements in Division 23 Section "Hvac Insulation".
- B. Heat-Exchanger, Brush-Cleaning System Installation
1. Install brush-cleaning system control panel adjacent to chiller control panel.
 2. Arrange piping to provide service access to four-way valve assembly without affecting access to chiller. Secure valve to prevent lateral movement and vibration during operation.
 3. Provide field electric power, as required, to each system control panel and electric actuated valve.
 4. Provide pneumatic piping with pressure regulator and isolation valve to each pneumatic supply connection. Coordinate field source of air with manufacturer to ensure that requirements are satisfied for proper valve operation.
 5. Interconnect brush-cleaning system controls with chiller controls. Coordinate requirements to ensure safe, trouble-free operation.
 6. Functionally test the entire brush-cleaning system, including the valve, actuator, position indicator, and control panel, with chiller in operation.
- C. Connections
1. Comply with requirements in Division 23 Section "Hydronic Piping" for hydronic piping. Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Comply with requirements in Division 23 Section "Steam And Condensate Heating Piping" for steam and condensate piping. Drawings indicate general arrangement of piping, fittings, and specialties.
 3. Install piping adjacent to chiller to allow service and maintenance.
 4. Generator Steam Piping Connections:
 - a. Connect steam piping with trapped drip leg, gate valve, strainer, control valve, and pressure gage. Install pressure reducing valve and safety relief valve upstream from steam-control valve to protect control valve from excessive steam pressure. Make connections to chiller with a flange **OR** union, **as directed**.
 - b. Connect steam condensate piping with vacuum breaker, trapped drip leg, gate valve, strainer, float and thermostatic trap(s), condensate cooler, **as directed**, condensate receiver, **as directed**, condensate receiver and pump, **as directed**, and check valve. Make connections to chiller with a flange **OR** union, **as directed**.
 5. Generator Hot-Water Connections: Connect to generator inlet with shutoff valve, strainer, **as directed**, flexible connector, **as directed**, control valve, thermometer, and plugged tee with shutoff valve and pressure gage. Connect to generator outlet with shutoff valve, check valve, balancing valve, flexible connector, **as directed**, flow switch, thermometer, plugged tee with



shutoff valve and pressure gage, flow meter, **as directed**, and drain connection with valve. Make connections to chiller with a flange **OR** mechanical coupling, **as directed**.

6. Evaporator-Fluid Connections: Connect to evaporator inlet with shutoff valve, strainer, **as directed**, flexible connector, **as directed**, thermometer, and plugged tee with shutoff valve and pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, **as directed**, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, flow meter, **as directed**, and drain connection with valve. Make connections to chiller with a flange **OR** mechanical coupling, **as directed**.
7. Absorber/Condenser-Fluid Connections: Connect to inlet with shutoff valve, strainer, **as directed**, flexible connector, **as directed**, thermometer, and plugged tee with shutoff valve and pressure gage. Connect to outlet with shutoff valve, balancing valve, flexible connector, **as directed**, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, flow meter, **as directed**, and drain connection with valve. Make connections to chiller with a flange **OR** mechanical coupling, **as directed**.
 - a. If not factory furnished or installed, provide pipe connecting fluid connection of absorber discharge and condenser inlet.
8. Refrigerant Pressure Relief Device Connections: Extend vent piping **OR** separate vent piping for each chiller, **as directed**, to the outdoors without valves or restrictions. Comply with ASHRAE 15. Connect to chiller pressure relief device with flexible connector and dirt leg with drain valve.
9. Extend purge vent piping **OR** separate purge vent piping for each chiller, **as directed**, to the outdoors. Comply with ASHRAE 15.
10. Connect each chiller drain connection with a union and drain pipe, and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection.

D. Startup Service

1. Engage a factory-authorized service representative to perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.
 - b. Operate chiller for run-in period.
 - c. Verify that absorbent and refrigerant charge is sufficient and chiller has been leak tested.
 - d. Verify that pumps are installed and functional.
 - e. Verify that thermometers and gages are installed.
 - f. Operate chiller for run-in period.
 - g. Verify that refrigerant pressure relief device is vented outside.
 - h. Verify proper motor rotation.
 - i. Verify static deflection of vibration isolators including deflection during chiller startup and shutdown.
 - j. Verify and record performance of fluid flow and low-temperature interlocks for evaporator and condenser.
 - k. Verify and record performance of chiller protection devices.
 - l. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
2. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assembly, installation, and connection.
3. Prepare test and inspection startup reports.

E. Demonstration

1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chillers.

END OF SECTION 23 62 13 00



Task	Specification	Specification Description
23 62 23 00	23 01 60 00	Condensing Units



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SECTION 23 63 13 00 - AIR-COOLED CONDENSERS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for air-cooled condensers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes packaged, air-cooled condensers for outdoor and indoor installation.

C. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Signed and sealed by a qualified professional engineer.
 - a. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints, **as directed**, and for designing vibration isolation bases.
 - b. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails and equipment mounting frames.
 - c. Wiring Diagrams: Power, signal, and control wiring.
3. Manufacturer Seismic Qualification Certification: Submit certification that air-cooled condensers, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment". Include the following:
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
4. Field quality-control test reports.
5. Operation and maintenance data.
6. LEED Submittal:
 - a. Product Data for Credit EA 4: Documentation required by Credit EA 4 indicating that equipment and refrigerants comply.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Fabricate and label refrigeration system according to ASHRAE 15, "Safety Code for Mechanical Refrigeration."
3. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.2 PRODUCTS**A. Manufactured Units**

1. Description: Factory assembled and tested; consisting of casing, condenser coils, condenser fans and motors, and unit controls.
2. Condenser Coil: Seamless copper-tube, finned coil; factory tested at 425 psig (2930 kPa).
 - a. Coil Fin: Aluminum **OR** Copper, **as directed**.
 - b. Coil Coating: **As directed**.
 - c. Circuit: To match compressors with liquid subcooling coil, **as directed**.
 - d. Refrigerant Accessories, **as directed**: Provide receiver, pressure control, and solenoid valve for each circuit.

3. Condenser Fans and Drives: Propeller fans with aluminum or galvanized-steel **OR** galvanized-steel **OR** stainless-steel, **as directed**, fan blades, for vertical **OR** horizontal, **as directed**, air discharge; directly driven with permanently lubricated ballbearing motors with integral current- and thermal-overload protection.
OR
Condenser Fans and Drives: Forward-curved centrifugal fans for vertical **OR** horizontal, **as directed**, air discharge.
 - a. Fan on steel shaft with self-aligning ball bearings.
 - b. V-belt drive with minimum of two belts; variable pitch drive pulley.
 - c. Motor mounted on adjustable slide base.
4. Operating and Safety Controls: Include condenser fan motor thermal and overload cutouts; 115-V control transformer, if required; magnetic contactors for condenser fan motors and a nonfused factory-mounted and -wired disconnect switch for single external electrical power connection.
5. Unit Casings: Galvanized or zinc-coated steel treated and finished with manufacturer's standard paint coating **OR** Stainless steel, **as directed**, designed for outdoor installation with weather protection for components and controls **OR** indoor installation, **as directed**, and with the following:
 - a. Removable panels for access to controls, condenser fans, motors, and drives.
 - b. Plated-steel **OR** Stainless-steel, **as directed**, fan guards.
 - c. Lifting eyes.
 - d. Removable legs.
 - e. 1-inch- (25-mm-) thick inlet filter.

B. Motors

1. General requirements for motors are specified in Division 14 Section "Facility Chutes".
 - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 22.

C. Source Quality Control

1. Verification of Performance: Rate air-cooled condensers according to ARI 460.
2. Testing Requirements: Factory test sound-power-level ratings according to ARI 270.

1.3 EXECUTION

A. Installation

1. Install units level and plumb, firmly anchored in locations indicated; maintain manufacturer's recommended clearances.
2. Install air-cooled condensers on concrete base. Concrete base is specified in Division 23 Section "Common Work Results For Hvac" and concrete materials and installation requirements are specified in Division 31.
3. Concrete Bases:
 - a. Install dowel rods to connect concrete base to concrete slab. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of the base.
 - b. For equipment supported on structural slab, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - e. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
4. Install roof-mounting units on equipment supports specified in Division 07.

5. Vibration Isolation: Mount air-cooled condensers on rubber pads with a minimum deflection of 1/4 inch (6.35 mm). Vibration isolation devices and installation requirements are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
OR
Vibration Isolation: Mount air-cooled condensers on restrained spring isolators with a minimum deflection of <Insert measurement>. Vibration isolation devices and installation requirements are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 6. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch (25 mm). Vibration- and seismic-control devices are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Secure vibration and seismic controls, and suspended units to structure.**OR**
Support suspended units from structure using threaded steel rods.
 7. Maintain manufacturer's recommended clearances for service and maintenance.
 8. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.
- B. Connections
1. Piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Install piping adjacent to machine to allow service and maintenance.
 3. Refrigerant Piping: Connect piping to unit with pressure relief, service valve, filter-dryer, and moisture indicator on each refrigerant-circuit liquid line. Refrigerant piping and specialties are specified in Division 23 Section "Refrigerant Piping".
- C. Field Quality Control
1. Perform the following field tests and inspections and prepare test reports:
 - a. Perform electrical test and visual and mechanical inspection.
 - b. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - c. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Complete manufacturer's starting checklist.
 - d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - e. Verify proper airflow over coils.
 2. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.
 3. Remove and replace malfunctioning air-cooled condensers and retest as specified above.
- D. Startup Service
1. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
 - a. Inspect for physical damage to unit casing.
 - b. Verify that access doors move freely and are weathertight.
 - c. Clean units and inspect for construction debris.
 - d. Verify that all bolts and screws are tight.
 - e. Adjust vibration isolation and flexible connections.
 - f. Verify that controls are connected and operational.
 2. Lubricate bearings on fans.
 3. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
 4. Start unit according to manufacturer's written instructions and complete manufacturer's startup checklist.
 5. Measure and record airflow over coils.
 6. Verify proper operation of capacity control device.



7. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.
 8. After startup and performance test, lubricate bearings.
- E. Demonstration
1. Train Owner's maintenance personnel to adjust, operate, and maintain air-cooled condensers.

END OF SECTION 23 63 13 00



Task	Specification	Specification Description
23 63 13 00	23 01 60 00	Condensing Units



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SECTION 23 64 13 16 - DIRECT-FIRED ABSORPTION WATER CHILLERS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for direct-fired absorption water chillers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Packaged, water-cooled, direct-fired absorption chillers.
 - b. Heat-exchanger, brush-cleaning system.

C. Definitions

1. BAS: Building automation system.
2. COP: Coefficient of performance. The ratio of the rate of heat removal to the rate of energy input using consistent units for any given set of rating conditions.
3. IPLV: Integrated part-load value. A single-number, part-load efficiency figure of merit calculated per the method defined by ARI 560 and referenced to ARI standard rating conditions.
4. NPLV: Nonstandard part-load value. A single-number, part-load efficiency figure of merit calculated per the method defined by ARI 560 and intended for operating conditions other than the ARI standard rating conditions.

D. Performance Requirements

1. Seismic Performance: Direct-fired absorption chillers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Condenser-Fluid Temperature Performance:
 - a. Startup Condenser-Fluid Temperature: Chiller shall be capable of starting with an entering condenser-fluid temperature of 60 deg F (16 deg C) and providing stable operation until the system temperature is elevated to the minimum operating entering condenser-fluid temperature.
 - b. Minimum Operating Condenser-Fluid Temperature: Chiller shall be capable of continuous operation over the entire capacity range indicated with an entering condenser-fluid temperature of 70 deg F (21 deg C).
 - c. Make factory modifications to standard chiller design if necessary to comply with performance indicated.
3. Site Altitude: Chiller shall be suitable for altitude at which it is installed without affecting performance indicated. Make adjustments to affected chiller components to account for site altitude.
4. Performance Tolerance: Comply with the following in lieu of ARI 560:
 - a. Allowable Capacity Tolerance: Zero percent.
 - b. Allowable IPLV/NPLV Performance Tolerance: Zero percent.

E. Submittals

1. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, furnished specialties and accessories, and the following:
 - a. Performance at ARI standard conditions and at conditions indicated.
 - b. Performance at ARI standard unloading conditions.
 - c. Minimum evaporator flow rate.

- d. Absorbent capacity of chiller.
- e. Refrigerant capacity of chiller.
- f. Fluid capacity of evaporator and condenser.
- g. Fluid capacity of generator.
- h. Characteristics of safety relief devices.
- i. Minimum entering condenser-fluid temperature.
- j. Performance at varying capacities with constant design condenser-fluid temperature. Repeat performance at varying capacities for different condenser-fluid temperatures from design to minimum in 5 deg F (3 deg C) increments.
- k. If equipped, fluid capacity of dedicated hot-water heater exchanger.
- l. Combustion-air flow.
- m. Exhaust gas airflow.
- n. Exhaust gas minimum and maximum operating temperature.
- 2. LEED Submittals:
 - a. Product Data for Prerequisite EA 2: Documentation indicating that units comply with applicable requirements in ASHRAE/IESNA 90.1.
 - b. Product Data for Prerequisite EA 3: Documentation indicating that refrigerants comply.
 - c. Product Data for Credit EA 4: Documentation indicating that equipment and refrigerants comply.
- 3. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, load distribution, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
 - c. Insulated Surface Diagrams: Indicating cold and hot surfaces requiring field-applied insulation with area tabulated for each.
- 4. Coordination Drawings: Floor plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - a. Structural supports.
 - b. Piping roughing-in requirements.
 - c. Wiring roughing-in requirements, including spaces reserved for electrical equipment.
 - d. Access requirements, including working clearances for mechanical controls and electrical equipment, and clearances for tube pull and service.
- 5. Certificates: For certification required in "Quality Assurance" Article.
- 6. Seismic Qualification Certificates: For chillers, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- 7. Source quality-control reports.
- 8. Startup service reports.
- 9. Operation and Maintenance Data: For each chiller to include in emergency, operation, and maintenance manuals.
- 10. Warranty: Sample of special warranty.

F. Quality Assurance

- 1. ARI Rating: Rate chiller performance according to requirements in ARI 560.
- 2. ASHRAE Compliance:
 - a. ASHRAE 15 for safety code for mechanical refrigeration.
 - b. ASHRAE/IESNA 90.1.
- 3. ASME Compliance: Fabricate and label chiller pressure vessels to comply with applicable portions of ASME Boiler and Pressure Vessel Code.
- 4. Comply with NFPA 70.

5. Comply with requirements of UL and UL Canada, and include label by a qualified testing agency showing compliance.
 - a. UL Compliance: UL 726, "Oil-Fired Boiler Assemblies" **OR** UL 726, "Oil-Fired Boiler Assemblies"; and UL 795, "Commercial-Industrial Gas Heating Equipment" **OR** UL 795, "Commercial-Industrial Gas Heating Equipment", **as directed**.
- G. Delivery, Storage, And Handling
 1. Ship chillers factory charged with nitrogen.
 2. Ship absorbent and refrigerant in chillers or in containers separate from chillers.
OR
Ship absorbent and refrigerant in containers separate from chillers.
 3. Package chiller for export shipping in totally enclosed bagging **OR** crate **OR** crate with bagging, **as directed**.
- H. Coordination
 1. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases.
 2. Coordinate sizes, locations, and anchoring attachments of structural-steel support structures.
- I. Warranty
 1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of chillers that fail in materials or workmanship within specified warranty period.
 - a. Extended warranties include, but are not limited to, the following:
 - 1) Complete chiller.
OR
Pumps and motors **OR** Purge unit **OR** Burner assembly, **as directed**.
OR
Absorbent **OR** Absorbent and refrigerant, **as directed**, only.
 - 2) Parts only **OR** only and labor, **as directed**.
 - 3) Loss of absorbent and refrigerant for any reason.
 - b. Warranty Period: Two **OR** Three **OR** Four **OR** Five, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

- A. Manufactured Unit
 1. Description: Factory-assembled and -tested, hermetic-design chiller complete with absorber, evaporator, condenser, generator, solution heat exchanger, controls, absorbent solution pump with motor, refrigerant pump with motor, purge unit with motor, burner assembly, motor controllers, rupture disk, interconnecting unit piping and wiring, indicated accessories, and mounting frame.
 - a. Disassemble chiller into major assemblies, as required by the installation, after factory testing and before packaging for shipment.
 2. Absorbent and Refrigerant:
 - a. Absorbent: Lithium bromide solution with corrosion inhibitor.
 - b. Refrigerant: Deionized or distilled, **as directed**, water.
 - c. Performance Enhancer: Heat and mass transfer enhancer to improve performance.
 3. Seismic Fabrication Requirements: Fabricate mounting base and attachment to chiller, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" when mounting base is anchored to building structure.
- B. Pumps

1. Hermetically sealed, self-lubricating, and fitted with self-adjusting, spring-loaded, wear-compensating, tapered carbon bearings.
2. Pump motor assembly shall be designed to operate for not less than 50,000 hours between inspections.
3. Pump motors shall be cooled and bearings lubricated, either by fluid being pumped or by a filtered supply of liquid refrigerant.
4. Pump suction and discharge shall be equipped with isolation valves.
5. Absorbent solution and refrigerant shall have separate and dedicated pumps.
 - a. Absorbent solution and refrigerant flow-control method shall be manufacturer's choice to comply with operating requirements indicated.
6. Purge System: Unit mounted and factory wired, equipped with controls and a pump to automatically remove noncondensable vapors.
 - a. Purge Pump Motor: Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Enclosure: Open dripproof **OR** Totally enclosed, **as directed**.

C. Heat-Exchanger Shells

1. Configuration: Two shells; one shell consists of the absorber/evaporator, low-stage generator/condenser and the other shell consists of the high-stage generator. Where indicated, equip chiller with a dedicated hot-water heat exchanger.
2. Construction: Fabricated from continuously welded carbon-steel sheet or plate, or from seamless pipe.
3. Design Pressure and Temperature Rating: Comply with applicable requirements in ASME Boiler and Pressure Vessel Code.
4. End Tube Sheets: Carbon-steel plates continuously welded to each end of shell; drilled and reamed to accommodate tubes, with positive seal between fluid in tubes and refrigerant in shell.
5. Intermediate Tube Sheets: Carbon-steel plates installed in shell and spaced along length of tube at intervals required to eliminate vibration and to avoid tube contact resulting in abrasion and wear.
6. Generator/Condenser Shell Pressure Relief Device: Manufacturer's standard rupture disk complying with requirements in ASHRAE 15 and in applicable portions of ASME Boiler and Pressure Vessel Code.

D. Absorber

1. Nozzle or Dispersion Trays: Designed to evenly distribute absorbent solution over tubes; constructed of brass, stainless steel, or another material that will not corrode.
2. Tubes:
 - a. Individually replaceable, straight tubes expanded into tube sheets. Replaceable from either end without damage to tube sheets and other tubes.
 - b. Material: Copper **OR** Copper-nickel alloy, **as directed**.
 - c. Minimum Wall Thickness: Manufacturer's choice **OR** 0.025 inch (0.6 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.
 - d. External Finish: Manufacturer's standard.
 - e. Internal Finish: Enhanced **OR** Smooth, **as directed**.
3. Water Boxes:
 - a. Carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - b. Standard **OR** Marine-type, **as directed**, water box with piping connections.
 - 1) Water boxes and marine-type water-box covers, **as directed**, shall have lifting lugs or eyebolts.
 - 2) Hinged **OR** Davited, **as directed**, water boxes.
OR
Hinged **OR** Davited, **as directed**, marine-type water-box covers.
 - c. Standard water box without piping connections.

- 1) Water boxes shall have lifting lugs or eyebolts.
 - 2) Hinged **OR** Davited, **as directed**, water boxes.
 - d. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - e. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - f. Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
 4. Additional Corrosion Protection:
 - a. Electrolytic corrosion-inhibitor anode.
 - b. Coat wetted surfaces with a corrosion-resistant finish.
OR
Using same material as tubes, clad surfaces of end tube sheets in contact with fluid. Coat other wetted surfaces, including water boxes, with a corrosion-resistant finish.
 5. Absorber/Condenser Crossover Piping: Factory-furnished and -installed piping connecting fluid connection of absorber discharge to condenser inlet.
- E. Evaporator
1. Nozzle or Dispersion Trays: Designed to evenly distribute refrigerant over tubes; constructed of brass, stainless steel, or another material that will not corrode.
 2. Refrigerant Holding Pan: Steel or stainless steel.
 3. Tubes:
 - a. Individually replaceable, straight tubes expanded into tube sheets. Replaceable from either end without damage to tube sheets and other tubes.
 - b. Material: Copper **OR** Copper-nickel alloy, **as directed**.
 - c. Minimum Wall Thickness: Manufacturer's choice **OR** 0.025 inch (0.6 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.
 - d. External Finish: Manufacturer's standard.
 - e. Internal Finish: Enhanced **OR** Smooth, **as directed**.
 4. Water Boxes:
 - a. Carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - b. Standard **OR** Marine-type, **as directed**, water box with piping connections.
 - 1) Water boxes and marine-type water-box covers, **as directed**, shall have lifting lugs or eyebolts.
 - 2) Hinged **OR** Davited, **as directed**, water boxes.
OR
Hinged **OR** Davited, **as directed**, marine-type water-box covers.
 - c. Standard water box without piping connections.
 - 1) Water boxes shall have lifting lugs or eyebolts.
 - 2) Hinged **OR** Davited, **as directed**, water boxes.
 - d. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - e. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - f. Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
- F. Condenser
1. Refrigerant Holding Pan: Steel or stainless steel.
 2. Tubes:
 - a. Individually replaceable, straight tubes expanded into tube sheets. Replaceable from either end without damage to tube sheets and other tubes.
 - b. Material: Copper **OR** Copper-nickel alloy, **as directed**.
 - c. Minimum Wall Thickness: Manufacturer's choice **OR** 0.025 inch (0.6 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.

- d. External Finish: Manufacturer's standard.
- e. Internal Finish: Enhanced **OR** Smooth, **as directed**.
- 3. Water Boxes:
 - a. Carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - b. Standard **OR** Marine-type, **as directed**, water box with piping connections.
 - 1) Water boxes and marine-type water-box covers, **as directed**, shall have lifting lugs or eyebolts.
 - 2) Hinged **OR** Davited, **as directed**, water boxes.
OR
Hinged **OR** Davited, **as directed**, marine-type water-box covers.
 - c. Standard water box without piping connections.
 - 1) Water boxes shall have lifting lugs or eyebolts.
 - 2) Hinged **OR** Davited, **as directed**, water boxes.
 - d. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - e. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - f. Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
- 4. Additional Corrosion Protection:
 - a. Electrolytic corrosion-inhibitor anode.
 - b. Coat wetted surfaces with a corrosion-resistant finish.
OR
Using same material as tubes, clad surfaces of end tube sheets in contact with fluid. Coat other wetted surfaces, including water boxes, with a corrosion-resistant finish.

G. First-Stage Generator

- 1. Tubes:
 - a. Replaceable, **as directed**, straight, or U tubes expanded into tube sheets.
 - b. Material: Manufacturer's standard **OR** Steel, **as directed**.
 - c. Minimum Wall Thickness: Manufacturer's choice.
 - d. External Finish: Manufacturer's standard.
 - e. Internal Finish: Manufacturer's choice; enhanced or smooth.
- 2. Water Boxes:
 - a. Carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - b. Standard water box.
 - c. Water boxes shall have lifting lugs or eyebolts.
 - d. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - e. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - f. Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.

H. Second-Stage Generator

- 1. Tubes:
 - a. Individually replaceable, straight tubes expanded into tube sheets. Replaceable from either end without damage to tube sheets and other tubes.
 - b. Material: Copper **OR** Copper-nickel alloy, **as directed**.
 - c. Minimum Wall Thickness: Manufacturer's choice **OR** 0.025 inch (0.6 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.
 - d. External Finish: Manufacturer's standard.
 - e. Internal Finish: Manufacturer's standard.

2. Water Boxes:
 - a. Carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - b. Standard type.
 - c. Water boxes shall have lifting lugs or eyebolts.
 - d. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - e. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - f. Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
- I. Dedicated Hot-Water Heat Exchanger
 1. Tubes:
 - a. Individually replaceable, straight tubes expanded into tube sheets. Replaceable from either end without damage to tube sheets and other tubes.
 - b. Material: Copper **OR** Copper-nickel alloy, **as directed**.
 - c. Minimum Wall Thickness: Manufacturer's choice **OR** 0.025 inch (0.6 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.
 - d. External Finish: Manufacturer's standard.
 - e. Internal Finish: Manufacturer's standard.
 2. Water Boxes:
 - a. Carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - b. Standard type.
 - c. Water boxes shall have lifting lugs or eyebolts.
 - d. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - e. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - f. Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
- J. Solution Heat Exchanger
 1. Description: Shell-and-tube or brazed-plate heat exchanger, an integral part of chiller, increases cycle efficiency by preheating the weak solution on its way to the generator while precooling the strong solution returning from the generator.
- K. Burner Assembly
 1. Burner: Welded construction with multivane, stainless-steel, flame-retention diffuser suitable for natural gas **OR** propane **OR** fuel oil, **as directed**. Mount burner on hinged access door to permit access to combustion chamber, **as directed**.
 2. Blower: Centrifugal fan integral to burner, directly driven by motor; with adjustable damper assembly and locking quadrant to set air-fuel ratio.
 - a. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 3. Oil Supply: Control devices and modulating control sequence shall comply with requirements of ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.
 - a. Oil Pump: Two-stage, gear-type oil pump shall be capable of producing 300-psig (2070-kPa) discharge pressure and 15-in. Hg (50.7-kPa) vacuum.
 - b. Oil Piping Specialties:
 - 1) Suction-line, manual, gate valve.
 - 2) Removable-mesh oil strainer.



- 3) 0- to 30-in. Hg (0- to 101.3-kPa) vacuum; 0- to 30-psig (0- to 207-kPa) vacuum-pressure gage.
- 4) 0- to 300-psig (0- to 2070-kPa) oil-nozzle pressure gage.
- 5) Nozzle-line, solenoid-safety-shutoff oil valve.
4. Oil Pilot: Intermittent-electric-spark **OR** Interrupted-electric-spark, **as directed**, pilot ignition with 100 percent main-valve and pilot-safety shutoff solenoid with cadmium sulfide **OR** UV scanner, **as directed**, flame-safety control.
5. Gas Train: Control devices and modulating control sequence shall comply with requirements of ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.
6. Gas Pilot: Intermittent-electric-spark **OR** Interrupted-electric-spark, **as directed**, pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.
7. Burner assembly shall be equipped to limit nitrogen oxide emissions to 20 **OR** 30, **as directed**, ppm.

L. Electrical

1. Factory installed and wired, and functionally tested at factory before shipment.
2. Single-point, field-power connection to fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**. Minimum withstand rating shall be as required by electrical power distribution system, but not less than 42,000 **OR** 65,000, **as directed**, A.
 - a. Branch power circuit to each motor, dedicated electrical load, and to controls with disconnect switch or circuit breaker, **as directed**.
 - 1) NEMA KS 1, heavy-duty fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
 - 2) NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit-trip set point.
 - b. NEMA ICS 2, Class A, full-voltage, nonreversing motor controller, hand-off-auto switch, and overcurrent protection for each motor.
 - c. Control-circuit transformer with primary and secondary side fuses.
3. Terminal blocks with numbered and color-coded, **as directed**, wiring to match wiring diagram. Spare wiring terminal block for connection to external controls or equipment.
4. Wiring Outside of Enclosures: Factory installed in metal raceway except make terminal connections with not more than a 24-inch (610-mm) length of liquidtight **OR** flexible metallic, **as directed**, conduit.

M. Controls

1. Chiller control panel shall be separate from burner control panel.
2. Burner Control Panel: Factory or field, **as directed**, mounted. Maintains safe operating conditions, burner safety limits, burner operation, and interface with chiller controls; include the following components:
 - a. On-off switch.
 - b. Flame safeguard.
 - c. Contacts for remote monitoring of flame failure.
 - d. Contacts for proof of combustion air.
 - e. Exhaust gas temperature limit switch.
 - f. Control-circuit transformer.
 - g. Burner motor controls.
 - h. Fuel-oil pump controls, if chiller is equipped with fuel-oil pump.
 - i. Visual indication of on/off status of ignition, blower, and main fuel.
 - j. Alarm bell.
3. Control: Standalone and microprocessor based, with all memory stored in nonvolatile memory so that reprogramming is not required on loss of electrical power.
4. Enclosure: Unit mounted, NEMA 250, Type 1 **OR** Type 4 **OR** Type 4x, **as directed**, hinged or lockable.

5. Operator Interface: Multiple-character digital or graphic display with dynamic update of information and with keypad or touch-sensitive display located on front of control enclosure. Display the following information in either imperial or metric units selectable through the interface:
 - a. Date and time.
 - b. Operating or alarm status.
 - c. Operating hours.
 - d. Outdoor-air temperature if required for chilled-water reset.
 - e. Temperature and pressure of operating set points.
 - f. Entering and leaving temperatures of chilled and condenser water.
 - g. Refrigerant temperature.
 - h. Solution concentration and temperature.
 - i. Indication of solution and purge-pump operation.
 - j. Generator shell pressure.
 - k. Number of starts.
 - l. Number of purge cycles.
 - m. Entering and leaving hot-water temperatures.
 - n. Burner firing rate displayed in percent.
6. Control Functions:
 - a. Manual or automatic startup and shutdown time schedule.
 - b. Automatic cycle to prevent crystallization.
 - c. Entering and leaving chilled-water temperatures and control set points. Chilled-water temperature shall be reset based on return-water **OR** outdoor-air **OR** space, **as directed**, temperature.
 - d. Entering and leaving hot-water temperatures and control set points. Hot-water temperature shall be reset based on return-water **OR** outdoor-air **OR** space, **as directed**, temperature.
 - e. Condenser-fluid temperature.
 - f. Cooling provided and heating energy used within programmable time periods, minimum monthly.
 - g. Heating provided and heating energy used within programmable time periods, minimum monthly.
7. Capacity Control: Automatically controls burner firing rate to maintain chilled-water temperature set point for cooling loads and heating-water temperature set point for heating loads ranging from 30 to 100 percent.
8. Safety Shutdowns: Chiller shall automatically shut down and require manual restart. Display a message following each safety shutdown.
 - a. Crystallization.
 - b. Low refrigerant temperature.
 - c. Loss of chilled- or condenser-water flow.
 - d. Low leaving chilled-water temperature, 2 deg F (1 deg C) below set point.
 - e. First-stage generator low-solution level.
 - f. First-stage generator high temperature or pressure.
 - g. Burner alarm or control malfunction.
 - h. Power failure.
 - i. Solution pump overloads.
 - j. External auxiliary safety shutdown.
 - k. High solution concentration.
 - l. Incomplete dilution cycle.
9. Warning Conditions: Chiller shall remain operational but inhibit burner firing rate to prevent safety shutdown. Control panel shall close warning contacts and generate a message when one of the following operating conditions is detected:
 - a. Low refrigerant temperature.
 - b. High generator temperature or pressure.
 - c. High or low entering condenser-water temperature.
 - d. Solution temperature sensor failure.
 - e. Low chilled-water flow.

- f. Purge-pump current overload.
- 10. Cycling Shutdowns: Permit automatic restart when preprogrammed limits are reached. Display a message following each cycle shutdown.
 - a. Cooling Mode:
 - 1) Loss of condenser-water flow.
 - 2) Low leaving chilled-water temperature.
 - 3) Power failure.
 - b. Heating Mode:
 - 1) Loss of hot-water flow.
 - 2) High leaving hot-water temperature.
 - 3) Power failure.
- 11. Trending: Capability to trend analog data up to five parameters simultaneously over an adjustable period and frequency of polling.
- 12. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: view only; view and operate; and view, operate, and service.
- 13. Control Authority: At least four conditions: Off, local manual control at chiller, local automatic control at chiller, and automatic control through a remote source.
- 14. Communication Port: RS-232 port, USB 2.0 port, or equivalent connection capable of connecting a printer and a notebook computer.
- 15. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display chiller status and alarms.
 - a. Hardwired Points:
 - 1) Monitoring: On-off status, common trouble alarm.
 - 2) Control: On-off operation, chilled-water, discharge temperature set-point adjustment **OR** hot-water, discharge temperature set-point adjustment, **as directed**.
 - b. ASHRAE 135 (BACnet) **OR** LonTalk **OR** Modbus **OR** Industry-accepted, open-protocol, **as directed**, communication interface with the BAS shall enable the BAS operator to remotely control and monitor the chiller from an operator workstation. Control features and monitoring points displayed locally at chiller control panel shall be available through the BAS.

N. Finish

- 1. Paint chiller, using manufacturer's standard procedures, except comply with the following minimum requirements:
 - a. Provide at least one coat of primer with a total dry film thickness of at least 2 mils (0.05 mm).
 - b. Provide at least two coats of alkyd-modified, vinyl enamel **OR** epoxy **OR** polyurethane, **as directed**, finish with a total dry film thickness of at least 4 mils (0.10 mm).
 - c. Paint surfaces that are to be insulated before applying the insulation.
 - d. Paint installed insulation to match adjacent uninsulated surfaces.
 - e. Color of finish coat to be manufacturer's standard **OR** custom color selected by the Owner.

O. Accessories

- 1. Sight Glasses: Equip unit with sight glasses for visual inspection of absorbent solution and refrigerant levels. Provide at least one sight glass in absorber and evaporator sections.
- 2. Flow Switches:
 - a. Chiller manufacturer shall furnish a switch for each condenser **OR** evaporator and condenser, **as directed**, and shall verify field-mounting location before installation.
 - b. Paddle Flow Switches:
 - 1) Vane operated to actuate a double-pole, double-throw switch with one pole field wired to the chiller control panel and the other pole field wired to the BAS.
 - 2) Contacts: Platinum alloy, silver alloy, or gold-plated switch contacts with a rating of 10 A at 120-V ac.
 - 3) Pressure rating equal to pressure rating of heat exchanger.

- 4) Construct body and wetted parts of Type 316 stainless steel.
 - 5) House switch in an NEMA 250, Type 4 enclosure constructed of die-cast aluminum.
 - 6) Vane length to suit installation.
 - c. Pressure Differential Switches:
 - 1) Construction: Wetted parts of body and trim constructed of Type 316 stainless steel.
 - 2) Performance: Switch shall withstand, without damage, the full-pressure rating of the heat exchanger applied to either port and exhibit zero set point shift due to variation in working pressure.
 - 3) Set Point: Screw type, field adjustable.
 - 4) Electrical Connections: Internally mounted, screw-type terminal blocks.
 - 5) Switch Enclosure: NEMA 250, Type 4.
 - 6) Switch Action: Double-pole, double-throw switch with one pole field wired to the chiller control panel and the other pole field wired to the BAS.
 3. Vibration Isolation:
 - a. Chiller manufacturer shall furnish neoprene-pad vibration isolation for each chiller.
 - 1) Two layers of 0.375-inch- (10-mm-) thick, ribbed- or waffle-pattern neoprene pads separated by a 16-gage, stainless-steel plate.
 - 2) Fabricate pads from 40- to 50-durometer neoprene.
 - 3) Provide stainless-steel square bearing plate to load the pad uniformly between 20 and 40 psig (138 and 276 kPa) with a 0.12- to 0.16-inch (3- to 4-mm) deflection.
- P. Heat-Exchanger, Brush-Cleaning System
1. Furnish for field installation a brush-cleaning system on each chiller condenser for tube cleaning and improved heat transfer.
 2. System shall maintain tube fouling at or below design conditions without interrupting normal equipment operation.
 3. System shall consist of a brush inserted in each tube and a catch basket attached to each end of the tube. A four-way valve shall operate to reverse the direction of water flow to push the brush through the tube while removing tube deposits. Four-way reversing valve's actuator shall be controlled by a preset time cycle that provides regular tube brushing during equipment operation. Frequency of the brushing cycle shall be set up to match Project requirements.
 4. Components:
 - a. Brush: Each brush shall have nylon bristles, titanium wires, and polypropylene tips. Brush interference fit with the ID of the tube shall not exceed 0.025 inch (0.6 mm).
 - b. Basket: Single-piece polypropylene basket with neck OD to press fit inner diameter of tube. Design shall provide for insertion of eddy current probe or removal of brushes without removing baskets from the valve.
 - c. Four-Way Valve:
 - 1) Construct valve body of carbon steel with internal sealing parts of hard rubber and Type 304 stainless steel.
 - 2) Configure valve with parallel flow connections to minimize field installation piping.
 - 3) Construct valve to comply with ASME Boiler and Pressure Vessel Code , at a system working pressure equal to condenser.
 - 4) Pipe connections shall be flanged.
 - 5) Valve manufacturer to test and certify a maximum leakage rate of less than 0.05 percent of the design flow rate at operation conditions of maximum differential pressure.
 - 6) Hydrostatically test valve to 1.5 times the design working pressure.
 - 7) Design the valve to cause no more than 0.5-psig (3-kPa) pressure drop at design flow conditions.
 - 8) Provide valve with valve-mounted indicating/warning light, which shall light before the valve begins rotation.
 - 9) Valve Actuator: Mount electric actuator to operate valve.
OR
Valve Actuator: Mount pneumatic piston-type actuator to operate valve. Actuator shall be suitable for operation using field-supplied air pressure.

- 10) Position Switches: Factory mount microswitches on valve to indicate the complete turn of valve in both normal and reverse flow.
- d. Control Panel: Factory or field mount a control panel on chiller. Control panel shall include the following features:
 - 1) NEMA 250, Type 1 **OR** Type 4 **OR** Type 4x **OR** Type 12, **as directed**, enclosure.
 - 2) Timer to automatically initiate the cleaning cycle over a 24-hour period.
 - 3) Manual override of preset cleaning cycle.
 - 4) Visual indication of "Power On," "Diverter Position," "Normal Flow," "Reverse Flow," and "Valve Malfunction" indicating a slow or incomplete valve turn.
 - 5) For pneumatic actuators, mount four-way solenoid valve for actuator operation in the control panel.
 - 6) Flow-switch bypass.
 - 7) Unloading signal to chiller.

Q. Source Quality Control

1. Perform functional run tests of chillers before shipping.
2. Factory test and inspect absorber, generator, evaporator, and condenser according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1. Pressure test tube-side of heat exchangers, including water boxes, to 1.5 times the rated pressure. Vacuum and pressure test shells for leaks.
3. Rate sound power level according to ARI 575.
4. Burner Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion requirements indicated.
5. Factory performance test chillers, before shipping, according to ARI 560.
 - a. Test the following conditions:
 - 1) Design conditions indicated.
 - 2) Reduction in capacity from design to minimum load in steps of 10 **OR** 25 **OR** 33, **as directed**, with condenser fluid at design conditions.
OR
Reduction in capacity from design to minimum load in steps of 10 **OR** 25 **OR** 33, **as directed**, with varying entering condenser-fluid temperature from design to minimum conditions in 5 deg F (3 deg C) increments.
OR
At one **OR** two **OR** three **OR** four **OR** five **OR** 10, **as directed**, point(s) of varying part-load performance to be selected by Owner at time of test.
6. Factory sound test chillers, before shipping, according to ARI 575.
 - a. Test the following conditions:
 - 1) Design conditions indicated.
 - 2) Chiller operating at calculated worst-case sound condition.
 - 3) At one **OR** two **OR** three **OR** four **OR** five, **as directed**, point(s) of varying part-load performance to be selected by Owner at time of test.
7. Allow Owner access to place where chillers are being tested. Notify the Owner 14 days in advance of testing.
8. Prepare test report indicating test procedures, instrumentation, test conditions, and results. Submit copy of results within one week of test date.

1.3 EXECUTION

A. Examination

1. Examine chillers before installation. Reject chillers that are damaged.
2. Examine roughing-in for equipment support, anchor-bolt sizes and locations, piping, and electrical connections to verify actual locations, sizes, and other conditions affecting chiller performance, maintenance, and operations before equipment installation.

- a. Final chiller locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Chiller Installation

1. Install chillers on support structure indicated.
2. Equipment Mounting (for equipment supported on concrete bases and vibration isolation devices): Install chiller on concrete bases using elastomeric pads. Comply with requirements for concrete bases specified in Division 03 Section "Cast-in-place Concrete". Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1/2 inch (13 mm), **as directed**.
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - c. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Equipment Mounting (for equipment supported on vibration isolation devices without a concrete base): Install chiller using elastomeric pads. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1/2 inch (13 mm), **as directed**.
4. Equipment Mounting (for equipment installed on concrete bases without vibration isolation devices): Install chiller on concrete bases. Comply with requirements for concrete bases specified in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Install chillers with seismic-restraint device. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
6. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
7. Maintain manufacturer's recommended clearances for service and maintenance.
8. Charge chiller with absorbent and refrigerant if not factory charged.
9. Install separate devices furnished by manufacturer and not factory installed.
10. Insulate hot and cold chiller surfaces that are recommended by chiller manufacturer to be insulated. Comply with requirements in Division 23 Section "Hvac Insulation".
11. Install electrical devices furnished with chiller but not specified to be factory mounted.
12. Install control wiring to field-mounted electrical devices.

C. Heat-Exchanger, Brush-Cleaning System Installation

1. Install brush-cleaning system control panel adjacent to chiller control panel.
2. Arrange piping to provide service access to four-way valve assembly without affecting access to chiller. Secure valve to prevent lateral movement and vibration during operation.
3. Provide field electric power, as required, to each system control panel and electric-actuated valve.

4. Provide pneumatic piping with pressure regulator and an isolation valve to each pneumatic supply connection. Coordinate field source of air with manufacturer to ensure that requirements are satisfied for proper valve operation.
5. Interconnect brush-cleaning system controls with chiller controls. Coordinate requirements to ensure safe, trouble-free operation.
6. Functionally test the entire brush-cleaning system, including the valve, actuator, position indicator, and control panel, with chiller in operation.

D. Connections

1. Comply with requirements for hydronic piping in Division 23 Section "Hydronic Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
2. Comply with requirements for gas piping in Division 23 Section(s) "Facility Natural-gas Piping" OR "Facility Liquefied-petroleum Gas Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
3. Connect gas piping full size to gas-train inlet with shutoff valve and union.
4. Install gas-fired boilers according to NFPA 54.
5. Comply with requirements for fuel-oil piping in Division 23 Section "Facility Fuel-oil Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
6. Connect oil piping full size to burner inlet with shutoff valve and union.
7. Install oil-fired boilers according to NFPA 31.
8. Install piping adjacent to chiller to allow service and maintenance.
9. Hot-Water Heat-Exchanger Connections: Connect to heat-exchanger inlet with shutoff valve, strainer, flexible connector, thermometer, and plugged tee with shutoff valve and pressure gage. Connect to heat-exchanger outlet with shutoff valve, check valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, flow meter, and drain connection with valve. Make connections to chiller with a flange or mechanical coupling.
10. Evaporator-Fluid Connections: Connect to evaporator inlet with shutoff valve, strainer, flexible connector, thermometer, and plugged tee with shutoff valve and pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, flow meter, and drain connection with valve. Make connections to chiller with a flange or mechanical coupling.
11. Absorber/Condenser-Fluid Connections: Connect to inlet with shutoff valve, strainer, flexible connector, thermometer, and plugged tee with shutoff valve and pressure gage. Connect to outlet with shutoff valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, flow meter, and drain connection with valve. Make connections to chiller with a flange or mechanical coupling.
 - a. If not factory furnished or installed, provide pipe connecting fluid connection of absorber discharge and condenser inlet.
12. Refrigerant Pressure Relief Device Connections: Extend vent piping **OR** separate vent piping for each chiller, **as directed**, to the outdoors without valves or restrictions. Comply with ASHRAE 15. Connect to chiller pressure relief device with flexible connector and dirt leg with drain valve.
13. Extend purge vent piping **OR** separate purge vent piping for each chiller, **as directed**, to the outdoors. Comply with ASHRAE 15.
14. Connect each chiller drain connection with a union and drain pipe, and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection.
15. Comply with requirements for chimney system in Division 23 Section "Breechings, Chimneys, And Stacks". Drawings indicate general arrangement of pipe, fittings, and specialties. Connect chimney system to chiller burner outlet and extend to the outdoors.
16. Connect fuel-fired burner assembly and blower and associated damper for combustion air.

E. Startup Service

1. Perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.

- b. Operate chiller for run-in period.
 - c. Verify that absorbent and refrigerant charge is sufficient and chiller has been leak tested.
 - d. Verify that pumps are installed and functional.
 - e. Verify that thermometers and gages are installed.
 - f. Operate chiller for run-in period.
 - g. Verify that refrigerant pressure relief device is vented to the outdoors.
 - h. Verify proper motor rotation.
 - i. Verify proper fuel supply. Adjust air-fuel ratio and combustion.
 - j. Verify proper combustion-air source.
 - k. Verify proper exhaust emissions.
 - l. Verify static deflection of vibration isolators including deflection during chiller startup and shutdown.
 - m. Verify and record performance of fluid flow and low-temperature interlocks for evaporator and condenser.
 - n. Verify and record performance of chiller protection devices.
 - o. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
 - p. Burner Test: Adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas.
- 2. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assembly, installation, and connection.
 - 3. Prepare test and inspection startup reports.
- F. Demonstration
- 1. Train Owner's maintenance personnel to adjust, operate, and maintain chillers. Video record the training sessions, **as directed**.

END OF SECTION 23 64 13 16



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Task	Specification	Specification Description
23 64 13 16	23 62 13 00	Indirect-Fired Absorption Water Chillers



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SECTION 23 64 16 00 - MPF CENTRIFUGAL WATER CHILLERS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Packaged, water-cooled, electric-motor-driven centrifugal chillers.

1.2 PERFORMANCE REQUIREMENTS

- A. Condenser-Fluid Temperature Performance:
1. Startup Condenser-Fluid Temperature: Chiller shall be capable of starting with an entering condenser-fluid temperature of 55 deg F (13 deg C) and providing stable operation until the system temperature is elevated to the minimum operating entering condenser-fluid temperature.
 2. Make factory modifications to standard chiller design if necessary to comply with performance indicated.
- B. Site Altitude: Chiller shall be suitable for altitude at which installed without affecting performance indicated. Make adjustments to affected chiller components to account for site altitude.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Certificates: For certification required in "Quality Assurance" Article.
- D. Startup service reports.
- E. Operation and maintenance data.
- F. Warranty.

1.4 QUALITY ASSURANCE

- A. ARI Rating: Rate chiller performance according to requirements in ARI 550/590.
- B. ASHRAE Compliance:
 - 1. ASHRAE 15 for safety code for mechanical refrigeration.
 - 2. ASHRAE 147 for refrigerant leaks, recovery, and handling and storage requirements.
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004.
- D. ASME Compliance: Fabricate and label chillers to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, as applicable to chiller design. For chillers charged with R-134a refrigerant, include an ASME U-stamp and nameplate certifying compliance.
- E. Comply with NFPA 70.
- F. Comply with requirements of UL and UL Canada, and include label by a qualified testing agency showing compliance.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of chillers that fail in materials or workmanship within specified warranty period.
 - 1. Extended warranties include, but are not limited to, the following:
 - a. Complete compressor and drive assembly including refrigerant and oil charge.
 - b. Parts only.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Carrier Corporation; a United Technologies company.
 - 2. McQuay International.
 - 3. Trane; a division of American Standard.
 - 4. YORK International Corporation.

2.2 MANUFACTURED UNIT

- A. Description: Factory-assembled chiller complete with compressor, compressor motor, compressor motor controller, evaporator, condenser, [controls, interconnecting unit piping and wiring, and indicated accessories.
 - 1. For chillers with dual compressors, provide each compressor with a dedicated motor and motor controller, and provide for continued operation when either compressor-drive assembly fails or is being serviced.

NOTE TO SPECIFIER*Retain paragraph below for projects in seismic areas.*

- B. Fabricate chiller mounting base with reinforcement strong enough to resist chiller movement during a seismic event when chiller is anchored to field support structure.

2.3 COMPRESSOR-DRIVE ASSEMBLY

- A. Description: Single-stage or multistage, variable-displacement, centrifugal-type compressor driven by an electric motor.
- B. Compressor:
 - 1. Casing: Cast iron, precision ground.
 - 2. Impeller: High-strength cast aluminum or cast-aluminum alloy on carbon- or alloy-steel shaft.
- C. Compressor Motor:
 - 1. Continuous-duty, squirrel-cage, induction-type, two-pole motor with energy efficiency required to suit chiller energy efficiency indicated.
 - 2. Factory mounted, aligned, and balanced as part of compressor assembly before shipping.
 - 3. Motor shall be of sufficient capacity to drive compressor throughout entire operating range without overload and with sufficient capacity to start and accelerate compressor without damage.
 - 4. For chillers with open drives, provide motor with open-dripproof enclosure.
 - 5. Provide motor with thermistor or RTD to monitor bearing temperature and report information to chiller control panel.
 - 6. Provide open-drive motor with internal electric heater, internally powered from chiller power supply.
- D. Service: Easily accessible for inspection and service.
 - 1. Compressor's internal components shall be accessible without having to remove compressor-drive assembly from chiller.
 - 2. Provide lifting lugs or eyebolts attached to casing.
- E. Capacity Control: Modulating, variable-inlet, guide-vane assembly combined with hot-gas bypass, if necessary, to achieve performance indicated.
 - 1. Maintain stable operation that is free of surge, cavitation, and vibration throughout range of operation. Configure to achieve most energy-efficient operation possible.
 - 2. Operating Range: From 100 to 10 percent of design capacity.
 - 3. Chillers with variable frequency controllers shall modulate compressor speed with variable-inlet, guide-vane control to achieve optimum energy efficiency.
- F. Oil Lubrication System: Consisting of pump, filtration, heater, cooler, factory-wired power connection, and controls.

2.4 REFRIGERATION

- A. Refrigerant:
 - 1. Type: R-134aASHRAE 34, Class A1.
 - 2. Compatibility: Chiller parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
- B. Refrigerant Flow Control: Manufacturer's standard refrigerant flow-control device satisfying performance requirements indicated.

- C. Pressure Relief Device:
 - 1. Comply with requirements in ASHRAE 15 and in applicable portions of ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- D. Positive-Pressure System:
 - 1. During nonoperational periods, positive-pressure system shall automatically maintain a positive pressure for atmosphere in the refrigerant pressure vessel of not less than 0.5 psig (3 kPa) (adjustable) up to a pressure that remains within the vessel design pressure limits.
 - 2. System shall be factory wired and include controller, electric heat, pressure transmitter, or switch.
- E. Refrigerant Isolation for Chillers Using R-134a:
 - 1. Factory install positive shutoff, manual isolation valves in the compressor discharge line to the condenser and the refrigerant liquid line leaving the condenser to allow for isolation and storage of full refrigerant charge in the chiller condenser shell. In addition, provide isolation valve on suction side of compressor from evaporator to allow for isolation and storage of full refrigerant charge in the chiller evaporator shell.

2.5 EVAPORATOR

- A. Description: Shell-and-tube design with water in tubes and refrigerant surrounding tubes within shell. Shell is separate from condenser.
- B. Shell Material: Carbon-steel rolled plates with continuously welded seams or seamless pipe.
- C. Designed to prevent liquid refrigerant carryover from entering compressor.
- D. Provide evaporator with sight glass or other form of positive visual verification of liquid-refrigerant level.
- E. Tubes:
 - 1. Individually replaceable from either end and without damage to tube sheets and other tubes.
 - 2. Mechanically expanded into end sheets and physically attached to intermediate tube sheets.
 - 3. Tube materials vary among manufacturers and chiller models; verify availability with manufacturer. First option in first subparagraph below is current standard of listed manufacturers.
 - 4. Material: Copper.
 - 5. Minimum Wall Thickness: 0.028 inch (0.7 mm).
 - 6. External Finish: Manufacturer's standard.
 - 7. Internal Finish: Enhanced.
- F. End Tube Sheets: Continuously welded to each end of shell; drilled and reamed to accommodate tubes with positive seal between fluid in tubes and refrigerant in shell.
- G. Intermediate Tube Sheets: Installed in shell and spaced along length of tube at intervals required to eliminate vibration and to avoid contact of tubes resulting in abrasion and wear.
- H. Water Box:
 - 1. Cast-iron or carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - 2. Standard or Marine type for water box with piping connections. Standard type for water box without piping connections.
 - 3. Provide water boxes [and marine water-box covers] with lifting lugs or eyebolts.
 - 4. Retain one of first two subparagraphs below for special applications.
 - 5. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - 6. Fit each water box with 3/4- or 1-inch (19- or 25-mm) drain connection at low point and vent connection at high point, each with threaded plug.

2.6 CONDENSER

- A. Description: Shell-and-tube design with water in tubes and refrigerant surrounding tubes within shell. Shell is separate from evaporator.
- B. Shell Material: Carbon-steel rolled plates with continuously welded seams or seamless pipe.
- C. Designed to prevent direct impingement of high-velocity hot gas from compressor discharge on tubes.
- D. Provide condenser with sight glass or other form of positive visual verification of refrigerant charge and condition.
- E. Tubes:
 - 1. Individually replaceable from either end and without damage to tube sheets and other tubes.
 - 2. Mechanically expanded into end sheets and physically attached to intermediate tube sheets.
 - 3. Material: Copper.
 - 4. Minimum Wall Thickness: 0.028 inch (0.7 mm).
 - 5. External Finish: Manufacturer's standard.
 - 6. Internal Finish: Enhanced.
- F. End Tube Sheets: Continuously welded to each end of shell; drilled and reamed to accommodate tubes with positive seal between fluid in tubes and refrigerant in shell.
- G. Intermediate Tube Sheets: Installed in shell and spaced along length of tube at intervals required to eliminate vibration and to avoid contact of tubes resulting in abrasion and wear.
- H. Water Box:
 - 1. Cast-iron or carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - 2. Standard or Marine type for water box with piping connections. Standard type for water box without piping connections.
 - 3. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - 4. Fit each water box with 3/4- or 1-inch (19- or 25-mm) drain connection at low point and vent connection at high point, each with threaded plug.
- I. Additional Corrosion Protection:
 - 1. Electrolytic corrosion-inhibitor anode.
 - 2. Retain one of two subparagraphs below.
 - 3. Coat wetted surfaces with a corrosion-resistant finish.
 - 4. Using same material as tubes, clad surfaces of end tube sheets in contact with fluid. Coat other wetted surfaces, including water boxes, with a corrosion-resistant finish.

2.7 INSULATION

- A. Closed-cell, flexible elastomeric thermal insulation complying with ASTM C 534, Type I for tube and Type II for sheet materials.
 - 1. Thickness: 3/4 inch (19 mm).
- B. Adhesive: As recommended by insulation manufacturer.
- C. Factory apply insulation over all cold surfaces of chiller capable of forming condensation. Components shall include, but not be limited to, evaporator shell and end tube sheets, evaporator water boxes including nozzles, refrigerant suction pipe from evaporator to compressor, cold surfaces of compressor, refrigerant-cooled motor, and auxiliary piping.
 - 1. Apply adhesive to 100 percent of insulation contact surface.
 - 2. Before insulating steel surfaces, prepare surfaces for paint, and prime and paint as indicated for other painted components. Do not insulate unpainted steel surfaces.

3. Seal seams and joints to provide a vapor barrier.
4. After adhesive has fully cured, paint exposed surfaces of insulation to match other painted parts.

2.8 ELECTRICAL

- A. Factory installed and wired, and functionally tested at factory before shipment.
- B. Single-point, field-power connection to fused disconnect switch. Minimum withstand rating shall be as required by electrical power distribution system.
- C. Terminal blocks with numbered and color-coded wiring to match wiring diagram. Spare wiring terminal block for connection to external controls or equipment.

2.9 MOTOR CONTROLLER

NOTE TO SPECIFIER

Not all chiller manufacturers provide all features specified in this specification section; verify availability, and edit subparagraphs below to match project. Coordinate electrical requirements with Drawings and Division 26 Sections. Delete this section if chiller is to be provided with a variable frequency drive controller.

- A. Enclosure: Factory installed, unit mounted, with hinged full-front access door.
- B. Overload Relay: Shall be sized according to UL 1995 or shall be an integral component of chiller control microprocessor.
- C. Star-Delta, Reduced-Voltage Controller: NEMA ICS 2, closed transition.
- D. Autotransformer Reduced-Voltage Controller: NEMA ICS 2, closed transition; include isolation switch and current-limiting fuses.
- E. Solid-State, Reduced-Voltage Controller: NEMA ICS 2.
 1. Surge suppressor in solid-state power circuits providing three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
 2. Visual indication of motor and control status, including the following conditions:
 - a. Controller on.
 - b. Overload trip.
 - c. Loss of phase.
 - d. Starter fault.
- F. Accessories: Devices shall be factory installed in controller enclosure unless otherwise indicated.

NOTE TO SPECIFIER

Edit subparagraphs below to match project.

1. Externally Operated, Door-Interlocked Disconnect:
2. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.
3. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.
4. Control Relays: Time-delay relays.
5. Elapsed-Time Meters: Numerical readout in hours on face of enclosure.

6. Number-of-Starts Counter: Numerical readout on face of enclosure.
7. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:
 - a. Selectable, digital display of the following:
 - 1) Phase Currents, Each Phase: Plus or minus 1 percent.
 - 2) Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
 - 3) Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
 - 4) Three-Phase Real Power: Plus or minus 2 percent.
 - 5) Three-Phase Reactive Power: Plus or minus 2 percent.
 - 6) Power Factor: Plus or minus 2 percent.
 - 7) Frequency: Plus or minus 0.5 percent.
 - 8) Integrated Demand with Demand Interval Selectable from Five to 60 Minutes: Plus or minus 2 percent.
 - 9) Accumulated energy, in megawatt hours (joules), plus or minus 2 percent; stored values unaffected by power outages for up to 72 hours.
 - b. Mounting: Display and control unit flush or semirecessed in instrument compartment door.
8. Phase-Failure, Phase-Reversal, Undervoltage Relays: Solid-state sensing circuit with adjustable undervoltage setting and isolated output contacts for hardwired connection.
9. Power Protection: Chiller shall shut down within six cycles of power interruption.

NOTE TO SPECIFIER

Delete this section if chillers are to be provided with starters in lieu of variable frequency drive controllers. Edit subparagraphs to match proposed chiller(s).

2.10 VARIABLE SPEED DRIVE

- A. Provide where scheduled on Drawings.
- B. A variable speed drive shall be factory installed on the chiller. The variable speed drive shall vary the compressor motor speed by controlling the frequency and voltage of the electrical power to the motor. The adaptive capacity control logic shall automatically adjust motor speed and compressor pre-rotation van position independently for maximum part-load efficiency by analyzing information fed to it by sensors located throughout the chiller.
- C. Drive shall be pulse width modulation type utilizing insulated gate bipolar transistors with a power factor of 0.95 or better at all loads and speeds.
- D. The variable speed drive shall be unit-mounted in a NEMA-1 enclosure with all power and control wiring between the drive and chiller factory installed, including power to the chiller oil pump. Field power wiring shall be a single point connection and electrical lugs for incoming power wiring shall be provided. The entire chiller package shall be UL listed.
- E. The following features shall be provided:
 1. A door interlocked circuit breaker, capable of being padlocked.
 2. UL listed ground fault protection.
 3. Overvoltage and undervoltage protection.
 4. 3-phase sensing motor.
 5. Overcurrent protection.
 6. Single phase protection
 7. Insensitive to phase rotation.
 8. Over temperature protection.
 9. Digital readout at the chiller unit control panel of:
 - a. Output Frequency.
 - b. Output Voltage.



- c. Input Kilowatts (kW) and Kilowatt-hours (kWh).
- d. Self-diagnostic service parameters.

F. Separate meters for this information shall not be acceptable. A harmonic filter that limits electrical power supply distortion for the variable speed drive to comply with the guidelines of IEEE Std. 519-1992 shall be provided. The filter shall be unit mounted within the same NEMA -1 enclosure and shall be UL listed. The following digital readouts shall be provided at the chiller unit control panel as part of the filter package:

- 1. Input kVA.
- 2. Total power factor.
- 3. 3-Phase input voltage.
- 4. 3-Phase input current.
- 5. 3-Phase input voltage total harmonic distortion (THD).
- 6. 3-Phase input current total demand distortion (TDD).
- 7. Self-diagnostic service parameters.

2.11 CONTROLS

NOTE TO SPECIFIER

Coordinate this section with Division 25 Section " Building Automation System (BAS) General

- A. Control: Standalone and microprocessor based, with all memory stored in nonvolatile memory so that reprogramming is not required on loss of electrical power.
- B. Enclosure: Unit mounted, NEMA 250, Type 1, hinged or lockable; factory wired with a single-point, field-power connection and a separate control circuit.
- C. Operator Interface: Multiple-character digital or graphic display with dynamic update of information and with keypad or touch-sensitive display located on front of control enclosure. In either imperial or metric units selectable through the interface, display the following information:

NOTE TO SPECIFIER

Revise list below to suit Project.

- D. Trending: Capability to trend analog data of up to five parameters simultaneously over an adjustable period and frequency of polling.
- E. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: view only; view and operate; and view, operate, and service.
- F. Control Authority: At least four conditions: Off, local manual control at chiller, local automatic control at chiller, and automatic control through a remote source.
- G. Communication Port: RS-232 port, USB 2.0 port, or equivalent connection capable of connecting a printer and a notebook computer.

NOTE TO SPECIFIER

Coordinate with Division 25 Section " Building Automation System (BAS) General

"

- H. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display chiller status and alarms.
 - 1. ASHRAE 135 (BACnet) or Modbus communication interface with the BAS shall enable the BAS operator to remotely control and monitor the chiller from an operator workstation. Control features and monitoring points displayed locally at chiller control panel shall be available through the BAS.

2.12 FINISH

- A. Paint chiller, using manufacturer's standard procedures.

2.13 ACCESSORIES

- A. Flow Switches:
 - 1. Chiller manufacturer shall furnish a switch for evaporator and confirm field-mounting location before installation.
 - 2. Flow Switches:
- B. Vibration Isolation:
 - 1. Chiller manufacturer shall furnish vibration isolation for each chiller.
 - 2. Neoprene Pad:
 - a. Two layers of 0.375-inch- (10-mm-) thick, ribbed- or waffle-pattern neoprene pads separated by a 16-gage, stainless-steel plate.
 - b. Fabricate pads from 40- to 50-durometer neoprene.
 - c. Provide stainless-steel square bearing plate to load the pad uniformly between 20 and 40 psig (138 and 276 kPa) with a 0.12- to 0.16-inch (3- to 4-mm) deflection.

2.14 CAPACITIES AND CHARACTERISTICS

NOTE TO SPECIFIER

List minimum efficiencies from 4.2.10.1 of Repair and Alterations Criteria.

- A. Full-Load Efficiency:
 - 1. Min. EER: **[Insert value]**.
- B. Part-Load Efficiency:
 - 1. Min. IPLV: **[Insert value]**.

2.15 SOURCE QUALITY CONTROL

- A. For chillers using R-134a refrigerant, factory test and inspect evaporator and condenser according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- B. For chillers using R-123 refrigerant, factory test and inspect evaporator and condenser according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1. Pressure test fluid side of heat exchangers, including water boxes, to 1.5 times the rated pressure. Pressure proof test refrigerant side of heat exchangers to a minimum of 45 psig (310 kPa). Vacuum and pressure test for leaks.
- C. For chillers located indoors, rate sound power level according to ARI 575.

PART 3 - EXECUTION

3.1 CHILLER INSTALLATION

- A. Install chillers on support structure indicated.
- B. Equipment Mounting: Install chiller on concrete bases using elastomeric pads. Comply with requirements for concrete bases specified in Division 3 Sections.
- C. Maintain manufacturer's recommended clearances for service and maintenance.
- D. Charge chiller with refrigerant and fill with oil if not factory installed.
- E. Install separate devices furnished by manufacturer and not factory installed.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Division 23 Section "Hydronic Piping" and Division 23 Section "Refrigerant Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to chiller to allow service and maintenance.
- C. Evaporator Fluid Connections: Connect to evaporator inlet with shutoff valve, flexible connector, thermometer, and plugged tee with pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, and drain connection with valve.
- D. Condenser-Fluid Connections: Connect to condenser inlet with shutoff valve, flexible connector, thermometer, and plugged tee with pressure gage. Connect to condenser outlet with shutoff valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with shutoff valve and pressure gage and drain connection with valve. Refrigerant Pressure Relief Device Connections: For chillers installed indoors, extend vent piping to the outdoors without valves or restrictions. Comply with ASHRAE 15. Connect to chiller pressure relief device with flexible connector and dirt leg with drain valve.
- E. Connect each chiller drain connection with a union and drain pipe, and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection.

3.3 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Verify that refrigerant charge is sufficient and chiller has been leak tested.
 - 3. Verify that pumps are installed and functional.
 - 4. Verify that thermometers and gages are installed.
 - 5. Operate chiller for run-in period.
 - 6. Retain first subparagraph below for oil-lubricated chillers.
 - 7. Check bearing lubrication and oil levels.
 - 8. Verify that refrigerant pressure relief device is vented outside.
 - 9. Verify proper motor rotation.
 - 10. Verify static deflection of vibration isolators, including deflection during chiller startup and shutdown.

11. Verify and record performance of fluid flow and low-temperature interlocks for evaporator and condenser.
 12. Verify and record performance of chiller protection devices.
 13. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
- B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assembly, installation, and connection.
- C. Prepare test and inspection startup reports.

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Last revised: 6/25/2013

END OF SECTION 23 64 16 00



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SECTION 23 64 16 16 - FAN-COIL UNITS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for fan-coil units. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes fan-coil units and accessories.

C. Definitions

1. BAS: Building automation system.

D. Submittals

1. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.
2. LEED Submittals:
 - a. Product Data for Credit EA 4: Documentation required by Credit EA 4 indicating that equipment and refrigerants comply.
 - b. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
3. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - a. Wiring Diagrams: Power, signal, and control wiring.
4. Manufacturer Seismic Qualification Certification: Submit certification that fan-coil units, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
5. Field quality-control test reports.
6. Operation and maintenance data.
7. Warranty: Special warranty specified in this Section.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
3. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

F. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of condensing units that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Compressor failure.
 - 2) Condenser coil leak.
 - b. Warranty Period: Four **OR** Five **OR** 10, **as directed**, years from date of Final Completion.
 - c. Warranty Period (Compressor Only): Five **OR** 10, **as directed**, years from date of Final Completion.

- d. Warranty Period (Condenser Coil Only): Five years from date of Final Completion.

1.2 PRODUCTS

A. Fan-Coil Units

1. Description: Factory-packaged and -tested units rated according to ARI 440, ASHRAE 33, and UL 1995.
2. Coil Section Insulation: 1/2-inch (13-mm) **OR** 1-inch (25-mm), **as directed**, thick, coated glass fiber **OR** foil-covered, closed-cell foam **OR** matte-finish, closed-cell foam, **as directed**, complying with ASTM C 1071 and attached with adhesive complying with ASTM C 916.
 - a. Fire-Hazard Classification: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
 - b. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
3. Main and Auxiliary Drain Pans: Plastic **OR** Stainless steel **OR** Insulated galvanized steel with plastic liner, **as directed**. Fabricate pans and drain connections to comply with ASHRAE 62.1. Drain pans shall be removable, **as directed**.
4. Chassis: Galvanized steel where exposed to moisture. Floor-mounting units shall have leveling screws.
5. Cabinet: Steel with factory prime coating, ready for field painting **OR** baked-enamel finish in manufacturer's standard paint color as selected by the Owner **OR** baked-enamel finish in manufacturer's custom paint color as selected by the Owner, **as directed**.
 - a. Vertical Unit Front Panels: Removable, steel, with integral stamped **OR** polyethylene **OR** steel, **as directed**, discharge grille and channel-formed edges, cam fasteners, and insulation on back of panel.
 - b. Horizontal Unit Bottom Panels: Fastened to unit with cam fasteners and hinge and attached with safety chain; with integral stamped **OR** cast-aluminum, **as directed**, discharge grilles.
 - c. Stack Unit Discharge and Return Grille: Aluminum double-deflection discharge grille, and louvered- or panel-type return grille; color as selected by the Owner from manufacturer's standard **OR** custom, **as directed**, colors. Return grille shall provide maintenance access to fan-coil unit.
 - d. Steel recessing flanges for recessing fan-coil units into ceiling or wall.
6. Outdoor-Air Wall Box: Minimum 0.1265-inch- (3.2-mm-) thick, aluminum, rain-resistant louver and box with integral eliminators and bird screen.
 - a. Louver Configuration: Horizontal **OR** Vertical, **as directed**, rain-resistant louver.
 - b. Louver Material: Aluminum **OR** Steel, **as directed**.
 - c. Bird Screen: 1/2-inch (13-mm) mesh screen on interior side of louver.
 - d. Decorative Grille: On outside of intake.
 - e. Finish: Anodized aluminum **OR** Baked enamel, **as directed**, color as selected by the Owner from manufacturer's standard **OR** custom, **as directed**, colors.
7. Outdoor-Air Damper: Galvanized-steel blades with edge and end seals and nylon bearings; with electronic **OR** pneumatic, **as directed**, two-position **OR** modulating, **as directed**, actuators.
8. Filters: Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
 - a. Washable Foam: 70 percent arrestance and 3 MERV.
 - b. Glass Fiber Treated with Adhesive: 80 percent arrestance and 5 MERV.
 - c. Pleated Cotton-Polyester Media: 90 percent arrestance and 7 MERV.
9. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), rated for a minimum working pressure of 200 psig (1378 kPa) and a maximum entering-water temperature of 220 deg F (104 deg C). Include manual air vent and drain valve.

10. Steam Coils: Copper distributing, **as directed**, tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), rated for a minimum working pressure of 75 psig (517 kPa).
11. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with fuses in terminal box for overcurrent protection and limit controls for high-temperature protection. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.
12. Fan and Motor Board: Removable.
 - a. Fan: Forward curved, double width, centrifugal; directly connected to motor. Thermoplastic or painted-steel wheels, and aluminum, painted-steel, or galvanized-steel fan scrolls.
 - b. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - c. Wiring Termination: Connect motor to chassis wiring with plug connection.
13. Factory, Hydronic Piping Package: ASTM B 88, Type L (ASTM B 88M, Type B) **OR** ASTM B 88, Type M (ASTM B 88M Type C), **as directed**, copper tube with wrought-copper fittings and brazed joints. Label piping to indicate service, inlet, and outlet.
 - a. Two **OR** Three, **as directed**, -way, two-position **OR** modulating, **as directed**, control valve for dual-temperature coil.
 - b. Two **OR** Three, **as directed**, -way, two-position **OR** modulating, **as directed**, control valve for chilled-water coil.
 - c. Two **OR** Three, **as directed**, -way, two-position **OR** modulating, **as directed**, control valve for heating coil.
 - d. Two **OR** Three, **as directed**, -way two-position **OR** modulating, **as directed**, control valve for hot-water reheat coil.
 - e. Hose Kits: Minimum 400-psig (2758-kPa) working pressure, and operating temperatures from 33 to 211 deg F (0.5 to 99 deg C). Tag hose kits to equipment designations.
 - 1) Length: 24 inches (600 mm) **OR** 36 inches (900 mm), **as directed**.
 - 2) Minimum Diameter: Equal to fan-coil-unit connection size.
 - f. Two-Piece Ball Valves: Bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig (4140-kPa) minimum CWP rating and blowout-proof stem.
 - g. Calibrated-Orifice Balancing Valves: Bronze body, ball type; 125-psig (860-kPa) working pressure, 250-deg F (121-deg C) maximum operating temperature; with calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, threaded ends, and equipped with a memory stop to retain set position.
 - h. Automatic Flow-Control Valve: Brass or ferrous-metal body; 300-psig (2070-kPa) working pressure at 250 deg F (121 deg C), with removable, corrosion-resistant, tamperproof, self-cleaning piston spring; factory set to maintain constant indicated flow with plus or minus 10 percent over differential pressure range of 2 to 80 psig (13.8 to 552 kPa).
 - i. Y-Pattern Hydronic Strainers: Cast-iron body (ASTM A 126, Class B); 125-psig (860-kPa) working pressure; with threaded connections, bolted cover, perforated stainless-steel basket, and bottom drain connection. Include minimum NPS 1/2 (DN 15) hose-end, full-port, ball-type blowdown valve in drain connection.
 - j. Wrought-Copper Unions: ASME B16.22.
 - k. Risers: ASTM B 88, Type L (ASTM B 88M, Type B) **OR** ASTM B 88, Type M (ASTM B 88M Type C), **as directed**, copper pipe with hose and ball valve for system flushing.
14. Control devices and operational sequences are specified in Division 23 Section(s) "Instrumentation And Control For Hvac" AND "Sequence Of Operations For Hvac Controls".
15. Basic Unit Controls:
 - a. Control voltage transformer.
 - b. Wall-mounting **OR** Unit-mounted, **as directed**, thermostat with the following features:
 - 1) Heat-cool-off switch.
 - 2) Fan on-auto switch.
 - 3) Fan-speed switch.

- 4) Manual **OR** Automatic, **as directed**, changeover.
- 5) Adjustable deadband.
- 6) Concealed **OR** Exposed, **as directed**, set point.
- 7) Concealed **OR** Exposed, **as directed**, indication.
- 8) Degree F **OR** Degree C, **as directed**, indication.
- c. Wall-mounting **OR** Unit-mounted, **as directed**, humidistat.
 - 1) Concealed **OR** Exposed, **as directed**, set point.
 - 2) Concealed **OR** Exposed, **as directed**, indication.
- d. Wall-mounting **OR** Unit-mounted, **as directed**, temperature sensor.
- e. Unoccupied-period-override push button.
- f. Data entry and access port.
 - 1) Input data includes room temperature, and humidity set points and occupied and unoccupied periods.
 - 2) Output data includes room temperature and humidity, supply-air temperature, entering-water temperature, operating mode, and status.
- 16. DDC, **as directed**, Terminal Controller:
 - a. Scheduled Operation: Occupied and unoccupied periods on seven-day clock with a minimum of four programmable periods per day.
 - b. Unoccupied Period Override Operation: Two, **as directed**, hours.
 - c. Unit Supply-Air Fan Operation:
 - 1) Occupied Periods: Fan runs continuously.
 - 2) Unoccupied Periods: Fan cycles to maintain room setback temperature.
 - d. Hydronic-Cooling-Coil Operation:
 - 1) Occupied Periods: Open **OR** Modulate, **as directed**, control valve to maintain room temperature.
 - 2) Unoccupied Periods: Close control valve.
 - e. Heating-Coil Operation:
 - 1) Occupied Periods: Open control valve **OR** Modulate control valve **OR** Energize electric-resistance coil, **as directed**, to provide heating if room temperature falls below thermostat set point.
 - 2) Unoccupied Periods: Start fan and open control valve **OR** modulate control valve **OR** energize electric-resistance coil, **as directed**, if room temperature falls below setback temperature.
 - f. Dual-Temperature Hydronic-Coil Operation:
 - 1) Occupied Periods: When chilled water is available, open **OR** modulate, **as directed**, control valve if room temperature exceeds thermostat set point. When hot water is available, open control valve if temperature falls below thermostat set point.
 - 2) Unoccupied Periods: When chilled water is available, close control valve. When hot water is available, open **OR** modulate, **as directed**, control valve if room temperature falls below thermostat setback temperature.
 - g. Reheat-Coil Operation:
 - 1) Humidity Control for Occupied Periods:
 - a) Humidistat opens control valve **OR** modulates control valve **OR** energizes electric-resistance coil, **as directed**, to provide heating. As space temperature rises above the set point, cooling coil valve opens **OR** modulates, **as directed**, to maintain room temperature.
 - 2) Humidity Control for Unoccupied Periods: Close control valve **OR** De-energize, **as directed**.
 - 3) Occupied Periods:
 - a) Heating Operations: Open control valve **OR** Modulate control valve **OR** Energize electric-resistance coil, **as directed**, to provide heating if room temperature falls below thermostat set point.
 - b) Humidity-Control Operations: Humidistat opens control valve **OR** modulates control valve **OR** energizes electric-resistance coil, **as directed**, to provide

- heating. As space temperature rises above the set point, cooling coil valve opens **OR** modulates, **as directed**, to maintain room temperature.
- 4) Unoccupied Periods: Start fan and open control valve **OR** modulate control valve **OR** energize electric-resistance coil, **as directed**, if room temperature falls below setback temperature. Humidity control is not available.
 - h. Outdoor-Air Damper Operation:
 - 1) Occupied Periods: Open damper to fixed position for 25 percent outdoor air.
 - 2) Unoccupied periods: Close damper.
 - i. Outdoor-Air Damper Operation:
 - 1) Occupied Periods:
 - a) Outdoor-Air Temperature below Room Temperature: If room temperature is above thermostat set point, modulate outdoor-air damper to maintain room temperature (outdoor-air economizer). If room temperature is below thermostat set point, position damper to fixed minimum position.
 - b) Outdoor-Air Temperature above Room Temperature: Position damper to fixed minimum position for 25 percent outdoor air.
 - 2) Unoccupied Periods: Close damper.
 - j. Controller shall have volatile-memory backup.
17. BAS Interface Requirements:
- a. Interface relay for scheduled operation.
 - b. Interface relay to provide indication of fault at the central workstation.
 - c. Provide BACnet **OR** LonWorks, **as directed**, interface for central BAS workstation for the following functions:
 - 1) Adjust set points.
 - 2) Fan-coil-unit start, stop, and operating status.
 - 3) Data inquiry, including outdoor-air damper position, **as directed**, supply- and room-air temperature and humidity, **as directed**.
 - 4) Occupied and unoccupied schedules.
18. Electrical Connection: Factory wire motors and controls for a single electrical connection.

B. Ducted Fan-Coil Units

- 1. Description: Factory-packaged and -tested units rated according to ARI 440, ASHRAE 33, and UL 1995.
- 2. Coil Section Insulation: 1/2-inch (13-mm) **OR** 1-inch (25-mm), **as directed**, thick coated **OR** foil-faced, **as directed**, glass fiber complying with ASTM C 1071 and attached with adhesive complying with ASTM C 916.
 - a. Fire-Hazard Classification: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
 - b. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- 3. Drain Pans: Plastic **OR** Stainless steel **OR** Insulated galvanized steel with plastic liner, **as directed**. Fabricate pans and drain connections to comply with ASHRAE 62.1.
- 4. Chassis: Galvanized steel where exposed to moisture, with baked-enamel finish and removable access panels.
- 5. Cabinets: Steel with baked-enamel finish in manufacturer's standard paint color.
 - a. Supply-Air Plenum: Sheet metal plenum finished and insulated to match the chassis with mill-finish, aluminum, double-deflection grille, **as directed**.
 - b. Return-Air Plenum: Sheet metal plenum finished to match the chassis.
 - c. Mixing Plenum: Sheet metal plenum finished and insulated to match the chassis with outdoor- and return-air, formed-steel dampers.
 - d. Dampers: Galvanized steel with extruded-vinyl blade seals, flexible-metal jamb seals, and interlocking linkage.
- 6. Filters: Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
 - a. Washable Foam: 70 percent arrestance and 3 MERV.

- b. Glass Fiber Treated with Adhesive: 80 percent arrestance and 5 MERV.
- c. Pleated Cotton-Polyester Media: 90 percent arrestance and 7 MERV.
- 7. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), rated for a minimum working pressure of 200 psig (1378 kPa) and a maximum entering-water temperature of 220 deg F (104 deg C). Include manual air vent and drain.
- 8. Indoor Refrigerant Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), and brazed joints at fittings. Comply with ARI 210/240, and leak test to minimum 450 psig (3105 kPa) for a minimum 300-psig (2070-kPa) working pressure. Include thermal expansion valve.
- 9. Steam Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), rated for a minimum working pressure of 75 psig (517 kPa).
- 10. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with fuses in terminal box for overcurrent protection and limit controls for high-temperature protection of heaters. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.
- 11. Direct-Driven Fans: Double width, forward curved, centrifugal; with permanently lubricated, multispeed motor resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and painted-steel or galvanized-steel fan scrolls.
OR
Belt-Driven Fans: Double width, forward curved, centrifugal; with permanently lubricated, single-speed motor installed on an adjustable fan base resiliently mounted in the cabinet. Aluminum or painted-steel wheels, and painted-steel or galvanized-steel fan scrolls.
- a. Motors: Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
- 12. Factory, Hydronic Piping Package: ASTM B 88, Type L (ASTM B 88M, Type B) **OR** ASTM B 88, Type M (ASTM B 88M Type C), **as directed**, copper tube with wrought-copper fittings and brazed joints. Label piping to indicate service, inlet, and outlet.
 - a. Two **OR** Three, **as directed**, -way, two-position **OR** modulating, **as directed**, control valve for chilled-water coil.
 - b. Two **OR** Three, **as directed**, -way, two-position **OR** modulating, **as directed**, control valve for heating coil.
 - c. Two **OR** Three, **as directed**, -way, two-position **OR** modulating, **as directed**, control valve for dual-temperature coil.
 - d. Two **OR** Three, **as directed**, -way, two-position **OR** modulating, **as directed**, control valve for reheat coil.
 - e. Hose Kits: Minimum 400-psig (2758-kPa) working pressure, and operating temperatures from 33 to 211 deg F (0.5 to 99 deg C). Tag hose kits to equipment designations.
 - 1) Length: 24 inches (600 mm) **OR** 36 inches (900 mm), **as directed**.
 - 2) Minimum Diameter: Equal to fan-coil-unit connection size.
 - f. Two-Piece Ball Valves: Bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig (4140-kPa) minimum CWP rating and blowout-proof stem.
 - g. Calibrated-Orifice Balancing Valves: Bronze body, ball type; 125-psig (860-kPa) working pressure, 250 deg F (121 deg C) maximum operating temperature; with calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, threaded ends, and equipped with a memory stop to retain set position.
 - h. Automatic Flow-Control Valve: Brass or ferrous-metal body; 300-psig (2070-kPa) working pressure at 250 deg F (121 deg C); with removable, corrosion-resistant, tamperproof, self-cleaning piston spring; factory set to maintain constant indicated flow with plus or minus 10 percent over differential pressure range of 2 to 80 psig (13.8 to 552 kPa).
 - i. Y-Pattern Hydronic Strainers: Cast-iron body (ASTM A 126, Class B); 125-psig (860-kPa) working pressure, with threaded connections, bolted cover, perforated stainless-steel basket, and bottom drain connection. Include minimum NPS 1/2 (DN 15) hose-end, full-port, ball-type blowdown valve in drain connection.
 - j. Wrought-Copper Unions: ASME B16.22.

13. Remote condensing units are specified in Division 23 Section "Packaged Compressor And Condenser Units".
14. Remote Condensing Units: Factory assembled and tested, consisting of compressors, condenser coils, fans, motors, refrigerant receiver, and operating controls. Construct, test, and rate condensing units according to ARI 210/240 and ASHRAE 15.
 - a. Casing: Steel with baked-enamel finish, removable panels for access to controls, weep holes for water drainage, and mounting holes in base.
 - b. Compressor: Hermetic, scroll **OR** reciprocating, **as directed**, type; internally isolated for vibration with factory-installed safety devices as follows:
 - 1) Antirecycle timer.
 - 2) High-pressure cutout.
 - 3) Low-pressure cutout or loss-of-charge switch.
 - 4) Internal thermal-overload protection.
 - 5) Current and voltage sensitive safety devices.
 - c. Compressor Motor: Start capacitor, relay, and contactor. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - d. Energy Efficiency: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Standard for Buildings except Low-Rise Residential Buildings."
 - e. Refrigerant Piping Materials: ASTM B 743 copper tube with wrought-copper fittings and brazed joints.
 - f. Refrigerant: R-22 **OR** R-407C **OR** R-410A, **as directed**.
 - g. Low ambient controls to permit operation down to 45 deg F (7 deg C).
 - h. Crankcase heater.
 - i. Charging and service fittings on exterior of casing.
 - j. Filter dryer.
 - k. Air-to-Air Heat Pump: Pilot-operated, sliding-type reversing valve with replaceable magnetic coil, and controls for air-to-air heat pump operation with supplemental heat operation.
 - l. Hot-gas-bypass, constant-pressure expansion valve and controls to maintain continuous refrigeration system operation at 10 percent of full load.
 - m. Condenser: Copper-tube, aluminum-fin coil, with liquid subcooler.
 - n. Condenser Fan: Direct-drive, aluminum propeller fan.
 - 1) Motor: Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - o. Accessories: Polyethylene mounting base to provide a permanent foundation.
15. Control devices and operational sequence are specified in Division 23 Section(s) "Instrumentation And Control For Hvac" AND "Sequence Of Operations For Hvac Controls".
16. Basic Unit Controls:
 - a. Control voltage transformer.
 - b. Wall-mounting **OR** Unit-mounted, **as directed**, thermostat with the following features.
 - 1) Heat-cool-off switch.
 - 2) Fan on-auto switch.
 - 3) Fan-speed switch.
 - 4) Manual **OR** Automatic, **as directed**, changeover.
 - 5) Adjustable deadband.
 - 6) Concealed **OR** Exposed, **as directed**, set point.
 - 7) Concealed **OR** Exposed, **as directed**, indication.
 - 8) Degree F **OR** Degree C, **as directed**, indication.
 - c. Wall-mounting **OR** Unit-mounted, **as directed**, humidistat.
 - 1) Concealed **OR** Exposed, **as directed**, set point.
 - 2) Concealed **OR** Exposed, **as directed**, indication.
 - d. Wall-mounting **OR** Unit-mounted, **as directed**, temperature sensor.
 - e. Unoccupied-period-override push button.
 - f. Data entry and access port.
 - 1) Input data includes room temperature, and humidity set points and occupied and unoccupied periods.

- 2) Output data includes room temperature and humidity, supply-air temperature, entering-water temperature, operating mode, and status.
17. DDC, **as directed**, Terminal Controller:
 - a. Scheduled Operation: Occupied and unoccupied periods on seven-day clock with a minimum of four programmable periods per day.
 - b. Unoccupied Period Override Operation: Two, **as directed**, hours.
 - c. Unit Supply-Air Fan Operation:
 - 1) Occupied Periods: Fan runs continuously.
 - 2) Unoccupied Periods: Fan cycles to maintain room setback temperature.
 - d. Hydronic-Cooling-Coil Operation:
 - 1) Occupied Periods: Open **OR** Modulate, **as directed**, control valve to maintain room temperature.
 - 2) Unoccupied Periods: Close control valve.
 - e. Refrigerant-Coil Operation:
 - 1) Occupied Periods: Start compressor to maintain room temperature or humidistat set point.
 - 2) Unoccupied Periods: Stop compressor cooling and cycle compressor for heating to maintain setback temperature.
 - f. Supplemental, **as directed**, Heating-Coil Operation:
 - 1) Occupied Periods: Open control valve **OR** Modulate control valve **OR** Energize electric-resistance coil, **as directed**, to provide heating if room temperature falls below thermostat set point.
 - 2) Unoccupied Periods: Start fan and open control valve **OR** modulate control valve **OR** energize electric-resistance coil, **as directed**, if room temperature falls below setback temperature.
 - 3) Switch refrigerant-reversing valve to operate supplemental coil for heating when outdoor temperature is below 25 deg F (4 deg C).
 - g. Dual-Temperature Hydronic-Coil Operation:
 - 1) Occupied Periods: When chilled water is available, open **OR** modulate, **as directed**, control valve if room temperature exceeds thermostat set point. When hot water is available, open **OR** modulate, **as directed**, control valve if temperature falls below thermostat set point.
 - 2) Unoccupied Periods: When chilled water is available, close valve. When hot water is available, open **OR** modulate, **as directed**, control valve if room temperature falls below thermostat setback temperature.
 - h. Reheat-Coil Operation:
 - 1) Humidity Control for Occupied Periods: Humidistat opens control valve **OR** modulates control valve **OR** energizes electric-resistance coil, **as directed**, to provide heating. As room temperature rises above the set point, cooling coil valve opens **OR** modulates, **as directed**, to maintain room temperature.
 - 2) Humidity Control for Unoccupied Periods: Close control valve **OR** De-energize, **as directed**.
 - 3) Occupied Periods:
 - a) Heating Operations: Open control valve **OR** Modulate control valve **OR** Energize electric-resistance coil, **as directed**, to provide heating if room temperature falls below thermostat set point.
 - b) Humidity-Control Operations: Humidistat opens control valve **OR** modulates control valve **OR** energizes electric-resistance coil, **as directed**, to provide heating. As room temperature rises above the set point, cooling coil valve opens **OR** modulates, **as directed**, to maintain room temperature.
 - 4) Unoccupied Periods: Start fan and open control valve **OR** modulate control valve **OR** energize electric-resistance coil, **as directed**, if room temperature falls below setback temperature. Humidity control is not available.
 - i. Outdoor-Air Damper Operation (for fixed, minimum outdoor-air intake):
 - 1) Occupied Periods: Open damper to fixed position for 25 percent outdoor air.

- 2) Unoccupied Periods: Close damper.
- j. Outdoor-Air Damper Operation (for outdoor-air economizer cycle based on temperature):
 - 1) Occupied Periods:
 - a) Outdoor-Air Temperature below Room Temperature: If room temperature is above room-temperature set point, modulate outdoor- and return-air dampers to maintain room-temperature set point (outdoor-air economizer). If room temperature is below set point, position damper to fixed minimum setting.
 - b) Outdoor-Air Temperature above Room Temperature: Position damper to fixed minimum position for 25 percent outdoor air.
 - 2) Unoccupied Periods: Close outdoor-air damper and open return-air damper.
- k. Outdoor-Air Damper Operation (for outdoor-air economizer cycle based on enthalpy):
 - 1) Occupied Periods:
 - a) Outdoor-Air Enthalpy below Room Enthalpy: If room temperature is above room-temperature set point, modulate outdoor-air damper to maintain room temperature (outdoor-air economizer). If room temperature is below set point, position damper to fixed minimum position for 25 percent outdoor air.
 - b) Outdoor-Air Enthalpy above Room Enthalpy: Position damper to fixed minimum position for 25 percent outdoor air.
 - 2) Unoccupied Periods: Close outdoor-air damper and open return-air damper.
- l. Controller shall have volatile-memory backup.
- 18. BAS Interface Requirements:
 - a. Interface relay for scheduled operation.
 - b. Interface relay to provide indication of fault at the central workstation.
 - c. Provide BACnet **OR** LonWorks, **as directed**, interface for central BAS workstation for the following functions:
 - 1) Adjust set points.
 - 2) Fan-coil-unit start, stop, and operating status.
 - 3) Data inquiry including outdoor-air damper position,, **as directed** supply- and room-air temperature and humidity, **as directed**.
 - 4) Occupied and unoccupied schedules.
- 19. Electrical Connection: Factory wire motors and controls for a single electrical connection.

1.3 EXECUTION

A. Installation

- 1. Install fan-coil units level and plumb.
- 2. Install fan-coil units to comply with NFPA 90A.
- 3. Suspend fan-coil units from structure with elastomeric hangers. Vibration isolators are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
- 4. Verify locations of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches (1220 mm) **OR** 60 inches (1525 mm), **as directed**, above finished floor.
- 5. Install new filters in each fan-coil unit within two weeks after Final Completion.

B. Connections

- 1. Piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:
 - a. Install piping adjacent to machine to allow service and maintenance.
 - b. Connect piping to fan-coil-unit factory hydronic piping package. Install piping package if shipped loose.
 - c. Connect condensate drain to indirect waste.
 - 1) Install condensate trap of adequate depth to seal against the pressure of fan. Install cleanouts in piping at changes of direction.



2. Connect supply and return ducts to fan-coil units with flexible duct connectors specified in Division 23 Section "Air Duct Accessories". Comply with safety requirements in UL 1995 for duct connections.
3. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
4. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

C. Field Quality Control

1. Perform the following field tests and inspections and prepare test reports:
 - a. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - b. Operate electric heating elements through each stage to verify proper operation and electrical connections.
 - c. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
2. Remove and replace malfunctioning units and retest as specified above.

D. Adjusting

1. Adjust initial temperature and humidity set points.
2. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

E. Demonstration

1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fan-coil units.

END OF SECTION 23 64 16 16

SECTION 23 64 19 00 - RECIPROCATING WATER CHILLERS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for reciprocating water chillers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Packaged, water-cooled, electric-motor-driven, reciprocating water chillers.
 - b. Packaged, air-cooled, electric-motor-driven, reciprocating water chillers.
 - c. Packaged refrigerant recovery units.

C. Definitions

1. COP: Coefficient of performance. The ratio of the rate of heat removal to the rate of energy input using consistent units for any given set of rating conditions.
2. EER: Energy-efficiency ratio. The ratio of the cooling capacity given in terms of Btu/h to the total power input given in terms of watts at any given set of rating conditions.
3. IPLV: Integrated part-load value. A single number part-load efficiency figure of merit calculated per the method defined by ARI 550/590 and referenced to ARI standard rating conditions.
4. kW/Ton: The ratio of total power input of the chiller in kilowatts to the net refrigerating capacity in tons at any given set of rating conditions.
5. NPLV: Nonstandard part-load value. A single number part-load efficiency figure of merit calculated per the method defined by ARI 550/590 and intended for operating conditions other than the ARI standard rating conditions.

D. Performance Requirements

1. Seismic Performance: Reciprocating water chillers shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

E. Submittals

1. Product Data: Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.
2. Seismic Qualification Certificates: For water chillers, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
3. Source quality-control test reports.
4. Startup service reports.
5. Operation and maintenance data.
6. Warranty: Sample of special warranty.

F. Quality Assurance

1. ARI Certification: Certify chiller according to ARI 590 certification program.

2. ARI Rating: Rate water chiller performance according to requirements in ARI 550/590, "Water Chilling Packages Using the Vapor Compression Cycle."
3. ASHRAE Compliance: ASHRAE 15 for safety code for mechanical refrigeration.
4. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
5. ASME Compliance: Fabricate and stamp water chiller heat exchangers to comply with ASME Boiler and Pressure Vessel Code.
6. Comply with NFPA 70.

G. Delivery, Storage, And Handling

1. Ship water chillers from the factory fully charged with refrigerant and filled with oil.
2. Package water chiller for export shipping.

H. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water chillers that fail in materials or workmanship within five years from date of Final Completion.

1.2 PRODUCTS

A. Packaged Water-Cooled Water Chillers

1. Description: Factory-assembled and run-tested water chiller complete with compressor(s), compressor motors and motor controllers, evaporator, condenser where indicated, electrical power, controls, and indicated accessories.
2. Fabricate water chiller mounting base with reinforcement strong enough to resist water chiller movement during a seismic event when water chiller is anchored to field support structure.
3. Compressors:
 - a. Description: Positive-displacement direct drive with semihermetically sealed and accessible bolted casings.
 - b. Each compressor provided with suction and discharge service valves, crankcase oil heater, and suction strainer.
 - c. Operating Speed: 1750 rpm for 60-Hz applications.
 - d. Capacity Control: Combinations of cylinder unloading and on-off compressor cycling of multiple compressors, **as directed**, plus hot-gas bypass, **as directed**. Compressor shall be capable of operating at part-load conditions without increased vibration over normal vibration at full-load operation and shall be capable of continuous operation at its lowest step of unloading.
 - e. Oil Lubrication System: Automatically reversible, positive-displacement pump with strainer, sight glass, filling connection, filter with magnetic plug, and initial oil charge.
 - f. Vibration Isolation: Mount individual compressors on either neoprene or spring isolators.
 - g. Sound-reduction package shall consist of acoustic enclosures around the compressors that are designed to reduce sound level without affecting performance.
4. Compressor Motors:
 - a. Hermetically sealed and cooled by refrigerant suction gas.
 - b. High-torque, four-pole induction type with inherent thermal-overload protection on each phase.
5. Compressor Motor Controllers:
 - a. Across the Line: NEMA ICS 2, Class A, full voltage, nonreversing.
OR
Part-Wind Start: NEMA ICS 2, Class A, reduced voltage, nonreversing.
6. Refrigeration:
 - a. Refrigerant: R-22. Classified as Safety Group A1 according to ASHRAE 34.
 - b. Refrigerant Compatibility: Parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.

- c. Refrigerant Circuit: Each circuit shall include a thermal **OR** an electronic, **as directed**, expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.
 - d. Refrigerant Isolation: Factory install positive shutoff isolation valves in the compressor discharge line and the refrigerant liquid-line to allow the isolation and storage of the refrigerant charge in the chiller condenser.
- 7. Evaporator:
 - a. Brazed-plate or shell-and-tube design, as indicated.
 - b. Shell and Tube:
 - 1) Description: Direct-expansion, shell-and-tube design with fluid flowing through the shell and refrigerant flowing through the tubes within the shell.
 - 2) Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
 - 3) Shell Material: Carbon steel.
 - 4) Shell Heads: Removable carbon-steel heads with multipass baffles designed to ensure positive oil return and located at each end of the tube bundle.
 - 5) Shell Nozzles: Fluid nozzles located along the side of the shell and terminated with mechanical-coupling end connections for connection to field piping.
 - 6) Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.
 - c. Brazed Plate:
 - 1) Direct-expansion, single-pass, brazed-plate design.
 - 2) Type 316 stainless-steel construction.
 - 3) Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
 - 4) Fluid Nozzles: Terminate with mechanical-coupling end connections for connection to field piping.
- 8. Condenser:
 - a. Shell and tube, brazed plate, or without integral condenser; as indicated.
 - b. Shell and Tube:
 - 1) Description: Shell-and-tube design with refrigerant flowing through the shell and fluid flowing through the tubes within the shell.
 - 2) Provides positive subcooling of liquid refrigerant.
 - 3) Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
 - 4) Shell Material: Carbon steel.
 - 5) Water Boxes: Removable, of carbon-steel construction, located at each end of the tube bundle with fluid nozzles terminated with mechanical-coupling end connections for connection to field piping.
 - 6) Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.
 - 7) Provide each condenser with a pressure relief device, purge cock, and liquid-line shutoff valve.
 - c. Brazed Plate:
 - 1) Single-pass, brazed-plate design provides positive subcooling of liquid refrigerant.
 - 2) Type 316 stainless-steel construction.
 - 3) Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
 - 4) Fluid Nozzles: Terminate with mechanical-coupling end connections for connection to field piping.
 - 5) Provide each condenser with a liquid-line shutoff valve.
 - d. Provide water chiller without an integral condenser and design chiller for field connection to remote condenser. Coordinate requirements with Division 23 Section "Air-cooled Refrigerant Condensers".

9. Electrical Power:
 - a. Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to water chiller.
 - b. House in a unit-mounted, NEMA 250, Type 1, **as directed**, enclosure with hinged access door with lock and key or padlock and key.
 - c. Wiring shall be numbered and color-coded to match wiring diagram.
 - d. Install factory wiring outside of an enclosure in a raceway.
 - e. Field power interface shall be to wire lugs **OR** NEMA KS 1, heavy-duty, nonfused disconnect switch, **as directed**.
 - f. Provide branch power circuit to each motor and to controls with one of the following disconnecting means:
 - 1) NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
 - 2) NEMA KS 1, heavy-duty, nonfusible switch.
 - 3) NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
 - g. Provide each motor with overcurrent protection.
 - h. Overload relay sized according to UL 1995, or an integral component of water chiller control microprocessor.
 - i. Phase-Failure and Undervoltage: Solid-state sensing with adjustable settings.
 - j. Controls Transformer: Unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.
 - k. Control Relays: Auxiliary and adjustable time-delay relays.
 - l. Indicate the following for water chiller electrical power supply:
 - 1) Current, phase to phase, for all three phases.
 - 2) Voltage, phase to phase and phase to neutral for all three phases.
 - 3) Three-phase real power (kilowatts).
 - 4) Three-phase reactive power (kilovolt amperes reactive).
 - 5) Power factor.
 - 6) Running log of total power versus time (kilowatt hours).
 - 7) Fault log, with time and date of each.
10. Controls:
 - a. Stand-alone, microprocessor based.
 - b. Enclosure: Share enclosure with electrical power devices or provide a separate enclosure of matching construction.
 - c. Operator Interface: Keypad or pressure-sensitive touch screen. Multiple-character, backlit, liquid-crystal display or light-emitting diodes. Display the following:
 - 1) Date and time.
 - 2) Operating or alarm status.
 - 3) Operating hours.
 - 4) Outside-air temperature if required for chilled-water reset.
 - 5) Temperature and pressure of operating set points.
 - 6) Entering and leaving temperatures of chilled water.
 - 7) Entering and leaving temperatures of condenser water.
 - 8) Refrigerant pressures in evaporator and condenser.
 - 9) Saturation temperature in evaporator and condenser.
 - 10) No cooling load condition.
 - 11) Elapsed time meter (compressor run status).
 - 12) Pump status.
 - 13) Antirecycling timer status.
 - 14) Percent of maximum motor amperage.
 - 15) Current-limit set point.
 - 16) Number of compressor starts.
 - d. Control Functions:
 - 1) Manual or automatic startup and shutdown time schedule.



- 2) Entering and leaving chilled-water temperatures, control set points, and motor load limit. Chilled-water leaving temperature shall be reset based on return-water **OR** outside-air **OR** space, **as directed**, temperature.
 - 3) Current limit and demand limit.
 - 4) Condenser-water temperature.
 - 5) External water chiller emergency stop.
 - 6) Antirecycling timer.
 - 7) Automatic lead-lag switching.
 - e. Manual-Reset Safety Controls: The following conditions shall shut down water chiller and require manual reset:
 - 1) Low evaporator pressure or high condenser pressure.
 - 2) Low chilled-water temperature.
 - 3) Refrigerant high pressure.
 - 4) High or low oil pressure.
 - 5) High oil temperature.
 - 6) Loss of chilled-water flow.
 - 7) Loss of condenser-water flow.
 - 8) Control device failure.
 - f. Building Automation System Interface: Factory-installed hardware and software to enable building automation system to monitor, control, and display water chiller status and alarms.
 - 1) Hardwired Points:
 - a) Monitoring: On/off status, common trouble alarm **OR** electrical power demand (kilowatts) **OR** electrical power consumption (kilowatt hours), **as directed**.
 - b) Control: On/off operation, chilled-water discharge temperature set-point adjustment **OR** electrical power demand limit, **as directed**.
 - 2) ASHRAE 135 (BACnet) **OR** LonTalk **OR** Industry-accepted open-protocol, **as directed**, communication interface with building automation system shall enable building automation system operator to control and monitor the water chiller from a remote operator workstation. Control features and monitoring points displayed locally at water chiller control panel shall be available through building automation system.
 11. Insulation:
 - a. Material: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I, for tubular materials and Type II, for sheet materials.
 - b. Thickness: 3/4 inch (19 mm).
 - c. Factory-applied insulation over cold surfaces of water chiller components.
 - 1) Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface. Seal seams and joints.
 - d. Apply protective coating to exposed surfaces of insulation.
 12. Accessories:
 - a. Factory-furnished, chilled-water and condenser-water, **as directed**, flow switches for field installation.
 - b. Individual compressor suction and discharge pressure gages with shutoff valves.
 - c. Factory-furnished spring isolators for field installation.
- B. Packaged Air-Cooled Water Chillers
1. Description: Factory-assembled and run-tested water chiller complete with base and frame, condenser casing, compressors, compressor motors and motor controllers, evaporator, condenser coils, condenser fans and motors, electrical power, controls, and accessories.
 2. Fabricate base, frame, and attachment to water chiller components strong enough to resist movement during a seismic event when water chiller base is anchored to field support structure.
 3. Cabinet:
 - a. Base: Galvanized-steel base extending the perimeter of water chiller. Secure frame, compressors, and evaporator to base to provide a single-piece unit. Base shall be designed to limit deflection to L/200 and shall be a minimum of 4 inches (100 mm) high.



- b. Frame: Rigid galvanized-steel frame secured to base and designed to support cabinet, condenser, control panel, and other chiller components not directly supported from base.
 - c. Casing: Galvanized steel.
 - d. Finish: Coat base, frame, and casing with a corrosion-resistant coating capable of withstanding a 500-hour salt-spray test according to ASTM B 117.
 - e. Sound-reduction package consisting of the following:
 - 1) Acoustic enclosure around compressors.
 - 2) Reduced-speed fans with acoustic treatment.
 - 3) Designed to reduce sound level without affecting performance.
 - f. Security Package: Provide security grilles with fasteners for additional protection of compressors, evaporator, and condenser coils. Grilles shall be coated for corrosion resistance and shall be removable for service access.
4. Compressors:
- a. Description: Positive-displacement direct drive with semihermetically sealed and accessible bolted casings.
 - b. Each compressor provided with suction and discharge service valves, crankcase oil heater, and suction strainer.
 - c. Operating Speed: 1750 rpm for 60-Hz applications.
 - d. Capacity Control: Combinations of cylinder unloading and on-off compressor cycling of multiple compressors, plus hot-gas bypass, **as directed**. Compressor shall be capable of operating at part-load conditions without increased vibration over normal vibration at full-load operation and shall be capable of continuous operation at its lowest step of unloading.
 - e. Oil Lubrication System: Automatically reversible, positive-displacement pump with strainer, sight glass, filling connection, filter with magnetic plug, and initial oil charge.
 - f. Vibration Isolation: Mount individual compressors on spring isolators with an isolation efficiency of 95 percent.
5. Compressor Motors:
- a. Hermetically sealed and cooled by refrigerant suction gas.
 - b. High-torque, four-pole induction type with inherent thermal-overload protection on each phase.
6. Compressor Motor Controllers:
- a. Across the Line: NEMA ICS 2, Class A, full voltage, nonreversing.
OR
Part-Wind Start: NEMA ICS 2, Class A, reduced voltage, nonreversing.
7. Refrigeration:
- a. Refrigerant: R-22. Classified as Safety Group A1 according to ASHRAE 34.
 - b. Refrigerant Compatibility: Parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
 - c. Refrigerant Circuit: Each circuit shall include a thermal **OR** an electronic, **as directed**, expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.
 - d. Refrigerant Isolation: Factory install positive shutoff isolation valves in the compressor discharge line and the refrigerant liquid-line to allow the isolation and storage of the refrigerant charge in the chiller condenser.
8. Evaporator:
- a. Description: Direct-expansion shell-and-tube design with fluid flowing through the shell and refrigerant flowing through the tubes within the shell.
 - b. Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
 - c. Shell Material: Carbon steel.
 - d. Shell Heads: Removable carbon-steel heads with multipass baffles designed to ensure positive oil return and located at each end of the tube bundle.

- e. Shell Nozzles: Fluid nozzles located along the side of the shell and terminated with mechanical-coupling end connections for connection to field piping.
 - f. Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.
 - g. Heater: Factory-installed and -wired electric heater with integral controls designed to protect the evaporator to minus 20 deg F (minus 29 deg C).
 - h. Remote Mounting: Designed for remote field mounting where indicated. Provide kit for field installation.
9. Air-Cooled Condenser:
- a. Plate-fin coil with integral subcooling circuit, leak tested at 150 psig (1034 kPa).
 - 1) Construct coils of copper tubes mechanically bonded to aluminum **OR** aluminum with precoated epoxy-phenolic **OR** copper, **as directed**, fins.
 - 2) Coat coils with a baked epoxy corrosion-resistant coating after fabrication.
 - 3) Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.
 - b. Fans: Direct-drive propeller type with statically and dynamically balanced fan blades, arranged for vertical air discharge.
 - c. Fan Motors: Totally enclosed air over (TEAO) enclosure, with permanently lubricated bearings, and having built-in overcurrent- and thermal-overload protection.
 - d. Fan Guards: Steel safety guards with corrosion-resistant coating.
10. Electrical Power:
- a. Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to water chiller.
 - b. House in a unit-mounted, NEMA 250, Type 3R **OR** Type 4, **as directed**, enclosure with hinged access door with lock and key or padlock and key.
 - c. Wiring shall be numbered and color-coded to match wiring diagram.
 - d. Install factory wiring outside of an enclosure in a raceway.
 - e. Field power interface shall be to wire lugs **OR** NEMA KS 1, heavy-duty, nonfused disconnect switch, **as directed**.
 - f. Provide branch power circuit to each motor and to controls with one of the following disconnecting means:
 - 1) NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
 - 2) NEMA KS 1, heavy-duty, nonfusible switch.
 - 3) NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
 - g. Provide each motor with overcurrent protection.
 - h. Overload relay sized according to UL 1995, or an integral component of water chiller control microprocessor.
 - i. Phase-Failure and Undervoltage: Solid-state sensing with adjustable settings.
 - j. Transformer: Unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.
 - 1) Power unit-mounted controls where indicated.
 - 2) Power unit-mounted, ground-fault interrupt (GFI) duplex receptacle.
 - k. Control Relays: Auxiliary and adjustable time-delay relays.
 - l. Indicate the following for water chiller electrical power supply:
 - 1) Current, phase to phase, for all three phases.
 - 2) Voltage, phase to phase and phase to neutral for all three phases.
 - 3) Three-phase real power (kilowatts).
 - 4) Three-phase reactive power (kilovolt amperes reactive).
 - 5) Power factor.
 - 6) Running log of total power versus time (kilowatt hours).
 - 7) Fault log, with time and date of each.
11. Controls:
- a. Stand-alone, microprocessor based.

- b. Enclosure: Share enclosure with electrical power devices or provide a separate enclosure of matching construction.
 - c. Operator Interface: Keypad or pressure-sensitive touch screen. Multiple-character, backlit, liquid-crystal display or light-emitting diodes. Display the following:
 - 1) Date and time.
 - 2) Operating or alarm status.
 - 3) Operating hours.
 - 4) Outside-air temperature if required for chilled-water reset.
 - 5) Temperature and pressure of operating set points.
 - 6) Entering and leaving temperatures of chilled water.
 - 7) Refrigerant pressures in evaporator and condenser.
 - 8) Saturation temperature in evaporator and condenser.
 - 9) No cooling load condition.
 - 10) Elapsed time meter (compressor run status).
 - 11) Pump status.
 - 12) Antirecycling timer status.
 - 13) Percent of maximum motor amperage.
 - 14) Current-limit set point.
 - 15) Number of compressor starts.
 - d. Control Functions:
 - 1) Manual or automatic startup and shutdown time schedule.
 - 2) Entering and leaving chilled-water temperature, control set points, and motor load limit. Chilled-water leaving temperature shall be reset based on return-water **OR** outside-air **OR** space, **as directed**, temperature.
 - 3) Current limit and demand limit.
 - 4) External water chiller emergency stop.
 - 5) Antirecycling timer.
 - 6) Automatic lead-lag switching.
 - e. Manual-Reset Safety Controls: The following conditions shall shut down water chiller and require manual reset:
 - 1) Low evaporator pressure or high condenser pressure.
 - 2) Low chilled-water temperature.
 - 3) Refrigerant high pressure.
 - 4) High or low oil pressure.
 - 5) High oil temperature.
 - 6) Loss of chilled-water flow.
 - 7) Control device failure.
 - f. Building Automation System Interface: Factory-installed hardware and software to enable building automation system to monitor, control, and display water chiller status and alarms.
 - 1) Hardwired Points:
 - a) Monitoring: On/off status, common trouble alarm **OR** electrical power demand (kilowatts) **OR** electrical power consumption (kilowatt hours), **as directed**.
 - b) Control: On/off operation, chilled-water discharge temperature set-point adjustment **OR** electrical power demand limit, **as directed**.
 - 2) ASHRAE 135 (BACnet) **OR** LonTalk **OR** Industry-accepted open-protocol, **as directed**, communication interface with building automation system shall enable building automation system operator to control and monitor the water chiller from a remote operator workstation. Control features and monitoring points displayed locally at water chiller control panel shall be available through building automation system.
12. Insulation:
- a. Material: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I, for tubular materials and Type II, for sheet materials.
 - b. Thickness: 3/4 inch (19 mm).

- c. Factory-applied insulation over cold surfaces of water chiller components.
 - 1) Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface. Seal seams and joints.
 - d. Apply protective coating to exposed surfaces of insulation.
 - 13. Accessories:
 - a. Factory-furnished, chilled-water and condenser-water, **as directed**, flow switches for field installation.
 - b. Individual compressor suction and discharge pressure gages with shutoff valves.
 - c. Factory-furnished spring isolators for field installation.
 - C. Packaged Refrigerant Recovery Units
 - 1. Packaged portable unit shall consist of compressor, air-cooled condenser, recovery system, tank pressure gages, filter-dryer, and valving that allows for switching between liquid and vapor recovery mode. Refrigerant recovery unit shall be factory mounted on an ASME-constructed and -stamped refrigerant storage vessel that is sized to hold the full refrigerant charge of the largest water chiller.
 - D. Source Quality Control
 - 1. Perform functional test of water chillers before shipping.
 - 2. Factory performance test water chillers, **as directed**, before shipping, according to ARI 550/590, "Water Chilling Packages Using the Vapor Compression Cycle."
 - a. Allow Owner access to place where water chillers are being tested. Notify the Owner 14 days in advance of testing.
 - 3. Factory test and inspect evaporator and water-cooled condenser, **as directed**, according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1. Stamp with ASME label.
 - 4. For water chillers located indoors, rate sound power level according to ARI 575 procedure.
 - 5. For water chillers located outdoors, rate sound power level according to ARI 370 procedure.
- 1.3 EXECUTION
- A. Water Chiller Installation
 - 1. Install water chillers on support structure indicated.
 - 2. Equipment Mounting: Install water chiller on concrete bases using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements in Division 03 Section "Cast-in-place Concrete". Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1 inch (25 mm), **as directed**.
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - c. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Equipment Mounting: Install water chiller using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1 inch (25 mm), **as directed**.
 - 4. Equipment Mounting: Install water chiller on vibration isolation inertia bases. Comply with requirements specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - 5. Equipment Mounting: Install water chiller on concrete bases. Comply with requirements in Division 03 Section "Cast-in-place Concrete".

- a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
- b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
- c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
- d. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Maintain manufacturer's recommended clearances for service and maintenance.
7. Charge water chiller with refrigerant if not factory charged and fill with oil if not factory installed.
8. Install separate devices furnished by manufacturer and not factory installed.

B. Connections

1. Comply with requirements in Division 23 Section "Hydronic Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
2. Comply with requirements in Division 23 Section "Refrigerant Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
3. Install piping adjacent to chiller to allow service and maintenance.
4. Evaporator Fluid Connections: Connect to evaporator inlet with shutoff valve, strainer, **as directed**, flexible connector, **as directed**, thermometer, and plugged tee with pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, **as directed**, flow switch, thermometer, plugged tee with pressure gage, flow meter, **as directed**, and drain connection with valve. Make connections to water chiller with a union **OR** flange **OR** mechanical coupling, **as directed**.
5. Condenser Fluid Connections: Connect to condenser inlet with shutoff valve, strainer, **as directed**, flexible connector, **as directed**, thermometer, and plugged tee with pressure gage. Connect to condenser outlet with shutoff valve, balancing valve, flexible connector, **as directed**, flow switch, thermometer, plugged tee with pressure gage, flow meter, **as directed**, and drain connection with valve. Make connections to water chiller with a union **OR** flange **OR** mechanical coupling, **as directed**.
6. Refrigerant Pressure Relief Valve Connections: For water chillers installed indoors, extend vent piping to the outside without valves or restrictions. Comply with ASHRAE 15, **as directed**.
7. Connect each drain connection with a union and drain pipe, and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection if required.

C. Startup Service

1. Perform startup service.
2. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.
3. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
 - a. Verify that refrigerant charge is sufficient and water chiller has been leak tested.
 - b. Verify that pumps are installed and functional.
 - c. Verify that thermometers and gages are installed.
 - d. Operate water chiller for run-in period.
 - e. Check bearing lubrication and oil levels.
 - f. Verify that refrigerant pressure relief for chillers installed indoors is vented outside.
 - g. Verify proper motor rotation.
 - h. Verify static deflection of vibration isolators, including deflection during water chiller startup and shutdown.
 - i. Verify and record performance of chilled-water and condenser-water, **as directed**, flow and low-temperature interlocks.
 - j. Verify and record performance of water chiller protection devices.
 - k. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
4. Prepare a written startup report that records results of tests and inspections.



END OF SECTION 23 64 19 00



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SECTION 23 64 23 00 - SCROLL WATER CHILLERS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for scroll water chillers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Packaged, water-cooled, electric-motor-driven, scroll water chillers.
 - b. Packaged, air-cooled, electric-motor-driven, scroll water chillers.
 - c. Packaged refrigerant recovery units.

C. Definitions

1. COP: Coefficient of performance. The ratio of the rate of heat removal to the rate of energy input using consistent units for any given set of rating conditions.
2. EER: Energy-efficiency ratio. The ratio of the cooling capacity given in terms of Btu/h to the total power input given in terms of watts at any given set of rating conditions.
3. IPLV: Integrated part-load value. A single number part-load efficiency figure of merit calculated per the method defined by ARI 550/590 and referenced to ARI standard rating conditions.
4. kW/Ton: The ratio of total power input of the chiller in kilowatts to the net refrigerating capacity in tons at any given set of rating conditions.
5. NPLV: Nonstandard part-load value. A single number part-load efficiency figure of merit calculated per the method defined by ARI 550/590 and intended for operating conditions other than the ARI standard rating conditions.

D. Performance Requirements

1. Seismic Performance: Scroll water chillers shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

E. Submittals

1. Product Data: Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.
2. LEED Submittal:
 - a. Product Data for Credit EA 4: Documentation required by Credit EA 4 indicating that equipment and refrigerants comply.
3. Certificates: For certification required in "Quality Assurance" Article.
4. Seismic Qualification Certificates: For water chillers, accessories, and components from manufacturers.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
5. Startup service reports.
6. Operation and maintenance data.
7. Warranty: Sample of special warranty.

F. Quality Assurance

1. ARI Certification: Certify chiller according to ARI 590 certification program.
2. ARI Rating: Rate water chiller performance according to requirements in ARI 550/590, "Water Chilling Packages Using the Vapor Compression Cycle."
3. ASHRAE Compliance: ASHRAE 15 for safety code for mechanical refrigeration.
4. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
5. ASME Compliance: Fabricate and stamp water chiller heat exchangers to comply with ASME Boiler and Pressure Vessel Code.
6. Comply with NFPA 70.

G. Delivery, Storage, And Handling

1. Ship water chillers from the factory fully charged with refrigerant and filled with oil.
2. Package water chiller for export shipping.

H. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water chillers that fail in materials or workmanship within five years from date of Final Completion.

1.2 PRODUCTS

A. Packaged Water-Cooled Water Chillers

1. Description: Factory-assembled and run-tested water chiller complete with compressor(s), compressor motors and motor controllers, evaporator, condenser where indicated, electrical power, controls, and indicated accessories.
2. Fabricate water chiller mounting base with reinforcement strong enough to resist water chiller movement during a seismic event when water chiller is anchored to field support structure.
3. Compressors:
 - a. Description: Positive-displacement direct drive with hermetically sealed casing.
 - b. Each compressor provided with suction and discharge service valves, crankcase oil heater, and suction strainer.
 - c. Operating Speed: Nominal 3600 rpm for 60-Hz applications.
 - d. Capacity Control: On-off compressor cycling, plus hot-gas bypass, **as directed**.
 - e. Oil Lubrication System: Automatic pump with strainer, sight glass, filling connection, filter with magnetic plug, and initial oil charge.
 - f. Vibration Isolation: Mount individual compressors on vibration isolators.
 - g. Sound-reduction package shall consist of acoustic enclosures around the compressors that are designed to reduce sound level without affecting performance.
4. Compressor Motors:
 - a. Hermetically sealed and cooled by refrigerant suction gas.
 - b. High-torque, two-pole induction type with inherent thermal-overload protection on each phase.
5. Compressor Motor Controllers:
 - a. Across the Line: NEMA ICS 2, Class A, full voltage, nonreversing.
6. Refrigeration:
 - a. Refrigerant: R-22. Classified as Safety Group A1 according to ASHRAE 34.
 - b. Refrigerant Compatibility: Parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
 - c. Refrigerant Circuit: Each circuit shall include a thermal-expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.

- d. Refrigerant Isolation: Factory install positive shutoff isolation valves in the compressor discharge line and the refrigerant liquid-line to allow the isolation and storage of the refrigerant charge in the chiller condenser.
- 7. Evaporator:
 - a. Brazed-plate or shell-and-tube design, as indicated.
 - b. Shell and Tube:
 - 1) Description: Direct-expansion, shell-and-tube design with fluid flowing through the shell and refrigerant flowing through the tubes within the shell.
 - 2) Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
 - 3) Shell Material: Carbon steel.
 - 4) Shell Heads: Removable carbon-steel heads with multipass baffles designed to ensure positive oil return and located at each end of the tube bundle.
 - 5) Shell Nozzles: Fluid nozzles located along the side of the shell and terminated with mechanical-coupling end connections for connection to field piping.
 - 6) Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.
 - c. Brazed Plate:
 - 1) Direct-expansion, single-pass, brazed-plate design.
 - 2) Type 316 stainless-steel construction.
 - 3) Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
 - 4) Fluid Nozzles: Terminate with mechanical-coupling end connections for connection to field piping.
- 8. Condenser:
 - a. Shell and tube or without integral condenser; as indicated.
 - b. Shell and Tube:
 - 1) Description: Shell-and-tube design with refrigerant flowing through the shell and fluid flowing through the tubes within the shell.
 - 2) Provides positive subcooling of liquid refrigerant.
 - 3) Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
 - 4) Shell Material: Carbon steel.
 - 5) Water Boxes: Removable, of carbon-steel construction, located at each end of the tube bundle with fluid nozzles terminated with mechanical-coupling end connections for connection to field piping.
 - 6) Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.
 - 7) Provide each condenser with a pressure relief device, purge cock, and liquid-line shutoff valve.
 - c. Provide water chiller without an integral condenser and design chiller for field connection to remote condenser. Coordinate requirements with Division 23 Section "Air-cooled Refrigerant Condensers".
- 9. Electrical Power:
 - a. Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to water chiller.
 - b. House in a unit-mounted, NEMA 250, Type 1, **as directed**, enclosure with hinged access door with lock and key or padlock and key.
 - c. Wiring shall be numbered and color-coded to match wiring diagram.
 - d. Install factory wiring outside of an enclosure in a raceway.
 - e. Field power interface shall be to wire lugs **OR** NEMA KS 1, heavy-duty, nonfused disconnect switch, **as directed**.
 - f. Provide branch power circuit to each motor and to controls with one of the following disconnecting means:
 - 1) NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.

- 2) NEMA KS 1, heavy-duty, nonfusible switch.
- 3) NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
- g. Provide each motor with overcurrent protection.
- h. Overload relay sized according to UL 1995, or an integral component of water chiller control microprocessor.
- i. Phase-Failure and Undervoltage: Solid-state sensing with adjustable settings.
- j. Controls Transformer: Unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.
- k. Control Relays: Auxiliary and adjustable time-delay relays.
- l. Indicate the following for water chiller electrical power supply:
 - 1) Current, phase to phase, for all three phases.
 - 2) Voltage, phase to phase and phase to neutral for all three phases.
 - 3) Three-phase real power (kilowatts).
 - 4) Three-phase reactive power (kilovolt amperes reactive).
 - 5) Power factor.
 - 6) Running log of total power versus time (kilowatt hours).
 - 7) Fault log, with time and date of each.
- 10. Controls:
 - a. Stand-alone, microprocessor based.
 - b. Enclosure: Share enclosure with electrical power devices or provide a separate enclosure of matching construction.
 - c. Operator Interface: Keypad or pressure-sensitive touch screen. Multiple-character, backlit, liquid-crystal display or light-emitting diodes. Display the following:
 - 1) Date and time.
 - 2) Operating or alarm status.
 - 3) Operating hours.
 - 4) Outside-air temperature if required for chilled-water reset.
 - 5) Temperature and pressure of operating set points.
 - 6) Entering and leaving temperatures of chilled water.
 - 7) Entering and leaving temperatures of condenser water.
 - 8) Refrigerant pressures in evaporator and condenser.
 - 9) Saturation temperature in evaporator and condenser.
 - 10) No cooling load condition.
 - 11) Elapsed time meter (compressor run status).
 - 12) Pump status.
 - 13) Antirecycling timer status.
 - 14) Percent of maximum motor amperage.
 - 15) Current-limit set point.
 - 16) Number of compressor starts.
 - d. Control Functions:
 - 1) Manual or automatic startup and shutdown time schedule.
 - 2) Entering and leaving chilled-water temperatures, control set points, and motor load limit. Chilled-water leaving temperature shall be reset based on return-water **OR** outside-air **OR** space, **as directed**, temperature.
 - 3) Current limit and demand limit.
 - 4) Condenser-water temperature.
 - 5) External water chiller emergency stop.
 - 6) Antirecycling timer.
 - 7) Automatic lead-lag switching.
 - e. Manual-Reset Safety Controls: The following conditions shall shut down water chiller and require manual reset:
 - 1) Low evaporator pressure or high condenser pressure.
 - 2) Low chilled-water temperature.
 - 3) Refrigerant high pressure.

- 4) High or low oil pressure.
- 5) High oil temperature.
- 6) Loss of chilled-water flow.
- 7) Loss of condenser-water flow.
- 8) Control device failure.
- f. Building Automation System Interface: Factory-installed hardware and software to enable building automation system to monitor, control, and display water chiller status and alarms.
 - 1) Hardwired Points:
 - a) Monitoring: On/off status, common trouble alarm **OR** electrical power demand (kilowatts) **OR** electrical power consumption (kilowatt hours), **as directed**.
 - b) Control: On/off operation, chilled-water discharge temperature set-point adjustment **OR** electrical power demand limit, **as directed**.
 - 2) ASHRAE 135 (BACnet) **OR** LonTalk **OR** Modbus **OR** Industry-accepted open-protocol, **as directed**, communication interface with building automation system shall enable building automation system operator to remotely control and monitor the water chiller from an operator workstation. Control features and monitoring points displayed locally at water chiller control panel shall be available through building automation system.
- 11. Insulation:
 - a. Material: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I, for tubular materials and Type II, for sheet materials.
 - b. Thickness: 3/4 inch (19 mm).
 - c. Factory-applied insulation over cold surfaces of water chiller components.
 - 1) Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface. Seal seams and joints.
 - d. Apply protective coating to exposed surfaces of insulation.
- 12. Accessories:
 - a. Factory-furnished, chilled-water and condenser-water, **as directed**, flow switches for field installation.
 - b. Individual compressor suction and discharge pressure gages with shutoff valves for each refrigeration circuit.
 - c. Factory-furnished neoprene **OR** spring, **as directed**, isolators for field installation.
- B. Packaged Air-Cooled Water Chillers
 - 1. Description: Factory-assembled and run-tested water chiller complete with base and frame, condenser casing, compressors, compressor motors and motor controllers, evaporator, condenser coils, condenser fans and motors, electrical power, controls, and accessories.
 - 2. Fabricate base, frame, and attachment to water chiller components strong enough to resist movement during a seismic event when water chiller base is anchored to field support structure.
 - 3. Cabinet:
 - a. Base: Galvanized-steel base extending the perimeter of water chiller. Secure frame, compressors, and evaporator to base to provide a single-piece unit.
 - b. Frame: Rigid galvanized-steel frame secured to base and designed to support cabinet, condenser, control panel, and other chiller components not directly supported from base.
 - c. Casing: Galvanized steel.
 - d. Finish: Coat base, frame, and casing with a corrosion-resistant coating capable of withstanding a 500-hour salt-spray test according to ASTM B 117.
 - e. Sound-reduction package consisting of the following:
 - 1) Acoustic enclosure around compressors.
 - 2) Reduced-speed fans with acoustic treatment.
 - 3) Designed to reduce sound level without affecting performance.
 - f. Security Package: Provide security grilles with fasteners for additional protection of compressors, evaporator, and condenser coils. Grilles shall be coated for corrosion resistance and shall be removable for service access.
 - 4. Compressors:

- a. Description: Positive-displacement direct drive with hermetically sealed casing.
- b. Each compressor provided with suction and discharge service valves, crankcase oil heater, and suction strainer.
- c. Operating Speed: Nominal 3600 rpm for 60-Hz applications.
- d. Capacity Control: On-off compressor cycling, plus hot-gas bypass, **as directed**.
- e. Oil Lubrication System: Automatic pump with strainer, sight glass, filling connection, filter with magnetic plug, and initial oil charge.
- f. Vibration Isolation: Mount individual compressors on vibration isolators.
- 5. Compressor Motors:
 - a. Hermetically sealed and cooled by refrigerant suction gas.
 - b. High-torque, two-pole induction type with inherent thermal-overload protection on each phase.
- 6. Compressor Motor Controllers:
 - a. Across the Line: NEMA ICS 2, Class A, full voltage, nonreversing.
- 7. Refrigeration:
 - a. Refrigerant: R-22 **OR** R-407c **OR** R-410a, **as directed**. Classified as Safety Group A1 according to ASHRAE 34.
 - b. Refrigerant Compatibility: Parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
 - c. Refrigerant Circuit: Each circuit shall include a thermal-expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.
 - d. Refrigerant Isolation: Factory install positive shutoff isolation valves in the compressor discharge line and the refrigerant liquid-line to allow the isolation and storage of the refrigerant charge in the chiller condenser.
- 8. Evaporator:
 - a. Brazed-plate or shell-and-tube design, as indicated.
 - b. Shell and Tube:
 - 1) Description: Direct-expansion, shell-and-tube design with fluid flowing through the shell and refrigerant flowing through the tubes within the shell.
 - 2) Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
 - 3) Shell Material: Carbon steel.
 - 4) Shell Heads: Removable carbon-steel heads with multipass baffles designed to ensure positive oil return and located at each end of the tube bundle.
 - 5) Shell Nozzles: Fluid nozzles located along the side of the shell and terminated with mechanical-coupling end connections for connection to field piping.
 - 6) Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.
 - c. Brazed Plate:
 - 1) Direct-expansion, single-pass, brazed-plate design.
 - 2) Type 316 stainless-steel construction.
 - 3) Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
 - 4) Fluid Nozzles: Terminate with mechanical-coupling end connections for connection to field piping.
 - d. Heater: Factory-installed and -wired electric heater with integral controls designed to protect the evaporator to minus 20 deg F (minus 29 deg C).
 - e. Remote Mounting: Designed for remote field mounting where indicated. Provide kit for field installation.
- 9. Air-Cooled Condenser:
 - a. Plate-fin coil with integral subcooling on each circuit, rated at 450 psig (3103 kPa).
 - 1) Construct coils of copper tubes mechanically bonded to aluminum **OR** aluminum with precoated epoxy-phenolic **OR** copper, **as directed**, fins.

- 2) Coat coils with a baked epoxy corrosion-resistant coating after fabrication.
 - 3) Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.
 - b. Fans: Direct-drive propeller type with statically and dynamically balanced fan blades, arranged for vertical air discharge.
 - c. Fan Motors: Totally enclosed nonventilating (TENV) or totally enclosed air over (TEAO) enclosure, with permanently lubricated bearings, and having built-in overcurrent- and thermal-overload protection.
 - d. Fan Guards: Steel safety guards with corrosion-resistant coating.
- 10. Electrical Power:
 - a. Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to water chiller.
 - b. House in a unit-mounted, NEMA 250, Type 3R, **as directed**, enclosure with hinged access door with lock and key or padlock and key.
 - c. Wiring shall be numbered and color-coded to match wiring diagram.
 - d. Install factory wiring outside of an enclosure in a raceway.
 - e. Field power interface shall be to wire lugs **OR** NEMA KS 1, heavy-duty, nonfused disconnect switch, **as directed**.
 - f. Provide branch power circuit to each motor and to controls with one of the following disconnecting means:
 - 1) NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
 - 2) NEMA KS 1, heavy-duty, nonfusible switch.
 - 3) NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
 - g. Provide each motor with overcurrent protection.
 - h. Overload relay sized according to UL 1995, or an integral component of water chiller control microprocessor.
 - i. Phase-Failure and Undervoltage: Solid-state sensing with adjustable settings.
 - j. Provide power factor correction capacitors to correct power factor to 0.90 **OR** 0.95, **as directed**, at full load.
 - k. Transformer: Unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.
 - 1) Power unit-mounted controls where indicated.
 - 2) Power unit-mounted, ground fault interrupt (GFI) duplex receptacle.
 - l. Control Relays: Auxiliary and adjustable time-delay relays.
 - m. Indicate the following for water chiller electrical power supply:
 - 1) Current, phase to phase, for all three phases.
 - 2) Voltage, phase to phase and phase to neutral for all three phases.
 - 3) Three-phase real power (kilowatts).
 - 4) Three-phase reactive power (kilovolt amperes reactive).
 - 5) Power factor.
 - 6) Running log of total power versus time (kilowatt hours).
 - 7) Fault log, with time and date of each.
- 11. Controls:
 - a. Stand-alone, microprocessor based.
 - b. Enclosure: Share enclosure with electrical power devices or provide a separate enclosure of matching construction.
 - c. Operator Interface: Keypad or pressure-sensitive touch screen. Multiple-character, backlit, liquid-crystal display or light-emitting diodes. Display the following:
 - 1) Date and time.
 - 2) Operating or alarm status.
 - 3) Operating hours.
 - 4) Outside-air temperature if required for chilled-water reset.
 - 5) Temperature and pressure of operating set points.
 - 6) Entering and leaving temperatures of chilled water.

- 7) Refrigerant pressures in evaporator and condenser.
- 8) Saturation temperature in evaporator and condenser.
- 9) No cooling load condition.
- 10) Elapsed time meter (compressor run status).
- 11) Pump status.
- 12) Antirecycling timer status.
- 13) Percent of maximum motor amperage.
- 14) Current-limit set point.
- 15) Number of compressor starts.
- d. Control Functions:
 - 1) Manual or automatic startup and shutdown time schedule.
 - 2) Entering and leaving chilled-water temperatures, control set points, and motor load limit. Chilled-water leaving temperature shall be reset based on return-water **OR** outside-air **OR** space, **as directed**, temperature.
 - 3) Current limit and demand limit.
 - 4) External water chiller emergency stop.
 - 5) Antirecycling timer.
 - 6) Automatic lead-lag switching.
- e. Manual-Reset Safety Controls: The following conditions shall shut down water chiller and require manual reset:
 - 1) Low evaporator pressure or high condenser pressure.
 - 2) Low chilled-water temperature.
 - 3) Refrigerant high pressure.
 - 4) High or low oil pressure.
 - 5) High oil temperature.
 - 6) Loss of chilled-water flow.
 - 7) Control device failure.
- f. Building Automation System Interface: Factory-installed hardware and software to enable building automation system to monitor, control, and display water chiller status and alarms.
 - 1) Hardwired Points:
 - a) Monitoring: On/off status, common trouble alarm **OR** electrical power demand (kilowatts) **OR** electrical power consumption (kilowatt hours), **as directed**.
 - b) Control: On/off operation, chilled-water discharge temperature set-point adjustment **OR** electrical power demand limit, **as directed**.
 - 2) ASHRAE 135 (BACnet) **OR** LonTalk **OR** Industry-accepted open-protocol, **as directed**, communication interface with building automation system shall enable building automation system operator to remotely control and monitor the water chiller from an operator workstation. Control features and monitoring points displayed locally at water chiller control panel shall be available through building automation system.
- 12. Insulation:
 - a. Material: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I, for tubular materials and Type II, for sheet materials.
 - b. Thickness: 3/4 inch (19 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
 - c. Factory-applied insulation over cold surfaces of water chiller components.
 - 1) Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface. Seal seams and joints.
 - d. Apply protective coating to exposed surfaces of insulation.
- 13. Accessories:
 - a. Factory-furnished, chilled-water and condenser-water, **as directed**, flow switches for field installation.
 - b. Individual compressor suction and discharge pressure gages with shutoff valves for each refrigeration circuit.
 - c. Factory-furnished neoprene **OR** spring, **as directed**, isolators for field installation.

- C. Packaged Refrigerant Recovery Units
 - 1. Packaged portable unit shall consist of compressor, air-cooled condenser, recovery system, tank pressure gages, filter-dryer, and valving that allows for switching between liquid and vapor recovery mode. Refrigerant recovery unit shall be factory mounted on an ASME-constructed and -stamped refrigerant storage vessel that is sized to hold the full refrigerant charge of the largest water chiller.
- D. Source Quality Control
 - 1. Perform functional test of water chillers before shipping.
 - 2. Factory performance test water chillers, **as directed**, before shipping, according to ARI 550/590, "Water Chilling Packages Using the Vapor Compression Cycle."
 - a. Allow Owner access to place where water chillers are being tested. Notify the Owner 14 days in advance of testing.
 - 3. Factory test and inspect evaporator and water-cooled condenser, **as directed**, according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1. Stamp with ASME label.
 - 4. For water chillers located indoors, rate sound power level according to ARI 575 procedure.
 - 5. For water chillers located outdoors, rate sound power level according to ARI 370 procedure.

1.3 EXECUTION

- A. Water Chiller Installation
 - 1. Install water chillers on support structure indicated.
 - 2. Equipment Mounting: Install water chiller on concrete bases using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements in Division 03 Section "Cast-in-place Concrete". Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1 inch (25 mm), **as directed**.
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - c. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Equipment Mounting: Install water chiller using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1 inch (25 mm), **as directed**.
 - 4. Equipment Mounting: Install water chiller on vibration isolation inertia bases. Comply with requirements specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - 5. Equipment Mounting: Install water chiller on concrete bases. Comply with requirements in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Maintain manufacturer's recommended clearances for service and maintenance.
 - 7. Charge water chiller with refrigerant if not factory charged and fill with oil if not factory installed.
 - 8. Install separate devices furnished by manufacturer and not factory installed.

B. Connections

1. Comply with requirements in Division 23 Section "Hydronic Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
2. Comply with requirements in Division 23 Section "Refrigerant Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
3. Install piping adjacent to chiller to allow service and maintenance.
4. Evaporator Fluid Connections: Connect to evaporator inlet with shutoff valve, strainer, **as directed**, flexible connector, **as directed**, thermometer, and plugged tee with pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, **as directed**, flow switch, thermometer, plugged tee with pressure gage, flow meter, **as directed**, and drain connection with valve. Make connections to water chiller with a union **OR** flange **OR** mechanical coupling, **as directed**.
5. Condenser Fluid Connections: Connect to condenser inlet with shutoff valve, strainer, **as directed**, flexible connector, **as directed**, thermometer, and plugged tee with pressure gage. Connect to condenser outlet with shutoff valve, balancing valve, flexible connector, **as directed**, flow switch, thermometer, plugged tee with pressure gage, flow meter, **as directed**, and drain connection with valve. Make connections to water chiller with a union **OR** flange **OR** mechanical coupling, **as directed**.
6. Refrigerant Pressure Relief Valve Connections: For water chillers installed indoors, extend vent piping to the outside without valves or restrictions. Comply with ASHRAE 15, **as directed**.
7. Connect each drain connection with a union and drain pipe and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection if required.

C. Startup Service

1. Perform startup service.
2. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.
3. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
 - a. Verify that refrigerant charge is sufficient and water chiller has been leak tested.
 - b. Verify that pumps are installed and functional.
 - c. Verify that thermometers and gages are installed.
 - d. Operate water chiller for run-in period.
 - e. Check bearing lubrication and oil levels.
 - f. Verify that refrigerant pressure relief device for chillers installed indoors is vented outside.
 - g. Verify proper motor rotation.
 - h. Verify static deflection of vibration isolators, including deflection during water chiller startup and shutdown.
 - i. Verify and record performance of chilled-water and condenser-water, **as directed**, flow and low-temperature interlocks.
 - j. Verify and record performance of water chiller protection devices.
 - k. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
4. Prepare a written startup report that records results of tests and inspections.

END OF SECTION 23 64 23 00



SECTION 23 64 23 00A - MPF AIR-COOLED ROTARY WATER CHILLERS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Packaged, air-cooled, electric-motor-driven, scroll or screw water chillers.

1.2 SUBMITTALS

- A. Product Data: Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.
- B. ARI sound power data
- C. Startup service reports.
- D. Operation and maintenance data.
- E. Warranty.

1.3 QUALITY ASSURANCE

- A. ARI Certification: Certify chiller according to ARI 590 certification program.
- B. ARI Rating: Rate water chiller performance according to requirements in ARI 550/590, "Water Chilling Packages Using the Vapor Compression Cycle."
- C. ASHRAE Compliance: ASHRAE 15 for safety code for mechanical refrigeration.
- D. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2007, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- E. ASME Compliance: Fabricate and stamp water chiller heat exchangers to comply with ASME Boiler and Pressure Vessel Code.
- F. Comply with NFPA 70.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water chillers that fail in materials or workmanship within specified period.
 - 1. Compressor Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PACKAGED AIR-COOLED WATER CHILLERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Carrier Corporation; a United Technologies company.
 - 2. Trane.
 - 3. York International Corporation.
 - 4. McQuay International
- B. Description: Factory-assembled and run-tested water chiller complete with base and frame, condenser casing, compressors, compressor motors and motor controllers, evaporator, condenser coils, condenser fans and motors, electrical power, controls, and accessories.
- C. Fabricate base, frame, and attachment to water chiller components strong enough to resist movement during a seismic event when water chiller base is anchored to field support structure.
- D. Complete sound power and sound pressure data shall be provided that indicates no peaks above 92 dB in the 1K to 8K octave bands for Sound Power, no peaks above 65 dB in the 1K to 8K octave bands for Sound Pressure, and A-weighted values at 100% load not exceeding 98 dBA for Sound Power and 71 dBA Sound Pressure
 - 1. Provide sound-reduction package consisting of the following as needed to meet the lowest radiated sound:
 - a. Ultra low sound condenser fans.
 - b. Compressor blankets with sound attenuating properties.
 - c. Variable speed compressors.
 - d. Hot gas silencers or sound enclosures to limit noise from refrigerant piping.
 - e. RIS vibration isolators.
 - f. Etc.
- E. Cabinet:
 - 1. Base: Galvanized-steel base extending the perimeter of water chiller. Secure frame, compressors, and evaporator to base to provide a single-piece unit.
 - 2. Frame: Rigid galvanized-steel frame secured to base and designed to support cabinet, condenser, control panel, and other chiller components not directly supported from base.
 - 3. Casing: Galvanized steel.
 - 4. Finish: Coat base, frame, and casing with a corrosion-resistant coating capable of withstanding a 1000-hour salt-spray test according to ASTM B 117.
 - 5. Security Package: Provide security grilles with fasteners for additional protection of compressors, evaporator, and condenser coils. Grilles shall be coated for corrosion resistance and shall be removable for service access.
- F. Compressors:
 - 1. Description: Positive-displacement direct drive with hermetically sealed casing.
 - 2. Each compressor provided with suction and discharge service valves, crankcase oil heater, and suction strainer.
 - 3. Operating Speed: Nominal 3600 rpm for 60-Hz applications.

4. Capacity Control: On-off compressor cycling.
 5. Oil Lubrication System: Automatic pump with strainer, sight glass, filling connection, filter with magnetic plug, and initial oil charge.
 6. Vibration Isolation: Mount individual compressors on vibration isolators.
- G. Compressor Motors:
1. Hermetically sealed and cooled by refrigerant suction gas.
 2. High-torque, two-pole induction type with inherent thermal-overload protection on each phase.
 - 3.
- H. Compressor Motor Controllers:
1. Across the Line: NEMA ICS 2, Class A, full voltage, nonreversing.
- I. Refrigeration:
1. Refrigerant R-410a or R-134a. Classified as Safety Group A1 according to ASHRAE 34.
 2. Refrigerant Compatibility: Parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
 3. Refrigerant Circuit: Each circuit shall include a thermal-expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.
 4. Refrigerant Isolation: Factory install positive shutoff isolation valves in the compressor discharge line and the refrigerant liquid-line to allow the isolation and storage of the refrigerant charge in the chiller condenser.
- J. Evaporator:
1. Brazed-plate or shell-and-tube design, as indicated.
 2. Shell and Tube:
 - a. Description: Direct-expansion, shell-and-tube design with fluid flowing through the shell and refrigerant flowing through the tubes within the shell.
 - b. Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
 - c. Shell Material: Carbon steel.
 - d. Shell Heads: Removable carbon-steel heads with multipass baffles designed to ensure positive oil return and located at each end of the tube bundle.
 - e. Shell Nozzles: Fluid nozzles located along the side of the shell and terminated with mechanical-coupling end connections for connection to field piping.
 - f. Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.
 3. Brazed Plate:
 - a. Direct-expansion, single-pass, brazed-plate design.
 - b. Type 316 stainless-steel construction.
 - c. Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
 - d. Fluid Nozzles: Terminate with mechanical-coupling end connections for connection to field piping.
 4. Heater: Factory-installed and -wired electric heater with integral controls designed to protect the evaporator to minus 20 deg F.
 5. Remote Mounting: Designed for remote field mounting where indicated. Provide kit for field installation.
- K. Air-Cooled Condenser:
1. Plate-fin coil with integral subcooling on each circuit, rated at 450 psig.
 - a. Construct coils of copper tubes mechanically bonded to aluminum fins.
 - b. Coat coils with a baked epoxy heresite corrosion-resistant coating after fabrication.
 - c. Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.



2. Fans: Direct-drive propeller type with statically and dynamically balanced fan blades, arranged for vertical air discharge. Ultra low sound type.
3. Fan Motors: Totally enclosed nonventilating (TENV) or totally enclosed air over (TEAO) enclosure, with permanently lubricated bearings, and having built-in overcurrent- and thermal-overload protection.
4. Fan Guards: Steel safety guards with corrosion-resistant coating.

L. Electrical Power:

1. Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to water chiller.
2. House in a unit-mounted, NEMA 250, Type 3R enclosure with hinged access door with lock and key or padlock and key.
3. Wiring shall be numbered and color-coded to match wiring diagram.
4. Install factory wiring outside of an enclosure in a raceway.
5. Field power interface shall be to nonfused disconnect switch.
6. Provide branch power circuit to each motor and to controls with one of the following disconnecting means:
 - a. NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
 - b. NEMA KS 1, heavy-duty, nonfusible switch.
 - c. NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
7. Provide each motor with overcurrent protection.
8. Overload relay sized according to UL 1995, or an integral component of water chiller control microprocessor.
9. Phase-Failure and Undervoltage: Solid-state sensing with adjustable settings.
10. Provide power factor correction capacitors to correct power factor to 0.90 at full load.
11. Transformer: Unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.
 - a. Power unit-mounted controls where indicated.
 - b. Power unit-mounted, ground fault interrupt (GFI) duplex receptacle.
12. Control Relays: Auxiliary and adjustable time-delay relays.
13. Indicate the following for water chiller electrical power supply:
 - a. Current, phase to phase, for all three phases.
 - b. Voltage, phase to phase and phase to neutral for all three phases.
 - c. Three-phase real power (kilowatts).
 - d. Three-phase reactive power (kilovolt amperes reactive).
 - e. Power factor.
 - f. Running log of total power versus time (kilowatt hours).
 - g. Fault log, with time and date of each.

M. Controls:

1. Stand-alone, microprocessor based.
2. Enclosure: Share enclosure with electrical power devices or provide a separate enclosure of matching construction.
3. Operator Interface: Keypad or pressure-sensitive touch screen. Multiple-character, backlit, liquid-crystal display or light-emitting diodes. Display the following:
 - a. Date and time.
 - b. Operating or alarm status.
 - c. Operating hours.
 - d. Outside-air temperature if required for chilled-water reset.
 - e. Temperature and pressure of operating set points.
 - f. Entering and leaving temperatures of chilled water.
 - g. Refrigerant pressures in evaporator and condenser.
 - h. Saturation temperature in evaporator and condenser.

- i. No cooling load condition.
 - j. Elapsed time meter (compressor run status).
 - k. Pump status.
 - l. Antirecycling timer status.
 - m. Percent of maximum motor amperage.
 - n. Current-limit set point.
 - o. Number of compressor starts.
 - 4. Control Functions:
 - a. Manual or automatic startup and shutdown time schedule.
 - b. Entering and leaving chilled-water temperatures, control set points, and motor load limit. Chilled-water leaving temperature shall be reset based on [return-water] [outside-air] [space] temperature.
 - c. Current limit and demand limit.
 - d. External water chiller emergency stop.
 - e. Antirecycling timer.
 - f. Automatic lead-lag switching.
 - g.
 - 5. Manual-Reset Safety Controls: The following conditions shall shut down water chiller and require manual reset:
 - a. Low evaporator pressure or high condenser pressure.
 - b. Low chilled-water temperature.
 - c. Refrigerant high pressure.
 - d. High or low oil pressure.
 - e. High oil temperature.
 - f. Loss of chilled-water flow.
 - g. Control device failure.
 - N. Insulation:
 - 1. Material: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I, for tubular materials and Type II, for sheet materials.
 - 2. Thickness: 3/4 inch and K=0.28.
 - 3. Factory-applied insulation over cold surfaces of water chiller components.
 - a. Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface. Seal seams and joints.
 - 4. Apply protective coating to exposed surfaces of insulation.
 - O. Accessories:
 - 1. Factory-furnished, chilled-water flow switches for field installation.
 - 2. Individual compressor suction and discharge pressure gages with shutoff valves for each refrigeration circuit.
 - 3. Factory-furnished neoprene isolators for field installation.
 - P. Capacities and Characteristics:
 - 1. As per Scheduled characteristics
- ## 2.2 SOURCE QUALITY CONTROL
- A. Perform functional test of water chillers before shipping.
 - B. Factory test and inspect evaporator according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1. Stamp with ASME label.
 - C. For water chillers located outdoors, rate sound power level according to ARI 370 procedure.

PART 3 - EXECUTION

3.1 WATER CHILLER INSTALLATION

- A. Install water chillers on support structure indicated.
- B. Equipment Mounting: Install water chiller on concrete bases using elastomeric pads. Comply with requirements in Division 03 Section "Cast-in-Place Concrete"
 - 1. Minimum Deflection: 1/4 inch
- C. Maintain manufacturer's recommended clearances for service and maintenance.
- D. Charge water chiller with refrigerant if not factory charged and fill with oil if not factory installed.
- E. Install separate devices furnished by manufacturer and not factory installed.

3.2 CONNECTIONS

- A. Comply with requirements in Division 23 Section "Hydronic Piping" Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to chiller to allow service and maintenance.
- C. Evaporator Fluid Connections: Connect to evaporator inlet with shutoff valve, strainer, flexible connector, thermometer, and plugged tee with pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with pressure gage, flow meter, and drain connection with valve. Make connections to water chiller with a union, flange, or mechanical coupling.
- D. Connect each drain connection with a union and drain pipe and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection if required.

3.3 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.
- C. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
 - 1. Verify that refrigerant charge is sufficient and water chiller has been leak tested.
 - 2. Verify that pumps are installed and functional.
 - 3. Verify that thermometers and gages are installed.
 - 4. Operate water chiller for run-in period.
 - 5. Check bearing lubrication and oil levels.
 - 6. Verify proper motor rotation.
 - 7. Verify static deflection of vibration isolators, including deflection during water chiller startup and shutdown.
 - 8. Verify and record performance of chilled-water flow and low-temperature interlocks.
 - 9. Verify and record performance of water chiller protection devices.
 - 10. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.



- D. Prepare a written startup report that records results of tests and inspections.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 6/25/13

END OF SECTION 23 64 23 00a



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SECTION 23 64 23 00A - CSF AIR-COOLED ROTARY WATER CHILLERS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Packaged Rooftop Units are part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.23 64 23 00a

PART 1 -

PART 2 - GENERAL

2.1 SUMMARY

- A. Section Includes: Packaged, air-cooled, electric-motor-driven, scroll or screw water chillers.

2.2 SUBMITTALS

- A. Product Data: Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.
- B. ARI sound power data
- C. Startup service reports.
- D. Operation and maintenance data.
- E. Warranty.

2.3 QUALITY ASSURANCE

- A. ARI Certification: Certify chiller according to ARI 590 certification program.
- B. ARI Rating: Rate water chiller performance according to requirements in ARI 550/590, "Water Chilling Packages Using the Vapor Compression Cycle."
- C. ASHRAE Compliance: ASHRAE 15 for safety code for mechanical refrigeration.
- D. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2007, Section 6 - "Heating, Ventilating, and Air-Conditioning."



- E. ASME Compliance: Fabricate and stamp water chiller heat exchangers to comply with ASME Boiler and Pressure Vessel Code.
- F. Comply with NFPA 70.

2.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water chillers that fail in materials or workmanship within specified period.
 - 1. Compressor Warranty Period: Five years from date of Substantial Completion.

PART 3 - PRODUCTS

3.1 PACKAGED AIR-COOLED WATER CHILLERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Carrier Corporation; a United Technologies company.
 - 2. Trane.
 - 3. York International Corporation.
 - 4. McQuay International
- B. Description: Factory-assembled and run-tested water chiller complete with base and frame, condenser casing, compressors, compressor motors and motor controllers, evaporator, condenser coils, condenser fans and motors, electrical power, controls, and accessories.
- C. Fabricate base, frame, and attachment to water chiller components strong enough to resist movement during a seismic event when water chiller base is anchored to field support structure.
- D. Complete sound power and sound pressure data shall be provided that indicates no peaks above 92 dB in the 1K to 8K octave bands for Sound Power, no peaks above 65 dB in the 1K to 8K octave bands for Sound Pressure, and A-weighted values at 100% load not exceeding 98 dBA for Sound Power and 71 dBA Sound Pressure
 - 1. Provide sound-reduction package consisting of the following as needed to meet the lowest radiated sound:
 - a. Ultra low sound condenser fans.
 - b. Compressor blankets with sound attenuating properties.
 - c. Variable speed compressors.
 - d. Hot gas silencers or sound enclosures to limit noise from refrigerant piping.
 - e. RIS vibration isolators.
 - f. Etc.
- E. Cabinet:
 - 1. Base: Galvanized-steel base extending the perimeter of water chiller. Secure frame, compressors, and evaporator to base to provide a single-piece unit.
 - 2. Frame: Rigid galvanized-steel frame secured to base and designed to support cabinet, condenser, control panel, and other chiller components not directly supported from base.
 - 3. Casing: Galvanized steel.
 - 4. Finish: Coat base, frame, and casing with a corrosion-resistant coating capable of withstanding a 1000-hour salt-spray test according to ASTM B 117.
 - 5. Security Package: Provide security grilles with fasteners for additional protection of compressors, evaporator, and condenser coils. Grilles shall be coated for corrosion resistance and shall be removable for service access.

- F. Compressors:
1. Description: Positive-displacement direct drive with hermetically sealed casing.
 2. Each compressor provided with suction and discharge service valves, crankcase oil heater, and suction strainer.
 3. Operating Speed: Nominal 3600 rpm for 60-Hz applications.
 4. Capacity Control: On-off compressor cycling.
 5. Oil Lubrication System: Automatic pump with strainer, sight glass, filling connection, filter with magnetic plug, and initial oil charge.
 6. Vibration Isolation: Mount individual compressors on vibration isolators.
- G. Compressor Motors:
1. Hermetically sealed and cooled by refrigerant suction gas.
 2. High-torque, two-pole induction type with inherent thermal-overload protection on each phase.
 - 3.
- H. Compressor Motor Controllers:
1. Across the Line: NEMA ICS 2, Class A, full voltage, nonreversing.
- I. Refrigeration:
1. Refrigerant R-410a or R-134a. Classified as Safety Group A1 according to ASHRAE 34.
 2. Refrigerant Compatibility: Parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
 3. Refrigerant Circuit: Each circuit shall include a thermal-expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.
 4. Refrigerant Isolation: Factory install positive shutoff isolation valves in the compressor discharge line and the refrigerant liquid-line to allow the isolation and storage of the refrigerant charge in the chiller condenser.
- J. Evaporator:
1. Brazed-plate or shell-and-tube design, as indicated.
 2. Shell and Tube:
 - a. Description: Direct-expansion, shell-and-tube design with fluid flowing through the shell and refrigerant flowing through the tubes within the shell.
 - b. Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
 - c. Shell Material: Carbon steel.
 - d. Shell Heads: Removable carbon-steel heads with multipass baffles designed to ensure positive oil return and located at each end of the tube bundle.
 - e. Shell Nozzles: Fluid nozzles located along the side of the shell and terminated with mechanical-coupling end connections for connection to field piping.
 - f. Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.
 3. Brazed Plate:
 - a. Direct-expansion, single-pass, brazed-plate design.
 - b. Type 316 stainless-steel construction.
 - c. Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
 - d. Fluid Nozzles: Terminate with mechanical-coupling end connections for connection to field piping.
 4. Heater: Factory-installed and -wired electric heater with integral controls designed to protect the evaporator to minus 20 deg F.
 5. Remote Mounting: Designed for remote field mounting where indicated. Provide kit for field installation.
- K. Air-Cooled Condenser:

1. Plate-fin coil with integral subcooling on each circuit, rated at 450 psig.
 - a. Construct coils of copper tubes mechanically bonded to aluminum fins.
 - b. Coat coils with a baked epoxy heresite corrosion-resistant coating after fabrication.
 - c. Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.
 2. Fans: Direct-drive propeller type with statically and dynamically balanced fan blades, arranged for vertical air discharge. Ultra low sound type.
 3. Fan Motors: Totally enclosed nonventilating (TENV) or totally enclosed air over (TEAO) enclosure, with permanently lubricated bearings, and having built-in overcurrent- and thermal-overload protection.
 4. Fan Guards: Steel safety guards with corrosion-resistant coating.
- L. Electrical Power:
1. Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to water chiller.
 2. House in a unit-mounted, NEMA 250, Type 3R enclosure with hinged access door with lock and key or padlock and key.
 3. Wiring shall be numbered and color-coded to match wiring diagram.
 4. Install factory wiring outside of an enclosure in a raceway.
 5. Field power interface shall be to nonfused disconnect switch.
 6. Provide branch power circuit to each motor and to controls with one of the following disconnecting means:
 - a. NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
 - b. NEMA KS 1, heavy-duty, nonfusible switch.
 - c. NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
 7. Provide each motor with overcurrent protection.
 8. Overload relay sized according to UL 1995, or an integral component of water chiller control microprocessor.
 9. Phase-Failure and Undervoltage: Solid-state sensing with adjustable settings.
 10. Provide power factor correction capacitors to correct power factor to 0.90 at full load.
 11. Transformer: Unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.
 - a. Power unit-mounted controls where indicated.
 - b. Power unit-mounted, ground fault interrupt (GFI) duplex receptacle.
 12. Control Relays: Auxiliary and adjustable time-delay relays.
 13. Indicate the following for water chiller electrical power supply:
 - a. Current, phase to phase, for all three phases.
 - b. Voltage, phase to phase and phase to neutral for all three phases.
 - c. Three-phase real power (kilowatts).
 - d. Three-phase reactive power (kilovolt amperes reactive).
 - e. Power factor.
 - f. Running log of total power versus time (kilowatt hours).
 - g. Fault log, with time and date of each.
- M. Controls:
1. Stand-alone, microprocessor based.
 2. Enclosure: Share enclosure with electrical power devices or provide a separate enclosure of matching construction.
 3. Operator Interface: Keypad or pressure-sensitive touch screen. Multiple-character, backlit, liquid-crystal display or light-emitting diodes. Display the following:
 - a. Date and time.
 - b. Operating or alarm status.
 - c. Operating hours.

- d. Outside-air temperature if required for chilled-water reset.
- e. Temperature and pressure of operating set points.
- f. Entering and leaving temperatures of chilled water.
- g. Refrigerant pressures in evaporator and condenser.
- h. Saturation temperature in evaporator and condenser.
- i. No cooling load condition.
- j. Elapsed time meter (compressor run status).
- k. Pump status.
- l. Antirecycling timer status.
- m. Percent of maximum motor amperage.
- n. Current-limit set point.
- o. Number of compressor starts.
- 4. Control Functions:
 - a. Manual or automatic startup and shutdown time schedule.
 - b. Entering and leaving chilled-water temperatures, control set points, and motor load limit. Chilled-water leaving temperature shall be reset based on [return-water] [outside-air] [space] temperature.
 - c. Current limit and demand limit.
 - d. External water chiller emergency stop.
 - e. Antirecycling timer.
 - f. Automatic lead-lag switching.
 - g.
- 5. Manual-Reset Safety Controls: The following conditions shall shut down water chiller and require manual reset:
 - a. Low evaporator pressure or high condenser pressure.
 - b. Low chilled-water temperature.
 - c. Refrigerant high pressure.
 - d. High or low oil pressure.
 - e. High oil temperature.
 - f. Loss of chilled-water flow.
 - g. Control device failure.
- N. Insulation:
 - 1. Material: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I, for tubular materials and Type II, for sheet materials.
 - 2. Thickness: 3/4 inch and K=0.28.
 - 3. Factory-applied insulation over cold surfaces of water chiller components.
 - a. Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface. Seal seams and joints.
 - 4. Apply protective coating to exposed surfaces of insulation.
- O. Accessories:
 - 1. Factory-furnished, chilled-water flow switches for field installation.
 - 2. Individual compressor suction and discharge pressure gages with shutoff valves for each refrigeration circuit.
 - 3. Factory-furnished neoprene isolators for field installation.
- P. Capacities and Characteristics:
 - 1. As per Scheduled characteristics

3.2 SOURCE QUALITY CONTROL

- A. Perform functional test of water chillers before shipping.
- B. Factory test and inspect evaporator according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1. Stamp with ASME label.

- C. For water chillers located outdoors, rate sound power level according to ARI 370 procedure.

PART 4 - EXECUTION

4.1 WATER CHILLER INSTALLATION

- A. Install water chillers on support structure indicated.
- B. Equipment Mounting: Install water chiller on concrete bases using elastomeric pads. Comply with requirements in Division 03 Section "Cast-in-Place Concrete"
 - 1. Minimum Deflection: 1/4 inch
- C. Maintain manufacturer's recommended clearances for service and maintenance.
- D. Charge water chiller with refrigerant if not factory charged and fill with oil if not factory installed.
- E. Install separate devices furnished by manufacturer and not factory installed.

4.2 CONNECTIONS

- A. Comply with requirements in Division 23 Section "Hydronic Piping" Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to chiller to allow service and maintenance.
- C. Evaporator Fluid Connections: Connect to evaporator inlet with shutoff valve, strainer, flexible connector, thermometer, and plugged tee with pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with pressure gage, flow meter, and drain connection with valve. Make connections to water chiller with a union, flange, or mechanical coupling.
- D. Connect each drain connection with a union and drain pipe and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection if required.

4.3 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.
- C. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
 - 1. Verify that refrigerant charge is sufficient and water chiller has been leak tested.
 - 2. Verify that pumps are installed and functional.
 - 3. Verify that thermometers and gages are installed.
 - 4. Operate water chiller for run-in period.
 - 5. Check bearing lubrication and oil levels.
 - 6. Verify proper motor rotation.
 - 7. Verify static deflection of vibration isolators, including deflection during water chiller startup and shutdown.
 - 8. Verify and record performance of chilled-water flow and low-temperature interlocks.



9. Verify and record performance of water chiller protection devices.
 10. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
- D. Prepare a written startup report that records results of tests and inspections.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 6/25/13

END OF SECTION



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Task	Specification	Specification Description
23 64 23 00	23 64 19 00	Reciprocating Water Chillers
23 64 26 00	23 61 16 00	Rotary-Screw Water Chillers



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SECTION 23 65 00 00 - CSF COOLING TOWERS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Packaged Rooftop Units are part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.23 65 00 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Closed-circuit, forced-draft, counterflow cooling towers.
2. Open-circuit, induced-draft, crossflow cooling towers.
3. Open-circuit, induced-draft, counterflow cooling towers.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, pressure drop, fan performance data, rating curves with selected points indicated, furnished specialties, and accessories.
- B. Shop Drawings: Complete set of manufacturer's prints of cooling tower assemblies, control panels, sections and elevations, and unit isolation.
- C. Startup service reports.
- D. Operation and maintenance data.
- E. Warranty.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- C. Retain first paragraph below if heat-exchanger coil of closed-circuit cooling towers requires ASME Boiler and Pressure Vessel Code construction.

- D. ASME Compliance: Fabricate and label heat-exchanger coils to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace the following components of cooling towers that fail in materials or workmanship within specified warranty period:
1. Fan assembly including fan, drive, and motor.
 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project. Preference is to utilize induced-draft crossflow towers, however, additional tower types have been included below which may be required based upon available space where towers are located. Specifier shall delete products not to be used or considered.

2.1 CLOSED-CIRCUIT, FORCED-DRAFT, COUNTERFLOW COOLING TOWERS

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
1. Baltimore Aircoil Company; Models VFL and VF1.
 2. Delta Cooling Towers, Inc.; Model Pioneer.
 3. Evapco Inc.; Models LSWA and LRW.
 4. Recold; Models JM and JW.
 5. <Insert manufacturer's name; product name or designation>.

NOTE TO SPECIFIER

Retain first paragraph below for projects in seismic areas.

- B. Fabricate cooling tower mounting base with reinforcement strong enough to resist cooling tower movement during a seismic event when cooling tower is anchored to field support structure.
- C. Casing:
1. Casing Material: [FRP with UV inhibitors] [Polymer-coated galvanized steel] [Stainless steel].

NOTE TO SPECIFIER

Retain first subparagraph below and delete option in subparagraph heading above if frame material is different than casing.

2. Frame Material: Stainless steel.
 3. Fasteners: Stainless steel.
 4. Joints and Seams: Sealed watertight.
 5. Welded Connections: Continuous and watertight.
- D. Collection Basin:

1. Material: Stainless steel.
 2. Strainer: Removable stainless-steel strainer with openings smaller than nozzle orifices.
 3. Overflow and drain connections.
 4. Makeup water connection.
- E. Mechanically Operated, Collection Basin Water-Level Control: Manufacturer's standard adjustable, mechanical float assembly and valve.
- F. Electric Basin Heater:
1. Stainless-Steel Electric Immersion Heaters: Installed in a threaded coupling on the side of the collection basin.
 2. Heater Control Panel: Mounted on the side of each cooling tower cell.
 3. Enclosure: NEMA 250, Type 4X.
 4. Magnetic contactors controlled by a temperature sensor/controller to maintain collection basin water-temperature set point. Water-level probe shall monitor cooling tower water level and de-energize the heater when the water reaches low-level set point.
 5. Control-circuit transformer with primary and secondary side fuses.
 6. Terminal blocks with numbered and color-coded wiring to match wiring diagram.
 7. Single-point, field-power connection to a fused disconnect switch and heater branch circuiting complying with NFPA 70.
 8. Factory Wiring Method: Metal raceway for factory-installed wiring outside of enclosures, except make connections to each electric basin heater with liquidtight conduit.
- G. Water Distribution Piping: Main header and lateral branch piping designed for even distribution over fill throughout the flow range without the need for balancing valves and for connecting individual, removable, nonclogging spray nozzles.

NOTE TO SPECIFIER

In first subparagraph below, PVC is manufacturer's most common standard offering. Other requirements may require use of other materials.

1. Pipe Material: PVC <Insert material>.
 2. Spray Nozzle Material: [Plastic] [Polypropylene] [PVC] <Insert material>.
 3. Piping Supports: Corrosion-resistant hangers and supports designed to resist movement during operation and shipment.
- H. Spray Pump: Close-coupled, end-suction, single-stage, bronze-fitted centrifugal pump; with suction strainer and flow balancing valve, and mechanical seal suitable for outdoor service.
1. General Requirements for Spray Pump Motor: Comply with NEMA designation and temperature-rating requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment" and not indicated below.
 2. Motor Enclosure: Totally enclosed fan cooled (TEFC)
 3. Energy Efficiency: NEMA Premium Efficient.
 4. Service Factor: 1.15.
- I. Heat-Exchanger Coils:
1. Tube and Tube Sheet Materials: [Copper tube with stainless-steel sheet] [Stainless-steel tube and sheet].
 2. ASME Compliance: Designed, manufactured, and tested according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, and bearing ASME "U" stamp; and sloped for complete drainage of fluid by gravity.
 3. Field Piping Connections: Vent, supply, and return[suitable for mating to ASME B16.5, Class 150 flange].

- J. Centrifugal Fan: Double-width, double-inlet, forward-curved blades, and statically and dynamically balanced at the factory after assembly.
1. Number of Fans: Each cooling tower cell shall have a single fan or multiple fans connected to a common shaft.
 2. Fan Wheel and Housing Materials: Galvanized steel.
 3. Fan Shaft: Steel, coated to resist corrosion.
 4. Protective Enclosure: Removable, galvanized-steel, wire-mesh screens complying with OSHA regulations.
 5. Fan Shaft Bearings: Self-aligning, grease-lubricated ball or roller bearings with moisture-proof seals and premium, moisture-resistant grease suitable for temperatures between minus 20 and plus 300 deg F (minus 29 and plus 149 deg C). Bearings designed for an L-10 life of 50,000 hours.
 6. Bearings Grease Fittings: Extended lubrication lines to an easily accessible location.
- K. Belt Drive:
1. Belt-Drive Service Factor: 1.5 based on motor nameplate horsepower.
 2. Sheaves: Fan and motor shafts shall have taper-lock sheaves fabricated from corrosion-resistant materials.
 3. Belt: One-piece, multigrooved, solid-back belt.
 4. Belt Material: Oil resistant, nonstatic conducting, and constructed of neoprene polyester cord.
 5. Belt-Drive Guard: Comply with OSHA regulations.

NOTE TO SPECIFIER

Retain subparagraph below if Project requires functionality of a single fan with two motors. Feature is proprietary.

- L. Two-Motor, Single-Fan Drive:
1. Two single-speed motors per fan, one sized for full speed and load, and the other sized for [67] <Insert value> percent of full-load speed.
 2. Belt Drives: Each motor shall have belt drive complying with requirements for belt drives and configured for operation when other motor fails.
 3. Motor controller and wiring same as two-speed, two-winding motor.
- M. Fan Motor:
1. General Requirements for Fan Motors: Comply with NEMA designation and temperature-rating requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment" and not indicated below.
 2. Motor Enclosure: Totally enclosed air over (TEAO) or Totally enclosed fan cooled (TEFC)] with epoxy or polyurethane finish.
 3. Energy Efficiency: NEMA Premium Efficient.
 4. Service Factor: 1.15.
 5. Insulation: Class F.
 6. Variable-Speed Motors: Inverter-duty rated per NEMA MG-1, Section IV, "Performance Standard Applying to All Machines," Part 31, "Definite-Purpose, Inverter-Fed, Polyphase Motors."
- N. Controls: Comply with requirements in Division 23 Section "Instrumentation and Control for HVAC."
- O. Personnel Access Components:
1. Doors: Large enough for personnel to access cooling tower internal components from cooling tower end walls.
 2. External Ladders with Safety Cages: Aluminum, galvanized- or stainless-steel, fixed ladders with ladder extensions to access external platforms and top of cooling tower from adjacent grade without the need for portable ladders. Comply with 29 CFR 1910.27.
 3. External Platforms with Handrails: Aluminum, FRP, or galvanized-steel bar grating at cooling tower access doors when cooling towers are elevated and not accessible from grade.

4. Handrail: Aluminum, galvanized steel, or stainless steel complete with kneerail and toeboard at platforms and around top of cooling tower. Comply with 29 CFR 1910.23.
5. Internal Platforms: Aluminum, FRP, or galvanized-steel bar grating.
6. Spanning the collection basin from one end of cooling tower to the other and positioned to form a path between the access doors. Platform shall be elevated so that all parts are above the high water level of the collection basin.

2.2 OPEN-CIRCUIT, INDUCED-DRAFT, CROSSFLOW COOLING TOWERS

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 1. Amcot Cooling Tower Corp.; Models LRC-H, LRC-LNS Series.
 2. Baltimore Aircoil Company; Series 1500 and 3000.
 3. Marley Cooling Technologies, an SPX Corporation; Models Aquatower, AV series, NC Class, Primus.
 4. <Insert manufacturer's name; product name or designation>.
- B. Fabricate cooling tower mounting base with reinforcement strong enough to resist cooling tower movement during a seismic event when cooling tower is anchored to field support structure.
- C. Cooling tower designed to resist wind load of 30 lbf/sq. ft. (1.44 kPa).
- D. Casing and Frame:
 1. Casing and Frame Material: Stainless steel.
 2. Frame Material: Stainless steel.
 3. Fasteners: Stainless steel.
 4. Joints and Seams: Sealed watertight.
 5. Welded Connections: Continuous and watertight.
- E. Collection Basin:
 1. Material: Stainless steel.
 2. Removable stainless-steel strainer with openings smaller than nozzle orifices.
 3. Overflow and drain connections.
 4. Makeup water connection.
 5. Outlet Connection: ASME B16.5, Class 150 flange.

NOTE TO SPECIFIER

If project has a multiple-cell cooling tower or multiple cooling towers, retain the subparagraph below.

6. Equalizer connection for field-installed equalizer piping.
- F. Mechanically Operated, Collection Basin Water-Level Control: Manufacturer's standard adjustable, mechanical float assembly and valve.
- G. Electric Basin Heater (where required):
 1. Stainless-Steel Electric Immersion Heaters: Installed in a threaded coupling on the side of the collection basin.
 2. Heater Control Panel: Mounted on the side of each cooling tower cell.
 3. Enclosure: NEMA 250, Type 4X.
 4. Magnetic contactors controlled by a temperature sensor/controller to maintain collection basin water-temperature set point. Water-level probe shall monitor cooling tower water level and de-energize the heater when the water reaches low-level set point.
 5. Control-circuit transformer with primary and secondary side fuses.
 6. Terminal blocks with numbered and color-coded wiring to match wiring diagram.



7. Single-point, field-power connection to a fused disconnect switch and heater branch circuiting complying with NFPA 70.
8. Factory Wiring Method: Metal raceway for factory-installed wiring outside of enclosures, except make connections to each electric basin heater with liquidtight conduit.
- H. Gravity Water Distribution Basin: Nonpressurized design with head of water level in basin adequate to overcome spray nozzle losses and designed to evenly distribute water over fill throughout the flow range indicated.
 1. Material: Stainless steel.
 2. Removable Panels: Same material as basin to completely cover top of basin. Secure panels to basin with removable stainless-steel hardware.
 3. Valves: Manufacturer's standard valve installed at each inlet connection and arranged to balance or shut off flow to each gravity distribution basin.
- I. Fill:
 1. Manufacturers standard fill.
- J. Drift Eliminator:
 1. Manufacturers standard drift eliminator.
- K. Air-Intake Louvers:
 1. Material: FRP or PVC.
 2. UV Treatment: Inhibitors to protect against damage caused by UV radiation.
 3. Louver Blades: Arranged to uniformly direct air into cooling tower, to minimize air resistance, and to prevent water from splashing out of tower during all modes of operation including operation with fans off.
- L. Axial Fan: Balanced at the factory after assembly.
 1. Blade Material: Aluminum.
 2. Hub Material: Aluminum.
 3. Protective Enclosure: Removable, galvanized-steel, wire-mesh screens complying with OSHA regulations.
 4. Bearings Grease Fittings: Extended lubrication lines to an easily accessible location.

NOTE TO SPECIFIER

Retain paragraph below if belt drive is used.

- M. Belt Drive:
 1. Sheaves: Fan and motor shafts shall have taper-lock sheaves fabricated from corrosion-resistant materials.
 2. Belt Material: Oil resistant, nonstatic conducting, and constructed of neoprene polyester cord.
 3. Belt-Drive Guard: Comply with OSHA regulations.

NOTE TO SPECIFIER

Retain paragraph below if gear drive is used.

- N. Gear Drive: Right angle, reduced speed, and designed for cooling tower applications according to CTI STD 111. Motor and gear drive shall be aligned before shipment.
 1. Housing: Cast iron, with epoxy or polyurethane finish, beveled high-strength steel gears continuously bathed in oil, and with lubrication to other internal parts at all operating speeds.
 2. Mounting: Directly mounted to fan hub and connected to motor so motor shaft is in horizontal position.
 3. Operation: Able to operate both forward and in reverse.



4. Drive Shaft Material: Stainless steel, and fitted with flexible couplings on both ends. Provide exposed shaft and couplings with guards according to OSHA regulations.
5. Extend oil fill, drain, and vent to outside of cooling tower casing using galvanized-steel piping. Provide installation with oil-level sight glass.

O. Fan Motor:

NOTE TO SPECIFIER

Edit first paragraph below based upon requirements of project.

1. Motor Enclosure: Totally enclosed air over (TEAO) or Totally enclosed fan cooled (TEFC).
2. Energy Efficiency: NEMA Premium Efficient.
3. Insulation: Class F.
4. Variable-Speed Motors: Inverter-duty rated per NEMA MG-1, Section IV, "Performance Standard Applying to All Machines," Part 31, "Definite-Purpose, Inverter-Fed, Polyphase Motors."

NOTE TO SPECIFIER

Retain first subparagraph below if Project requires specific motor location.

5. Motor Location: Mounted outside of cooling tower casing and cooling tower discharge airstream.

NOTE TO SPECIFIER

Retain subparagraph below for belt-drive units.

6. Motor Base: Adjustable, or other suitable provision for adjusting belt tension.

P. Controls: Comply with requirements in Division 23 Section "HVAC Instrumentation and Controls."

Q. Personnel Access Components:

NOTE TO SPECIFIER

Retain applicable subparagraphs, based on Project conditions, to require these components.

1. Doors: Large enough for personnel to access cooling tower internal components from both cooling tower end walls. Doors shall be operable from both sides of the door.
2. External Ladders with Safety Cages: Aluminum, galvanized- or stainless-steel, fixed ladders with ladder extensions to access external platforms and top of cooling tower from adjacent grade without the need for portable ladders. Comply with 29 CFR 1910.27.
3. External Platforms with Handrails: Aluminum, FRP, or galvanized-steel bar grating at cooling tower access doors when cooling towers are elevated and not accessible from grade.
4. Handrail: Aluminum, galvanized steel, or stainless steel complete with kneerail and toeboard, around top of cooling tower to safeguard personnel while accessing components located on top of cooling tower. Comply with 29 CFR 1910.23.
5. Internal Platforms: Aluminum, FRP, or galvanized-steel bar grating.
 - a. Spanning the collection basin from one end of cooling tower to the other and positioned to form a path between the access doors. Platform shall be elevated so that all parts are above the high water level of the collection basin.
 - b. Elevated internal platforms with handrails accessible from fixed vertical ladders to access the fan drive assembly when out of reach from collection basin platform.

2.3 OPEN-CIRCUIT, INDUCED-DRAFT, COUNTERFLOW COOLING TOWERS

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
1. Amcot Cooling Tower Corp.; Model ST.
 2. Delta Cooling Towers, Inc.; Model Paragon, Premier, TM Series.
 3. Evapco Inc.; Models AT, ICT, REP, UBT, and USS.
 4. Protec Cooling Towers, Inc.; Model PTC.
 5. Recold; Model MT.
 6. Thermal Care, Inc., a division of MFRI, Inc.; Models FC and FT.
 7. <Insert manufacturer's name; product name or designation>.
- B. Fabricate cooling tower mounting base with reinforcement strong enough to resist cooling tower movement during a seismic event when cooling tower is anchored to field support structure.
- C. Cooling tower designed to resist wind load of 30 lbf/sq. ft. (1.44 kPa).
- D. Casing and Frame:
1. Casing and Frame Material: Stainless steel.
 2. Frame Material: Stainless steel.
 3. Fasteners: Stainless steel.
 4. Joints and Seams: Sealed watertight.
 5. Welded Connections: Continuous and watertight.
- E. Collection Basin:
1. Material: Stainless steel.
 2. Removable stainless-steel strainer with openings smaller than nozzle orifices.
 3. Overflow and drain connections.
 4. Makeup water connection.
 5. Outlet Connection: ASME B16.5, Class 150 flange.

NOTE TO SPECIFIER

If project has a multiple-cell cooling tower or multiple cooling towers, retain the subparagraph below.

6. Equalizer connection for field-installed equalizer piping.
- F. Mechanically Operated, Collection Basin Water-Level Control: Manufacturer's standard adjustable, mechanical float assembly and valve.
- G. Electric Basin Heater (where required):
1. Stainless-Steel Electric Immersion Heaters: Installed in a threaded coupling on the side of the collection basin.
 2. Heater Control Panel: Mounted on the side of each cooling tower cell.
 3. Enclosure: NEMA 250, Type 4X.
 4. Magnetic contactors controlled by a temperature sensor/controller to maintain collection basin water-temperature set point. Water-level probe shall monitor cooling tower water level and de-energize the heater when the water reaches low-level set point.
 5. Control-circuit transformer with primary and secondary side fuses.
 6. Terminal blocks with numbered and color-coded wiring to match wiring diagram.
 7. Single-point, field-power connection to a fused disconnect switch and heater branch circuiting complying with NFPA 70.
 8. Factory Wiring Method: Metal raceway for factory-installed wiring outside of enclosures, except make connections to each electric basin heater with liquidtight conduit.

- H. Pressurized Water Distribution Piping: Main header and lateral branch piping designed for even distribution over heat-exchanger coil or fill throughout the flow range without the need for balancing valves and for connecting individual, removable, nonclogging spray nozzles.
1. Pipe Material: Fiberglass or PVC.
 2. Spray Nozzle Material: [Plastic] [Polypropylene] [PVC] <Insert material>.
 3. Piping Supports: Corrosion-resistant hangers and supports to resist movement during operation and shipment.
- I. Fill:
1. Manufacturers standard fill.
- J. Drift Eliminator:
1. Manufacturers standard drift eliminator.
- K. Air-Intake Louvers:
1. Material: FRP or PVC.
 2. UV Treatment: Inhibitors to protect against damage caused by UV radiation.
 3. Louver Blades: Arranged to uniformly direct air into cooling tower, to minimize air resistance, and to prevent water from splashing out of tower during all modes of operation including operation with fans off.
- L. Axial Fan: Balanced at the factory after assembly.
1. Blade Material: Aluminum.
 2. Hub Material: Aluminum.
 3. Protective Enclosure: Removable, galvanized-steel, wire-mesh screens complying with OSHA regulations.
 4. Bearings Grease Fittings: Extended lubrication lines to an easily accessible location.

NOTE TO SPECIFIER*Retain paragraph below if belt drive is used.*

- M. Belt Drive:
1. Sheaves: Fan and motor shafts shall have taper-lock sheaves fabricated from corrosion-resistant materials.
 2. Belt Material: Oil resistant, nonstatic conducting, and constructed of neoprene polyester cord.
 3. Belt-Drive Guard: Comply with OSHA regulations.

NOTE TO SPECIFIER*Retain paragraph below if gear drive is used.*

- N. Gear Drive: Right angle, reduced speed, and designed for cooling tower applications according to CTI STD 111. Motor and gear drive shall be aligned before shipment.
1. Housing: Cast iron, with epoxy or polyurethane finish, beveled high-strength steel gears continuously bathed in oil, and with lubrication to other internal parts at all operating speeds.
 2. Mounting: Directly mounted to fan hub and connected to motor so motor shaft is in horizontal position.
 3. Operation: Able to operate both forward and in reverse.
 4. Drive Shaft Material: Stainless steel, and fitted with flexible couplings on both ends. Provide exposed shaft and couplings with guards according to OSHA regulations.
 5. Extend oil fill, drain, and vent to outside of cooling tower casing using galvanized-steel piping. Provide installation with oil-level sight glass.

- O. Fan Motor:

NOTE TO SPECIFIER



Edit first paragraph below based upon requirements of project.

1. Motor Enclosure: Totally enclosed air over (TEAO) or Totally enclosed fan cooled (TEFC).
2. Energy Efficiency: NEMA Premium Efficient.
3. Insulation: Class F.
4. Variable-Speed Motors: Inverter-duty rated per NEMA MG-1, Section IV, "Performance Standard Applying to All Machines," Part 31, "Definite-Purpose, Inverter-Fed, Polyphase Motors."

NOTE TO SPECIFIER

Retain first subparagraph below if Project requires specific motor location.

5. Motor Location: Mounted outside of cooling tower casing and cooling tower discharge airstream.

NOTE TO SPECIFIER

Retain subparagraph below for belt-drive units.

6. Motor Base: Adjustable, or other suitable provision for adjusting belt tension.

P. Controls: Comply with requirements in Division 23 Section "HVAC Instrumentation and Controls."

Q. Personnel Access Components:

NOTE TO SPECIFIER

Retain applicable subparagraphs, based on Project conditions, to require these components.

1. Doors: Large enough for personnel to access cooling tower internal components from both cooling tower end walls. Doors shall be operable from both sides of the door.
2. External Ladders with Safety Cages: Aluminum, galvanized- or stainless-steel, fixed ladders with ladder extensions to access external platforms and top of cooling tower from adjacent grade without the need for portable ladders. Comply with 29 CFR 1910.27.
3. External Platforms with Handrails: Aluminum, FRP, or galvanized-steel bar grating at cooling tower access doors when cooling towers are elevated and not accessible from grade.
4. Handrail: Aluminum, galvanized steel, or stainless steel complete with kneerail and toeboard, around top of cooling tower to safeguard personnel while accessing components located on top of cooling tower. Comply with 29 CFR 1910.23.
5. Internal Platforms: Aluminum, FRP, or galvanized-steel bar grating.
 - a. Spanning the collection basin from one end of cooling tower to the other and positioned to form a path between the access doors. Platform shall be elevated so that all parts are above the high water level of the collection basin.
 - b. Elevated internal platforms with handrails accessible from fixed vertical ladders to access the fan drive assembly when out of reach from collection basin platform.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cooling towers on support structure indicated.
- B. Install anchor bolts to elevations required for proper attachment to supported equipment.

- C. Maintain manufacturer's recommended clearances for service and maintenance.
- D. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.
 - 1. CONNECTIONS
- E. Piping installation requirements are specified in other Division 22 and 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- F. Install piping adjacent to cooling towers to allow service and maintenance.
- G. Install flexible pipe connectors at pipe connections of cooling towers mounted on vibration isolators.
- H. Provide drain piping with valve at cooling tower drain connections and at low points in piping.
- I. Connect cooling tower overflows and drains, and piping drains to sanitary sewage system.
- J. Domestic Water Piping: Comply with applicable requirements in Division 22 Section "Domestic Water Piping." Connect to water-level control with shutoff valve and union, flange, or mechanical coupling at each connection.
- K. Supply and Return Piping: Comply with applicable requirements in Division 23 Section "Hydronic Piping." Connect to entering cooling tower connections with shutoff valve, balancing valve, thermometer, plugged tee with pressure gage, and drain connection with valve. Connect to leaving cooling tower connection with shutoff valve.

NOTE TO SPECIFIER

Retain first paragraph below if external equalizer piping is required.

- L. Equalizer Piping: Piping requirements to match supply and return piping. Connect an equalizer pipe, full size of cooling tower connection, between tower cells. Connect to cooling tower with shutoff valve.

3.2 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

NOTE TO SPECIFIER

Retain subparagraph below to require a factory-authorized service representative to assist Contractor with inspections, tests, and adjustments.

- 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

- B. Cooling towers will be considered defective if they do not pass tests and inspections.

3.3 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.
- C. Obtain performance data from manufacturer.

1. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

NOTE TO SPECIFIER

Edit subparagraphs below based upon requirements of project.

- a. Clean entire unit including basins.
- b. Verify that accessories are properly installed.
- c. Verify clearances for airflow and for cooling tower servicing.
- d. Check for vibration isolation and structural support.
- e. Lubricate bearings.
- f. Verify fan rotation for correct direction and for vibration or binding and correct problems.
- g. Adjust belts to proper alignment and tension.
- h. Verify proper oil level in gear-drive housing. Fill with oil to proper level.
- i. Operate variable-speed fans through entire operating range and check for harmonic vibration imbalance. Set motor controller to skip speeds resulting in abnormal vibration.
- j. Check vibration switch setting. Verify operation.
- k. Verify water level in tower basin. Fill to proper startup level. Check makeup water-level control and valve.
- l. Verify operation of basin heater and control.
- m. Verify that cooling tower air discharge is not recirculating air into tower or HVAC air intakes. Recommend corrective action.
- n. Replace defective and malfunctioning units.

D. Start cooling tower and associated water pumps. Follow manufacturer's written starting procedures.

E. Prepare a written startup report that records the results of tests and inspections.

3.4 ADJUSTING

- A. Set and balance water flow to each tower inlet.
- B. Adjust water-level control for proper operating level.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain cooling towers.

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Last revised: 6/25/2013

END OF SECTION



SECTION 23 65 00 00 - MPF COOLING TOWERS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Closed-circuit, forced-draft, counterflow cooling towers.
 - 2. Open-circuit, induced-draft, crossflow cooling towers.
 - 3. Open-circuit, induced-draft, counterflow cooling towers.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, pressure drop, fan performance data, rating curves with selected points indicated, furnished specialties, and accessories.
- B. Shop Drawings: Complete set of manufacturer's prints of cooling tower assemblies, control panels, sections and elevations, and unit isolation.
- C. Startup service reports.
- D. Operation and maintenance data.
- E. Warranty.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- C. Retain first paragraph below if heat-exchanger coil of closed-circuit cooling towers requires ASME Boiler and Pressure Vessel Code construction.

- D. ASME Compliance: Fabricate and label heat-exchanger coils to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace the following components of cooling towers that fail in materials or workmanship within specified warranty period:
1. Fan assembly including fan, drive, and motor.
 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project. Preference is to utilize induced-draft crossflow towers, however, additional tower types have been included below which may be required based upon available space where towers are located. Specifier shall delete products not to be used or considered.

2.1 CLOSED-CIRCUIT, FORCED-DRAFT, COUNTERFLOW COOLING TOWERS

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
1. Baltimore Aircoil Company; Models VFL and VF1.
 2. Delta Cooling Towers, Inc.; Model Pioneer.
 3. Evapco Inc.; Models LSWA and LRW.
 4. Recold; Models JM and JW.
 5. <Insert manufacturer's name; product name or designation>.

NOTE TO SPECIFIER

Retain first paragraph below for projects in seismic areas.

- B. Fabricate cooling tower mounting base with reinforcement strong enough to resist cooling tower movement during a seismic event when cooling tower is anchored to field support structure.
- C. Casing:
1. Casing Material: [FRP with UV inhibitors] [Polymer-coated galvanized steel] [Stainless steel].

NOTE TO SPECIFIER

Retain first subparagraph below and delete option in subparagraph heading above if frame material is different than casing.

2. Frame Material: Stainless steel.
 3. Fasteners: Stainless steel.
 4. Joints and Seams: Sealed watertight.
 5. Welded Connections: Continuous and watertight.
- D. Collection Basin:

1. Material: Stainless steel.
 2. Strainer: Removable stainless-steel strainer with openings smaller than nozzle orifices.
 3. Overflow and drain connections.
 4. Makeup water connection.
- E. Mechanically Operated, Collection Basin Water-Level Control: Manufacturer's standard adjustable, mechanical float assembly and valve.
- F. Electric Basin Heater:
1. Stainless-Steel Electric Immersion Heaters: Installed in a threaded coupling on the side of the collection basin.
 2. Heater Control Panel: Mounted on the side of each cooling tower cell.
 3. Enclosure: NEMA 250, Type 4X.
 4. Magnetic contactors controlled by a temperature sensor/controller to maintain collection basin water-temperature set point. Water-level probe shall monitor cooling tower water level and de-energize the heater when the water reaches low-level set point.
 5. Control-circuit transformer with primary and secondary side fuses.
 6. Terminal blocks with numbered and color-coded wiring to match wiring diagram.
 7. Single-point, field-power connection to a fused disconnect switch and heater branch circuiting complying with NFPA 70.
 8. Factory Wiring Method: Metal raceway for factory-installed wiring outside of enclosures, except make connections to each electric basin heater with liquidtight conduit.
- G. Water Distribution Piping: Main header and lateral branch piping designed for even distribution over fill throughout the flow range without the need for balancing valves and for connecting individual, removable, nonclogging spray nozzles.

NOTE TO SPECIFIER

In first subparagraph below, PVC is manufacturer's most common standard offering. Other requirements may require use of other materials.

1. Pipe Material: PVC <Insert material>.
 2. Spray Nozzle Material: [Plastic] [Polypropylene] [PVC] <Insert material>.
 3. Piping Supports: Corrosion-resistant hangers and supports designed to resist movement during operation and shipment.
- H. Spray Pump: Close-coupled, end-suction, single-stage, bronze-fitted centrifugal pump; with suction strainer and flow balancing valve, and mechanical seal suitable for outdoor service.
1. General Requirements for Spray Pump Motor: Comply with NEMA designation and temperature-rating requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment" and not indicated below.
 2. Motor Enclosure: Totally enclosed fan cooled (TEFC)
 3. Energy Efficiency: NEMA Premium Efficient.
 4. Service Factor: 1.15.
- I. Heat-Exchanger Coils:
1. Tube and Tube Sheet Materials: [Copper tube with stainless-steel sheet] [Stainless-steel tube and sheet].
 2. ASME Compliance: Designed, manufactured, and tested according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, and bearing ASME "U" stamp; and sloped for complete drainage of fluid by gravity.
 3. Field Piping Connections: Vent, supply, and return[suitable for mating to ASME B16.5, Class 150 flange].

- J. Centrifugal Fan: Double-width, double-inlet, forward-curved blades, and statically and dynamically balanced at the factory after assembly.
1. Number of Fans: Each cooling tower cell shall have a single fan or multiple fans connected to a common shaft.
 2. Fan Wheel and Housing Materials: Galvanized steel.
 3. Fan Shaft: Steel, coated to resist corrosion.
 4. Protective Enclosure: Removable, galvanized-steel, wire-mesh screens complying with OSHA regulations.
 5. Fan Shaft Bearings: Self-aligning, grease-lubricated ball or roller bearings with moisture-proof seals and premium, moisture-resistant grease suitable for temperatures between minus 20 and plus 300 deg F (minus 29 and plus 149 deg C). Bearings designed for an L-10 life of 50,000 hours.
 6. Bearings Grease Fittings: Extended lubrication lines to an easily accessible location.
- K. Belt Drive:
1. Belt-Drive Service Factor: 1.5 based on motor nameplate horsepower.
 2. Sheaves: Fan and motor shafts shall have taper-lock sheaves fabricated from corrosion-resistant materials.
 3. Belt: One-piece, multigrooved, solid-back belt.
 4. Belt Material: Oil resistant, nonstatic conducting, and constructed of neoprene polyester cord.
 5. Belt-Drive Guard: Comply with OSHA regulations.

NOTE TO SPECIFIER

Retain subparagraph below if Project requires functionality of a single fan with two motors. Feature is proprietary.

- L. Two-Motor, Single-Fan Drive:
1. Two single-speed motors per fan, one sized for full speed and load, and the other sized for [67] <Insert value> percent of full-load speed.
 2. Belt Drives: Each motor shall have belt drive complying with requirements for belt drives and configured for operation when other motor fails.
 3. Motor controller and wiring same as two-speed, two-winding motor.
- M. Fan Motor:
1. General Requirements for Fan Motors: Comply with NEMA designation and temperature-rating requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment" and not indicated below.
 2. Motor Enclosure: Totally enclosed air over (TEAO) or Totally enclosed fan cooled (TEFC)] with epoxy or polyurethane finish.
 3. Energy Efficiency: NEMA Premium Efficient.
 4. Service Factor: 1.15.
 5. Insulation: Class F.
 6. Variable-Speed Motors: Inverter-duty rated per NEMA MG-1, Section IV, "Performance Standard Applying to All Machines," Part 31, "Definite-Purpose, Inverter-Fed, Polyphase Motors."
- N. Controls: Comply with requirements in Division 23 Section "Instrumentation and Control for HVAC."
- O. Personnel Access Components:
1. Doors: Large enough for personnel to access cooling tower internal components from cooling tower end walls.
 2. External Ladders with Safety Cages: Aluminum, galvanized- or stainless-steel, fixed ladders with ladder extensions to access external platforms and top of cooling tower from adjacent grade without the need for portable ladders. Comply with 29 CFR 1910.27.
 3. External Platforms with Handrails: Aluminum, FRP, or galvanized-steel bar grating at cooling tower access doors when cooling towers are elevated and not accessible from grade.

4. Handrail: Aluminum, galvanized steel, or stainless steel complete with kneerail and toeboard at platforms and around top of cooling tower. Comply with 29 CFR 1910.23.
5. Internal Platforms: Aluminum, FRP, or galvanized-steel bar grating.
6. Spanning the collection basin from one end of cooling tower to the other and positioned to form a path between the access doors. Platform shall be elevated so that all parts are above the high water level of the collection basin.

2.2 OPEN-CIRCUIT, INDUCED-DRAFT, CROSSFLOW COOLING TOWERS

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 1. Amcot Cooling Tower Corp.; Models LRC-H, LRC-LNS Series.
 2. Baltimore Aircoil Company; Series 1500 and 3000.
 3. Marley Cooling Technologies, an SPX Corporation; Models Aquatower, AV series, NC Class, Primus.
 4. <Insert manufacturer's name; product name or designation>.
- B. Fabricate cooling tower mounting base with reinforcement strong enough to resist cooling tower movement during a seismic event when cooling tower is anchored to field support structure.
- C. Cooling tower designed to resist wind load of 30 lbf/sq. ft. (1.44 kPa).
- D. Casing and Frame:
 1. Casing and Frame Material: Stainless steel.
 2. Frame Material: Stainless steel.
 3. Fasteners: Stainless steel.
 4. Joints and Seams: Sealed watertight.
 5. Welded Connections: Continuous and watertight.
- E. Collection Basin:
 1. Material: Stainless steel.
 2. Removable stainless-steel strainer with openings smaller than nozzle orifices.
 3. Overflow and drain connections.
 4. Makeup water connection.
 5. Outlet Connection: ASME B16.5, Class 150 flange.

NOTE TO SPECIFIER

If project has a multiple-cell cooling tower or multiple cooling towers, retain the subparagraph below.

6. Equalizer connection for field-installed equalizer piping.
- F. Mechanically Operated, Collection Basin Water-Level Control: Manufacturer's standard adjustable, mechanical float assembly and valve.
- G. Electric Basin Heater (where required):
 1. Stainless-Steel Electric Immersion Heaters: Installed in a threaded coupling on the side of the collection basin.
 2. Heater Control Panel: Mounted on the side of each cooling tower cell.
 3. Enclosure: NEMA 250, Type 4X.
 4. Magnetic contactors controlled by a temperature sensor/controller to maintain collection basin water-temperature set point. Water-level probe shall monitor cooling tower water level and de-energize the heater when the water reaches low-level set point.
 5. Control-circuit transformer with primary and secondary side fuses.
 6. Terminal blocks with numbered and color-coded wiring to match wiring diagram.



7. Single-point, field-power connection to a fused disconnect switch and heater branch circuiting complying with NFPA 70.
 8. Factory Wiring Method: Metal raceway for factory-installed wiring outside of enclosures, except make connections to each electric basin heater with liquidtight conduit.
- H. Gravity Water Distribution Basin: Nonpressurized design with head of water level in basin adequate to overcome spray nozzle losses and designed to evenly distribute water over fill throughout the flow range indicated.
1. Material: Stainless steel.
 2. Removable Panels: Same material as basin to completely cover top of basin. Secure panels to basin with removable stainless-steel hardware.
 3. Valves: Manufacturer's standard valve installed at each inlet connection and arranged to balance or shut off flow to each gravity distribution basin.
- I. Fill:
1. Manufacturers standard fill.
- J. Drift Eliminator:
1. Manufacturers standard drift eliminator.
- K. Air-Intake Louvers:
1. Material: FRP or PVC.
 2. UV Treatment: Inhibitors to protect against damage caused by UV radiation.
 3. Louver Blades: Arranged to uniformly direct air into cooling tower, to minimize air resistance, and to prevent water from splashing out of tower during all modes of operation including operation with fans off.
- L. Axial Fan: Balanced at the factory after assembly.
1. Blade Material: Aluminum.
 2. Hub Material: Aluminum.
 3. Protective Enclosure: Removable, galvanized-steel, wire-mesh screens complying with OSHA regulations.
 4. Bearings Grease Fittings: Extended lubrication lines to an easily accessible location.

NOTE TO SPECIFIER

Retain paragraph below if belt drive is used.

- M. Belt Drive:
1. Sheaves: Fan and motor shafts shall have taper-lock sheaves fabricated from corrosion-resistant materials.
 2. Belt Material: Oil resistant, nonstatic conducting, and constructed of neoprene polyester cord.
 3. Belt-Drive Guard: Comply with OSHA regulations.

NOTE TO SPECIFIER

Retain paragraph below if gear drive is used.

- N. Gear Drive: Right angle, reduced speed, and designed for cooling tower applications according to CTI STD 111. Motor and gear drive shall be aligned before shipment.
1. Housing: Cast iron, with epoxy or polyurethane finish, beveled high-strength steel gears continuously bathed in oil, and with lubrication to other internal parts at all operating speeds.
 2. Mounting: Directly mounted to fan hub and connected to motor so motor shaft is in horizontal position.
 3. Operation: Able to operate both forward and in reverse.



4. Drive Shaft Material: Stainless steel, and fitted with flexible couplings on both ends. Provide exposed shaft and couplings with guards according to OSHA regulations.
5. Extend oil fill, drain, and vent to outside of cooling tower casing using galvanized-steel piping. Provide installation with oil-level sight glass.

O. Fan Motor:

NOTE TO SPECIFIER

Edit first paragraph below based upon requirements of project.

1. Motor Enclosure: Totally enclosed air over (TEAO) or Totally enclosed fan cooled (TEFC).
2. Energy Efficiency: NEMA Premium Efficient.
3. Insulation: Class F.
4. Variable-Speed Motors: Inverter-duty rated per NEMA MG-1, Section IV, "Performance Standard Applying to All Machines," Part 31, "Definite-Purpose, Inverter-Fed, Polyphase Motors."

NOTE TO SPECIFIER

Retain first subparagraph below if Project requires specific motor location.

5. Motor Location: Mounted outside of cooling tower casing and cooling tower discharge airstream.

NOTE TO SPECIFIER

Retain subparagraph below for belt-drive units.

6. Motor Base: Adjustable, or other suitable provision for adjusting belt tension.

P. Controls: Comply with requirements in Division 23 Section "HVAC Instrumentation and Controls."

Q. Personnel Access Components:

NOTE TO SPECIFIER

Retain applicable subparagraphs, based on Project conditions, to require these components.

1. Doors: Large enough for personnel to access cooling tower internal components from both cooling tower end walls. Doors shall be operable from both sides of the door.
2. External Ladders with Safety Cages: Aluminum, galvanized- or stainless-steel, fixed ladders with ladder extensions to access external platforms and top of cooling tower from adjacent grade without the need for portable ladders. Comply with 29 CFR 1910.27.
3. External Platforms with Handrails: Aluminum, FRP, or galvanized-steel bar grating at cooling tower access doors when cooling towers are elevated and not accessible from grade.
4. Handrail: Aluminum, galvanized steel, or stainless steel complete with kneerail and toeboard, around top of cooling tower to safeguard personnel while accessing components located on top of cooling tower. Comply with 29 CFR 1910.23.
5. Internal Platforms: Aluminum, FRP, or galvanized-steel bar grating.
 - a. Spanning the collection basin from one end of cooling tower to the other and positioned to form a path between the access doors. Platform shall be elevated so that all parts are above the high water level of the collection basin.
 - b. Elevated internal platforms with handrails accessible from fixed vertical ladders to access the fan drive assembly when out of reach from collection basin platform.

2.3 OPEN-CIRCUIT, INDUCED-DRAFT, COUNTERFLOW COOLING TOWERS

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
1. Amcot Cooling Tower Corp.; Model ST.
 2. Delta Cooling Towers, Inc.; Model Paragon, Premier, TM Series.
 3. Evapco Inc.; Models AT, ICT, REP, UBT, and USS.
 4. Protec Cooling Towers, Inc.; Model PTC.
 5. Recold; Model MT.
 6. Thermal Care, Inc., a division of MFRI, Inc.; Models FC and FT.
 7. <Insert manufacturer's name; product name or designation>.
- B. Fabricate cooling tower mounting base with reinforcement strong enough to resist cooling tower movement during a seismic event when cooling tower is anchored to field support structure.
- C. Cooling tower designed to resist wind load of 30 lbf/sq. ft. (1.44 kPa).
- D. Casing and Frame:
1. Casing and Frame Material: Stainless steel.
 2. Frame Material: Stainless steel.
 3. Fasteners: Stainless steel.
 4. Joints and Seams: Sealed watertight.
 5. Welded Connections: Continuous and watertight.
- E. Collection Basin:
1. Material: Stainless steel.
 2. Removable stainless-steel strainer with openings smaller than nozzle orifices.
 3. Overflow and drain connections.
 4. Makeup water connection.
 5. Outlet Connection: ASME B16.5, Class 150 flange.

NOTE TO SPECIFIER

If project has a multiple-cell cooling tower or multiple cooling towers, retain the subparagraph below.

6. Equalizer connection for field-installed equalizer piping.
- F. Mechanically Operated, Collection Basin Water-Level Control: Manufacturer's standard adjustable, mechanical float assembly and valve.
- G. Electric Basin Heater (where required):
1. Stainless-Steel Electric Immersion Heaters: Installed in a threaded coupling on the side of the collection basin.
 2. Heater Control Panel: Mounted on the side of each cooling tower cell.
 3. Enclosure: NEMA 250, Type 4X.
 4. Magnetic contactors controlled by a temperature sensor/controller to maintain collection basin water-temperature set point. Water-level probe shall monitor cooling tower water level and de-energize the heater when the water reaches low-level set point.
 5. Control-circuit transformer with primary and secondary side fuses.
 6. Terminal blocks with numbered and color-coded wiring to match wiring diagram.
 7. Single-point, field-power connection to a fused disconnect switch and heater branch circuiting complying with NFPA 70.
 8. Factory Wiring Method: Metal raceway for factory-installed wiring outside of enclosures, except make connections to each electric basin heater with liquidtight conduit.

- H. Pressurized Water Distribution Piping: Main header and lateral branch piping designed for even distribution over heat-exchanger coil or fill throughout the flow range without the need for balancing valves and for connecting individual, removable, nonclogging spray nozzles.
1. Pipe Material: Fiberglass or PVC.
 2. Spray Nozzle Material: [Plastic] [Polypropylene] [PVC] <Insert material>.
 3. Piping Supports: Corrosion-resistant hangers and supports to resist movement during operation and shipment.
- I. Fill:
1. Manufacturers standard fill.
- J. Drift Eliminator:
1. Manufacturers standard drift eliminator.
- K. Air-Intake Louvers:
1. Material: FRP or PVC.
 2. UV Treatment: Inhibitors to protect against damage caused by UV radiation.
 3. Louver Blades: Arranged to uniformly direct air into cooling tower, to minimize air resistance, and to prevent water from splashing out of tower during all modes of operation including operation with fans off.
- L. Axial Fan: Balanced at the factory after assembly.
1. Blade Material: Aluminum.
 2. Hub Material: Aluminum.
 3. Protective Enclosure: Removable, galvanized-steel, wire-mesh screens complying with OSHA regulations.
 4. Bearings Grease Fittings: Extended lubrication lines to an easily accessible location.

NOTE TO SPECIFIER*Retain paragraph below if belt drive is used.*

- M. Belt Drive:
1. Sheaves: Fan and motor shafts shall have taper-lock sheaves fabricated from corrosion-resistant materials.
 2. Belt Material: Oil resistant, nonstatic conducting, and constructed of neoprene polyester cord.
 3. Belt-Drive Guard: Comply with OSHA regulations.

NOTE TO SPECIFIER*Retain paragraph below if gear drive is used.*

- N. Gear Drive: Right angle, reduced speed, and designed for cooling tower applications according to CTI STD 111. Motor and gear drive shall be aligned before shipment.
1. Housing: Cast iron, with epoxy or polyurethane finish, beveled high-strength steel gears continuously bathed in oil, and with lubrication to other internal parts at all operating speeds.
 2. Mounting: Directly mounted to fan hub and connected to motor so motor shaft is in horizontal position.
 3. Operation: Able to operate both forward and in reverse.
 4. Drive Shaft Material: Stainless steel, and fitted with flexible couplings on both ends. Provide exposed shaft and couplings with guards according to OSHA regulations.
 5. Extend oil fill, drain, and vent to outside of cooling tower casing using galvanized-steel piping. Provide installation with oil-level sight glass.

- O. Fan Motor:

NOTE TO SPECIFIER



Edit first paragraph below based upon requirements of project.

1. Motor Enclosure: Totally enclosed air over (TEAO) or Totally enclosed fan cooled (TEFC).
2. Energy Efficiency: NEMA Premium Efficient.
3. Insulation: Class F.
4. Variable-Speed Motors: Inverter-duty rated per NEMA MG-1, Section IV, "Performance Standard Applying to All Machines," Part 31, "Definite-Purpose, Inverter-Fed, Polyphase Motors."

NOTE TO SPECIFIER

Retain first subparagraph below if Project requires specific motor location.

5. Motor Location: Mounted outside of cooling tower casing and cooling tower discharge airstream.

NOTE TO SPECIFIER

Retain subparagraph below for belt-drive units.

6. Motor Base: Adjustable, or other suitable provision for adjusting belt tension.

P. Controls: Comply with requirements in Division 23 Section "HVAC Instrumentation and Controls."

Q. Personnel Access Components:

NOTE TO SPECIFIER

Retain applicable subparagraphs, based on Project conditions, to require these components.

1. Doors: Large enough for personnel to access cooling tower internal components from both cooling tower end walls. Doors shall be operable from both sides of the door.
2. External Ladders with Safety Cages: Aluminum, galvanized- or stainless-steel, fixed ladders with ladder extensions to access external platforms and top of cooling tower from adjacent grade without the need for portable ladders. Comply with 29 CFR 1910.27.
3. External Platforms with Handrails: Aluminum, FRP, or galvanized-steel bar grating at cooling tower access doors when cooling towers are elevated and not accessible from grade.
4. Handrail: Aluminum, galvanized steel, or stainless steel complete with kneerail and toeboard, around top of cooling tower to safeguard personnel while accessing components located on top of cooling tower. Comply with 29 CFR 1910.23.
5. Internal Platforms: Aluminum, FRP, or galvanized-steel bar grating.
 - a. Spanning the collection basin from one end of cooling tower to the other and positioned to form a path between the access doors. Platform shall be elevated so that all parts are above the high water level of the collection basin.
 - b. Elevated internal platforms with handrails accessible from fixed vertical ladders to access the fan drive assembly when out of reach from collection basin platform.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cooling towers on support structure indicated.
- B. Install anchor bolts to elevations required for proper attachment to supported equipment.

- C. Maintain manufacturer's recommended clearances for service and maintenance.
- D. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.
 - 1. CONNECTIONS
- E. Piping installation requirements are specified in other Division 22 and 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- F. Install piping adjacent to cooling towers to allow service and maintenance.
- G. Install flexible pipe connectors at pipe connections of cooling towers mounted on vibration isolators.
- H. Provide drain piping with valve at cooling tower drain connections and at low points in piping.
- I. Connect cooling tower overflows and drains, and piping drains to sanitary sewage system.
- J. Domestic Water Piping: Comply with applicable requirements in Division 22 Section "Domestic Water Piping." Connect to water-level control with shutoff valve and union, flange, or mechanical coupling at each connection.
- K. Supply and Return Piping: Comply with applicable requirements in Division 23 Section "Hydronic Piping." Connect to entering cooling tower connections with shutoff valve, balancing valve, thermometer, plugged tee with pressure gage, and drain connection with valve. Connect to leaving cooling tower connection with shutoff valve.

NOTE TO SPECIFIER

Retain first paragraph below if external equalizer piping is required.

- L. Equalizer Piping: Piping requirements to match supply and return piping. Connect an equalizer pipe, full size of cooling tower connection, between tower cells. Connect to cooling tower with shutoff valve.

3.2 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

NOTE TO SPECIFIER

Retain subparagraph below to require a factory-authorized service representative to assist Contractor with inspections, tests, and adjustments.

- 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

- B. Cooling towers will be considered defective if they do not pass tests and inspections.

3.3 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.
- C. Obtain performance data from manufacturer.

1. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

NOTE TO SPECIFIER

Edit subparagraphs below based upon requirements of project.

- a. Clean entire unit including basins.
- b. Verify that accessories are properly installed.
- c. Verify clearances for airflow and for cooling tower servicing.
- d. Check for vibration isolation and structural support.
- e. Lubricate bearings.
- f. Verify fan rotation for correct direction and for vibration or binding and correct problems.
- g. Adjust belts to proper alignment and tension.
- h. Verify proper oil level in gear-drive housing. Fill with oil to proper level.
- i. Operate variable-speed fans through entire operating range and check for harmonic vibration imbalance. Set motor controller to skip speeds resulting in abnormal vibration.
- j. Check vibration switch setting. Verify operation.
- k. Verify water level in tower basin. Fill to proper startup level. Check makeup water-level control and valve.
- l. Verify operation of basin heater and control.
- m. Verify that cooling tower air discharge is not recirculating air into tower or HVAC air intakes. Recommend corrective action.
- n. Replace defective and malfunctioning units.

D. Start cooling tower and associated water pumps. Follow manufacturer's written starting procedures.

E. Prepare a written startup report that records the results of tests and inspections.

3.4 ADJUSTING

- A. Set and balance water flow to each tower inlet.
- B. Adjust water-level control for proper operating level.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain cooling towers.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 9/4/2013

END OF SECTION 23 65 00 00



Task	Specification	Specification Description
23 65 00 00	01 22 16 00	No Specification Required
23 71 13 23	22 05 23 00	Piped Utilities Basic Materials And Methods
23 71 13 23	22 12 23 26	Facility Fuel-Oil Piping
23 71 13 23	23 11 23 00	Facility Liquefied-Petroleum Gas Piping



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SECTION 23 72 00 00 - MPF AIR-TO-AIR ENERGY RECOVERY EQUIPMENT

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Heat wheels.
 2. Fixed-plate sensible heat exchangers.
 3. Fixed-plate total heat exchangers.

1.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Air-to-air energy recovery equipment shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, furnished specialties, and accessories.
- B. Shop Drawings: For air-to-air energy recovery equipment. Include plans, elevations, sections, details, and attachments to other work.
1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 2. Wiring Diagrams: For power, signal, and control wiring.

NOTE TO SPECIFIER

Retain subparagraph below for facilities located in seismic zones. .

- C. Seismic Qualification Certificates: For air-to-air energy recovery equipment, accessories, and components, from manufacturer.
- D. Operation and maintenance data.



1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ARI Compliance: Capacity ratings for air-to-air energy recovery equipment shall comply with ARI 1060, "Rating Air-to-Air Energy Recovery Equipment."
- C. UL Compliance: Packaged heat recovery ventilators shall comply with requirements in UL 1812, "Ducted Heat Recovery Ventilators"; or UL 1815, "Nonducted Heat Recovery Ventilators."

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of air-to-air energy recovery equipment that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Fixed-Plate Total Heat Exchangers: 10 years.

PART 2 - PRODUCTS

2.1 HEAT WHEELS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Advanced Thermal Technologies.
 - 2. Airxchange.
 - 3. American Energy Exchange, Inc
 - 4. Dais Analytic.
 - 5. Loren Cook Company.
 - 6. SEMCO Incorporated.
 - 7. Trane; American Standard Inc.
 - 8. <Insert manufacturer's name>.
- B. Casing:
 - 1. Steel with standard factory-painted finish.
 - 2. Integral purge section limiting carryover of exhaust air to between 0.05 percent at 1.6-inch wg and 0.20 percent at 4-inch wg differential pressure.
 - 3. Casing seals on periphery of rotor and on duct divider and purge section.
 - 4. Support vertical rotors on grease-lubricated ball bearings having extended grease fittings or permanently lubricated bearings. Support horizontal rotors on tapered roller bearing.

NOTE TO SPECIFIER

Retain one of first two paragraphs below.

- C. Rotor: Aluminum segmented wheel strengthened with radial spokes, with nontoxic, noncorrosive, silica-gel desiccant coating.
 - 1. Maximum Solid Size for Media to Pass: 800 micrometer.
- D. Rotor: Polymer segmented wheel strengthened with radial spokes impregnated with nonmigrating, water-selective, molecular-sieve desiccant coating.
 - 1. Maximum Solid Size for Media to Pass: 800 micrometer.

- E. Drive: Fractional horsepower motor and gear reducer, with speed changed by variable frequency controller and self-adjusting multilink belt around outside of rotor.
 - 1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - 2. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 3. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
- F. Controls:
 - 1. Starting relay, factory mounted and wired, and manual motor starter for field wiring.
 - 2. Variable frequency controller, factory mounted and wired, permitting input of field connected 4-20 mA or 1-10-V control signal.
 - 3. Pilot-Light Indicator: Display rotor rotation and speed.
 - 4. Speed Settings: Adjustable settings for maximum and minimum rotor speed limits.
- G. Extended-Surface, Disposable Panel Filters:
 - 1. Comply with NFPA 90A.
 - 2. Provide minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
 - 3. Provide filter holding frames arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lift out from access plenum.
 - 4. Factory-fabricated, dry, extended-surface type.
 - 5. Merv (ASHRAE 52.2): 7.
 - 6. Media: Fibrous material formed into deep-V-shaped pleats and held by self-supporting wire grid.
 - 7. Media-Grid Frame: Nonflammable cardboard.
 - 8. Mounting Frames: Welded, galvanized steel with gaskets and fasteners, suitable for bolting together into built-up filter banks.

2.2 FIXED-PLATE SENSIBLE HEAT EXCHANGERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. American Energy Exchange, Inc.
 - 2. Dais Analytic
 - 3. Des Champs Technologies.
 - 4. Exothermics; a brand of Eclipse, Inc.
 - 5. Nutech Brands Inc.
 - 6. RenewAire LLC.
 - 7. United Air Specialists, Inc.; a CLARCOR company.
 - 8. <Insert manufacturer's name>.
- B. Casing: Enameled steel, with galvanized-steel liner with duct collars.
- C. Casing Insulation: 1/2-inch- thick, foil-faced glass fiber.
- D. Plates: Evenly spaced and sealed and arranged for counter airflow.
 - 1. Plate Material: [Embossed aluminum] [Stainless steel] [Polypropylene copolymer (high-density plastic)].
- E. Extended-Surface, Disposable Panel Filters:
 - 1. Comply with NFPA 90A.
 - 2. Provide minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

3. Provide filter holding frames arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lift out from access plenum.
4. Factory-fabricated, dry, extended-surface type.
5. Thickness: 2 inches.
6. Merv (ASHRAE 52.2): 7.
7. Media: Fibrous material formed into deep-V-shaped pleats and held by self-supporting wire grid.
8. Media-Grid Frame: Nonflammable cardboard.
9. Mounting Frames: Welded, galvanized steel with gaskets and fasteners, suitable for bolting together into built-up filter banks.

2.3 FIXED-PLATE TOTAL HEAT EXCHANGERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Mitsubishi Electric Sales Canada Inc.
 2. RenewAire LLC.
 3. <Insert manufacturer's name>.
- B. Casing: Galvanized steel.
- C. Plates: Evenly spaced and sealed and arranged for counter airflow.
 1. Plate Material: Chemically treated paper with selective hygroscopicity and moisture permeability, and gas barrier properties.
- D. Bypass Plenum: Within casing, with gasketed face-and-bypass dampers having operating rods extended outside casing.
- E. Extended-Surface, Disposable Panel Filters:
 1. Comply with NFPA 90A.
 2. Provide minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
 3. Provide filter holding frames arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lift out from access plenum.
 4. Factory-fabricated, dry, extended-surface type.
 5. Thickness: 1 inch or 2 inches
 6. Merv (ASHRAE 52.2): 7.
 7. Media: Fibrous material formed into deep-V-shaped pleats and held by self-supporting wire grid.
 8. Media-Grid Frame: [Nonflammable cardboard] [Galvanized steel] [Fire-retardant, 3/4-inch particleboard with gaskets].
 9. Mounting Frames: Welded, galvanized steel with gaskets and fasteners, suitable for bolting together into built-up filter banks.

PART 3 - EXECUTION

3.1 INSTALLATION

NOTE TO SPECIFIER

Retain first paragraph below for heat wheels.

- A. Install heat wheels so supply and exhaust airstreams flow in opposite directions and rotation is away from exhaust side to purge section to supply side.



1. Install access doors in both supply and exhaust ducts, both upstream and downstream, for access to wheel surfaces, drive motor, and seals.
2. Install removable panels or access doors between supply and exhaust ducts on building side for bypass during startup.
3. Access doors and panels are specified in Division 23 Section "Air Duct Accessories."

NOTE TO SPECIFIER

Retain first paragraph below for fixed-plate heat exchangers.

- B. Install fixed-plate heat exchangers so supply and exhaust airstreams flow in opposite directions.
 1. Install duct access doors in both supply and exhaust ducts, both upstream and downstream, for access to heat exchanger. Access doors and panels are specified in Division 23 Section "Air Duct Accessories."
- C. Install floor-mounted units on 4-inch-high concrete base[designed to withstand, without damage to equipment, seismic force required by code].

NOTE TO SPECIFIER

Retain first paragraph below for equipment supported on a concrete base on grade without vibration isolation devices.

- D. Equipment Mounting: Install air-to-air energy recovery equipment on concrete bases. Comply with requirements for concrete bases specified in Division 03.
 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

NOTE TO SPECIFIER

Retain first paragraph below for suspended units. Retain option for projects in seismic areas.

- E. Suspended Units: Suspend [and brace] units from structural-steel support frame using threaded steel rods and spring hangers. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
- F. Install units with clearances for service and maintenance.
- G. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.
- H. Pipe drains from units and drain pans to nearest floor drain; use ASTM D 1785, Schedule 40 PVC pipe and solvent-welded fittings, same size as condensate drain connection.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Division 23 Section "Hydronic Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Comply with requirements for ductwork specified in Division 23 Section "Metal Ducts."
- C. Install piping adjacent to machine to allow service and maintenance.



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END OF SECTION 23 72 00 00



SECTION 23 73 13 00 - MPF MODULAR INDOOR AIR-HANDLING UNITS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes modular air-handling units with coils for indoor installations.

1.2 SUBMITTALS

- A. Product Data: For each type of modular indoor air-handling unit indicated. Include the following:
 - 1. Certified fan-performance curves with system operating conditions indicated.
 - 2. Certified fan-sound power ratings.
 - 3. Certified coil-performance ratings with system operating conditions indicated.
 - 4. Motor ratings, electrical characteristics, and motor and fan accessories.
 - 5. Material gages and finishes.
- A. Shop Drawings:
 - 1. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.
 - 2. Wiring Diagrams: Power, signal, and control wiring.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain modular indoor air-handling units through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of modular indoor air-handling units and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. NFPA Compliance: Modular indoor air-handling units and components shall be designed, fabricated, and installed in compliance with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."

- E. ARI Certification: Modular indoor air-handling units and their components shall be factory tested according to ARI 430, "Central-Station Air-Handling Units," and shall be listed and labeled by ARI.
- F. Comply with NFPA 70.

1.4 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into slab.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.
- C. Coordinate size and location of structural-steel support members.

1.5 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Filters: One (1) set for each modular indoor air-handling unit.
 - 2. Fan Belts: One (1) set for each modular indoor air-handling unit fan.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Carrier; Div. of United Technologies Corp.
 - 2. CES Group Inc.; Governair, Mammoth, Temtrol, Venmar Ventrol, Webco Divisions.
 - 3. Johnson Controls, Inc.
 - 4. McQuay International.
 - 5. Trane

2.2 MANUFACTURED UNITS

- A. Modular indoor air-handling units shall be factory assembled and consist of fans, motor and drive assembly, coils, damper, plenums, filters, condensate pans, control devices, and accessories.

2.3 CABINET

- A. Cabinet: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.
 - 1. Outside Casing: G90 galvanized steel, 16 gauge frames and 18 gauge panels. Provide with thermal breaks to prevent exterior condensation from occurring.
 - 2. Inside Casing: G90 Galvanized steel, 20 gauge.
 - 3. Floor Plate: Galvanized steel, 0.1382 inch thick.

4. Cabinet Insulation: Comply with NFPA 90A.
 - a. Thickness: 2 inch, 1.5 lb. density.
 - b. Thermal Conductivity (k-Value): 0.26 at 75 deg F mean temperature.
 - c. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50, when tested according to ASTM C 411.
 - d. Liner Adhesive: Comply with NFPA 90A and ASTM C 916.
 - e. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
 - f. Location and Application: Factory applied with adhesive or mechanical fasteners between inside and outside casings.
 5. Access Panels and Doors: Same materials and finishes as cabinet, complete with hinges, latches, handles, and gaskets. Inspection and access panels and doors shall be sized and located to allow periodic maintenance and inspections. Provide access panels and doors in the following locations:
 - a. Fan Section: Inspection and access panels.
 - b. Access Section: Doors.
 - c. Coil Section: Inspection panel.
 - d. Filter Section: Inspection and access panels to allow periodic removal and installation of filters.
 6. Condensate Drain Pans: Formed sections of stainless-steel sheet complying with requirements in ASHRAE 62. Fabricate pans to collect condensate from cooling coils (including coil piping connections and return bends) when units are operating at maximum catalogued face velocity across cooling coil.
 - a. Drain Connections: Threaded.
- B. Fan-Section Construction: Belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and support structure and equipped with formed-steel channel base for integral mounting of fan, motor, and casing panels. Mount fan with vibration isolation.
1. Centrifugal Fan Housings: Formed- and reinforced-steel panels to make curved scroll housings with shaped cutoff, spun-metal inlet bell, and access doors or panels to allow entry to internal parts and components.
 - a. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
 - b. Performance Class: AMCA 99-2408, Class suitable for airflow and static pressure rating.
 - c. Horizontal Flanged Split Housing: Bolted construction.
 2. Fan Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and motor horsepower.
 3. Forward-Curved Fan Wheels: Galvanized-steel construction with inlet flange, backplate, and shallow blades with inlet and tip curved forward in direction of airflow and mechanically secured to flange and backplate; cast-steel hub swaged to backplate and fastened to shaft with set screws.
 4. Shafts: Statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
 - a. Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.
 - b. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
 5. Grease-Lubricated Shaft Bearings: Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.
 - a. Ball-Bearing Rating Life: AFBMA-ANSI, L_{50} of **200,000** hours.
 - b. Roller-Bearing Rating Life: AFBMA-ANSI, L_{50} of **200,000** hours.
 6. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation and with **1.2** service factor based on fan motor.

- a. Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
- b. 5-hp limit in first subparagraph below is standard with many manufacturers but is a designer's choice.
- c. Motor Pulleys: Adjustable pitch for use with 5-hp motors and smaller; fixed pitch for use with motors larger than 5 hp. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
- d. Belts: Oil resistant, nonsparking, and nonstatic; matched for multiple belt drives.
- e. Belt Guards: Fabricate to OSHA/SMACNA requirements; 0.1046-inch-thick, 3/4-inch diamond-mesh wire screen welded to steel angle frame or equivalent; prime coated.
- f. Motor Mount: Adjustable for belt tensioning.
7. Vibration Control: Install fans on open-spring vibration isolators having a minimum of 1-inch static deflection and side snubbers.
8. Fan-Section Source Quality Control:
 - a. Sound Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Fans shall bear AMCA-certified sound ratings seal.
 - b. Factory test fan performance for flow rate, pressure, power, air density, rotation speed, and efficiency. Establish ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."
- C. Motors: Refer to Division 23 Section "Motors" for general requirements.
 1. Torque Characteristics: Sufficient to accelerate driven loads satisfactorily.
 2. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range.
 3. Temperature Rating: 50 deg C maximum temperature rise at 40 deg C ambient for continuous duty at full load (Class A Insulation).
 4. Service Factor: 1.15 for polyphase motors and 1.0 for inverter duty.
 5. Motor Construction: NEMA MG 1, general purpose, inverter duty, Design B mounted on adjustable base.
 6. Motor Insulation: Insulation system shall exceed the NEMA MG-1 Part 31 Standard and shall be Class F minimum.
 7. Bearings: The following features are required:
 - a. Ball or roller bearings with inner and outer shaft seals.
 - b. Grease lubricated.
 - c. Designed to resist thrust loading where belt or other drives produce lateral or axial thrust in motor.
 8. Overload Protection: Built-in, automatically resetting, thermal-overload protection.
 9. Noise Rating: Quiet.
 10. Efficiency: Energy-efficient motors shall have a minimum efficiency as scheduled according to IEEE 112, Test Method B. If efficiency is not specified, motors shall have a higher efficiency than "average standard industry motors" according to IEEE 112, Test Method B.
 11. Nameplate: Indicate ratings, characteristics, construction, special features, and full identification of manufacturer.
- D. Coil Sections: Common or individual, insulated, stainless-steel casings for cooling coils. Design and construct to facilitate removal and replacement of coil for maintenance and to ensure full airflow through coils.
- E. Water Coils: Continuous circuit coil fabricated according to ARI 410.
 1. Piping Connections: Threaded, on same end.
 2. Tubes: Copper.
 3. Fins: Aluminum with fin spacing of no more than 10 fpi.
 4. Fin and Tube Joint: Mechanical bond.
 5. Headers: Seamless copper tube with brazed joints, prime coated.

6. Casings: Stainless-steel channel frame, heavy duty.
 7. Provide with vent and drain connections.
 8. Ratings: Design tested and rated according to ASHRAE 33 and ARI 410.
 - a. Working-Pressure Ratings: 250 psig, 300 deg F.
 9. Source Quality Control: Test to 300 psig underwater.
- F. Filters: Comply with NFPA 90A.
1. Filter Section: Provide filter holding frames arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side.
 2. Disposable Panel Filters: Factory-fabricated, viscous-coated, flat-panel-type, disposable air filters with holding frames.
 - a. Media: Interlaced glass fibers sprayed with nonflammable adhesive.
 - b. Frame: Galvanized steel with metal grid on outlet side, steel rod grid on inlet side, hinged, and with pull and retaining handles.
 - c. 2" thick 30% efficient prefilters and 4" thick 65% final filters.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of steam, hydronic, and condensate drainage piping systems and electrical services to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install modular indoor air-handling units with the following vibration-control devices.
- B. Ground Floor, Floor-Mounted Units: Support on manufacturer provided base rails using neoprene pads between base rails and slab.
- C. Arrange installation of units to provide access space around modular indoor air-handling units for service and maintenance.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 and 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.
- C. Flexible connections in first paragraph below may not be necessary. Verify requirements with Project conditions.
- D. Connect piping to modular indoor air-handling units mounted on vibration isolators with flexible connectors.
- E. Connect condensate drain pans using NPS 1-1/4 (DN 32), Type M copper tubing. Extend to nearest floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.



- F. Hot- and Chilled-Water Piping: Comply with applicable requirements in Division 23 Section "Hydronic Piping." Connect to supply and return coil tapplings with shutoff or balancing valve and union or flange at each connection.
- G. Refrigerant Piping: Comply with applicable requirements in Division 23 Section "Refrigerant Piping." Connect to supply and return coil tapplings with shutoff valve and union or flange at each connection.
- H. Coordinate duct installations and specialty arrangements with schematics on Drawings and with requirements specified in duct and duct accessory Specifications. If Drawings are explicit enough, these requirements may be reduced or omitted.
- I. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connections.
- J. Electrical: Comply with applicable requirements in Division 26 Sections for power wiring, switches, and motor controls.
- K. Ground equipment according to Division 26 Section "Grounding and Bonding."
- L. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
 - 1. Leak Test: After installation, fill water and steam coils with water and test coils and connections for leaks. Repair leaks and retest until no leaks exist.
 - 2. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Final Checks before Startup: Perform the following:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Perform cleaning and adjusting specified in this Section.
 - 4. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.
 - 5. Set outside- and return-air mixing dampers to minimum outside-air setting.
 - 6. Comb coil fins for parallel orientation.
 - 7. Install clean filters.
 - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.
- C. Starting procedures for modular indoor air-handling units include the following:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm. Replace motor pulleys as required to achieve design conditions.
 2. Measure and record motor electrical values for voltage and amperage.
 3. Manually operate dampers from fully closed to fully open position and record fan performance.
- D. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for modular indoor air-handling system testing, adjusting, and balancing.

3.6 CLEANING

- A. Clean modular indoor air-handling units internally, on completion of installation, according to manufacturer's written instructions. Clean fan interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheels, cabinets, and coils entering air face.
- B. After completing system installation and testing, adjusting, and balancing modular indoor air-handling and air-distribution systems, clean filter housings and install new filters.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain modular indoor air-handling units. Refer to Division 1 Section "Closeout Procedures."

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END OF SECTION 23 73 13 00



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SECTION 23 74 13 00 - PACKAGED, OUTDOOR, CENTRAL-STATION AIR-HANDLING UNITS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for packaged, outdoor, central-station air-handling units. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes packaged, outdoor, central-station air-handling units (rooftop units) with the following components and accessories:
 - a. Direct-expansion cooling.
 - b. Heat-pump refrigeration components.
 - c. Hot-gas reheat.
 - d. Electric-heating coils.
 - e. Gas furnace.
 - f. Economizer outdoor- and return-air damper section.
 - g. Integral, space temperature controls.
 - h. Roof curbs.

C. Definitions

1. DDC: Direct-digital controls.
2. ECM: Electrically commutated motor.
3. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.
4. Outdoor-Air Refrigerant-Coil Fan: The outdoor-air refrigerant-coil fan in RTUs. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.
5. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.
6. Supply-Air Fan: The fan providing supply air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.
7. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.
8. VVT: Variable-air volume and temperature.

D. Performance Requirements

1. Delegated Design: Design RTU supports to comply with wind and seismic, **as directed**, performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Wind-Restraint Performance:
 - a. Basic Wind Speed: **<Insert value>**.
 - b. Building Classification Category: **I OR II OR III OR IV, as directed**.
 - c. Minimum 10 lb/sq. ft (48.8 kg/sq. m) multiplied by the maximum area of the mechanical component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.
3. Seismic Performance: RTUs shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

- a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

E. Submittals

1. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
2. LEED Submittals:
 - a. Product Data for Credit EA 4: Documentation required by Credit EA 4 indicating that equipment and refrigerants comply.
 - b. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
3. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - a. Wiring Diagrams: Power, signal, and control wiring.
4. Delegated-Design Submittal: For RTU supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints, **as directed**, and for designing vibration isolation bases.
 - b. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
 - c. Wind- and Seismic-Restraint Details, **as directed**: Detail fabrication and attachment of wind and seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.
5. Manufacturer Wind Loading Qualification Certification: Submit certification that specified equipment will withstand wind forces identified in "Performance Requirements" Article and in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
6. Manufacturer Seismic Qualification Certification: Submit certification that RTUs, accessories, and components will withstand seismic forces defined in "Performance Requirements" Article and in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
7. Field quality-control test reports.
8. Operation and maintenance data.
9. Warranty: Special warranty specified in this Section.

F. Quality Assurance

1. ARI Compliance:
 - a. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTUs.
 - b. Comply with ARI 270 for testing and rating sound performance for RTUs.
2. ASHRAE Compliance:
 - a. Comply with ASHRAE 15 for refrigeration system safety.
 - b. Comply with ASHRAE 33 for methods of testing cooling and heating coils.

- c. Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
3. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
4. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.
5. UL Compliance: Comply with UL 1995.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

G. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTUs that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period for Compressors: Manufacturer's standard, but not less than five **OR** 10, **as directed**, years from date of Final Completion.
 - b. Warranty Period for Gas Furnace Heat Exchangers: Manufacturer's standard, but not less than five **OR** 10 **OR** 15 **OR** 20, **as directed**, years from date of Final Completion.
 - c. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than three years from date of Final Completion.
 - d. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Final Completion.

1.2 PRODUCTS

A. Casing

1. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.
2. Exterior Casing Material: Galvanized steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
 - a. Exterior Casing Thickness: 0.052 inch (1.3 mm) **OR** 0.0626 inch (1.6 mm) **OR** 0.079 inch (2.0 mm), **as directed**, thick.
3. Inner Casing Fabrication Requirements:
 - a. Inside Casing: Galvanized steel, 0.034 inch (0.86 mm) **OR** 0.028 inch (0.7 mm), **as directed**, thick, perforated 40 percent free area, **as directed**.
4. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
 - a. Materials: ASTM C 1071, Type I.
 - b. Thickness: 1/2 inch (13 mm) **OR** 1 inch (25 mm), **as directed**.
 - c. Liner materials shall have air-stream surface coated with an erosion- and temperature-resistant coating or faced with a plain or coated fibrous mat or fabric.
 - d. Liner Adhesive: Comply with ASTM C 916, Type I.
5. Condensate Drain Pans: Formed sections of galvanized-steel **OR** stainless-steel, **as directed**, sheet, a minimum of 2 inches (50 mm) deep, and complying with ASHRAE 62.1, **as directed**.
 - a. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
 - b. Drain Connections: Threaded nipple both sides of drain pan, **as directed**.
 - c. Pan-Top Surface Coating: Corrosion-resistant compound for galvanized-steel drain pans.
6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

B. Fans

1. Direct-Driven Supply-Air Fans: Double width, forward curved **OR** backward inclined, **as directed**, centrifugal; with permanently lubricated, multispeed **OR** ECM, **as directed**, motor resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.

OR

Belt-Driven Supply-Air Fans: Double width, forward curved, centrifugal; with permanently lubricated, single-speed motor installed on an adjustable fan base resiliently mounted in the casing. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.

2. Condenser-Coil Fan: Propeller, mounted on shaft of permanently lubricated motor.
3. Relief-Air Fan: Propeller **OR** Forward curved **OR** Backward inclined, **as directed**, shaft mounted on permanently lubricated motor.
4. Seismic Fabrication Requirements: Fabricate fan section, internal mounting frame and attachment to fans, fan housings, motors, casings, accessories, and other fan section components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" when fan-mounted frame and RTU-mounted frame are anchored to building structure.
5. Fan Motor: Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".

C. Coils

1. Supply-Air Refrigerant Coil:
 - a. Aluminum-plate **OR** Copper-plate, **as directed**, fin and seamless internally grooved, **as directed**, copper tube in steel casing with equalizing-type vertical distributor.
 - b. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
 - c. Coil Split: Interlaced.
 - d. Baked phenolic **OR** Cathodic epoxy, **as directed**, coating.
 - e. Condensate Drain Pan: Galvanized steel with corrosion-resistant coating **OR** Stainless steel, **as directed**, formed with pitch and drain connections complying with ASHRAE 62.1, **as directed**.
2. Outdoor-Air Refrigerant Coil:
 - a. Aluminum-plate **OR** Copper-plate, **as directed**, fin and seamless internally grooved, **as directed**, copper tube in steel casing with equalizing-type vertical distributor.
 - b. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
 - c. Baked phenolic **OR** Cathodic epoxy, **as directed**, coating.
3. Hot-Gas Reheat Refrigerant Coil:
 - a. Aluminum-plate **OR** Copper-plate, **as directed**, fin and seamless internally grooved, **as directed**, copper tube in steel casing with equalizing-type vertical distributor.
 - b. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
 - c. Baked phenolic **OR** Cathodic epoxy, **as directed**, coating.
4. Electric-Resistance Heating:
 - a. Open Heating Elements: Resistance wire of 80 percent nickel and 20 percent chromium, supported and insulated by floating ceramic bushings recessed into casing openings, fastened to supporting brackets, and mounted in galvanized-steel frame. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.
 - b. Overtemperature Protection: Disk-type, automatically reset, thermal-cutout, safety device; serviceable through terminal box.
 - c. Overcurrent Protection: Manual-reset thermal cutouts, factory wired in each heater stage.
 - d. Control Panel: Unit mounted with disconnecting means and overcurrent protection. Include the following controls:
 - 1) Magnetic **OR** Mercury, **as directed**, contactors.
 - 2) Step Controller: Pilot lights and override toggle switch for each step.
 - 3) SCR Controller: Pilot lights operate on load ratio, a minimum of five steps.
 - 4) Time-delay relay.
 - 5) Airflow proving switch.

D. Refrigerant Circuit Components

1. Number of Refrigerant Circuits: One **OR** Two, **as directed**.
2. Compressor: Hermetic, reciprocating **OR** Semihermetic, reciprocating **OR** Hermetic, scroll, **as directed**, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater, **as directed**.
3. Refrigeration Specialties:
 - a. Refrigerant: R-22 **OR** R-407C **OR** R-410A, **as directed**.
 - b. Expansion valve with replaceable thermostatic element.
 - c. Refrigerant filter/dryer.
 - d. Manual-reset high-pressure safety switch.
 - e. Automatic-reset low-pressure safety switch.
 - f. Minimum off-time relay.
 - g. Automatic-reset compressor motor thermal overload.
 - h. Brass service valves installed in compressor suction and liquid lines.
 - i. Low-ambient kit high-pressure sensor.
 - j. Hot-gas reheat solenoid valve with a replaceable magnetic coil.
 - k. Hot-gas bypass solenoid valve with a replaceable magnetic coil.
 - l. Four-way reversing valve with a replaceable magnetic coil, thermostatic expansion valves with bypass check valves, and a suction line accumulator.

E. Air Filtration

1. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
 - a. Glass Fiber: Minimum 80 percent arrestance, and MERV 5.
 - b. Pleated: Minimum 90 percent arrestance, and MERV 7.

F. Gas Furnace

1. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47 and NFPA 54.
 - a. CSA Approval: Designed and certified by and bearing label of CSA.
2. Burners: Stainless steel.
 - a. Fuel: Natural **OR** Propane, **as directed**, gas.
 - b. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.
 - c. High-Altitude Model **OR** Kit, **as directed**: For Project elevations more than 2000 feet (610 m) above sea level.
3. Heat-Exchanger and Drain Pan: Stainless steel.
4. Venting: Gravity vented with vertical extension, **as directed**.
OR
Power Vent: Integral, motorized centrifugal fan interlocked with gas valve with vertical extension, **as directed**.
5. Safety Controls:
 - a. Gas Control Valve: Single stage **OR** Two stage **OR** Modulating, **as directed**.
 - b. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

G. Dampers

1. Outdoor-Air Damper: Linked damper blades, for 0 to 25 percent outdoor air, with manual **OR** motorized, **as directed**, damper filter.
2. Outdoor- and Return-Air Mixing Dampers: Parallel- or opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.
 - a. Damper Motor: Modulating with adjustable minimum position.
 - b. Relief-Air Damper: Gravity actuated or motorized, as required by ASHRAE/IESNA 90.1, with bird screen and hood.

H. Electrical Power Connection

1. Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit, **as directed**, and control-circuit transformer with built-in overcurrent protection.
- I. Controls
 1. Control equipment and sequence of operation are specified in Division 23 Section "Instrumentation And Control For Hvac".
 2. Basic Unit Controls:
 - a. Control-voltage transformer.
 - b. Wall-mounted thermostat or sensor with the following features:
 - 1) Heat-cool-off switch.
 - 2) Fan on-auto switch.
 - 3) Fan-speed switch.
 - 4) Manual **OR** Automatic, **as directed**, changeover.
 - 5) Adjustable deadband.
 - 6) Concealed **OR** Exposed, **as directed**, set point.
 - 7) Concealed **OR** Exposed, **as directed**, indication.
 - 8) Degree F **OR** Degree C, **as directed**, indication.
 - 9) Unoccupied-period-override push button.
 - 10) Data entry and access port to input temperature and humidity, **as directed**, set points, occupied and unoccupied periods, and output room temperature and humidity, **as directed**, supply-air temperature, operating mode, and status.
 - c. Wall-mounted humidistat or sensor with the following features:
 - 1) Concealed **OR** Exposed, **as directed**, set point.
 - 2) Concealed **OR** Exposed, **as directed**, indication.
 - d. Remote Wall **OR** Unit, **as directed**, -Mounted Annunciator Panel for Each Unit:
 - 1) Lights to indicate power on, cooling, heating, fan running, filter dirty, and unit alarm or failure.
 - 2) DDC controller or programmable timer and interface with HVAC instrumentation and control system.
 - 3) Digital display of outdoor-air temperature, supply-air temperature, return-air temperature, economizer damper position, indoor-air quality, and control parameters.
 3. Electronic **OR** DDC, **as directed**, Controller:
 - a. Controller shall have volatile-memory backup.
 - b. Safety Control Operation:
 - 1) Smoke Detectors: Stop fan and close outdoor-air damper if smoke is detected. Provide additional contacts for alarm interface to fire alarm control panel.
 - 2) Firestats: Stop fan and close outdoor-air damper if air greater than 130 deg F (54 deg C) enters unit. Provide additional contacts for alarm interface to fire alarm control panel.
 - 3) Fire Alarm Control Panel Interface: Provide control interface to coordinate with operating sequence described in Division 28 Section(s) "Digital, Addressable Fire-alarm System" **OR** "Zoned (dc Loop) Fire-alarm System", **as directed**.
 - 4) Low-Discharge Temperature: Stop fan and close outdoor-air damper if supply air temperature is less than 40 deg F (4 deg C).
 - 5) Defrost Control for Condenser Coil: Pressure differential switch to initiate defrost sequence.
 - c. Scheduled Operation: Occupied and unoccupied periods on seven-day **OR** 365-day, **as directed**, clock with a minimum of two **OR** four, **as directed**, programmable periods per day.
 - d. Unoccupied Period:
 - 1) Heating Setback: 10 deg F (5.6 deg C).
 - 2) Cooling Setback: System off.
 - 3) Override Operation: Two hours.
 - e. Supply Fan Operation:

- 1) Occupied Periods: Run fan continuously.
 - 2) Unoccupied Periods: Cycle fan to maintain setback temperature.
 - f. Refrigerant Circuit Operation:
 - 1) Occupied Periods: Cycle or stage compressors, and operate hot-gas bypass, **as directed**, to match compressor output to cooling load to maintain room **OR** discharge, **as directed**, temperature and humidity, **as directed**. Cycle condenser fans to maintain maximum hot-gas pressure. Operate low-ambient control kit to maintain minimum hot-gas pressure.
 - 2) Unoccupied Periods: Compressors off **OR** Cycle compressors and condenser fans for heating to maintain setback temperature, **as directed**.
 - 3) Switch reversing valve for heating or cooling mode on air-to-air heat pump.
 - g. Hot-Gas Reheat-Coil Operation:
 - 1) Occupied Periods: Humidistat opens hot-gas valve to provide hot-gas reheat, and cycles compressor.
 - 2) Unoccupied Periods: Reheat not required.
 - h. Gas Furnace Operation:
 - 1) Occupied Periods: Cycle **OR** Stage **OR** Modulate, **as directed**, burner to maintain room **OR** discharge, **as directed**, temperature.
 - 2) Unoccupied Periods: Cycle burner to maintain setback temperature.
 - i. Electric-Heating-Coil Operation:
 - 1) Occupied Periods: Cycle **OR** Stage **OR** Modulate, **as directed**, coil to maintain room **OR** discharge, **as directed**, temperature.
 - 2) Unoccupied Periods: Energize coil to maintain setback temperature.
 - 3) Operate supplemental electric heating coil with compressor for heating with outdoor temperature below 25 deg F (minus 4 deg C).
 - j. Fixed Minimum Outdoor-Air Damper Operation:
 - 1) Occupied Periods: Open to 25 percent.
 - 2) Unoccupied Periods: Close the outdoor-air damper.
 - k. Economizer Outdoor-Air Damper Operation:
 - 1) Occupied Periods: Open to 10 **OR** 25, **as directed**, percent fixed minimum intake, and maximum 100 percent of the fan capacity to comply with ASHRAE Cycle II. Controller shall permit air-side economizer operation when outdoor air is less than 60 deg F (15 deg C). Use outdoor-air temperature **OR** mixed-air and outdoor-air temperature **OR** outdoor-air enthalpy **OR** mixed-air temperature and select between outdoor-air and return-air enthalpy, **as directed**, to adjust mixing dampers. Start relief-air fan with end switch on outdoor-air damper, **as directed**. During economizer cycle operation, lock out cooling.
 - 2) Unoccupied Periods: Close outdoor-air damper and open return-air damper.
 - 3) Outdoor-Airflow Monitor: Accuracy maximum plus or minus 5 percent within 15 and 100 percent of total outdoor air. Monitor microprocessor shall adjust for temperature, and output shall range from 2- to 10-V dc **OR** 4 to 20 mA, **as directed**.
 - l. Carbon Dioxide Sensor Operation:
 - 1) Occupied Periods: Reset minimum outdoor-air ratio down to minimum 10 percent to maintain maximum 1000-ppm concentration.
 - 2) Unoccupied Periods: Close outdoor-air damper and open return-air damper.
 - m. VVT Relays:
 - 1) Provide heating- and cooling-mode changeover relays compatible with VVT terminal control system required in Division 23 Section(s) "Air Terminal Units" AND "Instrumentation And Control For Hvac".
4. Interface Requirements for HVAC Instrumentation and Control System:
 - a. Interface relay for scheduled operation.
 - b. Interface relay to provide indication of fault at the central workstation and diagnostic code storage.
 - c. Provide BACnet **OR** LonWorks, **as directed**, compatible interface for central HVAC control workstation for the following:
 - 1) Adjusting set points.

- 2) Monitoring supply fan start, stop, and operation.
- 3) Inquiring data to include outdoor-air damper position, **as directed**, supply- and room-air temperature and humidity, **as directed**.
- 4) Monitoring occupied and unoccupied operations.
- 5) Monitoring constant and variable motor loads.
- 6) Monitoring variable-frequency drive operation.
- 7) Monitoring cooling load.
- 8) Monitoring economizer cycles.
- 9) Monitoring air-distribution static pressure and ventilation air volume.

J. Accessories

1. Electric heater with integral thermostat maintains minimum 50 deg F (10 deg C) temperature in gas burner compartment.
2. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required. Outlet shall be energized even if the unit main disconnect is open, **as directed**.
3. Low-ambient kit using staged **OR** damper on **OR** variable-speed, **as directed**, condenser fans for operation down to 35 deg F (1.7 deg C).
4. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.
5. Coil guards of painted, galvanized-steel wire.
6. Hail guards of galvanized steel, painted to match casing.
7. Concentric diffuser with white louvers and polished aluminum return grilles, insulated diffuser box with mounting flanges, and interior transition.

K. Roof Curbs

1. Roof curbs with vibration isolators and wind or seismic restraints are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
OR
Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.
 - a. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
 - 1) Materials: ASTM C 1071, Type I or II.
 - 2) Thickness: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**.
 - b. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
 - 1) Liner Adhesive: Comply with ASTM C 916, Type I.
 - 2) Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
 - 3) Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
 - 4) Liner Adhesive: Comply with ASTM C 916, Type I.
2. Curb Height: 14 inches (355 mm) **OR** 24 inches (610 mm) **OR** 36 inches (910 mm), **as directed**.
3. Wind and Seismic Restraints: Metal brackets compatible with the curb and casing, painted to match RTU, used to anchor unit to the curb, and designed for loads at Project site. Comply with requirements in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" for wind-load requirements.

1.3 EXECUTION

A. Installation

1. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - a. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger than supported equipment and minimum 6 inches (150 mm) above finished ground elevation.
 - b. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - c. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - d. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - e. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-place Concrete".
 2. Equipment Mounting: Install RTUs on concrete base using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-place Concrete".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1 inch (25 mm), **as directed**.
OR
Roof Curb: Install on roof structure or concrete base, level and secure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts" **OR** ARI Guideline B, **as directed**. Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Division 07 Section "Roof Accessories". Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.
 3. Unit Support: Install unit level on structural curbs **OR** pilings, **as directed**. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.
 4. Install wind and seismic restraints according to manufacturer's written instructions. Wind and seismically restrained vibration isolation roof-curb rails are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
- B. Connections
1. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.
 2. Install piping adjacent to RTUs to allow service and maintenance.
 - a. Gas Piping: Comply with applicable requirements in Division 23 Section(s) "Facility Natural-gas Piping" **OR** "Facility Liquefied-petroleum Gas Piping", **as directed**. Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.
 3. Duct installation requirements are specified in other Division 21. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
 - a. Install ducts to termination at top of roof curb.
 - b. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
 - c. Connect supply ducts to RTUs with flexible duct connectors specified in Division 23 Section "Air Duct Accessories".
 - d. Install return-air duct continuously through roof structure.
 - e. Install normal-weight, 3000-psi (20.7-MPa), compressive strength (28-day) concrete mix inside roof curb, 4 inches (100 mm) thick. Concrete, formwork, and reinforcement are specified in Division 31.
- C. Field Quality Control
1. Perform tests and inspections and prepare test reports.
 2. Tests and Inspections:
 - a. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
 - b. Inspect for and remove shipping bolts, blocks, and tie-down straps.



- c. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
- d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Remove and replace malfunctioning units and retest as specified above.

D. Startup Service

1. Engage a factory-authorized service representative to perform startup service.
2. Complete installation and startup checks according to manufacturer's written instructions and do the following:
 - a. Inspect for visible damage to unit casing.
 - b. Inspect for visible damage to furnace combustion chamber.
 - c. Inspect for visible damage to compressor, coils, and fans.
 - d. Inspect internal insulation.
 - e. Verify that labels are clearly visible.
 - f. Verify that clearances have been provided for servicing.
 - g. Verify that controls are connected and operable.
 - h. Verify that filters are installed.
 - i. Clean condenser coil and inspect for construction debris.
 - j. Clean furnace flue and inspect for construction debris.
 - k. Connect and purge gas line.
 - l. Remove packing from vibration isolators.
 - m. Inspect operation of barometric relief dampers.
 - n. Verify lubrication on fan and motor bearings.
 - o. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
 - p. Adjust fan belts to proper alignment and tension.
 - q. Start unit according to manufacturer's written instructions.
 - 1) Start refrigeration system.
 - 2) Do not operate below recommended low-ambient temperature.
 - 3) Complete startup sheets and attach copy with Contractor's startup report.
 - r. Inspect and record performance of interlocks and protective devices; verify sequences.
 - s. Operate unit for an initial period as recommended or required by manufacturer.
 - t. Perform the following operations for both minimum and maximum firing. Adjust burner for peak efficiency.
 - 1) Measure gas pressure on manifold.
 - 2) Inspect operation of power vents.
 - 3) Measure combustion-air temperature at inlet to combustion chamber.
 - 4) Measure flue-gas temperature at furnace discharge.
 - 5) Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
 - 6) Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
 - u. Calibrate thermostats.
 - v. Adjust and inspect high-temperature limits.
 - w. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
 - x. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F (8 deg C) above return-air temperature:
 - 1) Coil leaving-air, dry- and wet-bulb temperatures.
 - 2) Coil entering-air, dry- and wet-bulb temperatures.
 - 3) Outdoor-air, dry-bulb temperature.
 - 4) Outdoor-air-coil, discharge-air, dry-bulb temperature.
 - y. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
 - z. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.

- 1) Supply-air volume.
 - 2) Return-air volume.
 - 3) Relief-air volume.
 - 4) Outdoor-air intake volume.
 - aa. Simulate maximum cooling demand and inspect the following:
 - 1) Compressor refrigerant suction and hot-gas pressures.
 - 2) Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.
 - bb. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:
 - 1) High-temperature limit on gas-fired heat exchanger.
 - 2) Low-temperature safety operation.
 - 3) Filter high-pressure differential alarm.
 - 4) Economizer to minimum outdoor-air changeover.
 - 5) Relief-air fan operation.
 - 6) Smoke and firestat alarms.
 - cc. After startup and performance testing and prior to Final Completion, replace existing filters with new filters.
- E. Cleaning And Adjusting
 - 1. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose.
 - 2. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.
- F. Demonstration
- G. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs.

END OF SECTION 23 74 13 00



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SECTION 23 74 13 00a - ROOFTOP REPLACEMENT AIR UNITS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for rooftop replacement-air units. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes cooling-only and cooling and heating rooftop replacement-air units.

C. Definitions

1. DDC: Direct-digital controls.

D. Submittals

1. Product Data: Include rated capacities, furnished specialties, and accessories.
2. Shop Drawings: Include details of installation and wiring diagrams.
3. Coordination Drawings: Rooftop replacement-air units to roof-curb mounting details drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - a. Size and location of rooftop replacement-air unit mounting rails and anchor points and methods for anchoring units to roof curb.
 - b. Required roof penetrations for ducts, pipes, and electrical raceways, including size and location of each penetration.
4. Startup service reports.
5. Operation and maintenance data.
6. Warranty: Special warranty specified in this Section.
7. LEED Submittals:
 - a. Product Data for Credit EA 4: Documentation required by Credit EA 4 indicating that equipment and refrigerants comply.
 - b. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
3. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

F. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components listed below that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Final Completion.
 - b. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than five **OR** 10, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Cabinet

1. Construction: Single **OR** Double, **as directed**, wall.
2. Exterior Casing: Galvanized steel with baked-enamel paint finish and **OR** Stainless steel, **as directed**, with lifting lugs and knockouts for electrical and piping connections.
3. Interior Casing: Galvanized-steel **OR** Stainless steel, **as directed**.
4. Base Rails: Galvanized-steel **OR** Stainless-steel, **as directed**, rails for mounting on roof curb.
5. Service Doors: Hinged access doors with neoprene gaskets.
6. Internal Insulation: Fibrous-glass duct lining complying with ASTM C 1071, Type II.
 - a. Thickness: 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**.
 - b. Insulation Adhesive: Comply with ASTM C 916, Type I.
 - c. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to casing without damaging liner and without causing air leakage when applied as recommended by manufacturer.
7. Condensate Drain Pans: Formed sections of galvanized-steel **OR** stainless-steel, **as directed**, sheet designed for self-drainage. Fabricate pans and drain connection to comply with ASHRAE 62.1.
8. Roof Curb: Full-perimeter curb of sheet metal, minimum 8 inches (200 mm) **OR** 12 inches (300 mm) **OR** 16 inches (400 mm), **as directed**, high, with wood nailer, neoprene sealing strip, and welded Z-bar flashing.
9. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

B. Supply-Air Fan

1. Fan: Forward-curved centrifugal; statically and dynamically balanced, galvanized **OR** coated, **as directed**, steel, mounted on solid-steel shaft with self-aligning, permanently lubricated ball bearings **OR** pillow-block bearings rated L₅₀ for 200,000 hours and having external grease fittings, **as directed**.
2. Motor: Open dripproof **OR** Totally enclosed, **as directed**, single-speed **OR** two-speed, **as directed**, motor.
3. Drive: V-belt drive with matching fan pulley and adjustable motor sheaves and belt assembly with minimum 1.4 service factor.
4. Mounting: Fan wheel, motor, and drives shall be mounted in fan casing with restrained, **as directed**, elastomeric **OR** spring, **as directed**, isolators.

C. Refrigeration System

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."
2. Compressors: Reciprocating **OR** Scroll, **as directed**, compressors with integral vibration isolators, internal overcurrent and overtemperature protection, internal pressure relief, and crankcase heater, **as directed**.
3. Minimum Efficiency: As defined by ASHRAE/IESNA 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
4. Refrigerant: R-22 **OR** R-407C **OR** R-410A, **as directed**.
5. Refrigeration System Specialties:
 - a. Expansion valve with replaceable thermostatic element.
 - b. Refrigerant dryer.
 - c. High-pressure switch.
 - d. Low-pressure switch.
 - e. Thermostat for coil freeze-up protection during low ambient temperature operation or loss of air.
 - f. Brass service valves installed in discharge and liquid lines.
 - g. Operating charge of refrigerant.

6. Capacity Control: Hot-gas bypass refrigerant control for capacity control with continuous dehumidification on a single compressor.
OR
Capacity Control: Patented, Rawal APR control with zero to 100 percent modulating capacity control using hot-gas bypass. Evaporator coil shall be continuously active for dehumidification.
OR
Capacity Control: Single compressor with evaporator and condenser coil within the refrigerant section to provide initial precooling and reheat for humidity control.
OR
Capacity Control: Heat-pipe heat exchanger shall wrap around the evaporator coil to precool the air entering the evaporator coil, and reheat the air leaving the evaporator coil to control humidity.
 7. Refrigerant Coils: Evaporator and condenser **OR** Evaporator, condenser, and reheat condenser, **as directed**, coils shall be designed, tested, fabricated, and rated according to ARI 410 and ASHRAE 33. Coils shall be leak tested under water with air at 315 psig (2170 kPa).
 - a. Capacity Reduction: Circuit coils for face **OR** row **OR** interleaved, **as directed**, control.
 - b. Tubes: Copper.
 - c. Fins: Aluminum **OR** Copper, **as directed**, with minimum fin spacing of 0.071 inch (1.81 mm), **as directed**.
 - d. Fin and Tube Joint: Mechanical bond.
 - e. Suction and Distributor: Seamless copper tube with brazed joints.
 - f. Coating: Phenolic epoxy corrosion-protection coating on both coils.
 - g. Source Quality Control: Test to 450 psig (3105 kPa), and to 300 psig (2070 kPa) underwater.
 8. Condenser Fan: Propeller type, directly driven by motor.
 9. Safety Controls:
 - a. Compressor motor and outside-coil fan motor low ambient lockout.
 - b. Overcurrent protection for compressor motor and outside-coil fan motors.
- D. Direct-Fired Gas Furnace
1. Description: Factory assembled, piped, and wired; complying with NFPA 54, "National Fuel Gas Code"; ANSI Z83.4, "Non-Recirculating Direct Gas-Fired Industrial Air Heaters"; and ANSI Z83.18, "Direct Gas-Fired Industrial Air Heaters," for direct-fired gas furnace.
 2. Burners: Cast-iron burner with stainless-steel mixing plates.
 - a. Rated for a maximum turndown ratio of 30:1.
 - b. Fuel: Natural **OR** Propane, **as directed**, gas.
 3. Safety Controls:
 - a. Gas manifold safety switches and controls shall comply with ANSI standards and FMG **OR** and IRI, **as directed**.
 - b. Pilot: Intermittent spark igniter.
 - c. Purge-period timer shall automatically delay burner ignition and bypass low-limit control.
 - d. External gas-pressure regulator shall regulate pressure to not more than 0.5 psig (3.4 kPa).
 - e. Airflow Proving Switch: Dual pressure switch senses correct airflow before energizing pilot and requires airflow to be maintained within minimum and maximum pressure settings across burner.
 - f. Manual-Reset, High-Limit Switch: Stops burner and closes main gas valve if high-limit temperature is exceeded.
 - g. Gas Train: Redundant, main gas valves, electric pilot valve, main and pilot gas-pressure regulators, main and pilot manual shutoff valves, main and pilot pressure taps, and high-low gas-pressure switches **OR** to comply with FMG requirements **OR** to comply with IRI requirements, **as directed**.
- E. Indirect-Fired Gas Furnace
1. Description: Factory assembled, piped, and wired; complying with NFPA 54, "National Fuel Gas Code," and ANSI Z21.47, "Gas-Fired Central Furnaces."
 - a. AGA Approval: Designed and certified by and bearing label of AGA.

2. Burners: Aluminized steel with stainless-steel inserts **OR** Stainless steel, **as directed**.
 - a. Minimum AFUE: **<Insert value>** percent.
OR
Minimum Thermal Efficiency: **<Insert value>** percent.
OR
Minimum Combustion Efficiency: **<Insert value>** percent.
 - b. Fuel: Natural **OR** Propane, **as directed**, gas.
 - c. Ignition: Electronically controlled electric spark with flame sensor.
 - d. High-Altitude Model **OR** Kit, **as directed**: For Project elevations more than 2000 feet (610 m) above sea level.
3. Heat-Exchanger Drain Pan: Stainless steel.
4. Venting: Gravity vented.
OR
Power Vent: Integral, motorized centrifugal fan interlocked with gas valve.
5. Safety Controls:
 - a. Gas Control Valve: Single stage **OR** Two stage **OR** Electronic modulating, **as directed**.
 - b. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

F. Electric-Resistance Heating

1. Electric-Resistance Heating Elements: Coiled resistance wire of 80 percent nickel and 20 percent chromium; surrounded by compacted magnesium oxide powder in tubular-steel sheath; with spiral-wound, copper-plated, steel fins continuously brazed to sheath.
OR
Electric-Resistance Heating Elements: Open-coil resistance wire of 80 percent nickel and 20 percent chromium; supported and insulated by floating ceramic bushings recessed into casing openings, fastened to supporting brackets, and mounted in galvanized-steel frame.
 - a. Heating Capacity: Low density 35 W per sq. in. (54 kW per sq. m), factory wired for single-point wiring connection; with time delay for element staging, and overcurrent and overheat protective devices.
 - b. Safety Controls:
 - 1) Blower-motor interlock, air-pressure switch.
 - 2) Quiet mercury contactors.
 - 3) Time delay between steps.
 - 4) Integral, nonfused power disconnect switch.

G. Heating Coils

1. Hot-Water Coils: Continuous-circuit **OR** Self-draining **OR** Cleanable, **as directed**, coil fabricated and tested according to ARI 410 with aluminum fins and seamless copper tube in galvanized-steel **OR** stainless-steel, **as directed**, casing.
 - a. Headers: Cast iron with drain and air vent tappings **OR** Cast iron with cleaning plugs, and drain and air vent tappings **OR** Seamless copper tube with brazed joints, prime coated **OR** Fabricated steel with brazed joints, prime coated, **as directed**.
 - b. Control valves are specified in Division 23 Section "Instrumentation And Control For Hvac".
2. Steam Coils: Distributing coil fabricated and tested according to ARI 410, with threaded steam supply and condensate connections. Nonfreeze type having aluminum-plate fin and seamless copper double tube in galvanized-steel casing, pitched for proper drainage; tested to 150 psig (1035 kPa) and leak tested to 100 psig (690 kPa) with air under water.
 - a. Control valves are specified in Division 23 Section "Instrumentation And Control For Hvac".

H. Cooling Coils

1. Chilled-Water Coils: Continuous-circuit **OR** Self-draining **OR** Cleanable, **as directed**, coil fabricated and tested according to ARI 410 with aluminum fins and seamless copper tube in galvanized-steel **OR** stainless-steel, **as directed**, casing.

- a. Headers: Cast iron with drain and air vent tappings **OR** Cast iron with cleaning plugs, and drain and air vent tappings **OR** Seamless copper tube with brazed joints, prime coated **OR** Fabricated steel with brazed joints, prime coated, **as directed**.
 - b. Control valves are specified in Division 23 Section "Instrumentation And Control For Hvac".
- I. Outdoor-Air Intake And Dampers
- 1. Dampers: Leakage rate, according to AMCA 500, shall not exceed 2 percent of air quantity at face velocity of 2000 fpm (10 m/s) through damper and pressure differential of 4-inch wg (1000 Pa).
 - 2. Damper Operators: Electric.
 - 3. Mixing Boxes: Parallel-blade, galvanized-steel dampers mechanically fastened to steel operating rod inside cabinet. Connect operating rods with common interconnecting linkages so dampers operate simultaneously.
 - 4. Outdoor-Air Intake Hoods: Galvanized-steel **OR** Stainless steel, **as directed**, with bird screen complying with ASHRAE 62.1 and finish to match cabinet.
- J. Filters
- 1. Comply with NFPA 90A.
 - 2. Cleanable Filters: 2-inch- (50-mm-) thick, cleanable metal mesh.
OR
Disposable Panel Filters: 2-inch- (50-mm-) thick, factory-fabricated, flat-panel-type, disposable air filters with holding frames, with a minimum efficiency report value of 6 according to ASHRAE 52.2 and 90 percent average arrestance according to ASHRAE 52.1, **as directed**.
 - a. Media: Interlaced glass fibers sprayed with nonflammable adhesive.
 - b. Frame: Galvanized steel.
- K. Controls
- 1. Factory-wire connection for controls' power supply.
 - 2. Control devices, including sensors, transmitters, relays, switches, thermostats, humidistats, detectors, operators, actuators, and valves, shall be manufacturer's standard items to accomplish indicated control functions.
 - 3. Unit Controls: Solid-state control board and components with field-adjustable control parameters.
 - 4. Supply-Fan Control: Units shall be electrically interlocked with corresponding exhaust fans, to operate continuously when exhaust fans are running. Time clock shall switch operation from occupied to unoccupied. Night setback thermostat shall cycle fan during unoccupied periods to maintain space temperature.
 - a. Timer: Seven-day electronic clock.
 - b. Electrically interlock kitchen hood fire-extinguishing system to de-energize replacement-air unit when fire-extinguishing system discharges.
 - 5. Remote **OR** Unit, **as directed**, -Mounted Status Panel:
 - a. Cooling/Off/Heating Controls: Control operational mode.
 - b. Damper Position: Indicates position of outdoor-air dampers in terms of percentage of outdoor air.
 - c. Status Lights:
 - 1) Filter dirty.
 - 2) Fan operating.
 - 3) Cooling operating.
 - 4) Heating operating.
 - 6. Refrigeration System Controls:
 - a. Unit-mounted enthalpy controller shall lock out refrigerant system when outdoor-air enthalpy is less than 28 Btu/lb (65 kJ/kg) of dry air or outdoor-air temperature is less than 60 deg F (15 deg C).
 - b. Outdoor-air sensor de-energizes dehumidifier operation when outdoor-air temperature is less than 60 deg F (15 deg C).
 - c. Wall-mounting, relative-humidity sensor energizes dehumidifier operation when relative humidity is more than 60 percent.

7. Heating Controls:
 - a. Factory-mounted sensor in supply-fan outlet **OR** Remote-mounting sensor for field installation in supply-air duct, **as directed**, with sensor adjustment located in control panel modulates gas furnace burner to maintain space temperature.
 - b. Wall-mounting, space-temperature sensor with temperature adjustment **OR** unit-mounted temperature adjustment **OR** adjustment on remote-control panel, **as directed**, that modulates gas furnace burner to maintain space temperature.
 - c. Remote Setback Thermostat: Adjustable room thermostat selected by timer, set at 50 deg F (10 deg C); cycles supply fan and gas furnace burner to maintain space temperature.
 - d. Staged Burner Control: Two **OR** Four, **as directed**, steps of control.
OR
Electromechanical or Electronic Burner Control: 20 to 100 percent modulation of the firing rate. 10 to 100 percent with dual furnace units.
 8. Electric-Resistance Heating Controls: Wall-mounting thermostat controls SCR **OR** sequences stages, **as directed**.
 9. Damper Controls:
 - a. Wall-mounting pressure sensor modulates outdoor- and return-air dampers to maintain a positive pressure in space served by rooftop replacement-air unit at minimum 0.05-inch wg (12.4 Pa).
 - b. When exhaust fans stop, set outdoor- and return-air damper to 75 **OR** 50 **OR** 25, **as directed**, percent outdoor air. When exhaust fans start, close return-air damper and fully open outdoor-air damper.
 10. Integral Smoke Alarm: Smoke detector installed in supply and return air.
 11. DDC Temperature Control: Stand-alone control module for link between unit controls and DDC temperature-control system. Control module shall be compatible with temperature-control system specified in Division 23 Section "Instrumentation And Control For Hvac". Links shall include the following:
 - a. Start/stop interface relay, and relay to notify DDC temperature-control system alarm condition.
 - b. Hardware interface or additional sensors for the following:
 - 1) Room temperature.
 - 2) Discharge air temperature.
 - 3) Refrigeration system operating.
 - 4) Furnace operating.
- L. Motors
1. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".

1.3 EXECUTION

A. Installation

1. Install roof curb on roof structure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts" **OR** ARI Guideline B, **as directed**. Install and secure rooftop replacement-air units on curbs and coordinate roof penetrations and flashing with roof construction.
OR
Install restrained vibration isolation roof-curb rails on roof structure according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts" **OR** ARI Guideline B, **as directed**. Install and secure rooftop replacement-air units on rails and coordinate roof penetrations and flashing with roof construction. Restrained isolation roof-curb rails are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".

2. Install wall- and duct-mounting sensors, thermostats, and humidistats furnished by manufacturers for field installation. Install control wiring and make final connections to control devices and unit control panel.
 3. Install 3000-psi (20.7-MPa), compressive strength (28-day) concrete base inside roof curb, 4 inches (100 mm) thick. Concrete and reinforcement are specified in Division 31.
- B. Connections
1. Piping installation requirements are specified in other Division 21-. Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Install piping adjacent to machine to allow service and maintenance.
 - a. Gas Burner Connections: Comply with requirements in Division 23 Section(s) "Facility Natural-gas Piping" OR "Facility Liquefied-petroleum Gas Piping", **as directed**. Connect gas piping to burner, full size of gas train inlet, and connect with union, pressure regulator, **as directed**, and shutoff valve with sufficient clearance for burner removal and service.
 - b. Water Coil Connections: Comply with requirements in Division 23 Section "Hydronic Piping". Connect to supply and return coil with shutoff-duty valve and union or flange on the supply connection and with throttling-duty valve and union or flange on the return connection.
 - c. Steam Coil Connections: Comply with requirements in Division 23 Section "Steam And Condensate Heating Piping". Connect to steam piping with shutoff valve and union or flange; for condensate piping, starting from the coil connection, connect with union or flange, strainer, trap, and shutoff valve.
 3. Duct Connections: Duct installation requirements are specified in Division 23 Section "Metal Ducts". Drawings indicate the general arrangement of ducts. Connect supply and return, **as directed**, ducts to rooftop replacement-air units with flexible duct connectors. Flexible duct connectors are specified in Division 23 Section "Air Duct Accessories".
 4. Electrical Connections: Comply with requirements in Division 22 for power wiring, switches, and motor controls.
 5. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
- C. Startup Service
1. Engage a factory-authorized service representative to perform startup service.
 2. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
 - a. Inspect for visible damage to furnace combustion chamber.
 - b. Inspect for visible damage to compressor, air-cooled outside coil, and fans.
 - c. Inspect casing insulation for integrity, moisture content, and adhesion.
 - d. Verify that clearances have been provided for servicing.
 - e. Verify that controls are connected and operable.
 - f. Verify that filters are installed.
 - g. Clean outside coil and inspect for construction debris.
 - h. Clean furnace flue and inspect for construction debris.
 - i. Inspect operation of power vents.
 - j. Purge gas line.
 - k. Inspect and adjust vibration isolators and seismic restraints.
 - l. Verify bearing lubrication.
 - m. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
 - n. Adjust fan belts to proper alignment and tension.
 - o. Start unit.
 - p. Start refrigeration system when outdoor-air temperature is within normal operating limits.
 - q. Inspect and record performance of interlocks and protective devices including response to smoke detectors by fan controls and fire alarm.
 - r. Operate unit for run-in period.
 - s. Perform the following operations for both minimum and maximum firing and adjust burner for peak efficiency:

- 1) Measure gas pressure at manifold.
 - 2) Measure combustion-air temperature at inlet to combustion chamber.
 - 3) Measure flue-gas temperature at furnace discharge.
 - 4) Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
 - 5) Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
 - t. Calibrate thermostats.
 - u. Adjust and inspect high-temperature limits.
 - v. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers, **as directed**.
 - w. Start refrigeration system and measure and record the following:
 - 1) Coil leaving-air, dry- and wet-bulb temperatures.
 - 2) Coil entering-air, dry- and wet-bulb temperatures.
 - 3) Outdoor-air, dry-bulb temperature.
 - 4) Outdoor-air-coil, discharge-air, dry-bulb temperature.
 - x. Verify operational sequence of controls.
 - y. Measure and record the following airflows. Plot fan volumes on fan curve.
 - 1) Supply-air volume.
 - 2) Return-air volume.
 - 3) Outdoor-air intake volume.
 - z. Simulate maximum cooling demand and inspect the following:
 - 1) Compressor refrigerant suction and hot-gas pressures.
 - 2) Short circuiting of air through outside coil or from outside coil to outdoor-air intake.
 - aa. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:
 - 1) High-limit heat exchanger.
 - 2) Alarms.
 3. After startup and performance testing, change filters, verify bearing lubrication, and adjust belt tension.
 4. Remove and replace components that do not pass tests and inspections and retest as specified above.
 5. Prepare written report of the results of startup services.
- D. Adjusting
1. Adjust initial temperature and humidity set points.
 2. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
 3. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose.
- E. Demonstration
1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain rooftop replacement-air units.

END OF SECTION 23 74 13 00a

SECTION 23 74 13 00b - SELF-CONTAINED AIR-CONDITIONERS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for self-contained air-conditioners. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes packaged air **OR** water-cooled air-conditioning units, **as directed**, with refrigerant compressors and controls, intended for indoor installations.

C. Submittals

1. Product Data: For each unit indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories.
2. LEED Submittals:
 - a. Product Data for Credit EA 4: Documentation required by Credit EA 4 indicating that equipment and refrigerants comply.
 - b. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
3. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
4. Samples for Initial Selection: For units with factory-applied color finishes.
5. Operation and Maintenance Data: For self-contained air conditioners to include in emergency, operation, and maintenance manuals.
6. Warranty: Sample of special warranty.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency and marked for intended locations and application.
2. ARI Compliance:
 - a. Applicable requirements in ARI 210/240.
 - b. Applicable requirements in ARI 340/360.
 - c. Applicable requirements in ARI 390.
3. ASHRAE Compliance:
 - a. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
 - b. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Ventilation Rate Procedures," and Section 7 - "Construction and Startup."
4. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

E. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of self-contained air conditioners that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period:
 - 1) For Compressor: One **OR** Five year(s), **as directed**, from date of Final Completion.
 - 2) For Parts: One **OR** Five year(s), **as directed**, from date of Final Completion.
 - 3) For Labor: One **OR** Five year(s), **as directed**, from date of Final Completion.

1.2 PRODUCTS

A. Packaged Units

1. Description: Factory-assembled, wired, and tested, and fully charged with refrigerant and oil.
2. Configuration: Horizontal, ceiling-plenum mounted.
3. Configuration: Vertical, floor mounted; vertical and horizontal discharge.
4. Configuration: Horizontal, ceiling mounted and vertical, floor mounted; vertical and horizontal discharge.
5. Disconnect Switch: Factory mounted in control panel **OR** on equipment, **as directed**.

B. Cabinet

1. Frame and Panels: Structural-steel frame with galvanized-steel panels and access doors or panels.
 - a. Exterior-Surface Finish: Factory painted in color selected by Architect.
 - b. Interior-Surface Finish: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
2. Insulation: Minimum 1-inch- (25-mm-), thick, glass-fiber duct liner complying with ASTM C 1091 and having a microbial coating on cabinet interior and control panel. 1/2-inch- (13-mm-) thick liner is acceptable for units smaller than 15 tons (50 kW).
3. Return-Air Opening: Rear, open **OR** flange for duct connection, **as directed**.
4. Corrosion-Resistant Treatment: Phenolic coating on unit interior and exterior.

C. Supply-Air Fan

1. Fan Material: Galvanized steel.
2. Configuration: Double-width, double-inlet, forward-curved **OR** airfoil, **as directed**, centrifugal fan; statically and dynamically balanced. Vertical **OR** Horizontal discharge, **as directed**, with flexible discharge collar.
3. Drive: Belt, with fan mounted on permanently lubricated bearings **OR** Direct, with fan and motor resiliently mounted, **as directed**.
4. Fan Sheaves: Variable pitch, dynamically balanced, bored to fit shafts and keyed for initial startup.
5. Motor Sheave: Variable and adjustable pitch dynamically balanced, and selected to achieve specified rpm when set at midposition.
6. Belt Rating: As recommended by the manufacturer or a minimum of one and one-half times nameplate rating of motor.
7. Bearings: Grease lubricated with grease lines extended to exterior of unit with L-50 life at 200,000 hours.
8. Variable Air Volume: Variable-frequency motor controller with bypass.
9. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a. Special Motor Features: Premium efficiency, as defined in Division 23 Section "Common Motor Requirements For Hvac Equipment".
10. Isolation: Mount fan and motor on common subbase and mount assembly on spring isolators with minimum static deflection of **1 inch (25 mm)**.
11. Outdoor-Air-Intake Accessories:
 - a. Barometric Outdoor-Air Damper: Adjustable-blade damper allowing induction of up to 25 percent outdoor air when evaporator fan is running.
 - b. Motorized Outdoor-Air Damper: Motorized, two-position blade damper allowing induction of up to 25 percent outdoor air; with spring-return, low-voltage damper motor.
 - c. Energy-Recovery Ventilator: Assembly of desiccant-coated, heat-recovery wheels and centrifugal exhaust fans to transfer approximately 67 percent of the difference between the sensible and latent heat of outdoor and exhaust air.

- d. Air-Side Economizer: Damper assembly allowing induction of up to 100 percent outdoor air to maintain a selected mixed-air temperature; and exhaust damper and spring-return, low-voltage, modulating damper motor with minimum position adjustment.
- D. Refrigeration System
- 1. Compressor: Scroll type, hermetically sealed, 3600 rpm maximum, and resiliently mounted with positive lubrication and internal motor protection.
 - 2. Refrigerant Coils (Indoor and Outdoor for Air-Cooled Units): Seamless copper tubes expanded into aluminum fins.
 - a. Corrosion-Resistant Treatment: Phenolic coating applied with multiple dips and baked.
 - b. Refrigerant Circuits: A separate circuit for each compressor, with externally equalized thermal-expansion valve with adjustable superheat, filter dryer, sight glass, high-pressure relief valve, and charging valves.
 - c. Mount coil assembly over stainless-steel drain pan complying with ASHRAE 62.1 and having a condensate pump unit with integral float switch, pump-motor assembly, and condensate reservoir.
 - d. Refrigerant: R-22, R-407C or R-410A.
 - e. Expansion valve with replaceable thermostatic element.
 - f. Refrigerant dryer.
 - g. High-pressure switch.
 - h. Low-pressure switch.
 - i. Thermostat for coil freeze-up protection during low ambient temperature operation or loss of air.
 - j. Low ambient temperature switch.
 - k. Brass service valves installed in discharge and liquid lines.
 - 3. Water-Cooled Condenser:
 - a. Description: Factory assembled and tested; tube in tube coaxial type with water-regulating valve.
 - b. Tubing: Nonferrous **OR** Copper **OR** Cupro-nickel, **as directed**, inner tube; steel with corrosion-resistant coating; refrigerant and water-side leak tested to 400 psig (2760 kPa) underwater.
 - 4. Water-Side Economizer Section:
 - a. Description: Factory assembled and tested; consisting of water coil, modulating valves, controls, piping with cleanouts, and access panels.
 - b. Water Coil: Two **OR** Four rows, **as directed**, copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), and copper **OR** cast-iron, **as directed** headers; leak tested to 300 psig (2070 kPa) underwater; and having a two-position control valve.
- E. Heating Coil
- 1. Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm); leak tested to 300 psig (2070 kPa) underwater; and having a two-position control valve.
 - 2. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements with refractory ceramic support bushings; automatic-reset thermal cutout; built-in magnetic contactors; manual-reset thermal cutout; airflow-proving device; and one-time fuses in terminal box for overcurrent protection.
- F. Controls
- 1. Control Package: Factory wired, including contactor, high- and low-pressure cutouts, internal-winding thermostat for compressor, control-circuit transformer, and noncycling reset relay.
 - 2. Time-Delay Relay: Five-minute delay to prevent compressor cycling.
 - 3. Adjustable Thermostat: Unit mounted **OR** Remote, **as directed**, to control the following:
 - a. Supply fan.
 - b. Compressor.
 - c. Condenser.

- d. Hot-water coil valve.
 - e. Electric heater.
 - 4. System Selector Switch: Heat-off-cool **OR** Off-heat-auto-cool, **as directed**.
 - 5. Fan Control Switch: Auto-on.
 - 6. Time Clock, **as directed**: Cycle unit on and off.
 - 7. Microprocessor Control Panel: Controls unit functions, including refrigeration and safety controls, and the following:
 - a. Supply fan.
 - b. Supply-fan motor speed.
 - c. Compressors.
 - d. Air-cooled condenser.
 - e. Cooling tower pump.
 - f. Modulating, hot-water coil valve.
 - g. Multistep, electric heater.
 - h. Time-of-day control to cycle unit on and off.
 - i. Night-heat, morning warm-up cycle.
 - j. Economizer control.
 - k. Panel-mounted control switch to operate unit in remote or local control mode, or to stop or reset.
 - l. Panel-mounted indication of the following:
 - 1) Operating status.
 - 2) System diagnostics and safety alarms.
 - 3) Supply-air temperature set point.
 - 4) Zone heating-temperature set point.
 - 5) Supply-air pressure set point.
 - 6) Economizer minimum position set point.
 - 7) Supply-air-pressure, high-limit set point.
 - 8) Monitor constant and variable motor loads.
 - 9) Monitor variable-frequency drive operation.
 - 10) Monitor economizer cycle.
 - 11) Monitor cooling load.
 - 12) Monitor air distribution static pressure and ventilation air volumes.
- G. Evaporator Coil
- 1. Direct-Expansion Coil: Seamless copper tubes expanded into aluminum fins.
 - a. Corrosion-Resistant Treatment, **as directed**: Phenolic coating applied with multiple dips and baked.
 - 2. Refrigerant Circuits: A separate circuit for each compressor, with externally equalized thermal-expansion valve with adjustable superheat, **as directed**, filter-dryer, sight glass, high-pressure relief valve, **as directed**, and charging valves.
- H. Remote Air-Cooled Condenser
- 1. Description: Factory assembled and tested; consisting of condenser coil, fans and motors, and operating controls; suitable for roof mounting.
 - a. Condenser Coil: Aluminum-fin copper tube with integral subcooler; leak tested to 450 psig (3110 kPa).
 - b. Condenser Fans: Direct-drive propeller type.
 - c. Fan Motors: Three-phase, permanently lubricated, ball-bearing motors with built-in thermal-overload protection. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - d. Refrigerant Line Kits: Annealed-copper suction and liquid lines that are factory cleaned, dried, pressurized, and sealed; insulated suction line; flared fittings at evaporator end, no fitting at condenser end; and service valves for both suction and liquid lines.
 - e. Terminate suction and liquid refrigerant piping with service valves within unit.
 - f. Low Ambient Control: Cycles fans to permit operation down to 45 deg F (7 deg C).

OR

Low Ambient Control: Cycles fans and modulates condenser fan damper assembly to permit operation down to 0 deg F (minus 18 deg C).

g. Coil Guard: Painted galvanized steel with louvered grilles.

h. Corrosion-Resistant Treatment: Phenolic coating applied in multiple dips and baked.

I. Integral Air-Cooled Condenser For Units 15 Tons (50 kW) And Smaller

1. Description: Factory assembled and tested; consisting of condenser coil, fans and motors, and cabinet.

a. Condenser Coil: Aluminum-fin copper tube with integral subcooler; leak tested to 425 psig (2930 kPa).

b. Condenser Fan: Direct-drive propeller type with permanently lubricated motor with built-in thermal-overload protection.

c. Low Ambient Control: Cycles fans to permit operation down to 0 deg F (minus 18 deg C).

J. Air Filters

1. Permanent Filters: 1-inch- (25-mm-) thick, cleanable panel filters.

OR

Disposable Filters: 1-inch- (25-mm-) **OR** 2-inch- (50-mm-), **as directed**, thick, glass-fiber, flat **OR** pleated, **as directed**, panel filters.

OR

Extended-Surface, Disposable Panel Filters: 2-inch- (50-mm-) **OR** 4-inch- (100-mm-), **as directed**, thick, dry, filters with fibrous media material formed into deep-V-shaped pleats and held by self-supporting wire grid holding frames, with nonflammable cardboard media and media-grid frame.

a. Efficiency: ASHRAE 52.2 MERV rating of 6 or higher.

2. Air-Pressure Switch (for units larger than 15 tons (50 kW)): Indicates dirty filters.

K. Accessories:

1. Manual outdoor-air damper.

2. Motorized outdoor-air damper.

3. Air-side economizer.

4. Water-side economizer.

5. Hot-gas bypass.

6. Air Pressure Switch: Indicates when differential pressure exceeds set point representing dirty filters.

L. Single-Point Electrical Characteristics:

1. Volts: 120 **OR** 208 **OR** 230 **OR** 460, **as directed**.

2. Phase: Single **OR** Three, **as directed**.

3. Hertz: 60.

4. Full-Load Amperes: **as directed**.

5. Minimum Circuit Ampacity: **as directed**.

6. Maximum Overcurrent Protection: **as directed**.

1.3 EXECUTION

A. Installation

1. Install units level and plumb.

2. Anchor units to structure.

3. Install seismic restraints.

4. Install static-pressure probe (for units larger than 15 tons (50 kW) equipped with inlet vanes).

5. Install water-cooled units with thermometer and pressure gage at the water supply and return connection.
6. Install vibration spring isolators under base of unit, with minimum static deflection of 1 inch (25 mm). Refer to Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".

B. Connections

1. Piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties.
 - a. Water Coil Connections: Comply with requirements in Division 23 Section "Hydronic Piping". Connect to supply and return coil with shutoff-duty valve and union or flange on the supply connection and with throttling-duty valve and union or flange on the return connection.
 - b. Water-Cooled Condenser Connections: Comply with requirements in Division 23 Section "Hydronic Piping". Connect to supply and return with shutoff-duty valve and union or flange on the supply connection and with throttling-duty valve and union or flange on the return connection.
2. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
3. Duct Connections: Duct installation requirements are specified in Division 23 Section "Metal Ducts". Drawings indicate the general arrangement of ducts. Connect supply and return, **as directed**, ducts to self-contained air-conditioners with flexible duct connectors. Flexible duct connectors are specified in Division 23 Section "Air Duct Accessories".

C. Field Quality Control

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
2. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
3. Tests and Inspections:
 - a. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
4. Units will be considered defective if they do not pass tests and inspections.
5. Prepare test and inspection reports.

D. Startup Service

1. Engage a factory-authorized service representative to perform **OR** perform startup service, **as directed**.

E. Demonstration

1. Engage a factory-authorized service representative to train **OR train** the Owner's maintenance personnel, **as directed** to adjust, operate, and maintain units.

END OF SECTION 23 74 13 00b

SECTION 23 74 23 00 - DIRECT-FIRED, MAKEUP AIR UNITS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for direct-fired H&V units. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes direct-fired H&V units with an evaporative cooling package, **as directed**.

C. Submittals

1. Product Data: Include rated capacities, furnished specialties, and accessories.
2. LEED Submittal:
 - a. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
3. Shop Drawings:
 - a. Mounting Details: For securing and flashing roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
 - b. Wiring Diagrams: Power, signal, and control wiring.
4. Operation and maintenance data.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Comply with NFPA 70.
3. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
4. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.2 PRODUCTS**A. Packaged Units**

1. Factory-assembled, prewired, self-contained unit consisting of cabinet, supply fan, controls, filters, **as directed**, evaporative cooling package, **as directed**, and direct-fired gas furnace to be installed outside **OR** inside, **as directed**, the building.

B. Cabinet

1. Cabinet: Single-wall **OR** Double-wall, **as directed**, galvanized-steel panels, formed to ensure rigidity and supported by galvanized-steel channels or structural channel supports with lifting lugs. Cabinet shall be fully weatherized for outside installation, **as directed**.
2. Access Panels: Lift-out **OR** Piano hinged with cam-lock fasteners, **as directed**, for furnace and fan motor assemblies on both sides of unit.
3. Internal Insulation: Fibrous-glass duct lining, comply with ASTM C 1071, Type II, applied on complete unit **OR** furnace and fan sections only, **as directed**.
 - a. Thickness: 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**.
 - b. Insulation Adhesive: Comply with ASTM C 916, Type I.



- c. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment to casing without damaging liner when applied as recommended by manufacturer and without causing air leakage.
 - 4. Finish: Heat-resistant, baked enamel.
 - 5. Discharge: Horizontal **OR** Vertical, **as directed**, -pattern, galvanized-steel assembly with diffusers incorporating individually adjustable vanes.
 - 6. Roof Curb: Full-perimeter curb of sheet metal, minimum 16 inches (400 mm) high, with wood nailer, neoprene sealing strip, and welded Z-bar flashing.
 - 7. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- C. Supply-Air Fan
- 1. Fan Type: Centrifugal, rated according to AMCA 210; statically and dynamically balanced, galvanized steel; mounted on solid-steel shaft with heavy-duty, self-aligning, permanently lubricated ball bearings **OR** pillow-block bearings rated for L50 or 200,000 hours with external grease fittings, **as directed**.
 - 2. Motor: Open dripproof **OR** Totally enclosed, **as directed**, single **OR** two, **as directed**, -speed motor.
 - 3. Drive: V-belt drive with matching fan pulley and adjustable motor sheaves and belt assembly.
 - 4. Mounting: Fan wheel, motor, and drives shall be mounted in fan casing with restrained, **as directed**, elastomeric **OR** spring, **as directed**, isolators.
- D. Outdoor-Air Intake
- 1. Outdoor-Air Hood: Galvanized steel with rain baffles, bird screen complying with ASHRAE 62.1, **as directed**, and finish to match cabinet; and sized to supply maximum 100 percent outdoor air.
- E. Air Filters
- 1. Comply with NFPA 90A.
 - 2. Cleanable Filters: 1-inch- (25-mm-) **OR** 2-inch-0 (50-mm-), **as directed**, thick, cleanable metal mesh.
 - 3. Disposable Panel Filters: 1-inch- (25-mm-) **OR** 2-inch- (50-mm-), **as directed**, thick, factory-fabricated, flat-panel-type, disposable air filters with holding frames, with a minimum efficiency report value of 6 according to ASHRAE 52.2 and 90 percent average arrestance according to ASHRAE 52.1, **as directed**.
 - a. Media: Interlaced glass **OR** polyester, **as directed**, fibers.
 - b. Frame: Galvanized steel.
- F. Dampers
- 1. Outdoor-Air and Return-Air, **as directed**, Damper: Galvanized-steel, opposed-blade dampers with vinyl blade seals and stainless-steel jamb seals, having a maximum leakage of 10 cfm/sq. ft. (51 L/s per sq. m) of damper area, at differential pressure of 2-inch wg (448 Pa).
 - 2. Fan-Discharge Dampers: Galvanized-steel, opposed-blade damper.
 - 3. Balancing/Bypass Dampers: Galvanized-steel, opposed-blade damper.
 - 4. Damper Operator: Direct coupled, electronic with spring return or fully modulating as required by the control sequence.
- G. Direct-Fired Gas Furnace
- 1. Description: Factory assembled, piped, and wired; and complying with ANSI Z83.4, "Direct Gas-Fired Make-Up Air Heaters"; ANSI Z83.18, "Direct Gas-Fired Industrial Air Heaters"; and NFPA 54, "National Fuel Gas Code."
 - 2. Inside Unit External Housing: Steel cabinet with integral support inserts.
 - 3. Outside Unit External Housing: Weatherproof steel cabinet with integral support inserts.
 - a. External Casing and Cabinet Finish: Baked enamel **OR** Powder coating, **as directed**, over corrosion-resistant-treated surface in color to match fan section.
 - 4. Burners: Cast-iron burner with stainless-steel mixing plates.

- a. Control Valve: Single stage **OR** Two stage **OR** Modulating with minimum turndown ratio of 25:1 or as otherwise directed, **as directed**.
 - b. Fuel: Natural **OR** Propane, **as directed**, gas.
 - c. Pilot: Electrically ignited by hot-surface ceramic igniter.
 5. Safety Controls:
 - a. Gas Manifold: Safety switches and controls to comply with ANSI standards **OR** FMG **OR** IRI, **as directed**.
 - b. Purge-Period Timer: Automatically delays burner ignition and bypasses low-limit control.
 - c. Airflow Proving Switch: Dual pressure switch senses correct airflow before energizing pilot and requires airflow to be maintained within minimum and maximum pressure settings across burner.
 - d. Manual-Reset, High-Limit Control Device: Stops burner and closes main gas valve if high-limit temperature is exceeded.
 - e. Gas Train: Redundant, automatic main gas valves, electric pilot valve, hydraulic **OR** electronic, **as directed**, modulating temperature control valve, main and pilot gas regulators, main and pilot manual shutoff valves, main and pilot pressure taps, and high-low gas pressure switches, **as directed**, to comply with IRI requirements **OR** to comply with FMG requirements, **as directed**.
 - f. Safety Lockout Switch: Locks out ignition sequence if burner fails to light after three tries. Controls are reset manually by turning the unit off and on.
 - g. Control Transformer: Integrally mounted 24-V ac.
- H. Evaporative Cooling Package
 1. Cabinet: Single-wall **OR** Double-wall, **as directed**, galvanized- or aluminized-steel panels lined with ABS polymer, **as directed**, formed to ensure rigidity and supported by galvanized-steel channels or structural channel supports with lifting lugs and having a stainless-steel reservoir with overflow and drain with full-port, brass-fitted ball valve. Cabinet shall be fully weatherized for outside installation, **as directed**.
 - a. External Casing and Cabinet Finish: Baked enamel **OR** Powder coating, **as directed**, over corrosion-resistant-treated surface in color to match fan section.
 2. Media: UL 900, Class 2, 6-inch- (150-mm-) **OR** 8-inch- (200-mm-) **OR** 12-inch- (300-mm-), **as directed**, thick cellulose **OR** glass-fiber, **as directed**, media with rigidizing agents, fungicides, and wetting agents. Minimum 90 percent contact factor.
 - a. Moisture elimination pad.
 3. Water-Circulation System: Submersible centrifugal sump pump with inlet strainer, brass balancing valve located in pump discharge, and thermally protected motor; water distribution troughs or piping at top of media pads; and float-operated, makeup water and bleed-off valves.
 - a. Automatic Fill and Drain Kit: Water supply and drain, solenoid valves for initial sump fill and for draining sump.
 4. Water-Saver System: Timer, solenoid valve, and water distribution piping to apply the water supply to the media.
 5. Comply with applicable requirements in ASHRAE 62.1.
- I. Controls
 1. Factory-wired, fuse-protected control transformer, connection for power supply and field-wired unit to remote control panel.
 2. Control Panel: Surface-mounted **OR** Recessed, with trim ring, **as directed**, remote panel, with engraved plastic cover, and the following lights and switches:
 - a. On-off **OR** On-off-auto, **as directed**, switch.
 - b. Summer-winter **OR** Heat-off-cool, **as directed**, switch. Automatic changeover, **as directed**.
 - c. Supply-fan operation indicating light.
 - d. Heating operation indicating light.
 - e. Damper position potentiometer.
 - f. Thermostat.
 - g. Cooling operation indicating light.

- h. Dirty-filter indicating light operated by unit-mounted differential pressure switch.
 - i. Safety-lockout indicating light.
 - 3. Refer to Division 23 Section "Instrumentation And Control For Hvac" for control equipment and sequence of operation.
 - 4. Control Devices:
 - a. Remote Thermostat: Adjustable room thermostat with temperature readout.
 - b. Remote Setback Thermostat: Adjustable room thermostat without temperature readout.
 - c. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
 - d. Fire-Protection Thermostats: Fixed or adjustable settings to operate at not less than 75 deg F (24 deg C) above normal maximum operating temperature.
 - e. Timers: Seven-day, programming-switch timer with synchronous-timing motor and seven-day dial; continuously charged, nickel-cadmium-battery-driven, eight-hour, power-failure carryover; multiple-switch trippers; minimum of two and maximum of eight signals per day with two normally open and two normally closed output contacts.
OR
Timers: Solid-state, programmable time control with 4 separate programs; 24-hour battery carryover; individual on-off-auto switches for each program; 365-day calendar with 20 programmable holidays; choice of fail-safe operation for each program; and system fault alarm.
 - f. Ionization-Type Smoke Detectors: 24-V dc, nominal; self-restoring; plug-in arrangement; integral visual-indicating light; sensitivity that can be tested and adjusted in place after installation; integral addressable module; remote controllability; responsive to both visible and invisible products of combustion; self-compensating for changes in environmental conditions.
 - g. Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed. Equip with filtered circuit to eliminate radio interference.
 - 5. Fan Control: Interlock fan to start with exhaust fan(s). See Division 23 Section(s) "Axial Hvac Fans" OR "Centrifugal Hvac Fans" OR "Hvac Power Ventilators" OR "Sequence Of Operations For Hvac Controls", **as directed**, for exhaust fan controls.
OR
Fan Control: Timer starts and stops direct-fired H&V unit and exhaust fan(s).
 - a. Fan-Discharge Thermostat: Stops fan when discharge-air temperature is less than 40 deg F (4 deg C).
 - b. Smoke detectors, located in supply and return, **as directed**, air, shall stop fans when the presence of smoke is detected.
 - c. Controls two **OR** variable, **as directed**, -speed motor controller using speed switch on control panel **OR** variable-speed potentiometer on control panel **OR** static-pressure transmitter, **as directed**.
 - 6. Outdoor-Air Damper Control, 100 Percent Outdoor-Air Units: Outdoor-air damper shall open when supply fan starts, and close when fan stops.
OR
Outdoor-Air and Fan-Discharge Damper Control, 100 Percent Outdoor-Air Units:
 - a. Outdoor-air damper shall open when supply fan starts, and close when fan stops.
 - b. Fan-discharge dampers shall operate to vary the amount of outdoor air to match exhaust-fan operation.
OR
Outdoor-Air and Balancing/Bypass Damper Control, Variable Outdoor-Air Units:
 - a. Outdoor-air damper shall open when supply fan starts, and close when fan stops.
 - b. Balancing/bypass dampers shall modulate to maintain minimum air velocity through burner.
OR
Outdoor-Air, Balancing/Bypass, and Return-Air Damper Control:
 - a. Outdoor-air damper shall open when supply fan starts, and close when fan stops.

- b. Return-air dampers shall modulate in response to potentiometer on control panel **OR** building pressure control, **as directed**.
 - c. Balancing/bypass dampers shall modulate to maintain minimum air velocity through the burner.
- 7. Temperature Control: Operates gas valve to maintain supply-air or room temperature.
 - a. Operates gas valve to maintain discharge-air temperature with factory-mounted sensor in fan outlet.
OR
Operates gas valve to maintain space temperature with wall-mounting, field-wired sensor with temperature adjustment, **as directed**, and unit-mounted control adjustment **OR** and adjustment on remote control panel, **as directed**.
 - b. Timer shall select remote setback thermostat to maintain space temperature at 50 deg F (10 deg C).
- 8. Evaporative Cooling Controls:
 - a. Start and stop water-circulation-system sump pump to maintain space temperature.
 - b. Automatic Fill Control: A switch in the unit control panel shall close sump drain valve and open makeup water valve.
 - c. Automatic Drain Control: Opens sump drain valve and closes makeup water valve from a switch in the unit control panel **OR** when an outside thermostat senses 40 deg F (4 deg C) or less, **as directed**.
 - d. Water-Saver System: Remote thermostat shall open water-supply valve to maintain dry-bulb temperature in space. Timer shall activate thermostat circuit.
- 9. DDC: Stand-alone control module for link between unit controls and DDC system. Control module shall be compatible with temperature-control system specified in Division 23 Section "Instrumentation And Control For Hvac".
 - a. Provide start and stop interface relay, and relay to notify DDC system alarm condition.
 - b. Provide hardware interface or additional sensors as follows:
 - 1) Room temperature.
 - 2) Discharge-air temperature.
 - 3) Furnace operating.

J. Motors

- 1. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".

1.3 EXECUTION

A. Installation

- 1. Install gas-fired units according to NFPA 54, "National Fuel Gas Code."
- 2. Install roof curb on roof structure, according to ARI Guideline B **OR** NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts", **as directed**. Install and secure direct-fired H&V units on curbs, and coordinate roof penetrations and flashing with roof construction.
OR
Install restrained vibration isolation roof-curb rails on roof structure according to ARI Guideline B **OR** NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts", **as directed**. Install and secure direct-fired H&V units on rails, and coordinate roof penetrations and flashing with roof construction. Restrained isolation roof-curb rails are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
- 3. Install suspended units from spring hangers with minimum 1-inch (25-mm) static deflection; refer to Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
OR



Install floor-mounted units on restrained, **as directed**, spring isolators with minimum 1-inch (25-mm) static deflection; refer to Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".

4. Install controls and equipment shipped by manufacturer for field installation with direct-fired H&V units.

B. Connections

1. Piping Connections: Drawings indicate general arrangement of piping, fittings, and specialties. Install piping adjacent to machine to allow service and maintenance.
 - a. Gas Piping: Comply with requirements in Division 23 Section(s) "Facility Natural-gas Piping" OR "Facility Liquefied-petroleum Gas Piping", **as directed**. Connect gas piping with shutoff valve and union and with sufficient clearance for burner removal and service. Provide AGA-approved flexible connectors.
 - b. Makeup Water: Comply with requirements in Division 22 Section "Domestic Water Piping" for valves and accessories on piping connections to evaporative cooling units.
 - c. Drain: Comply with requirements in Division 22 Section "Sanitary Waste And Vent Piping" for traps and accessories on piping connections to evaporative cooling units.
2. Duct Connections: Duct installation requirements are specified in Division 23 Section "Metal Ducts". Drawings indicate the general arrangement of ducts. Connect supply and return, **as directed**, ducts to direct-fired H&V units with flexible duct connectors. Flexible duct connectors are specified in Division 23 Section "Air Duct Accessories".
3. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
4. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

C. Startup Service

1. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
 - a. Inspect for visible damage to furnace combustion chamber.
 - b. Inspect casing insulation for integrity, moisture content, and adhesion.
 - c. Verify that clearances have been provided for servicing.
 - d. Verify that controls are connected and operable.
 - e. Verify that filters are installed.
 - f. Purge gas line.
 - g. Inspect and adjust vibration isolators and seismic restraints, **as directed**.
 - h. Verify bearing lubrication.
 - i. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
 - j. Adjust fan belts to proper alignment and tension.
 - k. Start unit according to manufacturer's written instructions.
 - l. Complete startup sheets and attach copy with Contractor's startup report.
 - m. Inspect and record performance of interlocks and protective devices; verify sequences.
 - n. Operate unit for run-in period recommended by manufacturer.
 - o. Perform the following operations for both minimum and maximum firing and adjust burner for peak efficiency:
 - 1) Measure gas pressure on manifold.
 - 2) Measure combustion-air temperature at inlet to combustion chamber.
 - 3) Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
 - p. Calibrate thermostats.
 - q. Adjust and inspect high-temperature limits.
 - r. Inspect dampers, if any, for proper stroke and interlock with return-air dampers.
 - s. Start evaporative cooler system and measure and record the following:
 - 1) Leaving-air, dry- and wet-bulb temperatures.
 - 2) Entering-air, dry- and wet-bulb temperatures.

- t. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
 - u. Measure and record airflow. Plot fan volumes on fan curve.
 - v. Verify operation of remote panel, including pilot-operation and failure modes. Inspect the following:
 - 1) High-limit heat.
 - 2) Alarms.
 - w. After startup and performance testing, change filters, verify bearing lubrication, and adjust belt tension.
- 2. Remove and replace malfunctioning components that do not pass tests and inspections and retest as specified above.
 - 3. Prepare written report of the results of startup services.
- D. Adjusting
- 1. Adjust initial temperature set points.
 - 2. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
 - 3. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
- E. Demonstration
- 1. Train Owner's maintenance personnel to adjust, operate, and maintain direct-fired H&V units.

END OF SECTION 23 74 23 00



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SECTION 23 74 23 00a - INDIRECT-FIRED, PACKAGED H&V UNITS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for indirect-fired, H&V units. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes indirect-fired H&V units with the following accessories:
 - a. Gas or Oil furnace.
 - b. Evaporative cooling package.

C. Submittals

1. Product Data: Include rated capacities, furnished specialties, and accessories.
2. Shop Drawings:
 - a. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - b. Mounting Details: For securing and flashing roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
 - c. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.
 - d. Wiring Diagrams: Power, signal, and control wiring.
3. Operation and maintenance data.
4. Warranty: Special warranty specified in this Section.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Comply with NFPA 70.

E. Warranty

1. Manufacturer's standard form in which manufacturer agrees to replace heat exchangers of indirect-fired H&V units that fail in materials or workmanship within five years **OR** 10 years, **as directed**, from date of Final Completion.

1.2 PRODUCTS**A. Packaged Units**

1. Factory-assembled, prewired, self-contained unit consisting of cabinet, supply fan, controls, filters, evaporative cooling package, **as directed**, and indirect-fired gas **OR** oil, **as directed**, furnace to be installed outside **OR** inside, **as directed**, the building.

B. Cabinet

1. Cabinet: Single-wall **OR** Double-wall, **as directed**, galvanized-steel panels, formed to ensure rigidity and supported by galvanized-steel channels or structural channel supports with lifting lugs. Cabinet shall be fully weatherized for outside installation, **as directed**.
2. Access Panels: Lift-out **OR** Piano hinged with cam-lock fasteners, **as directed**, for furnace and fan motor assemblies on both sides of unit.



3. Internal Insulation: Fibrous-glass duct lining, comply with ASTM C 1071, Type II, applied on complete unit for outside unit or furnace and fan sections only for inside unit.
 - a. Thickness: 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**.
 - b. Insulation Adhesive: Comply with ASTM C 916, Type I.
 - c. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment to casing without damaging liner when applied as recommended by manufacturer and without causing air leakage.
 4. Finish: Heat-resistant, baked enamel.
 5. Discharge: Horizontal-pattern **OR** Vertical-pattern, **as directed**, galvanized-steel assembly with diffusers incorporating individually adjustable vanes.
 6. Roof Curb: Full-perimeter curb of sheet metal, minimum 16 inches (400 mm), unless directed otherwise, high, with wood nailer, neoprene sealing strip, and welded Z-bar flashing.
- C. Supply-Air Fan
1. Fan Type: Centrifugal, rated according to AMCA 210; statically and dynamically balanced, galvanized steel; mounted on solid-steel shaft with heavy-duty, self-aligning, permanently lubricated ball bearings **OR** pillow-block bearings rated for L50 or 200,000 hours with external grease fittings, **as directed**.
 2. Motor: Open dripproof **OR** Totally enclosed, **as directed**, single-speed motor.
 3. Drive: V-belt drive with matching fan pulley and adjustable motor sheaves and belt assembly.
 4. Mounting: Fan wheel, motor, and drives shall be mounted in fan casing with restrained (for seismic areas), elastomeric **OR** spring, **as directed**, isolators.
- D. Outdoor-Air Intake
1. Outdoor-Air Hood: Galvanized steel with rain baffles, bird screen, and finish to match cabinet; and sized to supply maximum 30 percent **OR** 100 percent, **as directed**, outdoor air.
- E. Air Filters
1. Comply with NFPA 90A.
 2. Cleanable Filters: 1-inch- (25-mm-) **OR** 2-inch- (50-mm-), **as directed**, thick, cleanable metal mesh.
 3. Disposable Panel Filters: 1-inch- (25-mm-) **OR** 2-inch- (50-mm-), **as directed**, thick, factory-fabricated, flat-panel-type, disposable air filters with holding frames, with a minimum efficiency report value of 6 according to ASHRAE 52.2 and 90 percent average arrestance according to ASHRAE 52.1.
 - a. Media: Interlaced glass **OR** polyester, **as directed**, fibers.
 - b. Frame: Galvanized steel.
- F. Dampers
1. Outdoor-Air and Return-Air, **as directed**, Damper: Galvanized-steel, opposed-blade dampers with vinyl blade seals and stainless-steel jamb seals, having a maximum leakage of 10 cfm/sq. ft. (51 L/s per sq. m) of damper area, at differential pressure of 2-inch wg (448 Pa).
 2. Damper Operator: Direct coupled, electronic with spring return or fully modulating as required by the control sequence.
- G. Indirect-Fired Gas Furnace
1. Description: Factory assembled, piped, and wired; and complying with ANSI Z21.47, "Gas-Fired Central Furnaces," and NFPA 54, "National Fuel Gas Code."
 - a. AGA Approval: Designed and certified by and bearing label of AGA.
 - b. Burners: Aluminized steel with stainless-steel inserts **OR** Stainless steel, **as directed**.
 - 1) Gas Control Valve: Single stage **OR** Two stage **OR** Modulating, **as directed**.
 - 2) Fuel: Natural **OR** Propane, **as directed**, gas.
 - 3) Minimum Thermal Efficiency: 80 percent.
 - 4) Ignition: Electronically controlled electric spark with flame sensor.
 - 5) High-Altitude Model **OR** Kit, **as directed**: For Project elevation above sea level.

2. Venting: Gravity vented.
3. Power Vent: Integral, motorized centrifugal fan interlocked with gas valve.
4. Combustion-Air Intake: Separate combustion-air intake and vent terminal assembly.
5. Inside Unit External Housing: Steel cabinet with integral support inserts and removable bottom arranged to serve as drain pan.
6. Outside Unit External Housing: Weatherproof steel cabinet with integral support inserts and removable bottom arranged to serve as drain pan.
 - a. External Casing and Cabinet Finish: Baked enamel **OR** Powder coating, **as directed**, over corrosion-resistant-treated surface in color to match fan section.
7. Internal Casing: Aluminized steel, arranged to contain airflow, with duct flanges at inlet and outlet.
8. Heat Exchanger: Aluminized **OR** Stainless steel, **as directed**.
9. Heat-Exchanger Drain Pan: Stainless steel.
10. Safety Controls:
 - a. Vent Flow Verification: Differential pressure switch to verify open vent **OR** Flame rollout switch, **as directed**.
 - b. Control Transformer: 24-V ac.
 - c. High Limit: Thermal switch or fuse to stop burner.
 - d. Gas Train: Regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, hydraulic-modulating **OR** electronic-modulating, **as directed**, temperature control valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.
 - e. Purge-period timer shall automatically delay burner ignition and bypass low-limit control.
 - f. Gas Manifold: Safety switches and controls to comply with ANSI standards and FMG **OR** IRI, **as directed**.
 - g. Airflow Proving Switch: Differential pressure switch senses correct airflow before energizing pilot.
 - h. Automatic-Reset, High-Limit Control Device: Stops burner and closes main gas valve if high-limit temperature is exceeded.
 - i. Safety Lockout Switch: Locks out ignition sequence if burner fails to light after three tries. Controls are reset manually by turning the unit off and on.

H. Oil-Fired Furnace

1. Description: Factory assembled, piped, and wired; and complying with UL 727, "Oil-Fired Central Furnaces."
2. Inside Unit External Housing: Steel cabinet with integral support inserts and removable bottom arranged to serve as a drain pan.
3. Outside Unit External Housing: Weatherproof steel cabinet with integral support inserts and removable bottom arranged to serve as drain pan.
 - a. External Casing and Cabinet Finish: Baked enamel **OR** Powder coating, **as directed**, over corrosion-resistant-treated surface in color to match fan section.
4. Internal Casing: Aluminized steel, arranged to contain airflow, with duct flanges at inlet and outlet.
5. Heat Exchanger: Welded, stainless steel, unless directed otherwise, with flame observation port, carbon dioxide sample port, and access panels for clean-out and service.
6. Burners: Flame-retention, pressure-atomizing, forced-draft, gun type; with integral fuel pump and electronic spark ignition.
 - a. Fuel: No. 2, unless directed otherwise, fuel oil.
 - b. Minimum Thermal Efficiency: 80 percent **OR** 81 percent, **as directed**.
 - c. Ignition: Electronically controlled electric spark with flame sensor.
7. Safety Controls:
 - a. Factory piped and wired to electrical junction box mounted on unit.
 - b. Oil-pressure switch.
 - c. Control Transformer: Integrally mounted 24-V ac.
 - d. Cad-cell safety system.
 - e. Manual reset flame safety.
8. Accessories:



- a. Factory mounted and wired to electrical junction box on unit.
- b. Oil Booster Pump: 30-gph (108-L/h) **OR** 70-gph (252-L/h), **as directed**, capacity; motor and 2-stage fuel unit with pressure-regulating valve and strainer.
- c. Oil-pressure relief valve.
- d. Outdoor Combustion-Air Adapter: Sealed to housing and fitted with quick access cover, or door and fitting for terminating outdoor-air duct.

I. Evaporative Cooling Package

- 1. Cabinet: Single-wall **OR** Double-wall, **as directed**, galvanized- or aluminized-steel panels lined with ABS polymer, as required, formed to ensure rigidity and supported by galvanized-steel channels or structural channel supports with lifting lugs and having a stainless-steel reservoir with overflow and drain with full-port, brass-fitted ball valve. Cabinet shall be fully weatherized for outside installation, **as directed**.
 - a. External Casing and Cabinet Finish: Baked enamel, **unless directed otherwise to be** Powder coating, over corrosion-resistant-treated surface in color to match fan section.
- 2. Media: UL 900, Class 2, 6-inch- (150-mm-) **OR** 8-inch- (200-mm-) **OR** 12-inch- (300-mm-), **as directed**, thick cellulose **OR** glass-fiber, **as directed**, media with rigidizing agents, fungicides, and wetting agents. Minimum 90 percent contact factor.
 - a. Moisture elimination pad.
- 3. Water-Circulation System: Submersible centrifugal sump pump with inlet strainer, brass balancing valve located in pump discharge, and thermally protected motor; water distribution troughs or piping at top of media pads; and float-operated, makeup water and bleed-off valves.
 - a. Automatic Fill and Drain Kit: Water supply and drain, solenoid valves for initial sump fill and for draining sump.
- 4. Water-Saver System: Timer, solenoid valve, and water distribution piping to apply the water supply to the media.

J. Controls

- 1. Factory-wired, fuse-protected control transformer, connection for power supply and field-wired unit to remote control panel.
- 2. Control Panel: Surface-mounted **OR** Recessed, **as directed**, with trim ring, remote panel, with engraved plastic cover, and the following lights and switches:
 - a. On-off **OR** On-off-auto, **as directed**, fan switch.
 - b. Summer-winter **OR** Heat-off-cool, **as directed**, switch. Automatic changeover, **as directed**.
 - c. Supply-fan operation indicating light.
 - d. Heating operation indicating light.
 - e. Damper position potentiometer.
 - f. Thermostat.
 - g. Cooling operation indicating light.
 - h. Dirty-filter indicating light operated by unit-mounted differential pressure switch.
 - i. Safety-lockout indicating light.
- 3. Control Devices:
 - a. Remote Thermostat: Adjustable room thermostat with temperature readout.
 - b. Remote Setback Thermostat: Adjustable room thermostat without temperature readout.
 - c. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
 - d. Fire-Protection Thermostats: Fixed or adjustable settings to operate at not less than 75 deg F (24 deg C) above normal maximum operating temperature.
 - e. Timers: Seven-day, programming-switch timer with synchronous-timing motor and seven-day dial; continuously charged, nickel-cadmium-battery-driven, eight-hour, power-failure carryover; multiple-switch trippers; minimum of two and maximum of eight signals per day with two normally open and two normally closed output contacts.**OR**

- Timers: Solid-state, programmable time control with 4 separate programs; 24-hour battery carryover; individual on-off-auto switches for each program; 365-day calendar with 20 programmable holidays; choice of fail-safe operation for each program; and system fault alarm.
- f. Ionization-Type Smoke Detectors: 24-V dc, nominal; self-restoring; plug-in arrangement; integral visual-indicating light; sensitivity that can be tested and adjusted in place after installation; integral addressable module; remote controllability; responsive to both visible and invisible products of combustion; self-compensating for changes in environmental conditions.
4. Fan Control: Interlock fan to start with exhaust fan(s). See Division 23 Section(s) "Axial Hvac Fans" OR "Centrifugal Hvac Fans" OR "Hvac Power Ventilators" OR "Sequence Of Operations For Hvac Controls", **as directed**, for exhaust fan controls.
5. Fan Control: Timer starts and stops direct-fired H&V unit and exhaust fan(s).
- a. Fan-Discharge Thermostat (for units with evaporative cooling package): Stops fan when discharge-air temperature is less than 40 deg F (4 deg C).
- b. Smoke detectors, located in supply and return, **as directed**, air, shall stop fans when the presence of smoke is detected.
6. Outdoor-Air Damper Control, 100 Percent Outdoor-Air Units: Outdoor-air damper shall open when supply fan starts, and close when fan stops.
7. Mixed Outdoor- and Return-Air Damper Control: When fan is running, outdoor- and return-air dampers shall modulate to supply minimum outdoor air as follows:
- a. Minimum 30 percent outdoor air.
- b. Outdoor-air quantity adjusted by potentiometer on control panel.
- c. Outdoor-air quantity to maintain minimum building static pressure.
8. Temperature Control: Operates gas valve to maintain supply-air temperature.
- a. Operates gas valve to maintain discharge-air temperature with factory-mounted sensor in blower outlet.
- b. Operates gas valve to maintain space temperature with wall-mounting, field-wired sensor with temperature adjustment, **as directed**, and unit-mounted control adjustment, **OR** and adjustment on remote-control panel, **as directed**.
- c. Timer shall select remote setback thermostat to maintain space temperature at 50 deg F (10 deg C).
- d. Furnace Control: Two or four steps of control using one or two furnace sections in series.
OR
Furnace Control: 20 to 100 percent modulation of the firing rate. 10 to 100 percent with dual furnace units.
9. Evaporative Cooling Controls:
- a. Start and stop water-circulation-system sump pump to maintain space temperature.
- b. Automatic Fill Control: A switch in the unit control panel shall close sump drain valve and open makeup water valve.
- c. Automatic Drain Control: Opens sump drain valve and closes makeup water valve from a switch in the unit control panel **OR** when an outside thermostat senses 40 deg F (4 deg C) or less, **as directed**.
- d. Water-Saver System: Remote thermostat shall open water-supply valve to maintain dry-bulb temperature in space. Timer shall activate thermostat circuit.
10. DDC: Stand-alone control module for link between unit controls and DDC system. Control module shall be compatible with temperature-control system specified in Division 23 Section "Instrumentation And Control For Hvac".
- a. Provide start and stop interface relay, and relay to notify DDC system alarm condition.
- b. Provide hardware interface or additional sensors as follows:
- 1) Room temperature.
- 2) Discharge-air temperature.
- 3) Furnace operating.

K. Motors

1. Comply with requirements are specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".

1.3 EXECUTION

A. Installation

1. Install gas-fired units according to NFPA 54, "National Fuel Gas Code."
2. Install oil-fired duct heaters and associated fuel and vent piping according to NFPA 31 and applicable local codes and regulations.
3. Install roof curb on roof structure, according to ARI Guideline B **OR** NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts," **as directed**. Install and secure direct-fired H&V units on curbs, and coordinate roof penetrations and flashing with roof construction.
OR
Install restrained vibration isolation roof-curb rails on roof structure according to ARI Guideline B **OR** NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts," **as directed**. Install and secure indirect-fired H&V units on rails, and coordinate roof penetrations and flashing with roof construction. Restrained isolation roof-curb rails are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
4. Install suspended units from spring hangers with minimum 1-inch (25-mm) static deflection; refer to Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
5. Install floor-mounted units on restrained, **as directed**, spring isolators with minimum 1-inch (25-mm) static deflection; refer to Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
6. Install controls and equipment shipped by manufacturer for field installation with indirect-fired H&V units.
7. Piping Connections: Drawings indicate general arrangement of piping, fittings, and specialties. Install piping adjacent to machine to allow service and maintenance.
 - a. Gas Piping: Comply with requirements in Division 23 Section(s) "Facility Natural-gas Piping" **OR** "Facility Liquefied-petroleum Gas Piping", **as directed**. Connect gas piping with shutoff valve and union and with sufficient clearance for burner removal and service. Provide AGA-approved flexible connectors.
 - b. Fuel Oil Piping: Comply with requirements in Division 23 Section "Facility Fuel-oil Piping". Connect to fuel oil supply and return piping with shutoff valve and union at each connection.
 - c. Makeup Water: Comply with requirements in Division 22 Section "Domestic Water Piping" for valves and accessories on piping connections to evaporative cooling units.
 - d. Drain: Comply with requirements in Division 22 Section "Sanitary Waste And Vent Piping" for traps and accessories on piping connections to evaporative cooling units.
8. Duct Connections: Duct installation requirements are specified in Division 23 Section "Metal Ducts". Drawings indicate the general arrangement of ducts. Connect supply and return, **as directed**, ducts to indirect-fired H&V units with flexible duct connectors. Flexible duct connectors are specified in Division 23 Section "Air Duct Accessories".
9. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
10. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

END OF SECTION 23 74 23 00a



SECTION 23 74 70 00 - CSF ELECTRIC HEATERS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Electric Heating is part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.23 74 70 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Electric baseboard or pedestal radiation.
 - 2. Electric wall heaters.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Indicate unit operation, characteristics, wiring diagrams, power requirements, configuration, and finish for each type of unit specified.
 - 2. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.

1.3 QUALITY ASSURANCE

- A. Assembly: UL listed and labeled, with thermal box and cover, and built-in controls.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project. List minimum three manufacturers.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 - 1. Berko, Bennettsville, SC (800) 452-4179.
 - 2. Q-Mark, Bennettsville, SC (843) 479-4006.
 - 3. Chromalox, Pittsburgh, PA (412) 967-3800.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 BASEBOARD OR PEDESTAL RADIATION

- A. Baseboard or pedestal radiation heater with aluminum finned tube element, integral thermostat, housing constructed of baked enamel on steel, and automatic thermal cutouts. Finish to be gray baked enamel . Voltage and kW rating indicated on Drawings.

2.3 WALL HEATERS

- A. Wall mounted electric heater with cast aluminum finned heating grid, with a matched fan and motor and automatic thermal cutout; Integral thermostat and On-Off safety switch. Voltage and kW rating indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install units in accordance with manufacturer's published instructions.

- B. Install equipment exposed to finished areas after walls and ceiling are finished and painted. Avoid damage.
- C. Protection: Provide finished cabinet units with protective covers during balance of construction.
- D. Install electrical wiring in accordance with manufacturer's submittals and Division 26.
- E. Baseboard: Surface mount at locations indicated on Drawings.
- F. Wall Heaters: Recess wall mount at locations indicated on Drawings.

USPS CSF Specifications issued: 10/1/2013
Last revised: 5/11/11

END OF SECTION



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SECTION 23 76 13 00 - MECHANICAL DEHUMIDIFICATION UNITS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for mechanical dehumidification units. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes packaged, factory-assembled and -tested, refrigerant-type, mechanical dehumidification units designed for outdoor and indoor installation.

C. Performance Requirements

1. Seismic Performance: Dehumidification units shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

D. Submittals

1. Product Data: For each dehumidification unit indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. LEED Submittals:
 - a. Product Data for Credit EA 4: Documentation required by Credit EA 4 indicating that equipment and refrigerants comply.
 - b. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5, "Systems and Equipment."
3. Shop Drawings: For each dehumidification unit indicated. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
4. Delegated-Design Submittal: For dehumidification units indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
 - b. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
5. Seismic Qualification Certificates: For accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
6. Source quality-control reports.
7. Field quality-control reports.
8. Operation and Maintenance Data: For dehumidification units to include in emergency, operation, and maintenance manuals.
9. Warranty: Sample of special warranty.

- E. Quality Assurance
 - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. ASHRAE Compliance:
 - a. Applicable requirements in ASHRAE 62.1, Section 5, "Systems and Equipment" and Section 7, "Construction and Startup."
 - b. Applicable requirements in ASHRAE 15, "Safety Standard for Refrigeration Systems."
 - 3. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6, "Heating, Ventilating, and Air-Conditioning."
- F. Coordination
 - 1. Coordinate sizes and locations of concrete bases. Cast anchor-bolt inserts into bases.
 - 2. Coordinate installation of roof curbs, equipment supports, and roof penetrations.
- G. Warranty
 - 1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of dehumidification units that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period for Compressors: Manufacturer's standard, but not less than two **OR** five, **as directed**, years from date of Final Completion.
 - b. Warranty Period for Refrigerant Coils: Manufacturer's standard, but not less than five years from date of Final Completion.

1.2 PRODUCTS

- A. Casings
 - 1. Casing: Single-wall **OR** Double-wall, **as directed**, construction with corrosion-protective coating and exterior baked-enamel **OR** powder-coated, **as directed**, finish, stainless-steel fasteners, knockouts for electrical and piping connections, condensate drain connection, and lifting lugs.
 - a. Access: Removable panels **OR** Hinged access doors, **as directed**, with neoprene gaskets.
 - b. Insulation: Minimum 1/2-inch- (13-mm-) thick thermal insulation **OR** 2-inch- (50-mm-) thick, glass-fiber-insulation fill with no metal structure through the insulation, **as directed**.
 - c. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 - 2. Drain Pan and Connection: Plastic **OR** Stainless steel, **as directed**; insulated and complying with ASHRAE 62.1, **as directed**.
- B. Fans
 - 1. Supply Fans: Forward curved **OR** Backward inclined, **as directed**, centrifugal; galvanized steel with baked-enamel **OR** powder-coated, **as directed**, finish; belt driven with adjustable sheaves and self-aligning, grease-lubricated ball bearings with extended grease fittings easily accessible inside the casing of dehumidification unit.
 - 2. Exhaust **OR** Return, **as directed**, Fans: Forward curved **OR** Backward inclined, **as directed**, centrifugal; galvanized steel with baked-enamel **OR** powder-coated, **as directed**, finish; belt driven with adjustable sheaves and self-aligning, grease-lubricated ball bearings with extended grease fittings easily accessible inside the casing of dehumidification unit.
 - 3. Fan Motor: Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a. Enclosure Type: Totally enclosed, fan cooled.
- C. Filters
 - 1. Glass Fiber: Minimum 80 percent arrestance according to ASHRAE 52.1, and MERV 5 according to ASHRAE 52.2.

2. Pleated: Minimum 90 percent arrestance according to ASHRAE 52.1, and MERV 7 according to ASHRAE 52.2.
- D. Refrigeration System
1. Energy Efficiency: Equal to or greater than prescribed by ASHRAE/IESNA 90.1.
 2. Refrigerant Coils: Copper tubes with mechanically bonded aluminum fins; factory fabricated and tested to comply with ASHRAE 33 and ARI 410; with multiple refrigerant circuits, seamless-copper headers with brazed connections, and galvanized **OR** stainless, **as directed**, -steel frame. Coil and fins shall have a polyester coating. Coils shall have a minimum 300-psig (2070-kPa) working-pressure rating and be factory tested to 450 psig (3105 kPa) and to 300 psig (2070 kPa) while underwater.
 3. Compressors: Hermetic, scroll compressors with integral vibration isolators and crankcase heaters that de-energize during compressor operation; with thermal-expansion valves, filter-driers, sight glasses, compressor service valves, and liquid- and suction-line service valves.
 - a. Number of Refrigerant Circuits: Two for compressor capacities more than 7-1/2 tons (26.4 kW).
 - b. Refrigerant: R-22 **OR** R-134a **OR** R-407C **OR** R-410A, **as directed**.
OR
Refrigerant: R-134a, R-407C, or R-410A.
 - c. Capacity Control:
 - 1) Hot-gas bypass valve and piping on one compressor.
 - 2) Cycle compressor.
 - d. Low-Pressure Cutout: Manual reset after three automatic-reset failures.
 - e. High-Pressure Cutout: Manual reset.
 - f. Compressor Motor Overload Protection: Manual reset.
 - g. Antirecycling Timing Device: Prevent compressor restart for five minutes after shutdown.
 - h. Defrost Cycle (for ice rinks): Adjustable timer shuts off supply fan. Compressor cycles until suction line temperature confirms thawed evaporator coil. Timer limits defrost time to 10 minutes.
 4. Energy Recovery Heat Exchanger (Pool Heater): Cupronickel, coaxial, vented, double-wall construction for potable-water service.
- E. Remote-Mounted, Air-Cooled Condenser Unit
1. Casing: Steel, finished with baked enamel; with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
 2. Refrigerant Coil: ARI 210/240, copper tube with mechanically bonded aluminum fins; with liquid subcooler.
 3. Fan: Aluminum-propeller type, directly connected to permanently lubricated motor with integral thermal-overload protection.
 4. Adjustable, Low Ambient Head-Pressure Control: Designed to operate at temperatures as low as 0 deg F (minus 18 deg C) by cycling condenser fans and controlling speed of last fan of each circuit.
 5. Mounting Base: Polyethylene.
- F. Heating Coils
1. Hot-Water Coil: Continuous circuit coil fabricated according to ARI 410.
 - a. Tubes: Copper.
 - b. Fins: Aluminum **OR** Copper, **as directed**, with fin spacing 0.125 inch (3.18 mm) **OR** 0.091 inch (2.31 mm) **OR** 0.071 inch (1.80 mm) **OR** 0.067 inch (1.70 mm) **OR** 0.056 inch (1.42 mm) **OR** 0.0075 inch (0.19 mm), **as directed**.
 - c. Fin and Tube Joints: Mechanical bond.
 - d. Headers: Cast iron with drain and air vent tappings.
 - e. Frames: Galvanized-steel channel, 0.052 inch (1.3 mm).
 - f. Ratings: Design tested and rated according to ASHRAE 33 and ARI 410.
 - 1) Working-Pressure Ratings: 200 psig (1380 kPa), 325 deg F (163 deg C).

- ## G. Dampers

- ## H. Controls

1. Comply with requirements in Division 23 Section "Instrumentation And Control For Hvac" for control equipment and in Division 23 Section "Sequence Of Operations For Hvac Controls".
2. Control Panel: Integral service compartment containing fan-motor thermal and overload cutouts, compressor thermal and overload cutouts, 115-V control transformer if required, magnetic contactors for fan and compressor motors, and a nonfused factory-mounted and -wired disconnect switch for single external electrical power connection.
3. Building Automation System Interface: Factory-installed hardware and software to enable the building automation system to monitor, control, and display status and alarms.
4. Operating Control: Space humidistat cycles the compressor. Humidistat shall incorporate fan on-off-auto switch.
5. Operating Controls (for indoor pool units with typical manufacturer's control panel): Factory-installed microprocessor controller, capable of being remotely mounted.
 - a. Display the following on the face of controller:
 - 1) System on.
 - 2) System dehumidifying mode.
 - 3) System air-conditioning mode.
 - 4) System outdoor-air (economizer) mode.
 - 5) System heating pool water.
 - 6) Auxiliary space heat is operating.
 - 7) Unit requires service.
 - 8) Return-air (space) temperature.
 - 9) Return-air (space) humidity.
 - 10) Pool-water temperature.
 - 11) Outdoor-air temperature.
 - b. Indicate the following sensor failures on panel:
 - 1) Airflow: Dirty air filter, blocked airflow, and fan failure.
 - 2) Refrigerant high and low pressure.
 - 3) High water temperature.
 - 4) High and low evaporator temperature.
 - 5) Low water flow.
 - 6) Communication fault.
 - 7) System off.
 - 8) Antishort cycle delay.
 - 9) Power failure.
 - c. Provide access to the following set points on panel:
 - 1) Space temperature.
 - 2) Space relative humidity.
 - 3) Outdoor ventilation/air-conditioning changeover temperature.
 - 4) Airflow alarm.
 - d. Provide the following displays on panel:
 - 1) Space temperature.
 - 2) Space relative humidity.
 - 3) Outdoor-air temperature.
 - 4) Supply-air temperature.
 - 5) Return-air temperature.
 - 6) Airflow rating.
 - 7) Air-off evaporator temperature.
 - 8) Return-air relative humidity.
 - 9) Service codes.
 - e. Provide the following controls on panel:
 - 1) System on-off, fan continues to run.
 - 2) Fan on-off.
 - 3) Service code access.
 - 4) System dehumidifying mode.
 - 5) System air-conditioning mode.
 - 6) System outdoor-air (economizer) mode.

- 7) Auxiliary space heat is operating.
 - 8) Outdoor-air-temperature, conditioned-space-temperature, and control set-point-temperature digital display.
 - 9) Outdoor enthalpy digital display.
 - 10) Filter pressure drop digital display.
 - 11) Status: Airflow, fans, system, unit operation, and operating mode.
 - 12) Alarm digital display.
6. Operating Controls: Factory-installed microprocessor controller.
- a. Factory-installed operator panel with backlit display, capable of being remotely mounted, allows menu-driven display for navigation and control of unit.
 - b. Integral clock.
 - c. Personal computer interface.
 - d. Integral local area network for direct connection to BACnet **OR** LonWorks **OR** MODBUS, **as directed**.
 - e. Factory programmed.
 - f. Unit-Mounted Sensors:
 - 1) Airflow switch.
 - 2) Compressor-discharge temperature.
 - 3) Evaporator-air temperature.
 - 4) Pool-water-out temperature.
 - 5) Pool-water-in temperature.
 - 6) Relative humidity.
 - 7) Return-air temperature.
 - 8) Supply-air temperature.
 - g. Integral diagnostics.
 - h. Nonvolatile memory.
 - i. IP or SI display.
 - j. Provide the following status and alarm functions:
 - 1) System: On-off.
 - 2) Power failure.
 - 3) Fan: Off, overload.
 - 4) Compressor: On, turned off, overload, high pressure, low pressure, overheat, oil failure, and pumpdown.
 - 5) Evaporator damper closed.
 - 6) Pool: Low water flow, heating on.
 - 7) Dehumidification: Call for, on.
 - 8) Air Conditioning: Call for, on.
 - 9) System outdoor-air (economizer) mode.
 - 10) Auxiliary space heat on.
 - 11) Alarms: Firestat, freezestat, and filters.
 - k. Provide the following controls via operator panel:
 - 1) Compressor auto-off.
 - 2) Fan auto-off.
 - 3) Set-Point Adjustments: Relative humidity, temperatures, deadbands, and differentials.
 - 4) Sensor calibration.
 - l. Monitor constant and variable motor loads.
 - m. Monitor cooling load.
 - n. Monitor economizer cycles.
 - o. Monitor ventilation air volumes.
- I. Accessories
- 1. Water-Cooling Heat Exchanger: Coaxial, vented, double-wall construction; with three-way refrigerant control valve.
 - 2. Smoke Detectors: Photoelectric detector located in return-air plenum, to de-energize unit.

- a. Operating Voltage: 24-V dc, nominal.
 - b. Self-Restoring: Detectors do not require resetting or readjusting after actuation to restore them to normal operation.
 - c. Plug-in Arrangement: Detector and associated electronic components mounted in module with tamper-resistant connection to fixed base with twist-locking plug. Terminals in fixed base accept building wiring.
 - d. Integral Visual-Indicating Light: Digital-display type indicating detector operation.
 - e. Sensitivity: Can be tested and adjusted in-place after installation.
 - f. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the fire-alarm control panel.
 - g. Sensor: Digital display or infrared light source with matching silicon-cell receiver.
 - h. Detector Sensitivity: Between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) of smoke obscuration when tested according to UL 268A.
 - i. Integral Thermal Detector: Fixed-temperature type with 135 deg F (57 deg C) setting.
3. Electrical Convenience Outlet: 115-V ac fused, duplex, straight-blade receptacles, separately fused and located inside casing of dehumidification unit or in roof-curb perimeter.

J. Roof Curbs

1. Roof curbs with vibration isolators and wind or seismic restraints are specified in Division 15 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
2. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.
3. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
 - a. Materials: ASTM C 1071, Type I or II.
 - b. Thickness: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**.
 - c. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
 - d. Liner Adhesive: Comply with ASTM C 916, Type I.
 - e. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
 - f. Liner materials applied in this location shall have airstream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric, depending on service-air velocity.
4. Curb Height: 14 inches (355 mm) **OR** 24 inches (610 mm) **OR** 36 inches (910 mm), **as directed**.
5. Wind and Seismic Restraints: Metal brackets compatible with the curb and casing, painted to match dehumidification unit; used to anchor unit to the curb and designed for loads at Project site. Comply with requirements in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" for wind-load requirements.

K. Source Quality Control

1. Verification of Performance: Factory test and rate dehumidification units according to ARI 910.
2. Sound-Power-Level Ratings: Factory test and rate dehumidification units according to ARI 575.

1.3 EXECUTION

A. Examination

1. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
2. Examine roughing-in for hot-water **OR** steam **OR** refrigerant, **as directed**, piping systems to verify actual locations of piping connections before equipment installation.
3. Examine walls, floors, and roofs for suitable conditions where dehumidification units will be installed.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation

1. Equipment Mounting (for indoor or outdoor equipment supported on slabs-on-grade without vibration isolation devices): Install dehumidification units on concrete base(s). Comply with requirements for concrete base(s) specified in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
2. Equipment Mounting (for indoor or outdoor equipment supported on concrete equipment base with vibration isolation devices): Install dehumidification units on concrete base(s) using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements for concrete base(s) specified in Division 03 Section "Cast-in-place Concrete". Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1 inch (25 mm), **as directed**.
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - c. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Equipment Mounting (for installation of indoor or outdoor equipment on vibration isolation devices without concrete base): Install dehumidification units using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1 inch (25 mm), **as directed**.
4. Equipment Mounting (for installation of indoor or outdoor equipment on vibration isolation equipment base): Install dehumidification units on vibration isolation equipment base. Comply with requirements specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
5. For installation of indoor or outdoor equipment without vibration isolation devices, with seismic restraints, and without concrete base: Install dehumidification units with **<Insert seismic-restraint device>**. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
6. For indoor units suspended from structure: Install continuous-thread hanger rods and elastomeric hangers **OR** spring hangers **OR** spring hangers with vertical-limit stop, **as directed**, of size required to support weight of dehumidification unit.
 - a. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment". Fabricate brackets or supports as required.
 - b. Comply with requirements for hangers and supports specified in Division 23 Section "Hangers And Supports For Hvac Piping And Equipment".
7. Curb Support (if curbs are furnished with dehumidification units for rooftop installations): Install roof curb on roof structure, level and secure, according to NRCA's "The NRCA Roofing and Waterproofing Manual, Fifth Edition." Install and secure dehumidification units on curbs, and coordinate roof penetrations and flashing with roof construction. Secure units to curb support with anchor bolts.
8. Unit Support: Install dehumidification units level on structural curbs **OR** pilings, **as directed**. Coordinate wall penetrations and flashing with wall construction. Secure units to structural support with anchor bolts.

9. Isolation Curb Support (for units mounted on isolation curbs): Install dehumidification units on isolation curbs, and install flexible duct connectors and vibration isolation and seismic-control devices. Flexible duct connectors are specified in Division 23 Section "Air Duct Accessories". Vibration isolation and seismic-control devices are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
- C. Connections
1. Where piping is installed adjacent to dehumidification units, allow space for service and maintenance of dehumidification units.
 2. Connect piping to dehumidification units mounted on vibration isolators with flexible connectors.
 3. Connect condensate drain pans using minimum NPS 1-1/4 (DN 32) copper tubing. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan, and install cleanout at changes in direction.
 4. Refrigerant Piping: Comply with requirements in Division 23 Section "Refrigerant Piping". Connect to supply and return coil tapplings with shutoff valve and union or flange at each connection.
 5. Hot-Water Piping: Comply with requirements in Division 23 Section "Hydronic Piping". Connect to supply coil tapplings with shutoff valve, return coil tapplings with balancing valve, and union or flange at each connection.
 6. Steam and Condensate Piping: Comply with requirements in Division 23 Section "Steam And Condensate Heating Piping". Connect with shutoff valve and union or flange.
 7. Duct installation requirements are specified in other Division 21. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
 - a. Install ducts to termination in roof-mounted frames. Where indicated, terminate return-air duct through roof structure and insulate the space between roof and bottom of dehumidification unit.
- D. Field Quality Control
1. Perform tests and inspections.
 2. Tests and Inspections:
 - a. Leak Test: After installation, fill water coils with water, and test coils and connections for leaks. Repair leaks and retest until no leaks exist.
 - b. Charge refrigerant coils with refrigerant and test for leaks. Repair leaks and retest until no leaks exist.
 - c. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 3. Dehumidification unit will be considered defective if it does not pass tests and inspections.
 4. Prepare test and inspection reports.
- E. Startup Service
1. Perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.
 2. Perform the following final checks before startup:
 - a. Verify that shipping, blocking, and bracing are removed.
 - b. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - c. Perform cleaning and adjusting specified in this Section.
 - d. Disconnect fan drive from motor, verify proper motor rotation direction, and verify free fan wheel rotation and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.
 - e. Check lubrication of bearings, pulleys, belts, and other moving parts.
 - f. Set outside- and return-air mixing dampers to minimum outside-air setting.
 - g. Install clean filters.
 - h. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.



3. Starting procedures for dehumidification units include the following:
 - a. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm. Replace malfunctioning motors, bearings, and fan wheels.
 - b. Measure and record motor's electrical values for voltage and amperage.
 - c. Manually operate dampers from fully closed to fully open position and record fan performance.
4. Comply with requirements in Division 23 Section "Testing, Adjusting, And Balancing For Hvac" for testing, adjusting, and balancing of dehumidification unit.
5. Startup Report: Report findings during startup. Identify startup steps, corrective measures taken, and final results.

F. Adjusting

1. Adjust damper linkages for proper damper operation.
2. Adjust initial temperature and humidity set points.

G. Cleaning

1. Clean dehumidification units internally, on completion of installation, according to manufacturer's written instructions. Clean fan interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheels, cabinets, and coils' entering-air face.
2. After completing system installation, testing, and startup service of dehumidification units, clean filter housings and install new filters.

H. Demonstration

1. Train Owner's maintenance personnel to adjust, operate, and maintain dehumidification units.

END OF SECTION 23 76 13 00



23 - Heating, Ventilating, And Air-Conditioning
(HVAC)

Task	Specification	Specification Description
23 76 13 00	23 74 23 00	Direct-Fired, Makeup Air Units
23 76 13 00	23 74 23 00a	Indirect-Fired, Packaged H&V Units



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SECTION 23 81 00 00 - MPF DECENTRALIZED UNITARY HVAC EQUIPMENT**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Packaged Rooftop air handling units.

1.2 SUBMITTALS

- A. Product Data: Required.
- B. Shop Drawings: Required.

1.3 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.
- B. Reference Standards:
 - 1. Air Movement and Control Association International (AMCA)
 - 2. Underwriters Laboratories (UL) Standard 705
 - 3. Air Conditioning and Refrigeration Institute (ARI)
 - 4. National Environmental Balancing Bureau (NEBB)



PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 ROOFTOP AIR HANDLING UNITS

- A. Units shall be of light industrial grade construction, suitable for the scheduled duty requirements, as manufactured by AAON, Carrier, Lennox, McQuay, York (Johnson Controls, Inc.) or Trane. No substitutions permitted without an approved deviation. Units to be AMCA and ARI certified.
- B. Refrigerant: Only R-134a and R-410a refrigerants are permitted.
- C. Units consist of fans, heating (natural gas or propane) and cooling (Direct Expansion) coils, filters, mixing plenums, 100% modulating economizer, relief/exhaust section, access sections, refrigerant compressors, condensers and refrigerant piping.
- D. Condensing Coils: Aluminum fin on copper tubing or solid aluminium micro channel coils shall have a factory dipped process flexible epoxy polymer e-coat uniformly applied to all coil surface areas without material bridging between fins or channels. Coating process shall ensure complete coil encapsulation and a uniform dry film thickness from 0.8 – 1.2 mil on all surface areas including fin edges. Superior hardness characteristics of 2H per ASTM D3363-92A and a cross-hatch adhesion of 4B-5B per ASTM B3359-93. Impact resistance shall be up to 160 in/lb per ASTM D2794-93. Humidity and water immersion resistance shall be up to a minimum 1000 and 250 hours respectively (ASTM D2247-92 and ASTM D870-92). Corrosion durability shall be confirmed through testing to no less than 5,000 hours salt spray per ASTM B117-97.
- E. Unit casings: Double wall insulated with 1 inch thick and 1- ½” pcf density fiberglass and perforated sheet metal lining. Provide with hail guards to protect condenser coils in hail prone locations.
- F. Unit Efficiency: Unit Energy Efficiency Ratio (EER) and Integrated Part Load Value (IPLV) shall exceed ASHRAE 90.1 by minimum of 20%. This requirement may be reduced if there is no commercially available standard product of the type and capacity required that meets this requirement. If approved by the USPS, commercially available equipment shall be provided with the maximum efficiency available.
- G. Fans shall be double-width, double-inlet type with backwardly inclined or air foil blades.
- H. Sound Levels: Units shall be selected to provide acceptable level of HVAC generated noise within the facility.
- I. Condensate Pan: Provide under all cooling coil, humidifier, and fan sections; stainless steel, IAQ type.
- J. Access Doors: Provide an 18" wide, minimum, access door in each section of the unit.
- K. Filters: Prefilters: 2 inch thick, pleated type, 25 to 30% average efficiency (MERV 5).
Final Filters: 6 or 12 inch thick, cartridge type, 60 to 65% average efficiency (MERV 11).
- L. Antimicrobial treatment for filters in high humidity regions. High humidity regions are defined as regions where one or both of the following conditions occur:
 - 1. A 67° F. or higher wet-bulb temperature for 3000 or more hours during the warmest six consecutive months of the year.
 - 2. A 73° F. or higher wet-bulb temperature for 1500 hours or more during the warmest six consecutive months of the year.

- M. Controls: Native BACnet controller with room temperature sensor/control. Space sensors shall be located in the spaces served and shall be provided with a tamper proof covers.
1. Economizer Control: For variable air volume systems, monitor and actively control amount of ventilation air provided to space.
 2. Low Ambient Controller: Cycles condenser fan to permit operation down to low temperature observed in project location.
 3. Dampers: Motorized, ultra low leakage with gasketing to seal to a maximum leakage rate of 1 percent of nominal airflow at 1 inch WC.
 4. Equipment Manufacturer shall furnish and install a direct digital control (DDC) and building automation system (BAS) controller as specified in Sections 250504, 251404, 251004, and 251504. The controller shall utilize electronic sensing and microprocessor-based digital control to perform the functions specified. The BAS and digital control and communications components installed shall be an integrated distributed processing system utilizing BACnet communication requirements as defined by ASHRAE/ANSI 135-2004 for all communication. System components shall communicate using native BACnet in accordance with the Standard and all current addenda and annexes, including all building controllers and application specific controllers. Gateways to other communication protocols are not acceptable. The following requirements apply:
 - a. BACnet Building Controller Requirements:
 1. The BC(s) shall support all BIBBs defined in the BACnet Building Controller (B-BC) device profile as defined in the BACnet standard.
 2. BCs shall communicate over the BACnet Building Controller LAN.
 3. Each BC shall be connected to the BACnet Building Controller LAN communicating to/from other BCs.
 - b. BACnet AAC(s) and ASC(s) Requirements:
 1. The AAC(s) and ASC(s) shall support all BIBBs defined in the BACnet Building Controller (B-AAC and B-ASC) device profile as defined in the BACnet standard.
 2. AAC(s) and ASC(s) shall communicate over the BACnet Building Controller LAN or the ASC LAN or sub-LAN.
 3. Each AAC(s) and ASC(s) shall be connected to the BACnet Building Controller communicating to/from other BCs over a BACnet Building Controller LAN.
- N. Convenience Outlet: Provide one weather-proof 120-volt GFI convenience outlet mounted to the exterior of each unit.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

NOTE TO SPECIFIER

Retain paragraph below for RTUs requiring wind or seismic restraints.

- B. Install wind and seismic restraints according to manufacturer's written instructions.

NOTE TO SPECIFIER

Verify condensate drainage requirements of authorities having jurisdiction.



- C. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain, roof leader, roof scupper, or area drain.
- D. Install flexible connections between fan inlet and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.
- E. Provide sheaves required for final air balance.
- F. Install backdraft dampers on outlet from cabinet and ceiling exhausters fans and as indicated.
- G. Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

3.2 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Tests and Inspections:
 - 1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
 - 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace malfunctioning units and retest as specified above.

3.3 CLEANING AND ADJUSTING

- A. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

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END OF SECTION 23 81 00 00



SECTION 23 81 00 00 - CSF DECENTRALIZED UNITARY HVAC EQUIPMENT

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Packaged Rooftop Units are part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.23 81 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Packaged Rooftop Air Conditioning Unit (RTU)
 - 2. Temperature Controls
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 077213 – Manufactured Curbs
 - 2. Section 283100 – Fire Detection and Alarm
 - 3. Section 233100 – HVAC Ducts and Casings
 - 4. Section 230904 - Instrumentation and Control for HVAC (MSBD)
 - 5. Section 260519 – Low-Voltage Electrical Power Conductors and Cables

1.2 REFERENCES

- A. ARI 210 - Unitary Air Conditioning Equipment
- B. NFPA 70 - National Electrical Code
- C. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
- D. UL 465 - Central Cooling Air Conditioners

1.3 DEFINITIONS

- A. Roof Top Air Conditioning Unit (RTU): Single-packaged, self-contained, factory-assembled, pre-wired, Door unit consisting of cabinet and frame, evaporator fan, evaporator-coil, [electric heater] or [fuel-fired]



furnace] or [heat-pump], condenser coil, condenser fan, compressor(s), controls and filters in draw-through air flow configuration.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Provide product data for manufactured Units. Indicate performance capacities, energy-efficiency ratings and electrical characteristics.
 - 2. Shop Drawings: Provide shop drawings for manufactured Units. Indicate refrigerant pipe connections, ductwork connections, filter size and quantity, condensate drain connection, thermostatic valves, temperature controls connections and electrical rough-in connections with electrical characteristics and connection requirements.
 - 3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Project Record Documents: Accurately record the following:
 - a. Plan view of installed location of Units
 - b. Elevation or section view of installed Units.
 - 2. Warranty: Submit written minimum five (5) years warranty to include coverage for refrigeration compressors condenser and evaporator with forms completed in United States Postal Service name and registered with manufacturer as specified in this Section.
 - 3. Extra Products: Submit extra products as specified in this Section.
 - 4. Operating instruction: Document training by furnishing a sign-in sheet with a description of the training provided instructors name and organization, and those who received training. Refer to 017704 1.3, 1.4, and 1.5 for more specific training

1.5 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum five (5) years documented experience.
 - 2. Installer: Company specializing in performing the Work of this Section with minimum five (5) years documented experience.
- B. Regulatory Requirements:
 - 1. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.



2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Carrier 1-800-227-7437
 2. York 516-937-2327
 3. Trane 1-972-406-3656
 4. Lennox 972-497-5317
 5. AAON (918) 382-6400
 6. McQuay International 1-800-432-1342

NOTE TO SPECIFIER

If a different manufacturer or refrigerant is desired then an approved deviation request is required.

- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Not Permitted.

2.2 MATERIALS

- A. Cabinet -
1. Frame and Panels: Minimum 18 gauge galvanized steel structural frame members, minimum 20 gauge cabinet panels with baked enamel or powder coated finish, easily removed access doors or panels with quick release fasteners.
 2. Provide with hail guards to protect condenser coils in hail prone locations.
 3. Insulation: Minimum one half (1/2") inch (13 mm) thick acoustic duct liner with smooth, black neoprene air-side surface for lining cabinet interior. Edges exposed to conditioned air path shall be coated with black neoprene surface.
 4. Drain Pan: [Galvanized steel with corrosion-resistant coating][Stainless steel], insulated, high-slope for positive drainage per ASHRAE Standard 62-89. Drain pan shall extend under the complete coil section.
- B. Evaporator Fan -
1. Fans: [Direct-driven] or [V-Belt driven], with permanently lubricated bearings, double width, double inlet, forward curved centrifugal fan, statically and dynamically balanced, resiliently mounted. Minimum three (3) -speed, [direct drive] or [V-belt-driven] blower to provide required CFM at medium speed with minimum external static pressure of 0.75 in. wg.
 2. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed. Variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.
 3. Motors: [] hp [] volts, [] phase, 60 Hz; [multi-speed PSC type][to NEMA MG1, []].
- C. Evaporator Coil -
1. Direct expansion cooling coil shall be [] inch outside diameter , [] thick seamless copper tubes expanded into aluminum fins. Maximum coil face velocity shall not exceed five hundred [] feet per minute.
 2. Refrigeration circuit with externally equalized thermal expansion valve, filter-drier, and charging valves.
- D. Heater -
1. Electric-Resistance Heater: Helical nickel-chrome resistance wire coil heating elements with refractory ceramic support bushings, with automatic reset thermal cut-out, built-in magnetic contactors, manual reset thermal cut-out, airflow proving device, load fuses.



***** [OR] *****

2. Fuel Fired Furnace: [natural-gas] or [propane-gas] or [fuel-oil], self-contained, package unit complete with burner and controls. Aluminized steel heat exchanger, AGA certified, minimum AFUE efficiency of 75 percent. [Electronic pilot ignition shall be provided] or [Safety cut-off control to shut down burner motor if oil fails to ignite in forty-five (45) seconds.] Unit shall be provided as an integral part of the Roof Top Air Conditioning Unit.

***** [OR] *****

3. Heat Pump: Refrigerant system reversing valve. Provide auxiliary heaters.
- E. Air Filters - Easily removed one [] inch thick throw-away type with 25-30 percent ASHRAE Dust Spot Efficiency filter. Maximum filter face velocity shall not exceed five hundred [] feet per minute.
 - F. Condenser Fans - Direct-driven, with permanently lubricated bearings, thermal overload protection, weatherproofed, vertical discharge propeller type with fan guard, statically and dynamically balanced, resiliently mounted.
 - G. Condenser Coil - Shall be be [] inch outside diameter , [] thick seamless copper tubes expanded into aluminum fins with sub-cooling circuits, tested for leaks up to 425 psig. Suction and Liquid line service gauge ports and full charge of refrigerant. Provide refrigerant pressure switches to cycle condenser fans
 1. Condensing Coils: Aluminum fin on copper tubing or solid aluminium micro channel coils shall have a factory dipped process flexible epoxy polymer e-coat uniformly applied to all coil surface areas without material bridging between fins or channels. Coating process shall ensure complete coil encapsulation and a uniform dry film thickness from 0.8 – 1.2 mil on all surface areas including fin edges. Superior hardness characteristics of 2H per ASTM D3363-92A and a cross-hatch adhesion of 4B-5B per ASTM B3359-93. Impact resistance shall be up to 160 in/lb per ASTM D2794-93. Humidity and water immersion resistance shall be up to a minimum 1000 and 250 hours respectively (ASTM D2247-92 and ASTM D870-92). Corrosion durability shall be confirmed through testing to no less than 5,000 hours salt spray per ASTM B117-97. Coating can be field applied for smaller equipment to prevent delays during construction.
 - H. Compressor - Shall be hermetically sealed, 3600 rpm maximum, resiliently mounted with positive lubrication internal motor protection, refrigerant line filter drier, and crankcase heater. [Reversing valve for heat-pump units].
 - I. Refrigerant – Only R134a and R-410a refrigerant is permitted.
 - J. Controls:
 1. Controls – certified BacNet output directly from RTU to thermostats, sensors and other controllers, and to Building Automation System, if applicable.
 2. Low Ambient Controller: Cycles condenser fan to permit operation down to low temperature observed in project location.
 - K. Mixed-Air Casing:
 1. Dampers: Provide outside, return, and relief dampers with damper operator and control package to automatically vary outside air quantity. Outside air damper to fail to closed position. Relief dampers may be gravity balanced.
 2. Gaskets: Provide tight fitting dampers with edge gaskets maximum leakage 5 percent at 2 inches (500 Pa) pressure differential.
 3. Damper Operator: 24 volt with gear train sealed in oil with spring return to fail to closed position.
 - L. Pre-fab Roof Mounting Curb - Section 077213 - Curbs to be supplied and installed by General Contractor.



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings.
- C. Verify that proper power supply is available.
- D. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- E. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Mount RTU(s) on roof mounting curb providing water-tight enclosure to protect ductwork and utility services.
- B. Install RTU(s) level and in accordance with manufacturer's instructions.
- C. Install condensate drain pipes from Unit drain pan to designated location shown on drawings. Provide minimum 1/8 inch per foot slope on all horizontal pipes.

3.3 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Operating Instruction
 - 1. Provide on-site instruction to review the operation of the system and detail any common troubleshooting or maintenance that is required to ensure normal operation.
 - 2. Provide one complete set of equipment operating, installation, and programming manuals that will remain at the installed location.

NOTE TO SPECIFIER

Coordinate the following items with Contract Drawings;

DRAWING COORDINATION ITEMS

Drawings should indicate the following information related to this Section.

*Roof Top Air-Conditioning Unit Number [RTU-#]
Manufacturer
Model Number
Total Cooling Capacity
Total Sensible Cooling Capacity
[Total Heating Capacity] for heat-pumps*



*Energy Efficiency Ratio Ratings [SEER] or [EER]
Coefficient of Performance [COP] for heat-pumps
Electrical Characteristics
Supply Air Flow
Return Air Flow
Outside Air Intake Flow
Coil Entering Air DB Temperature
Coil Entering Air WB Temperature
Supply Air DB Temperature
Supply Air WB Temperature
Evaporator Fan Motor Horsepower
Auxiliary Heating Capacity
Total Capacity [Btu/hr] or [Kw]
Number of steps*

USPS CSF Specifications issued: 10/1/2013
Last revised: 8/29/2013

END OF SECTION

SECTION 23 81 13 00 - PACKAGED TERMINAL AIR CONDITIONERS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for packaged terminal air conditioners. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes packaged terminal air conditioners and their accessories and controls, in the following configurations:
 - a. Through-the-wall and freestanding air conditioners.
 - b. Cooling-only units.
 - c. Heat-pump units.
 - d. Cooling units with electric heat.
 - e. Cooling units with hydronic heat.
 - f. Cooling units with indirect-fired gas heat.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit EA 4: Documentation required by Credit EA 4 indicating that equipment and refrigerants comply.
 - b. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
3. Shop Drawings: For packaged terminal air conditioners. Include plans, elevations, sections, details for wall penetrations, seismic bracing, **as directed**, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
4. Color Samples: For unit cabinet, discharge grille, and exterior louver, and for each color and texture specified.
5. Field quality-control reports.
6. Operation and maintenance data.
7. Warranty: Sample of special warranty.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Ventilation Rate Procedures," and Section 7 - "Construction and Startup."
3. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

E. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged terminal air conditioners that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period for Sealed Refrigeration System: Manufacturer's standard, but not less than five years from date of Final Completion, including components and labor.
 - b. Warranty Period for Nonsealed System Parts: Manufacturer's standard, but not less than five years from date of Final Completion, including only components and excluding labor.



- c. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than five years from date of Final Completion.

1.2 PRODUCTS

A. Manufactured Units

- 1. Description: Factory-assembled and -tested, self-contained, packaged terminal air conditioner with room cabinet, electric refrigeration system, heating, **as directed**, and temperature controls; fully charged with refrigerant and filled with oil; with cord-connected **OR** hardwired, **as directed**, chassis.

B. Chassis

- 1. Cabinet: 0.052-inch- (1.32-mm-) thick steel with removable front panel with concealed latches.
 - a. Mounting: Wall with wall sleeve **OR** Floor with subbase, **as directed**.
 - b. Discharge Grille: Punched-louver discharge grille allowing four-way discharge-air pattern **OR** Extruded-aluminum discharge grille **OR** Reversible polycarbonate discharge grille allowing upward and horizontal airflow, **as directed**.
 - c. Louvers: Extruded aluminum with enamel finish **OR** Stamped aluminum with clear-anodized finish **OR** Stamped steel with enamel finish, **as directed**; white **OR** bronze **OR** brown **OR** beige, **as directed**, color.
 - d. Finish: Epoxy coating **OR** Baked enamel, **as directed**.
 - e. Access Door: Hinged door in top of cabinet for access to controls.
 - f. Cabinet Extension: Matching cabinet in construction and finish, allowing diversion of airflow to adjoining room; with grille.
 - g. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 - h. Subbase: Enameled steel with adjustable leveling feet and adjustable end plates, with factory-installed and -wired, fused disconnect switch and receptacle sized for unit, **as directed**.
 - i. Wall Sleeves: Galvanized steel with polyester finish **OR** Molded polymer **OR** Molded fiberglass-reinforced polyester, **as directed**.
- 2. Refrigeration System: Direct-expansion indoor coil with capillary restrictor; and hermetically sealed scroll compressor with vibration isolation and overload protection.
 - a. Indoor and Outdoor Coils: Seamless copper tubes mechanically expanded into aluminum fins with capillary tube distributor on indoor coil, **as directed**.
 - b. Accumulator.
 - c. Constant-pressure expansion valve.
 - d. Reversing valve.
 - e. Charge: R-22 **OR** R-407C **OR** R-410A, **as directed**.
- 3. Indoor Fan: Forward curved, centrifugal; with motor and positive-pressure ventilation damper with concealed manual **OR** electric, **as directed**, operator.
- 4. Filters: Washable polyurethane in molded plastic frame.
- 5. Condensate Drain: Drain pan to direct condensate to outdoor coil for re-evaporation **OR** and piping to direct condensate to building waste and vent piping, **as directed**.
 - a. Comply with ASHRAE 62.1 for drain pan construction and connections.
- 6. Outdoor Fan: Forward curved, centrifugal **OR** Propeller, **as directed**, type with separate **OR** driven by indoor fan, **as directed**, motor.
 - a. Indoor and Outdoor Fan Motors: Two speed; comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Fan Motors: Permanently lubricated split capacitor.
 - 2) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

- 3) Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 22.

C. Heating

1. Electric-Resistance Heating Coil: Nickel-chromium-wire, electric-resistance heating elements with contactor and high-temperature-limit switch.
OR
Hot-Water Heating Coil: Seamless copper tubes mechanically expanded into aluminum fins with two-way modulating control valve and air vent.
OR
Gas Heat:
 - a. General Requirements for Gas-Fired, Noncondensing Furnaces: Factory assembled, piped, wired, and tested; complying with ANSI Z21.86/CSA 2.32, "Vented Gas-Fired Space Heating Appliances," and with NFPA 54.
 - b. Type of Gas: Natural **OR** Propane, **as directed**.
 - c. Heat Exchanger: Aluminized-steel **OR** Stainless steel, **as directed**.
 - d. Burner:
 - 1) Gas Valve: 100 percent safety two-stage **OR** modulating, **as directed**, main gas valve, main shutoff valve, pressure regulator, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board.
 - 2) Ignition: Electric pilot ignition with hot-surface igniter or electric spark ignition.
 - e. Gas-Burner Safety Controls:
 - 1) Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.
 - 2) Flame Rollout Switch: Installed on burner box; prevents burner operation.
 - 3) Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.
 - f. Combustion-Air Inducer: Centrifugal fan prepurges heat exchanger and vents combustion products; thermally protected motor with sleeve bearings; pressure switch prevents operation if combustion-air inlet or flue outlet is blocked.
 - g. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; adjustable fan-on and fan-off timing; and terminals for connection to accessories.

D. Controls

1. Control Module: Unit-mounted digital panel with touchpad temperature control and with touchpad for heating, cooling, and fan operation. Include the following features:
 - a. Low Ambient Lockout Control: Prevents cooling-cycle operation below 40 deg F (5 deg C) outdoor air temperature.
 - b. Heat-Pump Ambient Control: Field-adjustable switch changes to heat-pump heating operation above 40 deg F (5 deg C) and to supplemental heating below plus 25 deg F (minus 4 deg C).
 - c. Temperature-Limit Control: Prevents occupant from exceeding preset setback **OR** setup, **as directed**, temperature.
 - d. Building Automation System Interface: Allows remote on-off control with setback temperature control.
 - e. Reverse-Cycle Defrost: Solid-state sensor monitors frost buildup on indoor **OR** outdoor, **as directed**, coil and reverses unit to melt frost.
2. Remote Control: Standard unit-mounted controls with remote-mounted, low-voltage adjustable thermostat with heat anticipator, heat-off-cool-auto **OR** heat-off-cool, **as directed**, switch, and on-auto, **as directed**, fan switch.
3. Outdoor Air: Manual **OR** Motorized, **as directed**, intake damper. Open intake when unit indoor air fan runs, **as directed**.

E. Source Quality Control

1. Sound-Power Level Ratings: Factory test to comply with ARI 300, "Sound Rating and Sound Transmission Loss of Packaged Terminal Equipment."

2. Unit Performance Ratings: Factory test to comply with ARI 310/380/CSA C744, "Packaged Terminal Air-Conditioners and Heat Pumps."

1.3 EXECUTION

A. Installation

1. Install units level and plumb, maintaining manufacturer's recommended clearances and tolerances.
2. Install wall sleeves in finished wall assembly; seal and weatherproof. Joint-sealant materials and applications are specified in Division 07 Section "Joint Sealants".
3. Install and anchor wall sleeves to withstand, without damage to equipment and structure, seismic forces required by building code.

B. Connections

1. Comply with requirements for piping specified in Division 23 Section "Hydronic Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
2. Comply with requirements for piping specified in Division 23 Section "Facility Natural-gas Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
3. Install piping adjacent to machine to allow service and maintenance.

C. Field Quality Control

1. Perform tests and inspections.
2. Tests and Inspections:
 - a. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - b. After installing packaged terminal air conditioners and after electrical circuitry has been energized, test for compliance with requirements.
 - c. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Packaged terminal air conditioners will be considered defective if they do not pass tests and inspections.
4. Prepare test and inspection reports.

D. Startup Service

1. Perform startup service.
2. After installation, verify the following:
 - a. Unit is level on base and is flashed in exterior wall.
 - b. Unit casing has no visible damage.
 - c. Compressor, air-cooled condenser coil, and fans have no visible damage.
 - d. Labels are clearly visible.
 - e. Controls are connected and operable.
 - f. Shipping bolts, blocks, and tie-down straps are removed.
 - g. Filters are installed and clean.
 - h. Drain pan and drain line are installed correctly.
 - i. Electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 22.
 - j. Installation. Perform startup checks according to manufacturer's written instructions, including the following:
 - 1) Lubricate bearings on fan.
 - 2) Check fan-wheel rotation for correct direction without vibration and binding.
3. After startup service and performance test, change filters.

E. Adjusting

1. Adjust initial temperature set points.
 2. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- F. Demonstration
1. Train Owner's maintenance personnel to adjust, operate, and maintain packaged terminal air conditioners.

END OF SECTION 23 81 13 00



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Task	Specification	Specification Description
23 81 16 00	23 81 13 00	Packaged Terminal Air Conditioners



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SECTION 23 81 23 00 - MPF COMPUTER-ROOM AIR-CONDITIONERS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Floor-mounted computer-room air conditioners, 6 tons (21 kW) and larger.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For computer-room air conditioners. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance:
 - 1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
 - 2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Ventilation Rate Procedures," and Section 7 - "Construction and Startup."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004.
- D. ASME Compliance: Fabricate and label water-cooled condenser shell to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of computer-room air conditioners that fail in materials or workmanship within specified warranty period.

NOTE TO SPECIFIER

Verify available warranties and warranty periods for units and components with manufacturers listed in Part 2 articles.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
2. Warranty Period for Humidifiers: Manufacturer's standard, but not less than three years from date of Substantial Completion.
3. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 FLOOR-MOUNTED UNITS 6 TONS (21 KW) AND LARGER

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Airflow Company; a division of The McClain Company, Inc.
 2. Compu-Aire, Inc.
 3. Data Aire Inc.
 4. Koldwave, Inc.; a Mestek company.
 5. Liebert Corporation.
 6. Stulz-ATS.
 7. <Insert manufacturer's name>.
- B. Description: Packaged, factory assembled, prewired, and prepiped; consisting of cabinet, fans, filters, humidifier, and controls.
- C. Cabinet and Frame: Welded steel, braced for rigidity, and supporting compressors and other mechanical equipment and fittings.
1. Doors and Access Panels: Galvanized steel with polyurethane gaskets, hinges, and concealed fastening devices.
 2. Insulation: Thermally and acoustically insulate cabinet interior with 1-inch- (25-mm-) thick duct liner.
 3. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
 4. Finish of Exterior Surfaces: Baked-on, textured vinyl enamel; color.
 5. Floor Stand: Welded tubular steel, with adjustable legs and vibration isolation pads.
- D. Supply-Air Fan(s):
1. Double-inlet, forward-curved centrifugal fan(s); statically and dynamically balanced.

2. Drive: V-belt, with steel shaft with self-aligning ball bearings and cast-iron or steel sheaves, variable- and adjustable-pitch motor sheave, minimum of two matched belts, with drive rated at a minimum of two times the nameplate rating of motor.
- E. Refrigeration System:
1. Compressors: Hermetic reciprocating or hermetic scroll; with oil strainer, internal motor overload protection, resilient suspension system, crankcase heater, manual-reset high-pressure switch, and pump-down low-pressure switch.
 2. Refrigeration Circuits: Two; each with hot-gas mufflers, thermal-expansion valve with external equalizer, liquid-line solenoid valve, liquid-line filter-dryer, sight glass with moisture indicator, service shutoff valves, charging valves, and charge of refrigerant.
 3. Refrigerant: R-407C or R-410A.
 4. Refrigerant Evaporator Coil: Alternate-row or split-face-circuit, direct-expansion coil of seamless copper tubes expanded into aluminum fins.
 5. Remote Air-Cooled Refrigerant Condenser: Corrosion-resistant cabinet, copper-tube aluminum-fin coils arranged for two circuits, multiple direct-drive propeller fans with permanently lubricated ball bearings, and single-phase motors with internal overload protection and integral electric control panel. Control capacity by cycling fans. Provide with low ambient control to permit operation down to low temperature observed in project location.
- F. Electric-Resistance Heating Coil: Enclosed finned-tube electric elements arranged for minimum of three stages, with thermal safety switches, manual-reset overload protection, and branch-circuit overcurrent protection.
- G. Refrigerant Heating Coil: Hot-gas coil of seamless copper tubes expanded into aluminum fins with three-way solenoid valve on first-stage refrigerant circuit.
- H. Infrared Humidifier: High-intensity quartz lamps mounted above stainless-steel evaporator pan, serviceable without disconnecting water, drain, or electrical connections; prepiped and using condensate water from cooling coils with stainless-steel or brass float-valve mechanism; located in bypass airstream; with flush-cycle timer and solenoid drain valve.
- I. Disconnect Switch: Nonautomatic, molded-case circuit breaker with handle accessible when panel is closed and capable of preventing access until switched to off position.
- J. Electronic-Control System: Solid state, with start button, stop button, temporary loss of power indicator, manual-reset circuit breakers, temperature control, humidity control, and monitor panel.
1. Monitor Panel: Backlighted, with no visible indicator lights until operating function is activated; indicators include cooling, humidification, loss of airflow, change filters, high temperature, low temperature, high humidity, low humidity, high head pressure (each compressor), and low suction pressure (each compressor).
 2. Temperature- and Humidity-Control Modules: Solid state, plug-in; with adjustable set point, push-to-test calibration check button, and built-in visual indicators to show mode of operation.
 3. Location: Behind hinged door in front of unit; isolated from conditioned airstream to allow service while system is operating.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install computer-room air conditioners level and plumb, maintaining manufacturer's recommended clearances.
- B. Air-Cooled Refrigerant Condenser Mounting: Install according to manufacturer's requirements.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.
- C. Water and Drainage Connections: Comply with applicable requirements in Division 15 Section "Domestic Water Piping." Provide adequate connections for water-cooled units, condensate drain, and humidifier flushing system.
- D. Refrigerant Piping: Comply with applicable requirements in Division 15 Section "Refrigerant Piping." Provide shutoff valves and piping.

3.3 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - 2. After installing computer-room air conditioners and after electrical circuitry has been energized, test for compliance with requirements.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Computer-room air conditioners will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.
- D. After startup service and performance test, change filters and flush humidifier.

3.4 ADJUSTING

- A. Adjust initial temperature and humidity set points.
- B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

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Last revised: 9/4/2013

END OF SECTION 23 81 23 00



SECTION 23 81 26 00 - CSF SPLIT-SYSTEM AIR CONDITIONERS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

*Use this section where Split-System Air Conditioning Unit HVAC System is part of the Work.
EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.*

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.23 81 26 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Air Handling/Furnace Unit.
 - 2. Condensing Unit.
 - 3. Refrigerant piping.
 - 4. Temperature Controls.
 - 5. Flue System.
 - 6. Refrigeration.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 DEFINITIONS

- A. Air Handling/Furnace Unit: Packaged, self-contained, factory-assembled, pre-wired, indoor unit consisting of cabinet, evaporator fan, evaporator-coil, heater, controls and filters.
- B. Condensing Unit: Packaged, self-contained, factory-assembled, pre-wired outdoor unit consisting of cabinet, condenser coil, condenser fan, compressor and controls.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - a. Product Data: Provide for Air Handling Units and Condensing Units. Indicate performance capacities, energy-efficiency ratings, and electrical characteristics.
 - b. Shop Drawings: Provide for Air Handling Units and Condensing Units. Indicate refrigerant pipe connections, ductwork connections, filter size and quantity, condensate drain connection,



thermostatic valves, temperature controls connections and electrical rough-in connections with electrical characteristics and connection requirements.

- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Project Record Documents: Accurately record the following:
 - a. Plan view of installed location for Air Handling Units and Condensing Units.
 - b. Elevation or section view of installed Air Handling Units and Condensing Units.
 - 2. Special Warranty: Submit written special warranty with forms completed in United States Postal Service name and registered with manufacturer as specified in this Section.
 - 3. Extra Products: Submit extra products as specified in this Section.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum five years documented experience.
 - 2. Installer: Company specializing in performing the Work of this Section with minimum five years documented experience.

1.5 WARRANTY

- A. Section 017704 - Closeout Procedures and Training.
- B. Special Warranty:
 - 1. Split-system units including refrigeration compressors.
 - 2. Warranty Period: 5 years labor and materials on air conditioning unit compressors.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Carrier.
 - 2. Lennox.
 - 3. Modine.
 - 4. Reznor.
 - 5. Trane.
 - 6. York.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 AIR HANDLING/FURNACE UNITS

- A. Unit Model: Indicated on Drawings.



B. Cabinet:

1. Frame and Panels: Minimum 22 gauge galvanized steel with baked enamel finish, easily removed access doors or panels with quick fasteners.
2. Insulation: Minimum one half 1/2 inch thick acoustic duct liner with smooth, black neoprene air-side surface for lining cabinet interior.
3. Drain Pan: Galvanized steel with corrosion-resistant coating, insulated, high-slope for positive drainage per ASHRAE Standard 62-89. Drain pan shall extend under the complete coil section.

C. Evaporator Fan:

NOTE TO SPECIFIER

Edit for Drive Type selected for specific Project.

1. Fans: Permanently lubricated bearings, forward curved centrifugal fan, statically and dynamically balanced, resiliently mounted. Minimum 3 -speed, [direct drive] or [V-belt-driven] blower to provide required CFM with minimum external static pressure of 0.5 inches wg. Normally set at high speed for cooling and medium speed for heating.
2. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed. Variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.

NOTE TO SPECIFIER

Edit for Motor Type selected for specific Project.

3. Motors: [___] hp [___] volts, [single phase] [three phase], 60 Hz; [multi-speed PSC type] [to NEMA MG1, [___]].

D. Evaporator Coil:

1. Direct expansion cooling coil shall be 1/2 inch outside diameter , 0.016 inch thick seamless copper tubes expanded into aluminum fins. Maximum coil face velocity shall not exceed 500 feet per minute.
2. Refrigeration circuit with externally equalized thermal expansion valve, filter-drier, and charging valves.

E. Heater:

NOTE TO SPECIFIER

OPTION 1: Use below when ELECTRIC RESISTANCE HEAT is selected for specific Project.

1. Electric-Resistance Heater: Helical nickel-chrome resistance wire coil heating elements with refractory ceramic support bushings, with automatic reset thermal cut-out, built-in magnetic contactors, manual reset thermal cut-out, airflow proving device, load fuses.

NOTE TO SPECIFIER

OPTION 2: Use below when FUEL FIRED FURNACE is selected for specific Project. Edit for Fuel Type used for specific Project.

2. Fuel Fired Furnace: [Natural-gas] [propane-gas] [fuel-oil], self-contained, package unit complete with burner and controls. [Aluminized steel] [Stainless steel] heat exchanger, AGA certified, minimum AFUE efficiency of 90 percent. [Electronic pilot ignition shall be provided] [Safety cut-off control to shut down burner motor if oil fails to ignite in 45 seconds.] Provide unit as an integral part of Air Handling Unit/Furnace. Provide manual gas isolation valve.

NOTE TO SPECIFIER

OPTION 3: Use below when HEAT PUMP is selected for specific Project.

- 3. Heat Pump: Condensing unit with refrigerant cycle reversing valve with auxiliary heater.
 - a. Auxiliary Electric-Resistance Heater: Helical nickel-chrome resistance wire coil heating elements with refractory ceramic support bushings, with automatic reset thermal cut-out, built-in magnetic contactors, manual reset thermal cut-out, airflow proving device, load fuses.

- F. Air Filters: Easily removed [1] [2] inch thick throw-away type with 25-30 percent ASHRAE Dust Spot Efficiency filter. Maximum filter face velocity shall not exceed 500 feet per minute.
- G. Controls: Factory wired, unit mounted terminal board and include 24 Volts control circuit transformer.
- H. Duct furnaces shall generally meet the specified requirements for electric and fuel fired furnace heaters.

2.3 CONDENSING UNIT

- A. Unit Model: Indicated on Drawings.
- B. Cabinet: Minimum 14 gauge galvanized steel welded frame with minimum 16 gauge galvanized steel panels and access doors with weather resistant, phosphatized finish.
- C. Condenser Fans: Direct-driven, with permanently lubricated bearings, thermal overload protection, weatherproofed, vertical discharge propeller type with fan guard, statically and dynamically balanced, resiliently mounted.
- D. Condenser Coil: 1/2 inch outside diameter , 0.016 inch thick seamless copper tubes expanded into aluminum fins with sub-cooling circuits, tested for leaks up to 425 psig. Suction and Liquid line service gauge ports and full charge of refrigerant.
- E. Compressor: Hermetically sealed, 3600 rpm maximum, resiliently mounted with positive lubrication internal motor protection and crankcase heater. Minimum EER 10.
 - 1. [Reversing valve for heat-pump units].
- F. Controls - Shall be factory wired and shall include contactors, high and low pressure cutouts, internal winding thermostat, 24 Volts control circuit transformer, non-cycling reset relay. Provide lockable disconnect switch at each new air handling unit/condensing unit. Provide low ambient controller to cycles condenser fan(s) to permit operation down to project area low temperature.

2.4 REFRIGERANT PIPING

- A. Per section 232300.

2.5 TEMPERATURE CONTROLS

- A. Per section [230904] or [230905]. For twinned furnace applications, install controls to stage burners and condensing units as required for proper heating and cooling. Blower units shall operate together.

2.6 COMBUSTION PRODUCTS/COMBUSTION AIR INLET VENT

- A. Provide directed vented intake and combustion vent systems per the manufacturer's installation requirements. Flue shall meet requirements of NFPA 211 and UL standards.

- B. Size according to manufacturer's recommendations. Insure that PVC combustion products vent does not drip on walking surfaces.

2.7 REFRIGERATION

- A. Only R-407c and R-410a refrigerant is permitted.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install refrigerant lines from Air Handling Unit Coil to Condensing Unit in accordance with manufacturer's recommendations. Insulate new suction piping in accordance with manufacturer's recommendations.
- C. Install condensate drain pipes from Air Handling Unit drain pan to designated location shown on drawings. Provide minimum 1/8 inch per foot slope on all horizontal pipes.
- D. On units over 2000 CFM capacity, provide smoke detector in supply air ductwork downstream of filters to shut down unit upon sensing smoke.
- E. Provide correct sized PVC pipes to exterior of building per manufacturer's instructions. Provide a concentric roof/wall termination kit. Paint to match exterior wall with oil based paint. Furnaces drawing their combustion air from the building are not acceptable. Insure that any condensate does not drip on walking surfaces.
- F. Connect units to electrical system. Provide fused disconnects. Connect to temperature control system. Test for proper operation. Where units are twinned, install controls to operate blowers together and stage burners and condensing units on demand.
- G. Connect air handling supply and return to ductwork using flexible connectors. Install smoke detector in supply downstream of filters to deactivate fan on sensing smoke.
- H. Connect burner to fuel supply. Provide separate fuel isolation valve for each burner. Test fuel piping for leaks. Adjust burners to maximum operating efficiency per manufacturer's recommendations. Check oil and refrigerant charge and superheat. Add additional refrigerant and oil as required. Comply with ASHRAE std 15. Paint exposed gas supply piping yellow.

NOTE TO SPECIFIER

Coordinate the following items with Contract Drawings;

DRAWING COORDINATION ITEMS

Drawings should indicate the following information related to this Section.

1. *Air-Conditioning System Number [AC-#]*



2. *Manufacturer*
3. *Air Handling Unit Number [AHU-#]*
 - a. *Model Number*
 - b. *Supply Air Flow*
 - c. *Return Air Flow*
 - d. *Outside Air Intake Flow*
 - e. *Coil Entering Air DB Temperature*
 - f. *Coil Entering Air WB Temperature*
 - g. *Supply Air DB Temperature*
 - h. *Supply Air WB Temperature*
 - i. *Fan Motor*
 - j. *Electrical Characteristics*
4. *[Gas] [Electrical] Heating Capacity [built-in with AHU]*
 - a. *Total Capacity [Btu/hr] or [Kw]*
 - b. *Number of steps*
 - c. *[Electrical Characteristics]*
 - d. *Minimum efficiency.*
5. *Condenser Unit Number [CU-#]*
Model Number
Total Cooling Capacity
Total Sensible Cooling Capacity
Total Heating Capacity] for heat-pumps
Energy Efficiency Ratio Ratings [SEER] or [EER]
Coefficient of Performance [COP] for heat-pumps
Electrical Characteristics
Refrigerant Vapor line size [#/#"]
Refrigerant Liquid line size [#/#"]

USPS CSF Specifications issued: 10/1/2013
Last revised: 9/4/2013

END OF SECTION



Task	Specification	Specification Description
23 81 43 00	23 81 13 00	Packaged Terminal Air Conditioners



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SECTION 23 82 16 00 - AIR COILS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for air coils. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following types of air coils that are not an integral part of air-handling units:
 - a. Hot-water.
 - b. Chilled-water.
 - c. Steam.
 - d. Refrigerant.
 - e. Electric.

C. Submittals

1. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each air coil. Include rated capacity and pressure drop for each air coil.
2. Shop Drawings: Diagram power, signal, and control wiring.
3. Field quality-control test reports.
4. Operation and maintenance data.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. ASHRAE Compliance:
 - a. Comply with ASHRAE 15 for refrigeration system safety.
 - b. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
 - c. Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

1.2 PRODUCTS**A. Water Coils**

1. Performance Ratings: Tested and rated according to ARI 410 and ASHRAE 33.
2. Minimum Working-Pressure/Temperature Ratings: 200 psig (1380 kPa), 325 deg F (163 deg C).
3. Source Quality Control: Factory tested to 300 psig (2070 kPa).
4. Tubes: ASTM B 743 copper, minimum 0.020 inch (0.508 mm) **OR** 0.035 inch (0.889 mm) **OR** 0.049 inch (1.245 mm), **as directed**, thick.
5. Fins: Aluminum **OR** Copper, **as directed**, minimum 0.006 inch (0.152 mm) **OR** 0.010 inch (0.254 mm), **as directed**, thick.
6. Headers: Cast iron with drain and air vent tappings **OR** Cast iron with cleaning plugs, and drain and air vent tappings **OR** Seamless copper tube with brazed joints, prime coated **OR** Steel with brazed joints, prime coated, **as directed**.
7. Frames: Galvanized-steel channel frame, minimum 0.052 inch (1.3 mm) **OR** 0.064 inch (1.6 mm) **OR** 0.079 inch (2.0 mm) **OR** 0.0625 inch (1.6 mm), **as directed**, thick for slip-in **OR** flanged, **as directed**, mounting.

OR

Frames: ASTM A 666, Type 304 **OR** 316, **as directed**, stainless steel, minimum 0.0625 inch (1.6 mm) thick for slip-in **OR** flanged, **as directed**, mounting.

8. Hot-Water Coil and Steam Coil, Face-and-Bypass Dampers: Alternating arrangement of coil segments and dampers.
 - a. Coil Configuration: Horizontal **OR** Vertical, **as directed**, tubes.
 - b. Dampers: Extruded-aluminum **OR** Galvanized-steel, **as directed**, blades with edge and end seals; full-length drive rod and mount for actuator in **OR** outside, **as directed**, the airstream.

B. Steam Coils

1. Performance Ratings: Tested and rated according to ARI 410 and ASHRAE 33.
2. Minimum Working-Pressure/Temperature Ratings: 100 psig (690 kPa), 400 deg F (204 deg C).
3. Source Quality Control: Factory tested to 300 psig (2070 kPa).
4. Tubes: ASTM B 743 copper, minimum 0.025 inch (0.635 mm) **OR** 0.035 inch (0.889 mm) **OR** 0.049 inch (1.245 mm), **as directed**, thick.
5. Fins: Aluminum **OR** Copper, **as directed**, minimum 0.006 inch (0.152 mm) **OR** 0.010 inch (0.254 mm), **as directed**, thick.
6. Headers: Cast iron with drain and air vent tapings **OR** Cast iron with cleaning plugs, and drain and air vent tapings **OR** Seamless copper tube with brazed joints, prime coated **OR** Steel with brazed joints, prime coated, **as directed**.
7. Tube Type: Single or distributing as indicated.
8. Frames: Galvanized-steel channel frame, minimum 0.052 inch (1.3 mm) **OR** 0.064 inch (1.6 mm) **OR** 0.079 inch (2.0 mm) **OR** 0.0625 inch (1.6 mm), **as directed**, thick for slip-in **OR** flanged, **as directed**, mounting.

OR

Frames: ASTM A 666, Type 304 **OR** 316, **as directed**, stainless steel, minimum 0.0625 inch (1.6 mm) thick for slip-in **OR** flanged, **as directed**, mounting.

9. Face-and-Bypass Dampers: Alternating arrangement of coil segments and dampers.
 - a. Coil Configuration: Horizontal **OR** Vertical, **as directed**, tubes.
 - b. Dampers: Extruded-aluminum **OR** Galvanized-steel, **as directed**, blades with edge and end seals; full-length drive rod and mount for actuator in **OR** outside, **as directed**, the airstream.

C. Refrigerant Coils

1. Performance Ratings: Tested and rated according to ARI 410 and ASHRAE 33.
2. Minimum Working-Pressure Rating: 300 psig (2070 kPa).
3. Source Quality Control: Factory tested to 450 psig (3105 kPa).
4. Tubes: ASTM B 743 copper, minimum 0.020 inch (0.508 mm) **OR** 0.035 inch (0.889 mm) **OR** 0.049 inch (1.245 mm), **as directed**, thick.
5. Fins: Aluminum **OR** Copper, **as directed**, minimum 0.006 inch (0.152 mm) **OR** 0.010 inch (0.254 mm), **as directed**, thick.
6. Suction and Distributor Piping: ASTM B 88, Type L (ASTM B 88M, Type B) copper tube with brazed joints.
7. Frames: Galvanized-steel channel frame, minimum 0.052 inch (1.3 mm) **OR** 0.064 inch (1.6 mm) **OR** 0.079 inch (2.0 mm) **OR** 0.0625 inch (1.6 mm), **as directed**, thick for slip-in **OR** flanged, **as directed**, mounting.

OR

Frames: ASTM A 666, Type 304 **OR** 316, **as directed**, stainless steel, minimum 0.0625 inch (1.6 mm) thick for slip-in **OR** flanged, **as directed**, mounting.

D. Electric Coils

1. Coil Assembly: Comply with UL 1995.

2. Heating Elements: Coiled resistance wire of 80 percent nickel and 20 percent chromium; surrounded by compacted magnesium-oxide powder in tubular-steel sheath; with spiral-wound, copper-plated, steel fins continuously brazed to sheath.
OR
Heating Elements: Open-coil resistance wire of 80 percent nickel and 20 percent chromium, supported and insulated by floating ceramic bushings recessed into casing openings, and fastened to supporting brackets.
3. High-Temperature Coil Protection: Disk-type, automatically reset, thermal-cutout, safety device; serviceable through terminal box without removing heater from duct or casing.
 - a. Secondary Protection: Load-carrying, manually reset or manually replaceable, thermal cutouts; factory wired in series with each heater stage.
4. Frames: Galvanized-steel channel frame, minimum 0.052 inch (1.3 mm) **OR** 0.064 inch (1.6 mm) **OR** 0.079 inch (2.0 mm) **OR** 0.0625 inch (1.6 mm), **as directed**, thick for slip-in **OR** flanged, **as directed**, mounting.
5. Control Panel: Unit **OR** Remote, **as directed**, mounted with disconnecting means and overcurrent protection. Include the following controls:
 - a. Magnetic contactor.
 - b. Mercury contactor.
 - c. Toggle switches; one per step.
 - d. Step controller.
 - e. Time-delay relay.
 - f. Pilot lights; one per step.
 - g. Airflow proving switch.
6. Refer to Division 23 Section "Instrumentation And Control For Hvac" for thermostat.
OR
Thermostats: Wall-mounted thermostats, with temperature range from 50 to 90 deg F (10 to plus 32 deg C), and 2.5 deg F (1.4 deg C) throttling range.

1.3 EXECUTION

A. Installation

1. Install coils level and plumb.
2. Install coils in metal ducts and casings constructed according to SMACNA's "HVAC Duct Construction Standards, Metal and Flexible."
3. Install galvanized-steel **OR** stainless-steel, **as directed**, drain pan under each cooling coil.
 - a. Construct drain pans with connection for drain; insulated and complying with ASHRAE 62.1, **as directed**.
 - b. Construct drain pans to extend beyond coil length and width and to connect to condensate trap and drainage.
 - c. Extend drain pan upstream and downstream from coil face.
 - d. Extend drain pan under coil headers and exposed supply piping.
4. Install moisture eliminators for cooling coils. Extend drain pan under moisture eliminator.
5. Straighten bent fins on air coils.
6. Clean coils using materials and methods recommended in writing by manufacturers, and clean inside of casings and enclosures to remove dust and debris.

B. Connections

1. Piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install piping adjacent to coils to allow service and maintenance.
3. Connect water piping with unions and shutoff valves to allow coils to be disconnected without draining piping. Control valves are specified in Division 23 Section "Instrumentation And Control For Hvac", and other piping specialties are specified in Division 23 Section "Hydronic Piping".
4. Connect steam piping with gate valve and union and steam condensate piping with union, strainer, trap, and gate valve to allow coils to be disconnected without draining piping. Control



valves are specified in Division 23 Section "Instrumentation And Control For Hvac", and other piping specialties are specified in Division 23 Section "Steam And Condensate Heating Piping".

5. Connect refrigerant piping according to Division 23 Section "Refrigerant Piping".
6. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
7. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

C. Field Quality Control

1. Perform the following field tests and inspections and prepare test reports:
 - a. Operational Test: After electrical circuitry has been energized, operate electric coils to confirm proper unit operation.
 - b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION 23 82 16 00



Task	Specification	Specification Description
23 82 19 00	23 64 16 16	Fan-Coil Units



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SECTION 23 82 29 00 - CONVECTION HEATING UNITS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for convection heating units. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Hydronic, Steam, and Electric baseboard radiators.
 - b. Hydronic, Steam, and Electric finned-tube radiators.
 - c. Hydronic, Steam, and Electric convectors.
 - d. Flat-pipe steel radiators.

C. Submittals

1. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each type of product indicated.
2. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Field quality-control test reports.
4. Operation and maintenance data.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.2 PRODUCTS**A. Electric Baseboard Radiators**

1. Description: Factory-packaged units constructed according to UL 499, UL 1030, and UL 2021.
2. Heating Elements: Nickel-chromium-wire heating element enclosed in metallic sheath mechanically bonded to fins, with high-temperature cutout and sensor running the full length of the element. Element supports shall eliminate thermal expansion noise.
3. Enclosures: Minimum 0.0329-inch- (0.85-mm-) **OR** 0.0428-inch- (1.1-mm-), **as directed**, thick steel, removable front cover.
4. Rust-Resistant Enclosures: Minimum 0.040-inch- (1.0-mm-) **OR** 0.052-inch- (1.3-mm-), **as directed**, thick ASTM A 653/A 653M, G60 galvanized-steel, removable front cover.
 - a. Full-height back.
 - b. Full-length damper.
 - c. End panel.
 - d. Plastic end **OR** End, **as directed**, caps.
 - e. Inside and outside corners.
 - f. Joiner pieces to snap together.
 - g. Finish: Baked-enamel finish in manufacturer's standard **OR** custom, **as directed**, color as selected.
 - h. Element Brackets: Primed and painted steel to support front panel and element.
5. Unit Controls: Integral line-voltage thermostat **OR** Integral electronic thermostat **OR** Remote line-voltage thermostat, **as directed**.

6. Accessories:
 - a. Filler sections without a heating element matching the adjacent enclosure.
 - b. Straight-blade-type receptacles complying with DSCC W-C-596G/GEN, NEMA WD 1, NEMA WD 6, and UL 498; in color selected.

B. Hot-Water Baseboard Radiators

1. Performance Ratings: Rate baseboard radiators according to Hydronics Institute's "I=B=R Testing and Rating Standard for Baseboard Radiation."
2. Heating Elements: Copper tubing mechanically expanded into flanged collars of evenly spaced aluminum fins resting on polypropylene element glides. One end of tube shall be belled.
 - a. Tube Diameter: NPS 1/2 (DN 15) **OR** NPS 3/4 (DN 20) **OR** NPS 1 (DN 25) **OR** NPS 1-1/4 (DN 32), **as directed**.
 - b. Fin Size: 2-1/2 by 2-1/2 inches (63 by 63 mm) **OR** 3 by 3 inches (76 by 76 mm), **as directed**.
 - c. Fin Spacing: 40 per foot (131 per meter) **OR** 50 per foot (164 per meter) **OR** 58 per foot (190 per meter), **as directed**.
 - d. Entering Air Temperature: 65 deg F (18 deg C).
 - e. Average Water Temperature: 180 deg F (82 deg C).
 - f. Minimum Water Velocity: 1/2 fps (0.15 m/s).
 - g. Entering Steam Pressure: 1 psig (6.9 kPa).
3. Heating Elements: Steel tubing mechanically expanded into flanged collars of evenly spaced steel fins resting on polypropylene element glides. Tube ends shall be threaded.
 - a. Tube Diameter: NPS 1-1/4 (DN 32).
 - b. Fin Size: 3 by 3 inches (76 by 76 mm).
 - c. Fin Spacing: 52 per foot (171 per meter).
 - d. Entering Air Temperature: 65 deg F (18 deg C).
 - e. Average Water Temperature: 180 deg F (82 deg C).
 - f. Minimum Water Velocity: 1/2 fps (0.15 m/s).
 - g. Entering Steam Pressure: 1 psig (6.9 kPa).
4. Enclosures: Minimum 0.0329-inch- (0.85-mm-) **OR** 0.0428-inch- (1.1-mm-), **as directed**, thick steel, removable front cover.
5. Rust-Resistant Enclosures: Minimum 0.040-inch- (1.0-mm-) **OR** 0.052-inch- (1.3-mm-), **as directed**, thick ASTM A 653/A 653M, G60 galvanized-steel, removable front cover.
 - a. Full-height back.
 - b. Full-length damper.
 - c. End panel.
 - d. End caps.
 - e. Inside and outside corners.
 - f. Valve access door.
 - g. Joiner pieces to snap together.
 - h. Finish: Baked-enamel finish in manufacturer's standard **OR** custom, **as directed**, color as selected.
 - i. Element Brackets: Primed and painted steel to support front panel and element.

C. Electric Finned-Tube Radiators

1. Description: Factory-packaged units constructed according to UL 499, UL 1030, and UL 2021.
2. Heating Elements: Nickel-chromium-wire heating element enclosed in metallic sheath mechanically bonded into fins, with high-temperature cutout and sensor running the full length of the element. Element supports shall eliminate thermal expansion noise.
3. Front Panel: Minimum 0.0428-inch- (1.1-mm-) **OR** 0.0528-inch- (1.35-mm-), **as directed**, thick steel.
4. Rust-Resistant Front Panel: Minimum 0.052-inch- (1.3-mm-) **OR** 0.064-inch- (1.6-mm-), **as directed**, thick ASTM A 653/A 653M, G60 galvanized steel.
5. Wall-Mounting Back Panel: Minimum 0.0329-inch- (0.85-mm-) thick steel, full height, with full-length channel support for front panel without exposed fasteners.

6. Floor-Mounting Pedestals: Conceal conduit for power and control wiring at maximum 36-inch (914-mm) spacing. Pedestal-mounting back panel shall be solid panel matching front panel.
7. Support Brackets: Locate at maximum 36-inch (914-mm) spacing to support front panel and element.
8. Finish: Baked-enamel **OR** epoxy, **as directed**, finish in manufacturer's standard **OR** custom, **as directed**, color as selected.
9. Damper: Knob-operated internal damper at enclosure outlet.
10. Access Doors: Factory made, permanently hinged with tamper-resistant fastener, minimum size 6 by 7 inches (150 by 175 mm), integral with enclosure.
11. Enclosure Style: Sloped **OR** Flat, **as directed**, top.
 - a. Front Inlet Grille: Punched louver; painted to match enclosure.
 - b. Front Inlet Grille: Extruded-aluminum linear bar grille; pencil-proof bar spacing.
 - 1) Mill-finish aluminum.
 - 2) Anodized finish color as selected from manufacturer's standard **OR** custom, **as directed**, colors.
 - 3) Painted to match enclosure.
 - c. Top **OR** Front, **as directed**, Outlet Grille: Punched louver; painted to match enclosure.
 - d. Top **OR** Front, **as directed**, Outlet Grille: Extruded-aluminum linear bar grille; pencil-proof bar spacing.
 - 1) Mill-finish aluminum.
 - 2) Anodized finish color as selected from manufacturer's standard **OR** custom, **as directed**, colors.
 - 3) Painted to match enclosure.
12. Unit Controls: Integral line-voltage thermostat with minimum range of 60 to 90 deg F (15 to 32 deg C) **OR** low-voltage relay and control transformer for remote thermostat, **as directed**.
13. Accessories: Integral disconnect switch, filler sections, corners, relay sections, and splice plates all matching the enclosure and grille finishes.

D. Hot-Water Finned-Tube Radiators

1. Performance Ratings: Rate finned-tube radiators according to Hydronics Institute's "I=B=R Testing and Rating Standard for Finned-Tube (Commercial) Radiation."
2. Heating Elements: Copper tubing mechanically expanded into flanged collars of evenly spaced aluminum fins resting on element supports. One tube end shall be belled.
 - a. Tube Diameter: NPS 3/4 (DN 20) **OR** NPS 1 (DN 25) **OR** NPS 1-1/4 (DN 32), **as directed**.
 - b. Fin Size: 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm), **as directed**.
 - c. Fin Spacing: 40 per foot (131 per meter) **OR** 50 per foot (164 per meter) **OR** 58 per foot (190 per meter), **as directed**.
 - d. Entering Air Temperature: 65 deg F (18 deg C).
 - e. Average Water Temperature: 180 deg F (82 deg C).
 - f. Minimum Water Velocity: 1/2 fps (0.15 m/s).
 - g. Entering Steam Pressure: 1 psig (6.9 kPa).
3. Heating Elements: Steel tubing mechanically expanded into flanged collars of evenly spaced steel fins resting on element supports. Tube ends shall be threaded.
 - a. Tube Diameter: NPS 1-1/4 (DN 32).
 - b. Fin Size: 4 by 4 inches (102 by 102 mm).
 - c. Fin Spacing: 52 per foot (171 per meter).
 - d. Entering Air Temperature: 65 deg F (18 deg C).
 - e. Average Water Temperature: 180 deg F (82 deg C).
 - f. Minimum Water Velocity: 1/2 fps (0.15 m/s).
 - g. Entering Steam Pressure: 1 psig (6.9 kPa).
4. Element Supports: Ball-bearing cradle type to permit longitudinal movement on enclosure brackets.
5. Front Panel: Minimum 0.0428-inch- (1.1-mm-) **OR** 0.0528-inch- (1.35-mm-), **as directed**, thick steel.
6. Rust-Resistant Front Panel: Minimum 0.052-inch- (1.3-mm-) **OR** 0.064-inch- (1.6-mm-), **as directed**, thick, ASTM A 653/A 653M, G60 galvanized steel.



7. Wall-Mounting Back Panel: Minimum 0.0329-inch- (0.85-mm-) thick steel, full height, with full-length channel support for front panel without exposed fasteners.
8. Floor-Mounting Pedestals: Conceal insulated piping at maximum 36-inch (914-mm) spacing. Pedestal-mounting back panel shall be solid panel matching front panel. Provide stainless-steel escutcheon for floor openings at pedestals.
9. Support Brackets: Locate at maximum 36-inch (914-mm) spacing to support front panel and element.
10. Finish: Baked-enamel **OR** epoxy, **as directed**, finish in manufacturer's standard **OR** custom, **as directed** color as selected.
11. Damper: Knob-operated internal damper at enclosure outlet.
12. Access Doors: Factory made, permanently hinged with tamper-resistant fastener, minimum size 6 by 7 inches (150 by 175 mm), integral with enclosure.
13. Enclosure Style: Sloped **OR** Flat, **as directed**, top.
 - a. Front Inlet Grille: Punched louver; painted to match enclosure.
 - b. Front Inlet Grille: Extruded-aluminum linear bar grille; pencil-proof bar spacing.
 - 1) Mill-finish aluminum.
 - 2) Anodized finish, color as selected from manufacturer's standard **OR** custom, **as directed**, colors.
 - 3) Painted to match enclosure.
 - c. Top **OR** Front, **as directed**, Outlet Grille: Punched louver; painted to match enclosure.
 - d. Top **OR** Front, **as directed**, Outlet Grille: Extruded-aluminum linear bar grille; pencil-proof bar spacing.
 - 1) Mill-finish aluminum.
 - 2) Anodized finish, color as selected from manufacturer's standard **OR** custom, **as directed**, colors.
 - 3) Painted to match enclosure.
14. Accessories: Filler sections, corners, relay sections, and splice plates all matching the enclosure and grille finishes.

E. Electric Convector

1. Description: Factory-packaged units constructed according to UL 499, UL 1030, and UL 2021.
2. Heating Elements: Nickel-chromium-wire heating element enclosed in metallic sheath mechanically bonded into fins, with high-temperature cutout and sensor running the full length of element. Element supports shall eliminate thermal expansion noise.
 - a. Heat Output: 300 **OR** 500 **OR** 750 **OR** 1000 **OR** 1250 **OR** 1500 **OR** 1750 **OR** 2000 **OR** 2250 **OR** 2500, **as directed**, W.
3. Front and Top Panel: Minimum 0.0528-inch- (1.35-mm-) **OR** 0.0677-inch- (1.7-mm-), **as directed** thick steel with exposed corners rounded; removable front panels with tamper-resistant fasteners braced and reinforced for stiffness.
4. Wall-Mounting Back and End Panels: Minimum 0.0428-inch- (1.1-mm-) thick steel.
5. Floor-Mounting Pedestals: Conceal conduit for power and control wiring at maximum 36-inch (914-mm) spacing. Pedestal-mounting back panel shall be solid panel matching front panel.
6. Support Brackets: Locate at maximum 36-inch (914-mm) spacing to support front panel and element.
7. Insulation: 1/2-inch- (13-mm-) thick, fibrous glass on inside of the back of the enclosure.
8. Finish: Baked-enamel finish in manufacturer's standard **OR** custom, **as directed**, color as selected.
9. Damper: Knob-operated internal damper.
10. Access Doors: Factory made, permanently hinged with tamper-resistant fastener, minimum size 6 by 7 inches (150 by 175 mm), integral with enclosure.
11. Enclosure Style: Sloped **OR** Flat, **as directed**, top.
 - a. Front Inlet Grille: Punched louver; painted to match enclosure.
 - b. Front Inlet Grille: Extruded-aluminum linear bar grille; pencil-proof bar spacing.
 - 1) Mill-finish aluminum.

- 2) Anodized finish, color as selected from manufacturer's standard **OR** custom, **as directed**, colors.
 - 3) Painted to match enclosure.
 - c. Top **OR** Front, **as directed**, Outlet Grille: Punched louver; painted to match enclosure.
 - d. Top **OR** Front, **as directed**, Outlet Grille: Extruded-aluminum linear bar grille; pencil-proof bar spacing.
 - 1) Mill-finish aluminum.
 - 2) Anodized finish, color as selected from manufacturer's standard **OR** custom, **as directed**, colors.
 - 3) Painted to match enclosure.
12. Unit Controls: Integral line-voltage thermostat with minimum range of 60 to 90 deg F (15 to 32 deg C) **OR** low-voltage relay and control transformer for remote thermostat, **as directed**.
13. Accessories: Integral disconnect switch, recessing flanges finished to match enclosure or overlapping front cover for fully recessed units, and rubber gaskets to seal cabinet at wall.

F. Hot-Water Or Steam Convectors

1. Convector Elements: Seamless copper tubing mechanically expanded into evenly spaced aluminum fins and rolled into cast-iron or brass headers with inlet/outlet and air vent; steel side plates and supports. Factory-pressure-test element at minimum 100 psig (690 kPa).
 - a. Entering Air Temperature: 65 deg F (18 deg C).
 - b. Average Water Temperature: 180 deg F (82 deg C).
 - c. Temperature Drop: 10 deg F (5.56 deg C) **OR** 20 deg F (11.1 deg C) **OR** 30 deg F (16.6 deg C), **as directed**.
 - d. Entering Steam Pressure: 1 psig (6.9 kPa).
2. Front and Top Panel: Minimum 0.0528-inch- (1.35-mm-) **OR** 0.0677-inch- (1.7-mm-), **as directed**, thick steel with exposed corners rounded; removable front panels with tamper-resistant fasteners braced and reinforced for stiffness.
3. Wall-Mounting Back and End Panels: Minimum 0.0428-inch- (1.1-mm-) thick steel.
4. Floor-Mounting Pedestals: Conceal conduit for power and control wiring at maximum 36-inch (914-mm) spacing. Pedestal-mounting back panel shall be solid panel matching front panel.
5. Support Brackets: Locate at maximum 36-inch (914-mm) spacing to support front panel and element.
6. Insulation: 1/2-inch- (13-mm-) thick, fibrous glass on inside of the back of the enclosure.
7. Finish: Baked-enamel finish in manufacturer's standard **OR** custom, **as directed** color as selected.
8. Damper: Knob-operated internal damper.
9. Access Doors: Factory made, permanently hinged with tamper-resistant fastener, minimum size 6 by 7 inches (150 by 175 mm), integral with enclosure.
10. Enclosure Style: Sloped **OR** Flat, **as directed**, top.
 - a. Front Inlet Grille: Punched louver; painted to match enclosure.
 - b. Front Inlet Grille: Extruded-aluminum linear bar grille; pencil-proof bar spacing.
 - 1) Mill-finish aluminum.
 - 2) Anodized finish, color as selected from manufacturer's standard **OR** custom, **as directed**, colors.
 - 3) Painted to match enclosure.
 - c. Top **OR** Front, **as directed**, Outlet Grille: Punched louver; painted to match enclosure.
 - d. Top **OR** Front, **as directed**, Outlet Grille: Extruded-aluminum linear bar grille; pencil-proof bar spacing.
 - 1) Mill-finish aluminum.
 - 2) Anodized finish, color as selected from manufacturer's standard **OR** custom, **as directed**, colors.
 - 3) Painted to match enclosure.

G. Flat-Pipe Steel Radiators

1. Heating Elements: Steel, welded and formed into flat, square, steel header with minimum thickness of 0.109 inches (2.76 mm). Include threaded piping and air vent connections.

- a. Working Pressure 56 psig (386 kPa): 0.048 inch (1.22 mm).
 - b. Working Pressure 85 psig (585 kPa): 0.058 inch (1.47 mm).
 - c. Working Pressure 128 psig (881 kPa): 0.078 inch (1.98 mm).
 - d. Room Air Temperature: 65 deg F (18 deg C).
 - e. Average Water Temperature: 180 deg F (82 deg C).
 - f. Temperature Drop: 10 deg F (5.56 deg C) **OR** 20 deg F (11.1 deg C) **OR** 30 deg F (16.6 deg C), **as directed**.
2. Mounting: Wall brackets **OR** Floor pedestals, **as directed**, on maximum spacing of 36 inches (914 mm).
 3. Finish: Baked-enamel finish in manufacturer's standard **OR** custom, **as directed**, color as selected.
 4. Accessories:
 - a. Steel piping covers finished to match radiator finish.
 - b. Flexible Expansion Compensation Hoses: Minimum 400-psig (2758-kPa) working pressure, and operating temperatures from 33 to 211 deg F (0.5 to 99.5 deg C).
 - 1) Length: 24 inches (600 mm) **OR** 36 inches (900 mm), **as directed**.
 - 2) Minimum Diameter: Equal to connection size.

1.3 EXECUTION

- A. Baseboard Radiator Installation
 1. Install units level and plumb.
 2. Install baseboard radiators according to Guide 2000 - Residential Hydronic Heating.
 3. Install enclosure continuously around corners, using outside and inside corner fittings.
 4. Join sections with splice plates and filler pieces to provide continuous enclosure.
 5. Install access doors for access to valves.
 6. Install enclosure continuously from wall to wall.
 7. Terminate enclosures with manufacturer's end caps except where enclosures are indicated to extend to adjoining walls.
 8. Install valves within reach of access door provided in enclosure.
 9. Install air-seal gasket between wall and recessing flanges or front cover of fully recessed unit.
 10. Install piping within pedestals for freestanding units.
- B. Finned-Tube Radiator Installation
 1. Install units level and plumb.
 2. Install finned-tube radiators according to Guide 2000 - Residential Hydronic Heating.
 3. Install enclosure continuously around corners, using outside and inside corner fittings.
 4. Join sections with splice plates and filler pieces to provide continuous enclosure.
 5. Install access doors for access to valves.
 6. Install enclosure continuously from wall to wall.
 7. Terminate enclosures with manufacturer's end caps, except where enclosures are indicated to extend to adjoining walls.
 8. Install valves within reach of access door provided in enclosure.
 9. Install air-seal gasket between wall and recessing flanges or front cover of fully recessed unit.
 10. Install piping within pedestals for freestanding units.
- C. Convector Installation
 1. Install units level and plumb.
 2. Install valves within reach of access door provided in enclosure.
 3. Install air-seal gasketing between wall and recessing flanges or front cover of fully recessed unit.
 4. Install piping within pedestals for freestanding units.
- D. Flat-Pipe Steel Radiator Installation
 1. Install units level and plumb.

2. Install expansion compensation hoses.
3. Install piping covers.

E. Connections

1. Piping installation requirements are specified in Division 23 Section(s) "Hydronic Piping" OR "Steam And Condensate Heating Piping", **as applicable**. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Connect hot-water units and components to piping according to Division 23 Section "Hydronic Piping".
 - a. Install shutoff valves on inlet and outlet, and balancing valve on outlet.
3. Connect steam units and components to piping according to Division 23 Section "Steam And Condensate Heating Piping".
 - a. Install shutoff valve on inlet; install strainer, steam trap, and shutoff valve on outlet.
4. Install control valves as required by Division 23 Section "Instrumentation And Control For Hvac".
5. Install piping adjacent to convection heating units to allow service and maintenance.
6. Ground electric convection heating units according to Division 26 Section "Grounding And Bonding For Electrical Systems".
7. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

F. Field Quality Control

1. Perform the following field tests and inspections and prepare test reports:
 - a. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - b. Operational Test: After electrical circuitry has been energized, start units to confirm proper convection heating unit operation.
 - c. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Remove and replace convection heating units that do not pass tests and inspections and retest as specified above.

END OF SECTION 23 82 29 00



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Task	Specification	Specification Description
23 82 29 00	01 22 16 00	No Specification Required
23 82 33 00	01 22 16 00	No Specification Required
23 82 33 00	23 82 29 00	Convection Heating Units
23 82 36 00	01 22 16 00	No Specification Required
23 82 36 00	23 82 29 00	Convection Heating Units



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SECTION 23 82 39 00 - CSF UNIT HEATERS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Unit Heaters are part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.23 82 39 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Gas fired unit heaters.
 - 2. Electric unit heater.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 230500 - Common Work Results for HVAC:

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Data indicating rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
 - 2. Shop Drawings: Indicate assembly, required clearances, and locations and sizes of field connections.
 - 3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
- B. Section 017704 - Closeout Procedures and Requirements: Procedures for closeout submittals.
 - 1. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listing.

1.3 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 - 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.
- B. Regulatory Requirements:
 - 1. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Incorporated as suitable for the purpose specified and indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Gas-Fired Unit Heaters: Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 - 1. Reznor, Memphis, TN (800) 695-1901.
 - 2. Lennox Industries, Incorporated, Dallas, TX (972) 497-5000.
 - 3. Trane Company, Lacrosse, WI (608) 787-2000.
- B. Electric Unit Heaters: Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 - 1. Berko, Bennettsville, SC (800) 452-4179.
 - 2. Reznor, Memphis, TN (800) 695-1901.
 - 3. Lennox Industries, Incorporated, Dallas, TX (972) 497-5000.
 - 4. Trane Company, Lacrosse, WI (608) 787-2000.
 - 5. Q Mark, Bennettsville, SC (843) 479-4006.
- C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 GAS-FIRED UNIT HEATER

- A. Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heat exchanger, burner, controls, and accessories:
 - 1. Heating: [Natural gas fired] [Propane gas fired].
 - 2. Discharge Louvers: Individually adjustable horizontal [and vertical] louvers to match cabinet finish.
 - 3. Downturn Nozzle: [30] [60] degree nozzle to match outlet and cabinet finish.

4. Poly-Tube Outlet Adapter: Transition duct to adapt from unit outlet to round outlet flange for polyethylene tube duct.
 5. Air Filters: Filter cabinet with [1 inch (25 mm)] [2 inch (50 mm)] thick [urethane, washable] [glass fiber, disposable] type filters.
- B. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors, glass fiber insulation and reflective liner.
- C. Supply Fan: [Propeller] [Centrifugal forward curved] type with [direct] [belt] drive [, variable pitch motor pulley].
- D. Heat Exchanger: [Aluminized steel] [Type E-3 stainless steel] [Type 321 stainless steel] welded construction.
- E. Gas Burner:
1. Atmospheric type with adjustable combustion air supply,
 2. Gas valve[, two stage] provides 100 percent safety gas shut-off; 24 volt combining pressure regulation, safety pilot, manual set (On-Off), pilot filtration, automatic electric valve.
 3. Electronic pilot ignition, with [electric spark] [hot surface] igniter.
 4. [Combustion air damper] [Automatic vent damper] with synchronous spring return damper motor.
 5. Non-corrosive combustion air blower with permanently lubricated motor.
- F. Gas Burner Safety Controls:
1. Thermocouple sensor: Prevents opening of gas valve until pilot flame is proven and stops gas flow on ignition failure.
 2. Flame rollout switch: Installed on burner box and prevents operation.
 3. Vent safety shutoff sensor: Temperature sensor installed on draft hood and prevents operation, manual reset.
 4. Limit Control: Fixed stop at maximum permissible setting, de-energizes burner on excessive bonnet temperature, automatic resets.
- G. Operating Controls
1. Room Thermostat: Cycles burner to maintain room temperature setting.
 2. Supply Fan Control: Energize from bonnet temperature independent of burner controls, with adjustable timed off delay and fixed timed on delay, with manual switch for continuous fan operation. [Provide continuous low speed fan operation.]
- H. Performance:
1. Ratings: Energy Efficiency Rating (EER) not less than requirements of ASHRAE 90A; seasonal efficiency to ASHRAE 103.
 2. Refer to Furnace Schedule. Gas heating capacities are sea level ratings.
 3. Air Handling:
 - a. Air flow: [_____] cfm ([_____] L/s).
 - b. External static pressure: [_____] inch wg ([_____] Pa).
 - c. Motor:
 - 1) [_____] hp ([_____] kW) [two speed].
 - 2) [_____] volts, [single] [three] phase, 60 Hz.
 4. Heating Capacity:
 - a. Heating output: [_____] Btuh ([_____] W).
 - b. Heating input: [_____] Btuh ([_____] W).
 - c. Annual fuel utilization efficiency (AFUE): [_____] percent.
 - d. Gas heating capacities are sea level ratings.

2.3 ELECTRIC UNIT HEATERS



- A. Description: Electric unit heater for suspended mounting, with fan forced air distribution over electric resistance heating coils and horizontal discharge.
- B. Input Voltage: [120] [208] [240] [277] [480] [_____] volts, 60 Hz, [single] [three] phase.
- C. Output Rating: [_____] kW, [_____] cu ft/min.
- D. Heating Element: [Enclosed copper tube, aluminum finned element of coiled nickel-chrome resistance wire centered in tubes and embedded in refractory material.] [Exposed helical coil of nickel-chrome resistance wire with refractory ceramic support bushings.] [_____].
- E. Input Fuses: Provide integral fuses for units rated more than 48 amperes full load.
- F. Provide line voltage disconnect switch for each input circuit.
- G. Fabrication: Fabricate cabinet of [heavy welded steel.] [_____].
- H. Provide [hinged and latched] [captive-screw held] panel for electrical connection and control compartment.
- I. Provide internal shroud around heating elements to assure uniform air flow and delivery temperature across heater face.
- J. Provide suitable fan blade protection using wire guard.
- K. Cabinet Finish: [Use corrosion-resisting primer and finish with [beige] [_____] baked enamel.] [_____].
- L. Contactor: Provide contactor control for unit.
- M. Thermostat: Provide integral [line voltage] [low voltage] thermostat to [directly control heater element.] [control contactor.]
- N. Provide low voltage control transformer.
- O. Operating Stages: [One.] [Two.] [_____].
- P. Provide terminal blocks for power and control wiring connections.
- Q. Louver: Provide discharge louver with individually adjustable blades.
- R. Room Thermostat: [NEMA DC 15; heating only [single line] [double line] break line voltage thermostat with control point reset, [thermometer,] [fan selector switch,] [and] [indicator lamps.] [NEMA DC 3; heating only [single line] [double line] break low voltage thermostat with control point reset, [thermometer,] [fan selector switch,] [and] [indicator lamps.] [Model [_____] , manufactured by [_____].]
- S. Mounting Accessories: [_____].

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.

- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify that required utilities are available, in proper location, and ready for use.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION - GAS FIRED UNIT HEATERS

- A. Install in accordance with manufacturer's published instructions.
- B. Locate each unit in position indicated on Drawings.
- C. Install unit with sufficient clearance from adjacent construction, piping, ductwork, and other obstructions to allow access for service and maintenance.
- D. Support unit heaters from structure using construction details indicated on Drawings.
- E. Install gas fired units to NFPA 54.
- F. Provide vent connections to NFPA 211.

3.3 INSTALLATION - ELECTRIC UNIT HEATERS

- A. Install in accordance with [NFPA 90A] [and] [NFPA 90B].
- B. Install oil fired units to NFPA 31.
- C. Install [unit heaters] [packaged air units] with vibration isolation.
- D. Provide operating controls; refer to Section .
- E. Provide connection to electrical power systems; refer to Section

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Verify operation of each electric heating unit by measuring input voltage and current simultaneously for period of ten minutes of continuous operation.

NOTE TO SPECIFIER

*Coordinate the following items with Contract Drawings;
DRAWING COORDINATION ITEMS*

Drawings should indicate the following information related to this Section.



1. *Location of unit heaters with units drawn to scale.*
 2. *Cabinet details, showing support of units, and interface between cabinets and architectural finishes.*
 3. *Size and location of piping and ductwork connections to unit heaters.*
 4. *Piping schematics showing piping connections, valves, and specialties, including valves for isolating and balancing, thermometers, unions, and gages.*
 5. *Electrical connections*
 6. *Thermostat locations.*
 7. *Special supports and anchorages on floor plans and details of supports as required. Include special supports and bracing required to meet seismic conditions.*
- *****

USPS CSF Specifications issued: 10/1/2013
Last revised: 5/11/11

END OF SECTION



SECTION 23 82 39 00 - MPF UNIT HEATERS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cabinet unit heaters with centrifugal fans and hot-water coils.
 - 2. Propeller unit heaters with hot-water coils.
 - 3. Wall and ceiling heaters with propeller fans and electric-resistance heating coils.

1.2 SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each product indicated.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Plans, elevations, sections, and details.
 - 2. Location and size of each field connection.
 - 3. Equipment schedules to include rated capacities, furnished specialties, and accessories.
- C. Field quality-control test reports.
- D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 CABINET UNIT HEATERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Airtherm; a Mestek Company.
2. Berko Electric Heating; a division of Marley Engineered Products.
3. Carrier Corporation.
4. Chromalox, Inc.; a division of Emerson Electric Company.
5. Dunham-Bush, Inc.
6. Engineered Air Ltd.
7. Indeeco.
8. International Environmental Corporation.
9. Markel Products; a division of TPI Corporation.
10. Marley Electric Heating; a division of Marley Engineered Products.
11. McQuay International.
12. Ouellet Canada Inc.
13. QMark Electric Heating; a division of Marley Engineered Products.
14. Rosemex Products.
15. Trane.
16. USA Coil & Air.
17. <Insert manufacturer's name.>

- B. Description: A factory-assembled and -tested unit complying with ARI 440.

NOTE TO SPECIFIER

**** Retain subparagraph below for electric cabinet unit heaters.**

1. Comply with UL 2021.

- C. Coil Section Insulation: Glass-fiber insulation; surfaces exposed to airstream shall be aluminum-foil facing to prevent erosion of glass fibers.

1. Thermal Conductivity (k-Value): 0.26 Btu x in./h x sq. ft. at 75 deg F mean temperature.
2. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
3. Adhesive: Comply with ASTM C 916 and with NFPA 90A or NFPA 90B.

NOTE TO SPECIFIER

Retain paragraph and subparagraphs below for surface, semi-recessed, and fully recessed units. Cabinet is not required for concealed units.

- D. Cabinet: Steel with baked-enamel finish with manufacturer's standard paint, in color selected by Architect.

1. Vertical Unit, Exposed Front Panels: Minimum 0.0528-inch-thick, galvanized, sheet steel, removable panels with channel-formed edges secured with tamperproof cam fasteners.
2. Horizontal Unit, Exposed Bottom Panels: Minimum 0.0528-inch-thick, galvanized, sheet steel, removable panels secured with tamperproof cam fasteners and safety chain.
3. Recessing Flanges: Steel, finished to match cabinet.
4. Control Access Door: Key operated.
5. Base: Minimum 0.0528-inch-thick steel, finished to match cabinet, <Insert dimension> high with leveling bolts.

NOTE TO SPECIFIER

Verify available filter types with manufacturer. Indicate filter thickness in "Capacities and Characteristics" Paragraph in this Article or in the Cabinet Unit Heater Schedule on Drawings.

- E. Filters: Minimum arrestance according to ASHRAE 52.1 and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
1. Washable Foam: 70 percent arrestance and 3 MERV.
 2. Glass Fiber Treated with Adhesive: 80 percent arrestance and 5 MERV.
 3. Pleated: 90 percent arrestance and 7 MERV.

NOTE TO SPECIFIER

Retain one of first two paragraphs below.

- F. Hot-Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain.
- G. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with fuses in terminal box for overcurrent protection and limit controls for high-temperature protection. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.
- H. Fan and Motor Board: Removable.
1. Fan: Forward curved, double width, centrifugal; directly connected to motor. Thermoplastic or painted-steel wheels, and aluminum, painted-steel, or galvanized-steel fan scrolls.
 2. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 3. Wiring Terminations: Connect motor to chassis wiring with plug connection.

NOTE TO SPECIFIER

Retain first paragraph and applicable subparagraphs below to require factory-piping package.

- I. Factory, Hot-Water Piping Package: ASTM B 88, Type L copper tube with wrought-copper fittings and brazed joints. Label piping to indicate service, inlet and outlet.
1. Hose Kits: Minimum 400-psig working pressure, and operating temperatures from 33 to 211 deg F. Tag hose kits to equipment designations.
 - a. Minimum Diameter: Equal to cabinet unit heater connection size.
 2. Two-Piece, Ball Valves: Bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.
 3. Calibrated-Orifice Balancing Valves: Bronze body, ball type, 125-psig working pressure, 250 deg F maximum operating temperature; with calibrated orifice or venture, connection for portable differential pressure meter with integral seals, threaded ends, and equipped with a memory stop to retain set position.
 4. Y-Pattern, Hot-Water Strainers: Cast-iron body (ASTM A 126, Class B); 125-psig minimum working pressure; with threaded connections, bolted cover, perforated stainless-steel basket, and bottom drain connection. Include minimum NPS 1/2 threaded pipe and full-port ball valve in strainer drain connection.
 5. Wrought-Copper Unions: ASME B16.22.
- J. Control devices and operational sequences are specified in Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls."



NOTE TO SPECIFIER

Retain paragraph above and delete paragraph and subparagraphs below if controls are part of overall temperature-control system.

- K. Basic Unit Controls:
1. Control voltage transformer.
 2. Unit-mounted thermostat with the following features.
 - a. Heat-off switch.
 - b. Fan on-auto switch.

NOTE TO SPECIFIER

Retain first subparagraph below if multispeed motors are specified.

- c. Manual fan speed switch.
 - d. Adjustable deadband.
 - e. Concealed set point.
 - f. Deg F indication.
3. Unit-mounted temperature sensor.
4. Unoccupied period override push button.
5. Data entry and access port.
 - a. Input data includes room temperature, and occupied and unoccupied periods.
 - b. Output data includes room temperature, supply-air temperature, entering-water temperature, operating mode, and status.

- L. Electrical Connection: Factory wire motors and controls for a single field connection.

NOTE TO SPECIFIER

If Project has more than one type or configuration of heater, delete paragraph and subparagraphs below and schedule cabinet unit heaters on Drawings.

2.2 PROPELLER UNIT HEATERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Airtherm; a Mestek Company.
 2. Engineered Air Ltd.
 3. McQuay International.
 4. Rosemex Products.
 5. Ruffneck Heaters; a division of Lexa Corporation.
 6. Trane.
 7. <Insert manufacturer's name.>
- C. Description: An assembly including casing, coil, fan, and motor in **vertical or horizontal** discharge configuration with adjustable discharge louvers.

NOTE TO SPECIFIER

*** Retain subparagraph below for electric unit heaters.*

- D. Comply with UL 2021.



- E. Cabinet: Removable panels for maintenance access to controls.
- F. Cabinet Finish: Manufacturer's standard baked enamel applied to factory-assembled and -tested propeller unit heater before shipping.
- G. Discharge Louver: Adjustable fin diffuser for horizontal units and conical diffuser for vertical units.
- H. Hot-Water Coil: Test and rate hot-water propeller unit heater coils according to ASHRAE 33. Copper tube, minimum 0.025-inch wall thickness, with mechanically bonded aluminum fins spaced no closer than 0.1 inch and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 325 deg F, with manual air vent. Test for leaks to 350 psig underwater.
- I. Electric-Resistance Heating Elements: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in steel or corrosion-resistant metallic sheath with fins no closer than 0.16 inch. Element ends shall be enclosed in terminal box. Fin surface temperature shall not exceed 550 deg F at any point during normal operation.
 - 1. Circuit Protection: One-time fuses in terminal box for overcurrent protection and limit controls for high-temperature protection of heaters.
 - 2. Wiring Terminations: Stainless-steel or corrosion-resistant material.
- J. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.
- K. Fan Motors: Comply with requirements in "Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - 1. Motor Type: Permanently lubricated.

NOTE TO SPECIFIER

Delete first paragraph below if controls are part of control system specified in Division 23 Section "Instrumentation and Control for HVAC."

- L. Control Devices: Unit-mounted thermostat.

2.3 WALL AND CEILING HEATERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Berko Electric Heating; a division of Marley Engineered Products.
 - 2. Chromalox, Inc.; a division of Emerson Electric Company.
 - 3. Indeco.
 - 4. Markel Products; a division of TPI Corporation.
 - 5. Marley Electric Heating; a division of Marley Engineered Products.
 - 6. Ouellet Canada Inc.
 - 7. QMark Electric Heating; a division of Marley Engineered Products.
 - 8. Trane.
 - 9. <Insert manufacturer's name.>
- B. Description: An assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.
- C. Cabinet:
 - 1. Front Panel: Stamped-steel louver, with removable panels fastened with tamperproof fasteners.
 - 2. Finish: Baked enamel over baked-on primer with manufacturer's standard color selected by Architect, applied to factory-assembled and -tested wall and ceiling heaters before shipping.
- D. Surface-Mounting Cabinet Enclosure: Steel with finish to match cabinet.



- E. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high temperature protection.[Provide integral circuit breaker for overcurrent protection.]
- F. Fan: Aluminum propeller directly connected to motor.
 - 1. Motor: Permanently lubricated[, multispeed]. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
- G. Controls: Unit-mounted thermostat.[Low-voltage relay with transformer kit.]
- H. Electrical Connection: Factory wire motors and controls for a single field connection with disconnect switch.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install unit heaters to comply with NFPA 90A.

NOTE TO SPECIFIER

Edit supports below for facilities location in seismic zones.

- B. Suspend cabinet unit heaters from structure with elastomeric hangers [and seismic restraints]. Vibration isolators [and seismic restraints] are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
- C. Suspend propeller unit heaters from structure with all-thread hanger rods and [elastomeric hangers] [spring hangers] [spring hangers with vertical-limit stop]. Hanger rods and attachments to structure are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Vibration hangers are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

NOTE TO SPECIFIER

Retain paragraph below if controls are provided by unit heater manufacturer. To comply with requirements of the Americans with Disabilities Act, verify mounting height with authorities having jurisdiction

- D. Install wall-mounting thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

NOTE TO SPECIFIER

Retain first paragraph below for hot-water unit heaters.

- E. Unless otherwise indicated, install union and gate or ball valve on supply-water connection and union and calibrated balancing valve on return-water connection of unit heater.
- F. Install new filters in each fan-coil unit within two weeks of Substantial Completion.



- G. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- H. Install piping adjacent to machine to allow service and maintenance.
- I. Connect piping to cabinet unit heater's factory, hot-water piping package. Install the piping package if shipped loose.

NOTE TO SPECIFIER

Retain paragraph below for concealed cabinet unit heaters. Coordinate duct installation requirements with Drawings and with requirements specified in Division 23 Sections "Metal Ducts," and "Air Duct Accessories."

- *****
- J. Connect supply and return ducts to cabinet unit heaters with flexible duct connectors specified in Division 23 Section "Air Duct Accessories."
- *****

NOTE TO SPECIFIER

Retain first paragraph below for cabinet unit heaters with hot-water coils.

- *****
- K. Comply with safety requirements in UL 1995.
 - L. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
 - M. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

NOTE TO SPECIFIER

Retain first subparagraph below for units that have electric-resistance heating coils.

- *****
- 2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
 - 3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
 - B. Remove and replace malfunctioning units and retest as specified above.

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Last revised: 9/4/2013

END OF SECTION 23 82 39 00



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Task	Specification	Specification Description
23 82 39 13	01 22 16 00	No Specification Required
23 82 39 16	01 22 16 00	No Specification Required
23 82 39 19	01 22 16 00	No Specification Required
23 82 39 19	23 55 23 13	Radiant Heating and Cooling Units



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SECTION 23 83 13 00 - RADIANT-HEATING ELECTRIC CABLES**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for radiant-heating electric cables. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes electric heating cables for ceiling or floor radiant heating, snow and ice melting on pavement, and freezer-floor frost-heave prevention with the following electric heating cables:
 - a. Mineral insulated, series resistance.
 - b. Plastic insulated, series resistance.
 - c. Self-regulating, parallel resistance.

C. Submittals

1. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each type of product indicated.
 - a. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.
2. Shop Drawings: For electric heating cable. Include plans, sections, details, and attachments to other work.
 - a. Wiring Diagrams: Power, signal, and control wiring.
3. Field quality-control test reports.
4. Operation and Maintenance Data.
5. Warranty: Special warranty specified in this Section.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within 10 **OR** 15, **as directed**, years from date of Final Completion.

1.2 PRODUCTS**A. Mineral-Insulated, Series-Resistance Heating Cables**

1. Heating Element: Single- or dual-conductor resistor wire. Terminate with waterproof, factory-assembled nonheating leads with connectors at both ends.
2. Electrical Insulating Mineral: Magnesium oxide.
3. Cable Cover: Copper/nickel alloy and high-density polyethylene outer jacket, **as directed**.
4. Maximum Operating Temperature: 300 deg F (150 deg C).

B. Plastic-Insulated, Series-Resistance Heating Cables

1. Comply with UL 1673.
2. Heating Element: Single- or dual-stranded resistor wire. Terminate with waterproof, factory-assembled nonheating leads with connectors at both ends.

3. Electrical Insulating Jacket: Minimum 4.0-mil (0.10-mm) Kapton with silicone jacket or Tefzel.
4. Cable Cover: Aluminum braid and silicone or Hylar outer jacket, **as directed**.
5. Maximum Operating Temperature: 300 deg F (150 deg C).
6. Heating Cable Mats: Factory-fabricated cable and fiberglass or plastic mesh with uniform 1-1/2-inch (38-mm) **OR** 3-inch (76-mm), **as directed**, cable spacing, in 18-inch (457-mm) **OR** 36-inch (914-mm), **as directed**, widths.

C. Self-Regulating, Parallel-Resistance Heating Cables

1. Comply with UL 1673.
2. Heating Element: Pair of parallel No. 16 **OR** 18, **as directed**, AWG, tinned **OR** nickel-coated, **as directed**, stranded copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled nonheating leads with connectors at one end, and seal the opposite end watertight. Cable shall be capable of crossing over itself once without overheating.
3. Electrical Insulating Jacket: Flame-retardant polyolefin.
4. Cable Cover: Tinned-copper **OR** Stainless-steel, **as directed**, braid, and polyolefin outer jacket with UV inhibitor, **as directed**.
5. Maximum Operating Temperature (Power On): 150 deg F (65 deg C).
6. Heating Cable Mats: Factory-fabricated cable and fiberglass or plastic mesh with uniform 1-1/2-inch (38-mm) **OR** 3-inch (76-mm), **as directed**, cable spacing, in 18-inch (457-mm) **OR** 36-inch (914-mm), **as directed**, widths.
7. Maximum Operating Temperature: 300 deg F (150 deg C).

D. Controls

1. Refer to Division 23 Section(s) "Instrumentation And Control For Hvac" AND "Sequence Of Operations For Hvac Controls".
2. Wall-Mounting Thermostats for Ceiling and Floor Heating Cables:
 - a. Minimum temperature range from 50 to 90 deg F (10 to 32 deg C).
 - b. Manually operated with on-off switch.
3. Precipitation and Temperature Sensor for Snow Melting on Pavement:
 - a. Microprocessor-based **OR** Automatic, **as directed**, control with manual on, automatic, and standby/reset switch.
 - b. Precipitation and temperature sensors shall sense the surface conditions of pavement and shall be programmed to energize the cable as follows:
 - 1) Temperature Span: 34 to 44 deg F (1 to 7 deg C).
 - 2) Adjustable Delay Off Span: 30 to 90 minutes.
 - 3) Energize Cables: Following two-minute delay if ambient temperature is below set point and precipitation is detected.
 - 4) De-Energize Cables: On detection of a dry surface plus time delay.
 - c. Corrosion-proof and waterproof enclosure suitable for outdoor mounting, for controls and precipitation and temperature sensors.
 - d. Minimum 30-A contactor to energize cable or close other contactors.
 - e. Precipitation sensor shall be mounted in pavement.
 - f. Provide relay with contacts to indicate operational status, on or off, for interface with central HVAC control system workstation.

E. Accessories

1. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.

1.3 EXECUTION

A. Applications

1. Install the following types of electric heating cable for the applications described:
 - a. Ceiling Radiant Heating: Plastic-insulated, series-resistance **OR** Self-regulating, parallel-resistance, **as directed**, heating cable.
 - b. Floor Radiant Heating: Plastic-insulated, series-resistance **OR** Self-regulating, parallel-resistance, **as directed**, heating cable.
 - c. Snow and Ice Melting on Pavement: Mineral-insulated, series-resistance **OR** Plastic-insulated, series-resistance **OR** Self-regulating, parallel-resistance, **as directed**, heating cable.
 - d. Freezer-Floor Frost-Heave Prevention: Plastic-insulated, series-resistance **OR** Self-regulating, parallel-resistance, **as directed**, heating cable.
- B. Installation
 1. Install electric heating cable or mats across expansion, construction, and control joints according to manufacturer's written recommendations using cable protection conduit and slack cable to allow movement without damage to cable.
 2. Do not energize cables embedded in concrete or plaster until those assemblies are cured.
 3. Electric Heating Cable Installation for Ceiling Radiant Heating: Install heating cable with heat-conductive fill materials such as plaster, to ensure direct contact with finished radiant surfaces.
 4. Electric Heating Cable Installation for Floor Radiant Heating: Install heating cable with heat-conductive fill materials such as concrete, to ensure direct contact with finished radiant surfaces.
 5. Electric Heating Cable Installation for Snow and Ice Melting on Pavement:
 - a. Install heating cable with heat-conductive fill materials such as asphalt or concrete, to ensure direct contact with finished radiant surfaces.
 - b. Install cables or mats after applying bituminous binder course to lower base; ensure that second bituminous binder course is applied to cables before pouring finish topping.
 6. Electric Heating Cable Installation for Freezer-Floor Frost-Heave Prevention: Install electric heating cable below insulation in subsoil.
 7. Set field-adjustable switches and circuit-breaker trip ranges.
 8. Protect installed heating cables, including nonheating leads, from damage.
- C. Connections
 1. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 2. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
- D. Field Quality Control
 1. Testing: Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
 - a. Test cables for electrical continuity and insulation integrity before energizing.
 - b. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.
 2. Repeat tests for continuity, insulation resistance, and input power after applying finished surface on heating cables.
 3. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 23 83 13 00



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Task	Specification	Specification Description
23 83 13 00	07 72 56 00	Heat Tracing for Fire-Suppression Piping
23 83 13 00	07 72 56 00a	Heat Tracing for Plumbing Piping
23 83 13 00	07 72 56 00b	Heat Tracing for HVAC Piping
23 83 33 00	01 22 16 00	No Specification Required



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SECTION 23 84 13 00 - MPF HUMIDIFIERS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes self-contained humidifiers.

1.2 SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Detail fabrication and installation of humidifiers. Include piping details, plans, elevations, sections, details of components, manifolds, and attachments to other work.
 - 1. Include wiring diagrams.
- C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with ARI 640, "Commercial and Industrial Humidifiers."

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 SELF-CONTAINED HUMIDIFIERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Armstrong International, Inc.
 - 2. Carel USA, LLC.
 - 3. Carnes Co., Inc.
 - 4. Herrmidifier.
 - 5. Hygromatik; Spirax Sarco, Inc.
 - 6. Nortec Industries Inc.
- B. Electric-Resistance Heater Container: Cleanable, ASTM A 666, stainless steel. Comply with UL 499.
- C. Electrode Cylinder: Replaceable plastic assembly. Comply with UL 499.
- D. Manifold: ASTM A 666, Type stainless-steel tube extending across entire width of duct or plenum and equipped with mounting brackets on ends.
- E. Cabinet: Sheet metal enclosure for housing heater cylinder, electrical wiring, components, controls, and control panel. Enclosure shall include baked-enamel finish, hinged or removable access door, and threaded outlet in bottom of cabinet for drain piping.
- F. Control Panel:
 - 1. Factory-wired disconnect switch.
 - 2. Liquid-crystal display.
 - 3. Programmable keyboard.
 - 4. Set-point adjustment.
 - 5. Warning signal indicating end of replaceable cylinder[**or ionic bed insert**] life.
 - 6. Low-voltage, control circuit.
 - 7. Diagnostic, maintenance, alarm, and status features.
 - 8. High-water sensor to prevent overfilling.
- G. Controls:
 - 1. Microprocessor-based control system for modulating or cycling control, and start/stop and status monitoring for interface to central HVAC instrumentation and controls.
 - 2. Solenoid-fill and automatic drain valves to maintain water level and temper hot drain water.
 - 3. Field-adjustable timer to control drain cycle for flush duration and interval.
 - 4. Controls shall drain tanks if no demand for humidification for more than 72 hours.
 - 5. Conductivity-type level controls.
- H. Accessories:
 - 1. Airflow switch for preventing humidifier operation without airflow.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install humidifiers with required clearance for service and maintenance.
- B. Seal humidifier manifold duct or plenum penetrations with flange.
- C. Install humidifier manifolds in metal ducts and casings constructed according to SMACNA's "HVAC Duct Construction Standards, Metal and Flexible."
- D. Install stainless-steel drain pan under each manifold mounted in duct.

1. Construct drain pans with connection for drain; insulated
 2. Connect to condensate trap and drainage piping.
 3. Extend drain pan upstream and downstream from manifold a minimum distance recommended by manufacturer but not less than required by ASHRAE 62.1-2004.
- E. Install manifold supply piping pitched to drain condensate back to humidifier.
- F. Piping installation requirements are specified in other Division 22 and 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
1. Install piping adjacent to humidifiers to allow service and maintenance.
 2. Install shutoff valve, strainer, backflow preventer, and union in humidifier makeup line.
- G. Install electrical devices and piping specialties furnished by manufacturer but not factory mounted.
- H. Retain first four paragraphs below for gas-fired, self-contained humidifiers.
- I. Install piping from safety relief valves to nearest floor drain.
- J. Connect gas piping full size to steam-generator, gas-train inlet with union. Gas piping materials and specialties are specified in Division 23 Section "Fuel Gas Piping."
- K. Connect breeching full size to steam-generator outlet. Venting materials are specified in Division 23 Section "Breechings, Chimneys, and Stacks."
- L. Connect combustion-air inlet to intake terminal using PVC piping with solvent-cemented joints. Run from boiler connection to outside and terminate adjacent to flue termination.
- M. Ground equipment according to Division 26 Section "Grounding and Bonding."
- N. Connect wiring according to Division 26 Section "Conductors and Cables."

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace malfunctioning units and retest as specified above.

3.3 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain humidifiers.

END OF SECTION 23 84 13 00



Task	Specification	Specification Description
23 84 16 00	01 22 16 00	No Specification Required
23 84 16 00	23 76 13 00	Mechanical Dehumidification Units



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SECTION 25 05 04 00 - MPF BUILDING AUTOMATION SYSTEM (BAS) GENERAL

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.25 05 04 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes
 - 1. General Requirements
 - 2. Description of Work
 - 3. Quality Assurance
 - 4. System Architecture
 - 5. Distributed Processing Units/Quantity and Location
 - 6. Demolition and Reuse of Existing Materials and Equipment
 - 7. Sequence of Work
- B. Related documents
 - 1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
 - 2. Section 260500 – Common Work Results for Electrical
 - 3. Section 260533 – Raceway and Boxes for Electrical Systems
 - 4. Section 265100 – Interior Lighting
 - 5. Section 265600 – Exterior Lighting
 - 6. Section 260623 – Lighting Control Devices
 - 7. Section 270500 – Common Work Results for Communications
 - 8. Section 230500 – Common Work Results for HVAC
 - 9. Section 253004 – BAS Basic Materials, Interface Devices and Sensors
 - 10. Section 251104 - Metering Devices
 - 11. Section 251404 - BAS Equipment, Software and Programming

NOTE TO SPECIFIER

Select the following specification sections according to the project requirements

- 12. Section 255104 – EEMS Integration
- 13. Section 259004 – Sequence of Operation
- 14. Section 250804 – Building Automation System (BAS) Commissioning

1.2 DESCRIPTION OF WORK

- A. The Direct Digital Control (DDC) and Building Automation System (BAS) defined in this specification shall interface with the USPS EEMS Network, and shall utilize the BACnet communication requirements as defined by ASHRAE/ANSI 135-2004 for all communication. Towards this end, contractor shall provide a router/gateway(s) as necessary to facilitate all specified objects and services and have them configured/mapped as applicable.



- B. Contractor shall furnish and install a Direct Digital Control and Building Automation System. The new BAS shall utilize electronic sensing, microprocessor-based digital control, and electronic actuation of dampers and valves to perform control sequences and functions specified. The BAS for this project will generally consist of monitoring and control of systems listed below. Reference control drawings, sequences of operation, and points lists.

NOTE TO SPECIFIER

Describe scope of the project in first set of brackets [____]. Describe HVAC systems being controlled in second set of brackets [____].

- C. The systems to be controlled under work of this section basically comprise: []. The HVAC systems being controlled are: []. This Section and related sections defines the manner and method by which these controls function.

1.3 APPLICATION OF OPEN PROTOCOLS

- A. Subject to the detailed requirements provided throughout the specifications, the BAS and digital control and communications components installed, as work of this contract shall be an integrated distributed processing system utilizing BACnet. System components shall communicate using native BACnet in accordance with ASHRAE Standard 135 and current addenda and annexes, including all workstations, all building controllers, and all application specific controllers. Gateways to other communication protocols are not an acceptable solution and should only be used when communicating with a device or piece of equipment not provided by this contractor and/or only when directed by the Contracting officer.

1.4 QUALITY ASSURANCE

NOTE TO SPECIFIER

Use "A" to define any specific qualifications needed; otherwise leave "Reserved"

- A. Reserved
- B. All products used in this project shall be a current product under manufacture. Spare parts are to be available for a period of at least five years after project commissioning. The vendor shall have a stated policy of maintaining backward compatibility with previous versions of its product.
- C. Product Line Demonstrated History: The product line being proposed for the project must have an installed history of demonstrated satisfactory operation for a length of 2 years since date of final completion in at least 10 installations of comparative size and complexity. Submittals shall document this requirement with references.
- D. Installer's Qualifications: Firms specializing and experienced in control system installations for not less than 5 years. Firms with experience in DDC installation projects with point counts equal to this project and systems of the same character as this project. If installer is a Value Added Reseller (VAR) of a manufacturer's product, installer must demonstrate at least three years prior experience with that manufacturer's products. Experience starts with awarded Final Completion of previous projects. Submittals must document this experience with references.



- E. Installer's Experience with Proposed Product Line: Firms shall have specialized in and be experienced with the installation of the proposed product line for not less than one year from date of final completion on at least 3 projects of similar size and complexity. Submittals shall document this experience with references.
- F. Installer's Field Coordinator and Sequence Programmer Qualifications: Individual(s) shall specialize in and be experienced with control system installation for not less than 5 years. Proposed field coordinator shall have experience with the installation of the proposed product line for not less than 2 projects of similar size and complexity. Installer shall submit the names of the proposed individual and at least one alternate for each duty. Submittals shall document this experience with references. The proposed individuals must show proof of the following training:
 - 1. Product Line Training: Individuals overseeing the installation and configuration of the proposed product line must provide evidence of the most advanced training offered by the Manufacturer on that product line for installation and configuration
 - 2. Programming Training: Individuals involved with programming the site-specific sequences shall provide evidence of the most advanced programming training offered by the vendor of the programming application offered by the Manufacturer.
- G. Installer's Service Qualifications: The installer must be experienced in control system operation, maintenance and service. Installer must document a minimum 5 year history of servicing installations of similar size and complexity. Installer must also document at least a one year history of servicing the proposed product line.
- H. Installer's Response Time and Proximity
- I. Installer must maintain a fully capable service facility within a 30 [] mile radius of the project site. Service facility shall manage the emergency service dispatches and maintain the inventory of spare parts.
 - 1. Emergency response time should be within an hour. Installer must demonstrate the ability to meet the response times.

1.5 CODES AND STANDARDS

- A. The following codes and standard intended to apply as applicable as not all will apply to all installations
- B. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - 1. ASHRAE 135-2004 and all addenda: BACnet - A Data Communication Protocol for Building Automation and Control Networks. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. 2004 including all Addendums.
- C. Electronics Industries Alliance
 - 1. EIA-709.1-A-99: Control Network Protocol Specification
 - 2. EIA-709.3-99: Free-Topology Twisted-Pair Channel Specification
 - 3. EIA-232: Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange.
 - 4. EIA-458: Standard Optical Fiber Material Classes and Preferred Sizes
 - 5. EIA-485: Standard for Electrical Characteristics of Generator and Receivers for use in Balanced Digital Multipoint Systems.
 - 6. EIA-472: General and Sectional Specifications for Fiber Optic Cable
 - 7. EIA-475: Generic and Sectional Specifications for Fiber Optic Connectors and all Sectional Specifications
 - 8. EIA-573: Generic and Sectional Specifications for Field Portable Polishing Device for Preparation Optical Fiber and all Sectional Specifications
 - 9. EIA-590: Standard for Physical Location and Protection of Below-Ground Fiber Optic Cable Plant and all Sectional Specifications



- D. Underwriters Laboratories
 - 1. UL 916: Energy Management Systems.
- E. NEMA Compliance
 - 1. NEMA 250: Enclosure for Electrical Equipment
 - 2. NEMA ICS 1: General Standards for Industrial Controls.
- F. NFPA Compliance
 - 1. NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" where applicable to controls and control sequences.
 - 2. NFPA 70 National Electrical Code (NEC)
- G. Institute of Electrical and Electronics Engineers (IEEE)
 - 1. IEEE 142: Recommended Practice for Grounding of Industrial and Commercial Power Systems
 - 2. IEEE 802.3: CSMA/CD (Ethernet – Based) LAN
 - 3. IEEE 802.4: Token Bus Working Group (ARCNET – Based) LAN

1.6 DEFINITIONS

- A. Advanced Application Controller (AAC): A device with limited resources relative to the Building Controller (BC). It may support a level of programming and may also be intended for application-specific applications.
- B. Application Protocol Data Unit (APDU): A unit of data specified in an application protocol and consisting of application protocol control information and possible application user data (ISO 9545).
- C. Application Specific Controller (ASC): A device with limited resources relative to the Advanced Application Controller (AAC). It may support a level of programming and may also be intended for application-specific applications. .
- D. BACnet/BACnet Standard: BACnet communication requirements as defined by ASHRAE/ANSI 135-2004.
- E. BACnet Interoperability Building Blocks (BIBB): A BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBS are combined to build the BACnet functional requirements for a device in a specification.
- F. Binding: In the general sense, binding refers to the associations or mappings of the sources network variable and their intended opr required destinations.
- G. Building Automation System (BAS): The entire integrated management and control system.
- H. Building Controller (BC): A fully programmable device capable of carrying out a number of tasks including control and monitoring via direct digital control (DDC) of specific systems, acting as a communications router between the LAN backbone and sub-LANs, and data storage for trend information, time schedules, and alarm data.
- I. Change of Value (COV): An event that occurs when a measured or calculated analog value changes by a predefined amount (ASHRAE/ANSI 135-2004).
- J. Client: A device that is the requestor of services from a server. A client device makes requests of and receives responses from a server device.



- K. Continuous Monitoring: A sampling and recording of a variable based on time or change of state (e.g. trending an analog value, monitoring a binary change of state).
- L. Controller or Control Unit (CU): Intelligent stand-alone control panel. Controller is a generic reference and shall include BCs, AACs, and ASCs as appropriate.
- M. Control Systems Server (CSS): This shall be a computer (or computers) that maintains the system's configuration and programming database. This may double as an operator workstation.
- N. Direct Digital Control (DDC): Microprocessor-based control including Analog/Digital conversion and program logic.
- O. Enterprise Energy Management System (EEMS): The USPS Enterprise Energy management System is an existing Ethernet/Internet-based network based system connecting multiple facilities with a central data warehouse and server and, accessible via standard web-browser and Terminal Services.
- P. Functional Profile: A collection of variables required to define the key parameters for a standard application. As this applies to the HVAC industry, this would include applications like VAV terminal, fan coil units, and the like.
- Q. Gateway (GTWY): A device, which contains two or more dissimilar networks/protocols, permitting information exchange between them (ASHRAE/ANSI 135-2004).
- R. Hand Held Device (HHD): Manufacturer's microprocessor based device for direct connection to a Controller.
- S. IT LAN: Reference to the facility's Information Technology network, used for normal business-related e-mail and Internet communication.
- T. LAN Interface Device (LANID): Device or function used to facilitate communication and sharing of data throughout the BAS
- U. Local Area Network (LAN): General term for a network segment within the architecture. Various types and functions of LANs are defined herein.
- V. Local Supervisory LAN: Ethernet-based LAN connecting Primary Controller LANs with each other and OWs, CSSs and EEMS if specified. See System Architecture below. CAN BE THE PRIMARY CONTROLLING LAN.
- W. Master-Slave/Token Passing (MS/TP): Data link protocol as defined by the BACnet standard. (ASHRAE/ANSI 135-2004).
- X. Open Database Connectivity (ODBC): An open standard application-programming interface (API) for accessing a database developed. ODBC compliant systems make it possible to access any data from any application, regardless of which database management system (DBMS) is handling the data.
- Y. Operator Interface (OI): A device used by the operator to manage the BAS including OWs, POTs, and HHDs.
- Z. Operator Workstation (OWS): The user's interface with the BAS system. As the BAS network devices are stand-alone, the OWS is not required for communications to occur.
- AA. Point-to-Point (PTP): Serial communication as defined in the BACnet standard.
- BB. Portable Operators Terminal (POT): Laptop PC used both for direct connection to a controller and for remote dial up connection.



- CC. Protocol Implementation Conformance Statement (PICS): A written document, created by the manufacturer of a device, which identifies the particular options specified by BACnet that are implemented in the device (ASHRAE/ANSI 135-2004).
- DD. Primary Controlling LAN: High speed, peer-to-peer controller LAN connecting BCs and optionally AACs and ASCs. Refer to System Architecture below.
- EE. Router: A device that connects two or more networks at the network layer.
- FF. Secondary Controlling LAN: LAN connecting AACs and ASCs, generally lower speed and less reliable than the Primary Controlling LAN. Refer to System Architecture below.
- GG. Server: A device that is a provider of services to a client. A client device makes requests of and receives responses from a server device.
- HH. SQL: Standardized Query Language, a standardized means for requesting information from a database.
- II. XML (Extensible Markup Language): A specification developed by the World Wide Web Consortium. XML is a pared-down version of SGML, designed especially for Web documents. It allows designers to create their own customized tags, enabling the definition, transmission, validation, and interpretation of data between applications and between organizations.

1.7 FUNCTIONAL INTENT

- A. Throughout Sections 250504 through 251404, the BAS Sequences of Operation (Section 259004), and BAS System Commissioning (Section 250804) detailed requirements are specified, some of which indicate a means, method or configuration acceptable to meet that requirement. Contractor may submit products that utilize alternate means, methods, and configurations that meet the functional intent. However, these will only be allowed with prior approval before proposal submission.

1.8 SUBMITTALS

- A. Submit under provisions of Section 013300.
- B. Electronic Submittals: While all requirements for hard copy submittal apply, control submittals and O&M information shall also be provided in electronic format as follows.
 - 1. Drawings and Diagrams: Shop drawings shall be provided on electronic media as an AutoCAD 2004 or later version drawing file and/or Adobe Portable Document Format file. All 'x reference' and font files must be provided with AutoCAD files.
 - 2. Other Submittals: All other submittals shall be provided in Adobe Portable Document Format
- C. Qualifications: Manufacturer, Installer, and Key personnel qualifications as indicated for the appropriate item above.
- D. Product Data: Submit manufacturer's technical product data for each control device, panel, and accessory furnished, indicating dimensions, capacities, performance and electrical characteristics, and material finishes. Also include installation and start-up instructions.
- E. Shop Drawings: Submit shop drawings for each control system, including a complete drawing for each air handling unit, system, pump, device, etc. with all point descriptors, addresses and point names indicated. Each shop drawing shall contain the following information:
 - 1. System Architecture and System Layout:



- a. One-line diagram indicating schematic locations of all control units, workstations, LAN interface devices, gateways, etc. Indicate network number, device ID, address, device instance, drawing reference number, and controller type for each control unit. Indicate media, protocol, baud rate, and type of each LAN. All optical isolators, repeaters, end-of-line resistors, junctions, ground locations etc. shall be located on the diagram.
 - b. Provide floor plans locating all control units, workstations, servers, LAN interface devices, gateways, etc. Include all WAN and LAN communication wiring routing, power wiring, power originating sources, and low voltage power wiring. Indicate network number, device ID, address, device instance, and controller type for each control unit. Indicate media, protocol, baud rate, and type of each LAN. All optical isolators, repeaters, end-of-line resistors, junctions, ground locations etc. shall be located on the floor plans. Wiring routing as-built conditions shall be maintained accurately throughout the construction period and the drawing shall be updated to accurately reflect accurate, actual installed conditions.
 2. Schematic flow diagram of each air and water system showing fans, coils, dampers, valves, pumps, heat exchange equipment and control devices. Include verbal description of sequence of operation.
 3. All physical points on the schematic flow diagram shall be indicated with names, descriptors, and point addresses identified as listed in the point summary table.
 4. On each schematic, provide a point summary table listing building number and abbreviation, Ethernet backbone network number, network number, device ID, full point name, point description, , object ID (object type, instance number). See Section 251404 - Part III for additional requirements.
 5. Provide as a separate table a listing of each BACnet object to include Device ID, object ID description, alarm value, for each I/O, virtual and calculated point
 6. Label each control device with setting or adjustable range of control.
 7. Label each input and output with the appropriate range.
 8. Provide a Bill of Materials with each schematic. Indicate device identification to match schematic and actual field labeling, quantity, actual product ordering number, manufacturer, description, size, voltage range, pressure range, temperature range, etc. as applicable.
 9. With each schematic, provide valve and actuator information including size, Cv, design flow, design pressure drop, manufacturer, model number, close off rating, etc. Indicate normal positions of spring return valves and dampers.
 10. Indicate all required electrical wiring. Electrical wiring diagrams shall include both ladder logic type diagram for motor starter, control, and safety circuits and detailed digital interface panel point termination diagrams with all wire numbers and terminal block numbers identified. Provide panel termination drawings on separate drawings. Ladder diagrams shall appear on system schematic. Clearly differentiate between portions of wiring, which are existing, factory-installed and portions to be field-installed.
 11. Sheets shall be consecutively numbered.
 12. Each sheet shall have a title indicating the type of information included and the HVAC system controlled.
 13. Table of Contents listing sheet titles and sheet numbers.
 14. Legend and list of abbreviations.
 15. Memory allocation projections.
 16. Submit along with shop drawings but under separate cover calculated and guaranteed system response times of the most heavily loaded LAN in the system.
- F. Open Protocol Information
1. BACnet Systems:
 - a. BACnet object description, object ID, and device ID, for each I/O point.
 - b. Documentation for any non-standard BACnet objects, properties, or enumerations used detailing their structure, data types, and any associated lists of enumerated values.



- c. Submit PICS indicating the BACnet functionality and configuration of each controller.
- G. Framed Control Drawings: Laminated control drawings including system control schematics, sequences of operation and panel termination drawings, shall be provided in panels for major pieces of equipment. Terminal unit drawings shall be located in the central plant equipment panel or mechanical room panel.
- H. Control Logic Documentation
 - 1. Submit control logic program listings (for graphical programming) and logic flow charts illustrating (for line type programs) to document the control software of all control units.
 - 2. Control logic shall be annotated to describe how it accomplishes the sequence of operation. Annotations shall be sufficient to allow an operator to relate each program component (block or line) to corresponding portions of the specified Sequence of Operation.
 - 3. Include written description of each control sequence.
 - 4. Include control response, settings, setpoints, throttling ranges, gains, reset schedules, adjustable parameters and limits.
 - 5. Sheets shall be consecutively numbered.
 - 6. Each sheet shall have a title indicating the controller designations and the HVAC system controlled.
 - 7. Include Table of Contents listing sheet titles and sheet numbers
 - 8. Submit one complete set of programming and operating manuals for all digital controllers concurrently with control logic documentation. This set will count toward the required number of Operation and Maintenance materials specified below and in Section 017704.
- I. Operation and Maintenance Materials:
 - 1. Submit documents under provisions of Section 013300. One copy of the materials shall be delivered directly to the USPS facilities operation staff, in addition to the copies required by other Sections.
 - 2. Submit maintenance instructions and spare parts lists for each type of control device, control unit, and accessory.
 - 3. Submit BAS User's Guides (Operating Manuals) for each controller type and for all workstation hardware and software and workstation peripherals.
 - 4. Submit BAS advanced Programming Manuals for each controller type and for all workstation software.
 - 5. Include all submittals (product data, shop drawings, control logic documentation, hardware manuals, software manuals, installation guides or manuals, maintenance instructions and spare parts lists) in maintenance manual; in accordance with requirements of Division 1.
 - 6. Submit listing required preventative and predictive maintenance tasks required for all equipment furnished, network and system health monitoring and activities. For each item listed, provide specific task instructions, acceptance criteria and recommended task frequency.
 - 7. Submit schedule of planned maintenance tasks to be completed by the vendor during the warranty period specified below.
- J. Controls contractor shall provide to the USPS with all product line technical manuals and technical bulletins, to include new and upgraded products, by the same distribution channel as to dealers or branches. This service will be provided for 5 years as part of the contract price, and will be offered to the USPS thereafter for the same price as to a dealer or branch.
- K. Manufacturers Certificates: For all listed and/or labeled products, provide certificate of conformance.
- L. Product Warranty Certificates: submit manufacturers product warranty certificates covering the hardware provided.



1.9 PROJECT RECORD DOCUMENTS

- A. Submit documents under provisions of Section 013300.
- B. Record copies of product data and control shop drawings updated to reflect the final installed condition.
- C. Record copies of approved control logic programming and database on paper and on CD's. Accurately record actual setpoints and settings of controls, final sequence of operation, including changes to programs made after submission and approval of shop drawings and including changes to programs made during specified testing.
- D. Record copies of approved project specific graphic software on CDs.
- E. Record copies shall include individual floor plans with controller locations with all interconnecting wiring routing including space sensors, LAN wiring, power wiring, low voltage power wiring. Indicate device instance, MAC address and drawing reference number.
- F. Provide record riser diagram showing the location of all controllers.
- G. Maintain project record documents throughout the warranty period and submit final documents at the end of the warranty period

1.10 SYSTEM ARCHITECTURE

- A. The system provided shall incorporate hardware resources sufficient to meet the functional requirements of these Specifications. The Contractor shall include all items not specifically itemized in these Specifications that are necessary to implement, maintain, and operate the system in compliance with the functional intent of these Specifications.
- B. The system shall be configured as a distributed processing network(s) capable of expansion as specified below.
- C. The system architecture shall consist of an Ethernet-based, wide area network (WAN), a single Local Area Network (LAN) or multi-leveled LANs that support BCs, AACs, ASCs, Operator Workstations (OWS), and Remote Communication Devices (RCDs) as applicable. The following indicates a functional description of the BAS structure.
 - 1. EEMS LAN: Internet-based network connecting multiple facilities with a central data warehouse and then EEMS server. This is an existing infrastructure and contractor is not required to configure any components of this EEMS. Contractor is however required to provide BACnet Objects and services at the Local Supervisory LAN via BACnet over IP. Refer to Section 251404 for requirements.
 - 2. Local Supervisory LAN: The Local Supervisory LAN shall be an Ethernet-based, 100 Mbps LAN connecting Primary Control LANs and OWSS. The LAN serves as the inter-BC communications path and OWS-to-BC gateway and communications path. Refer to section 251404 coordination requirements with USPS. LAN shall be IEEE 802.3 Ethernet over Fiber or Category 5 cable with switches and routers that support 100 Mbps throughput. Power-line carrier communication shall not be acceptable for communications. The higher level layers of this network shall be BACnet as described below:
 - a. BACnet Supervisory LAN: BACnet/IP as defined in Addendum A (Annex J) of the BACnet standard, and shall share a common network number for the Ethernet backbone, as defined in BACnet. Point/Object naming conventions are specified in 251404 - Part III.
 - 3. Primary Controller LAN ('Primary LAN'): High-speed, peer-to-peer communicating LAN used to connect AACs, ASCs and Building Controllers (BCs) and communicate exclusively control information. Acceptable technologies include:



- a. Ethernet (IEEE802.3)
- b. ARCNET (IEEE802.4)
4. Secondary Controller LAN ('Secondary LAN'): Network used to connect AACs or ASCs to BC. These can be Master Slave/ Token Passing or polling, in addition to those allowed for Primary Controller LANs. Network speed vs. the number of controllers on the LAN shall be dictated by the response time and trending requirements.

- D. Dynamic Data Access: Any data throughout any level of the network shall be available to and accessible by all other devices, Controllers and OWS, whether directly connected or connected remotely.

NOTE TO SPECIFIER

Remote data access to specified below is controlled due to network security. Before specifying remote access confer with USPS.

- E. [Remote Data Access: The system shall support the following methods of remote access to the building data.
1. Dial-in via minimum of a 56k modem. Dial-in connection shall allow access to all control system facilities and graphics with appropriate password. The USPS shall provide and pay for the digital grade voice line to support this remote connection.
 2. DSL/Broadband/Fiber. All workstations shall be equipped with standard 100 megabit Ethernet cards; the USPS at its option may elect to use DSL or other broadband service to access the system.
 3. Browser-based access: A remote user using a standard browser shall be able access all control system facilities and graphics with proper password. USPS shall secure and be responsible for the continuous Internet connection. The following paradigms are acceptable for browser-based access:
 - a. Native Internet-based user interfaces (HTML, Java, XML, etc.) that do not require a plug-in.
 - b. User interfaces that via a standard browser use a freely distributed and automatically downloaded and installed plug-in or 'thick' client that presents the user interface across the web.]
- F. The communication speed between the controllers, LAN interface devices, and operator interface devices shall be sufficient to ensure fast system response time under any loading condition. Contractor shall submit guaranteed response times with shop drawings including calculations to support the guarantee. In no case shall delay times between an event, request, or command initiation and its completion be greater than those listed herein. Contractor shall reconfigure LAN as necessary to accomplish these performance requirements. Generally requirements do not apply when a remote connection must be established via modem:
1. 5 seconds between a Level 1 (critical) alarm occurrence and enunciation at operator workstation.
 2. 10 seconds between a Level 2 alarm occurrence and enunciation at operator workstation.
 3. 20 seconds between and a Level 3-5 alarm occurrence and enunciation at operator workstation.
 4. 10 seconds between an operator command via the operator interface to change a setpoint and the subsequent change in the controller.
 5. 5 seconds between an operator command via the operator interface to start/stop a device and the subsequent command to be received at the controller.
 6. 10 seconds between a change of value or state of an input and it being updated on the operator interface.
 7. 10 seconds between an operator selection of a graphic and it completely painting the screen and updating at least 10 points.



- G. Control Systems Server (CSS): This shall be a computer (or computers) that maintain the systems configuration and programming database. This will double as an operator workstation. It shall hold the backup files of the information downloaded into the individual controllers and as such support uploading and downloading that information directly to/from the controllers. It shall also act as a control information server to non-control system based programs. It shall allow secure multiple-access to the control information. Refer to Section 251404 - BAS Field Panels for its requirements.
- H. The Operator Work Station (OWS) interface shall provide for overall system supervision, graphical user interface, management report generation, alarm annunciation, and remote monitoring. Refer to Section 251404 – BAS Field Panels.
- I. The BCs, AACs, ASCs, shall monitor, control, and provide the field interface for all points specified. Each BC, AAC, or ASC shall be capable of performing all specified energy management functions, and all DDC functions, independent of other BCs, AACs, or ASCs and operator interface devices as more fully specified in Section 251404 - BAS Field Panels..
- J. Systems Configuration Database: The system architecture shall support maintaining the systems configuration database on a server or workstation on the Local Supervisory LAN. User tools provided to the USPS shall allow configuring, updating, maintaining, etc. current configurations and settings whether they are initiated at the server or the end device. Database Schema shall be published and provided to the USPS to facilitate easy access to the data.
- K. Interruptions or fault at any point on any Primary Controller LAN shall not interrupt communications between other nodes on the network. If a LAN is severed, two separate networks shall be formed and communications within each network shall continue uninterrupted.
- L. All line drivers, signal boosters, and signal conditioners etc. shall be provided as necessary for proper data communication.
- M. Anytime any controller's database or program is changed in the field, the controller shall be capable of automatically uploading the new data to the CSS.

1.11 WARRANTY MAINTENANCE

- A. Contractor shall warrant all products and labor for a period of one year after Substantial Completion.
- B. The USPS reserves the right to make changes to the BAS during the warranty period. Such changes do not constitute a waiver of warranty. The Contractor shall warrant parts and installation work regardless of any such changes made by the USPS, unless the Contractor provides clear and convincing evidence that a specific problem is the result of such changes to the BAS.
- C. At no cost to the USPS, during the warranty period, the Contractor shall provide maintenance services for software and hardware components as specified below:
 - 1. Maintenance services shall be provided for all devices and hardware specified in sections 233004 through 251404. Service all equipment per the manufacturer's recommendations and maintenance schedule submitted. All devices shall be calibrated within the last month of the warranty period.
 - 2. Emergency Service: Any malfunction, failure, or defect in any hardware component or failure of any control programming that would result in property damage or loss of comfort control shall be corrected and repaired following notification by the USPS to the Contractor.
 - a. Response by telephone to any request for service shall be provided within two (2) hours of the USPS's initial telephone request for service.



- b. In the event that the malfunction, failure, or defect is not corrected through the telephonic communication, at least one (1) hardware and software technician, trained in the system to be serviced, shall be dispatched to the USPS's site within eight (8) hours of the USPS's initial telephone request for such services, as specified.
 3. Normal Service: Any malfunction, failure, or defect in any hardware component or failure of any control programming that would not result in property damage or loss of comfort control shall be corrected and repaired following telephonic notification by the USPS to the Contractor.
 - a. Response by telephone to any request for service shall be provided within eight (8) working hours (contractor specified 40 hr per week normal working period) of the USPS's initial telephone request for service.
 - b. In the event that the malfunction, failure, or defect is not corrected through the telephonic communication, at least one (1) hardware and software technician, trained in the system to be serviced, shall be dispatched to the USPS's site within three (3) working days of the USPS's initial telephone request for such services, as specified.
 4. Telephonic Request for Service: Contractor shall specify a maximum of three telephone numbers for the USPS to call in the event of a need for service. At least one of the lines shall be attended at any given time at all times. Alternatively, pagers can be used for technicians trained in system to be serviced. One of the three paged technicians shall respond to every call within 15 minutes.
 5. Technical Support: Contractor shall provide technical support by telephone throughout the warranty period.
 6. Preventive maintenance shall be provided throughout the warranty period in accordance with the hardware component manufacturer's requirements and submitted maintenance plan.

1.12 DELIVERY, STORAGE, AND HANDLING

- A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons during shipping, storage and handling as required to prevent equipment damage, and to eliminate dirt and moisture from equipment. Store equipment and materials inside and protect from weather.

1.13 LISTING AND LABELING

- A. The BAS and components shall be listed by Underwriters Laboratories (UL 916) as an Energy Management System.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 1. Automated Logic Corporation (ALC), Kennesaw, GA 770-429-3000.
 - a. Product: WebCTRL
 2. Siemens Building Technologies, Buffalo Grove, IL 847-215-1000.
 - a. Product: APOGEE
 3. Johnson Controls, Milwaukee, WI 414-524-4000.



a. Product: Metasys

B. Product options and substitutions. Substitutions: Not Permitted.

2.2 MATERIALS AND EQUIPMENT

A. Materials shall be new, the best of their respective kinds without imperfections or blemishes and shall not be damaged in any way. Used equipment shall not be used in any way for the permanent installation except where drawings or specs specifically allow existing materials to remain in place.

2.3 UNIFORMITY

A. To the extent practical, all equipment of the same type serving the same function shall be identical and from the same manufacturer

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF CONTROL SYSTEMS

A. General: Install systems and materials in accordance with manufacturer's instructions, roughing-in drawings and details shown on drawings.

B. Refer to additional requirements in other sections of this specification.

NOTE TO SPECIFIER

Digital control stations should specifically be shown on the drawings. You should select appropriate wall/floor locations that minimize wire and tube runs and coordinate these locations with other disciplines. Gateway and CSS devices should be located in environmentally controlled spaces similar to an IT closet with a dedicated terminal unit. If the project is a control renovation, locate spare breakers in a power panel where the control contractor can obtain 120V power and show it on the floor plans.

3.3 DIGITAL CONTROL STATIONS, CONTROLLER QUANTITY AND LOCATION

NOTE TO SPECIFIER

AE shall designate locations for control stations and specifically reserve wall/floor space and indicate it on the drawings and coordinate it with other trades. Preferably you will have the electrical contract provide power (normal, emergency or uninterruptible as applicable) and then delete the requirement for this contractor to provide the power.



- A. Individual Digital Control Stations (DCS) are referenced to indicate allocation of points to each DCS and DCS location. Digital control stations shall consist of one or multiple controllers to meet requirements of this specification.
- B. Where a DCS is referenced, Contractor shall provide at least one (1) controller, and additional controllers as required, in sufficient quantity to meet the requirements of this Specification. Restrictions in applying controllers are specified in Section 251404: BAS Field Panels.. This Contractor shall extend power to the DCS from an acceptable power panel. If the control contractor wishes to further distribute panels to other locations, control contractor is responsible for extending power to that location also. Furthermore, contractor is responsible for ensuring adequate locations for the panels that do not interfere with other requirements of the project and maintain adequate clearance for maintenance access.
- C. Contractor shall locate DCSs as referenced. It is the Contractor's responsibility to provide enough controllers to ensure a completely functioning system, according to the point list and sequence of operations.
- D. Contractor shall provide a minimum of the following:
 - 1. One DCS (including at least one controller) in each chilled water plant mechanical room.
 - 2. One controller for each air handler located in applicable mechanical room.
 - 3. One controller shall be provided for each terminal unit unless indicated otherwise.

3.4 SURGE PROTECTION

- A. The Contractor shall furnish and install any power supply surge protection, filters, etc. as necessary for proper operation and protection of all BCs, AAC/ASCS operator interfaces, printers, routers, gateways and other hardware and interface devices. All equipment shall be capable of handling voltage variations 10% above or below measured nominal value, with no affect on hardware, software, communications, and data storage.

NOTE TO SPECIFIER

Include this section only if applicable

3.5 DEMOLITION AND REUSE OF EXISTING MATERIALS AND EQUIPMENT [R&A PROJECTS ONLY]

NOTE TO SPECIFIER

Reuse of existing controls must be carefully coordinated by the AE. What stays and goes must be clear. As applicable, expand/edit this section to indicate what is allowed for reuse. The bottom line is assumptions will generally have to be made for bidding, but final acceptance of an existing device will not occur until the contractor tests it.

- A. Contractor shall assume that existing equipment that specifically is indicated to be reused is in good condition and is operable. Contractor, during the course of work, shall inspect these devices and determine if any devices are in need of replacement or repair. Contractor shall prepare an itemized list of suggested repairs/replacement. This repair/replacement will be at the discretion of the USPS and will be accomplished by expanding this contract.



- B. Existing wire, conduit, and control panel cabinets may be reused at the USPS Project Engineer's discretion, but only if such materials or equipment comply with the applicable specification for new materials and equipment. Such materials shall not be reused if visibly damaged or otherwise unsuitable for the intended service.
- C. Where such materials are reused, the contractor's shop drawings shall reflect the existing wiring designation. If existing labeling is illegible or otherwise does not comply with the applicable specification for labeling, wiring runs shall be relabeled in accordance with the requirements specified elsewhere.
- D. Existing pneumatic tubing located between the existing BAS panels and the pneumatic operators shall not be reused; however, conduit for such tubing may be reused. All other pneumatic tubing may be reused, but only if such materials comply with the applicable specification for new materials. Materials shall not be reused if visibly damaged or otherwise unsuitable for the intended service. All pneumatic tubing to be reused shall be pressure tested and all leaks shall be repaired. All reused pneumatic tubing shall be purged with dry air or nitrogen.
- E. The existing pneumatic main air supply system shall be modified as required and reused to serve existing pneumatic controls that are to remain, and shall be extended as necessary to serve new pneumatic controls. Where existing pneumatic controls are removed, main air piping shall be removed back to the point of connection to the main air supply which remains in use, and shall be capped or plugged.
- F. Existing valves and dampers and their operators may be reused only when pre-approved by the USPS. Contractor shall lubricate all damper linkages of dampers being controlled under this project.
- G. Other materials and equipment not specifically mentioned herein may be reused only if specifically allowed by indications on the drawings.
- H. For HVAC systems which are indicated to receive a new BAS, all existing materials and equipment associated with the existing pneumatic controls and EMCS shall be removed unless otherwise specified or indicated to remain, or unless reused in accordance with the above requirements, except for the following: 1) conduit and electrical boxes (but not wiring within conduit) may remain in place if not reused (leave a pull line); 2) inaccessible pneumatic tubing may remain in place if not reused. Existing materials and equipment to be removed shall be removed subject to the requirements in paragraph "Sequence of Work". For HVAC systems, which are not to receive a new DDC BAS, the existing pneumatic control system shall remain fully functional.

NOTE TO SPECIFIER

Include the following only when applicable. Obviously this will depend on the necessity of continuous operations and this is only a template. This item will typically have to be extensively customized for each project.

3.6 SEQUENCE OF WORK FOR EXISTING SYSTEMS CONVERSION [R&A PROJECTS ONLY]

- A. General: All work involving changeover of control functions from existing pneumatic control system to the new DDC BAS shall be performed in accordance with the following sequence in order to minimize the duration of equipment outages. The following descriptions are intended to indicate the sequence in which the work shall be performed, not to define fully the scope of the work.



- B. Install operator's terminal, peripherals, graphic software, and LAN prior to placing any equipment under the control of the new BAS.
- C. Work which requires shutting down a pump motor, fan motor, or chiller shall be considered a utility shutdown and shall be subject to the restrictions specified in Section 015000 - Temporary Facilities and Controls.
- D. The following sequence applies to an individually controlled HVAC subsystem, such as an air handling unit. Only one such system shall be placed under manual control (as described below) at any given time.
 - 1. Install controllers adjacent to (or within) existing control panels. Programming shall be complete (except for loading and debugging) prior to installation. Install all field devices, which do not require interruption of the existing control system.
 - 2. Install all conduit, wiring, and pneumatic tubing which does not require interruption of the existing control system.
 - 3. Provide temporary variable pressure type hand pumps at each pneumatically controlled output, for temporary use by the USPS's maintenance and operation contractor personnel. Schedule this step at least 48 hours in advance with the Building Engineer.
 - 4. Remove existing controls including wiring, conduit, and tubing (except materials to be reused in accordance with provisions specified elsewhere) which must be removed to facilitate installation of new BAS materials and equipment.
 - 5. Remove existing digital control system points (if applicable). Install and calibrate remainder of new BAS materials and equipment for this subsystem. Load controller software. Connect controller(s) to LAN.
 - 6. Perform all field testing and calibration that does not require connection of permanent pneumatic outputs.
 - 7. Remove temporary hand pumps and install permanent pneumatic output connections. Place the system under the control of the new DDC/BAS equipment. Conclude field testing and submit field testing report prior to placing the next subsystem under temporary manual control. The USPS shall be given a password with a priority level that allows monitoring (but not control until notification of substantial completion has been approved).
 - 8. Remove remaining existing pneumatic and digital control system materials and equipment (except materials to be reused in accordance with provisions specified elsewhere). All existing digital controls equipment for those subsystems that have not yet been converted shall remain intact, on-line, and fully functional.
- E. Schedule work in USPS occupied spaces 3 days in advance with the USPS's representative.

3.7 CONTROL POWER SOURCE AND SUPPLY

NOTE TO SPECIFIER

It is preferable to have the Division 26 contractor supply power to DCS locations and provide the appropriate level of power of all control system components as located by the AE. For instance, it is usually good to at least have emergency power (and sometimes uninterruptible power when available) at critical controllers, control system servers, routers, workstations etc. However, this section is mainly for retrofits where no Div 26 contractor applies.

- A. Section 250504 Contractor shall extend all power source wiring required for operation of all equipment and devices provided under Sections 250504 through 251404 and the Sequences of Operation [unless specifically shown on the drawings for specific locations].

NOTE TO SPECIFIER

The following item will have to be customized for each system and project. The consideration is where to power controllers from. For distributed controllers that are associated with one unit, it is convenient to power them along



with the system so the controller can take action based on the presence of power. However on large centralized panels, it may be best to put these on the most reliable source of power that serves the equipment being controlled and then provide for individual monitoring of the various system's power sources by the controller. The object here is to make a robust system that does not interpret power failures as device failure and therefore in some instances have to take down the unit for manual acknowledged reset. This can compromise reliability.

- B. General requirements for obtaining power include the following:
1. Obtain power from a source that feeds the equipment being controlled such that both the control component and the equipment are powered from the same panel. Where equipment is powered from a 460V source, obtain power from the electrically most proximate 120v source fed from a common origin.
 2. Where control equipment is located inside a new equipment enclosure, coordinate with the equipment manufacturer and feed the control with the same source as the equipment. If the equipment's control transformer is large enough and of the correct voltage to supply the control system it may be used. If the equipment's control transformer is not large enough or of the correct voltage to supply the controls provide separate transformer
 3. Where a controller controls multiple systems on varying levels of power reliability (normal, emergency, and/or interruptible), the controller shall be powered by the highest level of reliability served. Furthermore, the controller in that condition shall monitor each power type served to determine so logic can assess whether a failure is due to a power loss and respond appropriately. A three-phase monitor into a digital input shall suffice as power monitoring.
 4. Standalone Functionality: Refer to Section 251404.

NOTE TO SPECIFIER

The AE shall carefully coordinate the training requirements with the needs of the USPS facilities staff. Expansions of existing systems obviously require less training than brand new systems. The following generally outlines an on-site training session for which you always want some basic site-specific training on-site. The more advanced training may be better provided off site on a case-by-case basis. Edit to suit project.

3.8 BAS START UP, COMMISSIONING AND TRAINING

- A. Refer to Section 250804

3.9 SEQUENCE OF OPERATION

- A. Refer to Section 259004 - Sequence of Operation

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END OF SECTION



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SECTION 25 08 04 00 - MPF BUILDING AUTOMATION SYSTEM (BAS) COMMISSIONING

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.25 08 04 00

PART 1 - GENERAL

1.1 WORK INCLUDED

Building Automation System and equipment testing and start-up.

Validation of proper and thorough installation of BAS and equipment.

Functional testing of control systems.

Documentation of tests, procedures, and installations.

Coordination of BAS training.

Documentation of BAS Operation and Maintenance materials.

1.2 GENERAL DESCRIPTION

This section defines responsibilities of the BAS Contractor to Commission the Building Automation System.

Owner, at Owner's expense, shall retain a Commissioning Authority (CxA) who shall work with the Contractor to ensure that the systems, equipment, and interfaces are installed, tested, and operate per the design intent; that the systems are adequately documented; and that the Owner is adequately trained on system intent, operation, and maintenance.

1.3 RELATED SECTIONS:

1.4 RELATED WORK AND DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section

Commissioning Plan: The Cx Plan shall be available for reference as it outlines responsibilities outside of the Construction Contract. It gives the Contractor a perspective as to the overall process. It encompasses the entire Cx process including design phase and post construction tasks.

Section 013300 - Submittal Procedures: Stipulates additional copies of submittals to be submitted and refers to other sections for additional submittal requirements related to Cx.

Section 017704 - Closeout Procedures and Training: Defines the milestones in completion incorporating the Cx process.

MPF BUILDING AUTOMATION SYSTEM (BAS)



Section 019113 – General Commissioning Requirements: Specifies the general facility commissioning procedures common across all Divisions and the Contractor's responsibilities for the commissioning process.

Section 019113 – General Commissioning Requirements: Provides 'generic' functional performance testing procedures to illustrate the level-of-effort expected during acceptance testing.

Individual Specification Sections: Individual sections stipulate installation, start-up, warranty, O&M documentation, and training requirements for the system or device specified in the Section.

Section 220800 – Commissioning of Plumbing: Details the commissioning procedures specific to Division 22 work.

Section 230800 – Commissioning of HVAC: Details the commissioning procedures specific to Division 23 work.

Section 260800 – Commissioning of Electrical Systems: Details the commissioning procedures specific to Division 26 work.

1.5 DEFINITIONS AND ABBREVIATIONS

Refer to Section 019113 and the Cx Plan.

1.6 REFERENCE STANDARDS

ASHRAE Guideline 0-2005, "Guideline for Commissioning HVAC Systems"

ASHRAE Guideline, "Preparation of Operating and Maintenance Documentation for Building Systems"

NEBB - Procedural Standards for Building Systems Commissioning

1.7 SEQUENCING AND SCHEDULING

Refer Section 019113 and the Cx Plan.

1.8 COORDINATION MANAGEMENT PROTOCOLS

Coordination responsibilities and management protocols relative to Cx are initially defined in Section 019113 and the Commissioning Plan, but shall be refined and documented in the Construction Phase Cx Kick-Off meeting. Contractor shall have input in the protocols and all Parties will commit to scheduling obligations. The CxA will record and distribute.

1.9 CONTRACTOR RESPONSIBILITIES

General responsibilities of the Contractor are specified in Section 019113. The following responsibilities indicate specific responsibilities of the BAS contractor in addition to those responsibilities

Assist CxA in verification and performance testing. Assistance will generally include the following:

1. Establish trend logs of system operation as specified herein



2. Manipulate systems and equipment to facilitate functional performance testing as outlined in Section 019113.
3. Provide POTs or operator workstations in locations convenient to testing activities as specified below
4. Provide CxA with appropriate passwords, keys, and access to control panels and workstations.
5. Where control systems do not allow a test mode or the overriding of physical input values for testing, program an interim virtual point for all inputs that can be used to represent the point and be overridden for testing

NOTE TO SPECIFIER

THE FOLLOWING SOFTWARE OPTIMIZATION ASSISTANCE TIME NEEDS TO BE CUSTOMIZED AND/OR SELECTED FOR EACH PROJECT. FOR EXAMPLE LARGER PROJECTS MAY USE UP TO 24 HOURS WHEREAS SMALLER PROJECTS MAY USE 8 HOURS. SELECT THE APPLICABLE SYSTEM AND SUBMIT TO USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.

Provide a Control technician to work at the direction of Commissioning Authority for software optimization assistance for a minimum of [] hours. Refer to Part 3 for a description of the software optimization.

Train Owners Representatives in systems operations, control equipment use, operation, maintenance and repair. Training shall be conducted as follows:

6. Control system training shall be conducted by the Control Subcontractor. Control system training shall be as specified in Part - 3 of this section.

Contractor shall compensate the Owner for site time necessitated by incompleteness of systems or equipment at time of functional performance testing. All testing failures, which require on-site time for retesting, will be considered actual damages to the Owner. All parties under contract with the Owner who are affected by the retesting shall be included in the contract modification. All parties under contract with the Owner who are affected by the retesting shall be included in the contract modification. Refer to Section 019113 for more details.

1.10 SEQUENCING:

The following list outlines the general sequence of events for Commissioning of the Control systems.

1. Construction Phase:
 - a. Submit Product data and Shop Drawings, and receive approval.
 - b. Submit Control Logic Documentation, and receive approval.
 - c. Submit project-specific graphics for each "unique" system and receive approval
 - d. Submit electronic record copy of approved submittals.
 - e. Review and return Pre-Commissioning checklists, drafted by the CxA, incorporating manufacture specific start-up procedures accompanied by manufacturers pre-printed start up procedures for all equipment provided by the BAS contractor
 - f. Install controls.
 - g. Submit BAS O&Ms for review.
 - h. Receive BAS Pre-Commissioning checklists approval.
 - i. Submit Training Plan
 - j. Place systems under BAS control.
 - k. Prepare and initiate Trend Log data storage and format trend graphs.
 - l. Perform BAS start up.
 - m. Submit completed BAS Pre-Commissioning Checklists
 - n. Submit Commissioning BAS Software and provide password access to Owner and commissioning agent. Access level must provide for the manual override of all inputs, outputs and setpoints for the systems.



- o. Receive BAS Pre-Commissioning Report approval and approval to schedule Commissioning Demonstrations.
- p. Receive Demonstration approval and approval to schedule Acceptance Phase.
- q. Perform Functional Performance Testing and demonstrate systems to Commissioning Agent and Owner. Submit trend logs in format specified
- r. Train Owner on control system operation and maintenance.
- 2. Acceptance Phase
 - a. Two week Operational Test.
 - b. Receive Operational Test approval which enables start of Functional Testing.
 - c. Receive Acceptance Period approval which is Functional Completion for the BAS.
 - d. Substantial Completion
- 3. Warranty Phase
 - a. Train Owner on final Sequences and modes of operation.
 - b. Update facility manual content with any changes.
 - c. Update record drawings
 - d. Install Framed Control Drawings
 - e. Final Completion
 - f. Provide administrator access password access to Owner.
 - g. Revise and Re-Submit Record drawings and O&M manuals.
 - h. Schedule and begin Opposite Season Operational Test and Functional Performance Testing.
 - i. Receive Opposite Season Operational Test and FPT approval
 - j. Submit As-Built drawings and O&M manuals
 - k. Update Framed Control Drawings.
 - l. Complete owner training.
 - m. End of Warranty Period
 - n. End of Warranty Period and Final Acceptance

PART 2 - PRODUCTS

2.1 INSTRUMENTATION

Start up Testing Instrumentation: Instrumentation required for Contractor to verify readings and test system and equipment performance shall be provided by Contractor. All testing equipment u shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:

1. Temperature sensors and digital thermometers shall have a certified calibration within the past year and a resolution of + or - 0.1°F.
2. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year.
3. All equipment shall be calibrated according to the manufacturer's recommended intervals. Calibration tags shall be affixed or certificates readily available. All equipment used for testing and calibration shall be NIST/NBS traceable and calibrated within the preceding 6 month period. Certificates of calibration shall be submitted to the CxA prior to start-up of the BAS.

Functional Performance Testing Instrumentation: Standard instrumentation used for testing air and water flows, temperatures, humidity, noise levels, amperage, voltage, and pressure differential in air and water systems will be provided by CxA.



Special Tools: Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and turned over to the Owner upon project completion.

2.2 TEST KITS FOR METERS AND GAGES

Test kits for meters and gages shall be provided to the Owner new and in good condition. Previously used kits will be unacceptable. Kits shall be submitted prior to the Acceptance Phase. Kits included shall be as a minimum:

1. Digital indication of temperature and pressure with associated sensors to work with the P/T test ports
2. Companion readout kit (with fittings) for calibrated balancing valve with ranges as required by all devices on this project

2.3 TAB & COMMISSIONING PORTABLE OPERATORS TERMINAL

Provide the CxA with all software, connection devices, licenses, passwords, etc. to facilitate connection to the BAS throughout the building. Provide a license to graphic software, and all operating software necessary for testing and configuration of all control elements at all levels. License may be a temporary license that will expire after the completion of the Warranty Period. Options include:

1. A laptop computer provided by BAS Contractor for dedicated use by the CxA throughout the Construction and Acceptance Phases. This would be turned over to the Owner at the end of the Acceptance Phase
2. Browser access to the full graphic software. CxA will provide laptop however BAS contractor shall set up the laptop to successfully connect.
3. Licensed Client Software to be installed on CxA Computer. BAS contractor shall install the software and ensure it is functional.
4. Terminal Services session access to a Graphic server with required CALs to allow use of all required software. BAS contractor shall configure the CxA computer to connect to the terminal session.

Access to the BAS must be provided throughout the building as more fully defined as follows:

5. Full wireless connection to the graphic server throughout the building will be adequate.
6. Network connection for full access to the graphic server within 50' of any point in the building
7. Exception to 1 and 2 above: an acceptable alternative to full building access to the graphic server relating to terminal controls shall be providing to the CxA the devices and software required to connect to local terminal controllers through a connection port in the space such as connection to a jack on the temperature sensor (basically what is required by TAB specified below). This does not apply to mechanical rooms as full graphic access is required in mechanical rooms.

Provide software required by TAB to calibrate all flow sensors. TAB will provide computer to be used as a portable operator's terminal. Any manufacturer specific hardware such as connection cables, converters, hand held devices, etc. shall be provided by the contractor.

Connections shall be provided local to the device being calibrated. For instance, for VAV boxes, connection of the operator's terminal shall be either at the sensor as well as at the box. Otherwise a wireless system shall be provided to facilitate this local functionality.



PART 3 - EXECUTION

3.1 BAS START-UP TESTING, ADJUSTING, CALIBRATION

Work and/or systems installed under this Division shall be fully functioning prior to Demonstration and Acceptance Phase. Contractor shall start, test, adjust, and calibrate all work and/or systems under this Contract, as described below:

1. Inspect the installation of all devices. Review the manufacturer's installation instructions and validate that the device is installed in accordance with them.
2. Verify proper electrical voltages and amperages, and verify that all circuits are free from faults.
3. Verify integrity/safety of all electrical connections.
4. [For AHUs that use a throttled outside air damper position when minimum outside air is required, contractor shall mark existing minimum outside air damper position to allow replication by new controls.]
5. Coordinate with TAB subcontractor to obtain [and CxA] to fine tune control settings that are determined from balancing procedures. Record the following control settings as obtained from TAB contractor, and note any TAB deficiencies in the BAS Start-Up Report including but not limited to the following:
 - a. Optimum duct static pressure setpoints for VAV air handling units
 - b. Minimum outside air damper settings for air handling units
 - c. Optimum differential pressure setpoints for variable speed pumping systems
 - d. Calibration factors for all flow meters, flow stations, demand meters, consumption meters, etc.
 - i. BAS contractor shall provide hand held device (HHD) as a minimum to the TAB and CxA to facilitate calibration. Connection for any given device shall be local to it (i.e.: at the VAV box or at the thermostat). HHD or POT shall allow querying and editing of parameters required for proper calibration and start up.
 - e. Calibration parameters for venturi valves
6. Test, calibrate, and set all digital and analog sensing and actuating devices. Calibrate each instrumentation device by making a comparison between the BAS display and the reading at the device, using an instrument traceable to the National Bureau of Standards, which shall be at least twice as accurate as the device to be calibrated (e.g., if field device is +/-0.5% accurate, test equipment shall be +/-0.25% accurate over same range). Record the measured value and displayed value for each device in the BAS Start up Report.
7. Check and set zero and span adjustments for all transducers and transmitters.
8. For dampers and valves:
 - a. Check for adequate installation including free travel throughout range and adequate seal.
 - b. Where loops are sequenced, check for proper control without overlap
9. For actuators:
 - a. Check to insure that device seals tightly when the appropriate signal is applied to the operator.
 - b. Check for appropriate fail position, and that the stroke and range is as required and coordinated with the programmed ranges when it is operating under normal conditions.
 - c. For pneumatic operators, adjust the operator spring compression as required to achieve close off. If positioner or volume booster is installed on the operator, calibrate per manufacturer's procedure to achieve spring range indicated. Check split range positioners to verify proper operation. Record settings for each device.
 - d. Check the stroke and range under actual loading conditions and validate that they correlate with programmed values
 - e. For sequenced electronic actuators, calibrate per manufacturer's instructions to required ranges.



10. Check each digital control point by making a comparison between the control command at the CU and the status of the controlled device. Check each digital input point by making a comparison of the state of the sensing device and the OI display. Record the results for each device.
11. For outputs to reset other manufacturers devices (VFDs) and feedback from them, calibrate ranges to establish proper parameters. Coordinate with representative of the respective manufacturer and obtain their approval of the installation.
12. Verify proper sequences by using the approved checklists to record results. Verify proper sequence and operation of all specified functions.
13. Verify that all safety devices trip at appropriate conditions. Adjust setpoints accordingly.
14. Tune all control loops to obtain the fastest stable response without hunting, offset or overshoot. Record tuning parameters and response test results for each control loop in the BAS Start up Report. Except from a startup, maximum allowable variance from set point for controlled variables under normal load fluctuations shall be as follows. Within 3 minutes of any upset (for which the system has the capability to respond) in the control loop, tolerances shall be maintained (exceptions noted):
 - a. Duct air temperature: $\pm 1^{\circ}\text{F}$.
 - b. Space Temperature: $\pm 2^{\circ}\text{F}$
 - c. Chilled Water: $\pm .5^{\circ}\text{F}$
 - d. Hot water temperature: $\pm 2^{\circ}\text{F}$.
 - e. Duct pressure: $\pm 0.25''$ w.g.
 - f. Water pressure: ± 1 psid
 - g. Steam Pressure: ± 1 psid
 - h. Duct or space Humidity: $\pm 5\%$
 - i. Air flow control: $\pm 5\%$ of setpoint velocity.
 - j. Space Pressurization (on active control systems): $\pm 0.05''$ wg with no door or window movements
15. For communication interfaces and DDC control panels:
 - a. Ensure devices are properly installed with adequate clearance for maintenance and with clear labels in accordance with the record drawings.
 - b. Ensure that terminations are safe, secure and labeled in accordance with the record drawings.
 - c. Check power supplies for proper voltage ranges and loading.
 - d. Ensure that wiring and tubing are run in a neat and workman-like manner, either bound or enclosed in trough.
 - e. Check for adequate signal strength and acceptable bandwidth utilization on communication networks.
 - f. Check for stand alone performance of controllers by disconnecting the controller from the local area network (LAN). Verify the event is annunciated at OIs. Verify that the controlling LAN reconfigures as specified in the event of a LAN disconnection.
 - g. Ensure that all outputs and devices fail to their proper positions/states.
 - h. Ensure that buffered and/or volatile information is held through power outage
 - i. With all system and communications operating normally and all trends functioning, sample and record update/annunciation times for critical alarms fed from the panel to the OI.
 - j. Check for adequate grounding of all DDC panels and devices.
 - k. Run self diagnostic routines and ensure they are functional
 - l. Check the memory allocation and loading to ensure adequate and excess capacity is available and that it will not affect control functionality.
16. Coordinate desired initial alarm strategies with Owner's Operators. Set all required alarms and document the initial settings in the start up documentation
17. Coordinate all initial setpoints with Owner's Operators. Ensure those setpoints are active
18. For Operator Interfaces/Servers:
 - a. Verify that all elements on the graphics are functional and are properly bound to physical devices and/or virtual points, and that hot links or page jumps are functional and logical.
 - b. Output all specified BAS reports for review and approval.
 - c. Verify that the alarm printing and logging is functional and per requirements.



- d. Verify that trend archiving to disk and provide a sample to the CxA for review.
- e. Verify alarm enunciation functionality. Time delay from actual occurrence to the time updated or enunciated on the screen. Ensure it is per the specified requirements.
- f. Verify that real time and historical trends are accessible and viewable in graph format.
- g. Verify that paging/dial out alarm annunciation is functional.
- h. Verify the functionality of remote OIs and that a robust connection can be established consistently.
- i. Verify that required third party software applications required with the bid are installed and are functional.
- j. Demonstrate open protocol and custom third party interfaces reliably communicate and check response time.
- k. Verify response times and screen update and refresh times are per the requirements.
- l. Verify that all custom programs are editable from the OI. Check upload, download, back up and restore capabilities of system configuration information as well as custom programs.
- m. Verify schedules are set up and working.
- n. Verify Owner stipulated security and permissions is set up and functional.
- o. In concert with the Building Power Outage test, validate that critical GUI installations are properly powered by UPS and emergency outlets to keep it functional during a power outage. Validate that the space has adequate lighting to manage the building in the event of an outage.
- 19. Start up and check out control air compressors and air drying and filtering systems in accordance with the appropriate section and with manufacturer's instructions.
 - a. Validate adequate deliver and pressures
 - b. Validate max run time and cycle time vs manufacturer's recommendations
 - c. Validate that routing of the compressed air does not result in condensation at any point in the system when used with the specified drier
- 20. Verify proper interface with fire alarm system.

Submit Start-Up Documentation. This shall be completed, submitted, and approved prior to Acceptance Phase.

3.2 SENSOR CHECKOUT AND CALIBRATION

General Checkout: Verify that all sensor locations are appropriate and are away from causes of erratic operation. Verify that sensors with shielded cable are grounded only at one end. For sensor pairs that are used to determine a temperature or pressure difference, make sure they are reading within 0.2°F of each other for temperature and within a tolerance equal to 2% of the reading of each other for pressure. Tolerances for critical applications may be tighter.

Calibration: Calibrate all sensors using one of the following procedures:

1. Sensors without Transmitters--Standard Application: Make a reading with a calibrated test instrument within 6 inches of the site sensor at various points across the range. Verify that the sensor reading (via the permanent thermostat, gage or BAS) is within the tolerances specified for the sensor. If not, adjust offset and range, or replace sensor. Where sensors are subject to wide variations in the sensed variable, calibrate sensor within the highest and lowest 20% of the expected range.
2. Sensors with Transmitters--Standard Application: Disconnect sensor. Connect a signal generator in place of sensor. Connect ammeter in series between transmitter and BAS control panel. Using manufacturer's resistance-temperature data simulate minimum desired temperature. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the OI. Record all values and recalibrate controller as necessary to conform to tolerances.



Reconnect sensor. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or BAS) is within the tolerances specified. If not, replace sensor and repeat. For pressure sensors, perform a similar process with a suitable signal generator.

Sensor Tolerance: Sensors shall be within the tolerances specified for the device.

3.3 LOOP TUNING

For all control loops, contractor shall tune the loops to ensure the fastest stable response without hunting, offset or overshoot. Contractor shall introduce upsets to the load when possible to affect response. Otherwise, setpoints can be changed to affect the response.

Generally tune loops during periods of high gain.

Document all parameters either by capturing text, short interval trends, or screen shots of trend graph documenting the final response.

3.4 COIL VALVE LEAK CHECK

Verify proper close off of the valves. Ensure the valve seats properly by simulating the maximum anticipated pressure difference across the circuit. Calibrate air temperature sensors on each side of coil to be within 0.5°F of each other. Via the OI, command the valve to close. Energize fans. After 5 minutes observe air temperature difference across coil. If a temperature difference is indicated, and the piping surface temperature entering the coil is within 3°F of the water supply temp, leakage is probably occurring. If it appears that it is occurring, close the isolation valves to the coil to ensure the conditions change. If they do, this validates the valve is not closing. Remedy the condition by adjusting the stroke and range, increasing the actuator size/torque, replacing the seat, or replacing the valve as applicable.

3.5 VALVE STROKE SETUP AND CHECK

For all valve and actuator positions checked, verify the actual position against the OI readout.

Set pumps to normal operating mode. Command valve closed, verify that valve is closed, and adjust output zero signal as required. Command valve open, verify position is full open and adjust output signal as required. Command valve to a few intermediate positions. If actual valve position doesn't reasonably correspond, replace actuator or add pilot positioner (for pneumatics)

3.6 ALARM SETPOINT COORDINATION

The Contractor shall prepare a list of all conceptual point types and recommend the types and recommended alarming strategies and setpoint for review of CxA and Owner. Owner shall use this alarm list to provide direction to Contractor for alarm strategies and setpoints. Alarm list shall be provided at least two months prior to the first functional test. Contractor shall have alarm setpoints entered prior to functional testing. Omitting an alarm setting, using the wrong strategy, or entering the wrong setpoints will be considered a failure from the perspective of the functional test.

3.7 GRAPHIC COORDINATION

The Contractor shall prepare all graphics (only one example graphic is required for typical systems like terminal units) with points embedded for review of CxA and Owner. Owner shall use these graphics to



provide direction to Contractor for the required final graphic. All final graphics must be complete and active before functional testing. Any deviation from the approved graphics will be considered a failure from the perspective of the functional test.

3.8 BAS DEMONSTRATION

Demonstrate the operation of the BAS hardware, software, and all related components and systems to the satisfaction of the Commissioning Authority and Owner. Schedule the demonstration with the Owner's representative 1 week in advance. Demonstration shall not be scheduled until all hardware and software submittals, and the Start-Up Test Report are approved. If the Work fails to be demonstrated to conform to Contract specifications, so as to require scheduling of additional site visits by the Commissioning Authority for re-demonstration, Contractor shall reimburse Owner for costs of subsequent Commissioning Authority site visits.

The Contractor shall supply all personnel and equipment for the demonstration, including, but not limited to, instruments, ladders, etc. Contractor supplied personnel must be competent with and knowledgeable of all project-specific hardware, software, and the HVAC systems. All training documentation and submittals shall be at the job site.

Demonstration shall typically involve small representative samples of systems/equipment randomly selected by the Owner and CxA.

The system shall be demonstrated following the same procedures used in the Start-Up Test by using the approved Commissioning Checklists. Demonstration shall include, but not necessarily be limited to, the following:

1. Demonstrate that required software is installed on BAS workstations. Demonstrate that graphic screens, alarms, trends, and reports are installed as submitted and approved.
2. Demonstrate that points specified and shown can be interrogated and/or commanded (as applicable) from all workstations, as specified.
3. Demonstrate that remote dial-up communication abilities are in accordance with these Specifications.
4. Demonstrate correct calibration of input/output devices using the same methods specified for the start-Up tests. A maximum of 10 percent of I/O points shall be selected at random by Commissioning Authority and/or Owner for demonstration. Upon failure of any device to meet the specified end-to-end accuracy, an additional 10 percent of I/O points shall be selected at random by Commissioning Authority for demonstration. This process shall be repeated until 100 percent of randomly selected I/O points have been demonstrated to meet specified end-to-end accuracy.
5. Demonstrate that all DDC and other software programs exist at respective field panels. The Direct Digital Control (DDC) programming and point database shall be as submitted and approved.
6. Demonstrate that all DDC programs accomplish the specified sequences of operation.
7. Demonstrate that the panels automatically recover from power failures, as specified.
8. Demonstrate that the stand-alone operation of panels meets the requirements of these Specifications. Demonstrate that the panels' response to LAN communication failures meets the requirements of these Specifications.
9. Identify access to equipment selected by Commissioning Authority. Demonstrate that access is sufficient to perform required maintenance.
10. Demonstrate that required trend graphs and trend logs are set up per the requirements. Provide a sample of the data archive. Indicate the file names and locations.

BAS Demonstration shall be completed and approved prior to Functional testing.

Any tests successfully completed during the demonstration will be recorded as passed for the functional performance testing and will not have to be re-accomplished.



3.9 FUNCTIONAL PERFORMANCE TESTING

Requirements for assistance with functional performance testing are specified in Section 019113 – General commissioning Requirements, Section 220800 – Commissioning of Plumbing, Section 230800 – Commissioning of HVAC, and Section 260800 – Commissioning of Electrical Systems. Provide assistance during Functional Performance Testing per the enumerated Specifications.

3.10 BAS ACCEPTANCE PERIOD

After approval of the BAS Demonstration, and prior to Substantial Completion, Acceptance Phase shall commence. [Acceptance Period shall not be scheduled until all HVAC systems are in operation and have been accepted, all required cleaning and lubrication has been completed (i.e. filters changed, piping flushed, strainers cleaned, etc.), and TAB report has been submitted and approved. Acceptance Period and its approval will be performed on a system-by-system basis if mutually agreed upon by contractor and the Owner.]

Operational Test: At the beginning of the Acceptance Phase, the system shall operate properly for two weeks without malfunction, without alarm caused by control action or device failure, and with smooth and stable control of systems and equipment in conformance with these specifications. At the end of the two weeks, contractor shall forward the trend logs to the CxA for review. CxA shall determine if the system is ready for functional performance testing and document any problems requiring contractor attention.

1. If the systems are not ready for functional performance testing, Contractor shall correct problems and provide notification to the Owner's representative that all problems have been corrected. The Acceptance Period shall be restarted at a mutually scheduled time for an additional one week period. This process shall be repeated until Commissioning Authority issues notice that the BAS is ready for functional performance testing.

During the Acceptance Period, the contractor shall maintain a hard copy log of all alarms generated by the BAS. For each alarm received, contractor shall diagnose the cause of the alarm, and shall list on the log for each alarm, the diagnosed cause of the alarm, and the corrective action taken. If in the contractor's opinion, the cause of the alarm is not the responsibility of the contractor, contractor shall immediately notify the Owner's representative.

During the Acceptance Phase, the contractor shall maintain all controller network and workstation hardware and software in a state that will allow remote access by Commissioning Agent to Trend Logs as specified below.

3.11 TREND LOGS

This contractor shall configure and analyze all trends required under Division 23, as described below.

Trends are historical archives on computer disks that document the operation of the systems and equipment. Trends can be interval recordings of system I/O parameters or Change of Value based trends that record when a system value changes by more than a specified threshold.

CxA will analyze trend logs of the system operating parameters to evaluate normal system functionality. The requirements of the trending are specified below. Contractor shall establish these trends, ensure they are being stored properly, and forward the data in electronic format to the CxA.

Data shall include a single row of field headings and the data thereafter shall be contiguous. Each record shall include a date and time field. Recorded parameters for a given piece of equipment or component shall be trended at the same intervals and be presented in a maximum of two separate two dimensional formats with time being the vertical axis and field name being the horizontal axis. Data shall be forwarded in one of the following formats.



1. Microsoft ACCESS Database (.mdb)
2. Microsoft EXCEL Spreadsheet (.xls)
3. Comma Separated Value (.csv or .txt) preferably with quotes delimiting text fields and # delimiting date/time fields

Sample times indicated as COV (\pm) or change of value mean that the changed parameter only needs to be recorded after the value changes by the amount listed. When output to the trending file, the latest recorded value shall be listed with any given time increment record. If the BAS does not have the capability to record based on COV, the parameter shall be recorded based on the interval common to the unit.

Contractor shall provide the CxA with required passwords, phone numbers, etc. to allow the CxA access to the trend log data and allow downloading to a remote location. Contractor shall also provide step-by-step written instructions for accessing the data.

Trending Requirements: At a minimum, trend the following on 15 min. intervals for analog values and change of value for binary values.

4. Outside Air Temperature
5. Outside Air Enthalpy
6. Cooling Tons
7. All sensed Hydronic Temperatures
8. All sensed air temperatures on primary equipment
9. All damper outputs on primary equipment
10. All valve outputs on primary equipment
11. All sensed Fan Volumes on primary equipment
12. All inputs and outputs to VFDs
13. Return (or exhaust) Air Temperature on each air handler
14. All safety indications
15. Status on all primary equipment
16. All air and water pressures on primary equipment or systems
17. Space Temperatures
18. Steam Flow
19. Electricity consumption where monitored.
20. Natural Gas flows
21. Converter steam valves and hot water temperatures
22. Steam supply pressures and temperatures.
23. Basically all points on primary equipment and selected sampling of terminal points unless approved otherwise

Trending to document functional tests will typically be at a more frequent interval. Consult with the CxA to determine the required intervals for functional testing and modify intervals as required.

3.12 TREND GRAPHS

Trend graphs shall generally be used during the Acceptance Phase to facilitate and document testing. Prepare controller and workstation software to display graphical format trends during the Acceptance Period. Trend graphs shall demonstrate compliance with contract documents. Trended values and intervals shall be the same as those specified for the functional performance tests.

Set-up the trend graphs to provide a grouped display of all pertinent information for each control loop. For example, for a steam converter, one graph would include the HWS setpoint, HWS & R temperatures, and steam valve output. Consult CxA for questions regarding trend groupings.



Lines shall be labeled and shall be distinguishable from each other by using either different line types, or different line colors.

Indicate engineering units of the y-axis values; e.g. degrees F., inches w.g., Btu/lb, percent wide open, etc.

The y-axis scale shall be chosen so that all trended values are in a readable range. Do not mix trended values on one graph if their unit ranges are incompatible.

Trend outside air temperature, humidity, and enthalpy during each period in which any other points are trended.

All points trended for one HVAC subsystem (e.g. air handling unit, chilled water system, etc.) shall be trended during the same trend period.

Each graph shall be clearly labeled with HVAC subsystem title, date, and times.

3.13 WARRANTY PHASE BAS OPPOSITE SEASON TRENDING AND TESTING

Trending: throughout the Warranty Phase, trend logs shall be maintained as required for the Acceptance Period. Contractor shall forward archived trend logs to the CxA for review upon CxA's request. CxA will review these and notify contractor of any warranty work required.

Opposite Season Testing: Within 6 months of completion of the Acceptance Phase, CxA shall schedule and conduct Opposite Season functional performance testing. Contractor shall support this testing and remedy any deficiencies identified.

3.14 SOFTWARE OPTIMIZATION ASSISTANCE

The contractor shall provide the services of a controls technician as specified above at the project site to be at the disposal of the CxA. The purpose of this requirement is to make changes, enhancements and additions to control unit and/or workstation software that have been identified by the CxA during the construction and commissioning of the project and that are beyond the specified Contract requirements. The cost for this service shall be included with the bid. Requests for assistance shall be for contiguous or non-contiguous 8 hour days, unless otherwise mutually agreed upon by contractor, Commissioning Authority, and Owner. The Owner's representative shall notify contractor 2 days in advance of each day of requested assistance.

The controls technician provided shall be thoroughly trained in the programming and operation of the controller and workstation software. If the controls technician provided cannot perform every software task requested by the Commissioning Authority in a timely fashion, contractor shall provide additional qualified personnel at the project site as requested by the Commissioning Authority, to meet the total specified requirement [on-site.]

3.15 BAS OPERATOR TRAINING:

Provide up to 6 complete sets of User Manuals hard copy and one electronic copy to be used for training.

Contractor shall submit a Training Plan per the requirements of Div 1 for the scope of training he is responsible. Training Plan shall be forwarded to the Division 23 contractor who will compile, organize, format, and forward to the GC who will forward it to the AE and CxA for review.

NOTE TO SPECIFIER



THE FOLLOWING TRAINING HOURS NEEDS TO BE CUSTOMIZED AND/OR SELECTED FOR EACH PROJECT. FOR EXAMPLE LARGER PROJECTS MAY TAKE UP TO 40 HOURS WHEREAS SMALLER PROJECTS MAY TAKE 16 HOURS. SELECT THE APPLICABLE SYSTEM AND SUBMIT TO USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.

On Site Training: Provide services of controls contractor's qualified technical personnel for total of [40] [] hours to instruct Owners personnel in operation and maintenance of BAS. Instruction shall be in classroom setting at the project site for appropriate portions of the training. Training may be in non-contiguous days at the request of the Owner. The Owner's representative shall notify contractor 1 week in advance of each day of requested training. The contractor's designated training personnel shall meet with the AE, CxA and Owner's representative for the purpose of discussing and fine-tuning the training agenda prior to the first training session. Training agenda shall generally be as follows:

1. Basic Operator Workstation Training – [8] [] hours for all potential users of the OWS in 4 hour non-contiguous segments:
 - a. Brief walk-through of building, including identification of all controlled equipment and condensed demonstration of controller portable and built-in operator interface device display capabilities.
 - b. Brief overview of the various parts of the O&M manual, including hardware and software programming and operating publications, catalog data, controls installation drawings, and DDC programming documentation.
 - c. Demonstration of workstation login/logout procedures, password setup, and exception reporting.
 - d. Demonstration of workstation menu penetration and broad overview of the various workstation features.
 - e. Overview of systems installed
 - f. Present all site specific naming conventions and points lists, open protocol information, configuration databases, back up sequences, upload/download procedures, etc.
 - g. Overview of scheduling procedures.
 - h. Overview of alarm features, including how to acknowledge and respond to alarms, archive alarms and mine them
 - i. Overview of trend features, including how to set up and view trends.
 - j. Overview of workstation reporting features and introductory level report generation and scheduling.
2. Control Technician Training: [16] [] hours that can be in 4 hour non-contiguous segments for individuals who will troubleshoot the system hardware, I/O devices, and the systems in general.
 - a. General review of sequence of operation and control logic for the project site, including standalone and fail safe modes of operation
 - b. Uploading/Downloading and backing up controller configuration and application programs
 - c. Review of installed components including all communication devices, controllers, I/O, etc., and how to install/replace, maintain, commission, and diagnose them
 - d. Introduction to Controller programming and overview of the programming application interface.
 - e. Defining trends: generating graphs in real time; archiving trends, accessing historical archive and generating reports from them.
 - f. Introductory network administration
 - g. Introduction to Creating and editing graphics
 - h. Review of setpoint optimization and fine-tuning concepts.
 - i. OI use and maintenance
 - j. Web page creation as applicable
3. System Administrator Training: Two [2] [] hour sessions that may be done in 2- hour segments on non-contiguous days. Target audience is the person who will be maintaining the system from an IT perspective as well as Owners IT personnel. Agenda shall be as follows:



- a. Overview of system architecture including all routers, bridges, repeaters, gateways, communications protocols, servers, controllers, etc.
- b. Overview of and recommendations for backing up and restoring the system configuration database
- c. Server Maintenance
- d. Security Management: assigning passwords and rights for various users on the server, workstations and GUI software.
4. BAS Sequence Training
 - a. The BAC shall conduct a [12] [____] hour session that can be in 4 hour non-contiguous segments to present the final sequences programmed into the control system. The session will basically present:
 - i. Control System Architecture
 - ii. Addressing and location of panels
 - iii. Schematic configuration of the systems
 - iv. Final programmed sequences. It shall present the written sequences and illustrate the programming that accomplishes those sequences. This session is typically presented on site by the primary BAS technician that managed the installation of the controls at that facility.
 - b. The BAC shall be use the Record Control Shop Drawings as the handout for the training. The audience for the session will be the Building Operators and managers. The setting should be primarily classroom. Since the presentation will typically need to use a live Operator Interface, BAC shall work out the logistics of projecting the video for an effective presentation.

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END OF SECTION



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SECTION 25 11 04 00 - MPF METERING DEVICES

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS FACILITIES, THROUGH THE CONTRACTING OFFICER'S REPRESENTATIVE.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.25 11 04 00

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Electric Meters
- B. Flow Meters
- C. Wiring
- D. Testing Equipment

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Section 230500 - Common Work Results for HVAC
- C. Section 260500 – Common Work Results for Communications
- D. Section 260533 – Raceway and Boxes for Electrical Systems
- E. Section 260623 – Lighting Control Devices
- F. Section 250504 - Building Automation System (BAS) General
- G. Section 253004 – (BAS) Basic Materials, Interface Devices, and Sensors
- H. Section 251404 - BAS Equipment, Software and Programming
- I. Section 255104 – EEMS Integration
- J. Section 259004 – Sequence of Operation
- K. Section 250804 – Building Automation System (BAS) Commissioning

1.3 DESCRIPTION OF WORK

- A. Refer to Section 250504 for general requirements.
- B. Refer to other Division-23 sections for installation of instrument wells, piping in mechanical systems; not work of this section.



- C. Provide the following electrical work as work of this section, complying with requirements of Division-26 sections:
1. Control wiring between field-installed meter, indicating devices, and unit control panels.
 2. Wiring associated with indicating and alarm panels (remote alarm panels) and connections to their associated field devices.
 3. All other necessary wiring for fully complete and functional control system as specified.

1.4 WORK BY OTHERS

- A. Water Pressure Taps, Thermal Wells, Flow Switches, Flow Meters, etc. that will have wet surfaces, shall be installed under the applicable piping Section under the direction of Section 251104 Contractor who will be fully responsible for the proper installation and application.
- B. Controlled Equipment Power Wiring shall be furnished and installed under Division 26. Where control involves 120V control devices controlling 120V equipment, Division 26 Contractor shall extend power wiring to the equipment. Section 253004 Contractor shall extend it from the equipment to the control device.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

NOTE TO SPECIFIER

Edit the following to suit the project. Delete all pneumatic references for new facilities or where existing pneumatic control systems will not be partially utilized.

- A. General: Provide electronic [pneumatic][and][electric] control products in sizes and capacities indicated, consisting of valves, dampers, thermostats, clocks, controllers, sensors, and other components as required for a complete installation. Except as otherwise indicated, provide manufacturer's standard materials and components as published in their product information; designed and constructed as recommended by manufacturer, and as required for application indicated.
- B. Part Substitutions: Permitted per Division 1.
- C. Instrument Pipe and Tube
1. Hydronic and Instruments
 - a. Connection To Main Piping: Provide ½ inch minimum size threadolet, ½" x 2 inch brass nipple, and ½" ball valve for connection to welded steel piping. Provide tee fitting for other types of piping.
 - b. Remote Instruments: Adapt from ball valve to specified tubing and extend to remote instruments. Provide a union or otherwise removable fitting at ball valve so that connection to main can be cleaned with straight rod. Where manifolds with test ports are not provided for instrument, provide tees with ¼" FPT branch with plug for use as test port. Adapt from tubing size to instrument connection.
 - c. Line Mounted Instruments: Extend rigid piping from ball valve to instrument. Do not use close or running thread nipples. Adapt from ball valve outlet to instrument connection size. Provide a plugged tee if pipe makes 90 degree bend at outlet of valve to allow cleaning of connection to main with straight rod without removing instrument.
 - d. Instrument Tubing: Seamless copper tubing, Type K or L, ASTM B 88; with cast-bronze solder joint fittings, ANSI B1.18; or wrought-copper solder-joint fittings, ANSI B16.22; or brass compression-type fittings. Solder shall be 95/5 tin antimony, or other suitable lead



- free composition solder. Tubing OD size shall be not less than the larger of ¼" or the instrument connection size.
 - e. Rigid Piping For Line Mounted Instruments: Schedule 40 threaded brass, with threaded brass fittings.
 - 2. Low Pressure Air Instrument Sensing Lines
 - a. Connections: Use suitable bulkhead type fitting and static sensing tip for static pressure connections. Adapt tubing to instrument connection.
 - b. Tubing: Virgin polyethylene non-metallic tubing type FR, ASTM D 2737, and with flame-retardant harness for multiple tubing. Use compression or push-on brass fittings.
- D. Communication Wiring: All wiring shall be in accordance with National Electrical Codes and Division 26 of this specification. Conduit systems shall be MC, EMT, PVC or as otherwise allowed by code. Non plenum rated wiring shall be in conduit meeting Division 26 requirements when run through plenum spaces.
 - 1. Contractor shall supply all communication wiring between Metering devices and Building Controllers, AAC's, ASC's and local or remote peripherals
 - 2. Communication wiring shall be individually 100% shielded pairs per manufacturers recommendations for distances installed, with overall PVC cover, Class 2, plenum-rated run with no splices and separate from any wiring over thirty (30) volts. Shield shall be terminated and wiring shall be grounded as recommended by equipment manufacturer.
- E. Signal Wiring: Contractor shall run all signal wiring in accordance with National Electric Codes and the Division 26 Specification. Conduit systems shall be MC, EMT, PVC or as otherwise allowed by code. Non plenum rated wiring shall be in conduit meeting Division 26 requirements when run through plenum spaces.
 - 1. Signal wiring to all field devices, including, but not limited to, all sensors, transducers, transmitters, switches, etc. shall be twisted, 100% shielded pair, minimum 18-gauge wire, with PVC cover. Signal wiring shall be run with no splices and separate from any wiring above thirty (30) volts.
 - 2. Signal wiring shield shall be grounded at controller end only unless otherwise recommended by the controller manufacturer.

2.2 GENERAL METER DEVICES

- A. It shall be the Contractor's responsibility to assure that all metering devices are compatible with controller hardware and software.
- B. Meters specified herein are generally 'two-wire' type transmitters, with power for the device to be supplied from the respective controller. If the receiving device is not equipped to provide this power, or is not designed to work with 'two-wire' type transmitters, or if metering device is to serve as input to more than one controller, or where the length of wire to the controller will unacceptably affect the accuracy, the Contractor shall provide 'four-wire' type equal transmitter and necessary regulated DC power supply or 120 VAC power supply, as required.
- C. For field devices specified hereinafter that require signal conditioners, signal boosters, signal repeaters, or other devices for proper interface to controllers, Contractor shall furnish and install proper device, including 120V power as required. Such devices shall have accuracy equal to, or better than, the accuracy listed for respective field devices.
- D. For devices specified to have a communication Interface, interface shall use one of the following protocols:
 - 1. BACnet MS/TCP communications compliant to ASHRAE Standard 135.
 - 2. Modbus RTU communications
 - 3. Modbus TCP/IP communications



- E. Accuracy: As stated in this Section, accuracy shall include combined effects of nonlinearity, nonrepeatability and hysteresis.

NOTE TO SPECIFIER

Edit the following to suit the project. The application of meters and submeters needs to be balanced against the added benefit the collected information will provide in energy use reductions and monitoring for M&V purposes.

2.3 PRESSURE TRANSMITTERS

- A. Liquid, Steam and Gas:
1. General: Two-wire smart cell type transmitter, 4-20 mA or 1-5 Vdc user-selectable linear or square root output, adjustable span and zero, stainless steel wetted parts.
 2. Environmental limits: -40 to 250 °F (-40 to 121°C), 0 to 100% RH..
 3. Accuracy: better than 0.2 percent of span.
 4. Output Damping: Time constant user selectable from 0 to 36 seconds.
 5. Vibration Effect: Less than $\pm 0.1\%$ of upper range limit from 15 to 2000 Hz in any axis relative to pipe mounted process conditions.
 6. Electrical Enclosure: NEMA-4, -4X, -7, -9.
 7. Approvals: FM, CSA.
 8. Acceptable Manufacturers: Rosemount Inc. 3051 Series, Foxboro, Johnson-Yokagawa, Siemens Sitran
- B. Accessories
1. Valve Manifold
 - a. Provide a three valve manifold for all liquid or steam pressure sensors.
 - b. Manifold shall include high and low pressure isolation valves, pressure vent valve
 - c. Manifold may mount integral with transmitter or remotely.
 2. Provide siphon loop on all stream pressure transmitters

2.4 DIFFERENTIAL PRESSURE TRANSMITTERS (DP)

- A. Liquid, Steam and Gas:
1. General: Two-wire smart DP cell type transmitter, 4-20 mA or 1-5 Vdc user-selectable linear or square root output, adjustable span and zero, stainless steel wetted parts.
 2. Environmental limits: -40 to 250 °F (-40 to 121°C), 0 to 100% RH..
 3. Accuracy: better than 0.2 percent of span.
 4. Output Damping: Time constant user selectable from 0 to 36 seconds.
 5. Vibration Effect: Less than $\pm 0.1\%$ of upper range limit from 15 to 2000 Hz in any axis relative to pipe mounted process conditions.
 6. Electrical Enclosure: NEMA-4, -4X, -7, -9.
 7. Approvals: FM, CSA.
 8. Acceptable Manufacturers: Rosemount Inc. 3051 Series, Foxboro, Johnson-Yokagawa, Siemens Sitran
- B. Accessories
1. Valve Bypass Manifold
 - a. Provide a five valve bypass manifold for all liquid or steam sensors.
 - b. Manifold shall include high and low pressure isolation valves, high and low pressure vent valves, and a bypass valve
 - c. Manifold may mount integral with transmitter or remotely.



2.5 CURRENT TRANSDUCERS

- A. Clamp-On Design Current Transducer
1. Transducer shall measure true (rms.) current.
 2. Range: 208/270/480 Volt, up to 2000 amp
 3. Output: 0-5 VDC.
 4. Accuracy: +/- 1% from 10 % to 100 % of the rated current over a temperature range of 0-60° C.
 5. Transducer shall be internally isolated to 2000 VAC. Transducer case isolation shall be 600 VAC.
 6. Acceptable Manufacturers: Veris Industries H922, KELE SC100, NK Technologies ATR.

2.6 KW TRANSDUCERS

- A. Clamp-On Design kW Transducer (for Power Sensing)
1. Transducer shall consist of three split-core CTs hinged at both axes with embedded electronics or external CT as required.
 2. Range: 1-10 amps minimum, 20-200 amps maximum
 3. Output: 0-5 VDC.
 4. Accuracy: $\pm 1\%$ from 20 to 100 Hz.
 5. Transducer shall be internally isolated to 2000 VAC. Transducer case isolation shall be 600 VAC.
 6. Acceptable Manufacturers: Veris H8044 NK Technologies AP series.

NOTE TO SPECIFIER

New Construction and Major R&A projects shall be equipped with advanced metering for whole building (utility level) metering of electricity. Include para. 2.7 below for all applicable R&A projects. Delete para. 2.7 below for all new construction and R&A projects that involve switchgear replacement; advanced electric metering shall be provide as an integral part of the electrical switchgear (per section 262413 – Switchboards) for these type projects.

2.7 ADVANCED METERING EQUIPMENT (ELECTRICAL UTILITY MAINS).

- A. The meter device shall be UL listed. All meters shall have the following ratings, features, and functions.
1. Designed for multifunction electrical measurements on 3 phase power systems. The Meter shall support 3-Element Wye, 2.5 Element Wye, 2 Element Delta, 4 wire Delta systems.
 2. Provide surge withstand ratings confirming to ANSI C62.41 (6KV)
 3. Be user programmable for voltage range to any PT ratio.
 4. Accept a direct voltage input range of up to 576 Volts Line to Neutral, and a range of up to 721 Volts Line to Line.
 5. Accept a current input of up to 11 amps continuous. Start up current for a 5 Amp input shall be no greater than .005 Amps.
 6. Have the following additional ratings and features:
 - a. Fault Current Withstand shall be 100 Amps for 10 seconds, 300 Amps for 3 seconds, and 500 Amps for 1 second.
 - b. Meter shall be programmable for current to any CT ratio.
 - c. All inputs and outputs shall be galvanically isolated to 2500 Volts AC.
 7. Accept current inputs of class 10: (0 to 11A), 5 Amp Nominal and class 2 (0 to 2A), 1A Nominal Secondary.
 8. Provide an accuracy of +/- 0.5% or better for volts and amps, and 0.5% for power and energy functions and meet or exceed the accuracy requirements of ANSI C12.20 (Class 0.5%).
 9. Provide true RMS measurements of voltage, phase to neutral and phase to phase; current, per phase and neutral.
 10. Provide sampling at 400+ samples per cycle on all channels measured readings simultaneously.
 11. The meter shall utilize 24 bit Analog to Digital conversion.



12. Provide at a minimum Voltage and current per phase, kW, kVAR, PF, kVA, Frequency, kWh, %THD (% of total Harmonic Distortion).
13. Shall be a traceable revenue meter, which shall contain a utility grade test pulse allowing power providers to verify and confirm that the meter is performing to its rated accuracy.
14. The meter shall include 1 independent communications port on the back, with advanced features. The port shall provide Ethernet communication speaking Modbus/IP, Modbus MS/TCP or BACnet MS/TCP protocols
15. Provide user configured fixed window or sliding window demand. This shall allow the user to set up the particular utility demand profile.
 - a. Readings for kW, kVAR, kVA and PF shall be calculated using utility demand features.
 - b. All other parameters shall offer max and min capability over the user selectable averaging period.
 - c. Voltage shall provide an instantaneous max and min reading displaying the highest surge and lowest sag seen by the meter.
16. Capable of operating on a power supply of 90 to 265 Volts AC and 100 to 370 Volts DC. Universal Power AC/DC Supply shall be available. An option shall also be available to operate on a power supply from 18-60 VDC.
17. Meter shall provide update rate of 100msec for Watts, Var and VA. All other parameters shall be 1 second.
18. The meter shall be provided with I/O expandability through option card slots..

B. Meter Software features

1. Meter shall provide internally calculated values based in voltage and current inputs. The following parameters shall be provided for each measured phase and total of all 3 phases: volts, amps, kW, kVAR, PF, kVA, frequency., kWh, %THD. predicted kW based on selected demand period.
2. All meter setup parameters shall be adjustable though a software configuration tools, though the front panel keypad or though a web based browser. All meter configurations shall be password protected from alteration.
3. All meter parameters shall be accessible through the Modbus TCP/IP, Modbus RTU communication protocol or BACNet.

C. Acceptable Manufactures Models

1. Schnieder Electric/Square D – PM750
2. Electro Industries - Shark S100
3. Siemens – PAC3200
4. General Electric – EPM 6000
5. E-MON/D-MON

D. Accessories:

1. Current transformers: All CT's should conform to the ANSI standard accuracy class for metering service of 0.3 or better and shall be provided with certificates of test stipulating the ratio and phase angle corrections at 10% and 100% of rating with the standard ANSI burden nearest to the actual "in-service" burden Whenever practical, the CT's should be designed to withstand continuous operation and maintain class 0.3 or better metering accuracy at twice or more of rated current (ex. Transformer thermal rating factor greater than or equal to 2)
2. Voltage Transformers: All VT's should conform to the ANSI standard accuracy class for metering service of 0.3 or better and be provided with certificates of test stipulating the ratio and phase angle corrections at 100% rating with zero burden and with the rated maximum standard burden.
3. Test Block/Switches: These test blocks should be designed to provide a means to measure the input quantities from the current and/or voltage transformers and to allow the application of test quantities.

NOTE TO SPECIFIER



AE should confer with the gas utility provider to see if existing meters can be retrofitted with a pulse initiator. This is the preferred method for metering incoming utility services. If meters cannot be retrofitted or other submetering is required, AE must indicate which flow meters below are acceptable natural gas applications.

2.8 UTILITY PROVIDED MAIN GAS METER PULSE INITIATOR

- A. Existing main gas meters shall be retrofitted by the utility provider to provide usage information. Contractor is to coordinate retrofit with the utility provider.

NOTE TO SPECIFIER

AE should confer with the utility provider to see if existing meters can be retrofitted with a pulse initiator. This is the preferred method for metering incoming utility services. If meters cannot be retrofit, replace or other submetering is required, i.e. tower water make-up, AE must clearly indicate which flow meters are acceptable for the application.

2.9 UTILITY PROVIDED MAIN WATER METER PULSE INITIATOR

- A. Existing main meters shall be retrofitted by the utility provider to provide usage information. Contractor is to coordinate retrofit with the utility provider.

2.10 DOMESTIC, POTABLE AND RECLAIMED WATER SERVICE METERS

- A. The type or combination of types of meters to be used for recording water consumption from a service must accurately record consumption over the expected range of flow. The size selected shall ensure pressure losses are within acceptable limits and provide long meter life. There are three types of cold-water meters accepted for use. These are displacement, turbine and compound types. The actual meter or combination of meters accepted for use must accurately account for the total water use of the property serviced
- B. Displacement meters are to be either nutating disk or oscillating piston type are to conform to AWWA C-700. Meters are to have a bronze case with cast iron or plastic frost protection cover. Meters 38mm and 50mm in size are to have oval two bolt flanged ends.
 - 1. Acceptable Manufacturers: Sensus (Invensys, Rockwell) SR11 or SR' Neptune (Schlumberger) T-10
- C. Turbine meters are to conform to the AWWA C-701 class II. Meters are to have a cast bronze case with flanged connections. Meters 38mm and 50mm in size are to have oval two bolt flanged ends.
 - 1. Acceptable Manufacturers: Sensus (Invensys, Rockwell) Series 'W', Neptune (Schlumberger) HP
- D. Compound meters are to conform to AWWA C-702. Meters are to have a cast bronze case with flanged connections. 50mm in size are to have oval two bolt flanged ends.
 - 1. Acceptable Manufacturers: Sensus (Invensys, Rockwell) SRH, Neptune (Schlumberger) TRU/FLO
- E. Accessories
 - 1. Registers: All meter shall be provided with a direct reading odometer style register. Unit of measure shall be hundreds of cubic feet. Register shall have a sweep hand or flow indicator for low flow indication. Compound meters shall provide registers appropriately scaled for each meter section.
 - 2. Contact output: Integral to the register or as a separate device, meter shall provide a dry contact closure for monitoring by other systems. Contract shall not require an external power source for



activation. Pulse shall be scaled to provide 1 pulse per 10 gallons for meters with a maximum flow rate less than 100 GPM and 1 pulse per 100 gallons for all other flow ranges.

3. Strainers: All meters are to be installed with a meter of the style recommended by the meter manufacturer.

NOTE TO SPECIFIER

AE should confer with the utility provider to see if existing meters can be retrofitted with a pulse initiator or replaced with a new meter with this feature, as this is the preferred method for metering incoming utility services. The meter below should be considered if the utility meters are not available and therefore shall be thoroughly evaluated economically. Coordinate and obtain approval through the USPS Contracting Officer. If meters cannot be retrofit or replaced, AE must clearly indicate which flow meters are acceptable for the application and delete references to non-applicable meters.

2.11 INSERTION TYPE TURBINE METER FOR WATER SERVICE

- A. Turbine Insertion Flow Meter sensing method shall be impedance sensing (iron magnetic and non-photoelectric), with volumetric accuracy of +/- 2% of reading over middle 80% of operating range, and +/- 4% of reading over the entire operating range. Turbine Insertion Flow Meter shall have maximum operating pressure of 400 psi and maximum operating temperature of 200°F continuous (220°F peak). All wetted metal parts shall be constructed of 316 stainless steel. Flow meter shall meet or exceed all of the accuracy, head loss, flow limits, pressure and material requirements of the AWWA standard C704-70 for the respective pipe or tube size. Analog outputs shall consist of non-interactive zero and span adjustments, a DC linearly of 0.1% of span, voltage output of 0-10 V, and current output of 4-20 mA.

1. Install in water systems with a minimum of 10 pipe diameters unobstructed flow.

NOTE TO SPECIFIER

Double turbine insertion required at between 10 and 4 diameters unobstructed flow.

2. Acceptable Manufacturers: Onicon Corp., Emco, Nice.

NOTE TO SPECIFIER

AE should confer with the utility provider to see if existing meters can be retrofit with a pulse initiator or replaced with a new meter with this feature, as this is the preferred method for metering incoming utility services. The meters below should be considered if the utility meters are not available and therefore shall be thoroughly evaluated economically. Coordinate and obtain approval through the USPS Contracting Officer. If meters cannot be retrofit or replaced, AE must clearly indicate which flow meters are acceptable for the application and delete references to non-applicable meters.

2.12 VORTEX SHEDDING FLOW METER FOR LIQUID, STEAM AND GAS SERVICE:

- A. Output: 4-20 mA, 0-10 VDC, or 0-5 VDC
- B. Maximum Fluid Temperature: 800 °F (427 °C)
- C. Wetted Parts: Stainless Steel
- D. Housing: NEMA 4X
- E. Turndown: 10:1 minimum.
- F. Accuracy: 0.5% of calibrated span for liquids, 1% of calibrated span for steam and gases.



- G. Body: Wafer style or ANSI flanged to match piping specification
- H. Insertion: Hot tap insertable with guide and extraction device
- I. Acceptable Manufacturers: Foxboro 83 series, Sierra, Rosemount, Siemens, and Onicon .

2.13 VENTURI FLOW METER FOR WATER SERVICE

- A. Flow Sensing Element: Differential-pressure Venturi-type designed for installation in piping.
- B. Construction: Bronze or cadmium plated steel with brass quick connect fittings and attached tag with flow conversion data and rated flow. Ends shall be threaded for 2" and smaller and flanged or welded for larger than 2".
- C. Differential transmitter shall be dual range industrial grade as specified above.
- D. Apply Venturi-type flow meters where minimum flow range is no less than 40% of maximum flow.

2.14 ULTRASONIC FLOW METER FOR WATER SERVICE:

- A. General: Single-channel non-wetted ultrasonic meter to measure volumetric fluid using transit-time flow measurement:
- B. Measurement: [Single channel] [Two Channel] measurement.
- C. Enclosure: Epoxy-coated aluminum NEMA 4X, IP66 weatherproof.
- D. Accuracy: $\pm 2\%$ of velocity reading at 1 to 40 ft/s.
- E. Rangeability: 100 to 1.
- F. Repeatability: ± 0.2 to 0.5% at full scale.
- G. Input Power: 120 VAC or 24VDC.
- H. Operating Temperature: 14° to 140°F .
- I. Control Panel: Stainless Steel case. Digital display: 2-line x 16-character LCD display, LED backlight, configurable to display up to 4 measurement parameters in sequence.
- J. Keypad: 6-button internal keypad.
- K. Output: [Single Channel – one 4-20 mA] [Two Channel – two 4-20 mA].
- L. Output Units: Velocity in ft/s or m/s.
- M. Volumetric Flow: Cubic feet (ft³), cubic meters (m³), gallons (gal), and liters (L).
- N. Totalizer Cubic feet (ft³), cubic meters (m³), gallons (gal), and liters (L).
- O. Transducer Temperature Range: -40° to 140°F .
- P. Provide all slide track brackets, stainless steel chain or strap, for a complete installation. Provide connector cables and connectors as required for a complete system.
- Q. Acceptable Manufacturers: EMCO. Siemens, Controlotron, Sierra.

**NOTE TO SPECIFIER**

AE should only utilize BTU meter below if facility is fed from and charged by a District Utility system providing hot or chilled water system. Use and specification shall be provided only in close coordination with the USPS Contracting Officer. This metering type is atypical for nearly all facilities and would only be used as a check against utility charges if an auxiliary contact is not provided by the utility company or if secondary confirmation of charges is requested by the USPS Contracting Officer. Omit this metering section if district hot water or chilled water are not provided.

2.15 BTU METERING DEVICES (HOT AND CHILLED WATER SYSTEMS)

- A. The entire BTU metering device shall be built and calibrated by a single manufacturer and shall consist of a flow meter, two temperature sensors, a Btu meter, temperature thermowells, and all required mechanical installation. A certificate of NIST* traceable calibration shall be provided with each system. All equipment shall be covered by the manufacturer's two year warranty.
 - 1. Insertion Temperature sensors: Temperature sensors shall be loop-powered current based (mA) sensors and shall be bath-calibrated and matched (NIST* traceable) for the specific temperature range for each application. The calculated differential temperature used in the energy calculation shall be accurate to within +0.15°F (including the error from individual temperature sensors, sensor matching, input offsets, and calculations).
 - 2. Flow Meter: Provide an turbine or ultrasonic flowmeter as specified in other paragraphs.
 - 3. Btu Meter: The Btu meter shall provide the following points both at the integral LCD and as data available through a communications interface: Energy Total, Energy Rate, Flow Rate, Supply Temperature Return Temperature. Output signals shall be either serial network (protocol conforming to BACnet® MS/TP, MODBUS RTU, or MODBUS TCP) and via individual analog and pulse outputs. Communication interface shall allow the reset of total energy and total flow. Each Btu meter shall be factory programmed for its specific application, and shall be re-programmable using the integral front panel keypad.
- B. Acceptable Manufacturer: Onicon, Sierra, Nice, Siemens.

2.16 COMPRESSED AIR FLOW TRANSMITTERS

- A. Insertion Mass Flow Type
 - 1. Provide a loop powered, thermal mass flow type level with adjustable span and zero.
 - 2. Output: 4-20 mA.
 - 3. Integral display
 - 4. Electrical Enclosure: NEMA 4, 4X, 7, 9.
 - 5. Approvals: UL or CSA.
 - 6. Accuracy: ±1% of reading.
 - 7. Sierra 640S, Nice, Siemens, Foxboro
- B. Insertion Vortex shedding Type
 - 1. Output: 4-20 mA, 0-10 VDC, or 0-5 VDC
 - 2. Maximum Fluid Temperature: 800 °F (427 °C)
 - 3. Wetted Parts: Stainless Steel
 - 4. Housing: NEMA 4X
 - 5. Turndown: 10:1 minimum.
 - 6. Accuracy: 1% of calibrated spa.
 - 7. Body: Wafer style or ANSI flanged to match piping specification.
 - 8. Insertion: Hot tap insertable with guide and extraction device.



9. Acceptable Manufacturers: Foxboro 83 series, Johnson-Yokagawa, and Rosemount Siemens, Onicon F2000.

2.17 CONTINUOUS LEVEL TRANSMITTERS

- A. Capacitance Type
 1. Provide a loop powered, continuous capacitance type level transmitter with adjustable span and zero.
 2. Output: 4-20 mA.
 3. Probe: Fluoropolymer coated stainless steel rod or cable. Provide cable probe with end attachment hardware or weight.
 4. Electrical Enclosure: NEMA 4, 4X, 7, 9.
 5. Approvals: UL or CSA.
 6. Accuracy: $\pm 1\%$ of calibrated span.
 7. Process Connection: MPT or ANSI Flange as required.
 8. Acceptable Manufacturers: Drexelbrook, Endress & Hauser. Substitutions shall be allowed per Division 1.
- B. Hydrostatic Pressure
 1. Two wire smart d/p cell type transmitter
 2. 4-20 mA or 1 to 5 volt user selectable linear or square root output
 3. Adjustable span and zero
 4. Stainless steel wetted parts
 5. Environmental limits: -40 to 250 °F (-40 to 121 °C), 0 to 100% RH
 6. Accuracy: less than 0.1 percent of span
 7. Output Damping: time constant user selectable from 0 to 36 seconds
 8. Vibration Effect: Less than $\pm 0.1\%$ of upper range limit from 15 to 2000 Hz in any axis relative to pipe mounted process conditions.
 9. Electrical Enclosure: NEMA 4, 4X, 7, 9
 10. Approvals: FM, CSA
 11. Acceptable Manufacturers: Rosemount Inc. 3051 Series, Foxboro, and Johnson-Yokagawa Siemens.

2.18 FUEL OIL METERS

- A. Type:
 1. High precision oscillating piston oil flow
 2. Body: Cast bronze
 3. Internal components: Brass Chamber; aluminum piston
 4. Seals: compatible with oil type
- B. Ratings:
 1. Maximum operation pressure: 225 PSI
 2. Maximum operating temperature: 260degree F
- C. Accuracy: $\pm 1\%$ from 10% to 90% operating range.
- D. Process Connection: MPT or ANSI Flange as required.
- E. Accessories
 1. Registers: All meters shall be provided with a direct reading odometer style register. Unit of measure shall be gallons. Register shall have a sweep hand or flow indicator for low flow indication.
 2. Contact output: Integral to the register, meter shall provide a dry reed contact closure for monitoring by other systems. Contact shall not require an external power source for activation.



Pulse shall be scaled to provide 10 pulse per 1 gallon for ¾"meters and smaller. All other meters shall provide 1 pulse per 1 gallon

3. Strainers: All meters are to be installed with a stainless steel strainer of the style recommended by the meter manufacturer.

F. Acceptable Manufacturers: AMCO, Elster.

2.19 NAMEPLATES

- A. Provide engraved phenolic or micarta nameplates for all equipment, components, and field devices furnished. Nameplates shall be 1/8 thick, black, with white center core, and shall be minimum 1" x 3", with minimum 1/4" high block lettering. Nameplates for devices smaller than 1" x 3" shall be attached to adjacent surface.
- B. Each nameplate shall identify the device tag number as identified on the control drawings.

2.20 TESTING EQUIPMENT

- A. Contractor shall test and calibrate all signaling circuits of all field devices to ascertain that required digital and accurate analog signals are transmitted, received, and displayed at system operator terminals, and make all repairs and recalibrations required to complete test. Contractor shall be responsible for test equipment required to perform these tests and calibrations. Test equipment used for testing and calibration of field devices shall be at least twice as accurate as respective field device (e.g., if field device is +/-0.5% accurate, test equipment shall be +/-0.25% accurate over same range).

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF METERS

- A. General: Install systems and materials in accordance with manufacturer's instructions, roughing-in drawings and details shown on drawings. Install electrical components and use electrical products complying with requirements of National Electric Code and all local codes.
- B. Control Wiring: The term "control wiring" is defined to include providing of wire, conduit and miscellaneous materials as required for mounting and connection of electric control devices.
 1. Wiring System: Install complete wiring system for electric control systems. Conceal wiring except in mechanical rooms and areas where other conduit and piping are exposed. Installation of wiring shall generally follow building lines. Install in accordance with National Electrical Code and Division 26 of this Specification. Fasten flexible conductors bridging cabinets and doors, neatly along hinge side, and protect against abrasion. Tie and support conductors neatly.
 2. Control Wiring Conductors: Install control wiring conductors, without splices between terminal points, color-coded. Install in neat workmanlike manner, securely fastened. Install in accordance with National Electrical Code and Division 26 of this Specification.
 3. Communication wiring, signal wiring and low voltage control wiring shall be installed separate from any wiring over thirty (30) volts. Signal wiring shield shall be grounded at controller end only, unless otherwise recommended by the controller manufacturer.



4. Install all control wiring external to panels in electric metallic tubing or raceway. However, communication wiring, signal wiring and low voltage control wiring may be run without conduit in concealed, accessible locations if noise immunity is ensured. Contractor will be fully responsible for noise immunity and rewire in conduit if electrical or RF noise affects performance. Accessible locations are defined as areas inside mechanical equipment enclosures, such as heating and cooling units, instrument panels etc.; in accessible pipe chases with easy access, or suspended ceilings with easy access. Installation of wiring shall generally follow building lines. Run in a neat and orderly fashion, bundled where applicable, and completely suspended (strapped to rigid elements or routed through wiring rings) away from areas of normal access. Tie and support conductors neatly with suitable nylon ties. Conductors shall not be supported by the ceiling system or ceiling support system. Conductors shall be pulled tight and be installed as high as practically possible in ceiling cavities. Wiring shall not be laid on the ceiling or duct. Conductors shall not be installed between the top cord of a joist or beam and the bottom of roof decking. Contractor shall be fully responsible for noise immunity and rewire in conduit if electrical or RF noise affects performance.
 5. Number-code or color-code conductors appropriately for future identification and servicing of control system. Code shall be as indicated on approved installation drawings.
- C. Electric meters: Install shorting switches and test blocks for all PT and CTs according to manufacturer's instructions.
- D. Fluid Flow Sensors: Install per manufacturer's recommendations in an unobstructed straight length of pipe.
- E. Pressure Transmitters: Install valve manifolds at transmitters per manufactures requirements. Provide isolation/ shutoff valve at pressure tap connection to piping.
- F. Cutting and Patching Insulation: Repair insulation to maintain integrity of insulation and vapor barrier jacket. Use hydraulic insulating cement to fill voids and finish with material matching or compatible with adjacent jacket material.

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END OF SECTION



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SECTION 25 13 04 00 - CSF FACILITY SYSTEM INTEGRATION INTO ENTERPRISE ENERGY MANAGEMENT

NOTE TO SPECIFIER

This section is intended for CSF Medium facilities that will have an Enterprise Energy Management System (EEMS). See the Standard Design Criteria (SDC) for information on EEMS requirements. For CSF Medium facilities without an EEMS or CSF Small facilities, this section is not applicable.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.25 13 04 00

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. General installation and integration requirements necessary to establish monitoring / control capabilities between USPS building systems such as lighting and HVAC control systems and EEMS thru the installation of a Local Interface Device (LID).

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Section 230500 - Common Work Results for HVAC
- C. Section 238100 – Decentralized Unitary HVAC Equipment
- D. Section 230593 – Testing, Adjusting and Balancing for HVAC
- E. Section 230800 – Commissioning of HVAC
- F. Section 230904 - Instrumentation and Control For HVAC (CSF Medium)
- G. Section 251304 - Facility System Integration Into Enterprise Energy Management System (EEMS)
- H. Section 260500 – Common Work Results for Communications
- I. Section 260533 – Raceway and Boxes for Electrical Systems
- J. Section 260623 – Lighting Controls

1.3 DESCRIPTION OF WORK

- A. Contractor shall provide all interface devices, software and installation required to successfully establish communication between USPS building systems and EEMS via the Postal Routed Network (PRN). The two basic building system scenarios outlined below covered by this specification are:
 - 1. Small to Medium Size Facilities with Only Manual Controls – In this scenario the LID shall function in a supervisory role to manage HVAC devices ie RTU's and have intelligent controllers which replace manual controls and provides real-time capabilities that monitor, control, store, and transmit facility energy consumption and operational data over the PRN.
 - 2. Facilities with existing building controls – In this scenario the LID shall integrate with existing building control systems and function as a gateway to communicate with EEMS. The solution

CSF FACILITY SYSTEM INTEGRATION INTO ENTERPRISE



shall provide real-time capabilities that monitor, store, and transmit facility energy consumption and operational data over the internet.

1.4 INSTALLATION REQUIREMENTS

- A. All installations shall be in accordance with USPS SDC.
- B. All installations shall be in accordance with local electrical codes.
- C. All work to be coordinated thru USPS & site
- D. In accordance with all USPS IT & Security requirements
- E. Installation and integration shall be performed by a qualified system integrator.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturer's offering products which may be incorporated in the Work include the following:
 - 1. GridPoint Inc.,
5305 Valley Park Dr., Ste 2
Roanoke VA 24019-3082
Ray Finnegan, Account Manager
Phone: 540-527-4605
Mobile: 540-226-2913
Email: rfinnegan@gridpoint.com
- B. Product options and substitutions. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS AND EQUIPMENT

- A. Materials shall be new, the best of their respective kinds without imperfections or blemishes and shall not be damaged in any way. Used equipment shall not be used in any way for the permanent installation except where drawings or specs specifically allow existing materials to remain in place.

2.3 NETWORK CONNECTION

- A. USPS Enterprise Energy Management Server (EEMS):
- B. EEMS is network based system connecting multiple facilities with a central data warehouse and server, accessible via standard web-browser internal to the postal network. This is an existing infrastructure and the Contractor is not required to configure any components of this WAN. Contractor is however required to provide a single point of connection (Local Interfacing Device) to EEMS server utilizing one of the following protocols:
 - 1. FOX
 - 2. OBIX
 - 3. BACnet
 - 4. OPC
 - 5. SNMP
 - 6. MODBUS TCP



2.4 LOCAL INTERFACING DEVICE COMMUNICATION REQUIREMENTS

- A. The LID shall be a microprocessor-based communications device which acts as a supervisor/gateway (depending on scenario outline above) between the local site building automation devices (lighting control systems, HVAC, etc.) and the USPS network to support remote monitoring capabilities.
- B. At a minimum the Contractor installed LID shall communicate with building automation devices through one of the following protocols:
 - 1. BACnet
 - 2. MODBUS
 - 3. LONworks
- C. The LID shall perform information translation between the building automation devices and EEMS and shall be applicable to systems in which the same functionality is not provided in the local building controls.
- D. The LID shall contain its own microprocessor, RAM, battery, real-time clock, communication ports, and power supply.
- E. The LID shall be protected from any memory loss due power failure for a minimum of 14 days.
- F. The LID shall be mounted in a lockable enclosure.
- G. The LID shall be transparent to control functions.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Examine areas and conditions under which LID is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF LOCAL INTERFACING DEVICE:

- A. General: Install systems and materials in accordance with manufacturer's instructions, rough-in drawings and details shown on drawings.
- B. Contractor shall provide all interface devices and software to provide an integrated system.
- C. Contractor shall closely coordinate with the USPS, or designated representative, to establish IP addresses and communications to assure proper operation of the building control system on the USPS WAN/LAN.
- D. Installation of LID shall be based on the scenario's outline above
 - 1. Small to Medium Size Facilities with Only Manual Controls – device shall be install in electrical room.
 - 2. Facilities with existing building controls – device shall be installed in close proximity to Building Automation System (BAS) computer.
 - 3. Power requirements are outlined in the manufacturer's instructions but if necessary may require the installation of the power receptacle in close proximity to the LID.
- E. Access to the Local Area Network (LAN) is required to establish communications with LID and EEMS. Contractor shall coordinate with local USPS IT the following:
 - 1. Location of nearest LAN access point and if necessary install LAN drop in close proximity to LID. If LAN drop installed Local IT shall confirm IT drop installed on proper sub-net before installation contractor leaves facility.



2. Work with Local IT to acquire the all necessary IP, Gateway and Sub-net Mask addresses. All addresses assigned shall use the hardware code "EM".
- F. The contractor shall deliver to the USPS the final Point Summary Table prior to substantial completion of the system for review and approval.
- G. Prior to substantial completion of the system, the contractor shall deliver to the USPS a summary of all trend and schedule objects defined to meet this specification.
- H. The contractor shall deliver upon approval by the USPS, the full Point Summary Table and definitions of all trend and schedule objects to the USPS Remote Enterprise Server contractor for development of system graphics and server database development.
- I. Contractor shall coordinate with the USPS Remote Enterprise Server contractor in developing system graphics, commissioning documentation and testing.
- J. Contractor shall coordinate with the facility and generate a list contacts that shall be responsible for acknowledgment of EEMS notifications.

3.3 INTEGRATION WITH BUILDING SYSTEMS

- A. Contractor shall be complaint with all USPS IT & Security requirements prior to access to the USPS network.
- B. The USPS shall provide the following information to the Contractor:
 1. Hardware specifications (Once contract is awarded)
 2. A list of the minimum points required for integration (Attachment A)
 3. A copy of the current point's lists for all designated systems which are to be integrated into EEMS.
 4. USPS point naming convention standard (Attachment A)
 5. As-built drawings of systems to-be integrated
 - 6.
- C. Contractor shall establish communications with all building systems designated by the USPS. If communications cannot be successfully established then Contractor is to provide a proposed solution and cost estimate for USPS review.
- 1.
- D. All monitored points must be mapped to EEMS (Tridium AX Supervisor) and follow established point naming conventions.
- E. Contractor responsible for commissioning integration system which will require coordinating efforts with EEMS technical support.
- F. The contractor shall deliver to the USPS a Point Summary Table and summary of all trend & schedule objects prior to substantial completion of the system for review and approval.

3.4 POINT STRUCTURING AND NAMING

- A. General: The intent of this section is to require a consistent means of naming points across all USPS facilities. Contractor shall configure the systems from the perspective of the Enterprise, not solely the local project. The Contractor shall submit a proposed Point Summary Table for review prior to any object programming or project startup.
- B. Point Naming Convention
 1. All point names shall adhere to the format as in Attachment A. Naming convention shall apply to all physical I/O points, virtual points, calculated points and all application program parameters.



2. The USPS shall designate the Building name and facility ID.

3.5 DOCUMENTATION

- A. Provide written description of LID location (pictures if possible)
- B. Document all addresses used
 1. IP
 2. Gateway
 3. Sub-net Mask
- C. Document all building systems integrated
- D. Commissioning documentation
- E. A copy of all documentation sent to Facilities Energy



ATTACHMENT A
USPS Point and Device Naming Convention

NOTE TO SPECIFIER

The following is a typical point list for HVAC and lighting monitoring without incoming utility monitoring. This list may be edited depending on the type of controlled devices or meters existing in the building or specified elsewhere to be monitored as part of the EEMS. Insert alarm limits as required for the project. There may be more than one incoming electric main to some medium sized CSF. For the gas main monitoring, indicate in other specification sections that the contractor needs to coordinate with the local gas company to modify their meter to provide a contact pulse initiator if one is not present.

AHU Points	EEMS Standard Name
Occupied Status	OccStatus
Supply Fan	SplyFanStatus
Cur Clg SP	CurClgSp
Cur Htg SP	CurHtgSp
Occupied Clg SP	CurClgSp
Occupied Htg SP	OccClgSp
Unoccupied Clg SP	UnoccClgSp
Unoccupied Htg SP	UnoccHtgSp
Supply Temp	SupplyTemp
Zone1SpaceTemp	Zone1SpaceTemp
Zone2SpaceTemp	Zone2SpaceTemp
Zone3SpaceTemp	Zone3SpaceTemp
Zone4SpaceTemp	Zone4SpaceTemp
Avg. SpaceTemp	AvgSpaceTemp
Space Temp	SpaceTemp
CurrentCoolingSignal	ClgSignal
CurrentHeatingSignal	HtgSignal
FanStatus	FanStatus
Heat/Cool Mode	HeatCoolMode
HeatingSignal	HtgSignal
CoolingSignal	ClgSignal
Chilled Water Valve	ChwValve
Hot Water Valve	HwValve
Gas Valve	GasValve
Condenser Water Valve	CwValve
ZoneSpaceTemp	ZoneSpaceTemp
FCU Points	Standard Name
Status	UnitStatus
Space Temp	SpaceTemp
Space SP	SpaceSp
Start/Stop	OccCmd
RTU Points	Standard Name



Occupied Status	OccStatus
Supply Fan	SplyFanStatus
Supply Temp	SupplyTemp
SpaceTemp	SpaceTemp
Occupied Cooling Setpoint	OccClgSp
Occupied Heating Setpoint	OccHtgSp
Unoccupied Cooling Setpoint	UnoccClgSp
Unoccupied Heating Setpoint	UnoccHtgSp
Supply Temp	SupplyTemp
Supply Fan Cmd	SupplyFanCmd
Space SP	SpaceSp
HeatingCmdStg1	HtgCmdStg1
HeatingCmdStg2	HtgCmdStg2
CoolingCmdStg1	ClgCmdStg1
CoolingCmdStg2	ClgCmdStg2
HeatingSignal	HtgSignal
CoolingSignal	ClgSignal
Compressor1	ClgCmdStg1
Compresso2	ClgCmdStg2
EffectiveOccupancy	OccCmd
MUA Points	Standard Name
Occupied Status	OccStatus
Supply Fan	SplyFanStatus
Supply Temp	SupplyTemp
SpaceTemp	SpaceTemp
Space Temp Set Point	SpaceSp
Cur Clg SP	CurClgSp
Cur Htg SP	CurHtgSp
Hot Water Valve	HwValve
DischargeAir	SupplyTemp
Fan St/St	FanCmd
VAV points	Standard Name
Occupied Status	OccStatus
Supply Temp	SupplyTemp
SpaceTemp	SpaceTemp
Cur Clg SP	CurClgSp
Cur Htg SP	CurHtgSp
Room Temp	SpaceTemp
Space Setpoint	SpaceSp
Fan Command	FanCmd
HeatingSignal	HtgSignal
CoolingSignal	ClgSignal
HWS	Standard Name
Water Supply Temp	HwSupplyTemp
Water Return Temp	HwReturnTemp



Boiler Points	Standard Name
Boiler Pump Status	PumpStatus
Boiler Status	BoilerStatus
Supply Temp	SupplyTemp
Return Temp	ReturnTemp
Firing Status	FiringStatus
Pump Status	PumpStatus
Boiler Command	BoilerCommand
Space Temp	SpaceTemp
HW Distribution P1 Status	Pump1Status
HW Distribution P2 Status	Pump2Status
HW Distribution P3 Status	Pump3Status
Boiler Enable Status	BoilerEnableStatus
CWS	Standard Name
Chilled Water Supply Temp	ChwSupplyTemp
Chilled Water Return Temp	ChwReturnTemp
Condenser Water Supply Temp (Cooling Tower)	CwSupplyTemp
Condenser Water Return Temp (Cooling Tower)	CwReturnTemp
Pump Status	PumpStatus
Supply Temp	SupplyTemp
Return Temp	ReturnTemp
Tower Low Fan Status	CtLowFanStatus
Tower High Fan Status	CtHighFanStatus
Tower Fan Status	CtFanStatus
Enable Status	EnableStatus
Motor %KW	MotorKw
HVC	Standard Name
Occupied Status	OccStatus
Supply Fan Low Speed	SpdyLowFanStatus
Supply Fan High Speed	SpdyHighFanStatus
Supply Temp	SupplyTemp
Return Temp	ReturnTemp
HeatingMode	HtgMode
CoolingMode	ClgMode
Lighting	
Zone Status	ZoneCmd
Panel Status?	PanelStatus

Equipment Naming Convention

Roof Top Unit	RTU<nn>
Air Handling Unit	AHU<nn>
Variable Air Volume	VAV<nn>
Mixed Air Unit	MAU<nn>
Field Coil Unit	FCU<nn>
Boiler	Boiler<nn>

Site Naming Convention

Site Naming Convention

<State Code><ZipCode>-<nn>

Example: WASHINGTON USPS HQTRS
BLDG
DC20260-01

Station Naming Convention

<State Code><ZipCode>-<nn>-<A-Z>

Example: WASHINGTON USPS HQTRS
BLDG
Station 1 (Controller 1)
DC20260-01-A

USPS CSF Specification issued: 5/1/2014
Last revised: 4/16/2014

END OF SECTION



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SECTION 25 14 04 00 - MPF BAS EQUIPMENT, SOFTWARE AND PROGRAMMING

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.25 14 04 00

*****GENERAL

1.1 SECTION INCLUDES:

- A. Building Controller (BC)
- B. Advance Application Specific Controller (AAC)
- C. Application Specific Controller (ASC)
- D. Network Integration Devices
- E. BAS Operator Interfaces
- F. BAS and Network Software, Programming and Energy Management Applications

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Section 270500 – Common Work Results for Communications
- C. Section 230500 - Common Work Results for HVAC
- D. Section 250504 - Building Automation System (BAS) General
- E. Section 253004 - BAS Basic Materials, Interface Devices, and Sensors
- F. Section 251104 – METERING DEVICES
- G. Section 255104- EEMS Integration
- H. Section 259004 - Sequence of Operation
- I. Section 250804 – Building Automation System (BAS) Commissioning

1.3 DESCRIPTION OF WORK:

- A. Refer to Section 250504 for general requirements.
- B. Furnish and install DDC Control units and/or Smart Devices required to support specified building automation system functions.
- C. Provide all interface devices and software to provide an integrated system connecting BCs, AACs, ASCs and Gateways [in a stand alone local area network] [or] [connected to the IT USPS network].



- D. Fully configure systems and furnish and install all software, programming and dynamic color graphics for a complete and fully functioning system as specified.
- E. Refer Section 259004 - Sequence of Operation for specific sequences of operation for controlled equipment and .

1.4 LICENSING

- A. Include licensing for all software packages at all required controllers and workstations.
- B. All operator interface, programming environment, networking, database management and any other software used by the Contractor to needed to configure or operate the system to its full capabilities shall be licensed and provided to the USPS.
- C. All software should be available on all Operator Workstations or CSSs provided, and on all Portable Operator Terminals. Hardware and software keys to provide all rights shall be installed on all workstations. At least 2 sets of CDs shall be provided with backup software for all software provided, so that the USPS may reinstall any software as necessary. Include all licensing for workstation operating systems, and all required third-party software licenses.
- D. Provide licensing and original software copies for each OWS or CSS.
- E. Upgrade all software packages to the release (version) in effect at the end of the Warranty Period.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

THIS SECTION INCLUDES COORDINATION OF USPS NETWORK SERVICES AND MULTIPLE CONTRACTORS. REVIEW WITH THE USPS CONTRACTING OFFICER AND DESIGN MANAGER THE REQUIREMENTS FOR INTEGRATION WITH THE EEMS SYSTEM. SELECT THE OPTIONS WHICH APPLY. INTEGRATION REQUIRES THE SELECTION OF THE LAST TWO PARAGRAPHS FOR IT COORDINATION AND SECURITY PROTOCOLS.

2.1 NETWORK CONNECTION

- A. USPS EEMS: Ethernet-based network connecting multiple facilities with a central data warehouse and server, accessible via terminal services within the Postal Routed. This is an existing infrastructure and Contractor is not required to configure any components of this WAN. Contractor is however required to provide BACnet Objects and services on the Local Supervisory LAN via BACnet over IP [as part of this project] or [in preparation for future integration with the EEMS].
- B. The Contractor is required to connect to and provide all control variables and network variables for control as described in detail in this and other specifications to the EEMS but generally include:
 1. All Trend Data Objects. The controllers/systems to which these variables are applicable shall be bound and the name of the receiving variable shall be the same for these controllers/systems.
 2. All Alarm Events. The controllers/systems to which these variables are applicable shall be bound and the name of the receiving variable shall be the same for these controllers/systems.
 3. All set point variables. The controllers/systems to which these variables are applicable shall be bound and the name of the receiving variable shall be the same for these controllers/systems.
 4. Zone Occupancy and setpoint adjustment variables. The controllers/systems to which these variables are applicable shall be bound and the name of the receiving variable shall be the same for these controllers/systems.



5. All system/building mode variables/Objects (Schedules, Occupied, Unoccupied, Warm-up, Cool-down, Optimal Start/stop, etc.). [The building controls contractor shall inform the EEMS Integrator of all occupancy commands required.] The controllers/systems to which the occupancy commands are applicable shall be bound and the name of the receiving variable shall be the same for these controllers/systems.
- C. BACnet standardized Device Profile (Annex L)
 1. BACnet Building Controller (B-BC)
- D. The following BIBBs must be supported on the Local Supervisory LAN using Ethernet directly by the Building Controller:
 1. BACnet Data Sharing Objects (DS-):
 - a. Read Property (RP-A) Initiate
 - b. Read Property (RP-B) Execute
 - c. Read Property Multiple (RPM-A) Initiate
 - d. Read Property Multiple (RPM-B) Execute
 - e. Write Property (WP-A) Initiate
 - f. Write Property (WP-B) Execute
 - g. Write Property Multiple (WPM-A) Initiate
 - h. Write Property Multiple (WPM-B) Execute
 - i. COV (COV-A) Initiate
 - j. COV (COV-B) Execute
 - k. COV Unsolicited (COVU-A) Initiate
 - l. COV Unsolicited (COVU-B) Execute
 2. BACnet Scheduling (SCHED)
 - a. Scheduling-Internal-B (I-B) Execute
 - b. Scheduling-External-B (I-B) Execute
 3. BACnet Alarm and Event Object (AE-)
 - a. Alarm and Event-Notification-A (N-A) Initiate
 - b. Alarm and Event-Notification Internal-B (N-I-B) Execute
 - c. Alarm and Event-ACK-A (ACK-A) Initiate
 - d. Alarm and Event-ACK-B (ACK-B) Execute
 - e. Alarm and Event-Alarm Summary-B (ASUM-B) Execute
 - f. Alarm and Event-Enrollment Summary-A (ESUM-A) Initiate
 - g. Alarm and Event-Enrollment Summary-B (ESUM-B) Execute
 - h. Alarm and Event-Information-A (INFO-A) Initiate
 - i. Alarm and Event-Information-B (INFO-B) Execute
 4. BACnet Trending Object (T-)
 - a. Alarm and Event-Notification-A (N-A) Initiate
 - b. Alarm and Event-Notification Internal-B (N-I-B) Execute
 - c. Trending-Viewing and Modifying Trends-A (VMT-A) Initiate
 - d. Trending-Viewing and Modifying Trends-Internal-B (VMT-I-B) Execute
 - e. Trending-Viewing and Modifying Trends-External-B (VMT-E-B) Execute
 - f. Trending Automated trend Retrieval-B (ATR-B) Execute
 5. BACnet Network Management (NM-)
 - a. Network Management-Connection Establishment-A (CE-A)
 6. BACnet Device Management (DM-)
 - a. Device Management-Dynamic Device Binding-A (DBB-A) Initiate
 - b. Device Management-Dynamic Device Binding-B (DBB-B) Execute
 - c. Device Management-Dynamic Object Binding-A (DOB-A) Initiate
 - d. Device Management-Dynamic Object Binding-B (DOB-B) Execute
 - e. Device Management-Dynamic Communication Control-B (DCC-B) Execute
 - f. Device Management-Dynamic Private Transfer-A (PT-A) Initiate
 - g. Device Management-Dynamic Private Transfer-B (PT-B) Execute
 - h. Device Management-Dynamic Text Message-A (TM-A) Initiate
 - i. Device Management-Dynamic Text Message-B (TM-B) Execute



- j. Device Management-Dynamic Time Synchronization-B (TS-B) Execute
 - k. Device Management-Reinitialize Device-B (RD-B) Execute
 - l. Device Management-Backup and Restore-B (BR-B) Execute
 - m. Device Management-List Manipulation-B (LM-B) Execute
 - n. Device Management-Object Creation and Deletion -B (OCD-B) Execute
- E. The following BACnet standard object types must be supported on the Local Supervisory LAN using Ethernet directly by the Building Controller:
- 1. Calendar – Creatable
 - 2. Calendar - Deletable
 - 3. Command – Creatable
 - 4. Command - Deletable
 - 5. Notification Class – Creatable
 - 6. Notification Class - Deletable
 - 7. Schedule – Creatable
 - 8. Schedule - Deletable
- F. The one of the following BACnet data link layer options must be provided on the Local Supervisory LAN using Ethernet directly by the Building Controller:
- 1. BACnet IP, (Annex J)
 - 2. BACnet IP, (Annex J), Foreign Device
- G. The following BACnet segmentation capability must be supported on the Local Supervisory LAN using Ethernet directly by the Building Controller:
- 1. Provide transmission of segmented messages with a window size of 32
 - 2. Provide receipt of segmented messages with a window size of 32
- H. The static BACnet device address binding must be supported by the BACnet device.
- I. The contractor is required to coordinate all network connections, IP addresses and other work related to or involving the USPS IT network with the proper project and IT department personnel. It is the contractor responsibility to schedule coordination and gain all required approvals to meet the project schedule.
- J. [Contractor is required to comply with all USPS Security and IT requirements and protocols for systems and personnel before beginning work on network connected systems]

NOTE TO SPECIFIER

Select one of the two following paragraphs depending on the installation configuration. If the contractor is totally responsible for all the Primary Controlling LAN hardware and installation, use the first. If USPS is providing the IT infrastructure, include the second

2.2 [PRIMARY CONTROLLING LAN HARDWARE

- A. The infrastructure and hardware for the Primary Controlling LAN shall be provided by [others][the USPS] as part of the facility IT system. The Contractor shall coordinate all equipment connections, device naming and security requirements with the infrastructure provider.
- B. Unless specified elsewhere, Contractor shall provide all hardware, physical media, software and programming for the Secondary controlling LAN.



2.3 [PRIMARY CONTROLLING LAN HARDWARE

- A. Where not provided by the USPS to form a Local Supervisory LAN, provide the following:
 - 1. Network Switch - Cisco 100/1000 or approved equivalent.
 - 2. Firewall - Cisco PIX 500 series or approved equivalent.
 - 3. DSL Modem - Preapproved 2 or 4 wire SHDSL 2.3MBps minimum.
- B. The BAS Contractor shall submit to the USPS, or designated representative, all proposed hardware and software for approval prior to installation.
- C. Unless specified elsewhere, Contractor shall provide all hardware, physical media, software and programming for the Secondary Controlling LAN.]

2.4 STAND-ALONE FUNCTIONALITY

- A. General: These requirements clarify the requirement for stand-alone functionality relative to packaging I/O devices with a controller. Stand-alone functionality is specified with the controller and for each Application Category specified in Part 3. This item refers to acceptable paradigms for associating the points with the processor.
- B. Functional Boundary: Provide controllers so that all points associated with and common to one unit or other complete system/equipment shall reside within a single control unit. The boundaries of a standalone system shall be as dictated in the contract documents. Generally systems specified for the Application Category will dictate the boundary of the standalone control functionality. See related restrictions below. When referring to the controller as pertains to the standalone functionality, reference is specifically made to the processor. One processor shall execute all the related I/O control logic via one operating system that uses a common programming and configuration tool.
- C. The following configurations are considered acceptable with reference to a controller's standalone functionality:
 - 1. Points packaged as integral to the controller such that the point configuration is listed as an essential piece of information for ordering the controller (having a unique ordering number).
 - 2. Controllers with processors and modular back planes that allow plug in point modules as an integral part of the controller.
 - 3. I/O point expander boards, plugged directly into the main controller board to expand the point capacity of the controller.
 - 4. I/O point expansion devices connected to the main controller board via wiring and as such may be remote from the controller but within the same room and that communicate via a sub LAN protocol. These arrangements to be considered standalone shall have a sub LAN that is dedicated to that controller and include no other controller devices (AACs or ASCs). All wiring to interconnect the I/O expander board shall be:
 - a. Contained in the control panel enclosure;
 - b. Or run in conduit. Wiring shall only be accessible at the terminations.
- D. The following configurations are considered unacceptable with reference to a controller's standalone functionality:
 - 1. Multiple controllers enclosed in the same control panel to accomplish the point requirement.
 - 2. Programming or memory allocation in a separate controller to accommodate sequence of operation programming or trend storage requirements.

2.5 BUILDING CONTROLLER (BC)

- A. General Requirements:
 - 1. The BC(s) shall provide fully distributed control independent of the operational status of the OWSs and CSS. All necessary calculations required to achieve control shall be executed within



- the BC independent of any other device. All control strategies performed by the BC(s) shall be both operator definable and modifiable through the Operator Interfaces.
2. BCs shall perform overall system coordination, accept control programs, perform automated HVAC functions, control peripheral devices and perform all necessary mathematical and logical functions. BCs shall share information with the entire network of BCs and AACs/ASCs for full global control. Each controller shall permit multi-user operation from multiple workstations and portable operator terminals connected either locally or over the Primary Controller LAN. Each unit shall have its own internal RAM, non-volatile memory, microprocessor, battery backup, regulated power supply, power conditioning equipment, ports for connection of operating interface devices, and control enclosure. BCs shall be programmable from an operator workstation, portable operator's terminal, or hand held operating device. BC shall contain sufficient memory for all specified global control strategies, user defined reports and trending, communication programs, and central alarming.
 3. BCs shall be connected to a controller network that qualifies as a Primary Controlling LAN.
 4. All BCs shall be protected from any memory loss due to a loss of power by one or a combination of the following:
 - a. Volatile RAM shall have a battery backup using a lithium battery with a rated service life of fifty (50) hours, and a rated shelf life of at least five years. Self-diagnostic routine shall report an alarm for a low battery condition.
 - b. EEPROM, EPROM, or NOVRAM non-volatile memory
 5. In addition BCs may provide intelligent, standalone control of HVAC functions. Each BC may be capable of standalone direct digital operation utilizing its own processor, non-volatile memory, input/output, wiring terminal strips, A/D converters, real-time clock/calendar and voltage transient and lightning protection devices. Refer to standalone functionality specified above.
 6. The BC may provide for point mix flexibility and expandability. This requirement may be met via either a family of expander boards, modular input/output configuration, or a combination thereof. Refer to stand alone functionality specified above.
 7. All BC point data, algorithms and application software shall be modifiable from the Operator Workstation.
 8. Each BC shall execute application programs, calculations, and commands via a microprocessor resident in the BC. The database and all application programs for each BC shall be stored in non-volatile or battery backed volatile memory within the BC and will be able to upload/download to/from the OWS and/or CSS.
 9. BC shall provide buffer for holding alarms, messages, trends etc.
 10. Each BC shall include self-test diagnostics, which allow the BC to automatically alarm any malfunctions, or alarm conditions that exceed desired parameters as determined by programming input.
 11. Each BC shall contain software to perform full DDC/PID control loops.
 12. For systems requiring end-of-line resistors those resistors shall be located in the BC.
 13. Input-Output Processing
 - a. Digital Outputs (DO): Outputs shall be rated for a minimum 24 Vac or Vdc, 1 amp maximum current. Each shall be configurable as normally open or normally closed. Each output shall have an LED to indicate the operating mode of the output and [a manual hand off or auto switch to allow for override]. [If these HOA switches are not provided directly on the unit they shall be provided via isolation relays within the control enclosure.] Each DO shall be discrete outputs from the BC's board (multiplexing to a separate manufacturer's board is unacceptable). Provide suppression to limit transients to acceptable levels.
 - b. Analog Inputs (AI): AI shall be compatible with the field sensors provided. Provide signal conditioning, and zero and span calibration for each input. Each input shall be a discrete input to the BC's board (multiplexing to a separate manufacturers board is unacceptable unless specifically indicated otherwise). A/D converters shall have a minimum resolution of 12 bits.
 - c. Digital Inputs (DI): Monitor dry contact closures. Accept pulsed inputs of at least one per second. Source voltage for sensing shall be supplied by the BC and shall be isolated from



- the main board. Software multiplexing of an AI and resistors may only be done in non-critical applications and only with prior approval of Architect/Engineer.
- d. Universal Inputs (UI-AI or DI): To serve as either AI or DI as specified above.
 - e. Electronic Analog Outputs (AO): Voltage mode: 0-10 Vdc; Current mode: 4-20 mA. Provide zero and span calibration and circuit protection. Pulse Width Modulated (PWM) analog via a DO [and transducer] is acceptable only with USPS approval (Generally these will not be allowed on loops with a short time constant such as discharge temperature loops, economizer loops, pressure control loops and the like. They are generally acceptable for standard room temperature control loops.). Where these are allowed, transducer/actuator shall be programmable for normally open, normally closed, or hold last position and shall allow adjustable timing. Each DO shall be discrete outputs from the BC's board (multiplexing to a separate manufacturers board is unacceptable). D/A converters shall have a minimum resolution of 10 bits.
 - f. Analog Output Pneumatic (AOP), 0-20 psi: Pneumatic outputs via an I/P transducer, [PWM/P transducer], or digital to pneumatic transducer are acceptable. Multiplexed digital to pneumatic transducers are acceptable provided they are supplied as a standard product and part of the BC and provide individual feedback. Multiplexed pneumatic outputs of a separate manufacturer are unacceptable.
 - g. Pulsed Inputs: Capable of counting up to 8 pulses per second with buffer to accumulate pulse count. Pulses shall be counted at all times.
14. A communication port for operator interface through a terminal shall be provided in each BC. It shall be possible to perform all program and database back-up, system monitoring, control functions, and BC diagnostics through this port. Standalone BC panels shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers, or workstations.
 15. Each BC shall be equipped with loop tuning algorithm for precise proportional, integral, derivative (PID) control. Loop tuning tools provided with the Operator Workstation software is acceptable. In any case, tools to support loop tuning must be provided such that P, I, and D gains are automatically calculated.
 16. All analog output points shall have a selectable failure setpoint. The BC shall be capable of maintaining this failure setpoint in the event of a system malfunction, which causes loss of BC control, or loss of output signal, as long as power is available at the BC. The failure setpoint shall be selectable on a per point basis.
 17. Slope intercepts and gain adjustments shall be available on a per-point basis.
 18. BC Power Loss:
 - a. Upon a loss of power to any BC, the other units on the primary controlling network shall not in any way be affected.
 - b. Upon a loss of power to any BC, the battery backup shall ensure that the energy management control software, the Direct Digital Control software, the database parameters, and all other programs and data stored in the RAM are retained for a minimum of fifty (50) hours. An alarm diagnostic message shall indicate that the BC is under battery power.
 - c. Upon restoration of power within the specified battery backup period, the BC shall resume full operation without operator intervention. The BC shall automatically reset its clock such that proper operation of any time dependent function is possible without manual reset of the clock. All monitored functions shall be updated.
 - d. Should the duration of a loss of power exceed the specified battery back-up period or BC panel memory be lost for any reason, the panel shall automatically report the condition (upon resumption of power) and be capable of receiving a download via the network, and connected computer. In addition, the USPS shall be able to upload the most current versions of all energy management control programs, Direct Digital Control programs, database parameters, and all other data and programs in the memory of each BC to the CSS via the local area network, or to the laptop PC via the local RS-232C port[, or via the telephone line dial-up modem where applicable].
 19. BC Failure:



- a. Building Controller LAN Data Transmission Failure: BC shall continue to operate in stand-alone mode. BC shall store loss of communication alarm along with the time of the event. All control functions shall continue with the global values programmable to either last value or a specified value. Peer BCs shall recognize the loss, report alarm and reconfigure the LAN.
 - b. BC Hardware Failure: BC shall cease operation and terminate communication with other devices. All outputs shall go to their specified fail position.
 - 20. Each BC shall be equipped with firmware resident self-diagnostics for sensors and be capable of assessing an open or shorted sensor circuit and taking an appropriate control action (close valve, damper, etc.).
 - 21. BCs may include LAN communications interface functions for Secondary Controlling LANs.
 - 22. A minimum of four levels of password protection shall be provided at each BC.
 - 23. BCs shall be mounted on equipment, in packaged equipment enclosures, or locking wall mounted in a NEMA 1 enclosure, as specified elsewhere.
- B. BACnet Building Controller Requirements:
- 1. The BC(s) shall support all BIBBs defined in the BACnet Building Controller (B-BC) device profile as defined in the BACnet standard and elsewhere in this specification.
 - 2. BCs shall communicate over the Primary Controlling LAN.
 - 3. Each BC shall be connected to the Primary Controlling LAN communicating to/from other BCs.

2.6 ADVANCED APPLICATION SPECIFIC CONTROLLER (AAC) AND APPLICATION SPECIFIC CONTROLLER (ASC)

A. General Requirements:

- 1. AACs and ASCs shall provide intelligent, standalone control of HVAC equipment. Each unit shall have its own internal RAM, non-volatile memory and will continue to operate all local control functions in the event of a loss of communications on the ASC LAN or sub-LAN. Refer to standalone requirements by application specified in Part 3 of this section. In addition, its control data information should be sharable through a BC with every other BC on the entire network.
- 2. Each AAC and ASC shall include self-test diagnostics that allow the AAC /ASC to automatically relay to the BC, LAN Interface Device or workstation, any malfunctions or abnormal conditions within the AAC /ASC or alarm conditions of inputs that exceed desired parameters as determined by programming input.
- 3. AACs and ASCs shall include sufficient memory to perform the specific control functions required for its application and to communicate with other devices.
- 4. Each AAC and ASC must be capable of stand-alone direct digital operation utilizing its own processor, non-volatile memory, input/output, minimum 8 bit A to D conversion, voltage transient and lightning protection devices. All volatile memory shall have a battery backup of at least fifty-(50) hrs with a battery life of five years.
- 5. All point data; and algorithms within an AAC /ASC shall be configurable from the Operator Workstation.
- 6. AAC and ASC Input-Output Processing
 - a. Digital Outputs (DO): Outputs shall be rated for a minimum 24 VAC or VDC, 1 amp maximum current. Each shall be configurable as normally open or normally closed. Each output shall have an LED to indicate the operating mode of the output. Each DO shall be discrete outputs from the AAC/ASC's board (multiplexing to a separate manufacturer's board is unacceptable). Provide suppression to limit transients to acceptable levels.
 - b. Analog Inputs (AI) AI shall be compatible with the field sensors provided. Provide signal conditioning, and zero and span calibration for each input. Each input shall be a discrete input to the BC's board (multiplexing to a separate manufacturers board is unacceptable unless specifically indicated otherwise). A/D converters shall have a minimum resolution of 8-10 bits depending on application.



- c. Digital Inputs (DI): Monitor dry contact closures. Accept pulsed inputs of at least one per second. Source voltage for sensing shall be supplied by the BC and shall be isolated from the main board. Software multiplexing of an AI and resistors may only be done in non-critical applications and only with prior approval of Architect/Engineer
 - d. Universal Inputs (UI-AI or DI): To serve as either AI or DI as specified above.
 - e. Electronic Analog Outputs (AO) as required by application: voltage mode, 0-5VDC and 0-10VDC; current mode (4-20 mA). Provide zero and span calibration and circuit protection. Pulse Width Modulated (PWM) analog via a DO [and transducer] is acceptable only with USPS approval (Generally, PWM will not be allowed on loops with a short time constant such as discharge temperature loops, economizer loops, pressure control loops and the like. They are generally acceptable for standard room temperature control loops.). Where PWM is allowed, transducer/actuator shall be programmable for normally open, normally closed, or hold last position and shall allow adjustable timing. Each DO shall be discrete outputs from the BC's board (multiplexing to a separate manufacturers board is unacceptable). D/A converters shall have a minimum resolution of 8 bits.
 - f. Analog Output Pneumatic (AOP), 0-20 psi: Pneumatic outputs via an I/P transducer, PWM/P transducer, or digital to pneumatic transducer are acceptable. Multiplexed digital to pneumatic transducers are acceptable provided they are supplied as a standard product and part of the AAC /ASC and provide individual feedback. Multiplexed pneumatic outputs of a separate manufacturer are unacceptable.
- B. BACnet AAC(s) and ASC(s) Requirements:
- 1. The AAC(s) and ASC(s) shall support all BIBBs defined in the BACnet Building Controller (B-AAC and B-ASC) device profile as defined in the BACnet standard.
 - 2. AAC(s) and ASC(s) may communicate over the Primary Controlling LAN or a Secondary controlling LANs.
- C. Terminal Box Controllers: ASC(s) additional requirements
- 1. Terminal box controllers controlling damper positions to maintain a quantity of supply or exhaust air serving a space shall have an automatically initiated function that resets the volume regulator damper to the fully closed position on a scheduled basis. The controllers shall initially be set up to perform this function once every 24 hours. The purpose of this required function is to reset and synchronize the actual damper position with the calculated damper position and to assure the damper will completely close when commanded. The software shall select scheduled boxes randomly and shall not allow more than 5% of the total quantity of controllers in a building to perform this function at the same time. When possible the controllers shall perform this function when the supply or exhaust air system is not operating.

NOTE TO SPECIFIER

Connection of computing equipment to the USPS IT systems is controlled for security purposes. Coordinate with the USPS on whether the Contractor or USPS is to provide computer hardware.

NOTE TO SPECIFIER

Coordinate USPS on the following OWS and CCS. Depending on the size of the system and integration with the EEMS a local OWS may not be required. This choice also impacts sections on graphics and operator interfaces. Edit the following as applicable.

2.7 [OPERATOR WORKSTATION (OWS)]

- A. The OWS shall be located on site at the facility.



- B. [The USPS shall provide the computer hardware for the OWS. Contractor shall provide hardware and operating system requirements to USPS to meet the operating requirements of this specification.]
- C. [Provide personal computer (PC) with current generation multi-core Intel processor operating at 2.4 GHz minimum speed. Include 2 GB RAM and minimum of (1) 160GB/7200 RPM hard disk drives. Provide a x16 PCIe graphics card, Four USB 2.0 ports, 100/1000 Base-T network card and 16X DVD+/-RW Drive. Provide 19 in (1280 x 1024 min resolution, 6ms max refresh) LCD.]
- D. [Provide detachable keyboard with standard typewriter layout, function keys, and separate numeric keypad. Provide a USB mouse and mouse pad with the system. Provide one open serial port after configuration of the workstation to meet the requirements of the rest of these specifications.]
- E. Workstation PC shall have the capability of changing serial port interrupt vectors and IOBASE addresses through software.
- F. [Operating system for operator workstation must be Windows XP Professional or Windows Vista. Provide Microsoft Office 2007 Professional Software. All software shall be at least the latest version available as of the date of contract completion.]
- G. Provide software, graphics and programming as specified in below.
- H. Provide network card approved by BAS manufacturer to support Supervisory LAN communications (100/1000 Mbps Ethernet TCP/IP) for OWSs connected to the Local Supervisory LAN and network card or LANID where connected to the Primary Controller LAN.
- I. Provide additional hardware, video drivers, etc., to facilitate all control functions and software requirements specified for the BAS.

NOTE TO SPECIFIER

It is important that the CSS and OWSs be positioned on the drawings and or their location clearly defined. Edit the following as applicable.

- J. Operator Workstations shall be placed as follows and as indicated on the drawings or as directed by the USPS. CSS shall be placed in the [_____]

NOTE TO SPECIFIER

Coordinate USPS on the following CSS. Depending on the size of the system and integration with the EEMS a CSS may not be required. Edit the following as applicable.

NOTE TO SPECIFIER

Connection of computing equipment to the USPS IT systems is controlled for security purposes. Coordinate with the USPS on whether the Contractor or USPS is to provide computer hardware.

2.8 [CONTROL SYSTEM SERVER (CSS)]

- A. The CSS shall be located on site at the facility.
- B. [The USPS shall provide the computer hardware for the OWS. Contractor shall provide hardware and operating system requirements to USPS to meet the operating requirements of this specification.]



- C. [Provide personal computer (PC), either desktop or blade type server with current generation multi-core Intel processor operating at 2.4 GHz minimum speed. Include 2 GB RAM and minimum of two (2) 160GB/7200 RPM hard disk drives. Provide a minimum of Four USB 2.0 ports, 100/1000 Base-T network card and 16X DVD+/-RW Drive. Provide minimum 17 in (1280 x 1024 min resolution, 6ms max refresh) LCD.
- D. Provide detachable keyboard with standard typewriter layout, function keys, and separate numeric keypad. Provide a USB mouse and mouse pad with the system. Provide one open serial port after configuration of the workstation to meet the requirements of the rest of these specifications.]
- E. Provide software, graphics and programming as specified in elsewhere in this section
- F. Provide network card approved by BAS manufacturer to support Primary Controlling LAN communications (100/1000 Mbps Ethernet TCP/IP)
- G. Provide additional hardware, video drivers, etc., to facilitate all control functions and software requirements specified for the BAS.
- H. For CSSs that provide web services for presentation of data across the Ethernet, all Web components and services shall be installed with required licensing. CSS shall be configured to secure it to the extent practical inside the Primary Controlling LAN. CSS shall always function from behind a firewall provided either by the USPS network administrators in the case where they provide the LAN infrastructure, or by this contractor where the LAN is provided under this Division of the specifications.

NOTE TO SPECIFIER

It is important that the CSS and OWSs be positioned on the drawings and or their location clearly defined. Edit the following as applicable

- I. Control System Server shall be placed as follows and as indicated on the drawings or as directed by the USPS. CSS shall be placed in the [_____]

2.9 PRINTER

- A. Provide minimum 600x600 dpi, min 4 sheets per minute laser printer with 8-1/2" x 11" paper tray.
- B. Provide this printer at the Operator Workstation

2.10 GATEWAYS

- A. A Gateway shall be provided to link non-BACnet control products to the Primary Controlling LAN. The Gateway shall include all necessary hardware, software, etc. necessary to meet the requirements listed. All of the functionality described in this section is to be provided by using the capabilities of BACnet. Each Gateway shall have sufficient RAM initially installed to provide the ability to expand the number of BACnet objects of each type supported by 20% to accommodate future system changes.
- B. The gateway shall contain its own microprocessor, RAM, battery, real-time clock, communication ports, and power supply as specified for a BC in this Section. Each gateway shall be mounted in a lockable enclosure.
- C. Each Gateway shall BTL listed device meeting all BACnet requirements of a BC.
- D. Upon loss of power to a Gateway, the battery shall provide for minimum 100-hour backup of all programs and data in RAM. The battery shall be sealed and self-charging.



- E. The Gateway shall be transparent to control functions and shall not be required for information routing on the Primary LAN
- F. Each Gateway shall provide values for all points on the non-BACnet side of the Gateway to BACnet devices as if the values were originating from BACnet objects. The Gateway shall also provide a way for BACnet devices to modify (write) all points specified by the sequence of operations using standard BACnet services. All non physical points are required to be writable for each site.
- G. Each Gateway and any devices that the Gateway represents which have time of day information shall respond to workstation requests to synchronize the date and time. Each Gateway and any device that the Gateway represents shall support all BIBBS required of a similar native BACnet objects. Refer to the BIBBs listed above for other minimum requirements of the Gateway.
- H. All points in the non-BACnet system shall be made network-visible through the use of standard BACnet objects. All points shall be writable using standard BACnet services.
- I. All devices have a Device Object instance number that is unique throughout the entire USPS network. All BACnet devices shall be configured with a Device Object instance number that is based on the format specified (shown in decimal notation). This includes all physical devices as well as any logical BACnet devices that are physically represented by gateways.

2.11 CONTROLLER LOCAL AREA NETWORK INTERFACE DEVICES (LANID)

- A. The Controller LANID shall be a microprocessor-based communications device which acts as a gateway/router between the Primary LAN, Secondary LAN, an operator interface, or printer. These may be provided within a BC or as a separate device.
- B. The LANID shall perform information translation between the Primary LAN and the Secondary LAN, supervise communications on a polling secondary LAN, and shall be applicable to systems in which the same functionality is not provided in the BC. In systems where the LANID is a separate device, it shall contain its own microprocessor, RAM, battery, real-time clock, communication ports, and power supply as specified for a BC. Each LANID shall be mounted in a lockable enclosure.
- C. Each LANID shall support interrogation, full control, and all utilities associated with all BCs on the Primary LAN, all AACs and ASCs connected to all secondary LANs under the Primary Controller LAN, and all points connected to those PCUs and SCUs.
- D. Upon loss of power to a LANID, the battery shall provide for minimum 100-hour backup of all programs and data in RAM. The battery shall be sealed and self-charging.
- E. The LANID shall be transparent to control functions and shall not be required to control information routing on the Primary LAN
- F. All BACnet Interoperability Building Blocks (BIBBs) are required to be supported for each native BACnet device or Gateway. The Gateway shall support all BIBBs defined in the BACnet Gateway's device profile as defined in the BACnet standard.

2.12 SYSTEM SOFTWARE-GENERAL

- A. **Functionality and Completeness:** The Contractor shall furnish and install all software and programming necessary to provide a complete and functioning system as specified. The Contractor shall include all software and programming not specifically itemized in these Specifications, which is necessary to implement, maintain, operate, and diagnose the system in compliance with these and referenced Specifications.



- B. Configuration: The software shall support the system as a distributed processing network configuration.

2.13 CONTROLLER SOFTWARE

- A. BC Software Residency: Each BC as defined below shall be capable of control and monitoring of all points physically connected to it. All software including the following shall reside and execute at the BC:
1. Real-Time Operating System software
 2. Real-Time Clock/Calendar and network time synchronization
 3. BC diagnostic software
 4. LAN Communication software/firmware
 5. Direct Digital Control software
 6. Alarm Processing and Buffering software
 7. Energy Management software
 8. Data Trending, Accumulation, Reporting, and Buffering software
 9. I/O (physical and virtual) database
 10. Remote Communication software
- B. AAC/ASC Software Residency: Each AAC/ASC as defined below shall be capable of control and monitoring of all points physically connected to it. As a minimum, software including the following shall reside and execute at the AAC/ASC. Other software to support other required functions of the AAC/ASC may reside at the BC or LAN interface device with the restrictions/exceptions noted for per application class
1. Real-Time Operating System software
 2. AAC/ASC diagnostic software
 3. LAN Communication software
 4. Control software applicable to the unit it serves that will support a single mode of operation
 5. I/O (physical and virtual) database to support one mode of operation
- C. Stand Alone Capability: BC shall continue to perform all functions independent of a failure in other BC/AAC/ASC or other communication links to other BCs/AACs/ASCs. Trends and runtime totalization shall be retained in memory. BC memory shall be sufficient to provide program storage and specified trend buffering and allow 20% spare capacity for future modifications. Runtime totalization shall be available on all digital input and virtual status points. Accumulation/ Totalization shall be available for all analog input and calculated virtual points Refer also to refer to other sections of this specification for other aspects of standalone functionality.
- D. Operating System: Controllers shall include a real-time operating system resident in ROM. This software shall execute independently from any other devices in the system. It shall support all specified functions. It shall provide a command prioritization scheme to allow functional override of control functions. Refer also to other sections of this specification for other aspects of the controller's operating system.
- E. Network Communications: Each controller shall include software/firmware that supports the networking of CUs on a common communications trunk that forms the respective LAN. Network support shall include the following:
1. Primary Controlling LAN shall be a high-speed network designed and optimized for control system communication. If a Primary Controlling LAN communications trunk is severed, BCs shall reconfigure into two separate LANs and continue operations without interruption or Operator intervention.
 2. Controller communication software shall include error detection, correction, and re-transmission to ensure data integrity.
 3. Operator/System communication software shall facilitate communications between other BCs, all subordinate AACs/ASCs, Gateways and LAN Interface Devices or Operator Workstations. Software shall allow point interrogation, adjustment, addition/deletion, and programming while the controller is on line and functioning without disruption to unaffected points. The software



architecture shall allow networked controllers to share selected physical and virtual point information throughout the entire system.

- F. Diagnostic Software: Controller software shall include diagnostic software that checks memory and communications and reports any malfunctions
- G. Alarm/Messaging Software: Controller software shall support alarm/message processing and buffering software though BACnet objects as more fully specified below.
- H. Application Programs: CUs shall support and execute application programs as more fully specified below:
 - 1. All Direct Digital Control software, Energy Management Control software, and functional block application programming software templates shall be provided in a 'ready-to-use' state, and shall not require (but shall allow) USPS user programming.
 - 2. Line programs shall supply preprogrammed functions to support these energy management and functional block application algorithms. All functions shall be provided with printed narratives and/or flow diagrams to document algorithms and how to modify and use them.
- I. Security: Controller software shall support multiple level password access restriction as more fully specified below.
- J. Direct Digital Control: Controller shall support application of Direct Digital Control Logic. All logic modules shall be provided pre-programmed with written documentation to support their application. Provide the following logic modules as a minimum:
 - 1. Proportional-Integral-Derivative (PID) control with analog, PWM and floating output
 - 2. Two Position control (Hi or Low crossing with deadband)
 - 3. Single-Pole Double-Throw relay
 - 4. Delay Timer (delay-on-make, delay-on-break, and interval)
 - 5. Hi/Low Selection
 - 6. Reset or Scaling Module
 - 7. Logical Operators (AND, OR, NOT, XOR)
- K. Psychrometric Parameters: Controller software shall provide preprogrammed functions to calculate and present psychrometric parameters (given temperature and relative humidity) including the following as a minimum: Enthalpy, Wet Bulb Temperature.
- L. Updating/Storing Application Data: Site-specific programming residing in volatile memory shall be uploadable/downloadable from an OWS or CSS using BACnet services connected locally, to the Primary Controlling LAN, to the Secondary Controlling LAN and remotely via the internet and modem and telephone lines as applicable but all must be available. Initiation of an upload or download shall include all of the following methods; Manually, Scheduled, and Automatically upon detection of a loss or change.
- M. Restart: System software shall provide for orderly shutdown upon loss of power and automatic restart upon power restoration. Volatile memory shall be retained; outputs shall go to programmed fail (open, closed, or last) position. Equipment restart shall include a user definable time delay on each piece of equipment to stagger the restart. Loss of power shall be alarmed at operator interface indicating date and time.
- N. Time Synchronization: Operators shall be able to set the time and date in any device on the network that supports time-of-day functionality. The operator shall be able to select to set the time and date for an individual device, devices on a single network, or all devices simultaneously. Automatic time synchronization shall be provided using BACnet services.



- O. Misc. Calculations: System software shall automate calculation of psychometric functions, calendar functions, kWh/kW, and flow determination and totalization from pulsed or analog inputs, curve-fitting, look-up table, input/output scaling, time averaging of inputs and A/D conversion coefficients.

2.14 APPLICATION PROGRAMMING DESCRIPTION

- A. The application software shall be user programmable.
- B. This specification generally requires a programming convention that is logical, easy to learn, use, and diagnose. General approaches to application programming shall be provided by one, or a combination, of the following conventions:
 1. Point Definition: provide templates customized for point type, to support input of individual point information. Use standard BACnet Objects as applicable.
 2. Graphical Block Programming: Manipulation of graphic icon 'blocks', each of which represents a subroutine, in a functional/logical manner forming a control logic diagram. Blocks shall allow entry of adjustable settings and parameters via pop-up windows. Provide a utility that shall allow the graphic logic diagrams to be directly compiled into application programs. Logic diagrams shall be viewable either off-line, or on-line with real-time block output values.
 3. Functional Application Programming: Pre-programmed application specific programs that allow/require limited customization via 'fill-in-the-blanks' edit fields. Typical values would be setpoints gains, associated point names, alarm limits, etc.
 4. Line Programming: Textual syntax-based programming in a language similar to BASIC designed specifically for HVAC control. Subroutines or functions for energy management applications, setpoints, and adjustable parameters shall be customizable, but shall be provided preprogrammed and documented.
- C. Provide a means for testing and/or debugging the control programs both off-line and on-line.

2.15 ENERGY MANAGEMENT APPLICATIONS

- A. BC shall have the ability to perform all of the following energy management routines via preprogrammed function blocks or template programs. As a minimum provide the following whether or not required in the software:
 1. Time-of-Day Scheduling
 2. Calendar-Based Scheduling
 3. Holiday Scheduling
 4. Temporary Schedule Overrides
 5. Optimal Start/Optimal Stop-based on space temperature offset, outdoor air temperature, and building heating and cooling capacitance factors as a minimum
 6. Night Setback and Morning Recovery Control, with ventilation only during occupancy
 7. Economizer Control (enthalpy or dry-bulb)
 8. Peak Demand Limiting / Load Shedding
 9. Dead Band Control
- B. All programs shall be executed automatically without the need for operator intervention, and shall be flexible enough to allow operator customization. Programs shall be applied to building equipment as described in Section 259004 - Sequence of Operation.

2.16 PASSWORD PROTECTION

- A. Multiple-level password access protection shall be provided to allow the USPS's authorized BAS Administrator to limit workstation control, display and database manipulation capabilities as (s)he deems appropriate for each user, based upon an assigned user name with a unique password.



- B. All passwords for the system shall be provided to the USPS including administrator, dealer, or factory level passwords for the systems provided under this project.
- C. Passwords shall restrict access to all Control Units.
- D. Each user name shall be assigned to a discrete access level. A minimum of five levels of access shall be supported. Alternately, a comprehensive list of accessibility/functionality items shall be provided, to be enabled or disabled for each user.
- E. A minimum of 20 user names shall be supported and programmed per the USPS's direction.
- F. Operators shall be able to perform only those commands available for the access level assigned to their user name.
- G. User-definable, automatic log-off timers of from 1 to 60 minutes shall be provided to prevent operators from inadvertently leaving interface device software on-line.

2.17 ALARM AND EVENT MANAGEMENT REPORTING

- A. Alarm management shall be provided to monitor, buffer, and direct alarms and messages to operator devices and memory files. Each BC shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic, and prevent alarms from being lost. At no time shall a BC's ability to report alarms be affected by either operator activity at an Operator Workstation or local handheld device, or by communications with other panels on the network.
 - 1. Alarm Descriptor: Each alarm or point change shall include that point's English language description, and the time and date of occurrence. In addition to the alarm's descriptor and the time and date, the user shall be able to print, display and store an alarm message to more fully describe the alarm condition or direct operator response.
 - 2. Alarm Prioritization: The software shall allow users to define the handling and routing of each alarm by their assignment to discrete priority levels. A minimum of five priority levels shall be provided. For each priority level, users shall have the ability to enable or disable an audible tone whenever an alarm is reported and whenever an alarm returns to normal condition. Users shall have the ability to manually inhibit alarm reporting for each individual alarm and for each priority level. Contractor shall coordinate with the USPS on establishing alarm priority definitions. Alarm Level 1 Life Safety (i.e. smoke detector), Level 2 Critical (i.e. controller failure), Level 3 Abnormal (i.e. out-of-range temperature), Level 4 Energy Waste - where applicable (i.e. fighting valves), Level 5 Maintenance Message (i.e. runtime monitor, filter status).
 - 3. Alarm Report Routing: Each alarm priority level shall be associated with a unique user-defined list of operator devices including any combination of local or remote workstations, printers and workstation disk files. All alarms associated with a given priority level shall be routed to all operator devices on the user-defined list associated with that priority level. For each priority level, alarms shall be automatically routed to a default operator device in the event that alarms are unable to be routed to any operator device assigned to the priority level.
 - 4. Auto-Dial Alarm Routing: For alarm priority levels that include a remote workstation (accessed by modem) as one of the listed reporting destinations, the BC shall initiate a call to report the alarm, and shall terminate the call after alarm reporting is complete. System shall be capable of multiple retries and buffer alarms until a connection is made. If no connection is made, system shall attempt connection to an alternate dial-up workstation. System shall also be able to dial multiple pagers upon alarm activation.
 - 5. Alarm Acknowledgment: For alarm priority levels that are directed to a workstation screen, an indication of alarm receipt shall be displayed immediately regardless of the application in use at the workstation, and shall remain on the screen until acknowledged by a user having a password that allows alarm acknowledgment. Upon acknowledgment, the complete alarm message string



(including date, time, and user name of acknowledging operator) shall be stored in a selected file on the workstation hard disk.

- B. It shall be possible for any operator to receive a summary of all alarms regardless of acknowledgement status; for which a particular recipient is enrolled for notification; based on current event state; based on the particular BACnet event algorithm (e.g., change of value, change of state, out of range, and so on); alarm priority; and notification class.
- C. BACnet Alarming Services: All alarms and events shall be implemented using standard BACnet event detection and notification mechanisms. The workstation shall receive BACnet alarm and event notifications from any gateway or BACnet controller in the system and display them to an operator. Either intrinsic reporting or algorithmic change reporting may be used but the intrinsic reporting method is preferred. The workstation shall also log alarms and events, provide a way for an operator with sufficient privilege to acknowledge alarms, and log acknowledgements of alarms. It shall be possible for an operator to receive, at any time, a summary of all alarms that are currently in effect at any site whether or not they have been acknowledged. Operators shall also be able to view and change alarm limits for any alarm at the appropriate password level.
- D. Alarm Historical Database: The database shall store all alarms and events object occurrences in an ODBC or an OLE database-compliant relational database. Provide a commercially available ODBC driver or OLE database data provider, which would allow applications to access the data using standard Microsoft Windows Data Services.

2.18 TRENDING

- A. The requirements of BC trending shall include the following:
 - 1. Provide trends for all physical points, virtual points and calculated variables. Unless specified elsewhere all analog values shall be trended at 5 minute intervals and discrete point as COV. All trends shall be retained in the BC for a minimum of 14 days.
 - 2. The BAS shall utilize BACnet Trend Objects.
 - 3. The sample rate and data selection shall be selectable by the operator.
 - 4. The trended value range shall be selectable by the operator.
- B. Control Loop Performance Trends: Controllers incorporating PID control loops shall also provide high resolution sampling in less than six second increments for verification of control loop performance.
- C. Data Buffering and Archiving: Trend data shall be buffered at the BC, and uploaded to hard disk storage when archival is desired. All archived trends shall be transmitted to the on-site CSS as applicable. Uploads shall occur based upon a user-defined interval, manual command, or automatically when the trend buffers become full.
- D. Time Synchronization: Provide a time master that is installed and configured to synchronize the clocks of all BACnet devices supporting time synchronization. Synchronization shall be done using Coordinated Universal Time (UTC). All trend sample times shall be able to be synchronized. The frequency of time synchronization message transmission shall be selectable by the operator.

2.19 TOTALIZATION

- A. The BC shall support totalizing analog, digital, and pulsed inputs and be capable of accumulating, storing, and converting these totals to engineering units used in the documents. These values shall generally be accessible to the Operator Interfaces to support management-reporting functions.
- B. Totalization of electricity, steam and chilled water use/demand shall allow application of totals to different rate periods, which shall be user definable.



- C. When specified to provide electrical or utility Use/Demand from a utility pulse contact, the Contractor shall obtain from the local utility all information required to obtain meter data, including k factors, conversion constants, and the like.

2.20 POINT STRUCTURING AND NAMING

- A. General: The intent of this section is to require a consistent means of naming points across all USPS facilities. Contractor shall configure the systems from the perspective of the Enterprise, not solely the local project. The BAS Contractor shall coordinate with the USPS's representative and compile and submit a proposed Point Summary Table for review prior to any object programming or project startup.
- B. Point Naming Convention
 - 1. All point names shall adhere to the format as in Appendix A attached. Naming convention shall apply to all physical I/O points, virtual points, calculated points and all application program parameters. For each BAS object, a specific and unique BACnet object name shall be required.
 - 2. The USPS shall designate the *Building* descriptor and facility ID. The *System* descriptor shall further define the object in terms of air handling, cooling, heating, or other system. The *Equipment* descriptor shall define the equipment category; e.g., Chiller, Air Handler, or other equipment. The *Point* descriptor shall define the hardware or software type or function associated with the equipment; e.g., supply temperature, water pressure, alarm, mixed air temperature setpoint, etc. and shall contain any numbering conventions for multiples of equipment. Refer to appendix for further details.
- C. Device Instance Number Convention:
 - 1. BACnet network numbers and Device Object IDs shall be unique throughout the network.
 - 2. Refer to Appendix A for instance number ranges.
 - 3. All assignment of network numbers and Device Object IDs shall be coordinated with the USPS.
 - 4. The BAS Contractor shall coordinate with a designated USPS representative to ensure that no duplicate Device Object IDs occur.

2.21 OPERATOR INTERFACE GRAPHIC SOFTWARE

- A. Graphic software shall facilitate user-friendly interface to all aspects of the System Software specified above. The intent of this specification is to require a graphic package that provides for intuitive operation of the systems without extensive training and experience. It shall facilitate logical and simple system interrogation, modification, configuration, and diagnosis.
- B. Graphic software shall support multiple simultaneous screens to be displayed and resizable in a 'Windows'-like environment. All functions excepting text entry functions shall be executable with a mouse.
- C. Graphic software shall provide for multitasking such that third-party programs can be used while the OWS software is on line. Software shall provide the ability to alarm graphically even when operator is in another software package.
- D. The software shall allow for the USPS's creation of user-defined, color graphic displays of geographic maps, building plans, floor plans, and mechanical and electrical system schematics. These graphics shall be capable of displaying all point information from the database including any attributes associated with each point (i.e., engineering units, etc.). In addition, operators shall be able to command equipment or change setpoints from a graphic through the use of the mouse.
- E. Screen Penetration: The operator interface shall allow users to access the various system graphic screens via a graphical penetration scheme by using the mouse to select from menus or 'button' icons.



Each graphic screen shall be capable of having a unique list of other graphic screens that are directly linked through the selection of a menu item or button icon.

- F. **Dynamic Data Displays:** Dynamic physical point values shall automatically updated at a minimum frequency of 6 updates per minute without operator intervention. Point value fields shall be displayed with a color code depicting normal, abnormal, override and alarm conditions.
- G. **Point Override Feature:** Each displayed point shall be individually enabled/disabled to allow mouse-driven override of digital points or changing of analog points. Such overrides or changes shall occur in the control unit, not just in the workstation software. The graphic point override feature shall be subject to password level protection. Points that are overridden shall be reported as an alarm, and shall be displayed in a coded color. The alarm message shall include the operator's user name. A list of points that are currently in an override state shall be available through menu selection.
- H. **Dynamic Symbols:** Provide a selection of standard symbols that change in appearance based on the value of an associated point.
 - 1. **Analog symbol:** Provide a symbol that represents the value of an analog point as the length of a line or linear bar.
 - 2. **Digital symbol:** Provide symbols such as switches, pilot lights, rotating fan wheels, etc. to represent the value of digital input and output points.
 - 3. **Point Status Color:** Graphic presentations shall indicate different colors for different point statuses. (For instance, green = normal, red = alarm, gray (or '???') for non-response).
- I. **Graphics Development Package:** Graphic development and generation software shall be provided to allow the user to add, modify, or delete system graphic displays.
 - 1. The Contractor shall provide libraries of pre-engineered screens and symbols depicting standard air handling unit components (e.g. fans, cooling coils, filters, dampers, etc.), mechanical system components (e.g., pumps, chillers, cooling towers, boilers, etc.), complete mechanical systems (e.g. constant volume-terminal reheat, VAV, etc.) and electrical symbols.
 - 2. The Graphic Development Package shall use a mouse or similar pointing device to allow the user to perform the following:
 - a. Define symbols
 - b. Position items on graphic screens
 - c. Attach physical or virtual points to a graphic
 - d. Define background screens
 - e. Define connecting lines and curves
 - f. Locate, orient and size descriptive text
 - g. Define and display colors for all elements
 - h. Establish correlation between symbols or text and associated system points or other displays.
 - i. Create hot spots or link triggers to other graphic displays or other functions in the software.

2.22 OPERATOR WORKSTATION EQUIPMENT SCHEDULING

- A. Provide a graphic utility for user-friendly operator interface to adjust equipment-operating schedules.
- B. All schedules shall be implemented using BACnet objects and messages and retained in the BC. All building systems with date and time scheduling requirements shall have schedules represented by the BACnet Schedule object. All operators shall be able to view the entries for a schedule. Operators with sufficient privilege shall be able to modify schedule entries from any BACnet workstation.
- C. Scheduling feature shall include multiple seven-day master schedules, plus holiday schedule, each with start time and stop time. Master schedules shall be individually editable for each day and holiday.
- D. Scheduling feature shall allow for each individual equipment unit to be assigned to one of the master schedules.



- E. Timed override feature shall allow an operator to temporarily change the state of scheduled equipment. An override command shall be selectable to apply to an individual unit, all units assigned to a given master schedule, or to all units in a building. Timed override shall terminate at the end of an operator selectable time, or at the end of the scheduled occupied/unoccupied period, whichever comes first. A password level that does not allow assignment of master schedules shall allow a timed override feature.
- F. A yearly calendar feature shall allow assignment of holidays, and automatic reset of system real time clocks for transitions between daylight savings time and standard time.

2.23 OPERATOR WORKSTATION DYNAMIC PLOTTING

- A. The system software shall display data in both a tabular and graphical format. Provide a utility to dynamically plot either historical data or in real-time values on a given 2-dimensional dynamic plot/graph with at least two Y-axes. At least 5 dynamic plots shall be allowed simultaneously.
- B. Graphical trend format shall plot at least 8 different values for a given time period superimposed on the same graph. The 8 values shall be distinguishable by using unique colors. In printed form the 8 lines shall be distinguishable by different line symbology. Displayed trend graphs shall indicate the engineering units for each trended value.
- C. Where trended values on one table/graph are COV, software shall automatically fill the trend samples between COV entries.

2.24 OWS/ CSS DATA ACQUISITION AND STORAGE

- A. All points included in the typical equipment point list must be represented in a common, open or accessible format. All points should be provided as BACnet standard analog, binary, schedule, or trend objects when possible. Naming conventions for these points and network addressing are discussed in the 'Point Naming Conventions' paragraph below.
- B. Non-BACnet data from the BAS shall be stored in relational database format. The format and the naming convention used for storing the database files shall remain consistent across the database and across time. The relational structure shall allow for storage of any additional data points, which are added to the BAS in future. The metadata/schema or formal descriptions of the tables, columns, domains, and constraints shall be provided for each database.
- C. The database shall allow applications to access the data while the database is running. The database shall not require shutting down in order to provide read-write access to the data. Data shall be able to be read from the database without interrupting the continuous storage of trend data being carried by the BAS.
- D. The database shall be ODBC or OLE database compliant.

2.25 REMOTE PERSONAL COMPUTER WORKSTATION GRAPHIC SOFTWARE

- A. Remote graphic operator software shall provide all the functionality specified for the local graphic software. It shall also provide for dial-up communications using the specified modems via commercial telephone lines to connect to the Local Supervisory or Primary LAN, and using the Internet.
- B. Software shall not require graphic images to be sent across the phone lines or 56Kbps or slower Internet connection. Graphic images shall reside on the remote operator workstation hard drive and all licenses must be provided for the graphic software on the remote machine. . Exceptions to this requirement include:



1. System configuration uses an Internet server and presents web pages that can be pulled up using a standard browser.
 2. System configuration uses an Internet server and presents the standalone application running locally but controlled via a remote browser. Operator Interface Graphical Software application must therefore support multi-instancing to allow multiple simultaneous remote connections and use of the graphic software.
- C. Software shall be capable of initiating communication to the any LAN, upon user command, to perform all specified functions. Software shall be capable of initiating communication to the LANs in accordance with user-programmed time schedules to upload trend and report data. Software shall be capable of communicating from the LAN in accordance with user-programmed time schedules to report alarms, upload trend, and report data. Software shall automatically terminate the communication whenever all applications requiring modem connection are closed.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Examine areas and conditions under which control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF CONTROL SYSTEMS:

- A. General: Install systems and materials in accordance with manufacturer's instructions, specifications roughing-in drawings and details shown on drawings. Contractor shall install all controllers in accordance with manufacturer's installation procedures and practices.
- B. Refer to Section 250504 for requirements pertaining to control unit quantity and location.
- C. Contractor shall thoroughly and completely configure BAS system software, supplemental software, network communications, CSS, OWS, portable operators terminal, printer, and remote communications.

3.3 INSTALLATION OF OPERATOR INTERFACE DEVICES

- A. Set up the workstations and printers as indicated on the drawings. Install all software and verify that the systems are fully operational. Ensure licensing is provided for all software.
- B. No license, software component, key, etc or any piece of information required to install, configure, operate, diagnose and maintain the system shall be withheld from the USPS.
- C. Install electronic control system Operation and Maintenance Manuals, programming guides, network configuration tools, control shop drawings etc on each OWS and CSS. Provide interface or shortcuts to guide user to the appropriate information.
- D. Set up portable operator terminal and configure it as the remote workstation. Install all software and verify that the system is fully operational.
- E. Install systems and materials in accordance with manufacturer's instructions.
- F. Deliver hand-held devices/ Portable operator's terminal to the USPS prior to conducting the specified training.



3.4 HARDWARE APPLICATION REQUIREMENTS

- A. General: The functional intent of this specification is to allow cost effective application of manufacturers standard products while maintain the integrity and reliability of the control functions. A Building Controller as specified above is generally fully featured and customizable whereas the AAC/ASC refers to a more cost-effective unit designed for lower-end applications. Specific requirements indicated below are required for the respective application. Manufacturer may apply the most cost-effective unit that meets the requirement of that application.
- B. Standalone Capability: Each Control Unit shall be capable of performing the required sequence of operation for the associated equipment. All physical point data and calculated values required to accomplish the sequence of operation shall originate within the associated CU with only the exceptions enumerated below. Refer to Item 2.01 above for physical limitations of standalone functionality. Listed below are functional point data and calculated values that shall be allowed to be obtained from or stored by other CUs or SDs via LAN.
- C. Where associated control functions involve functions from different categories identified below, the requirements for the most restrictive category shall be met.
- D. Application Category 0 (Distributed monitoring)
1. Applications in this category include the following:
 - a. Monitoring of variables that are not used in a control loop, sequence logic, or safety.
 2. Points on BCs, AACs, and ASCs may be used in these applications as well as SDs and/or general-purpose I/O modules.
 3. Where these points are trended, contractor shall verify and document that the network bandwidth is acceptable for such trends and is still capable of acceptable and timely control function.
- E. Application Category 1 (Application Specific Controller):
1. Applications in this category include the following:
 - a. Fan Coil Units
 - b. Airflow Control Boxes (VAV and Constant Volume Terminal Units)
 - c. Misc. Heaters
 - d. Unitary equipment <15 tons (Package Terminal AC Units, Package Terminal Heat Pumps, Split-System AC Units, Split-System Heat Pumps, Water-Source Heat Pumps)
 - e. Induction Units
 - f. Variable Speed Drive (VSD) controllers not requiring safety shutdowns of the controlled device.
 2. ASCs may be used in these applications.
 3. Standalone Capability: Provide capability to execute control functions for the application for a given setpoint or mode, which shall generally be occupied mode control. Only the following data (as applicable) may be acquired from other controllers via LANs. In the event of a loss of communications with any other controller, or any fault in any system hardware that interrupts the acquisition of any of these values, the ASC shall use the last value obtained before the fault occurred. If such fault has not been corrected after the specified default delay time, specified default value(s) shall then be substituted until such fault has been corrected.

<u>Physical/Virtual Point</u>	<u>Default Value</u>
Scheduling Period	Normal
Morning Warm-Up	Off (cold discharge air)
Load Shed	Off (no shedding)
Summer/Winter	Winter
 4. Mounting:
 - a. ASCs that control equipment located above accessible ceilings shall be mounted on the equipment in an accessible enclosure and shall be rated for plenum use.
 - b. ASCs that control equipment mounted in a mechanical room may either be mounted in, on the equipment, or on the wall of the mechanical room at an adjacent, accessible location.



- c. ASCs that control equipment mounted outside or in occupied spaces shall either be located in the unit or in a proximate mechanical/utility space.
 - d. Section 230903 contractor may furnish ASCs to the terminal unit manufacturer for factory mounting.
 - 5. Programmability: Operator shall be able to modify all setpoints (temperature and airflow), scheduling parameters associated with the unit, tuning and set up parameters, interstage timing parameters, and mode settings. Application-specific block control algorithms may be used to meet the sequence of operations. The ability to customize the control algorithm is not required unless specifically indicated otherwise.
 - 6. LAN Restrictions: Limit the number of nodes on the network to the maximum recommended by the manufacturer.
- F. Application Category 2 (General Purpose Terminal Controller)
- 1. Applications in this category include the following:
 - a. Unitary Equipment \geq 15 tons (Air Conditioners, Heat Pumps, Packaged Heating/Cooling Units, and the like)
 - b. Small, Constant Volume Single Zone Air Handling Units
 - c. Constant Volume Pump Start/Stop
 - d. Misc. Equipment (Exhaust Fan) Start/Stop
 - e. Misc. Monitoring (not directly associated with a control sequence and where trending is not critical)
 - f. Steam Converter Control
 - 2. BCs may be used in these applications.
 - 3. ASC's may be used in these applications provided the ASC meets all requirements specified below. This category requires a general-purpose ASC to which application-specific control algorithms can be attached.
 - 4. Standalone Capability: Only the following data (as applicable) may be acquired from other ASCs via LANs. In the event of a loss of communications with any other ASCs, or any fault in any system hardware that interrupts the acquisition of any of these values, the AAC/ASC shall use the last value obtained before the fault occurred. If such fault has not been corrected after the specified default delay time, specified default value(s) shall then be substituted until such fault has been corrected.

<u>Physical/Virtual Point</u>	<u>Default Delay Time</u>	<u>Default Value</u>
Outside Air Temperature	3 minutes	80°F
Outside Air Humidity	3 minutes	60%RH
Outside Air Enthalpy	3 minutes	30 Btu/lb
Trend Data		N/A
Cooling/Heating Requests	3 minutes	None
 - 5. Mounting:
 - a. ASCs that control equipment located above accessible ceilings shall be mounted on the equipment and shall be rated for plenum use.
 - b. ASCs that control equipment located in occupied spaces or outside shall either be mounted within the equipment enclosure (responsibility for physical fit remains with the contractor) or in a nearby mechanical/utility room in which case it shall be enclosed in a NEMA 1, locking enclosure.
 - 6. Programmability: Operator shall be able to modify all setpoints (temperature and airflow), scheduling parameters associated with the unit, tuning and set up parameters, interstage timing parameters, and mode settings. Operator shall be able to address and configure spare inputs for monitoring. [Operator shall be able to address and configure spare outputs for simple single loop control actions or event initiated actions.] Application-specific block control algorithms shall used to meet the sequence of operations. The ability to customize the control algorithm is not required unless specifically indicated otherwise.
 - 7. LAN Restrictions: Limit the number of nodes servicing any one of these applications on the AAC/ASC LAN to 32.



G. Application Category 3 (Advanced Application Controller)

1. Applications in this category include the following:
 - a. Large Constant Volume Air Handlers
 - b. VAV Air Handlers {generally >5,000 and <10,000cfm}
 - c. Dual Duct Air Handlers {generally >5000 and < 10,000 cfm}
 - d. Multizone Air Handlers
 - e. Self Contained VAV Units
2. BCs may be used in these applications.
3. AAC's may be used in these applications provided:
 - a. The AAC's meets all requirements specified below.
 - b. All control functions and physical I/O associated with a given unit resides in one AAC.
 - c. Input A/D is 10-bit. *Exception:* 8-bit input A/D can be used when matched with high accuracy sensors, the range of which meets the resolution requirements specified for the applicable sensor in Section 230901.
 - d. Pulsed inputs required for the application can be monitored and accumulated effectively.
4. Standalone Capability: Only the following data (as applicable) may be acquired from other AACs via LANs. In the event of a loss of communications with any other AACs, or any fault in any system hardware that interrupts the acquisition of any of these values, the AAC shall use the last value obtained before the fault occurred. If such fault has not been corrected after the specified default delay time, specified default value(s) shall then be substituted until such fault has been corrected.

<u>physical/virtual point</u>	<u>default delay time</u>	<u>default value</u>
Outside Air Temperature	3 minutes	80°F
Outside Air Humidity	3 minutes	60%RH
Outside Air Enthalpy	3 minutes	30 Btu/lb
Enable Local Operation		Last Value
Cooling/Heating Requests	3 minutes	None
5. Mounting:
 - a. AACs that control equipment located above accessible ceilings shall be mounted on the equipment and shall be rated for plenum use.
 - b. AACs that control equipment located in occupied spaces or outside shall either be mounted within the equipment enclosure (responsibility for physical fit remains with the contractor) or in a near by mechanical/utility room in which case it shall be enclosed in a NEMA 1, locking enclosure.
6. Programmability: Operator shall be able to modify all setpoints (temperature and airflow), scheduling parameters associated with the unit, tuning and set up parameters, interstage timing parameters, and mode settings. Operator shall be able to address and configure spare inputs for monitoring. Operator shall be able to program custom DDC control algorithms and specify trending parameters, which will be retained in memory in the event of a loss of communications. Application-specific block control algorithms may be used provided they meet the sequence of operations. The control algorithms shall be completely customizable.
7. LAN Restrictions: Each LAN which participates in the transfer of data between the CU and the local operator workstation shall be subject to the following criteria:
 - a. Limit the number of nodes servicing any one of these applications on the AAC/ASC LAN to 16.
 - b. The building controller LAN shall be subject only to the manufacturer's published LAN limitations.

H. Application Category 4

1. Applications in this category include the following:
 - a. Central Cooling Plant
 - b. Central Heating Plant
 - c. Cooling Towers
 - d. Sequenced or Variable Speed Pump Control



- e. Local Chiller Control (unit specific)
- f. Local Free Cooling Heat Exchanger Control
- g. Air Handlers over 10,000 cfm or serving critical areas
- 2. BCs shall be used in these applications.

3.5 SITE-SPECIFIC APPLICATION PROGRAMMING

- A. Provide all database creation and site-specific application control programming as required by these Specifications, national and local standards and for a fully functioning system. Contractor shall provide all initial site-specific application programming and thoroughly document programming. Generally meet the intent of the written sequences of operation. It is the Contractor's responsibility to request clarification on sequence issues that require such clarification.
- B. All site-specific programming shall be fully documented and submitted for review and approval, both prior to downloading into the panel, at the completion of functional performance testing, and at the end of the warranty period.
- C. All programming, graphics and data files must be maintained in a logical system of directories with file names conforming to the naming standards identified in Appendix B. All files developed for the project will be the property of the USPS and shall remain on the workstation(s)/server(s) at the completion of the project.

3.6 CONTROL UNIT PASSWORD SETUP

- A. Set up the following password levels to include the specified capabilities:
 - 1. Level 1: (Programmer)
 - a. Level 2 capabilities
 - b. View, add, change and delete user names, passwords, password levels
 - 2. Level 2: (Operator)
 - a. Level 3 capabilities
 - b. Override output points
 - c. Change setpoints
 - d. Change equipment schedules
 - 3. Level 3: (Basic user)
 - a. Read point values
 - b. Read trend point data
- B. Contractor shall provide the initial setup of all USPS's operators by assigning user names, passwords and password levels. Provide a minimum of setup for 20 USPS users.
- C. Contractor shall remove all default passwords and backdoor entry methods from all CUs before the completion and commission of the equipment.

3.7 CONTROL UNIT POINT PARAMETERS

- A. Provide the following minimum programming for each analog input:
 - 1. Name
 - 2. Address
 - 3. COV threshold
 - 4. Engineering units
 - 5. Offset calibration and scaling factor for engineering units
 - 6. High and low alarm values and alarm differentials for return to normal condition
 - 7. High and low value reporting limits (reasonableness values), which shall prevent control logic from using shorted or open circuit values.



8. Default value to be used when the actual measured value is not reporting. This is required only for points that are transferred across the primary and/or secondary controlling networks and used in control programs residing in control units other than the one in which the point resides. Events causing the default value to be used shall include failure of the control unit in which the point resides, or failure of any network over which the point value is transferred.

B. Provide the following minimum programming for each analog output:

1. Name
2. Address
3. Engineering units
4. Offset calibration and scaling factor for engineering units
5. Output Range
6. Default value to be used when the normal controlling value is not reporting.

C. Provide the following minimum programming for each digital input:

1. Name
2. Address
3. Engineering units (on/off, open/closed, freeze/normal, etc.)
4. Message and alarm reporting as specified
5. Reporting of each change of state, and memory storage of the time of the last change of state
6. Totalization of on-time (for all motorized equipment status points), and accumulated number of off-to-on transitions.

D. Provide the following minimum programming for each digital output:

1. Name
2. Address
3. Engineering units (on/off, open/closed, freeze/normal, etc.)
4. Totalization of on-time and off time and accumulated number of off-to-on transitions.
5. Default value to be used when the normal controlling value is not reporting.

E. Provide the following minimum programming for each virtual and calculated point:

1. Name
2. Address if applicable
3. Engineering units (on/off, open/closed, freeze/normal, etc.)
4. Status association with a DI and failure alarming (as applicable)
5. Reporting of each change of state, and memory storage of the time of the last change of state.
6. Totalization of on-time (for status points), and totalization for calculated values
7. Default value to be used when the normal controlling value is not reporting.

3.8 CONTROL UNIT TRENDS

- A. Contractor shall establish and store trend logs. Trend logs shall be prepared for each physical input and output point, and all dynamic virtual points such as setpoints subject to a reset schedule, intermediate setpoint values for cascaded control loops and the like, as indicated in the points list, and as directed by the USPS.
- B. Sample trends indicated as COV (\pm) or change-of-value mean that the changed parameter only needs to be recorded after the value changes by the amount listed.
- C. Trending intervals or COV thresholds shall be and indicated in the points list and as directed by the USPS upon system start-up.
- D. The Contractor shall demonstrate functional trends as specified for a period of 30 days after successful system demonstration before Substantial Completion of the system.



- E. All trend data shall be stored in the BC for a minimum of 7 days

3.9 CONTROL UNIT ALARMS

- A. Override Alarms: Any point that is overridden through the override feature of the graphic workstation software shall be reported as a Level 3 alarm.
- B. Analog Input Alarms: For each analog input, program an alarm message for reporting whenever the analog value is outside of the programmed alarm limits. Report a 'Return-to-Normal' message after the analog value returns to the normal range, using a programmed alarm differential. The alarm limits shall be individually selected by the Contractor based on the following criteria unless indicated differently in the sequence of operations:
1. Space temperature, except as otherwise stated in sequence of operation: Level 3
 - a. Low alarm: 64°F
 - b. Low return-to-normal: 68°F
 - c. High alarm: 85°F
 - d. High return-to-normal: 80°F
 2. Controlled media temperature other than space temperature (e.g. AHU discharge air temperature, steam converter leaving water temperature, condenser water supply, chilled water supply, etc.): Level 3 (If controlled media temperature setpoint is reset, alarm setpoints shall be programmed to follow setpoint)
 - a. Low alarm: 3°F below setpoint
 - b. Low return-to-normal: 2°F below setpoint
 - c. High alarm: 3°F above setpoint
 - d. High return-to-normal: 2°F above setpoint.
 3. AHU mixed air temperature: Level 4
 - a. Low alarm: 45°F
 - b. Low return-to-normal: 46°F
 - c. High alarm: 90°F
 - d. High return-to-normal: 89°F
 4. Duct Pressure:
 - a. Low alarm: 0.5"w.g. below setpoint
 - b. Low return-to-normal: 0.25"w.g. below setpoint
 - c. High alarm: 0.5"w.g. above setpoint
 - d. High return-to-normal: 0.25"w.g. above setpoint
 5. Space humidity:
 - a. Low alarm: 35%
 - b. Low return-to-normal: 40%
 - c. High alarm: 75%
 - d. High return-to-normal: 70%
- C. HOA Switch Tampering Alarms: The Sequences of Operation are based on the presumption that motor starter Hand-Off-Auto (HOA) switches are in the 'Auto' position. [If a motorized equipment unit starts without a prior start command from the BAS, (as sensed by status sensing device), then BAS shall perform the remaining sequence as specified.] BAS shall also enunciate the following Level 5 alarm message if status indicates a unit is operational when the run command is not present:
1. DEVICE XXXX FAILURE: Status is indicated on {the device} even though it has been commanded to stop. Check the HOA switch, control relay, status sensing device, contactors, and other components involved in starting the unit. Acknowledge this alarm when the problem has been corrected.
- D. Maintenance Alarms: Enunciate Level 5 alarms when runtime accumulation exceeds a value specified by the operator
1. DEVICE XXXX REQUIRES MAINTENANCE. Runtime has exceeded specified value since last reset.



3.10 OPERATOR WORKSTATION CONTROL UNIT PASSWORD SETUP

- A. Set up the following password levels to include the specified capabilities:
1. Level 1: (USPS's BAS Administrator)
 - a. Level 2 capabilities
 - b. View, add, change and delete user names, passwords, password levels
 - c. All unrestricted system capabilities including all network management functions.
 2. Level 2: (Programmer)
 - a. Level 3 capabilities
 - b. Configure system software
 - c. Modify control unit programs
 - d. Modify graphic software
 - e. Essentially unrestricted except for viewing or modifying user names, passwords, password levels
 3. Level 3: (Senior HVAC Technician)
 - a. Level 4 capabilities
 - b. Override output points
 - c. Change setpoints
 - d. Change equipment schedules
 - e. Exit BAS software to use third party programs
 4. Level 4: (Junior HVAC Technician)
 - a. Level 5 capabilities
 - b. Acknowledge alarms
 - c. Temporarily override equipment schedules
 5. Level 5: (HVAC Technician Trainee)
 - a. Display all graphic data
 - b. Trend point data
- B. Contractor shall provide the initial setup of all USPS's operators by assigning user names, passwords and password levels. Provide a minimum of setup for [20[] USPS users.
- C. Contractor shall remove all default passwords and backdoor entry methods from all OWS /CCSs before the completion and commission of the equipment.

3.11 OPERATOR WORKSTATION TREND GRAPHS

- A. Prepare workstation software to display graphical format trends. Trended values and intervals shall be the same as those specified in this or related sections.
- B. Lines shall be labeled and shall be distinguishable from each other by using either different line types, or different line colors.
- C. Indicate engineering units of the y-axis values; e.g. degrees F., inches w.g., Btu/lb, percent open, etc.
- D. The y-axis scale shall be chosen so that all trended values are in a readable range. Use a secondary Y-axis to make the unit ranges compatible in the display.
- E. Trend outside air temperature, humidity, and enthalpy during each period in which any other points are trended.
- F. All points trended for one HVAC subsystem (e.g. air handling unit, chilled water system, etc.) shall be trended during the same trend period.
- G. Each graph shall be clearly labeled with HVAC subsystem title, date, and times.

**NOTE TO SPECIFIER**

AE must edit the following to be project specific. Consult with USPS

- H. See requirements for additional equipment-specific alarms specified in Section Section 259004-Sequence of Operation
- I. All alarms shall be stored in an SQL database.

3.12 OPERATOR WORKSTATION GRAPHIC SCREENS

NOTE TO SPECIFIER

AE must provide electronic control design drawings. Also edit the following to be project specific.

- A. Floor Plan Screens: The contract document drawings will be made available to the Contractor in AutoCAD 2004 format upon request. These drawings may be used only for developing backgrounds for specified graphic screens; however the USPS does not guarantee the suitability of these drawings for the Contractor's purpose.
 - 1. Provide graphic floor plan screens for each [floor] [wing] [tower] [other] of the building. Indicate the location of all equipment that is not located on the equipment room screens. Indicate the location of temperature sensors associated with each temperature-controlled zone (i.e., VAV terminals, fan-coils, single-zone AHUs, etc.) on the floor plan screens. [Zone background color shall change based on the temperature offset from setpoint]. Display the space temperature point adjacent to each temperature sensor symbol. Use a distinct line symbol to demarcate each terminal unit zone boundary. Use distinct colors to demarcate each air handling unit zone. [Mechanical floor plan drawings will be made available to the contractor upon request for the purpose of determining zone boundaries.] Indicate room numbers as provided by the USPS. Provide a drawing link from each space temperature sensor symbol and equipment symbol shown on the graphic floor plan screens to each corresponding equipment schematic graphic screen.
 - 2. Provide graphic floor plan screens for each mechanical equipment room and a plan screen of the roof. Indicate the location of each item of mechanical equipment. Provide a drawing link from each equipment symbol shown on the graphic plan view screen to each corresponding mechanical system schematic graphic screen.
 - 3. If multiple floor plans are necessary to show all areas, provide a graphic building key plan. Use elevation views and/or plan views as necessary to graphically indicate the location of all of the larger scale floor plans. Link graphic building key plan to larger scale partial floor plans. Provide links from each larger scale graphic floor plan screen to the building key plan and to each of the other graphic floor plan screens.
 - 4. Provide a graphic site plan with links to and from each building plan.
- B. System Schematic Screens: Provide graphic system schematic screen for each HVAC subsystem controlled with each I/O point in the project appearing on at least one graphic screen. System graphics shall include flow diagrams with status, setpoints, current analog input and output values, operator commands, etc. as applicable. General layout of the system shall be schematically correct. Input/output devices shall be shown in their schematically correct locations. Include appropriate engineering units for each displayed point value. Verbose names (English language descriptors) shall be included for each point on all graphics; this may be accomplished by the use of a pop-up window accessed by selecting the displayed point with the mouse. Indicate all adjustable setpoints on the applicable system schematic graphic screen or, if space does not allow, on a supplemental linked-setpoint screen.
 - 1. Provide graphic screens for each air handling system. Indicate outside air temperature and enthalpy, and mode of operation as applicable (i.e., occupied, unoccupied, warm-up, cool-down). Link screens for air handlers to the heating system and cooling system graphics. Link screens for supply and exhaust systems if they are not combined onto one screen.



2. Provide a graphic screen for each zone. Provide links to graphic system schematic screens of air handling units that serve the corresponding zone.
 3. Provide a cooling system graphic screen showing all points associated with the chillers, cooling towers and pumps. Indicate outside air dry-bulb temperature and calculated wet-bulb temperature. Link screens for chilled water and condenser water systems if they cannot fit onto one cooling plant graphic screen.
 4. Link screens for heating and cooling system graphics to utility history reports showing current and monthly electric uses, demands, peak values, and other pertinent values.
- C. Bar Chart Screens: On each graphic Bar Chart Screen, provide drawing links to the graphic air handling unit schematic screens.
1. Provide a graphic chilled water valve screen showing the analog output signal of all chilled water valves in a bar chart format, with signals expressed as percentage of fully open valve (percentage of full cooling). Indicate the discharge air temperature and setpoint of each air handling unit, cooling system chilled water supply and return temperatures and the outside air temperature and humidity on this graphic. Provide drawing links between the graphic cooling plant screen and this graphic screen.
 2. Provide a graphic heating water valve screen showing the analog output signal of all air handling unit heating water valves in a bar chart format, with signals expressed as percentage of fully open valve (percentage of full heating). Indicate the temperature of the controlled medium (such as AHU discharge air temperature or zone hot water supply temperature) and the associated setpoint and the outside air temperature and humidity.
- D. Alarms: Each programmed alarm shall appear on at least one graphic screen. In general, alarms shall be displayed on the graphic system schematic screen for the system that the alarm is associated with (for example, chiller alarm shall be shown on graphic cooling system schematic screen). For all graphic screens, display analog values that are in a 'high alarm' condition in a red color, 'low alarm' condition in a blue color. Indicate digital values that are in alarm condition in a red color.



APPENDIX A USPS Point and Device Naming Convention

PART 1 - GENERAL:

- A. Purpose: To establish standard naming conventions for all BMS system names for USPS EEMS and future BMS system expansion and upgrades. This standard provides consistence with all systems incorporated into it, allows for future expansion.
- B. Discussion: Enterprise systems are made of many components involving several levels of hierarchy and different types and capabilities of equipment. These various components are all associated in a physical/ hardware arrangement either at the enterprise, facility system or equipment level. The intent of this naming convention is to develop a standard method to identify EEMS point and systems and their relationship through various system hierarchies and components as described below. Although this is a tested convention, unforeseen circumstances or exceptions may occur, the contractor is required to identify these exceptions and seek approval of deviation from this standard before proceeding with point naming development.
- C. The USPS shall designate the *Building Name* and facility ID. The *System* descriptor shall further define the object in terms of air handling, cooling, heating, or other system. The *Equipment* descriptor shall define the equipment category; e.g., Chiller, Air Handler, or other equipment. The *Point* descriptor shall define the hardware or software type or function associated with the equipment; e.g., supply temperature, water pressure, alarm, mixed air temperature setpoint, etc. and shall contain any numbering conventions for multiples of equipment;

1.1 SYSTEM NAMING AND NOMENCLATURE CONVENTIONS

- A. All Point and Device Names, Descriptors and Engineering Units are CAPITALIZED and uniform.
- B. Object names shall not exceed 29 characters in length including separators.
- C. Levels of the naming hierarchy shall be separated by a period.
- D. Object descriptor shall not exceed 15 characters.
- E. All Engineering units must be consistent for similar measurements.
- F. For all analog output points = 0-100 % for control with 100% = full open or full speed, 0% = closed or min speed.
- G. Alarms for points Alarm States, Alarm Messages, High & Low Limits or State that caused an alarm must be submitted for review

1.2 OBJECT NAMING STRUCTURE

- A. Object names will follow the following structure: AB.CCCCCCCCC.DDD.EEEE. FFFF.GGGG.HHHH
 Where: AB is the facility's state represented by the two character postal state identifier. See Table A.1 below
 CCCCCCCCC The facility ID. See Table A.2 below
 DDD Utility or Facility System See Table A.3 below
 EEEE Major Equipment or Device System See Table A.4 below



FFFF	Sub-equipment or device parameter	See Table A.5 below
GGGG	Sub-equipment parameter	See Table A.5 below, optional
depending on Application		
HHHH	Sub-equipment parameter	See Table A.5 below, optional
depending on Application		

1.3 BACNET DEVICE OBJECT INSTANCE NUMBER

- A. BACnet Device Instance numbers are assigned by state. See Table A.1 below for the Instance Number ranges by state. Ranges of Numbers will be assigned by USPS in coordination with the EEMS provider

1.4 BACNET DEVICE OBJECT NAMING STRUCTURE

- A. BACnet Device Object names will follow the following structure: AB.CCCCCCCCCC.JJJ.KKKK.LLLL

Where:	AB	is the facility state abbreviation. See Table A.1 below
	CCCCCCCC	The facility ID. See Table A.2 below
	JJ	Two digit floor level code See Table A.6 below
	KKKK	Room or location Identifier See Table A.7 below
	LLLL	Equipment/ Function identifier to be used if network node is assigned to a particular piece of Major equipment i.e. air handler, chilled water system, etc. See Table A..8 below

**Table A.1: Facility State below)**

AB State postal
 abbreviation

State/ Possession	State Code	BACnet Device Number Range	
ALABAMA	AL	1	30,000
ALASKA	AK	30,001	40,000
ARIZONA	AZ	40,001	80,000
ARKANSAS	AR	80,001	100,000
CALIFORNIA	CA	100,001	550,000
COLORADO	CO	550,001	640,000
CONNECTICUT	CT	640,001	690,000
DELAWARE	DE	690,001	700,000
DISTRICT OF COLUMBIA	DC	700,001	750,000
FLORIDA	FL	750,001	1,000,000
GEORGIA	GA	1,000,001	1,080,000
HAWAII	HI	1,080,001	1,090,000
IDAHO	ID	1,090,001	1,100,000
ILLINOIS	IL	1,100,001	1,350,000
INDIANA	IN	1,350,001	1,410,000
IOWA	IA	1,410,001	1,440,000
KANSAS	KS	1,440,001	1,510,000
KENTUCKY	KY	1,510,001	1,540,000
LOUISIANA	LA	1,540,001	1,600,000
MAINE	ME	1,600,001	1,610,000
MARYLAND	MD	1,610,001	1,710,000



MASSACHUSETTS	MA	1,710,001	1,860,000
MICHIGAN	MI	1,860,001	1,980,000
MINNESOTA	MN	1,980,001	2,100,000
MISSISSIPPI	MS	2,100,001	2,110,000
MISSOURI	MO	2,110,001	2,260,000
MONTANA	MT	2,260,001	2,270,000
NEBRASKA	NE	2,270,001	2,280,000
NEVADA	NV	2,280,001	2,300,000
NEW HAMPSHIRE	NH	2,300,001	2,320,000
NEW JERSEY	NJ	2,320,001	2,470,000
NEW MEXICO	NM	2,470,001	2,480,000
NEW YORK	NY	2,480,001	2,930,000
NORTH CAROLINA	NC	2,930,001	3,000,000
NORTH DAKOTA	ND	3,000,001	3,010,000
OHIO	OH	3,010,001	3,140,000
OKLAHOMA	OK	3,140,001	3,210,000
OREGON	OR	3,210,001	3,250,000
PENNSYLVANIA	PA	3,250,001	3,500,000
PUERTO RICO	PR	3,500,001	3,510,000
RHODE ISLAND	RI	3,510,001	3,520,000
SOUTH CAROLINA	SC	3,520,001	3,550,000
SOUTH DAKOTA	SD	3,550,001	3,560,000
TENNESSEE	TN	3,560,001	3,630,000
TEXAS	TX	3,630,001	3,880,000
UTAH	UT	3,900,000	



		3,880,001	
VERMONT	VT	3,900,001	3,910,000
VIRGINIA	VA	3,910,001	3,980,000
WASHINGTON	WA	3,980,001	4,070,000
WEST VIRGINIA	WV	4,070,001	4,090,000
WISCONSIN	WI	4,090,001	4,140,000
WYOMING	WY	4,140,001	4,150,000

NOTE TO SPECIFIER

Provide the nine digit facility ID number and the associated approved facility name for each facility involved in this project

Table A.2: CCCCCCCC - Facility ID (Nine Characters)

Nine digit USPS facility ID							
Facility ID	Facility Name	Facility ID	Facility Name	Facility ID	Facility Name	Facility ID	Facility Name
CCCCCCCC		CCCCCCCC		CCCCCCCC		CCCCCCCC	

Table A.3: DDD - System (One to Three Characters)

UTL	Utility Mains (incoming)	CA	Compressed Air	ELE	Electrical Systems
AH	Air Handling	HHW	Heating Hot Water	LTG	Lighting
CHW	Chilled Water	DW	Domestic Water	LPS	Low Pressure Steam
CDW	Condenser Water	DHW	Domestic Hot Water	HPS	High Pressure Steam

Systems are major equipment systems or type of systems which can include different type of equipment serving the same purpose. Example: UTL is used for meters associated with all facility incoming mains. AH is incorporates all air handling equipment (RTU, AHU, FCU, etc.), CHW incorporates all equipment associated with chilled water


Table A.4: EEEE - Major Equipment, or Device System (Up to Six Characters)

Air Handling		Cooling	(If equip. has designation use that)	Heating	(If equip. has designation use that)	Non-HVAC Systems	
AH							
U#	Air Handling Unit	CHL#	Chiller	BLR#	Boiler	FA	Fire Alarm
MA			Chilled Water		Heating Water		
U#	Make-Up Air Unit	CHP#	Pump	HWP#	Pump	LTG	Lighting
			Condenser Water		Heating Water		Lighting
SF#	Supply Fan	CWP#	Pump	HW	System	LCP	Control Panel
					Domestic Hot		
RF#	Return Fan	CT#	Cooling Tower	DHW	Water	SC	Security
REF			Chemical		Domestic		
#	Relief Fan	CHM#	Treatment	DWP#	Water Pump		
					Floor Heating		
EF#	Exhaust Fan	SDP#	Sand Pump	FLH	System	Utility Mains	
			Computer Room				
HP#	Heat Pump	CRU#	AC Unit	UH#	Unit Heater	ELE	Electric
HP	Heat Pump (Water		Direct Expansion		Cabinet Unit	GA	
W#	Source)	DX#	Cooling	CUH#	Heater	S	Gas
FC	Fan Coil Unit with				Fin Tube	WT	
W#	Water coil	FAN#	Fan	FTR#	Radiator	R	Water
FCX	Fan Coil Unit with				Electric Duct		Low Pressure
#	DX cooling	SYS	System Point	EDH#	Heater	LPS	Steam
					Heat	HP	High Pressure
		TWR	Tower	HTX#	Exchanger	S	Steam
						WT	
Miscellaneous				SYS	System Point	R	WTR
RM	Room with				Condensate		
#	number			COND	Systems	OIL	Oil
SP	Sprinkler Room					PP	
R#	with number					N	Propane
GE	Emergency						
N#	Generator						



Table A.5: Device (Typically Two to Three Characters) – list can be expanded for non-typical devices with approval							
Analog Inputs		Analog Outputs		Digital Inputs		Digital Outputs	
AMP	Current (Amperes)	BPV	Bypass Valve	ALM	Alarm	BYP	Bypass
BSP	Building Static Pressure	CAD	Combustion Air Damper	DLK	Magnetic Door Lock	CCP	Contactors
BTU	British Thermal Units	CCV	Cooling Coil Valve	DXS	DX Cooling Stage	DX1	Cooling Coil Pump
CDT	Cold Deck Temperature	CDD	Cold Deck Damper	EMS	Emergency Stop Switch	DX2	1st Stage DX Cooling
DEW	Dewpoint Exhaust Velocity	EAD	Exhaust Damper	ENB	Enable Command	GH1	2nd Stage DX Cooling
EVP	Pressure Heat Coil	FBD	Face Bypass Damper	EPO	Emergency Power Off	GH2	1st Stage Gas Heating
HCT	Temperature	FCV	Flow Control Valve	FC	Free Cooling Status	HCP	2nd Stage Gas Heating
						HLS	Heating Coil Pump
							High/Low Speed
							Command with Status
HDT	Hot Deck Temperature	HCV	Heating Coil Valve	FF	Flame Failure		Feedback
LVL	Level Sensor Mixed Air	HDD	Hot Deck Damper	FIRE	Fire Alarm	HTS	Heat Stage
MAT	Temperature Outdoor Air	HUV	Humidity Valve	HSP	High Static Pressure	ISD	Isolation Damper
OAT	Temperature Return Air	ILV	Inlet Vane	HTD	High Temp Detector	RAF	Return Fan
RAE	Enthalpy	ISV	Isolation Valve	LSP	Low Suction Pressure	SAF	Supply Fan Start/Stop
							Command with Status
RAH	Return Air Humidity	MAD	Mixed Air Damper	LTD	Low Temp Detector	SS	Feedback
RAT	Return Air Temperature	OAD	Outside Air Damper	MOT	Motion Sensor	STB	Strobe
RMH	Room Humidity Room	RVD	Return VFD or Return Vane	PHO	Photocell		
RMT	Temperature	SAD	Supply Air Damper	PRF	Proof		
RSP	Return Static Pressure	SVD	Supply VFD or Supply Vane	RSD	Return Smoke Detector		
RVP	Return Velocity Pressure		Damper	RSP	Return Fan High Static		
RWT	Return Water Temperature			SSD	Supply Smoke Detector		
SAH	Supply Air Humidity			STS	Status		
SAT	Supply Air Temperature						
SSP	Supply Static Pressure						
SVP	Supply Velocity Pressure						

USPS Master Specifications Updated 5-1-2014



MAO	Mixed Air Damper Output	SCT	SSTO Cool Temp	BTUH	Energy Consumption (Heating)
MAS	Mixed Air Setpoint	SEA	Season	TON	Energy rate (Cooling)
MOD	Mode	SES	SSTO Early Start	TNHR	Energy Consumption (Cooling)
NCM	Night Cooling Mode	SHS	Supply Humidity Setpoint	CFM	Air flow
NCS	Night Cooling Setpoint	SPD	Speed %	CCF	Air consumption
NHM	Night Heating Mode	SWS	Supply Water Setpoint		
NCS	Night Cooling Setpoint				

Table A.6: JJ – Floor Level Code (Two Characters)

00	Basement and Tunnels	MZ	Mezzanine level
01	Ground floor	RF	Roof level
02	First floor above ground level		
03 etc	Succeeding floors above ground level		
If the facility floor numbering differs from the scheme above follow the facility floor level naming convention			

Table A.7: KKKK – Room/ location identifier (Characters as needed)

RM	Room	KK	Room number digits as needed
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Table A.8: LLLL Equipment/ Function identifier (Characters as needed)

Any description to help identify device service			
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USPS Mail Processing Facility Specification issued: 5/1/2014
Last revised: 04/16/2014

END OF SECTION



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SECTION 25 30 04 00 - MPF BAS BASIC MATERIALS AND SENSORS

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.25 30 04 00

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pneumatic Tubing
- B. Wiring
- C. Control Valves and Actuators
- D. Control Dampers and Actuators
- E. Control Panels
- F. Sensors
- G. Pneumatic Control Components (Gauges, switches, relays, etc.)
- H. Electric Control Components (Switches, EP Valves, Thermostats, Relays, Smoke Detectors, etc.)
- I. Transducers
- J. Air Flow Measuring Stations
- K. Current Switches
- L. Nameplates
- M. Testing Equipment

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Section 230500 - Common Work Results for HVAC
- C. Section 250504 - Building Automation System (BAS) General
- D. Section 251104 - Metering Devices
- E. Section 251404 - BAS Equipment, Software and Programming
- F. Section 255104 – EEMS Integration



- G. Section 259004- Sequence of Operation
- H. Section 250804 - Building Automation System (BAS) Commissioning

1.3 DESCRIPTION OF WORK

- A. Refer to Section 250504 for general requirements.
- B. Refer to other Division-22 and 23 sections for installation of instrument wells, valve bodies, and dampers in mechanical systems; not work of this section.
- C. Provide the following electrical work as work of this section, complying with requirements of Division-16 sections:
 1. Control wiring between field-installed controls, indicating devices, and unit control panels.
 2. Interlock wiring between electrically interlocked devices, sensors, and between a hand or auto position of motor starters as indicated for all mechanical and controls.
 3. Wiring associated with indicating and alarm panels (remote alarm panels) and connections to their associated field devices.
 4. All other necessary wiring for fully complete and functional control system as specified.

1.4 WORK BY OTHERS

- A. Control Valves furnished under this section shall be installed under the applicable piping section under the direction of Section 253004 Contractor who will be fully responsible for the proper operation of the valve.
- B. Control Dampers furnished under this section shall be installed under the applicable air distribution or air handling equipment section under the direction of Section 253004 Contractor who will be fully responsible for the proper operation of the damper
- C. Water Pressure Taps, Thermal Wells, Flow Switches, Flow Meters, etc. that will have wet surfaces, shall be installed under the applicable piping Section under the direction of Section 253004 Contractor who will be fully responsible for the proper installation and application.
- D. Controlled Equipment Power Wiring shall be furnished and installed under Division 16. Where control involves 120V control devices controlling 120V equipment, Division 16 Contractor shall extend power wiring to the equipment. Section 253004 Contractor shall extend it from the equipment to the control device.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

NOTE TO SPECIFIER

Edit the following to suit the project. The cost effectiveness of pneumatically driven actuators shall be assessed by the AE. The USPS prefers all electronic where practical and cost effective. Note that extensions of an existing pneumatically driven system with large actuators should be evaluated for cost effectiveness. The USPS would prefer at a minimum an alternate electronic device upgrade option on all renovation projects. The condition of the control air source and distribution equipment must also be taken into consideration.



- A. General: Provide electronic [pneumatic] [or] [electric] control products in sizes and capacities indicated, consisting of valves, dampers, thermostats, clocks, controllers, sensors, and other components as required for a complete installation. Except as otherwise indicated, provide manufacturer's standard materials and components as published in their product information; designed and constructed as recommended by manufacturer, and as required for application indicated.

NOTE TO SPECIFIER

Edit the following to suit the project. The Contractor may reuse existing control air in buildings where pneumatic controls will be replaced.

- B. Control Air Supply: The Contractor shall install air dryers and air filters so that all controllers and existing pneumatic devices receive a clean and dry air supply.
1. The control air filters shall remove oil and solid particles from the compressed air. Provide a prefilter and a final filter. The prefilter shall be rated for 100 percent removal of all solids 1 micron and larger, 100 percent removal of liquid water, and 70 percent removal of oil aerosols with 2000 ppm maximum inlet liquid loading. The final filter shall be rated for 100 percent removal of liquid water and solids larger than 0.03 micron; 99.999 percent removal of oil aerosols with 100 ppm maximum inlet liquid loading. Filters shall include replaceable filter element, differential pressure gauge, and automatic liquid drain trap. Filters shall be selected for a maximum pressure drop of 2 psig at compressor capacity. Filter bodies shall be rated for 225 psig or greater operating pressure. Transparent acrylic tube housings shall be protected by a perforated steel safety shield. Filters shall be Hankison, DelTech, Wilkerson, or Arrow Pneumatics. Furnish one (1) spare filter element per filter.
 2. For existing systems where no pneumatic tubing is subject to temperatures below 40°F and without refrigerated dryers, provide an air-cooled refrigerated dryer with flow capacity at 100 °F, 100 psig saturated entering air and 40 °F leaving dewpoint equal to or exceeding air compressor capacity. Refrigerated dryer shall be a single package unit with all necessary piping, refrigerant, controls, wiring and accessories. Dryer shall include refrigeration system, on/off switch, inlet air pressure gauge, and water separator with automatic drain. Refrigerant shall be R-134a. System shall be labeled by CSA or UL. Manufacturer shall be Hankison, Wilkerson, DelTech, Ingersol-Rand or Arrow Pneumatics.
 3. For existing systems with outdoor pneumatic components or components otherwise exposed to ambient conditions, provide a desiccant-type heatless self-regenerative air dryer for piping providing air supply to these components. Dryer capacity shall exceed connected load, plus a 30 percent allowance for expansion with inlet conditions of 100 deg f, saturated air at 100 psig, and outlet conditions of minus 40 °F dewpoint. Dryer maximum air pressure drop at rated flow shall not exceed 5 psig. Required air flow for regeneration shall not exceed 20 percent of dryer output capacity. Dryer shall include two desiccant towers, piping, changeover valves, exhaust silencers, controls and wiring. Desiccant towers shall be designed in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII, and shall be ASME stamped for 125 psig working pressure, and fitted with suitable relief valves if tower physical size places tower within the scope of the Code where stamp is required. Desiccant dryers shall be as manufactured by Hankison, Deltech, Arrow Pneumatics, Ingersol-Rand or Zurn.
 4. Main Air Piping (between the compressors and the field control panels): Hard drawn copper tubing, ASTM B 88, Type L.
 5. Branch Air Piping (to include main air between field control panels and field devices: Seamless copper tubing, Type K or L, ASTM B 88; with cast-bronze solder joint fittings, ANSI B1.18; or wrought-copper solder-joint fittings, ANSI B16.22; except brass compression-type fittings at connections to equipment. Solder shall be 95/5 tin antimony, or other suitable lead free composition solder.
 6. Branch Air Piping: Virgin polyethylene non-metallic tubing type FR, ASTM D 2737, and with flame-retardant harness for multiple tubing. Use compression or push-on brass fittings.
- C. Instrument Pipe and Tube
1. Hydronic and Instruments



- a. Connection To Main Piping: Provide ½ inch minimum size threadolet, ½" x 2 inch brass nipple, and ½" ball valve for connection to welded steel piping. Provide tee fitting for other types of piping.
 - b. Remote Instruments: Adapt from ball valve to specified tubing and extend to remote instruments. Provide a union or otherwise removable fitting at ball valve so that connection to main can be cleaned with straight rod. Where manifolds with test ports are not provided for instrument, provide tees with ¼" FPT branch with plug for use as test port. Adapt from tubing size to instrument connection.
 - c. Line Mounted Instruments: Extend rigid piping from ball valve to instrument. Do not use close or running thread nipples. Adapt from ball valve outlet to instrument connection size. Provide a plugged tee if pipe makes 90 degree bend at outlet of valve to allow cleaning of connection to main with straight rod without removing instrument.
 - d. Instrument Tubing: Seamless copper tubing, Type K or L, ASTM B 88; with cast-bronze solder joint fittings, ANSI B1.18; or wrought-copper solder-joint fittings, ANSI B16.22; or brass compression-type fittings. Solder shall be 95/5 tin antimony, or other suitable lead free composition solder. Tubing OD size shall be not less than the larger of ¼" or the instrument connection size.
 - e. Rigid Piping For Line Mounted Instruments: Schedule 40 threaded brass, with threaded brass fittings.
2. Low Pressure Air Instrument Sensing Lines
- a. Connections: Use suitable bulkhead type fitting and static sensing tip for static pressure connections. Adapt tubing to instrument connection.
 - b. Tubing: Virgin polyethylene non-metallic tubing type FR, ASTM D 2737, and with flame-retardant harness for multiple tubing. Use compression or push-on brass fittings.

NOTE TO SPECIFIER

Edit the following to suit the project. The USPS may elect to provide the communication of the Local Supervisory LAN as part of their existing IT network. In this case IT equipment design and equipment supply needs to be coordinated project IT designer and/or the USPS IT group. Confer with USPS

- D. Communication Wiring: All wiring shall be in accordance with National Electrical Codes and Division 16 of this specification.
 1. Contractor shall supply all communication wiring between Building Controllers, Routers, Gateways, AAC's, ASC's and local and remote peripherals (e.g., operator workstations, printers, and modems).
 2. Local Supervisory LAN: For any portions of this network required under this section of the specification, contractor shall use Fiber or Category 5e of standard TIA/EIA (100/1000BaseT). Network shall be run with no splices and separate from any wiring over thirty (30) volts.
 3. Primary and Secondary Controller LANs: Communication wiring shall be individually 100% shielded pairs per manufacturers recommendations for distances installed, with overall PVC cover, Class 2, plenum-rated run with no splices and separate from any wiring over thirty (30) volts. Shield shall be terminated and wiring shall be grounded as recommended by BC manufacturer.
- E. Signal Wiring: Contractor shall run all signal wiring in accordance with National Electric Codes and the Division 16 Specification.
 1. Signal wiring to all field devices, including, but not limited to, all sensors, transducers, transmitters, switches, etc. shall be twisted, 100% shielded pair, minimum 18-gauge wire, with PVC cover. Signal wiring shall be run with no splices and separate from any wiring above thirty (30) volts.
 2. Signal wiring shield shall be grounded at controller end only unless otherwise recommended by the controller manufacturer.
- F. Low Voltage Analog Output Wiring: Contractor shall run all low voltage control wiring in accordance with National Electric Codes and the Division 16 Specification.



1. Low voltage control wiring shall be minimum 16-gauge, twisted pair, 100% shielded, with PVC cover, Class 2 plenum-rated. Low voltage control wiring shall be run with no splices separate from any wiring above thirty (30) volts.
- G. Control Panels: Provide control panels with suitable brackets for wall mounting for each control system. Locate panel adjacent to systems served.
1. Fabricate panels of 16-gage furniture-grade steel, or 6063-T5 extruded aluminum alloy, totally enclosed on four sides, with hinged door and keyed lock, with manufacturer's standard shop-painted finish and color.
 2. Provide UL-listed cabinets for use with line voltage devices.
 3. Control panel shall be completely factory wired and piped, and all electrical connections made to a terminal strip. Control panel shall have standard manufacturer's color.
 4. All gauges and control components shall be identified by means of nameplates.
 5. All control tubing and wiring shall be run neatly and orderly in open slot wiring duct with cover.
 6. All control tube and wiring shall be labeled to match the control drawing submittals.
 7. Complete wiring and tubing termination drawings shall be mounted in or adjacent to panel.

2.2 CONTROL VALVES

NOTE TO SPECIFIER

Control valve sizing and selection is the initial responsibility of the AE and NOT left to the controls subcontractor. AE shall provide a valve schedule that lists the requirements of the valves for Cv, close off, temperature etc. This should be a result of analyzing the valves performance across the range of control.

- A. General: Provide factory fabricated control valves of type, body material and pressure class indicated. Where type or body material is not indicated, provide selection as determined by manufacturer for installation requirements and pressure class, based on maximum pressure and temperature in piping system. Provide valve size in accordance with scheduled or specified maximum pressure drop across control valve. Control valves shall be equipped with heavy-duty actuators, and with proper close-off rating for each individual application. Minimum close-off rating shall be as scheduled and adequate for each application, and shall generally be considered at dead head rating of the pump.
- B. Plug-Type Globe Pattern for Water Service:
1. Valve Sizing: Where not specifically indicated on the control drawings, modulating valves shall be sized for maximum full flow pressure drop between 50% and 100% of the branch circuit it is controlling unless scheduled otherwise. Two-position valves shall be same size as connecting piping.

NOTE TO SPECIFIER

Edit/Delete the following to suit the systems applicable.

2. Single Seated (Two-way) Valves: Valves shall have equal-percentage characteristic for typical heat exchanger service and linear characteristic for building loop connections to campus systems unless otherwise scheduled on the drawings. Valves shall have cage-type trim, providing seating and guiding surfaces for plug on 'top-and-bottom' guided plugs.
3. Double Seated (Three-way) Valves: Valves shall have linear characteristic. Valves shall be balanced-plug type, with cage-type trim providing seating and guiding surfaces on 'top-and-bottom' guided plugs.
4. Temperature Rating: 25°F minimum, 250°F maximum
5. Body: Bronze, screwed, 250 psi maximum working pressure for 1/2" to 2"; Cast Iron, flanged, 125 psi maximum working pressure for 2-1/2" and larger.
6. Valve Trim: Bronze; Stem: Polished stainless steel.
7. Packing: Spring Loaded Teflon or Synthetic Elastomer U-cups, self-adjusting.
8. Plug: Brass, bronze or stainless steel, Seat: Brass



9. Disc: Replaceable Composition or Stainless Steel Filled PTFE.
10. Ambient Operating Temperature Limits: -10 to 150°F (-12.2 to 66 °C)
11. Acceptable Manufacturers: Subject to compliance with the above requirements, approved manufacturers are as follows:
 - a. Johnson Controls
 - b. Invensys
 - c. Siemens
 - d. Warren
 - e. Delta
 - f. Belimo

C. Plug-Type Globe Pattern for Steam Service:

1. Valve Sizing: Where valve size is not specifically indicated on the drawings, size modulating valves for applications of 15 psig or less for 80% of inlet gage pressure unless scheduled otherwise. Modulating valves for applications of greater than 15 psig shall be sized for 42% of inlet absolute pressure unless scheduled otherwise. Two-position valves shall be same size as connecting piping.
2. Characteristics: Modified equal-percentage characteristics. Cage-type trim, providing seating and guiding surfaces for plug on "top and bottom" guided plugs.
 - a. Working Temperature: 250°F minimum for saturated steam applications of 15 psig or less; 366°F minimum for saturated steam applications of greater than 15 psig up to 150 psig.
3. Body: Bronze, screwed, 250 psig steam working pressure for 1/2" to 2"; Cast Iron, flanged, 100 psig steam working pressure for 2-1/2" and larger for applications of 50 psig or less.
4. Valve Trim, Plug, Seat and Stem: Polished stainless steel.
5. Packing: Spring Loaded Teflon.
6. Disc: Replaceable Composition or Stainless Steel Filled PTFE.
7. Acceptable Manufacturers: Subject to compliance with the above requirements, approved manufacturers are as follows:
 - a. Johnson Controls
 - b. Invensys
 - c. Siemens
 - d. Warren
 - e. Delta
 - f. Belimo

D. Butterfly Type:

1. Body: Extended neck epoxy coated cast or ductile iron with full lug pattern, ANSI Class 125 or 250 bolt pattern to match specified flanges.
2. Seat: EPDM, except in loop bypass applications where seat shall be metal to metal
3. Disc: Bronze or stainless steel, pinned or mechanically locked to shaft
4. Bearings: Bronze or stainless steel
5. Shaft: 416 stainless steel
6. Cold Service Pressure: 175 psi
7. Close Off: Bubble-tight shutoff to 150 psi
8. Operation: Valve and actuator operation shall be smooth both seating and unseating. Should more that 2 psi deadband be required to seat/unseat the valve, valve shall be replaced at no cost to the USPS.
9. Acceptable Manufacturers: Subject to compliance with requirements approved manufacturers are as follows:
 - a. Jamesbury WS815
 - b. Bray Series 31
 - c. Keystone AR2
 - d. Dezurik BGS

E. Ball Type



1. Body: Brass or bronze; one-, two-, or three-piece design; threaded ends.
 2. Seat: Reinforced Teflon
 3. Ball: Stainless steel.
 4. Port: Standard or 'V' style.
 5. Stem: Stainless steel, blow-out proof design, extended to match thickness of insulation.
 6. Cold Service Pressure: 600 psi WOG
 7. Steam working Pressure: 150 psi
 8. Acceptable Manufacturers: Subject to compliance with the above requirements, approved manufacturers are as follows:
 - a. Conbraco
 - b. Worcester
 - c. Nibco
 - d. Jamesbury
 - e. PBM
 - f. Delta
 - g. Belimo
- F. Segmented or Characterized Ball Type
1. Body: Carbon Steel (ASTM 216), one-piece design with wafer style ends.
 2. Seat: Reinforced Teflon (PTFE).
 3. Ball: Stainless steel ASTM A351
 4. Port: Segmented design with equal-percentage characteristic.
 5. Stem: Stainless steel.
 6. Cold Service Pressure: 200 psi WOG
 7. Cavitation Trim: Provide cavitation trim where indicated and/or required, designed to eliminate cavitation and noise while maintaining an equal percentage characteristic. Trim shall be a series of plates with orifices to break the pressure drop into multi-stages.
 8. Acceptable Manufacturers: Subject to compliance with requirements approved manufacturers are as follows:
 - a. Jamesbury R-Series
 - b. Fisher
 - c. Substitutions: As allowed in Division 1

2.3 CONTROL DAMPERS

- A. General: Provide factory fabricated automatic control dampers of sizes, velocity and pressure classes as required for smooth, stable, and controllable air flow. Provide parallel or opposed blade dampers as recommended by manufacturers sizing techniques. For dampers located near fan outlets, provide dampers rated for fan outlet velocity and close-off pressure, and recommended by damper manufacturer for fan discharge damper service. Control dampers used for smoke dampers shall comply with UL 555S. Control Dampers used for fire dampers shall comply with UL 555.
- B. For general isolation and modulating control service in rectangular ducts at velocities not greater than 1500 fpm (7.62 m/s), differential pressure not greater than 2.5" w.c. (622 Pa):
1. Performance: Test in accordance with AMCA 500.
 2. Frames: Galvanized steel, 16-gauge minimum thickness, welded or riveted with corner reinforcement.
 3. Blades: Stainless steel in lab exhausts and galvanized steel elsewhere, maximum blade size 8 inches (200 mm) wide by 48 inches (1219 mm) long, attached to minimum 1/2 inch (12.7 mm) shafts with set screws, 16 gauge minimum thickness.
 4. Blade Seals: Synthetic elastomer, mechanically attached, field replaceable.
 5. Jamb Seals: Stainless steel.
 6. Shaft Bearings: Oil impregnated sintered bronze, graphite impregnated nylon sleeve or other molded synthetic sleeve, with thrust washers at bearings.
 7. Linkage: Concealed in frame.
 8. Linkage Bearings: Oil impregnated sintered bronze or graphite impregnated nylon.



9. Leakage: Less than one percent based on approach velocity of 1500 ft./min. (7.62 m/s) and 1 inches wg. (249Pa).
 10. Maximum Pressure Differential: 2.5 inches wg. (622 Pa)
 11. Temperature Limits: -40 to 200 °F (-40 to 93 °C).
 12. Where opening size is larger than 48 inches (1219 mm) wide, or 72 inches (1829 mm) high, provide dampers in multiple sections, with intermediate frames and jackshafts appropriate for installation.
- C. For general isolation and modulating control service in rectangular ducts at velocities not greater than 4000 fpm (20.3 m/s), differential pressure not greater than 6" w.c. (1493 Pa):
1. Performance: Test in accordance with AMCA 500.
 2. Frames: Galvanized steel, 16-gauge minimum thickness, welded or riveted with corner reinforcement.
 3. Blades: extruded aluminum hollow airfoil shape, maximum blade size 8 inches (200 mm) wide by 48 inches (1219 mm) long, attached to minimum 1/2 inch (12.7 mm) shafts, 14 gauge minimum extrusion thickness.
 4. Blade Seals: Synthetic elastomeric, mechanically attached, field replaceable.
 5. Jamb Seals: Stainless steel.
 6. Shaft Bearings: Oil impregnated sintered bronze sleeve, graphite impregnated nylon sleeve, molded synthetic sleeve, or stainless steel sleeve, with thrust washers at bearings.
 7. Linkage: Concealed in frame.
 8. Linkage Bearings: Oil impregnated sintered bronze or graphite impregnated nylon.
 9. Leakage: Less than 0.1 percent based on approach velocity of 4000 ft./min. (20.3 m/s) and 1 inches wg. (249Pa).
 10. Maximum Pressure Differential: 6 inches wg. (622 Pa)
 11. Temperature Limits: -40 to 200 °F (-40 to 93 °C).
 12. Where opening size is larger than 48 inches (1219 mm) wide, or 72 inches (1829 mm) high, provide dampers in multiple sections, with appropriately intermediate frames, and jackshafts.
- D. For general isolation and modulating control service in rectangular ducts at velocities not greater than 4000 fpm, differential pressure not greater than 12" w.c.:
1. Performance: Test in accordance with AMCA 500.
 2. Frames: Galvanized steel, 12-gauge minimum thickness, welded or riveted with corner reinforcement.
 3. Blades: Extruded aluminum hollow airfoil shape, maximum blade size 8 inches (200 mm) wide by 48 inches (1219 mm) long, attached to minimum 3/4 inch (19 mm) shafts with set screws
 4. Shaft Bearings: Oil impregnated sintered bronze or stainless steel, pressed into frame, with thrust washers at bearings.
 5. Linkage: 10-gauge minimum thickness galvanized steel clevis type crank arms, 3/16" x3/4" (4.76 mm x 19 mm) minimum thickness tie rods.
 6. Linkage Bearings: Oil impregnated sintered bronze or graphite impregnated nylon.
 7. Leakage: Less than 0.2 percent based on approach velocity of 4000 ft./min. (20.3 m/s) and 1 inches wg. (249Pa) differential pressure.
 8. Maximum Pressure Differential: 12 inches wg. (2984 Pa)
 9. Temperature Limits: -40 to 300 °F (-40 to 149 °C).
 10. Where opening size is larger than 48 inches (1219 mm) wide, or 72 inches (1829 mm) high, provide dampers in multiple sections, with appropriately intermediate frames, and jackshafts.
- E. For general isolation and modulating control service in round ducts up to 40 inches in size at velocities not greater than 2500 fpm (12.7 m/s), differential pressure not greater than 4" w.c. (994 Pa):
1. Performance: Test in accordance with AMCA 500.
 2. Frames: rolled 12 gauge steel strip for sizes 6 inch and smaller, rolled 14 gauge steel channel for larger sizes, galvanized or aluminum finish.
 3. Blades: Steel construction, 12 gauge minimum thickness for dampers less than 18 inches (457 mm) in size, 10 gauge minimum thickness for larger dampers.



4. Blade Seals: Full circumference neoprene.
 5. Shaft: ½ inch (12.7 mm) diameter zinc or cadmium plated steel.
 6. Shaft Bearings: Oil impregnated sintered bronze or stainless steel, pressed into frame, with thrust washers at bearings.
 7. Leakage: Less than 0.2 percent based on approach velocity of 4000 ft./min. (20.3 m/s) and 1 inches wg. (249Pa) differential pressure.
 8. Maximum Pressure Differential: 4 inches wg. (994 Pa)
 9. Temperature Limits: -40 to 300 °F (-40 to 149 °C).
- F. For general isolation and modulating control service in round ducts up to 60 inches in size at velocities not greater than 4000 fpm (20.3 m/s), differential pressure not greater than 6" w.c. (1492 Pa):
1. Performance: Test in accordance with AMCA 500.
 2. Frames: rolled 10-gauge steel channel for sizes 48 inch and smaller, rolled 3/16 inch (4.76 mm) thick steel channel for larger sizes, galvanized or aluminum finish.
 3. Blades: Steel construction, 10-gauge minimum thickness for dampers not greater than 48 inches in size, ¼ inch (6.35 mm) minimum thickness for larger dampers.
 4. Blade stops: ½ inch x ¼ inch (12.7 mm x 6.35 mm) full circumference steel bar.
 5. Blade Seals: Full circumference neoprene.
 6. Shaft: zinc or cadmium plated steel, angle reinforcing as necessary.
 7. Shaft Bearings: Oil impregnated sintered bronze or stainless steel, pressed into frame, with thrust washers at bearings.
 8. Leakage: Less than 0.4 percent based on approach velocity of 4000 ft./min. (20.3 m/s) and 1 inches wg. (249Pa) differential pressure.
 9. Maximum Pressure Differential: 6 inches wg. (1492 Pa)
 10. Temperature Limits: -40 to 250 °F (-40 to 121 °C).

2.4 ACTUATORS

- A. General: Size actuators and linkages to operate their appropriate dampers or valves with sufficient reserve torque or force to provide smooth modulating action or 2-position action as specified. Select spring-return actuators with manual override to provide positive shut-off of devices as they are applied.
- B. Damper Actuators
1. Ambient Operating Temperature Limits: -10 to 150°F (-12.2 to 66 °C)
 2. Two Position Electric Actuators: Line voltage with spring return

NOTE TO SPECIFIER

Control drawings should clearly show where pneumatic Positive Positioners are required. Edit to suit project specifics

3. Pneumatic Actuators: Provide heavy-duty actuators with stroke indication and spring return. When so indicated and where more than 2 actuators are to be operated in sequence to each other, provide position feedback positive positioners with adjustable start point and operating range. Positive Positioners shall be provided on all modulating pneumatic valves larger than 1" and as shown on drawings.
4. Electronic Actuators: Provide actuators with spring return for two-position (24v), 0-5 Vdc, 0-10 Vdc, 2-10Vdc, 4-20 mA, or PWM input (subject to restrictions) as required. Actuators shall travel full stroke in less than 90 seconds. Actuators shall be designed for a minimum of 60,000 full cycles at full torque and be UL 873 listed. Provide stroke indicator. Actuators shall have positive positioning circuit. Where two actuators are required in parallel or in sequence provide an auxiliary actuator driver. Actuators shall have current limiting motor protection. Actuators shall have manual override where indicated. Modulating actuators for valves shall have minimum rangeability of 40 to 1.
 - a. Close-Off Pressure: Provide the minimum torque required, and spring return for fail positioning (unless otherwise specifically indicated) sized for required close-off pressure.



Required close-off pressure for two-way water valve applications shall be the shutoff head of associated pump. Required close-off rating of steam valve applications shall be design inlet steam pressure plus 50 percent for low pressure steam, and 10 percent for high pressure steam. Required close-off rating of air damper applications shall be shutoff pressure of associated fan, plus 10 percent.

- b. Acceptable Manufacturers: Subject to compliance with requirements approved manufacturers are as follows:
 - i. Belimo
 - ii. Johnson Controls
 - iii. Delta
 - iv. Invensys

C. Quarter-Turn Actuators (for ball and butterfly valves):

1. Electric

- a. Motor: Suitable for 120 or 240 Volt single-phase power supply. Insulation shall be NEMA Class F or better. Motor shall be rated for 100 percent duty cycle. Motors shall have inherent overload protection.
- b. Gear Train: Motor output shall be directed to a self locking gear drive mechanism. Gears shall be rated for torque input exceeding motor locked rotor torque.
- c. Wiring: Power and control wiring shall be wired to a terminal strip in the actuator enclosure
- d. Failsafe Positioning: Actuators shall be spring return type for failsafe positioning.
- e. Enclosure: Actuator enclosure shall be NEMA-4 rated, and shall have a minimum of two threaded conduit entries. Provide an enclosure heater for actuators located outside of buildings.
- f. Limit Switches: Travel limit switches shall be UL and CSA approved. Switches shall limit actuator in both open and closed positions.
- g. Mechanical Travel Stops: The actuator shall include mechanical travel stops of stainless steel construction to limit actuator to specific degrees of rotation.
- h. Manual Override: Actuators shall have manual actuator override to allow operation of the valve when power is off. For valves 4 inches and smaller the override may be a removable wrench or lever or geared handwheel type. For larger valves, the override shall be a fixed geared handwheel type. An automatic power cut-off switch shall be provided to disconnect power from the motor when the handwheel is engaged for manual operation.
- i. Valve Position Indicator: A valve position indicator with arrow and open and closed position marks shall be provided to indicate valve position.
- j. Torque Limit Switches: Provide torque limit switches to interrupt motor power when torque limit is exceeded in either direction of rotation.
- k. Position Controller: For valves used for modulating control, provide an electronic positioner capable of accepting 4-20 mA, 0-10 Vdc, 2-10 Vdc, and 135 Ohm potentiometer.
- l. Ambient Conditions: Actuator shall be designed for operation from -140 to 150 °F ambient temperatures with 0 to 100 percent relative humidity.

2. Pneumatic Single- and Double-Acting Cylinder Type:

- a. Air Cylinder: Shall consist of steel or aluminum cylinder, dual pistons, double rack and pinion gearing mechanism. Housing shall be protected both internally and externally with corrosion resistant coating. Actuator shall be equipped with piston guide rods or similar mechanism so that seals are not loaded as linear bearings. Single acting units shall have multiple symmetrically arranged springs to apply equal force to piston. Cylinder shall be configurable for direction of fail-safe mode in the field. Actuators shall be spring return type for failsafe positioning.
- b. Position Indication: Provide extended shaft position indicator that is removable for manual override of valve.
- c. Two-Position Actuators: Provide appropriate three-way or four-way solenoid valve mounted on the actuator. Solenoid valve electrical enclosure shall meet NEMA-4 requirements. Provide actuator with position switches where required.



- d. **Modulating Actuators:** Provide a rotary electronic positioner designed to accept 4-20 mA, 0-10 Vdc, 2-10 Vdc, or 135 Ohm potentiometer and operate integral 3-way or 4-way solenoid valve to position valve rotation angle as sensed by integral position feedback device to match signal input. Enclosure shall meet NEMA-4 requirements. Actuator linearity and resolution shall be 0.5% of span. Hysteresis and deadband shall be adjustable. Provide accessory mechanical or proximity type position switches and position transmitters where required. Actuators shall be spring return type for failsafe positioning. Provide an enclosure heater for positioners located outside of buildings.

2.5 GENERAL FIELD DEVICES

- A. Provide field devices for input and output of digital (binary) and analog signals into controllers (BCs, AACs, ASCs). Provide signal conditioning for all field devices as recommended by field device manufacturers, and as required for proper operation in the system.
- B. It shall be the Contractor's responsibility to assure that all field devices are compatible with controller hardware and software.
- C. Field devices specified herein are generally 'two-wire' type transmitters, with power for the device to be supplied from the respective controller. If the controller provided is not equipped to provide this power, or is not designed to work with 'two-wire' type transmitters, or if field device is to serve as input to more than one controller, or where the length of wire to the controller will unacceptably affect the accuracy, the Contractor shall provide 'four-wire' type equal transmitter and necessary regulated DC power supply or 120 VAC power supply, as required.
- D. For field devices specified hereinafter that require signal conditioners, signal boosters, signal repeaters, or other devices for proper interface to controllers, Contractor shall furnish and install proper device, including 120V power as required. Such devices shall have accuracy equal to, or better than, the accuracy listed for respective field devices.
- E. Accuracy: As stated in this Section, accuracy shall include combined effects of nonlinearity, nonrepeatability and hysteresis.

2.6 TEMPERATURE SENSORS (TS)

- A. Sensor range: When matched with A/D converter of BC, AAC/ASC, or SD, sensor range shall provide a resolution of no worse than 0.3°F (0.16 °C) (unless noted otherwise). Where thermistors are used, the stability shall be better than 0.25°F over 5 years.

NOTE TO SPECIFIER

AE shall carefully specify other applications where matched sensors are required for the specific project.

- B. **Matched Sensors:** The following applications shall require matched sensors. Refer to Section 251104:
1. **Building Loop Connections:** Provide matched loop and building supply sensors where control sequence requires controlling to a temperature rise (differential).
 2. **Hydronic Temperature Difference Calculations:** Provide matched supply and return temperature sensors where the pair is used for calculating temperature difference for use in load calculations or sequencing such as across chillers and plants.
 3. **Air Handling Unit Sequencing:** Provide matched pair for the cooling and heating coil leaving sensors where the sequence includes calculating an offset from the supply air setpoint to maintain a leaving heating coil temperature.

NOTE TO SPECIFIER



AE must designate where various amenities to room sensors are required. The following assumes that this will be indicated on the control design drawings. Otherwise AE must add the clarification below.

- C. Room Temperature Sensor: Shall be an element contained within a ventilated cover, suitable for wall mounting. Provide insulated base. Following sensing elements are acceptable:
 - 1. Sensing element shall be platinum RTD, thermistor, or integrated circuit, +/- 0.5°F accuracy at calibration point.
 - 2. Provide setpoint adjustment. The setpoint adjustment shall be a warmer/cooler indication that shall be scalable via the BAS.
 - 3. Provide an occupancy override button on the room sensor enclosure. This shall be a momentary contact closure
 - 4. Provide current temperature indication via an LCD or LED readout where indicated.
- D. Single-Point Duct Temperature Sensor: Shall consist of sensing element, junction box for wiring connections and gasket to prevent air leakage or vibration noise. Temperature range as required for resolution indicated in paragraph A. Sensor probe shall be 316 stainless steel.
 - 1. Sensing element shall be platinum RTD, thermistor, or integrated circuit, +/- 0.2°F accuracy at calibration point

NOTE TO SPECIFIER

Edit the following averaging length per square foot based on how homogeneous the air temperature will be at the installed location. For instance, a preheat sensor of a mixed air plenum will require more length than the discharge off a preheat coil in a 100% OA unit.

- E. Averaging Duct Temperature Sensor: Shall consist of an averaging element, junction box for wiring connections and gasket to prevent air leakage. Provide sensor lengths and quantities to result in one lineal foot of sensing element for each three square feet of cooling coil/duct face area. An averaging duct temperature sensor shall be used in ducts where stratification of the airstream may occur. i.e. mixed air temperatures, coil discharge temperatures, etc. Temperature range shall be as required for resolution indicated in paragraph A.
 - 1. Sensing element shall be platinum RTD, or thermistor, +/- 0.2°F accuracy at calibration point.
- F. Liquid immersion temperature sensor shall include brass thermowell, sensor and connection head for wiring connections. Temperature range shall be as required for resolution of 0.15°F.
 - 1. Sensing element (chilled water/glycol systems) shall be platinum RTD +/- 0.2°F accuracy at calibration point. Temperature range shall be as required for resolution of 0.15°F.
 - 2. Sensing element (other systems) shall be platinum RTD, thermistor, or integrated circuit, +/- 0.4°F accuracy at calibration point. Temperature range shall be as required for resolution of 0.3°F.
- G. Pipe Surface-Mount Temperature Sensor: Shall include metal junction box and clamps and shall be suitable for sensing pipe surface temperature and installation under insulation. Provide thermally conductive paste at pipe contact point. Temperature range shall be as require for resolution indicated in paragraph A. Surface-Mount temperature sensors shall only be used where specifically indicated on the drawings or specifications.
 - 1. Sensing element shall be platinum RTD, thermistor, or integrated circuit, +/- 0.4°F accuracy at calibration point.
- H. Outside air sensors shall consist of a sensor, sun shield, utility box, and watertight gasket to prevent water seepage. Temperature range shall be as require for resolution indicated in Paragraph A
 - 1. Sensing element shall be platinum RTD, thermistor, or integrated circuit, +/- 0.4°F accuracy at calibration point.



2.7 TEMPERATURE TRANSMITTERS

- A. Where required by Controller, or where wiring runs are over 50 feet, sensors as specified above may be matched with transmitters outputting 4-20 mA linearly across the specified temperature range. Transmitters shall have zero and span adjustments, an accuracy of 0.1°F when applied to the sensor range.

2.8 HUMIDITY TRANSMITTERS

- A. Units shall be suitable for duct, wall (room) or outdoor mounting. Unit shall be two-wire transmitter utilizing bulk polymer resistance change or thin film capacitance change humidity sensor. Unit shall produce linear continuous output of 4-20 mA for percent relative humidity (% RH). A combination temperature and humidity sensor may be used for zone level monitoring. Sensors shall have the following minimum performance and application criteria:
 - 1. Input Range: 0 to 100% RH.
 - 2. Accuracy(% RH): +/- 2% (when used for enthalpy calculation, dewpoint calculation or humidity control) or +/- 3% (monitoring only) between 20-90% RH at 77°F, including hysteresis, linearity, and repeatability.
 - 3. Sensor Operating Range: As required by application
 - 4. Long Term Stability: Less than 1% drift per year.
- B. Acceptable Manufacturers: Units shall be Vaisala HM Series, General Eastern, Microline, or Hy-Cal HT Series. Substitutions shall be allowed per Division 1.
- C. General Purpose Low Pressure Air: Generally for use in static measurement of duct pressure or constant volume air velocity pressure measurement where the range is applicable.
 - 1. General: Loop powered two-wire differential capacitance cell-type transmitter.
 - 2. Output: two wire 4-20 mA output with zero adjustment.
 - 3. Overall Accuracy: Plus or minus 1%.
 - 4. Minimum Range: 0.1 in. w.c.
 - 5. Maximum Range: 10 inches w.c.
 - 6. Housing: Polymer housing suitable for surface mounting.
 - 7. Acceptable Manufacturers: Modus T30. Substitutions shall be allowed per Division 1.
 - 8. Static Sensing Element: Provide pitot-type static pressure sensing tips similar to Dwyer model A-301 and connecting tubing.
 - 9. Range: Select for specified setpoint to be between 25% and 75% full-scale.
- D. General Purpose Low Pressure/Low Differential Air: Generally for use in static measurement of space pressure or constant volume air velocity pressure measurement where the range is applicable.
 - 1. General: Loop powered, two-wire differential capacitance cell type transmitter.
 - 2. Output: Two-wire 4-20 mA output with zero adjustment.
 - 3. Overall Accuracy: Plus or minus 1%.
 - 4. Minimum Range: 0 in. w.c.
 - 5. Maximum Range: 0.1, 0.25, or 0.5 inches w.c.
 - 6. Housing: Polymer housing suitable for surface mounting.
 - 7. Acceptable Manufacturers: Modus T30. Substitutions shall be allowed per Division 1.
 - 8. Static Sensing Element: Provide pitot-type static pressure sensing tips similar to Dwyer model A-301 and connecting tubing, where applicable.
 - 9. Range: Select for specified setpoint to be between 25% and 75% full-scale.
- E. VAV Velocity Pressure: Generally for use in variable volume air velocity pressure measurement where the range is applicable.
 - 1. General: Loop powered two-wire differential capacitance cell type transmitter.
 - 2. Output: Two-wire, 4-20 mA output with zero adjustment.
 - 3. Overall Accuracy: Plus or minus 0.25%
 - 4. Minimum Range: 0 in. w.c.



5. Maximum Range: 1 inch w.c.
6. Housing: Polymer housing suitable for surface mounting.
7. Acceptable Manufacturers: Setra. Substitutions shall be allowed per Division 1.
8. Range: Select for minimum range that will accept the maximum velocity pressure expected.

2.9 DIFFERENTIAL PRESSURE SWITCHES (DPS)

- A. General Service - Air: Diaphragm with adjustable setpoint and differential and snap acting form C contacts rated for the application. Provide manufacturer's recommended static pressure sensing tips and connecting tubing
- B. General Service - Water: Diaphragm with adjustable setpoint, 2 psig or adjustable differential, and snap-acting Form C contacts rated for the application. 60 psid minimum pressure differential range. 0°F to 160°F operating temperature range.

2.10 PRESSURE SWITCHES (PS)

- A. Diaphragm or bourdon tube with adjustable setpoint and differential and snap-acting Form C contacts rated for the application. Pressure switches shall be capable of withstanding 150% of rated pressure.
- B. Acceptable Manufacturers: Square D, ITT Neo-Dyn, ASCO, Penn, Honeywell, and Johnson Controls.

2.11 TRANSDUCERS

NOTE TO SPECIFIER

Note that PWM transducer applications must be approved by the USPS. Generally these will not be allowed on loops with a short time constant such as discharge temperature loops, economizer loops, pressure control loops and the like. They are generally acceptable for slower, standard room temperature control loops. If not to be allowed, carefully delete PWM-related language from this entire paragraph accordingly.

Edit below specifications to match project specifics. Delete reference to pneumatic control components if not applicable.

- A. Standard Capacity Electronic-to-Pneumatic (E-P) Transducers: E-P transducers shall be Voltage-to-Pneumatic (V-P) type, Current-to-Pneumatic (I-P) type[, and Pulse Width Modulated-to-Pneumatic (PWM-P) type]:
 1. Electrical Power Supply: 24 Vac or 24 Vdc.
 2. Pneumatic Air Supply: 30 psig (2.07 bar) maximum.
 3. Air Capacity: 1100 scim @ 20 psig (300 cm³/sec @ 1.4 bar).
 4. Air Consumption: Zero at steady state.
 5. Output Span: 0-20 psig (0-1.4 bar).
 6. Input: 4-20 mA, 0-5 Vdc, 1-5 Vdc, 0-10 Vdc, 2-10 Vdc, 0-15 Vdc, or 3-15 Vdc input. [Pulse width modulated or tri-state input shall be allowed].
 7. [Pulse Width Modulated and Tri-state Input Time Base: Dip switch selectable]
 8. Enclosure: Polymer designed for surface or panel mount.
 9. Air Connections: ¼" (6.35 mm) barbed.
 10. Failure Mode on Power Loss: Non-failsafe transducers shall have no output air loss. Failsafe transducers shall exhaust output upon power loss.
 11. Acceptable Manufacturers: RE Technologies Model UCP-522. Substitutions shall be allowed per Division 1.
- B. Binary to Analog Transducers ([Pulse Width Modulating or] Tri-State-to-Voltage or -Current):



1. Adjustable zero and span.
 2. Failure Mode on Power Loss: Shall be provided with memory feature to allow the transducer to return to last value on power failure.
 3. Accuracy: $\pm 1\%$ of span
 4. Output Span: 4-20 mA, 0-5 Vdc, 1-5 Vdc, 0-10Vdc, 2-10Vdc, 0-15Vdc, 3-15Vdc
 5. Input: 4-20 mA, pulse width modulated or tri-state input.
 6. [Pulse Width Modulated] and Tri-state Input Time Base: Dip switch selectable.
 7. Enclosure: Polymer designed for surface or panel mount.
 8. Failure Mode on Power Loss: Non-failsafe transducers shall have no output air loss. Failsafe transducers shall exhaust output upon power loss.
 9. Acceptable Manufacturers: RE Technologies Model PWA Series. Substitutions shall be allowed per Division 1..
- C. Electronic-to Electronic (Voltage or Current to Current or Voltage):
1. Adjustable zero and span.
 2. Failure Mode on Power Loss: Memory feature to allow the transducer to return to last value on power failure.
 3. Accuracy: $\pm 1\%$ of span.
 4. Output Span: 4-20 mA, 0-5 Vdc, 1-5 Vdc, 0-10 Vdc, 2-10 Vdc, 0-15 Vdc, 3-15 Vdc.
 5. Input: 0-20 Vdc, 0-20 ma, 0-10 kOhm.
 6. [Pulse Width Modulated and]Tri-state Input Time Base: Dip switch selectable
 7. Enclosure: Polymer enclosure designed for surface or panel mount.
 8. Acceptable Manufacturers: RE Technologies Model PWA Series. Substitutions shall be allowed per Division 1.

2.12 CURRENT SWITCHES (CS)

- A. Clamp-On or Solid-Core Design Current Operated Switch (for Constant Speed Motor Status Indication)
1. Range: 1.5 to 150 amps.
 2. Trip Point: Adjustable.
 3. Switch: Solid state, normally open, 1 to 135 Vac or Vdc, 0.3 Amps. Zero off state leakage.
 4. Lower Frequency Limit: 6 Hz.
 5. Trip Indication: LED
 6. Approvals: UL, CSA
 7. Max. Cable Size: 350 MCM
 8. Acceptable Manufacturers: Veris Industries H-708/908; Inc., RE Technologies SCS1150A-LED. Substitutions shall be allowed per Division 1.
- B. Clamp-on or Solid-Core Wire Through Current Switch (CS/CR) (for Constant Speed Motors): Same as CS with 24v command relay rated at 5A @ 240 Vac resistive, 3A @ 240 Vac inductive, load control contact power shall be induced from monitored conductor (minimum conductor current required to energize relay 5A, max. rating of 135A). Acceptable Manufacturers shall be Veris Industries, Inc., Model # H938/735; or RE Technologies RCS 1150. Substitutions shall be allowed per Division 1.
1. Where used for single-phase devices, provide the CS/CR in a self-contained unit in a housing similar with override switch to Kele RIBX. Substitutions shall be allowed per Division 1.
- C. Clamp-On Design Current Operated Switch for Variable Speed Motor Status Indication
1. Range: 1.5 to 135 Amps.
 2. Trip Point: Self-calibrating based on VA memory associated with frequency to detect loss of belt with subsequent increase of control output to 60 Hz.
 3. Switch: Solid state, normally open, 1 to 135 Vac or Vdc, 0.3 Amps. Zero off state leakage.
 4. Frequency Range: 5-75 Hz
 5. Trip Indication: LED
 6. Approvals: UL, CSA
 7. Max. Cable Size: 350 MCM



8. Acceptable Manufacturers: Veris Industries, Inc. H-904. Substitutions shall be allowed per Division 1.

D. Clamp-On Wire Through Current Switch (CS/CR) (for Variable Speed Motors): Same as CS with 24v command relay rated at 5A @ 240 Vac resistive, 3A @ 240 Vac inductive, load control contact power shall be induced from monitored conductor (minimum conductor current required to energize relay 5A, max. rating of 135A). Acceptable manufacturer shall be Veris Industries, Inc., Model # H934. Substitutions shall be allowed per Division 1.

E. Variable Speed Status: Where current switches are used to sense the status for variable speed devices, the CT shall include on-board VA/Hz memory to allow distinction between a belt break and subsequent ramp up to 60 Hz, versus operation at low speed. The belt break scenario shall be indicated as a loss of status and the operation at low speed shall indicate normal status.

2.13 OUTDOOR AIR STATIC PRESSURE SENSING TIP

A. Pressure sensor: Pressure sensing tip shall be designed to minimize the effects of wind and resulting velocity pressure up to 80 mph. Acceptable manufacturers shall be Dwyer A-306. Substitutions shall be allowed per Division 1.

B. Low Air Pressure Surge Dampener: 30-second time constant. Acceptable manufacturer shall be Modus SD030. Substitutions shall be allowed per Division 1.

2.14 AIRFLOW MEASURING STATIONS (AFMS)

A. Pitot Tube Grids: Provide an array of velocity pressure sensing elements with averaging manifolds and air straightening vanes packaged in a sheet metal casing. Distribute sensing elements in accordance with ASHRAE for traversing ducts. Provide taps to connect tubing from instrumentation. Label AFM with drawing number designation, design flow, velocity pressure, and pressure drop. Application of pitot grids shall be allowed only where minimum expected flow is greater than 30% or maximum flow

B. Hot Wire Grid: Provide an array of hot wire anemometer with air straightening package in a sheet metal casing. Provide averaging circuitry and transmitter to transmit a linear signal proportional to airflow.

C. Vortex Shedding Grid: Provide an array of vortex shedding elements designed to produce stable 'Karmen Vortices' that are linear with air velocity. Provide the electronics to totalize the pulses and output average velocity proportional to an output signal of 4-20ma.

1. Sensor Accuracy: $\pm 1.5\%$

2. Electronics Accuracy: $\pm 0.5\%$

3. Range: Select minimum range to accommodate the expected flow range of the project

4. Temperature Limits: 20-140°F

5. Acceptable Manufacturer: Tek-Air Systems Inc. 'Vortek' Model. Substitutions shall be allowed per Division 1.

2.15 AIR VELOCITY PRESSURE SENSORS (INSERTION TYPE)

A. Single or Multi-Point Averaging (as indicated): Sensing tip shall be for insertion into duct with mounting flange and push on tube connections. Material shall be suitable to the application.

NOTE TO SPECIFIER

Delete reference to CO₂ sensors if Demand Control Ventilation is not included in project specifics.



2.16 CO₂ SENSORS/TRANSMITTERS (CO₂)

- A. CO₂ sensors shall use silicon based, diffusion aspirated, infrared single beam, dual-wavelength sensor.
- B. Accuracy: ± 36 ppm at 800 ppm and 68°F.
- C. Stability: 5% over 5 years.
- D. Output: 4-20 mA, 0-10 Vdc or relay.
- E. Mounting: Duct or Wall as indicated.
- F. Acceptable Manufacturer: Vaisala, Inc. GMD20 (duct) or GMW20 (wall). Substitutions shall be allowed per Division 1.

NOTE TO SPECIFIER

Delete reference to pneumatic control components if not applicable. Typically, new installations will use electric control components. Pneumatics are typically used only in existing buildings where existing pneumatic control components are going to be reused.

2.17 PNEUMATIC CONTROL COMPONENTS

- A. Analog Pressure Gauges: Gauges shall be pneumatic type, minimum 1-1/2" in (38 mm) diameter, with white face and black numerals. Surface-mounted gauges shall have chrome plated trim and be a minimum of 2-1/2" in (64 mm) diameter.
- B. Pneumatic Actuated Pressure Switches (PE) (for 30 psig max pressure control systems): Pressure ranges and sensitivity of PEs shall match control system sequence of operation. Switch operation shall be externally adjustable over the operating pressure range (nominal 0-20 psig, 0 to 138 KPa). PE switches shall be SPDT type, rated for the particular application, and shall be UL listed. PE shall be as manufactured by Penn. Substitutions shall be allowed per Division 1.
- C. Pilot Positioners: Operating span adjustment range is from 3 to 13 psi (21 to 91 kPa). Positioner shall be furnished with a mounting bracket for attachment directly to the actuator.

2.18 ELECTRIC CONTROL COMPONENTS

- A. Limit Switches (LS): Limit switches shall be UL listed, SPDT or DPDT type, with adjustable trim arm. Limit switches shall be as manufactured by Square D, Allen Bradley. Substitutions shall be allowed per Division 1.
- B. Electric Solenoid-Operated Pneumatic Valves (EP): EP valves shall be rated for a minimum of 1.5 times their maximum operating static and differential pressure.. Valves shall be ported 2-way, 3-way, or 4-way and shall be normally closed or open as required by the application. EPs shall be sized for minimum pressure drop, and shall be UL and CSA listed. Furnish and install gauges on all inputs of EPs. Furnish an adjustable air pressure regulator on input side of solenoid valves serving actuators operating at greater than 30 psig.
 - 1. Coil Enclosure: Indoors shall be NEMA-1, Outdoors and NEMA-3, 4, 7, 9.
 - 2. Fluid Temperature Rating: Valves for compressed air and cold water service shall have 150 °F (66 °C) minimum rating. Valves for hot water or steam service shall have fluid temperature rating higher than the maximum expected fluid temperature.
 - 3. Acceptable Manufacturers: EP valves shall be as manufactured by ASCO or Parker. Substitutions shall be allowed per Division 1.



4. Coil Rating: EP valves shall have appropriate voltage coil rated for the application (i.e., 24 VAC, 120 VAC, 24 VDC, etc.).
- C. Low Temperature Detector ('Freezestat') (FZ): Low temperature detector shall consist of a 'cold spot' element which responds only to the lowest temperature along any one foot of entire element, minimum bulb size of 1/8" x 20' (3.2mm x 6.1m), junction box for wiring connections and gasket to prevent air leakage or vibration noise, DPST (4 wire, 2 circuit) with manual reset. Temperature range 15 to 55°F (-9.4 to 12.8°C), factory set at 38°F.
- D. High Temperature Detectors ('Firestat') (FS): High temperature detector shall consist of 3-pole contacts, a single point sensor, junction box for wiring connections and gasket to prevent air leakage of vibration noise, triple-pole, with manual reset. Temperature range 25 to 215°F (-4 to 102°C).
- E. Surface-Mounted Thermostat: Surface-mounted thermostat shall consist of SPDT contacts, operating temperature range of 50 to 150° F (10 to 65°C) , and a minimum 10°F fixed setpoint differential.
- F. Low Voltage Wall Thermostat: Wall-mounted thermostat shall consist of SPDT sealed mercury contacts, operating temperature range of 50 to 90°F (10 to 32°C), switch rating of 24 Vac (30 Vac max.), and both manual and automatic fan operation in both the heat and cool modes.
- G. Control Relays: All control relays shall be UL listed, with contacts rated for the application, and mounted in minimum NEMA-1 enclosure for indoor locations, NEMA-4 for outdoor locations.
 1. Control relays for use on electrical systems of 120 volts or less shall have, as a minimum, the following:
 - a. AC coil pull-in voltage range of +10%, -15% or nominal voltage.
 - b. Coil sealed volt-amperes (VA) not greater than four (4) VA.
 - c. Silver cadmium Form C (SPDT) contacts in a dustproof enclosure, with 8 or 11 pin type plug.
 - d. Pilot light indication of power-to-coil and coil retainer clips.
 - e. Coil rated for 50 and 60 Hz service.
 - f. Acceptable Manufacturers: Relays shall be Potter Brumfield, Model KRPA. Substitutions shall be allowed per Division 1.
 2. Relays used for across-the-line control (start/stop) of 120V motors, 1/4 HP, and 1/3 HP, shall be rated to break minimum 10 Amps inductive load. Relays shall be IDEC. Substitutions shall be allowed per Division 1.
 3. Relays used for stop/start control shall have low voltage coils (30 VAC or less), and shall be provided with transient and surge suppression devices at the controller interface.
- H. General Purpose Power Contactors: NEMA ICS 2, AC general-purpose magnetic contactor. ANSI/NEMA ICS 6, NEMA type 1 enclosure. Manufacturer shall be Square 'D', Cutler-Hammer or Westinghouse. Substitutions shall be allowed per Division 1.
- I. Control Transformers: Furnish and install control transformers as required. Control transformers shall be machine tool type, and shall be US and CSA listed. Primary and secondary sides shall be fused in accordance with the NEC. Transformer shall be proper size for application, and mounted in minimum NEMA-1 enclosure.
 1. Transformers shall be manufactured by Westinghouse, Square 'D', or Jefferson. Substitutions shall be allowed per Division 1.
- J. Time Delay Relays (TDR): TDRs shall be capable of on or off delayed functions, with adjustable timing periods, and cycle timing light. Contacts shall be rated for the application with a minimum of two (2) sets of Form C contacts, enclosed in a dustproof enclosure.
 1. TDRs shall have silver cadmium contacts with a minimum life span rating of one million operations. TDRs shall have solid state, plug-in type coils with transient suppression devices.
 2. TDRs shall be UL and CSA listed, Crouzet type.



- K. Electric Push Button Switch: Switch shall be momentary contact, oil tight, push button, with number of N.O. and/or N.C. contacts as required. Contacts shall be snap-action type, and rated for minimum 120 Vac operation. Switch shall be 800T type, as manufactured by Allen Bradley. Substitutions shall be allowed per Division 1.
- L. Pilot Light: Panel-mounted pilot light shall be NEMA ICS 2 oil tight, transformer type, with screw terminals, push-to-test unit, LED type, rated for 120 VAC. Unit shall be 800T type, as manufactured by Allen-Bradley. Substitutions shall be allowed per Division 1.
- M. Alarm Horn: Panel-mounted audible alarm horn shall be continuous tone, 120 Vac Sonalert solid-state electronic signal, as manufactured by Mallory. Substitutions shall be allowed per Division 1.
- N. Electric Selector Switch (SS): Switch shall be maintained contact, NEMA ICS 2, oil-tight selector switch with contact arrangement, as required. Contacts shall be rated for minimum 120 Vac operation. Switch shall be 800T type, as manufactured by Allen-Bradley. Substitutions shall be allowed per Division 1.

NOTE TO SPECIFIER

Delete reference to Refrigerant Monitor for all but chilled water R&A projects or where the volume of refrigerant contained within internal components exceeds the requirements of the applicable edition of ASHRAE Standard 15.

2.19 REFRIGERANT MONITOR

- A. General: Contractor shall provide a refrigerant sensitive infrared-based stationary refrigerant gas leak monitor system designed to continuously measure refrigerants. Refrigerant monitor shall be coordinated to detect [insert refrigerant types here if known or delete] refrigerants used in chiller equipment installed under Section 236416 Centrifugal Water Chillers. The alarm system shall comply with ANSI/ASHRAE 15-1994 and local code requirements.
- B. The refrigerant monitor shall be capable of monitoring multiple refrigerant gas compounds at multiple locations in concentrations of 0 PPM to a minimum of 1000 PPM. The Monitor shall have a low range resolution of 1 PPM in the range of 1 PPM through 100 PPM. Readings above 100 PPM must be accurate to within $\pm 5\%$ of reading. Accuracy shall be maintained within ambient environmental ranges of 0°C. through 50°C., (32°F. through 122°F.) and 5% through 90% relative humidity, non-condensing.
- C. The refrigerant monitor shall automatically and continuously monitor the areas through a sample draw type tubular pick up system with an internal pump and filter. The installation of the monitoring control and the tubing shall be in strict accordance with the manufactures instructions. The location, routing, and final position of the sample tubes shall be submitted to the engineer with all necessary shop drawings and monitor specifications and installation instructions. Tubing size, tubing material, and tube length limitations shall be within the specifications of the monitor manufacture. The location and method of tube support and hangers must be identified on the shop drawings. Each of the sampling tubes shall have end of line filters.
- D. The analyzer will be based on infrared detection technology, and will be factory tested and calibrated for the specified refrigerant or refrigerants. Factory certification of the calibrations shall be provided with the O&M manuals. . The analyzer shall provide a menu driven or automatic method of checking both zero, span calibration for each sensor, and allow for adjustment.
- E. The monitor shall be equipped with 4 outputs. Three relays shall energize at an adjustable user defined set point based on refrigerant concentration levels. The relay threshold adjustment shall be protected by keyed or password access controls. Adjustments and observations shall be made at the front panel operator interface. The relay threshold values can be viewed without a password. The digital display will continuously display the refrigerant concentration level and alarm status. The fourth output shall indicate a monitor malfunction alarm. The monitor shall also have an analog output that will provide a



liner scaled reference to the refrigerant concentration in parts per million. The analog output signal shall be an industry standard DC voltage, or mA current signal.

- F. The monitor shall have a NEMA-4 moisture resistant enclosure with a gasketed, hinged front cover. Conduits and tube connections shall be located on the bottom of the enclosure. The enclosure shall have a rust and corrosion resistant finish.
- G. The following alarm modes will be provided by the refrigerant monitor:
1. ALARM LEVEL ONE – Low level of refrigerant concentration at one of the sampling points has detected the presence of a possible refrigerant leak. The initial alarm threshold shall be set to 5 PPM (adj.) and increased if there are nuisance alarms. This alarm level shall be displayed on the refrigerant monitor interface panel, indicating which sensor has triggered the alarm, and the associated concentration of refrigerant in PPM. This event will also send an Alarm Level One signal to the BAS through a digital output from the monitor relay. This alarm will remain active until the refrigerant concentration is reduced below set point.
 2. ALARM LEVEL TWO – This alarm shall indicate that one of the sensors has detected a refrigerant concentration that is approaching dangerous levels in the area being monitored. This alarm shall be set to 25% below the maximum calculated refrigerant level specified in ANSI/ASHRAE 15-1994 and ASHRAE 34-1992. This alarm will be displayed on the monitor interface, and will indicate which of the sensors has caused the alarm, and the highest concentration in PPM. This event will also activate the beacon and audible alarm mounted on the refrigerant monitoring enclosure. This alarm will also be sent to the BAS through the digital output of the relay. In this mode the audible alarm can be silenced, but the beacon shall remain active until the fault is cleared
 3. ALARM LEVEL THREE – This alarm shall be set at the maximum calculated refrigerant level specified in ANSI/ASHRAE 15-1994 and ASHRAE 34-1992 whichever is the lowest concentration. The refrigerant monitor interface will display which sensor has caused the alarm, and the associated concentration in PPM. This event will also activate the beacon and audible alarm mounted on the refrigerant monitoring enclosure. If the audible alarm had been silenced by an earlier alarm, the activation of this level three alarm will cause the audible alarm to be activated again. The relay in the refrigerant monitoring panel shall activate the space ventilation system, and will disable all combustion or flame-producing equipment via hardwired control interlocks. In addition, this event will de-energize the energy source for any hot surface (850°F or 454°C) located in the space. Interlocks must also be provided to close any normally open doors or openings to the space for proper ventilation and isolation during this alarm condition. This alarm level will also signal the BAS through the digital output through the same relay. In this mode, the audible alarm can be silenced, but the beacon shall remain active until the fault is cleared.
- H. All alarm conditions shall be report to the BAS system as follows:
1. ALARM LEVEL ONE - The lowest refrigerant alarm level shall detect the presence of refrigerant in low concentrations and energize a relay to signal a low level alarm to the BAS operator terminal(s). The alarm shall display an alarm message stating that there is a potential refrigerant leak in the designated area.
 2. ALARM LEVEL TWO - The second refrigerant level alarm shall be a high refrigerant alarm alert. This alarm shall energize a relay to signal the BAS system indicating a high level alarm on the BAS operator terminal(s). This BAS alarm shall state that high levels of refrigerant have been detected in the designated area.
 3. FAULT ALARM – Reports a high level alarm to the BAS operator terminal(s) that there is a fault in the refrigerant monitoring alarm system.

NOTE TO SPECIFIER

Coordinate Fire Alarm interface and interlocks with Division 16. Edit below as needed to indicate necessary inter



2.20 SMOKE CONTROL/FIREMAN'S OVERRIDE PANEL

- A. Integral enunciator/control panel part of complete engineered and UUKL 864 listed system.
- B. Provide clear, laminated graphic schematically representing the building air systems. Status LEDs shall be associated with graphic representations of fans. Override switches shall be provided as required by NFPA 110 to allow override of the fans and dampers applicable to the code requirements.
- C. Interface with Fire Alarm System as required to implement the specified requirements in the Sequence of Operations.

2.21 NAMEPLATES

- A. Provide engraved phenolic or micarta nameplates for all equipment, components, and field devices furnished. Nameplates shall be 1/8 thick, black, with white center core, and shall be minimum 1" x 3", with minimum 1/4" high block lettering. Nameplates for devices smaller than 1" x 3" shall be attached to adjacent surface.
- B. Each nameplate shall identify the function for each device.

2.22 TESTING EQUIPMENT

- A. Contractor shall test and calibrate all signaling circuits of all field devices to ascertain that required digital and accurate analog signals are transmitted, received, and displayed at system operator terminals, and make all repairs and recalibrations required to complete test. Contractor shall be responsible for test equipment required to perform these tests and calibrations. Test equipment used for testing and calibration of field devices shall be at least twice as accurate as respective field device (e.g., if field device is +/-0.5% accurate, test equipment shall be +/-0.25% accurate over same range).

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF CONTROL SYSTEMS

- A. General: Install systems and materials in accordance with manufacturer's instructions, roughing-in drawings and details shown on drawings. Install electrical components and use electrical products complying with requirements of National Electric Code and all local codes.

NOTE TO SPECIFIER

Delete reference to pneumatic control components if not applicable. Typically, new installations will use electric control components. Pneumatics are typically used only in existing buildings where existing pneumatic control components are going to be reused.

- B. Main Control Air Piping: All main air piping between the compressors and the control panels shall be copper, run per ASTM B88



- C. **Branch Control Air Piping:** Accessible tubing is defined as that tubing run in mechanical equipment rooms; inside mechanical equipment enclosures, such as heating and cooling units, instrument panels; across roofs, in pipe chases, etc. Inaccessible tubing is defined as that tubing run in concrete slabs; furred walls; or ceilings with no access.
1. Provide copper tubing with maximum unsupported length of 3'-0", for accessible tubing run exposed to view. Polyethylene tubing may be used in lieu of above, when run within adequately supported, rigid enclosure, such as metallic raceways, or EMT. Terminal single-line connections less than 18 in length may be copper tubing, or polyethylene tubing run inside flexible steel protection. Accessible tubing run in concealed locations, such as pipe chases, suspended ceilings with easy access, etc. may be copper or polyethylene bundled and sheathed tubing.
 2. Provide copper or polyethylene tubing for inaccessible tubing, other than in concrete pour. If polyethylene tubing is used, install in EMT or vinyl-jacketed polyethylene tubing.
 3. Polyethylene piping may be used above suspended ceiling without conduit provided it is run in a neat and orderly fashion, bundled where applicable, and completely suspended (strapped to rigid elements or routed through wiring rings) away from areas of normal access. Tubing shall not be laid on the ceiling or duct.
 4. Pressure test control air piping at 30 psi (207 kPa) for 24 hours. Test fails if more than 2 psi loss occurs.
 5. Fasten flexible connections bridging cabinets and doors, neatly along hinge side, and protect against abrasion. Tie and support tubing neatly.
 6. Number-code or color-code tubing, except local individual room control tubing, for future identification and servicing of control system. Code shall be as indicated on approved installation drawings.
- D. **Control Wiring:** The term "control wiring" is defined to include providing of wire, conduit and miscellaneous materials as required for mounting and connection of electric control devices.
1. **Wiring System:** Install complete wiring system for electric control systems. Conceal wiring except in mechanical rooms and areas where other conduit and piping are exposed. Installation of wiring shall generally follow building lines. Install in accordance with National Electrical Code and Division 16 of this Specification. Fasten flexible conductors bridging cabinets and doors, neatly along hinge side, and protect against abrasion. Tie and support conductors neatly.
 2. **Control Wiring Conductors:** Install control wiring conductors, without splices between terminal points, color-coded. Install in neat workmanlike manner, securely fastened. Install in accordance with National Electrical Code and Division 16 of this Specification.
 3. Communication wiring, signal wiring and low voltage control wiring shall be installed separate from any wiring over thirty (30) volts. Signal wiring shield shall be grounded at controller end only, unless otherwise recommended by the controller manufacturer.
 4. All WAN and LAN Communication wiring shield shall be terminated as recommended by controller manufacturer. All WAN and LAN Communication wiring shall be labeled with a network number, device ID at each termination and shall correspond with the WAN and LAN system architecture and floor plan submittals.
 5. Install all control wiring external to panels in electric metallic tubing or raceway. However, communication wiring, signal wiring and low voltage control wiring may be run without conduit in concealed, accessible locations if noise immunity is ensured. Contractor will be fully responsible for noise immunity and rewire in conduit if electrical or RF noise affects performance. Accessible locations are defined as areas inside mechanical equipment enclosures, such as heating and cooling units, instrument panels etc.; in accessible pipe chases with easy access, or suspended ceilings with easy access. Installation of wiring shall generally follow building lines. Run in a neat and orderly fashion, bundled where applicable, and completely suspended (strapped to rigid elements or routed through wiring rings) away from areas of normal access. Tie and support conductors neatly with suitable nylon ties. Conductors shall not be supported by the ceiling system or ceiling support system. Conductors shall be pulled tight and be installed as high as practically possible in ceiling cavities. Wiring shall not be laid on the ceiling or duct. Conductors shall not be installed between the top cord of a joist or beam and the bottom of roof decking.



- Contractor shall be fully responsible for noise immunity and rewire in conduit if electrical or RF noise affects performance.
6. Number-code or color-code conductors appropriately for future identification and servicing of control system. Code shall be as indicated on approved installation drawings.
 - E. Control Valves: Install so that actuators, wiring, and tubing connections are accessible for maintenance. Where possible, install with valve stem axis vertical, with operator side up. Where vertical stem position is not possible, or would result in poor access, valves may be installed with stem horizontal. Do not install valves with stem below horizontal, or down.
 - F. Freezestats: Install freezestats in a serpentine fashion where shown on drawing. Provide one foot of element for each square foot of coil face area. Where coil face area exceeds required length of element, provide multiple devices, wired in parallel for normally open close on trip application, wired in series for normally closed, open on trip application. Adequately support with coil clips.
 - G. Averaging Temperature Sensors: Cover no more than two square feet per linear foot of sensor length unless otherwise specifically noted. Generally, where flow is sufficiently homogeneous/adequately mixed at sensing location, consult AE for requirements.

NOTE TO SPECIFIER

AE must specifically show locations of all flow meters and design in the straight length of duct or pipe required for accurate sensors. This length must be specifically shown on the drawing.

- H. Airflow Measuring Stations: Install per manufacturer's recommendations in an unobstructed straight length of duct (except those installations specifically designed for installation in fan inlet). For installations in fan inlets, provide on both inlets of double inlet fans and provide inlet cone adapter as recommended by AFM station manufacturer.
- I. Relative Humidity Sensors: Provide element guard as recommended by manufacturer for high velocity installations. For high limit sensors, position remote enough to allow full moisture absorption into the air stream before reaching the sensor.
- J. Flow Switches: Where possible, install in a straight run of pipe at least 15 diameters in length to minimize false indications.
- K. Current Switches for Motor Status Monitoring: Adjust so that setpoint is below minimum operating current and above motor no load current.
- L. Supply Duct Pressure Transmitters:
 1. General: Install pressure tips with at least 4 'round equivalent' duct diameters of straight duct with no takeoffs upstream. Install pressure tips securely fastened with tip facing upstream in accordance with manufacturer's installation instructions. Locate the transmitter at an accessible location to facilitate calibration.
 2. VAV System 'Down-Duct' Transmitters: Locate pressure tips approximately 2/3 of the hydraulic distance to the most remote terminal in the air system.
- M. Cutting and Patching Insulation: Repair insulation to maintain integrity of insulation and vapor barrier jacket. Use hydraulic insulating cement to fill voids and finish with material matching or compatible with adjacent jacket material.

NOTE TO SPECIFIER

Delete reference to Refrigerant Monitor for all but chilled water R&A projects or where the volume of refrigerant contained within internal components exceeds the requirements of the applicable edition of ASHRAE Standard 15.



3.3 REFRIGERANT MONITOR

- A. Install in accordance with the manufacturer's instructions. Place sensing tips in locations to maximize effectiveness.
- B. Hard wire interlocks to the emergency ventilation and shutdown of combustion devices.

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END OF SECTION



SECTION 25 51 04 00 - MPF EEMS INTEGRATION

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER. IF EEMS SYSTEM IS NOT TO BE INSTALLED OR INTEGRATED WITH THE BAS, THIS SECTION SHOULD BE OMITTED.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.25 51 04 00

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. EEMS Integration with Facility Systems
- B. EEMS Server Programming
- C. EEMS Graphic development
- D. EEMS Database development
- E. EEMS Data Acquisition and Storage
- F. Establishment of M&V parameter
- G. Establishment of Budgets and Targets
- H. [Enterprise System Operator Interfaces]
- I. [Enterprise Dynamic Color Graphics]

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Section 270500 - Common Work Results for Communications
- C. Section 250504 - Building Automation System (BAS) General
- D. Section 251104 – Metering Devices
- E. Section 251404 – BAS Equipment, Software and Programming
- F. Section 253004 – (BAS) Basic Materials, Interface Devices, and Sensors
- G. Section 259004 – Sequence of Operation
- H. Section 250804 – Building Automation System (BAS) Commissioning



1.3 GENERAL

- A. The USPS Enterprise Energy management System (EEMS) is an existing Ethernet/Internet-based network based system connecting multiple facilities with a central data warehouse and server and, accessible via standard web-browser and Terminal Services.
- B. The work of this section is to provide configuration and programming to extend the existing EEMS system functionality to new or retrofitted systems incorporated as part of this project.

1.4 DESCRIPTION OF WORK:

- A. Receive collected specified real time and trend data from facility building systems to provide full integration to the Enterprise Energy Management System.
- B. Establish communication links between the facility systems and the EEMS database server and applications through the existing USPS IT infrastructure
- C. Provide all required programming and database modifications to accommodate new site users, alarming, and reporting and other requirements specified on the EEMS database sever and applications.
- D. Format specified facility data for retransmission to the offsite EEMS data warehouse and web servers.
- E. Provide establishment of all required EEMS data warehouse parameters to support EEMS reporting functions
- F. Provide for the establishment of facility, systems or meter baselines, budgets, targets and tariffs to support standard EEMS reporting and project measurements and verifications plans
- G. Refer to 259004 - Sequence of Operation for specific point requirements and parameters
- H. Refer to MPF Design Criteria – Measurement and Verification and coordinate with the USPS Contracting Officer for specific requirements.

1.5 WORK BY OTHERS

- A. Installation of facility Building Automation Systems, Lighting Control systems and other field data collections systems.
- B. Installation, configuration, programming and start up of all field systems to provide specified data in BACnet format available across the USPS IT infrastructure
- C. Installation of field metering and submetering devices
- D. Installation, startup configuration and commissioning of IT infrastructure to allow communication to all portions of the EEMS system.

1.6 DEFINITIONS

- A. Contractor: The contractor responsible for executing the work included in the specification section. Generally this is the existing EEMS provider.



- B. EEMS: The USPS Enterprise Energy management System is an existing Ethernet/Internet-based network based system connecting multiple facilities with a central data warehouse and server and, accessible via standard web-browser and Terminal Services.
- C. EEMS Database Server:: USPS provided server or servers located on the USPS IT network supporting the collection and display of facility system real time and trend operational data.
- D. EEMS Data Warehouse : EEMS Remote offsite data warehouse and web application for long term archiving of USPS facility, energy and cost data

PART 2 - PRODUCTS

2.1 GENERAL

- A. There no products required to be installed at the facility for this work by this contractor. All field equipment and systems are provided by the other others under separate sections. All systems shall provide data from a BTL certified BACnet devices using ASHRAE 135 communications as specified elsewhere.
- B. This contractor shall provide all required EEMS software licenses as required to support the added users without a degradation of system response time below parameters established for the EEMS..

PART 3 - EXECUTION

3.1 SYSTEM CONFIGURATION

- A. This contractor shall coordinate with the other contractors through the contracting Officer to gather site device information and data required for setup of communications and database additions.
- B. Contractor shall thoroughly and completely configure existing EEMS system software, and load new data to meet the requirements of this and related sections.

3.2 SITE / USPS INFRASTRUCTURE PREPARATION

- A. Contractor shall through the Contracting Officer coordinate a meeting of relevant contractors to review system configuration and assist in planning data collection requirements in compliance with the project specifications.
- B. Before the contractor shall begin its work, USPS shall certify the established network ports, firewalls and has been opened for communication to the EEMS server across the network.
- C. Before the contractor shall began its work, all required BACnet Objects, Alarms, Trends and interfaces shall be established by others and be provide to this contractor ,though the contracting officer, BACnet device and object documentation for review and approval.

3.3 SITE-SPECIFIC APPLICATION PROGRAMMING

- A. Provide within the EEMS database server all database creation for site-specific points, as required by these specifications and established USPS for a fully functioning system. It is the Contractor's responsibility to request clarification on issues that require such clarification.



- B. All programming, [graphics] and data files must be maintained in a logical system of directories with self-explanatory file names.

3.4 OPERATOR SETUP

- A. Contractor shall provide to the Contracting Officer new user data forms for completion to establish user access rights to the EEMS. Contracting officer shall return completed forms providing user information and approved access rights to the EEMS database server applications and the EEMS website.
- B. Contractor shall provide the setup of a minimum of [] users for the EEMS database server.
- C. Contractor shall provide the setup of a minimum of [] users for the EEMS data warehouse web application.
- D. Contractor shall verify with the Contracting Officer the access rights of existing users to verify either the expansion or restriction of current access rights based on the addition of the new facility for both the EEMS data server and the EEMS data warehouse web application

3.5 EEMS DATABASE SERVER CONFIGURATION

- A. Contractor shall though the Contracting Officer a full network architecture from the control system contractor. Contactor shall perform the following:
 1. Review network for compliance with establish enterprise server standards and identify to and coordinate with the Contracting Officer and Control Contractor to correct discrepancies in facility network configuration
 2. With the support of the Control Contractor and USPS IT network technician, establish communication between the EEMS database server and the field panels as network communication devices.
 3. Prepare system for BACnet device and object discovery.
 4. Upload BACnet objects and verify the proper establishment of specified system points in the in the EEMS database server.

3.6 EEMS DATA TRANSFER

- A. Contractor shall establish scheduled trend collections to retrieve BACnet trend objects for specified points.
 1. Trend collections shall be scheduled a least twice per day and coordinated to minimize the impact to network traffic and database services.
 2. Trend data points shall be archived for a minimum of sixty (60) in the database server.
 3. Trend collection schedules shall be identified as specified in Appendix [].
- B. Contractor shall prepare and schedule trend reports for points identified to be archived on the EEMS data warehouse
 1. Trend reports shall be scheduled once per day and coordinated to minimize the impact to network traffic and database services.
 2. Trends shall be directed to the USPS transfer servers as established by USPS.
 3. Trend reports shall not exceed 200 points per report.
 4. Trend collection reports shall be identified as specified in Appendix [].
- C. The Contractor shall prepare AFT site and input files to accept file transfers provide, data cleansing and archiving in the EEMS data warehouse.

NOTE TO SPECIFIER



AE must edit the following to be project specific. If the EEMS data server is not used as an operator interface this section may not be needed. Consult with USPS

3.7 EEMS DATA SERVER TREND GRAPHS

- A. Prepare EEMS data server to display graphical format trends. Trended values and intervals shall be the same as those specified
- B. Lines shall be labeled and shall be distinguishable from each other by using either different line types, or different line colors.
- C. Indicate engineering units of the y-axis values; e.g. degrees F., inches w.g., Btu/lb, percent open, etc.
- D. The y-axis scale shall be chosen so that all trended values are in a readable range. Do not mix trended values on one graph if their unit ranges are incompatible.
- E. Trend outside air temperature, humidity, and enthalpy during each period in which any other points are trended.
- F. All points trended for one HVAC subsystem (e.g. air handling unit, chilled water system, etc.) shall be trended during the same trend period.
- G. Each graph shall be clearly labeled with HVAC subsystem title, date, and times.
- H. Graph files shall be named according to the EEMS naming standard.

NOTE TO SPECIFIER

AE must edit the following to be project specific. If the EEMS data server is not used as an operator interface this section may not be needed. Consult with USPS

3.8 EEMS DATABASE SERVER ALARMS

- A. Override Alarms: Any point that is overridden through the override feature of the graphic workstation software shall be reported as a Level 3 alarm.
- B. Alarms: For each analog input, program an alarm message for reporting whenever the analog value is outside of the programmed alarm limits. Report a 'Return-to-Normal' message after the analog value returns to the normal range, using a programmed alarm differential. The alarm limits shall be individually selected by the Contractor based on the following criteria:
- C. See requirements for additional equipment-specific alarms specified in Section 259004 - Sequence of Operation

NOTE TO SPECIFIER

AE must edit the following to be project specific. Establishment of alarms to be alarms must be indicated in the sequence of operation.

3.9 EEMS REMOTE NOTIFICATION ALARM

- A. For each alarm specified, provide an alarm notification through the USPS e-mail system to the designated person.



- B. Provide setup of alarm notification hierarchy and call groups as specified in the sequence of operation.
- C. Coordinate with the local BAS contractor and USPS contracting officer to review alarms, call groups and contact information before implementation

NOTE TO SPECIFIER

AE must edit the following to be project specific. If the EEMS data server is not used as an operator interface this section may not be needed. Consult with USPS

3.10 EEMS DATABASE SERVER GRAPHIC SCREENS

- A. The facility site graphics shall be incorporated into the previously established enterprise hierarchical graphic tree. The standardized site main screen shall be the first site specific graphic which to which all other graphics are linked.
- B. Standard system tabular graphics shall be provided for each applicable system. Standard tables shall be edited as required to customize each graphic to the specific systems.

NOTE TO SPECIFIER

AE must edit the following to be project specific. If the EEMS does not require a full graphical operator interface this section may not be required. Establishment of graphic screen requirements for the EEMS may be different than for the operator interface. Standard EEMS graphic screens may be used as required. Consult with USPS

- C. System Schematic Screens: Provide graphic system schematic screen for each HVAC subsystem controlled with each I/O point in the project appearing on at least one graphic screen. System graphics shall include flow diagrams with status, setpoints, current analog input and output values, operator commands, etc. as applicable. General layout of the system shall be schematically correct. Input/output devices shall be shown in their schematically correct locations. Include appropriate engineering units for each displayed point value. Verbose names (English language descriptors) shall be included for each point on all graphics; this may be accomplished by the use of a pop-up window accessed by selecting the displayed point with the mouse. Indicate all adjustable setpoints on the applicable system schematic graphic screen or, if space does not allow, on a supplemental linked-setpoint screen.
 - 1. Provide graphic screens for each air handling system. Indicate outside air temperature and enthalpy, and mode of operation as applicable (i.e., occupied, unoccupied, warm-up, cool-down). Link screens for air handlers to the heating system and cooling system graphics. Link screens for supply and exhaust systems if they are not combined onto one screen.
 - 2. Provide a graphic screen(s) for zoning. Provide links to graphic system schematic screens of air handling units that serve the corresponding zone.
 - 3. Provide a cooling system graphic screen showing all points associated with the chillers, cooling towers and pumps. Indicate outside air dry-bulb temperature and calculated wet-bulb temperature. Link screens for chilled water and condenser water systems if they cannot fit onto one cooling plant graphic screen.
- D. Alarms: Each alarm object shall appear on at least one graphic screen. In general, alarms shall be displayed on the graphic system schematic screen for the system that the alarm is associated with (for example, chiller alarm shall be shown on graphic cooling system schematic screen). For all graphic screens, display analog values that are in a 'high alarm' condition in a red color, 'low alarm' condition in a blue color. Indicate digital values that are in alarm condition in a red color.

NOTE TO SPECIFIER

AE must provide electronic control design drawings. If the EEMS does not require a full graphical interface this section may not be required. Also edit the following to be project specific.



- E. Floor Plan Screens: The contract document drawings will be made available to the Contractor in AutoCAD 2004 format upon request. These drawings may be used only for developing backgrounds for specified graphic screens; however the USPS does not guarantee the suitability of these drawings for the Contractor's purpose.
1. Provide graphic floor plan screens for each [floor] [wing] [tower] [other] of the building. Indicate the location of all equipment that is not located on the equipment room screens. Indicate the location of temperature sensors associated with each temperature-controlled zone (i.e., VAV terminals, fan-coils, single-zone AHUs, etc.) on the floor plan screens.. Display the space temperature point adjacent to each temperature sensor symbol. Use a distinct line symbol to demarcate each terminal unit zone boundary. Use distinct colors to demarcate each air handling unit zone. [Mechanical floor plan drawings will be made available to the contractor upon request for the purpose of determining zone boundaries.] Indicate room numbers as provided by the USPS. Provide a drawing link from each space temperature sensor symbol and equipment symbol shown on the graphic floor plan screens to each corresponding equipment schematic graphic screen.
 2. If multiple floor plans are necessary to show all areas, provide a graphic building key plan. Use elevation views and/or plan views as necessary to graphically indicate the location of all of the larger scale floor plans. Link graphic building key plan to larger scale partial floor plans. Provide links from each larger scale graphic floor plan screen to the building key plan and to each of the other graphic floor plan screens.
 3. Provide a graphic site plan with links to and from each building plan.

3.11 EEMS DATA WAREHOUSE CONFIGURATION

- A. The establishment of the facility in the data warehouse requires coordination of specific project data, facility data and financial data and other record information.. This facility may already be established in the warehouse database. This contractor shall complete all the functions below and any other database configurations not previously established that is required to fully meet system reporting and specification requirements.
1. Review the system points list, sequence of operations, and facility drawings and other relevant data to establish a hierarchical tree for all specified points. System hierarchy shall be reviewed and approved by the Contracting Officer before detailed database development proceeds.
 2. Verify with Contracting Officer system point units, reporting type, meter type and collection frequency.
 3. Establish all tariff rates for the facility in the database and apply same to all appropriate meters and devices
 4. Establish facility utility cost and energy budgets at the building level for all utility sources.
 5. Establish facility baselines for cost and energy consumption.

3.12 EEMS DATA WAREHOUSE CONFIGURATION

- A. The establishment of the facility in the data warehouse requires coordination of specific project data, facility data and financial data and other record information.. This facility may already be established in the warehouse database. This contractor shall complete all the functions below and any other database configurations not previously established that is required to fully meet system reporting and specification requirements.
1. Review the system points list, sequence of operations, and facility drawings and other relevant data to establish a hierarchical tree for all specified points. System hierarchy shall be reviewed and approved by the Contracting Officer before detailed database development proceeds.
 2. Verify with Contracting Officer system point units, reporting type, meter type and collection frequency.



3. Establish all tariff rates for the facility in the database and apply same to all appropriate meters and devices
4. Establish facility utility cost and energy budgets at the building level for all utility sources.
5. Establish facility baselines for cost and energy consumption.

NOTE TO SPECIFIER

If the project includes a retrofit that requires measurement and verification, Include the following section to establish M&V tracking within the EEMS. Coordinate this section with the project M&V requirements .Also edit the following to be project specific. Consult with USPS.

3.13 MEASUREMENT AND VERIFICATION TRACKING

- A. Contractor shall review all specifications for Measurement and Verification (M&V) requirements and request from the Contracting Officer the project M&V plan.
- B. Contractor shall compare M&V plans with the specified points indicated for data warehousing to verify that M&V tracking can be accomplished. Contractor shall identify to the Contracting Officer discrepancies for resolutions and directions as required.
- C. Contractor shall establish for each M&V function, baseline consumption and target reduction goals as a basis for savings verification.
- D. Contractor shall configure standard EEMS reports to automatically generate monthly M&V tracking reports showing baseline, projected and actual consumption isolated by retrofit measures. Reports shall be configured to be stored and/ or delivered to locations or person(s) as directed by the contracting officer.

3.14 START UP, COMMISSIONING AND TRAINING

- A. Refer to Section 250804 Building Automation System (BAS) Commissioning.

USPS Mail Processing Facility Specification issued: 5/1/2014
Last revised: 04/16/2014

END OF SECTION



SECTION 25 90 04 00 - MPF SEQUENCE OF OPERATION**

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.25 90 04 00

*******GENER**
AL

1.1 SUMMARY

- A. Section includes
 - 1. General Requirements
 - 2. Description of Work
- B. Related documents
 - 1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
 - 2. Section 230500 - Common Work Results for HVAC
 - 3. Section 250504 – Building Automation System (BAS) General
 - 4. Section 251104 - Metering Devices
 - 5. Section 251404 - BAS Equipment, Software and Programming
 - 6. Section 253004 – BAS Basic Materials and Sensors
 - 7. Section 260623 – Lighting Control Devices
 - 8. Section 265100 – Interior Lighting
 - 9. Section 265600 – Exterior Lighting

NOTE TO SPECIFIER

Select the following 255104 specification according to the project requirements

- 10. Section 255104 – EEMS Integration
- 11. Section 250804 – Building Automation System (BAS) System Commissioning
- 12. Section 262923 – Variable Frequency Motor Controllers

1.2 DESCRIPTION OF WORK

NOTE TO SPECIFIER

Select the following paragraphs which are dependent upon new construction or retrofit facilities.

- C. [This Section includes control sequences for HVAC systems, subsystems, and equipment. As requirements for monitoring and integration of multiple building systems and utilities for energy consumption.]
- D. [This Section includes control sequences for HVAC systems, subsystems, and equipment. As requirements for monitoring and integration of multiple building systems and utilities for energy consumption. This Section and Related Sections as listed above will be responsible for continued services to the existing building systems to remain in operation, to proposed systems partially completed and shall provide control and monitoring during the phased construction.]



PART 2 - EXECUTION

2.1 OUTDOOR AIR CONDITION MONITORING

- A. The controller will read the outside air temperature and humidity and calculate the outside air enthalpy, and will make these values available to the system.
- B. If the outside air temperature sensor is out of the normal set point parameter after a time delay (adj.), the controller will generate a sensor failure

2.2 OPTIMAL START PROGRAM (OSP)

- C. The Building Automation System (BAS) or Energy Management System (EMS) shall control the various Day/Night zones based upon an operator interactive time-of-day (TOD) program.
- D. The TOD program shall interact with an optimal start program (OSP) such that start times shall be assigned by the OSP to achieve the target occupancy space temperature (72° F winter, 75° F summer) at the precise time of building occupancy.
- E. Refer to the various sequences of operation to determine the amount of Day/Night zones required.
- F. During morning warm-up, all outside air dampers shall be full closed.

NOTE TO SPECIFIER

Edit the following paragraphs based on the job requirements. Day night zones should be arranged with respect to the air handlers serving various areas. Areas with VAV air handlers may be subdivided based on system size and area functions served. Representative areas are shown in the schedule, more may be added as needed. Consult with USPS

2.3 DAY/NIGHT ZONE CONTROL

- G. The facility shall be divided into day/night zones as indicated below. The unoccupied heating temperature setpoint for all zones is [55°] F. The unoccupied cooling setpoint is indicated in the table.
- H. The BAS/EMS shall control the building zones on the following occupied schedule:

Area	Weekday	Saturday	Sunday	Unoccupied Cooling
Workroom	[_____]	[_____]	[_____]	88°F
Docks	[_____]	[_____]	[_____]	NA
Administration	[_____]	[_____]	[_____]	88°F
Data Centers	[_____]	[_____]	[_____]	74°F
Cafeteria				88°F



Lobbies				88°F
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2.4 GENERAL MOTOR STARTING REQUIREMENTS

- I. Motors shall be started with a minimum delay of 5 seconds (adj.) between motors except when simultaneous operation sequence is required.
- J. Motors equipped with VFD's shall initially start at 30% speed (adj.) and then ramp up to the required operating speed.
- K. Relief fan motors shall not be allowed to start until the associated damper end switch is proven open.
- L. AHU and return/relief fan motors shall not be allowed to start until the associated return damper end switch is proven open.

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.5 ELECTRIC MAIN UTILITY METERING

NOTE TO SPECIFIER

Select one of the four following paragraphs based on the job requirements. This may require coordination with the electrical and IT infrastructure designers. Consult with USPS Contracting Officer

- M. [Provide required interfaces and programming to collect data from smart meters on the incoming mains installed by others. Provide the meter points and trending as indicated in the attached points list]
- N. [Provide required interfaces and programming to collect data from the existing smart meters on the incoming mains. Provide the meter points and trending as indicated in the attached points list]
- O. [Provide a smart meter as specified in section 251104 for each main incoming electrical feed. Provide the meter points and trending as indicated in the attached points list.]
- P. [Coordinate with the electric service provider to obtain a kWh pulse from the electrical providers metering equipment. Contractor is required to obtain the K-Factor of the meter pulses from the utility supplier. Provide a calculation of demand and accumulate total kWh.]
- Q. Provide the meter points and trending as indicated in the attached points list
- R. Phase Monitoring
 - 1. The BAS shall monitor the incoming power, if there is a phase voltage loss or phase voltage unbalance the BAS shall shut off all motorized equipment and the chiller, and issue an alarm. The BAS station shall have an icon to manually restart all equipment previously shut off.
 - 2. The system under voltage trip point on the voltage monitor shall be set to 420 volts (87.5% of nominal 480 volts).

NOTE TO SPECIFIER



Select one of options below based on the job requirements. A load shedding program may be established in conjunction with the local power supplier or may be developed within the project. This may require coordination with the electrical and lighting control designers. Consult with USPS

3.2 ELECTRICAL LOAD MANAGEMENT

- A. BAS shall provide load management capability as indicated below for peak avoidance and for peak alarm condition
- B. [The BAS shall use the data from the smart meter to establish a predicted demand warning and alarm setpoints for use in demand management. These setpoints shall be operator adjustable]
- C. Upon peak power warning condition indication provided by [Electrical Utility Demand Indication device (pulse output)] [Predicted demand warning condition from metered services]
 - 1. The BAS shall reset space temperature by 1 Deg. F. (increase or decrease based on cooling or heating mode of operation). Fan speed shall be reduced to maintain set point.
 - 2. The BAS shall initiate a [10%] shed request to Lighting control system.
- D. Upon peak power alarm condition indication provided by [Electrical Utility Demand Indication device (pulse output)] [Predicted demand alarm condition from metered services]
 - 1. The BAS shall reset space temperature by 2 Deg. F. (increase or decrease based on cooling or heating mode of operation). Fan speed shall be reduced to maintain set point.
 - 2. The fan speed of all units controlled by VFD's shall be reduced to 70%.
 - 3. During chilled water system operation the chilled water setpoint shall be increased by [3°F].
 - 4. The BAS shall initiate a [20%] shed request to Lighting control system.
- E. Coordinate input requirements to BAS with Division 16.
- F. On "Off Peak" time period, controls shall return to comfort set points.
- G. On restart from power failure, mechanical systems shall start in a staggered sequence to avoid peak current draw.

3.3 GAS UTILITY METERING

NOTE TO SPECIFIER

Select one of the following paragraphs based on the job requirements. This may require coordination with the mechanical or plumbing designers. Consult with USPS

- A. [Provide connection to gas meter provided by others to monitor the meter pulse contact. Coordinate with the meter provider to obtain meter K factor.]
- B. [Provide new gas meter as specified in section 251104]
- C. [Contractor shall arrange with the gas service provider to obtain a gas contact pulse for each gas meter serving the facility. Contractor is required to obtain the K-Factor of the meter pulses from the utility supplier.]
- D. Provide for each gas meter an accumulation of the total gas consumption and a calculation of the 15 minute gas demand use.



- E. For facilities with more than one gas meter provide a total consumption of all gas meters and total 15 minute demand calculation.
- F. Provide the meter points and trending as indicated in the attached points list

3.4 WATER UTILITY METERING

NOTE TO SPECIFIER

Select one of the following paragraphs based on the job requirements. This may require coordination with the mechanical or plumbing designers. Consult with USPS

- A. [Provide connection to water meter provided by others to monitor the meter pulse contact. Coordinate with the meter provider to obtain meter K factor.]
- B. [Provide new water meter as specified in section 251104]
- C. [Contractor shall arrange with the water service provider to obtain a gas contact pulse for each gas meter serving the facility. Contractor is required to obtain the K-Factor of the meter pulses from the utility supplier.]
- D. Provide for each water meter an accumulation of the total water consumption and a calculation of the 15 minute water demand use.
- E. For facilities with more than one water meter provide a total consumption of all water meters and total 15 minute demand calculation.
- F. Provide monitoring of all other system points as indicated on the attached point list and other system parameters as needed for operator control

3.5 STEAM UTILITY METERING

NOTE TO SPECIFIER

Select one of the following paragraphs based on the job requirements. This may require coordination with the mechanical or plumbing designers. Consult with USPS

- A. [Provide connection to steam meter provided by others to monitor the meter pulse contact or 4-20 ma signal. Coordinate with the meter provider to obtain meter K factor.]
- B. [Provide new steam metering system as specified in section 251104]
- C. [Contractor shall arrange with the steam service provider to obtain a contact pulse for each steam meter serving the facility. Contractor is required to obtain the K-Factor of the meter pulses from the utility supplier.]
- D. Provide for each steam meter an accumulation of the total consumption and a calculation of the 15 minute steam demand use if consumption is provided by pulse signal
- E. For facilities with more than one meter provide a total consumption of all meters and total 15 minute demand calculation.
- F. Provide monitoring of all other system points as indicated on the attached point list and other system parameters as needed for operator control.

NOTE TO SPECIFIER



In all the sections below insert required sequence of operation to meet the requirements of the system design and best energy conservation practices. Include in the final section energy monitoring paragraphs. Consult USPS

3.6 CHILLER PLANT CONTROL

A. [Sequence of operations]

B. Energy Monitoring

NOTE TO SPECIFIER

Select the submetering options below to meet the requirements of the system design and M&V plan. Balance metering cost to value received. System point list will need to be edited based on option selected. Consult USPS Contracting Officer.

1. [Provide an interface to the chiller control panels though a gateway or direct BACnet interface.]
2. [Install a kW transducer on the chiller feeds to monitor the chiller power]
3. [Install BTU metering system as specified in Section 251404] [for each chiller] [for total chilled water system]
4. [Provide a calculation of the total chilled water system energy demand and accumulated energy consumption and trend as indicated. Total chilled water system demand includes all chiller, dedicated chiller pump and chilled water system pumping power.]
5. Provide monitoring of all other system points as indicated on the attached point list and other system parameters as needed for operator control.

3.7 CHILLED WATER PUMPING CONTROL

A. [Sequence of operations]

B. Energy Monitoring

NOTE TO SPECIFIER

AE should only utilize BTU meter below if facility is fed from and charged by a District Utility system providing hot or chilled water system. Use and specification shall be provided only in close coordination with the USPS Contracting Officer. This metering type is atypical for nearly all facilities and would only be used as a check against utility charges if an auxiliary contact is not provided by the utility company or if secondary confirmation of charges is requested by the USPS Contracting Officer. Omit this metering section if district hot water or chilled water are not provided.

1. Provide for the [main][and][secondary] chilled water system a BTU monitoring system to measure energy delivered to the facility as specified in Section 251404
2. [Through the chilled water pump VFD communication interface provide points and trending as indicated in the attached points list]
3. Through the BTU meter communication interface provide the points and trending as indicated in the attached points list
4. Provide monitoring of all other system points as indicated on the attached point list and other system parameters as needed for operator control.

3.8 CONDENSER WATER CONTROL TOWER CONTROL

A. [Sequence of operations]



B. Energy Monitoring

Select the submetering option below to meet the requirements of the system design and M&V plan. Balance metering cost to value received. System point list will need to be edited based on option selected. Consult USPS Contracting Officer.

1. [Provide a KW transducer for [total system power feeder] [per each tower fan] as specified in section 251404]
2. [Through the tower fan VFD communication interface provide points and trending as indicated in the attached points list]
3. [Provide a calculation of the total condenser water system energy demand and accumulated energy consumption and trend as indicated. Total condenser water system demand includes all tower fans and condenser water system pumping power.]
4. Provide monitoring of all other system points as indicated on the attached point list and other system parameters as needed for operator control.

3.9 HEATING HOT WATER SYSTEM CONTROL

A. [Sequence of operations]

B. Energy Monitoring

NOTE TO SPECIFIER

AE should only utilize BTU meter below if facility is fed from and charged by a District Utility system providing hot or chilled water system. Use and specification shall be provided only in close coordination with the USPS Contracting Officer. This metering type is atypical for nearly all facilities and would only be used as a check against utility charges if an auxiliary contact is not provided by the utility company or if secondary confirmation of charges is requested by the USPS Contracting Officer. Omit this metering section if district hot water or chilled water are not provided.

1. Provide for the [main] [secondary] water system a BTU monitoring system to measure energy delivered to the facility as specified in Section 251404
2. [Through the hot water pump VFD communication interface provide points and trending as indicated in the attached points list]
3. Through the BTU meter communication interface provide the points and trending as indicated in the attached points list
4. Provide monitoring of all other system points as indicated on the attached point list and other system parameters as needed for operator control.

NOTE TO SPECIFIER

Repeat the section below as required for the different system configurations. Consult USPS

3.10 VAV AIR HANDLER SYSTEM CONTROL

A. [Sequence of operations]

B. Energy Monitoring

NOTE TO SPECIFIER

Select the submetering option below to meet the requirements of the system design and M&V plan. Balance metering cost to value received. System point list will need to be edited based on option selected. Consult USPS Contracting Officer.



1. Through the system VFD communication interface provide points and trending as indicated in the attached points list
2. Provide monitoring of all other system points as indicated on the attached point list and other system parameters as needed for operator control.

3.11 SINGLE ZONE AIR HANDLER SYSTEM CONTROL

A. [Sequence of operations]

B. Energy Monitoring

NOTE TO SPECIFIER

Select the submetering option below to meet the requirements of the system design and M&V plan. Balance metering cost to value received. System point list will need to be edited based on option selected. Consult USPS Contracting Officer.

1. Through the system VFD communication interface provide points and trending as indicated in the attached points list
2. Provide monitoring of all other system points as indicated on the attached point list and other system parameters as needed for operator control.

3.12 MISCELLANEOUS SYSTEMS MONITORING

A. [Sequence of operations]

B. Energy Monitoring

NOTE TO SPECIFIER

Select the submetering option below to meet the requirements of the system design and M&V plan. Balance metering cost to value received. System point list will need to be edited based on option selected. Consult USPS

1. Provide monitoring of system points as indicated on the attached point list and other system parameters as needed for operator control.

3.13 LIGHTING SYSTEMS MONITORING

- A. The BAS shall monitor the lighting system though the BACnet interface
- B. The BAS contractor shall provide programming to totalize the lighting system demand kW as received though a BACnet object from the lighting control system
- C. The BAS contractor shall provide all programming required to establish trend objects for the lighting system as indicated on the attached points list.



APPENDIX A

System Point Lists

PART 1 - GENERAL:

- A. Purpose: The following point list tables identify the general system control and monitoring points expected to be implemented for each system. Additional points may be needed to fully implement the control sequences and calculation algorithms. This should be included in the submittals specified in other sections. All additional points shall follow the point naming convention established in related sections.
- B. Point List table descriptions
 - 1. Point ID: system point name following point naming standard established in related sections.
 - 2. Description: Additional descriptive information relating to the point to expound on the system Point ID.
 - 3. Control SP: For points in control loops, the control loop setpoint.
 - 4. Alarm Data: Identification of alarm levels for the point identified. Contractor shall provide alarm objects for set with the identified parameters
 - 5. Trend Data: Indication of which points shall be trended and in what manner. All trends are stored in the field panel local memory.
 - a. Type: COV - change in value, value recorded and time stamped when value changes by a set threshold; Time – value recorded and time stamped at set time intervals.
 - b. Freq.: Set frequency interval, in minutes, a time based trend is stored.
 - c. Min Storage: The minimum number of samples either time based or COV to be stored in the field panel.
 - 6. Graphic Display: This group is an indication of where points shall be shown on system graphics and trend graph groupings. This is a general assignment of system points to graphic displays and graphs. Additional points may need to be shown to ease of operator functionality. All graphics and graphs shall be mocked up and submitted for approval before final programming.
 - a. System Diagram: The graphic screen, at a minimum on which the point is to be presented.
 - b. Trend graph: The trend graph grouping to which the point should be assigned. Trend graphs shall have their vertical scale set to include the typical range of the operating parameters measured. Scales shall be fixed to allow vertical units to be easily read values. On trend groupings with diverse parameters, a second vertical axis shall be set to allow reasonable comparisons of the relationships between parameters.
 - 7. EEMS: This group is an indication of which points shall be collected by the EEMS server for remote monitoring, display, alarm and historical archiving.
 - a. Server points: The indicated points' BACnet objects and any associated alarm and trend objects will be retrieved for real time display at the EEMS server by the EEMS contractor.
 - b. Trend Archive: The indicated points will be formatted into trend archiving in the EEMS by the EEMS contractor.



Points List – Incoming Utilities

Unit			Alarm Data						Trend data				Graphic Display		EEMS	
Point ID ?= State, .Facility ID			Hi Alr m	SP	Low Alar m	SP	Stat us Alar m	Se e Not e			Min. Stor age Note 3	Totaliz e Note 2	Syst em Dia gram	Tre nd Gr ap h	Ser ver Poi nts	Tren d Arch ive
AB.CCCCCCCC	Description	Cont rol SP							Type	q.						
Electric Mains																
?..UTL.ELE.M1.PH A.V	M1.PHA.V		X		X				TIME	5	23 00			1	X	X
?..UTL.ELE.M1.PH A.A	M1.PHA.A		X						TIME	5	23 00			1	X	X
?..UTL.ELE.M1.PH A.KW	M1.PHA.K W		X						TIME	5	23 00	kWh		2	X	X
?..UTL.ELE.M1.PH B.V	M1.PHB.V		X		X				TIME	5	23 00			1	X	X
?..UTL.ELE.M1.PH B.A	M1.PHB.A		X						TIME	5	23 00			1	X	X
?..UTL.ELE.M1.PH B.KW	M1.PHB.K W		X						TIME	5	23 00	kWh		2	X	X
?..UTL.ELE.M1.PH C.V	M1.PHC.V		X		X				TIME	5	23 00			1	X	X
?..UTL.ELE.M1.PH C.A	M1.PHC.A		X						TIME	5	23 00			1	X	X
?..UTL.ELE.M1.PH C.KW	M1.PHC.K W		X						TIME	5	23 00	kWh		2	X	X
?..UTL.ELE.M1.TOT.KW	M1.TOT.K W		X						TIME	5	23 00	kWh		3	X	X
?..UTL.ELE.M1.TOT.KWH	M1.TOT.K WH								TIME	15	10 00				X	X
?..UTL.ELE.M1.TOT.KVAR	M1.TOT.KV AR								TIME	5	23 00			3	X	X
?..UTL.ELE.M1.TOT.KVARH	M1.TOT.KV ARH								TIME	15	10 00	kVA RH			X	X
?..UTL.ELE.M1.TOT.KVA	M1.TOT.KV A								TIME	5	23 00			3	X	X
?..UTL.ELE.M1.TOT.KVAH	M1.TOT.KV AH								TIME	15	10 00				X	X



?.UTL.ELE.M1.TO T.PF	M1.TOT.PF				X					E T I M E	5	23 00			3	X	X
Gas Mains																	
?.UTL.GAS.M1.U SE	CONSUMP TION									T I M E	1 5	10 00	CC F			X	X
	(Accumulat e gas meter pulses)																
?.UTL.GAS.M1.D MD	15 MIN USE		X							T I M E	1 5	10 00	CC F		4	X	X
Water Mains																	
?.UTL.WTR.M1.T OT	CONSUMP TION									T I M E	1 5	10 00	MG AL			X	X
	(Accumulat e water meter pulses)																
?.UTL.WTR.M1.D MD	15 MINUTE USE		X							T I M E	1 5	10 00	GAL		5	X	X

Note 1: Repeat the utility points indicated for each main feed

Note 2: Totalize as follows: Run hours to the 0.1 hour; kWh to the integer kWh; Gas to integer CCF

Note 3: Trend data shall be retained in field panel for the sample quantity indicated and backed up to server at a minimum on a daily basis.

Trend Graph Descriptions: Trend graphs shall display 7 days historical trend data Provide a link on the system or data table graphics.

Graph 1: Electric Phase Trends

Graph 2: Electric Phase Power

Graph 3: Electric Total Power

Graph 4: Gas Main Demand

Graph 5: Water Main Demand



Points List – Chilled Water Systems/ Chillers / Condenser Water/ Towers

Unit			Alarm Data						Trend data				Graphic Display		EEMS	
			Cont rol SP	Hi Alar m	Lo w Alar m	SP	Stat us Alar m	Se e Not e	Type	Fre q.	Min. Stor age Note 3	Totalize Note 2	Syst em Dia gram	Tr en d Gr ap h	Ser ver Poi nts	Tren d Arch ive
Point ID ?= State, .Facility ID AB.CCCCCCCC	Description															
??.CHW.SYS.SWT	SUPPLY TEMP			X					TI ME	5	21 00			1	X	X
??.CHW.SYS.RWT	RETURN TEMP								TI ME	5	21 00			1	X	X
??.CHW.SYS.FLO	SYS FLOW								TI ME	5	21 00			1, 2	X	X
??.CHW.SYS.TON	SYS TON								TI ME	5	21 00	KTon -Hrs		1	X	X
??.CHW.SYS.TNHR	SYS PRODUCTION								TI ME	1 5	10 00				X	X
??.CHW.SYS.TOT.KW	CHW SYS KW			X					TI ME	5	21 00	KWh		1	X	X
??.CHW.SYS.TOT.KWH	CHW SYS KWH								TI ME	1 5	10 00				X	X
??.CHW.SYS.PSI	SYS PRESSURE			X		X			TI ME	5	21 00			2	X	
??.CHW.SYS.PSD	SYS DIFF PRES			X		X			TI ME	5	21 00			2	X	
??.CHW.SYS.PSS	SYS PRES STPT								TI ME	5	21 00			2	X	
??.CHW.CHP#.SS	START/STOP								CO V		20 0				X	
??.CHW.CHP#.RT	RUN TIME								TI ME	1 5	10 00	Hour s			X	
??.CHW.CHP#.PVO	VFD OUTPUT								TI ME	5	21 00			2	X	X
??.CHW.CHP#.SPD	SPEED %								TI ME	5	21 00			2	X	



??..CHW.CHP#.KW	PUMP KW									TIME	5	21 00	kWh			X	X
??..CHW.CHP#.KWH	PUMP ENERGY									TIME	15	10 00				X	X
??..CHW.CHL#.SS	START/STOP									COVER		10 00				X	
??..CHW.CHL#.SWT	SUPPLY TEMP									TIME	5	21 00			3	X	X
??..CHW.CHL#.SW S	SUPPLY STPT									TIME	5	21 00			3	X	X
??..CHW.CHL#.RWT	RETURN TEMP									TIME	5	21 00			3	X	X
??..CHW.CHL#.RT	RUN TIME									TIME	15	10 00	Hours			X	X
??..CHW.CHL#.KW	CHILLER KW			X						TIME	5	21 00	kWh		3	X	X
??..CHW.CHL#.KWH	CHILLER KWH									TIME	15	10 00				X	X
??..CHW.CHL#.SPD	SPEED %									TIME	5	21 00			3	X	
??..CHW.CHL#.FLO	SYS FLOW									TIME	5	21 00			3	X	X
??..CHW.CHL#.TON	SYS TON									TIME	5	21 00	KTon-Hrs		3	X	X
??..CHW.CHL#.TNHR	SYS PRODUCTION									TIME	15	10 00				X	X
??..CHW.CHL#.CST	COND SUP TEMP									TIME	5	21 00			3	X	
??..CHW.CHL#.CRT	COND RTN TEMP									TIME	5	21 00			3	X	
??..CDW.SYS.CST	COND SUP TEMP									TIME	5	21 00			4	X	
??..CDW.SYS.CSS	COND SUP STPT									TIME	5	21 00			4	X	
??..CDW.SYS.CRT	COND RTN TEMP									TIME	5	21 00			4	X	

[illegible]

Note 1:

Note 2: Totalize as follows: Run hours to the 0.1 hour; kWh to the integer kWh; Ton-Hrs to the integer Ton-Hours

Note 3: Trend data shall be retained in field panel for the sample quantity indicated and backed up to server at a minimum on a daily basis.

Trend Graph Descriptions: Trend graphs shall display 7 days historical trend data Provide a link on the system or data table graphics.

Graph 1: System Operation

Graph 2: System Pumping

Graph 3: Chiller Operation

Graph 4: Condenser System Operation

Points List – Hot Water Systems

Unit		Alarm Data							Trend data				Graphic Display		EEMS	
		Cont rol SP	Hi Alar m	SP	Lo w Alar m	SP	Stat us Alar m	Se e Not e	Type	Fre q.	Min. Stor age Note 3	Totaliz e Note 2	Syst em Dia gram	Tr en d Gr ap h	Ser ver Poi nts	Tren d Arch ive
Point ID ?= State, .Facility ID AB.CCCCCCCC	Description															
??.HHW.SYS.SWT ..	SUP WTR TEMP								TI ME	5	21 00			1	X	X
??.HHW.SYS.SWS ..	SUP WTR STPT								TI ME	5	21 00			1	X	X
??.HHW.SYS.BPV. .	WTR MIX VALVE								TI ME	5	21 00			1	X	
??.HHW.SYS.RWT ..	RTN WTR TEMP								TI ME	5	21 00			1	X	X
??.HHW.SYS.DT.. .	WTR DT								TI ME	5	21 00			1	X	
??.HHW.SYS.FLO W..	WATER FLOW								TI ME	5	21 00				X	X
??.HHW.SYS.BTU. .	SYSTEM BTU								TI ME	5	21 00	MB TU H		1	X	X
??.HHW.SYS.BTU H..	SYSTEM BTUH								TI ME	1 5	10 00				X	X
??.HHW.SYS.PSI	SYS PRESSURE		X		X				TI ME	5	21 00			2	X	
??.HHW.SYS.PSD	SYS DIFF PRES		X		X				TI ME	5	21 00			2	X	
??.HHW.SYS.PSS	SYS PRES STPT								TI ME	5	21 00			2	X	
??.HHW.HWP#.SS ..	START/ST OP								C O V		20 0	HO UR S			X	
??.HHW.HWP#.RT ..	RUN TIME								TI ME	1 5	10 00				X	X
??.HHW.HWP#.PV O..	VFD OUTPUT								TI ME	5	21 00			2	X	
??.HHW.HWP#.SP D..	SPEED %								TI ME	5	21 00			2	X	



										E T I M E							
??..HHW.HWP#.K W..	PUMP KW									5	21 00	kWh			2	X	X
??..HHW.HWP#.K WH..	PUMP ENERGY									1 5	10 00					X	X
??..HHW.BLR#.ST S..	BLR# STATUS									C O V		20 0				X	
??..HHW.BLR#.AL M..	BLR# ALARM									C O V		20 0				X	
??..HHW.BLR#.PM P.SS.	BLR# PUMP STAT									C O V		20 0				X	

Note 1:

Note 2: Totalize as follows: Run hours to the 0.1 hour; kWh to the integer kWh; BTU/h to the 0.1 MBTU/h

Note 3: Trend data shall be retained in field panel for the sample quantity indicated and backed up to server at a minimum on a daily basis.

Trend Graph Descriptions: Trend graphs shall display 7 days historical trend data. Provide a link on the system or data table graphics.

Graph 1: System Temperatures: scale system BTU on secondary axis

Graph 2: System Operation combine all pumps on one graph.

Graph 3:



Points List – VAV Air Handlers

Unit			Alarm Data						Trend data				Graphic Display		EEMS		
Point ID ?= State, .Facility ID		Cont rol SP	Hi Alar m	SP	Lo w Alar m	SP	Stat us Alar m	Se e Not e				Min. Stora ge Note 3	Totaliz e Note 2	Sys tem Dia gram	Tr en d Gr ap h	Ser ver Poi nts	Tre nd Arc hive
AB.CCCCCCCC	Description								Type	q.							
??AH.AHU#.MODE	AHU MODE								C O V			30 0			1	X	
??AH.AHU#.RAT	RA TEMP								T I M E	5		21 00			1	X	X
??AH.AHU#.RAH	RA HUMIDITY								T I M E	5		21 00				X	
??AH.AHU#.RAE	RA ENTHALPY								T I M E	5		21 00			1	X	
??AH.AHU#.RAC	RA CO2								T I M E	5		21 00			1	X	X
??AH.AHU#.RCF	RA CFM								T I M E	5		21 00			3	X	X
??AH.AHU#.RF.SS	R FAN STATUS								C O V			20 0	HO UR S			X	
??AH.AHU#.RF.VDO	R FAN VFD CNTRL								T I M E	5		21 00			3	X	
??AH.AHU#.RF.SPD	R FAN VFD %								T I M E	5		21 00			3	X	X
??AH.AHU#.RF.KW	R FAN KW								T I M E	5		21 00	KW H		3	X	X
??AH.AHU#.RF.KWH	R FAN ENERGY								T I M E	1 5		10 00				X	X
??AH.AHU#.RF.RT	R FAN RUN TIME								T I M E	1 5		10 00				X	X
??AH.AHU#.RF.AL	R FAN VFD ALARM								C O V			20 0				X	
??AH.AHU#.MAT	MIXED AIR TEMP								T I M E	5		21 00			1,2	X	X
??AH.AHU#.MAS	MIXED AIR STPT								T I M	5		21 00			1	X	X



										E T I M E							
??AH.AHU#.MAD	MIXED AIR DMPR									5	21 00				1	X	X
??AH.AHU#.LTD	LTD									C O V	20 0					X	
??AH.AHU#.FLT. DP	FLTR DIFF PRES		X							T I M E	5	21 00				X	
??AH.AHU#.OAD	OA DMPR									T I M E	5	21 00			1	X	
??AH.AHU#.OAF	OA FLOW									T I M E	5	21 00			1,3	X	X
??AH.AHU#.OAS	OA FLOW STPT									T I M E	5	21 00			1	X	
??AH.AHU#.OAT	OA TEMP									T I M E	5	21 00			1	X	
??AH.AHU#.OAE	OA ENTHALPY									T I M E	5	21 00			1	X	
??AH.AHU#.HCV	HTG COIL VLV									T I M E	5	21 00			2	X	X
??AH.AHU#.CCV	CLG COIL VLV									T I M E	5	21 00			2	X	X
??AH.AHU#.SF.S S	S FAN STATUS									C O V		20 0	HO UR S			X	
??AH.AHU#.SF.V DO	S FAN VFD CNTRL									T I M E	5	21 00			3	X	
??AH.AHU#.SF.S PD	S FAN VFD %									T I M E	5	21 00			3	X	X
??AH.AHU#.SF.K W	S FAN KW									T I M E	5	21 00	KW H		3	X	X
??AH.AHU#.SF.K WH	S FAN ENERGY									T I M E	1 5	10 00				X	X
??AH.AHU#.SF.R T	S FAN RUN TIME									T I M E	1 5	10 00				X	X
??AH.AHU#.SF.A LM	S FAN VFD ALARM									C O V		20 0				X	
??AH.AHU#.SAT	SUP AIR									T I	5	21			2	X	X



	TEMP									M E		00					
??..AH.AHU#.SAS	SUP AIR STPT									T I M E	5	21 00			2	X	X
??..AH.AHU#.SAH	SUP AIR HUMIDT									T I M E	5	21 00				X	
??..AH.AHU#.SAE	SUP AIR ENTH									T I M E	5	21 00				X	
??..AH.AHU#.SCF	SUP AIR CFM									T I M E	5	21 00			3	X	X
??..AH.AHU#.SSP	SUP STATIC PRES									T I M E	5	21 00			3	X	X
??..AH.AHU#.SSS	SUP STATIC STPT									T I M E	5	21 00			3	X	X
??..AH.AHU#.SSA	SUP STATIC ALARM									T I M E	5	21 00				X	
??..AH.AHU#.SDS	SUP DUCT STATIC									C O V		20 0			3	X	
ALTERNATIVE POINTS - RELIEF/EXHAUS T FANS																	
??..AH.AHU#.REF. SS	RLF FN STATUS									C O V		20 0	H O U R S			X	
??..AH.AHU#.REF. VDO	RLF FN VFD CNTRL									T I M E	5	21 00				X	
??..AH.AHU#.REF. SPD	RLF FN VFD %									T I M E	5	21 00				X	X
??..AH.AHU#.REF. KW	RLF FN KW									T I M E	5	21 00				X	X
??..AH.AHU#.REF. KWH	RLF FN ENERGY									T I M E	1 5	10 00				X	X
??..AH.AHU#.REF. RT	RLF FN RUN TIME									T I M E	5	21 00				X	X
??..AH.AHU#.REF. ALM	RLF FN VFD ALRM							X		C O V		20 0				X	
??..AH.AHU#.REF. DMPR	RELIEF DMPR									T I M	5	21 00				X	



									E								

Note 1: AHU modes shall include all specified modes of system operation. (Occupied, Unoccupied, Warm-up, Economizer, etc.)

Note 2: Totalize as follows: Run hours to the 0.1 hour; kWh to the integer kWh;

Note 3: Trend data shall be retained in field panel for the sample quantity indicated and backed up to server at a minimum on a daily basis.

Trend Graph Descriptions: Trend graphs shall display 7 days historical trend data Provide a link on the system or data table graphics.

Graph 1: Mixed Air Operation

Graph 2: System Temperatures/ Valve control

Graph 3: System Airflow/ Power



Points List – Single Zone Air Handlers

Unit			Alarm Data						Trend data				Graphic Display		EEMS	
		Cont rol SP	Hi Alar m		Lo w Alar m	SP	Stat us Alar m	Se e Not e		Fre q.	Min. Stor age Note 3	Totaliz e Note 2	Syst em Dia gram	Tr en d Gr ap h	Ser ver Poi nts	Tren d Arch ive
Point ID ?= State, .Facility ID AB.CCCCCCCC	Description								Type							
?.AH.AHU#.MODE ..	AHU MODE								C O V		30 0				X	
?.AH.AHU#.RAT..	RA TEMP								T I M E	5	21 00			1	X	X
?.AH.AHU#.RAH..	RA HUMIDITY								T I M E	5	21 00				X	
?.AH.AHU#.RAE..	RA ENTHALPY								T I M E	5	21 00			1	X	
?.AH.AHU#.MAT..	MIXED AIR TEMP				X				T I M E	5	21 00			1,2	X	X
?.AH.AHU#.MAS..	MIXED AIR STPT								T I M E	5	21 00			1		X
?.AH.AHU#.MAD..	MIXED AIR DMPR								T I M E	5	21 00			1	X	X
?.AH.AHU#.LTD..	LTD						X		C O V		20 0				X	
?.AH.AHU#.FLT.D P.	FLTR DIFF PRES		X						T I M E	5	21 00			3	X	
?.AH.AHU#.OAD..	OA DMPR								T I M E	5	21 00			1	X	
?.AH.AHU#.OAF..	OA FLOW				X				T I M E	5	21 00			1		X
?.AH.AHU#.OAS..	OA FLOW STPT								T I M E	5	21 00			1	X	
?.AH.AHU#.OAT..	OA TEMP								T I M E	5	21 00			1		X
?.AH.AHU#.OAE..	OA ENTHALPY								T I M E	5	21 00			1	X	
?.AH.AHU#.HCV..	HTG COIL VLV								T I M E	5	21 00			2	X	X



?..AH..AHU#.CCV..	CLG COIL VLV									TI ME	5	21 00				2	X		X
?..AH..AHU#.SF.SS.	S FAN STATUS									C O V		20 0	HO UR S				X		
?..AH..AHU#.SF.VD O.	S FAN VFD CNTRL									TI ME	5	21 00				3	X		
?..AH..AHU#.SF.SP D.	S FAN VFD %									TI ME	5	21 00				3	X		X
?..AH..AHU#.SF.KW .	S FAN KW									TI ME	5	21 00	KW H			3	X		X
?..AH..AHU#.SF.KW H.	S FAN ENERGY									TI ME	1 5	10 00					X		X
?..AH..AHU#.SF.RT.	S FAN RUN TIME									TI ME	1 5	10 00					X		X
?..AH..AHU#.SF.AL M.	S FAN VFD ALARM							X		C O V		20 0					X		
?..AH..AHU#.SAT..	SUP AIR TEMP									TI ME	5	21 00				2	X		X
?..AH..AHU#.SAS..	SUP AIR STPT									TI ME	5	21 00				2	X		X
?..AH..AHU#.SAH..	SUP AIR HUMIDT									TI ME	5	21 00					X		
?..AH..AHU#.SAE..	SUP AIR ENTH									TI ME	5	21 00					X		
?..AH..AHU#.RMT..	ROOM TEMP									TI ME	5	21 00					X		X
?..AH..AHU#.RMCS. .	ROOM CLG STPT					X				TI ME	5	21 00				2	X		X
?..AH..AHU#.RMHS. .	ROOM HTG STPT		X							TI ME	5	21 00				2	X		X
?..AH..AHU#.RMH..	ROOM HUMIDITY									TI ME	5	21 00					X		
?..AH..AHU#.RMC..	ROOM CO2		X							TI ME	5	21 00				1	X		X
.....																			
ALTERNATIVE																			



POINTS - RELIEF/EXHAUST FANS.....																
?..AH.AHU#.REF.S S.	RLF FN STATUS								C O V		20 0	HO UR S				X
?..AH.AHU#.REF.V DO.	RLF FN VFD CNTRL								T I M E	5	21 00			3		X
?..AH.AHU#.REF.S PD.	RLF FN VFD %								T I M E	5	21 00			3		X
?..AH.AHU#.REF.K W.	RLF FN KW								T I M E	5	21 00	KW H		3		X
?..AH.AHU#.REF.K WH.	RLF FN ENERGY								T I M E	1 5	10 0					X
?..AH.AHU#.REF.R T.	RLF FN RUN TIME								T I M E	1	10 0					X
?..AH.AHU#.REF.A LM.	RLF FN VFD ALRM								C O V		20 0					X
?..AH.AHU#.REF.D MPR.	RELIEF DMPR								T I M E	5	21 00					X

Note 1: System modes and status shall include all specified modes of system operation. (Cool, Heat, Auto, Off) (Cool, Heat, Off))

Note 2: Totalize as follows: Run hours to the 0.1 hour; kWh to the integer kWh;

Note 3: Trend data shall be retained in field panel for the sample quantity indicated and backed up to server at a minimum on a daily basis.

Trend Graph Descriptions: Trend graphs shall display 7 days historical trend data Provide a link on the system or data table graphics.

Graph 1: Mixed Air Operation

Graph 2: System Temperatures

Graph 3: System Power/Flows



Points List – Lighting Control Systems

Unit			Alarm Data						Trend data				Graphic Display		EEMS	
			Cont rol SP	Hi Alar m	SP	Lo w Alar m	SP	Stat us Alar m	Se e Not e			Min. Stor age Note 3	Totaliz e Note 2	Syst em Dia gram	Tr en d Gr aph	Ser ver Poi nts
Point ID ?= State, .Facility ID AB.CCCCCCCC	Description															
??.LTG.WRM.SYS. KW.	SYS DEMAND		X						TI M E	5	21 00	KW H		1,3	X	X
??.LTG.WRM.SYS. KWH.	SYS CONSUMP TION								TI M E	1 5	10 00				X	X
??.LTG.WRM.SYS. SLD.	SYS SHEDDABL E								TI M E	5	21 00			1	X	
??.LTG.WRM.SYS. SKW.	SYS SHED KW								TI M E	5	21 00			1	X	X
??.LTG.WRM.SYS. SCMD.	SYS SHED CMD								TI M E	5	21 00			1,3	X	X
??.LTG.WRM.Zn#. STAT.	ZN# STATUS								TI M E	5	21 00				X	
??.LTG.WRM.Zn#. KW.	ZN# DEMAND								TI M E	5	21 00	KW H		2,3	X	X
??.LTG.WRM.Zn#. KWH.	ZN# CONSUMP TION								TI M E	1 5	10 00			2	X	X
??.LTG.WRM.Zn#. SLD.	ZN# SHEDDABL E								TI M E	5	21 00			2	X	
??.LTG.WRM.Zn#. SKW.	ZN# SHED KW								TI M E	5	21 00			2	X	
??.LTG.WRM.Zn#. SCMD.	ZN# SHED CMD								TI M E	5	21 00			2	X	
														2	X	

Note 1: Repeat the zone points for the number of zones in the systems.

Note 2: Totalize as follows: Run hours to the 0.1 hour; kWh to the integer kWh;

Note 3: Trend data shall be retained in field panel for the sample quantity indicated and backed up to server at a minimum on a daily basis.



Trend Graph Descriptions: Trend graphs shall display 7 days historical trend data. Provide a link on the system or data table graphics.

Graph 1: System Operation Trends

Graph 2: Zone Operation Trends

Graph 3: Demand Graph: maximum 10 trends per graph; scale to make zone kW readable. Repeat system kW on each graph secondary axis.

USPS Mail Processing Facility Specification issued: 5/1/2014

Last revised: 04/16/2014

END OF SECTION



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Task	Specification	Specification Description
26 01 20 00	26 05 19 13	Electrical Renovation



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SECTION 26 05 00 00 - MPF COMMON WORK RESULTS FOR ELECTRICAL

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Basic electrical methods.
 - 2. Grounding and bonding.
 - 3. Hangers and supports.
 - 4. Electrical identification.
 - 5. Motor starters, controls, and connections to mechanical equipment.
 - 6. Electrical system testing and inspection.
- B. Related Documents: The contract documents, as defined in Section 011000 – Summary of Work, apply to the work of this section. Additional requirements and information necessary to complete the work of this section may be found in other documents.
- C. Related Sections:
 - 1. Section 078400 - Firestopping
 - 2. Section 220500 - Common Work Results for Plumbing
 - 3. Section 230915 - Variable Frequency Motor Controllers
 - 4. Section 251104 - Metering Devices
 - 5. Section 255104 - EMS Integration
 - 6. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.
 - 7. Section 260533 - Raceway and Boxes for Electrical Systems
 - 8. Section 260623 - Lighting Control Devices
 - 9. Section 261414 – Infrared Viewing Panes (IR Windows)
 - 10. Section 262200 - Low Voltage Transformers
 - 11. Section 262413 - Switchboards
 - 12. Section 262416 - Panelboards
 - 13. Section 262726 - Wiring Devices
 - 14. Section 262816 - Enclosed Switches and Circuit Breakers
 - 15. Section 264113 - Lightning Protection for Structures
 - 16. Section 264128 - Surge Protective Devices (SPD's)
 - 17. Section 265100 - Interior Lighting
 - 18. Section 265600 - Exterior Lighting
 - 19. Section 270500 - Common Work Results for Communications
 - 20. Section 275123 - Intercommunication and Program Systems
 - 21. Section 275116 - Public Address Paging Systems
 - 22. Section 275117 - Video Intercom and Exterior Gate Control System
 - 23. Section 275313 - Wireless, Synchronized, GPS Clock System
 - 24. Section 281304 - Enterprise Physical Access Control System (ePACS)



- 25. Section 281600 - Intrusion Detection System
- 26. [Section 282304 - Security, Burglary and Robbery Countermeasures Analog CCTV System]
- 27. [Section 282305 - Integrated Security and Investigative Platform (ISIP) CCTV System]
- 28. Section 283100 - Fire Detection and Alarm
- 29. Section 337173 - Electrical Utility Services

1.2 REFERENCES

- A. National Electrical Contractors Association (NECA):
 - 1. NECA SI - Standard of Installation.
- B. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA KS 1 - Enclosed Switches.
- C. National Electrical Testing Association (NETA):
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- D. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data:
 - a. Grounding electrodes and connections.
 - b. Starter electrical characteristics and connection requirements.
 - 2. Assurance/Control Submittals:
 - a. Electrical System Test Reports: Submit report including the following directly to Contracting Officer from Testing Laboratory, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements.
 - 1) Summary of project.
 - 2) Description of equipment tested.
 - 3) Description of test.
 - 4) Test results.
 - 5) Conclusions and recommendations.
 - 6) Appendix, including appropriate test forms.
 - 7) List of test equipment used and calibration date.
 - 8) Signature of responsible Testing Laboratory Officer.
 - b. Certificates: Manufacturer's certificate that each Product specified meet or exceed specified requirements.
 - c. Qualification Documentation: Submit documentation of experience indication compliance with specified qualification requirements.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Project Record Documents: Accurately record the following.
 - a. Locations of components and grounding electrodes.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing Work of this Section with minimum 5 years documented experience.



- B. Regulatory Requirements:
1. Products: Listed and classified by Underwriters Laboratories, Incorporated as suitable for the purpose specified and indicated.
 2. Work herein shall conform to all applicable laws, ordinances and regulations in accordance with the latest applicable requirements of:
 - a. National Electrical Manufacturer's Associates.
 - b. Standards of National Fire Protection Association (NFPA 72, 90A and 101).
 - c. Underwriter's Laboratories.
 - d. Occupational Safety and Health Agency Standards.
 - e. Illuminating Engineering Society Handbook.
 - f. The International Existing Building Code.
 - g. The International Electrical Code.
 - h. ASHRAE Standard 90.1 – 2010.
 - i. The International Energy Conservation Code.

1.5 BASIC ELECTRICAL METHODS

- A. Drawings are schematic and diagrammatic. Use judgment and care to install electrical Work to function properly and fit within building construction and finishes. Electrical conductors, conduit, components, not shown or specified, which are required for any device or system to produce a complete and operative system are required to be furnished and installed.
- B. Exact location of outlets are determined from dimension on Drawings, manufacturer's shop drawings, or as may be determined at Project Site. Do not scale Drawings for exact location of any item. Verify item mounting heights as required by project conditions prior to rough-in.
- C. Route conduits and wiring associated with new equipment and systems above ceilings, in existing chases, and concealed within building structure.
- D. Surface mounted raceways or conduit permitted only at locations indicated on Drawings.
- E. Circuit grouping, conduit or cable runs and home runs are indicated with number of conductors shown in each raceway to clarify operation and function of various systems. Provide proper number of conductors and conduits or cables to provide operative system as indicated on Contract Documents. Do not regroup any feeder circuits, branch circuits, home runs, and zone alarms at any point, from that shown on Contract Documents. Each conduit run shall contain no more than (6) current carrying conductors.
- F. Branch and home run circuits are indicated as 2, 3, or 4 wire circuits unless otherwise noted. Do not connect two ungrounded conductors to same circuit breaker/fused switch in any panel. Circuit runs consist of a maximum of five conductors; 3 phase conductors, 1 neutral conductor, and 1 equipment ground conductor, unless otherwise noted. Do not splice branch circuit conductors in any panels, safety switches, or circuit breakers in separate enclosures.
- G. The sharing of neutral conductors for multiwire branch circuits is prohibited. All branch circuits shall contain individual neutrals.
- H. Proposed equipment, switches or devices, shown mounted on and/or adjacent to equipment, which if installed, would impair proper operation of existing or new equipment, shall be removed and relocated by Contractor as required so equipment will function properly. Notify Contracting Officer immediately if any such condition exists.
- I. Seal and make permanently watertight penetrations by electrical raceways or equipment through ceilings, walls or floors.
 1. Seal penetrations in non-fire rated ceilings, walls or floors material specified in Section 079200 – Joint Sealants.



2. Seal penetrations in fire rated walls with material specified in Section 078400 - Firestopping.

J. Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A, and NFPA 70.

K. Install equipment and materials to provide required maintenance and code working clearance for servicing and maintenance. Coordinate final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow required space for removal of parts that require replacement or servicing.

NOTE TO SPECIFIER

Include paragraph 1.5L. below for Projects within existing buildings.

L. Remove existing equipment, lighting fixtures, switches, and receptacles as required to facilitate proposed installation and as specified in Section 024119 - Selective Structure Demolition. Remove existing wiring and conduit serving items to be removed. Conduit in inaccessible areas shall be cut off below finished surfaces and existing surface patched to match existing. Provide blank plates on existing flush mounted outlet boxes that will be abandoned. Remove all abandoned conductors from raceways.

NOTE TO SPECIFIER

Include paragraph 1.5M. below for facilities LEASED FROM LANDLORD.

M. Refer to section 015000 – Temporary Facilities & Controls for special requirements relating to facilities leased by USPS.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING

A. Grounding System Resistance: Five ohm.

B. Rod Electrodes:

1. Material: Copper.
2. Diameter: 3/4 inch.
3. Length: 10 feet.

C. [Active Electrodes]:

1. [Description: Metallic-salt-filled copper-tube electrode].
2. [Shape: As required to pass test].
3. [Length: As required to pass test].
4. [Connector: U-bolt pressure plate].

D. Mechanical Connectors: Bronze.

E. Electrode Conductor:

1. Material: Bare stranded copper.
2. [Foundation Electrodes: [2/0] [2] [_____] AWG].
3. [Grounding Electrode Conductor: Size to meet NFPA 70 requirements].



- F. [Grounding Well Components]:
 - 1. [Well Pipe: 8 inch NPS by 24 inch long clay tile concrete pipe with belled end].
 - 2. [Well Cover: Cast iron with legend "GROUND" embossed on cover.]

2.2 HANGERS AND SUPPORTS

- A. Product Requirements: Furnish and install approved materials, sizes, and types of anchors, fasteners, and supports to carry loads of equipment and conduit, including weight of wire in conduit plus 300 pounds.
- B. Materials and Finishes: Corrosion resistive.
- C. Anchors and Fasteners:
 - 1. Steel Structural Elements: Beam clamps and welded fasteners.
 - 2. Concrete Surfaces: Self-drilling anchors and expansion anchors.
 - 3. Hollow Masonry, Plaster, and Gypsum Board Partitions: Toggle bolts and hollow wall fasteners.
 - 4. Solid Masonry Walls: Expansion anchors.
 - 5. Sheet Metal: Sheet metal screws.
 - 6. Wood: Wood screws.

2.3 ELECTRICAL IDENTIFICATION

- A. Nameplates:
 - 1. Engraved three-layer laminated phenolic plastic, white letters on black background.
 - 2. Locations:
 - a. Each electrical distribution and control equipment enclosure.
 - b. Communication cabinets.
 - c. Terminal Cabinets.
 - d. Individual motor starter.
 - e. Separately enclosed circuit breakers.
 - f. Panelboards
 - g. Transformers.
 - h. Pull boxes.
 - i. Lighting contactor/control panel enclosure.
 - j. Relays.
 - k. Switches and disconnects.
 - 3. Letter Size:
 - a. Use 1/8 inch letters for identifying individual equipment and loads.
 - b. Use 1/4 inch letters for identifying grouped equipment and loads.
- B. Wire and Cable Markers:
 - 1. Description: Cloth tape or tubing type wire markers.
 - 2. Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.
 - 3. Identification:
 - a. Power and Lighting Circuits: Branch circuit or feeder number indicated on Drawings.
 - b. Control Circuits: Control wire number indicated on schematic and interconnection diagrams on Drawings.
 - c. Communications Cable: Per section 270500.
- C. Conduit Markers:
 - 1. Underground conduit routings shall be marked utilizing magnetic marker tape set atop of the entire conduit run.
 - a. Underground-Type Plastic Line Marker: Manufacturer's standard detectable permanent, bright colored, continuous-printed plastic tape, intended for direct-burial service; not less



than 6 inches wide by 4 mils thick. Provide tape with printing which most accurately indicates type of service of buried cable. Locate tape 12 inches above top of conduit.

- D. Arc Flash warning Signs: Furnish signs in accordance with NEC Article 110.16, warning of potential arc flash hazard and requiring suitable Personal protective equipment. Locate and install signs per INSTALLATION Section of this specification.

2.4 MOTOR STARTERS, CONTROLS, AND CONNECTIONS TO MECHANICAL EQUIPMENT

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Allen-Bradley Company, Milwaukee, WI (414) 382-2000.
 2. Cutler-Hammer Eaton Corp, Milwaukee, WI (800) 833-3927.
 3. Square D Company, Palatine, IL (847) 397-2600.
 4. General Electric Company, Plainville, CT (860) 747-7111.
 5. Siemens Energy and Automation, Alpharetta, GA (800) 964-4114.
 6. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Motor Starters
1. Provide manual, single phase, 120/277V, toggle type, motor rated switches with thermal overload element (sized at 115 percent of full load current) for fractional horsepower motors not requiring automatic control interfaces..
 2. Provide across-the-line, AC magnetic motor starters in applications where controls other than manual on and off are involved. Motor starters shall be UL labeled. Provide starters with the following features:
 - a. Rating for the voltage and current imposed.
 - b. Enclosure for the application usage: NEMA 1 for dry, indoors, NEMA 3R for outdoors, etc.
 - c. Control circuit voltage and amperage to match coil voltage and ratings of control apparatus.
 - d. Control transformers with primary and secondary fusing for control circuits, as required.
 - e. Overload elements for every conductor leg above ground. Elements are to be "thermal alloy" type, resettable and properly sized to motor nameplate rating. Elements located near boilers, heat strips, duct heaters or other heat sources or where heating by conduction or radiation can occur, shall be ambient temperature compensated types.
 - f. Adjustable phase loss/phase reversal protection (0-15 seconds), factory set at 7 seconds and a minimum of two field convertible auxiliary contacts.
 - g. Cover-mounted control switch is to be a "start-stop" or "hand-off-auto" type with "running" and "auto" pilot lights, as required by the control sequence. A suitable reset device for manually resetting overcurrent trip shall be provided.
 3. Starters for motors 10 hp or less shall be connected to automatically return the motor to service after a power interruption. Starters for motors over 10 hp shall be equipped with time delay relays so that after a power resumption and after a preset delay of 0-30 seconds, the motor shall automatically be returned to service.
 4. Combination magnetic motor starter/fused disconnect unit shall be utilized wherever possible.
- C. Furnish and Install the Following:
1. Conduit, wiring and electrical connections to motors, safety switches, starters, relays, electrical interlock circuits, valves, unit heaters, fan coil units, air handling units, and other similar equipment, required for complete and ready for operation. Coordinate with and review other sections of the specifications describing electrical equipment in order to fully understand the wiring requirements.



2. Starters as indicated on Drawings except factory provided starters such as those physically mounted on the unit or any piece of equipment where starter is furnished as an integral part of the equipment.
 3. Electrical line voltage control components and installation as specified in Division 26 Sections.
 4. Furnish and install low voltage (below 50 volts) control wiring as indicated on Drawings using metallic conduit and No. 12 type THHN wire, minimum.
 5. [Thermostat and special wire other than building wire].
- D. Refer to Drawings for quantity and size of motor starters.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION - GROUNDING AND BONDING

- A. Install rod electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.
- B. Provide grounding well pipe with cover at [each rod location] [rod locations where indicated]. Install well pipe top flush with finished grade or surface.
- C. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing, building steel above grade and metallic cold water pipe.
- D. Provide bonding and grounding in conformance with NFPA 70.
- E. Equipment Grounding Conductor: Provide separate, insulated conductor within all lighting and power raceways. Terminate each end on suitable lug, bus, or bushing.
- F. Testing and Inspection:
 1. Inspect and test in accordance with NETA ATS, where applicable.
 2. Perform inspections and tests listed in NETA ATS, Section 7.13.
 3. Test ground resistance of system with ground resistance tester. The resistance of the grounding system shall not exceed 5 ohms. Where tests show resistance-to-ground is over 5 ohms, take appropriate action to reduce resistance to 5 ohms, or less, but driving additional ground rods; then retest to demonstrate compliance. Install rods at least 8 feet apart.
 4. Method for testing individual ground rods and overall grounding system shall be accomplished by the three point method per military handbook 419. Test probes shall be placed minimum of 30 feet and 60 feet from rod being tested. Furnish written report of all test results for all ground rods.



3.3 INSTALLATION - HANGERS AND SUPPORTS

- A. Install products in accordance with manufacturer's published instructions.
- B. Furnish and install anchors, fasteners, and supports in accordance with NECA SI.
- C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- D. Do not use spring steel clips and clamps.
- E. Do not use powder-actuated anchors.
- F. Obtain permission from structural engineer before drilling or cutting structural members.
- G. Fabricate supports from structural steel angle or structural steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- H. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- I. In wet and damp locations use structural steel channel supports to stand cabinets and panelboards one inch off wall.
- J. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

3.4 INSTALLATION - ELECTRICAL IDENTIFICATION

- A. Install nameplate parallel to equipment lines.
- B. Secure nameplate to equipment front using stainless steel screws. Use minimum two screws at each end of nameplate.
- C. Secure nameplate to outside surface of door on panelboards and switchboards.
- D. Install Arc Flash Warning Signs on switchboards, paperboards, control panels, meter socked enclosures, and motor control centers likely to require examination, adjustment, servicing, or maintenance while energized. Locate sign so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

3.5 INSTALLATION – MOTOR STARTERS, CONTROLS, AND CONNECTIONS TO MECHANICAL EQUIPMENT

- A. Verify and check equipment manufacturer's nameplate and installation instructions to obtain exact location of outlets for equipment before installation.
- B. Wire and connect line voltage controls in accordance with approved wiring diagrams. Provide line voltage interlock and control wiring as indicated on Drawings using conduit and No. 12 type THHN wire.

3.6 FIELD QUALITY CONTROL - ELECTRICAL TESTING AND INSPECTION

- A. Section 014000 - Quality Requirements: Field testing and inspection.



- B. Section 260800 - Commissioning of Electrical Systems: Requirements related to Division 26 Commissioning
- C. Conduct testing to Determine that Electrical Equipment and Systems:
 - 1. Are in conformance with Contract Documents and applicable reference standards.
 - 2. Is properly installed without damage due either to installation or shipment.
 - 3. Operate correctly, meet design intent, and are performing at optimum level, in safe manner.
- D. Provide a complete written record of operational values to be used as a baseline for future operational testing.
- E. Instrumentation:
 - 1. Provide calibration program that assures applicable test instrumentation is maintained within rated accuracy and directly traceable to National Bureau of Standards.
 - 2. Calibrate instruments in accordance with following frequency schedule:
 - a. Field Instruments:
 - 1) Analog - 6 months maximum.
 - 2) Digital - 12 months maximum.
 - b. Leased Specialty Equipment: 12 months. (Where accuracy is guaranteed by lessor.)
 - 3. Dated Calibration Labels: Visible on test equipment.
 - 4. Keep records current; Show date and result of instruments calibrated or tested.
 - 5. Maintain current instrument calibration instruction and procedure for each test instrument.
 - 6. Calibrating Standard: Higher accuracy than that of instrument being calibrated.
- F. Regulatory Requirements:
 - 1. Safety Practices: Include, but not limited to, the following requirements:
 - a. Occupational Safety and Health Act of 1970 - OSHA.
 - b. Accident Prevention Manual for Industrial Operations, Seventh Edition, National Safety Council, Chapter 4.
 - c. Applicable State and Local Safety Operating Procedures.
 - d. NETA Safety/Accident Prevention Program.
 - e. United States Postal Service Safety Practices.
 - f. NFPA 70E - Electrical Safety Requirements for Employee Workplace.
 - g. American National Standards for Personnel Protection, ANSI Z244.1.
 - 2. Perform tests with apparatus de-energized except where otherwise specifically required herein.
 - 3. Testing Laboratory: Provide a designated safety representative present at Project Site and supervise safety operations.
 - 4. Power Circuits: Conductors shorted to ground by a hot line grounded device approved for the purpose.
 - 5. Do not proceed until safety representative has determined that it is safe to do so.
 - 6. Testing Laboratory: Provide sufficient protective barriers and warning signs to conduct specified tests safely.
- G. Tests and inspections include, but are not limited to the following:
 - 1. Proper operation of lights and equipment.
 - 2. Continuity of raceway system.
 - 3. Insulation leakage and impedances.
 - 4. Ground system resistance.
 - 5. Elimination of reverse rotation and single-phasing of motors.
 - 6. Sub-system tests indicated in other Sections.
 - 7. Proper operation of communications systems specified in Section 270500.
 - 8. Proper operation of intrusion detection systems specified in Section 281600.
 - 9. Proper operation of video surveillance system specified in [Section 282304][Section 282305].
 - 10. Proper operation of fire alarm system specified in Section 283100.
- H. Load balance all electrical phases, at device, panels, and switchboards.



- I. Perform electrical system testing and inspection as specified in each related Section and as specified in this Section.

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END OF SECTION 26 05 00 00



SECTION 26 05 00 00 - CSF COMMON WORK RESULTS FOR ELECTRICAL

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this Outline Specification Section for Customer Service Facilities only. This Specification defines "level of quality" for Customer Service Facility construction and is intended as a guide to the Architect/Engineer preparing the Construction Documents.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Basic electrical methods.
 - 2. Grounding and bonding.
 - 3. Hangers and supports.
 - 4. Electrical identification.
 - 5. Motor Starters, controls, and connections to mechanical equipment.
 - 6. Electrical system testing and inspection.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 019113 - General Commissioning Requirements
 - 2. Section 078400 - Firestopping
 - 3. Section 220500 - Common Work Results for Plumbing
 - 4. Section 230500 - Common Work Results for HVAC
 - 5. Section 230915 - Variable Frequency Motor Controllers
 - 6. Section 251104 - Metering Devices
 - 7. Section 251304 - EMS Communication to Remote Enterprise Server
 - 8. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.
 - 9. Section 260533 - Raceway and Boxes for Electrical Systems
 - 10. Section 260623 - Lighting Control Devices
 - 11. Section 260800 - Commissioning of Electrical Systems
 - 12. Section 262200 - Low Voltage Transformers
 - 13. Section 262413 - Switchboards

14. Section 262416 - Panelboards
15. Section 262726 - Wiring Devices
16. Section 262816 - Enclosed Switches and Circuit Breakers
17. Section 264113 - Lightning Protection for Structures
18. Section 264128 - Surge Protective Devices (SPD's)
19. Section 265100 - Interior Lighting
20. Section 265600 - Exterior Lighting
21. Section 270500 - Common Work Results for Communications
22. Section 275123 - Intercommunication and Program Systems
23. **Section 275116 - Public Address Paging Systems**
24. Section 281600 - Intrusion Detection
25. [\[Section 282304 - Security, Burglary and Robbery Countermeasures Analog CCTV System\]](#)
26. [\[Section 282305 - Integrated Security and Investigative Platform \(ISIP\) CCTV System\]](#)
27. Section 283100 - Fire Detection and Alarm
28. Section 337173 - Electrical Utility Services

1.2 REFERENCES

- A. National Electrical Contractors Association (NECA):
 1. NECA SI - Standard of Installation.
- B. National Electrical Manufacturers Association (NEMA):
 1. NEMA KS 1 - Enclosed Switches.
- C. National Electrical Testing Association (NETA):
 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- D. National Fire Protection Association (NFPA):
 1. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 1. Product Data:
 - a. Grounding electrodes and connections.
 - b. Starter electrical characteristics and connection requirements.
 2. Assurance/Control Submittals:
 - a. Electrical System Test Reports: Submit report including the following directly to Contracting Officer from Testing Laboratory, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements.
 - 1) Summary of project.
 - 2) Description of equipment tested.
 - 3) Description of test.
 - 4) Test results.
 - 5) Conclusions and recommendations.
 - 6) Appendix, including appropriate test forms.
 - 7) List of test equipment used and calibration date.
 - 8) Signature of responsible Testing Laboratory Officer.
 - b. Certificates: Manufacturer's certificate that each Product specified meet or exceed specified requirements.
 - c. Qualification Documentation: Submit documentation of experience indication compliance with specified qualification requirements.



- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Project Record Documents: Accurately record the following.
 - a. Locations of components and grounding electrodes.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing Work of this Section with minimum 5 years documented experience.
- B. Regulatory Requirements:
 - 1. Products: Listed and classified by Underwriters Laboratories, Incorporated as suitable for the purpose specified and indicated.
 - 2. Work herein shall conform to all applicable laws, ordinances and regulations in accordance with the latest applicable requirements of:
 - a. National Electrical Manufacturer's Associates.
 - b. Standards of National Fire Protection Association (NFPA 72, 90A and 101).
 - c. Underwriter's Laboratories.
 - d. Occupational Safety and Health Agency Standards.
 - e. Illuminating Engineering Society Handbook.
 - f. The International Existing Building Code.
 - g. The International Electrical Code.
 - h. ASHRAE Standard 90.1 – 2010.
 - i. The International Energy Conservation Code.

1.5 BASIC ELECTRICAL METHODS

- A. Drawings are schematic and diagrammatic. Use judgment and care to install electrical Work to function properly and fit within building construction and finishes. Electrical conductors, conduit, components, not shown or specified, which are required for any device or system to produce a complete and operative system are required to be furnished and installed.
- B. Exact location of outlets are determined from dimension on Drawings, manufacturer's shop drawings, or as may be determined at Project Site. Do not scale Drawings for exact location of any item. Verify item mounting heights as required by project conditions prior to rough-in.
- C. Route conduits and wiring associated with new equipment and systems above ceilings, in existing chases, and concealed within building structure.
- D. Surface mounted raceways or conduit permitted only at locations indicated on Drawings.
- E. Circuit grouping, conduit or cable runs and home runs are indicated with number of conductors shown in each raceway to clarify operation and function of various systems. Provide proper number of conductors and conduits or cables to provide operative system as indicated on Contract Documents. Do not regroup any feeder circuits, branch circuits, home runs, and zone alarms at any point, from that shown on Contract Documents. Each conduit run shall contain no more than (6) current carrying conductors.
- F. Branch and home run circuits are indicated as 2, 3, or 4 wire circuits unless otherwise noted. Do not connect two ungrounded conductors to same circuit breaker/fused switch in any panel. Circuit runs consist of a maximum of five conductors; 3 phase conductors, 1 neutral conductor, and 1 equipment ground conductor, unless otherwise noted. Do not splice branch circuit conductors in any panels, safety switches, or circuit breakers in separate enclosures.
- G. The sharing of neutral conductors for multiwire branch circuits is prohibited. All branch circuits shall contain individual neutrals.



- H. Proposed equipment, switches or devices, shown mounted on and/or adjacent to equipment, which if installed, would impair proper operation of existing or new equipment, shall be removed and relocated by Contractor as required so equipment will function properly. Notify Contracting Officer immediately if any such condition exists.
- I. Seal and make permanently watertight penetrations by electrical raceways or equipment through ceilings, walls or floors.
 - 1. Seal penetrations in non-fire rated ceilings, walls or floors material specified in Section 079200 – Joint Sealants.
 - 2. Seal penetrations in fire rated walls with material specified in Section 078400 - Firestopping.
- J. Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A, and NFPA 70.
- K. Install equipment and materials to provide required maintenance and code working clearance for servicing and maintenance. Coordinate final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow required space for removal of parts that require replacement or servicing.

NOTE TO SPECIFIER

Include paragraph 1.5L. below for Projects within existing buildings.

- L. Remove existing equipment, lighting fixtures, switches, and receptacles as required to facilitate proposed installation and as specified in Section 024119 - Selective Structure Demolition. Remove existing wiring and conduit serving items to be removed. Conduit in inaccessible areas shall be cut off below finished surfaces and existing surface patched to match existing. Provide blank plates on existing flush mounted outlet boxes that will be abandoned. Remove all abandoned conductors from raceways.

NOTE TO SPECIFIER

Include paragraph 1.5M. below for facilities LEASED FROM LANDLORD.

- M. Refer to section 015000 – Temporary Facilities & Controls for special requirements relating to facilities leased by USPS.

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 - 1. [\[Description: Metallic-salt-filled copper-tube electrode\]](#).
 - 2. [\[Shape: As required to pass test\]](#).



3. [Length: As required to pass test].
 4. [Connector: U-bolt pressure plate].
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- E. Electrode Conductor:
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- C. Anchors and Fasteners:
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- b. Control Circuits: Control wire number indicated on schematic and interconnection diagrams on Drawings.
- c. Communications Cable: Per section 270500.

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- 2. Cutler-Hammer Eaton Corp, Milwaukee, WI (800) 833-3927.
- 3. Square D Company, Palatine, IL (847) 397-2600.
- 4. General Electric Company, Plainville, CT (860) 747-7111.
- 5. Siemens Energy and Automation, Alpharetta, GA (800) 964-4114.
- 6. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

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- 2. Provide across-the-line, AC magnetic motor starters in applications where controls other than manual on and off are involved. Motor starters shall be UL labeled. Provide starters with the following features:
 - a. Rating for the voltage and current imposed.
 - b. Enclosure for the application usage: NEMA 1 for dry, indoors, NEMA 3R for outdoors, etc.
 - c. Control circuit voltage and amperage to match coil voltage and ratings of control apparatus.
 - d. Control transformers with primary and secondary fusing for control circuits, as required.
 - e. Overload elements for every conductor leg above ground. Elements are to be "thermal alloy" type, resettable and properly sized to motor nameplate rating. Elements located near boilers, heat strips, duct heaters or other heat sources or where heating by conduction or radiation can occur, shall be ambient temperature compensated types.
 - f. Adjustable phase loss/phase reversal protection (0-15 seconds), factory set at 7 seconds and a minimum of two field convertible auxiliary contacts.
 - g. Cover-mounted control switch is to be a "start-stop" or "hand-off-auto" type with "running" and "auto" pilot lights, as required by the control sequence. A suitable reset device for manually resetting overcurrent trip shall be provided.
- 3. Magnetic starters for motors 10 hp or less shall be connected to automatically return the motor to service after a power interruption. Starters for motors over 10 hp shall be equipped with time delay relays so that after a power resumption and after a preset delay of 0-30 seconds, the motor shall automatically be returned to service.
- 4. Combination magnetic motor starter/fused disconnect unit shall be utilized wherever possible.



- C. Furnish and Install the Following:
 - 1. Conduit, wiring and electrical connections to motors, safety switches, starters, relays, electrical interlock circuits, valves, unit heaters, fan coil units, air handling units, and other similar equipment, required for complete and ready for operation. Coordinate with and review other sections of the specifications describing electrical equipment in order to fully understand the wiring requirements.
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 - 3. Electrical line voltage control components and installation as specified in Division 26 Sections.
 - 4. Furnish and install low voltage (below 50 volts) control wiring as indicated on Drawings using metallic conduit and No. 12 type THHN wire, minimum.
 - 5. [\[Thermostat and special wire other than building wire\]](#).
- D. Refer to Drawings for quantity and size of motor starters.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION - GROUNDING AND BONDING

- A. Install rod electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.
- B. Provide grounding well pipe with cover at [\[each rod location\]](#) [\[rod locations where indicated\]](#). Install well pipe top flush with finished grade or surface.
- C. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing, building steel above grade and metallic cold water pipe.
- D. Provide bonding and grounding in conformance with NFPA 70.
- E. Equipment Grounding Conductor: Provide separate, insulated conductor within all lighting and power raceways. Terminate each end on suitable lug, bus, or bushing.
- F. Testing and Inspection:
 - 1. Inspect and test in accordance with NETA ATS, where applicable.
 - 2. Perform inspections and tests listed in NETA ATS, Section 7.13.

3. Test ground resistance of system with ground resistance tester. The resistance of the grounding system shall not exceed 5 ohms. Where tests show resistance-to-ground is over 5 ohms, take appropriate action to reduce resistance to 5 ohms, or less, but driving additional ground rods; then retest to demonstrate compliance. Install rods at least 8 feet apart.
4. Method for testing individual ground rods and overall grounding system shall be accomplished by the three point method per military handbook 419. Test probes shall be placed minimum of 30 feet and 60 feet from rod being tested. Furnish written report of all test results for all ground rods.

3.3 INSTALLATION - HANGERS AND SUPPORTS

- A. Install products in accordance with manufacturer's published instructions.
- B. Furnish and install anchors, fasteners, and supports in accordance with NECA SI.
- C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- D. Do not use spring steel clips and clamps.
- E. Do not use powder-actuated anchors.
- F. Obtain permission from structural engineer before drilling or cutting structural members.
- G. Fabricate supports from structural steel angle or structural steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- H. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- I. In wet and damp locations use structural steel channel supports to stand cabinets and panelboards one inch off wall.
- J. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

3.4 INSTALLATION - ELECTRICAL IDENTIFICATION

- A. Install nameplate parallel to equipment lines.
- B. Secure nameplate to equipment front using stainless steel screws. Use minimum two screws at each end of nameplate.
- C. Secure nameplate to outside surface of door on panelboards and switchboards.
- D. Install Arc Flash Warning Signs on switchboards, paperboards, control panels, meter socked enclosures, and motor control centers likely to require examination, adjustment, servicing, or maintenance while energized. Locate sign so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

3.5 INSTALLATION – MOTOR STARTERS, CONTROLS, AND CONNECTIONS TO MECHANICAL EQUIPMENT



- A. Verify and check equipment manufacturer's nameplate and installation instructions to obtain exact location of outlets for equipment before installation.
- B. Wire and connect line voltage controls in accordance with approved wiring diagrams. Provide line voltage interlock and control wiring as indicated on Drawings using conduit and No. 12 type THHN wire.

3.6 FIELD QUALITY CONTROL - ELECTRICAL TESTING AND INSPECTION

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Section 260800 - Commissioning of Electrical Systems: Requirements related to Division 26 Commissioning
- C. Conduct testing to Determine that Electrical Equipment and Systems:
 - 1. Are in conformance with Contract Documents and applicable reference standards.
 - 2. Is properly installed without damage due either to installation or shipment.
 - 3. Operate correctly, meet design intent, and are performing at optimum level, in safe manner.
- D. Provide a complete written record of operational values to be used as a baseline for future operational testing.
- E. Instrumentation:
 - 1. Provide calibration program that assures applicable test instrumentation is maintained within rated accuracy and directly traceable to National Bureau of Standards.
 - 2. Calibrate instruments in accordance with following frequency schedule:
 - a. Field Instruments:
 - 1) Analog - 6 months maximum.
 - 2) Digital - 12 months maximum.
 - b. Leased Specialty Equipment: 12 months. (Where accuracy is guaranteed by lessor.)
 - 3. Dated Calibration Labels: Visible on test equipment.
 - 4. Keep records current; show date and result of instruments calibrated or tested.
 - 5. Maintain current instrument calibration instruction and procedure for each test instrument.
 - 6. Calibrating Standard: Higher accuracy than that of instrument being calibrated.
- F. Regulatory Requirements:
 - 1. Safety Practices: Include, but not limited to, the following requirements:
 - a. Occupational Safety and Health Act of 1970 - OSHA.
 - b. Accident Prevention Manual for Industrial Operations, Seventh Edition, National Safety Council, Chapter 4.
 - c. Applicable State and Local Safety Operating Procedures.
 - d. NETA Safety/Accident Prevention Program.
 - e. United States Postal Service Safety Practices.
 - f. NFPA 70E - Electrical Safety Requirements for Employee Workplace.
 - g. American National Standards for Personnel Protection, ANSI Z244.1.
 - 2. Perform tests with apparatus de-energized except where otherwise specifically required herein.
 - 3. Testing Laboratory: Provide a designated safety representative present at Project Site and supervise safety operations.
 - 4. Power Circuits: Conductors shorted to ground by a hot line grounded device approved for the purpose.
 - 5. Do not proceed until safety representative has determined that it is safe to do so.
 - 6. Testing Laboratory: Provide sufficient protective barriers and warning signs to conduct specified tests safely.
- G. Tests and inspections include, but are not limited to the following:
 - 1. Proper operation of lights and equipment.
 - 2. Continuity of raceway system.

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3. Insulation leakage and impedances.
 4. Ground system resistance.
 5. Elimination of reverse rotation and single-phasing of motors.
 6. Sub-system tests indicated in other Sections.
 7. Proper operation of communications systems specified in Section 270500..
 8. Proper operation of intrusion detection systems specified in Section 281600.
 9. Proper operation of video surveillance system specified in [\[Section 282304\]](#)[\[Section 282305\]](#).
 10. Proper operation of fire alarm system specified in Section 283100.
- H. Load balance all electrical phases, at device, panels, and switchboards.
- I. Perform electrical system testing and inspection as specified in each related Section and as specified in this Section.

USPS CSF Specifications issued: 5/1/2014

Last revised: 4/16/2014

END OF SECTION 26 05 00 00



SECTION 26 05 13 00 - UNDERCARPET CABLES

1.1 GENERAL

- A. Description Of Work
 - 1. This specification covers the furnishing and installation of undercarpet cables. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.
- B. Summary
 - 1. This Section includes the following:
 - a. Undercarpet cable and service fittings for branch circuits.
 - b. Undercarpet cable and service fittings for communication and data transmission.
- C. Submittals
 - 1. Product Data: For each type of product indicated.
 - 2. Shop Drawings: Include plans, elevations, sections, details of components, and attachments to other work.
 - a. Indicate cable types, accessories, and transition boxes.
 - b. Indicate proposed layering of cables, cable dimensions, and installation requirements.
 - 3. Field quality-control test reports.
 - 4. Operation and maintenance data.
- D. Quality Assurance
 - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 2. Comply with NEMA UC 2, "Undercarpet Power Distribution Systems" and with NFPA 70.

1.2 PRODUCTS

- A. Power Distribution Cable
 - 1. Cable: Factory laminated and complying with NEMA UC 2; three-piece assembly including bottom shield, conductor assembly, and top shield.
 - a. Bottom Shield: Abrasion resistant, nonmetallic **OR** Metallic, **as directed**.
 - b. Conductor Assembly: Two **OR** Three **OR** Four, **as directed**, -wire branch circuit with insulated ground, **as directed**.
 - c. Top Shield: Copper or copper alloy.
 - 2. Current Rating: 20 **OR** 30 **OR** 20 and 30, **as directed**, A.
- B. Communication And Data Cable
 - 1. Category 5e Communication and Data Cable: Extruded-vinyl jacket over 4 unshielded, twisted pairs, No. 24 AWG, copper; complying with TIA/EIA 568-B; and tested to 300-lb (136-kg) rollover test.
- C. Pedestals
 - 1. Description: Manufacturer's standard low **OR** regular, **as directed**, -profile type, single **OR** two **OR** three, **as directed**, gang with single **OR** duplex, **as directed**, receptacles and Category 5e modular connectors, **as directed**.
 - a. Pedestal Colors: As selected from manufacturer's full range.
- D. Power Cable Transition Unit



1. Description: Interface transition unit, with junction box, for connecting three-, four-, or five-conductor, flat-conductor cable to building wiring system.

E. Communication And Data Cable Transition Unit

1. Description: Category 5 transition termination circuit board in wall-mounted box to convert round incoming cable to outgoing flat-undercarpet cable.

1.3 EXECUTION

A. Installation

1. Do not begin installation until heavy construction is completed and wheeled traffic is no longer a threat.
2. Do not stack cables in circulation routes.
3. Limit total installed height to 0.09 inch (2.29 mm).
4. Install cables in proper order with power-transmission cable first, followed by telephone cable and then data cable. Cross cables at 90-degree angles.
5. Install undercarpet cables and accessories using special tools as recommended by undercarpet cable manufacturer.

B. Connections

1. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
2. Connect undercarpet cable and components to branch circuits and to ground as indicated and instructed by manufacturer.

C. Field Quality Control

1. Perform tests and inspections and prepare test reports.
2. Tests and Inspections:
 - a. Branch-Circuit Cables: After cables have been installed and energized, perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - b. Communication and Data Cables: After cables have been installed and connected between telecommunications outlet and system cross-connect panel, test each cable according to TIA/EIA TSB67. Certify compliance with test parameters.
3. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 26 05 13 00



SECTION 26 05 13 00A - MPF MEDIUM VOLTAGE CABLES (5 KV – 15 KV)

NOTE TO SPECIFIER

Use this Outline Specification Section for Customer Service Facilities only. This Specification defines “level of quality” for Customer Service Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

This specification shall be utilized only upon written approval from USPS Headquarters, submitted through the Contracting Officer.

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes requirements for medium voltage 5 KV to 15 KV, shielded single and-multiple conductor power cables, cable splices and terminations.
- B. Related Documents: The Contract Documents, as defined in Section 011100 – Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 019113 - General Commissioning Requirements
 - 2. Section 260500 - Common Work Results for Electrical
 - 3. Section 260800 - Commissioning of Electrical Systems
 - 4. Section 261116 - Secondary Unit Substations
 - 5. Section 261216 - Dry-Type, Medium-Voltage Transformers
 - 6. Section 261313 - Medium Voltage Circuit Breaker Switchgear
 - 7. Section 261317 - Medium-Voltage Non-Fusible Interrupter Switchgear
 - 8. Section 337173 - Electrical Utility Services

1.2 REFERENCES

- A. The references listed below form a part of this specification to the extent referenced.
 - 1. AEIC C8: (2000) Extruded Dielectric Shielded Power Cables Rated 5 through 46 KV.
 - 2. ASTM B 3: (2001; R 2007) Standard Specification for Soft or Annealed Copper Wire.
 - 3. ASTM D 746: (2007) Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
 - 4. IEEE 383: (2003; R 2008) Standard for Qualifying Class 1E Electric Cables and, Field Splices for Nuclear Power Generating Stations 2004.
 - 5. IEEE 400.2: (2004; R 2005) Guide for Field Testing of Shielded Power Cable Systems Using Very Low Frequency (VLF).
 - 6. NEMA WC 74 / ICEA S-93-639: (2006) 5-46 KV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy.
 - 7. NFPA 70: National Electrical Code.



8. FED-STD-228: (2000) Cable and Wire, Insulated; Methods of Testing.

1.3 GENERAL REQUIREMENTS

- A. Provide Certificates for the following showing that the cable manufacturer has made factory-conducted tests on each shipping length of cable. Provide certified copies of test data that shows conformance with the referenced standards prior to delivery of cable.

1.4 SUBMITTALS

- A. Submit the following in accordance with Section 013300 - Procedures For Submittals.
1. Provide performance data and manufacturer's catalog data for each cable type.
 2. Provide field test reports for the following in accordance with Section 014000 - Quality Requirements: Field Inspection.
 - a. Dielectric Absorption Tests
 - b. High Voltage Tests
 3. Provide manufacturer's instructions showing the recommended sequence and method of installation.
 4. Provide qualifications for cable splicers.

1.5 QUALITY ASSURANCE

- A. Manufacturer qualifications: The bidder must have at least 10 years experience in manufacturing medium voltage cable assemblies.
- B. Regulatory requirements:
1. Conform to requirements of NFPA 70.
 2. Provide products listed and classified by Underwriters Laboratories, Inc.
- C. For the cable specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

1.6 QUALIFICATIONS

- A. Cable splicers performing splicing are required to have [10] [____] years experience in cable splicing and terminations. Once a termination or splice has been started by a worker, the same person completes that particular splice. Start and complete each termination and splice in one continuous work period.

1.7 CABLE VOLTAGE RATINGS

- A. Provide medium voltage power cables including multiple and single conductor cables rated as follows, phase-to-phase, for grounded and underground neutral systems:
1. Use cable rated [5,000] [15,000] volts, ungrounded neutral, on [2,400 / 4,160] [13,200 / 13,800] [12,470]-volt, three phase, 60-hertz distribution systems.
 2. Cable insulations shall be rated at 133 percent.

1.8 SHIPMENT

- A. Ship cables on reels such that the cable is protected from mechanical injury. Hermetically seal and securely attach each end of each length of cable to the reel.



- B. Make minimum reel drum diameter [14] [____] times the overall diameter of the cable. Provide a pulling eye that is installed by the manufacturer for each length of cable supplied for installation in ducts, manholes, and utility tunnels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
1. Okonite Cable, Inc., Ramsey, NJ (201) 825-0300.
 2. Pirelli Cable Corp., Olathe, KS (913) 829-2588.
 3. Southwire, Inc. Carrollton, GA (800) 444-1700.
 4. Substitutions permitted.

2.2 CONDUCTORS

- A. Provide 15 KV conductors that are MV-105 copper, conforming to ASTM B 3.

2.3 CABLE IDENTIFICATION

- A. Provide cables that have a tape placed immediately under the outer jacket showing the name of the manufacturer, the year in which the cable was manufactured, and a unique number for identification purposes. Closely group information on the tape at 1-foot intervals to permit complete identification.

2.4 FLAMMABILITY

- A. Test cables not to be enclosed in metallic conduit for flammability in accordance with [FED-STD-228, Method 5221 [vertical], [spark]] [IEEE 383, 20000 watt 70,000 Btu per hour per hour vertical tray flame test].

NOTE TO SPECIFIER

Single or multiple conductor cables may be utilized. Edit paragraphs 2.5 and 2.6 below accordingly.

2.5 MULTIPLE CONDUCTOR SHIELDED CABLES

- A. Multiple conductor ethylene propylene rubber (EPR) with jacketed interlocked armor
1. Provide multiple conductor insulated interlocked armor covered 15 KV cable assemblies that consist of: Class B stranded copper conductors, an extruded semi-conducting shield over the conductors, 5.6 millimeter 200 mils of ethylene propylene rubber (133 percent) insulation, an extruded or other approved semi-conducting shield, a 0.130 millimeter 5 mil minimum copper tape shield wrapped helically with a minimum of [12.5] [____] percent overlap and a PVC jacket.
- B. Provide multiple conductor, ethylene propylene rubber insulated with interlocked armor jacketed, shielded cable that conforms to NEMA WC 70, ANSI/NEMA WC 71/ICEA S-96-659, NEMA WC 74/ICEA S-93-639, AEIC C8, IEEE Std 532.



2.6 SINGLE CONDUCTOR SHIELDED CABLES

- A. Single conductor, ethylene propylene rubber insulated with jacketed interlocked armor
 - 1. Provide single conductor insulated interlocked armor covered 15 KV cable assemblies that consist of: Class B stranded copper conductors, an extruded semi-conducting shield over the conductors, 5.6 millimeter 220 mils of ethylene propylene rubber (133 percent) insulation, an extruded or other approved semi-conducting shield, a 0.130 millimeter 5 mil minimum copper tape shield wrapped helically with a minimum [12.5] [] percent overlap and a PVC jacket.
- B. Provide single conductor, ethylene propylene insulated, interlocked armor-jacketed, shielded cable that conforms to NEMA WC 70, ANSI/NEMA WC 71/ICEA S-96-659, NEMA WC 74/ICEA S-93-639 and AEIC C8.

2.7 NONMETALLIC JACKET

- A. Interlock Armored Cable
 - 1. Provide nonmetallic, corrosion resistant jacket over interlock armored cable that is [[thermoplastic black] [colored] [polyvinylchloride]] [black polyethylene] conforming to [NEMA WC 27500] [NEMA WC 2] [NEMA WC 70, ANSI/NEMA WC 71/ICEA S-96-659 and NEMA WC 74/ICEA S-93-639].
- B. Terminations
 - 1. Provide cable terminations with grounding terminals rated 15 kilovolts (KV), to withstand 45 KV ac for 10 seconds, minimum.

2.8 CABLE SUPPORTS AND FITTINGS

- A. Provide cable racks, cable tray supports and related fittings that are UL listed heavy-duty nonmetallic [glass-reinforced nylon] [polycarbonate].

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install medium-voltage cables in accordance with NFPA 70.
- B. Install cable inside buildings; by open wire method and ceiling mounted cable trays.



- C. Secure cables with heavy duty cable ties in trays mounted horizontally, where cable rests on tray bottom. Install cable ties at minimum of [10] [_____] foot intervals.
- D. Secure cables with [PVC coated] [non-metallic] cable clamps, straps, hangers, or other approved supporting devices in cable trays mounted vertically, where tray bottom is in a vertical plane.
- E. When field cuts or other damage occurs to the PVC coating, apply a liquid PVC patch to maintain the integrity of the coating. After the installation is complete, perform an inspection to ensure the absence of voids, pinholes, or cuts.
- F. Ensure that all cable tray is properly secured and supported prior to installing armored cable. Add permanent and/or temporary tray support devices as required to preclude cable tray failure during cable pulling or after cable is installed.
- G. Pull medium-voltage cables into cable tray with equipment designed for this purpose, including power-driven winch, cable-feeding flexible tube guide, cable grips, and lubricants. Employ a sufficient number of trained personnel and equipment to ensure the careful and proper installation of the cable.
- H. Unreel cable from the top of the reel. Carefully control payout. Make cable to be pulled be attached through a swivel to the main pulling wire by means of a [pulling eye] [suitable cable grip permitted only on cables less than 60 meter 200-feet long and less than 50 millimeter 2 inches in diameter].
- I. Use woven-wire cable grips to grip the cable end when pulling small cables and short straight lengths of heavier cables.
- J. Attach pulling eyes to the cable conductors to prevent damage to the cable structure. Use pulling eyes and cable grips together for nonmetallic sheathed cables to prevent damage to the cable structure. Provide a minimum bending radius in accordance with the following manufacturer's recommendations.
- K. Provide cables cut in the field that have the cut ends immediately sealed to prevent entrance of moisture. Seal cables with rubber tape wrapped down to [3] [_____] inches from the cable end. Cover-wrap rubber tape with polyvinylchloride tape.
- L. Dry terminations with medium voltage pennants, preformed, and hand wrapped stress cones are allowed for terminating cables.
- M. Installation includes built-up or prefabricated heat or cold shrink stress-relief cones at the terminals of all shielded cables.
- N. Splices within medium voltage cables are not acceptable.
- O. Provide bushings that are glazed wet-process electrical porcelain insulators, factory assembled and hermetically sealed.
- P. Provide cable connectors that are high-conductivity copper accurately machined and threaded for internal and external electrical connections. Provide cross-sectional and contact areas that are adequate to carry the full-load current rating of the conductors. Provide solder type cable connectors with gasket seal between the connector and bushing.
- Q. Provide bonding and grounding in conformance with NFPA 70.

3.3 FIELD QUALITY CONTROL - ELECTRICAL TESTING AND INSPECTION

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Section 260800 - Commissioning of Electrical Systems: Requirements related to Division 26 Commissioning



C. Instrumentation:

1. Provide calibration program that assures applicable test instrumentation is maintained within rated accuracy and directly traceable to National Bureau of Standards.
2. Calibrate instruments in accordance with following frequency schedule:
 - a. Field Instruments:
 - 1) Analog - 6 months maximum.
 - 2) Digital - 12 months maximum.
 - b. Leased Specialty Equipment: 12 months. (Where accuracy is guaranteed by lessor.)
3. Dated Calibration Labels: Visible on test equipment.
4. Keep records current; show date and result of instruments calibrated or tested.
5. Maintain current instrument calibration instruction and procedure for each test instrument.
6. Calibrating Standard: Higher accuracy than that of instrument being calibrated.

D. Regulatory Requirements:

1. Safety Practices: Include, but not limited to, the following requirements:
 - a. Occupational Safety and Health Act of 1970 - OSHA.
 - b. Accident Prevention Manual for Industrial Operations, Seventh Edition, National Safety Council, Chapter 4.
 - c. Applicable State and Local Safety Operating Procedures.
 - d. NETA Safety/Accident Prevention Program.
 - e. United States Postal Service Safety Practices.
 - f. NFPA 70E - Electrical Safety Requirements for Employee Workplace.
 - g. American National Standards for Personnel Protection, ANSI Z244.1.
2. Perform tests with apparatus de-energized except where otherwise specifically required herein.
3. Testing Laboratory: Provide a designated safety representative present at Project Site and supervise safety operations.
4. Do not proceed until safety representative has determined that it is safe to do so.
5. Testing Laboratory: Provide sufficient protective barriers and warning signs to conduct specified tests safely.

E. Testing and Inspection:

1. Inspect and test in accordance with NETA ATS, where applicable.
2. Perform inspections and tests listed in NETA ATS, Section 7.13.
3. Subject each to dielectric-absorption tests and high-voltage tests after the installation of medium-voltage power cables and terminations have been completed and before the cable is energized.
4. Provide test equipment, labor, and technical personnel as necessary to perform the electrical acceptance tests. Make arrangements to have tests witnessed and approved by the Contracting Officer. Completely isolate each power-cable installation from extraneous electrical connections at cable terminations.
5. Initially each power cable shall be subjected to a full dielectric-absorption test with 5000-volt insulation-resistance test set. Apply test for a long enough time to fully charge the cable. Record readings every 15 seconds during the first 3 minutes of test and at 1 minute intervals thereafter. Continue test until three equal readings, 1 minute apart, are obtained. Minimum reading is 200 megohms at an ambient temperature of 20 degrees C 68 degrees F. Correct readings taken at other than 20 degrees C 68 degrees F ambient temperatures.
6. Upon successful completion of the dielectric absorption tests, subject the cable to a direct-current high-potential test for 5 minutes with test voltages applied in accordance with AEIC C8 and IEEE 400.2 for ethylene propylene rubber-insulated cable.
7. Record leakage current readings every 30 seconds during the first 2 minutes and every minute thereafter for the remainder of the test. When the leakage current continues to increase after the first minute, immediately terminate the test and take steps to find and correct the fault. When a second test becomes necessary, repeat this test procedure.
8. Upon satisfactory completion of the high-potential test, give the cable a second dielectric-absorption test. Provide results of the second dielectric-absorption test that agree with the first



- test and that indicate no evidence of permanent injury to the cable caused by the high-potential test.
9. Record test data and include identification of cable and location, megohm readings versus time, leakage current readings versus time, and cable temperature versus time.
 10. Final acceptance depends upon the satisfactory performance of the cable under test. Do not energize cable until recorded test data has been approved by the Contracting Officer. Provide final test reports to the Contracting Officer. Provide reports with a cover letter/sheet clearly marked with the System name, Date, and the words "Final Test Report - Forward to the Systems Engineer/Condition Monitoring Office/Predictive Testing Group for inclusion in the Maintenance Database."

END OF SECTION

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END OF SECTION



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SECTION 26 05 19 00 - MPF LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY:

- A. Section Includes:
 - 1. Building wire and cable.
 - 2. Branch-circuit cable.
 - 3. Wiring connectors and connections.
 - 4. Drop cords.
 - 5. Busways.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections
 - 1. As specified in Section 260500 - Common Work Results for Electrical: Basic electrical methods.

1.2 REFERENCES

- A. As specified in Section 260500 – Common Work Results for Electrical.

1.3 SUBMITTALS

- A. As specified in Section 260500 - Common Work Results for Electrical.

1.4 QUALITY ASSURANCE

- A. As specified in Section 260500 – Common Work Results for Electrical.

1.5 DELIVERY, STORAGE, AND HANDLING

MPF LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS

AND CABLES



A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.

B. Deliver in accordance with NEMA WC 26.

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

PART 2 - PRODUCTS

2.1 BUILDING WIRE AND CABLE

A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:

1. Alcan Cable, Atlanta, GA (770) 392-2376.
2. Anixter, Inc., Skokie, IL (800) ANIXTER.
3. General Cable, Highland Heights, KY (800) 526-4391.
4. General Electric, Plainville, CT (860) 747-7111.
5. Okonite, Ramsey, NJ (201) 825-0300.
6. Southwire Company, Carrollton, GA (800) 444-1700.
7. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

B. Description: Single conductor insulated wire.

C. Conductor: Copper, except conductors #1/0 AWG and larger may be compact stranded aluminum if equipped with compression lugs and installed per manufacturer's recommendations and the National Electrical Code.

D. Insulation Voltage Rating: 600 Volts.

E. Insulation: NFPA 70, Type THHN/THWN or Type XHHW-2

F. Multiconductor cable: Metal clad cable, Type MC with ground wire.

1. Type "MC" cable shall be permitted for use in exposed or accessible ceiling spaces only. Type "MC" cable shall not be utilized above inaccessible hard ceilings or in damp locations. Cable shall be supported and secured where such support does not exceed 3 ft. intervals and shall be properly color coded to identify phase, neutral, ground and switch legs.

2.2 WIRING CONNECTORS

A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:

1. Buchanan Construction Products, Hackettstown, NJ (800) 610-5201.
2. Thomas and Betts, Memphis, TN (800) 695-1901.
3. 3M, St. Paul, MN (800) 364-3577.
4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

B. Compression Connectors; Conductor sizes #12 through #6 AWG:



1. Buchanan: 2006S or 2011S.
2. Thomas and Betts: [_____].
3. 3M; [_____].

2.3 DROP CORDS

- A. Description: Continuous length of cable with 20 Amp, 120 Volt locking blade type connector body at one end as indicated on Drawings. Secure cable at both ends with wire type stainless steel cable grips to prevent transmission of tension directly to conductors or terminal screws.
- B. Junction Box: Furnished and installed [flush with ceiling] anchored to building structure for fastening of upper cord grip.
- C. Cable: Type SO 600 volt flexible cord with three #12 stranded wires.
- D. Connector Body: Single 20 Amp, 120 volt, grounding receptacle of twist-lock type at one end and straight blade type at other end that grips on cable insulation and is manufactured for use with wire cable grips. Furnish and install drop cords in length required for a receptacle height of 6 feet 8 inches above finished floor.

2.4 BUSWAYS

- A. Basis of Design: General Electric "Spectra" series.
- B. Manufacturers: Subject to compliance with project requirements, manufacturers offering products which may be incorporated in the Work include the following:
 1. Eaton Corporation, Cutler-Hammer Products, Pittsburg, PA (800) 525-2000.
 2. General Electric Company (800) 626-2000.
 3. Siemens Energy and Automation, Alpharetta, GA (800) 964-4114.
 4. Square D Company, Palatine, IL (800) 392-8781.
 5. No substitutions permitted.
- C. Provide factory shop drawing submittals for each type of busway.
 1. Show fabrication and installation details of busway, including plans, elevations and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths and fittings.
 2. Seismic-Restraint Details: Signed and sealed by a qualified Professional Engineer, licensed in the state where Project is located, who is responsible for their preparation.
 - a. Design Calculations: Calculate requirements for selecting seismic restraints.
 - b. Detail fabrication, including anchorages and attachments to structure and to supported busways.
- D. Furnish and install a totally enclosed, low-impedance 5 wire, copper, busway system of the indicated ratings with all necessary fittings, power takeoffs, hanging devices and accessories.
 1. Materials and installation shall comply with applicable codes, recommended practices and standards of ANSI, IEEE, NEMA and UL. All components of the busway shall be UL listed. Arrangements, details and locations shall be as shown on the drawings and specified herein. The housing shall be of extruded aluminum and all hardware shall be painted to prevent corrosion.
 2. Joints shall be of the one-bolt removable/isolatable type with through-bolts that can be checked for tightness without de-energizing the system. The means of visual indication shall be a color change in the head of the bolt. It shall be possible to make up a joint from one side in the event the busway is installed against a wall or ceiling. The joint shall be so designed as to allow removal



of any length without disturbing adjacent lengths. Belleville springs shall be provided to give positive pressure over complete contact area.

3. Plug-in and feeder busway shall use identical parts and all multi-stacks shall be phase collected.
4. The maximum hot-spot temperature rise at any point in the busway at continuous rated load shall not exceed 55 degrees C above a maximum ambient temperature of 40 degrees C in any position.

- E. Furnish and install busway plugs of the types and ratings indicated. Plugs shall be UL labeled. Housing shall completely enclose the switching device and shall be of sheet steel furnished in ASNI-61 grey enamel over a rust inhibitor. Provide stab shields that protect ground plug body to busway housing before stabs make power contact. Provide grounding terminal inside plug body and adequate shielding to prevent access to live parts when cover is open. A ground stab to engage grounding tab on busway and internal ground bus shall be provided. Provide means for padlocking cover and operating handle in "off" position. The operating handle shall be easily moved from end to side of vice versa so that it will be in the correct position to operate from the floor.

1. Circuit breaker type plugs shall have an interrupting rating as indicated on the drawings. They shall have a releasable cover interlock that prevents opening of cover except with the breaker in "off" position. An interlock to prevent insertion or removal from busway when in "on" position shall be provided, as well as an interlock (releasable) to prevent closing circuit breaker with cover open.
2. Plug assists shall be furnished on all plugs over 100 Amps that will mechanically engage or disengage the plug from the busway, but only when the plug is in the "off" position.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. As specified in Section 260500 – Common Work Results for Electrical.

3.2 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

3.3 INSTALLATION - CONDUCTORS

- A. Wiring methods

1. Concealed Dry Interior Locations: Use only building wire, Type THHN/THWN or Type XHHW-2 insulation in metallic raceway or MC multiconductor cable.
2. Exposed Dry Interior Locations: Use only building wire, Type THHN/THWN or Type XHHW-2 insulation in metallic raceway or MC multiconductor cable.
3. Above Accessible Ceilings: Use only building wire, Type THHN/THWN or Type XHHW-2 insulation in metallic raceway or MC multiconductor cable.
4. Wet or Damp Interior Locations: Use only building wire, Type THW or THWN or Type XHHW-2 insulation in raceway.

- B. Install products in accordance with manufacturers published instructions and NECA SI.

- C. Use solid conductor for feeders and branch circuits 10 AWG and smaller.

- D. Use stranded conductors for control circuits and final connections to all vibration equipment.



- E. Use conductor not smaller than 12 AWG for power and lighting circuits.
- F. Use conductor not smaller than 14 AWG for control circuits.
- G. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.
- H. Use 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet.
- I. Pull all conductors into raceway at same time.
- J. Use approved wire pulling lubricant for all building wire.
- K. Protect exposed cable from damage.
- L. Neatly train and lace wiring inside boxes, equipment, and panelboards in accordance with NECA Standards.
- M. Clean conductor surfaces before installing lugs and connectors.
- N. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- O. For splices and taps, use only compression connectors for copper conductors, 6 AWG and larger or aluminum conductors 1/0 and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
- P. Use solderless pressure compression connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
- Q. Use conductors rated 90 degrees C, inside a ballast compartment or within 6 inches of any ballast.
- R. Conductor Sizes #8 and Larger: Class B stranding.
- S. Install Drop Cords to building structure at locations indicated on Drawings as indicated on Drawings.
- T. The sharing of neutral conductors for multiwire branch circuits is prohibited. All branch circuits shall contain individual neutral conductors.

3.4 INSTALLATION – BUSWAYS

- A. Horizontal runs of busway shall be UL listed for hanging on 10-foot centers in any position. Vertical riser runs of busway shall be supported with rigid and/or spring hangers. (Max. 16 ft. centers)
- B. Final field measurements shall be made by the contractor prior to release for manufacture to assure coordination with other trades. Contractor shall coordinate routing of busways with field conditions.
- C. Contractor shall provide all necessary mounting hardware as recommended by the manufacturer. Utilize trapeze hangers, spring isolators, and ½ inch all-thread on 10 foot centers. Installation shall comply with local seismic zone requirements.
 - 1. Provide approved manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, expansion joints and connectors. Obtain busway components from a single manufacturer.



- D. Engraved nameplates: ½ inch high black letters on yellow laminated plastic nameplate, engraved with the following wording: WARNING! DO NOT USE BUSWAY AS WALKWAY, LADDER OR SUPPORT.

3.5 CONSTRUCTION

- A. Interface With Other Work:
1. Identify wire and cable using Thomas and Betts type WM vinyl markers.
 2. Identify each conductor with its circuit number or other designation indicated on Drawings in all junction, pull, terminal boxes and cabinets. Identify neutrals with common circuit numbers in all junction, pull and terminal boxes, panels and cabinets.

NOTE TO SPECIFIER

Edit WIRING COLOR CODE below for voltage systems used for this Project.

3.6 WIRING COLOR CODE

- A. Comply with the following color code for each voltage system.

B. 208Y/120 Volt System:

1. Phase A - Black
2. Phase A Switch Leg - Black with "S" tag.
3. Phase B - Red
4. Phase B Switch Leg - Red with "S" tag.
5. Phase C - Blue.
6. Phase C - Switch Leg - Blue with "S" tag.
7. Travelers - Yellow.
8. Neutral - White.
9. Equipment Ground - Green.

C. 240/120 Volt System:

1. Phase A - Black.
2. Phase A Switch Leg - Black with "S" tag.
3. Phase B - Orange (High-Leg)
4. Phase C - Blue
5. Phase C Switch Leg - Blue with "S" tag.
6. Travelers - Yellow.
7. Neutral - White.
8. Equipment Ground - Green.

D. 480Y/277 Volt System:

1. Phase A - Brown
2. Phase A Switch Leg - Brown with "S" Tag.
3. Phase B - Orange.
4. Phase B Switch Leg - Orange with "S" Tag.
5. Phase C - Yellow
6. Phase C Switch -Leg- Yellow with "S" Tag.
7. Travelers - Yellow with "T" Tag.
8. Neutral - Grey.
9. Equipment Ground - Green with Yellow stripe.



- E. Use same color for same phase throughout. Use same colors for switch legs. Travelers shall be yellow. Phase rotation shall be same in all panels. Identify large cables with colored tape.
- F. Provide identification tags on each conductor entering panel, switch, junction box and pull box to identify conductor.

3.7 FIELD QUALITY CONTROL

- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. Cables, 600 Volt or less and size no. 3 or larger, shall be meggered using an industry-approved “megger with a minimum of 500 Volt internal generating voltage. All inspection, cleaning and testing procedures shall be in compliance with the recommendations and standards outlined in the “maintenance testing specifications for electrical power distribution equipment and systems”, latest edition, published by International Electrical Testing Association (NETA). Insulation resistance test values shall be no less than 250 megaohms. A typewritten report of all readings shall be prepared and submitted.

USPS Mail Processing Facility Specifications issued: 10/1/2013
Last revised: 9/4/2013

END OF SECTION 26 05 19 00



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SECTION 26 05 19 00 - CSF LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this Outline Specification Section for Customer Service Facilities only. This Specification defines "level of quality" for Customer Service Facility construction and is intended as a guide to the Architect/Engineer preparing the Construction Documents.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.26 05 19 00

PART 1 - GENERAL

1.1 SUMMARY:

- A. Section Includes:
 - 1. Building wire and cable.
 - 2. Branch-circuit cable.
 - 3. Wiring connectors and connections.
 - 4. Drop cords.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections
 - 1. As specified in Section 260500 - Common Work Results for Electrical.

1.2 REFERENCES

- A. As specified in Section 260500 - Common Work Results for Electrical

1.3 SUBMITTALS

- A. As specified in Section 260500 - Common Work Results for Electrical.

1.4 QUALITY ASSURANCE



- A. As specified in Section 260500 - Common Work Results for Electrical.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Deliver in accordance with NEMA WC 26.

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of preparation for Project.

PART 2 - PRODUCTS

2.1 BUILDING WIRE AND CABLE

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Alcan Cable, Atlanta, GA (770) 392-2376.
 2. Anixter, Inc., Skokie, IL (800) ANIXTER.
 3. General Cable, Highland Heights, KY (800) 526-4391.
 4. General Electric, Plainville, CT (860) 747-7111.
 5. Okonite, Ramsey, NJ (201) 825-0300.
 6. Southwire Company, Carrollton, GA (800) 444-1700.
 7. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Description: Single conductor insulated wire.
- C. Conductor: Copper, except conductors #1/0 AWG and larger may be compact stranded aluminum if equipped with compression lugs and installed per manufacturer's recommendations and the National Electrical Code.
- D. Insulation Voltage Rating: 600 Volts.
- E. Insulation: NFPA 70, Type THHN/THWN or Type XHHW-2
- F. Multiconductor cable: Metal clad cable, Type MC with ground wire.
1. Type "MC" cable shall be permitted for use in exposed or accessible ceiling spaces only. Type "MC" cable shall not be utilized above inaccessible hard ceilings or in damp locations. Cable shall be supported and secured where such support does not exceed 3 ft. intervals and shall be properly color coded to identify phase, neutral, ground and switch legs.

2.2 WIRING CONNECTORS

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Buchanan Construction Products, Hackettstown, NJ (800) 610-5201.
 2. Thomas and Betts, Memphis, TN (800) 695-1901.
 3. 3M, St. Paul, MN (800) 364-3577.



4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

B. Compression Connectors; Conductor sizes #12 through #6 AWG:

1. Buchanan: 2006S or 2011S.
2. Thomas and Betts: [_____].
3. 3M; [_____].

2.3 DROP CORDS

- A. Description: Continuous length of cable with 20 Amp, 120 Volt, locking blade type connector body at one end as indicated on Drawings. Secure cable at both ends with wire type stainless steel cable grips to prevent transmission of tension directly to conductors or terminal screws.
- B. Junction Box: Furnished and installed [flush with ceiling] anchored to building structure for fastening of uppercord grip.
- C. Cable: Type SO 600 volt flexible cord with three #12 stranded wires.
- D. Connector Body: Single 20 Amp, 120 volt, grounding receptacle of twistlock type at one end and straight blade type at other end that grips on cable insulation and is manufactured for use with wire cable grips. Furnish and install drop cords in length required for a receptacle height of 6 feet 8 inches above finished floor.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. As specified in Section 260500 - Common Work Results for Electrical.

3.2 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

3.3 INSTALLATION

- A. Wiring methods
 1. Concealed Dry Interior Locations: Use building wire, Type THHN/THWN or Type XHHW-2 insulation in metallic raceway or MC multiconductor cable.
 2. Exposed Dry Interior Locations: Use building wire, Type THHN/THWN or Type XHHW-2 insulation in metallic raceway or MC multiconductor cable.
 3. Above Accessible Ceilings: Use building wire, Type THHN/THWN or Type XHHW-2 insulation in metallic raceway or MC multiconductor cable.
 4. Wet or Damp Interior/Exterior Locations: Use only building wire, Type THHN/THWN or Type XHHW-2 insulation in raceway.
- B. Install products in accordance with manufacturers published instructions and NECA SI.
- C. Use solid conductor for feeders and branch circuits 10 AWG and smaller.



- D. Use stranded conductors for control circuits and final connections to all vibration equipment.
- E. Use conductor not smaller than 12 AWG for power and lighting circuits.
- F. Use conductor not smaller than 14 AWG for control circuits.
- G. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.
- H. Use 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet.
- I. Pull all conductors into raceway at same time.
- J. Use approved wire pulling lubricant for all building wire.
- K. Protect exposed cable from damage.
- L. Neatly train and lace wiring inside boxes, equipment, and panelboards in accordance with NECA Standards.
- M. Clean conductor surfaces before installing lugs and connectors.
- N. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- O. For splices and taps, use only compression connectors for copper conductors, 6 AWG and larger or aluminum conductors 1/0 and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
- P. Use solderless pressure compression connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
- Q. Use conductors rated 90 degrees C, inside a ballast compartment or within 6 inches of any ballast.
- R. Conductor Sizes #8 and Larger: Class B stranding.
- S. Install Drop Cords to building structure at locations indicated on Drawings as indicated on Drawings.
- T. The sharing of neutral conductors for multiwire branch circuits is prohibited. All branch circuits shall contain individual neutral conductors.

3.4 CONSTRUCTION

- A. Interface With Other Work:
 - 1. Identify wire and cable using Thomas and Betts type WM vinyl markers.
 - 2. Identify each conductor with its circuit number or other designation indicated on Drawings in all junction, pull, terminal boxes and cabinets. Identify neutrals with common circuit numbers in all junction, pull and terminal boxes, panels and cabinets.

NOTE TO SPECIFIER

Edit WIRING COLOR CODE below for voltage systems used for this Project.



3.5 WIRING COLOR CODE

- A. Comply with the following color code for each voltage system.
- B. 208Y/120 Volt System:
 - 1. Phase A - Black
 - 2. Phase A Switch Leg - Black with "S" tag.
 - 3. Phase B - Red
 - 4. Phase B Switch Leg - Red with "S" tag.
 - 5. Phase C - Blue.
 - 6. Phase C - Switch Leg - Blue with "S" tag.
 - 7. Travelers - Yellow.
 - 8. Neutral - White.
 - 9. Equipment Ground - Green.
- C. 240/120 Volt System:
 - 1. Phase A - Black.
 - 2. Phase A Switch Leg - Black with "S" tag.
 - 3. Phase B - Orange (High-Leg)
 - 4. Phase C - Blue
 - 5. Phase C Switch Leg - Blue with "S" tag.
 - 6. Travelers - Yellow.
 - 7. Neutral - White.
 - 8. Equipment Ground - Green.
- D. 480Y/277 Volt System:
 - 1. Phase A - Brown
 - 2. Phase A Switch Leg - Brown with "S" Tag.
 - 3. Phase B - Orange.
 - 4. Phase B Switch Leg - Orange with "S" Tag.
 - 5. Phase C - Yellow
 - 6. Phase C Switch -Leg- Yellow with "S" Tag.
 - 7. Travelers - Yellow with "T" Tag.
 - 8. Neutral - Grey.
 - 9. Equipment Ground - Green with Yellow stripe.
- E. Use same color for same phase throughout. Use same colors for switch legs. Travelers shall be yellow. Phase rotation shall be same in all panels. Identify large cables with colored tape.
- F. Provide identification tags on each conductor entering panel, switch, junction box and pull box to identify conductor.

3.6 FIELD QUALITY CONTROL

- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. Cables, 600 Volt or less and size no. 3 or larger, shall be meggered using an industry-approved "megger with a minimum of 500 Volt internal generating voltage. All inspection, cleaning and testing procedures shall be in compliance with the recommendations and standards outlined in the "maintenance testing specifications for electrical power distribution equipment and systems", latest edition, published by International Electrical Testing Association (NETA). Insulation resistance test values shall be no less than 250 megohms. A typewritten report of all readings shall be prepared and submitted.



USPS Master Specifications issued: 10/1/2013
Last revised:4/18/2011.

END OF SECTION



SECTION 26 05 19 13 - ELECTRICAL RENOVATION

DESCRIPTION OF WORK

This specification covers the furnishing and installation of materials for electrical renovation. Products shall be as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

GENERAL

Quality Assurance

1. Regulatory Requirements: Comply with following:
 - a. Electrical: National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code (NEC).
 - b. Accessibility:
 - 1) Architectural Barriers Act of 1968 as amended (42 USC 4152-4157) and HUD implementing regulations (24 CFR Part 40).
 - a) Uniform Federal Accessibility Standards (UFAS).
 - 2) Section 504 of the Rehabilitation Act of 1973 as amended (29 USC 794) and HUD implementing regulations 24 CFR Part 8.
 - 3) Fair Housing Accessibility Guidelines (24 CFR Chapter 1).
 - 4) Americans with Disabilities Act of 1990 (ADA) (28 CFR Part 35).

Project Conditions

2. Existing Conditions: Buildings will be occupied during construction. See Division 1 Section "Summary of Work." Do not interfere with use of occupied portions of building. Maintain free and safe passage to and from occupied areas.

Scheduling And Sequencing

3. Scheduling and Completion: Comply with requirements of Detailed Scope of Work.

Alterations, Cutting And Protection

4. Protection: Protect existing finishes, equipment, utilities and adjacent work, which is scheduled to remain, from damage.
5. Existing Operating Facilities: Confine operations to immediate vicinity of new work and do not interfere with or obstruct ingress or egress to and from adjacent facilities.

PRODUCTS

Materials

6. Electrical Materials and Devices: Comply with NFPA 70 (NEC):
 - a. Boxes: Galvanized steel, not less than 1.6 mm (0.0625 inch) thickness (NEC 370-20) grounded in accordance with NEC, Article 250, suitable for recess mounting.
 - 1) Provide boxes of appropriate shape and size for intended purpose.
 - b. Devices:
 - 1) Duplex Receptacles: 15 A or 20 A 115 V, UL Listed with screw side connections and corrugated bearing pads.
 - a) GFI Outlets: 115 V, 60 Hz, 15/20 A rating, UL Listed.
 - 2) Switches: 15 A, 115 V, single pole, single throw switch, UL Listed, with side screw connections and corrugated bearing pads.



- a) Garbage Disposal: Heavy duty, 120/277 VAC, 60 Hz, single pole, single throw, 20 A rate, UL listed and CSA certified.
 - 3) Cover Plates: Smooth plastic in color to match existing.
- c. Wiring: Insulated wire, Type NM 600 V with ground wire, sized as appropriate for intended purpose and in accordance with NEC.
 - 1) Aluminum Wire: Not allowed unless existing wiring is aluminum.
 - 2) Provide necessary fittings in accordance with NEC.

EXECUTION

Examination

- 7. Units, Spaces and Areas to be Renovated: Inspect to become familiar with existing conditions and to take measurements which are necessary for renovation work to be completed in accordance with contract requirements.
 - a. Carefully inspect condition of existing spaces including, but not limited to walls, floors, plumbing, electrical, etc. as essential to successful completion of renovation work.
 - b. Survey each space and verify dimensions for work.

Preparation

- 8. Building Occupation: Carry out renovation work to cause as little inconvenience to occupants as possible. See Division 1 Section "Summary of Work."
- 9. Protection: Protect and be responsible for existing buildings, facilities, utilities, and improvements within areas of construction operations.
 - a. Tenant's Property: Be responsible for any damage or loss to residents' property and to other work. Replace any material, which, in opinion of the Owner, has become damaged to extent that it could not be restored to its original condition.
 - b. Take precautions to protect residents and public from injury from construction operations.

Laying Out Work

- 10. Discrepancies: Verify dimensions and elevations indicated in layout of existing work.
 - a. Prior to commencing work, carefully compare and check Drawings (if any), for discrepancies in locations or elevations of work to be executed.
 - b. Refer discrepancies among Drawings (if any), Specifications and existing conditions to the Owner for adjustment before work affected is performed.
 - 1) Failure to make such notification shall place responsibility on Contractor to carry out work in satisfactory, workmanlike manner.
- 11. Contractor: Responsible for location and elevation of construction contemplated by Construction Documents.

Location Of Equipment And Piping

- 12. Drawings (if any) indicating location of equipment, piping, ductwork, etc. are diagrammatic and job conditions shall not always permit their installation in location shown. When this situation occurs, bring condition to the Owner's attention immediately. Relocation will be determined in joint conference.
- 13. Contractor: Do not relocate any items without first obtaining the Owner's acceptance. Remove and relocate such relocated items at own expense if so directed.

Electrical Work

- 14. General: Install boxes, wiring, and devices as indicated and required to connect and control electrical devices in accordance with NFPA 70 (NEC).
 - a. Boxes: Solidly anchor to framing or blocking.
- 15. Removing Electrical Switch or Duplex Outlet (Non-Hazardous Locations):
 - a. Box to Remain:
 - 1) Remove electrical device; cap hot and neutral with set-screw wire connectors.



- 2) Attach ground wire to remaining box with solid screw attachment.
 - 3) Provide and install natural finish aluminum blank cover plate with screw fasteners integral to match size of box remaining.
- b. Box to be removed:
 - 1) Remove electrical device and box and pull wire out of wall back to first circuit panel, disconnecting from circuit panel.
 - 2) Patch and repair hole in partition to match existing.
16. Garbage Disposal Electrical Hook-up: See Division 15 Section "Plumbing." Comply with NFPA 70 (NEC):
 - a. Wiring: Install from disposal through concealed spaces to house panel, anchoring wire, and providing necessary fittings.
 - b. Switch: Install above counter top backsplash.
17. Range Hood Electrical Hook-up: See Division 11 Section "Residential Appliances." Comply with NFPA 70 (NEC):
 - a. Electric service: Install insulated wire from range hood through concealed spaces to house panel, anchoring wire, and providing necessary fittings.
18. Water Heater Electrical Hook-up: See Division 15 Section "Domestic Water Heaters." Comply with NFPA 70 (NEC).
19. Furnace Electrical Hook-up: See Division 15 Section "Furnaces." Comply with NFPA 70 (NEC).
20. Smoke Detector Electrical Hook-up: See Division 13 Section "Fire Alarm." Comply with NFPA 70 (NEC).

Integrating Existing Work

21. Protection: Protect existing improvements from damage.
 - a. Where new work is to be connected to existing work, exercise special care not to disturb or damage existing work more than necessary.
 - b. Damaged Work: Replace, repair and restored to its original condition at no cost to Owner.

END OF SECTION 26 05 19 13



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Task	Specification	Specification Description
26 05 19 13	26 05 13 00	Undercarpet Cables



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SECTION 26 05 19 16 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of control-voltage electrical power cables. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. UTP cabling.
 - b. 50/125 **OR** 62.5/125, **as directed**,-micrometer, multimode optical fiber cabling.
 - c. RS-232 cabling.
 - d. RS-485 cabling.
 - e. Low-voltage control cabling.
 - f. Control-circuit conductors.
 - g. Identification products.

C. Definitions

1. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
2. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel section.
3. EMI: Electromagnetic interference.
4. IDC: Insulation displacement connector.
5. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
6. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
7. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).
8. RCDD: Registered Communications Distribution Designer.
9. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal side rails, and a bottom without ventilation openings.
10. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.
11. UTP: Unshielded twisted pair.

D. Submittals

1. Product Data: For each type of product indicated.
2. Field quality-control reports.
3. Maintenance data.

E. Quality Assurance

1. Testing Agency Qualifications: Member company of an NRTL.
 - a. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
2. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 **OR** 450, **as directed**, or less.



3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Delivery, Storage, And Handling

1. Test cables upon receipt at Project site.
 - a. Test optical fiber cable to determine the continuity of the strand end to end. Use optical fiber flashlight **OR** optical loss test set, **as directed**.
 - b. Test optical fiber cable on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; include the loss value of each. Retain test data and include the record in maintenance data.
 - c. Test each pair of UTP cable for open and short circuits.

1.2 PRODUCTS

A. Pathways

1. Support of Open Cabling: NRTL labeled for support of Category 5e **OR** Category 6, **as directed**, cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - a. Support brackets with cable tie slots for fastening cable ties to brackets.
 - b. Lacing bars, spools, J-hooks, and D-rings.
 - c. Straps and other devices.
2. Cable Trays:
 - a. Cable Tray Materials: Metal, suitable for indoors and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch (0.012 mm) thick **OR** hot-dip galvanizing, complying with ASTM A 123/A 123M, Grade 0.55, not less than 0.002165 inch (0.055 mm) thick, **as directed**.
 - 1) Basket Cable Trays: 6 inches (150 mm) wide and 2 inches (50 mm) deep. Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).
 - 2) Trough or Ventilated Cable Trays: Nominally 6 inches (150 mm) wide.
 - 3) Ladder Cable Trays: Nominally 18 inches (455 mm) wide, and a rung spacing of 12 inches (305 mm).
 - 4) Channel Cable Trays: One-piece construction, nominally 4 inches (100 mm) wide. Slot spacing shall not exceed 4-1/2 inches (115 mm) o.c.
 - 5) Solid-Bottom or Nonventilated Cable Trays: One-piece construction, nominally 12 inches (305 mm) wide. Provide with **OR** without, **as directed**, solid covers.
3. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway And Boxes For Electrical Systems". Flexible metal conduit shall not be used, **as directed**.
 - a. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

B. Backboards

1. Description: Plywood, fire-retardant treated, **as directed**, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels in Division 06 Section "Rough Carpentry".

C. UTP Cable

1. Description: 100-ohm, four-pair UTP, formed into 25-pair binder groups covered with a blue thermoplastic jacket, **as directed**.
 - a. Comply with ICEA S-90-661 for mechanical properties.
 - b. Comply with TIA/EIA-568-B.1 for performance specifications.
 - c. Comply with TIA/EIA-568-B.2, Category 5e **OR** Category 6, **as directed**.
 - d. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:



- 1) Communications, General Purpose: Type CM or Type CMG; or Type MPP, Type CMP, Type MPR, Type CMR, Type MP, or Type MPG, **as directed**.
 - 2) Communications, Plenum Rated: Type CMP or Type MPP, **as directed**, complying with NFPA 262.
 - 3) Communications, Riser Rated: Type CMR; or Type MPP, Type CMP, or Type MPR, **as directed**; complying with UL 1666.
 - 4) Communications, Limited Purpose: Type CMX; or Type MPP, Type CMP, Type MPR, Type CMR, Type MP, Type MPG, Type CM, or Type CMG, **as directed**.
 - 5) Multipurpose: Type MP or Type MPG; or Type MPP or Type MPR, **as directed**.
 - 6) Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
 - 7) Multipurpose, Riser Rated: Type MPR or Type MPP, **as directed**, complying with UL 1666.
- D. UTP Cable Hardware
1. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.
 2. Connecting Blocks: 110 style for Category 5e **OR** 110 style for Category 6 **OR** 66 style for Category 5e, **as directed**. Provide blocks for the number of cables terminated on the block, plus 25 percent spare; integral with connector bodies, including plugs and jacks where indicated.
- E. Optical Fiber Cable
1. Description: Multimode, 50/125 **OR** 62.5/125, **as directed**, -micrometer, 24-fiber, nonconductive, **as directed**, tight buffer, optical fiber cable.
 - a. Comply with ICEA S-83-596 for mechanical properties.
 - b. Comply with TIA/EIA-568-B.3 for performance specifications.
 - c. Comply with TIA/EIA-492AAAA-B **OR** TIA/EIA-492AAAA-A, **as directed**, for detailed specifications.
 - d. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
 - 1) General Purpose, Nonconductive: Type OFN or OFNG, or Type OFNR or Type OFNP, **as directed**.
 - 2) Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
 - 3) Riser Rated, Nonconductive: Type OFNR or Type OFNP, **as directed**, complying with UL 1666.
 - 4) General Purpose, Conductive: Type OFC or Type OFCG; or Type OFNG, Type OFN, Type OFCR, Type OFNR, Type OFCP, or Type OFNP, **as directed**.
 - 5) Plenum Rated, Conductive: Type OFCP or Type OFNP, **as directed**, complying with NFPA 262.
 - 6) Riser Rated, Conductive: Type OFCR; or Type OFNR, Type OFCP, or Type OFNP, **as directed**; complying with UL 1666.
 - e. Conductive cable shall be steel **OR** aluminum, **as directed**, -armored type.
 - f. Maximum Attenuation: 3.5 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
 - g. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
 2. Jacket:
 - a. Jacket Color: Aqua for 50/125 **OR** Orange for 62.5/125, **as directed**, -micrometer cable.
 - b. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.
 - c. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).
- F. Optical Fiber Cable Hardware
1. Cable Connecting Hardware: Comply with the Fiber Optic Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
 - a. Quick-connect, simplex and duplex, Type SC **OR** Type ST **OR** Type LC **OR** Type MT-RJ, **as directed**, connectors. Insertion loss not more than 0.75 dB.
 - b. Type SFF connectors may be used in termination racks, panels, and equipment packages.

**G. RS-232 Cable**

1. **Standard Cable: NFPA 70, Type CM.**
 - a. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
 - b. Polypropylene insulation.
 - c. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 - d. PVC jacket.
 - e. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.
 - f. Flame Resistance: Comply with UL 1581.
2. **Plenum-Rated Cable: NFPA 70, Type CMP.**
 - a. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
 - b. Plastic insulation.
 - c. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 - d. Plastic jacket.
 - e. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.
 - f. Flame Resistance: Comply with NFPA 262.

H. RS-485 Cable

1. **Standard Cable: NFPA 70, Type CM or Type CMG, as directed.**
 - a. Paired, two pairs, twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors.
 - b. PVC insulation.
 - c. Unshielded.
 - d. PVC jacket.
 - e. Flame Resistance: Comply with UL 1581.
2. **Plenum-Rated Cable: NFPA 70, Type CMP.**
 - a. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
 - b. Fluorinated ethylene propylene insulation.
 - c. Unshielded.
 - d. Fluorinated ethylene propylene jacket.
 - e. Flame Resistance: NFPA 262, Flame Test.

I. Low-Voltage Control Cable

1. **Paired Cable: NFPA 70, Type CMG.**
 - a. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
 - b. PVC insulation.
 - c. Unshielded.
 - d. PVC jacket.
 - e. Flame Resistance: Comply with UL 1581.
2. **Plenum-Rated, Paired Cable: NFPA 70, Type CMP.**
 - a. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
 - b. PVC insulation.
 - c. Unshielded.
 - d. PVC jacket.
 - e. Flame Resistance: Comply with NFPA 262.
3. **Paired Cable: NFPA 70, Type CMG.**
 - a. One pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
 - b. PVC insulation.
 - c. Unshielded.
 - d. PVC jacket.
 - e. Flame Resistance: Comply with UL 1581.
4. **Plenum-Rated, Paired Cable: NFPA 70, Type CMP.**
 - a. One pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
 - b. Fluorinated ethylene propylene insulation.
 - c. Unshielded.



- d. Plastic jacket.
 - e. Flame Resistance: NFPA 262, Flame Test.
- J. Control-Circuit Conductors
- 1. Class 1 Control Circuits: Stranded copper, Type THHN-THWN **OR** Type XHHN, **as directed**, in raceway, complying with UL 83 **OR** UL 44, **as directed**.
 - 2. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway **OR** Type XHHN, in raceway **OR** power-limited cable, concealed in building finishes **OR** power-limited tray cable, in cable tray, **as directed**, complying with UL 83 **OR** UL 44, **as directed**.
 - 3. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or Type TF, complying with UL 83.
- K. Identification Products
- 1. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
 - 2. Comply with requirements in Division 26 Section "Identification For Electrical Systems".
- L. Source Quality Control
- 1. Testing Agency: Engage a qualified testing agency to evaluate cables.
 - 2. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.
 - 3. Factory test UTP cables according to TIA/EIA-568-B.2.
 - 4. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.
 - 5. Cable will be considered defective if it does not pass tests and inspections.
 - 6. Prepare test and inspection reports.

1.3 EXECUTION

- A. Installation Of Pathways
- 1. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.
 - 2. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
 - 3. Comply with requirements in Division 26 Section "Raceway And Boxes For Electrical Systems" for installation of conduits and wireways.
 - 4. Install manufactured conduit sweeps and long-radius elbows if possible.
 - 5. Pathway Installation in Equipment Rooms:
 - a. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed or in the corner of room if multiple sheets of plywood are installed around perimeter walls of room.
 - b. Install cable trays to route cables if conduits cannot be located in these positions.
 - c. Secure conduits to backboard if entering room from overhead.
 - d. Extend conduits 3 inches (75 mm) above finished floor.
 - e. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
 - 6. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.
- B. Installation Of Conductors And Cables
- 1. Comply with NECA 1.
 - 2. General Requirements for Cabling:
 - a. Comply with TIA/EIA-568-B.1.
 - b. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - c. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.



- d. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
- e. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
- f. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
- g. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
- h. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
3. UTP Cable Installation:
 - a. Comply with TIA/EIA-568-B.2.
 - b. Install 110-style IDC termination hardware unless otherwise indicated.
 - c. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
4. Installation of Control-Circuit Conductors:
 - a. Install wiring in raceways. Comply with requirements specified in Division 26 Section "Raceway And Boxes For Electrical Systems".
5. Optical Fiber Cable Installation:
 - a. Comply with TIA/EIA-568-B.3.
 - b. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.
6. Open-Cable Installation:
 - a. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 - b. Suspend copper cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1525 mm) apart.
 - c. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
7. Installation of Cable Routed Exposed under Raised Floors:
 - a. Install plenum-rated cable only.
 - b. Install cabling after the flooring system has been installed in raised floor areas.
 - c. Coil cable 72 inches (1830 mm) long shall be neatly coiled not less than 12 inches (305 mm) in diameter below each feed point.
8. Separation from EMI Sources:
 - a. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 - b. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - 1) Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - 2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (305 mm).
 - 3) Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (600 mm).
 - c. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - 1) Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
 - 2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
 - 3) Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (305 mm).
 - d. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:



- 1) Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - 2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (75 mm).
 - 3) Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
 - e. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
 - f. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).
- C. Removal Of Conductors And Cables
1. Remove abandoned conductors and cables.
- D. Control-Circuit Conductors
1. Minimum Conductor Sizes:
 - a. Class 1 remote-control and signal circuits, No 14 AWG.
 - b. Class 2 low-energy, remote-control, and signal circuits, No. 16 AWG.
 - c. Class 3 low-energy, remote-control, alarm, and signal circuits, No 12 AWG.
- E. Firestopping
1. Comply with requirements in Division 07 Section "Penetration Firestopping".
 2. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
 3. Comply with BICSI TDMM, "Firestopping Systems" Article.
- F. Grounding
1. For data communication wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
 2. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding And Bonding For Electrical Systems".
- G. Identification
- H. Identify system components, wiring, and cabling according to TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".
- I. Field Quality Control
1. Perform tests and inspections.
 2. Tests and Inspections:
 - a. Visually inspect UTP and optical fiber cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
 - b. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - c. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not after cross connection.
 - 1) Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - d. Optical Fiber Cable Tests:
 - 1) Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - 2) Link End-to-End Attenuation Tests:
 - a) Multimode Link Measurements: Test at 850 or 1300 nm in one direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.



- b) Attenuation test results for links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.
- 3. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.
- 4. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- 5. Prepare test and inspection reports.

END OF SECTION 26 05 19 16



SECTION 26 05 19 16a - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for communications equipment room fittings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Telecommunications mounting elements.
 - b. Backboards.
 - c. Telecommunications equipment racks and cabinets.
 - d. Telecommunications service entrance pathways.
 - e. Grounding.

C. Definitions

1. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
2. BICSI: Building Industry Consulting Service International.
3. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel not exceeding 6 inches (152 mm) in width.
4. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
5. LAN: Local area network.
6. RCDD: Registered Communications Distribution Designer.
7. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of a bottom without ventilation openings within integral or separate longitudinal side rails.
8. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.

D. Performance Requirements

1. Seismic Performance: Floor-mounted cabinets and cable pathways shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

E. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
 - c. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.
3. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.
4. Seismic Qualification Certificates: For floor-mounted cabinets, accessories, and components, from manufacturer.



- a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
- b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions. Base certification on the maximum number of components capable of being mounted in each rack type. Identify components on which certification is based.
- c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

F. Quality Assurance

- 1. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - a. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of RCDD **OR** RCDD/NTS **OR** Commercial Installer, Level 2, **as directed**.
 - b. Installation Supervision: Installation shall be under the direct supervision of Registered Technician **OR** Level 2 Installer, **as directed**, who shall be present at all times when Work of this Section is performed at Project site.
 - c. Field Inspector: Currently registered by BICSI as RCDD **OR** Commercial Installer, Level 2, **as directed**, to perform the on-site inspection.
- 2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- 3. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- 4. Grounding: Comply with ANSI-J-STD-607-A.

G. Project Conditions

- 1. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

H. Coordination

- 1. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.
 - a. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
 - b. Record agreements reached in meetings and distribute them to other participants.
 - c. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
 - d. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.
- 2. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

1.2 PRODUCTS

A. Pathways

- 1. General Requirements: Comply with TIA/EIA-569-A.
- 2. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets.
 - a. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.



- b. Support brackets with cable tie slots for fastening cable ties to brackets.
 - c. Lacing bars, spools, J-hooks, and D-rings.
 - d. Straps and other devices.
 - 3. Cable Trays:
 - a. Cable Tray Materials: Metal, suitable for indoors and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch (0.012 mm) thick **OR** hot-dip galvanizing, complying with ASTM A 123/A 123M, Grade 0.55, not less than 0.002165 inch (0.055 mm) thick, **as directed**.
 - 1) Basket Cable Trays: 6 inches (150 mm) wide and 2 inches (50 mm) deep. Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).
 - 2) Trough Cable Trays: Nominally 6 inches (150 mm) wide.
 - 3) Ladder Cable Trays: Nominally 18 inches (455 mm) wide, and a rung spacing of 12 inches (305 mm).
 - 4) Channel Cable Trays: One-piece construction, nominally 4 inches (100 mm) wide. Slot spacing shall not exceed 4-1/2 inches (115 mm) o.c.
 - 5) Solid-Bottom Cable Trays: One-piece construction, nominally 12 inches (305 mm) wide. Provide with **OR** without, **as directed**, solid covers.
 - 4. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway And Boxes For Electrical Systems". Flexible metal conduit shall not be used.
 - a. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.
- B. Backboards
- 1. Backboards: Plywood, fire-retardant treated, **as directed**, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels specified in Division 06 Section "Rough Carpentry".
- C. Equipment Frames
- 1. General Frame Requirements:
 - a. Distribution Frames: Freestanding and wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
 - b. Module Dimension: Width compatible with EIA 310 standard, 19-inch (480-mm) panel mounting.
 - c. Finish: Manufacturer's standard, baked-polyester powder coat.
 - 2. Floor-Mounted Racks: Modular-type, steel **OR** aluminum, **as directed**, construction.
 - a. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug, and a power strip, **as directed**.
 - b. Baked-polyester powder coat finish.
 - 3. Modular Freestanding Cabinets:
 - a. Removable and lockable side panels.
 - b. Hinged and lockable front and rear doors.
 - c. Adjustable feet for leveling.
 - d. Screened ventilation openings in the roof and rear door.
 - e. Cable access provisions in the roof and base.
 - f. Grounding bus bar.
 - g. Rack **OR** Roof, **as directed**, -mounted, 550-cfm (260-L/s) fan with filter.
 - h. Power strip.
 - i. Baked-polyester powder coat finish.
 - j. All cabinets keyed alike.
 - 4. Modular Wall Cabinets:
 - a. Wall mounting.
 - b. Steel **OR** Aluminum, **as directed**, construction.
 - c. Treated to resist corrosion.
 - d. Lockable front and rear doors.



- e. Louvered side panels.
 - f. Cable access provisions top and bottom.
 - g. Grounding lug.
 - h. Rack **OR** Roof, **as directed**, -mounted, 250-cfm (118-L/s) fan.
 - i. Power strip.
 - j. All cabinets keyed alike.
5. Cable Management for Equipment Frames:
- a. Metal, with integral wire retaining fingers.
 - b. Baked-polyester powder coat finish.
 - c. Vertical cable management panels shall have front and rear channels, with covers.
 - d. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

D. Power Strips

- 1. Power Strips: Comply with UL 1363.
 - a. Rack mounting.
 - b. Six, 15-A, 120-V ac, NEMA WD 6, Configuration 5-15R **OR** 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R, **as directed**, receptacles.
 - c. LED indicator lights for power and protection status.
 - d. LED indicator lights for reverse polarity and open outlet ground.
 - e. Circuit Breaker and Thermal Fusing:
 - 1) When protection is lost, circuit opens and cannot be reset.
 - OR**
 - Unit continues to supply power if protection is lost.
 - f. Close-coupled, direct plug-in **OR** Cord connected with 15-foot (4.5-m), **as directed**, line cord.
 - g. Rocker-type on-off switch, illuminated when in on position.
 - h. Peak Single-Impulse Surge Current Rating: 33 **OR** 26 **OR** 13, **as directed**, kA per phase.
 - i. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all 3 modes shall be not more than 330 V.

E. Grounding

- 1. Comply with requirements in Division 26 Section "Grounding And Bonding For Electrical Systems" for grounding conductors and connectors.
- 2. Telecommunications Main Bus Bar:
 - a. Connectors: Mechanical type, cast silicon bronze, solderless compression **OR** exothermic, **as directed**, -type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
 - b. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide (6 mm thick by 100 mm wide) with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart.
 - c. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.
- 3. Comply with ANSI-J-STD-607-A.

F. Labeling

- 1. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

1.3 EXECUTION

A. Entrance Facilities

- 1. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.
- 2. Install underground **OR** buried **OR** aerial, **as directed**, pathways complying with recommendations in TIA/EIA-569-A, "Entrance Facilities" Article.



- a. Install underground **OR** buried, **as directed**, entrance pathway complying with Division 26 Section "Raceway And Boxes For Electrical Systems".
- B. Installation
1. Comply with NECA 1.
 2. Comply with BICSI TDMM for layout and installation of communications equipment rooms.
 3. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.
 4. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- C. Firestopping
1. Comply with requirements in Division 07 Section "Penetration Firestopping".
 2. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
 3. Comply with BICSI TDMM, "Firestopping Systems" Article.
- D. Grounding
1. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
 2. Comply with ANSI-J-STD-607-A.
 3. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
 4. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.
 - a. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.
- E. Identification
1. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Division 26 Section "Identification For Electrical Systems".
 2. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
 3. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 **OR** Class 3 **OR** Class 4, **as directed**, level of administration including optional identification requirements of this standard, **as directed**.
 4. Labels shall be preprinted or computer-printed type.

END OF SECTION 26 05 19 16a



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SECTION 26 05 19 16b - COMMUNICATIONS BACKBONE CABLING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for communications backbone cabling. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Pathways.
 - b. UTP cable.
 - c. 50/125 and 62.5/125-micrometer, optical fiber cabling.
 - d. Coaxial cable.
 - e. Cable connecting hardware, patch panels, and cross-connects.
 - f. Cabling identification products.

C. Definitions

1. BICSI: Building Industry Consulting Service International.
2. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
3. EMI: Electromagnetic interference.
4. IDC: Insulation displacement connector.
5. LAN: Local area network.
6. RCDD: Registered Communications Distribution Designer.
7. UTP: Unshielded twisted pair.

D. Backbone Cabling Description

1. Backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.
2. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

E. Performance Requirements

1. General Performance: Backbone cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

F. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings:
 - a. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
 - b. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
 - c. Cabling administration drawings and printouts.
 - d. Wiring diagrams to show typical wiring schematics including the following:
 - 1) Cross-connects.
 - 2) Patch panels.
 - 3) Patch cords.



- e. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
- f. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements.
- 3. Qualification Data: For Installer, **as directed**, qualified layout technician, installation supervisor, and field inspector.
- 4. Source quality-control reports.
- 5. Field quality-control reports.
- 6. Maintenance Data.
- 7. Software and Firmware Operational Documentation:
 - a. Software operating and upgrade manuals.
 - b. Program Software Backup: On magnetic media or compact disk, complete with data files.
 - c. Device address list.
 - d. Printout of software application and graphic screens.

G. Quality Assurance

- 1. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - a. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings, and field testing program development by an RCDD.
 - b. Installation Supervision: Installation shall be under the direct supervision of Registered Technician **OR** Level 2 Installer, **as directed**, who shall be present at all times when Work of this Section is performed at Project site.
- 2. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 **OR** 450, **as directed**, or less.
- 3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- 4. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- 5. Grounding: Comply with ANSI-J-STD-607-A.

H. Delivery, Storage, And Handling

- 1. Test cables upon receipt at Project site.
 - a. Test optical fiber cable to determine the continuity of the strand end to end. Use optical fiber flashlight or optical loss test set.
 - b. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.
 - c. Test each pair of UTP cable for open and short circuits.

I. Software Service Agreement

- 1. Technical Support: Beginning with Final Completion, provide software support for two years.
- 2. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Final Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - a. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.2 PRODUCTS

A. Pathways

- 1. General Requirements: Comply with TIA/EIA-569-A.



2. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - a. Support brackets with cable tie slots for fastening cable ties to brackets.
 - b. Lacing bars, spools, J-hooks, and D-rings.
 - c. Straps and other devices.
 3. Cable Trays:
 - a. Cable Tray Material: Metal, suitable for indoors, and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inches (0.012 mm) thick **OR** hot-dip galvanizing, complying with ASTM A 123/A 123M, Grade 0.55, not less than 0.002165 inches (0.055 mm) thick, **as directed**.
 - 1) Basket Cable Trays: 6 inches (150 mm) wide and 2 inches (50 mm) deep. Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).
 - 2) Trough Cable Trays: Nominally 6 inches (150 mm) wide.
 - 3) Ladder Cable Trays: Nominally 18 inches (455 mm) wide, and a rung spacing of 12 inches (305 mm).
 - 4) Channel Cable Trays: One-piece construction, nominally 4 inches (100 mm) wide. Slot spacing shall not exceed 4-1/2 inches (115 mm) o.c.
 - 5) Solid-Bottom Cable Trays: One-piece construction, nominally 12 inches (305 mm) wide. Provide with **OR** without, **as directed**, solid covers.
 4. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway And Boxes For Electrical Systems". Flexible metal conduit shall not be used.
 - a. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.
- B. Backboards
1. Backboards: Plywood, fire-retardant treated, **as directed**, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements in Division 06 Section "Rough Carpentry" for plywood backing panels.
- C. UTP Cable
1. Description: 100-ohm, 100-pair UTP, formed into 25-pair binder groups covered with a gray thermoplastic jacket and overall metallic shield.
 - a. Comply with ICEA S-90-661 for mechanical properties.
 - b. Comply with TIA/EIA-568-B.1 for performance specifications.
 - c. Comply with TIA/EIA-568-B.2, Category 5e **OR** Category 6, **OR** Category 6e **as directed**.
 - d. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - 1) Communications, General Purpose: Type CM or CMG; or MPP, CMP, MPR, CMR, MP, or MPG, **as directed**.
 - 2) Communications, Plenum Rated: Type CMP or MPP, **as directed**, complying with NFPA 262.
 - 3) Communications, Riser Rated: Type CMR; or MPP, CMP, or MPR, **as directed**, complying with UL 1666.
 - 4) Communications, Limited Purpose: Type CMX; or MPP, CMP, MPR, CMR, MP, MPG, CM, or CMG, **as directed**.
 - 5) Multipurpose: Type MP or MPG; or MPP or MPR, **as directed**.
 - 6) Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
 - 7) Multipurpose, Riser Rated: Type MPR or MPP, **as directed**, complying with UL 1666.
- D. UTP Cable Hardware
1. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.



2. Connecting Blocks: 110-style IDC for Category 5e **OR** 110-style IDC for Category 6 **OR** 66-style IDC for Category 5e, **OR** 110-style IDC for Category 6e **as directed**. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.
3. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
 - a. Number of Terminals per Field: One for each conductor in assigned cables.
4. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
 - a. Number of Jacks per Field: One for each four-pair UTP cable indicated **OR** conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria, **as directed**.
5. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
6. Patch Cords: Factory-made, 4-pair cables in 36-inch (900-mm) **OR** 48-inch (1200-mm), **as directed**, lengths; terminated with 8-position modular plug at each end.
 - a. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
 - b. Patch cords shall have color-coded boots for circuit identification.

E. Optical Fiber Cable

1. Description: Multimode, 50/125 **OR** 62.5/125, **as directed**, -micrometer, 24-fiber, nonconductive, **as directed**, tight buffer, optical fiber cable.
 - a. Comply with ICEA S-83-596 for mechanical properties.
 - b. Comply with TIA/EIA-568-B.3 for performance specifications.
 - c. Comply with TIA/EIA-492AAAA-B **OR** TIA/EIA-492AAAA-A, **as directed**, for detailed specifications.
 - d. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
 - 1) General Purpose, Nonconductive: Type OFN or OFNG, or OFNR, OFNP, **as directed**.
 - 2) Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
 - 3) Riser Rated, Nonconductive: Type OFNR or OFNP, **as directed**, complying with UL 1666.
 - 4) General Purpose, Conductive: Type OFC or OFCG; or OFNG, OFN, OFCR, OFNR, OFCP, or OFNP, **as directed**.
 - 5) Plenum Rated, Conductive: Type OFCP or OFNP, **as directed**, complying with NFPA 262.
 - 6) Riser Rated, Conductive: Type OFCR; or OFNR, OFCP, or OFNP, **as directed**, complying with UL 1666.
 - e. Conductive cable shall be steel **OR** aluminum, **as directed**, armored type.
 - f. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
 - g. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
2. Jacket:
 - a. Jacket Color: Aqua for 50/125-micrometer cable **OR** Orange for 62.5/125-micrometer cable, **as directed**.
 - b. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.
 - c. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

F. Optical Fiber Cable Hardware

1. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.
 - a. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.



2. Patch Cords: Factory-made, dual-fiber cables in 36-inch (900-mm) lengths.
 3. Cable Connecting Hardware:
 - a. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
 - b. Quick-connect, simplex and duplex, Type SC **OR** Type ST **OR** Type LC **OR** Type MT-RJ, **as directed**, connectors. Insertion loss not more than 0.75 dB.
 - c. Type SFF connectors may be used in termination racks, panels, and equipment packages.
- G. Coaxial Cable
1. General Coaxial Cable Requirements: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.
 2. RG-11/U: NFPA 70, Type CATV.
 - a. No. 14 AWG, solid, copper-covered steel conductor.
 - b. Gas-injected, foam-PE insulation.
 - c. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
 - d. Jacketed with sunlight-resistant, black PVC or PE.
 - e. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.
 3. RG59/U: NFPA 70, Type CATVR.
 - a. No. 20 AWG, solid, silver-plated, copper-covered steel conductor.
 - b. Gas-injected, foam-PE insulation.
 - c. Triple shielded with 100 percent aluminum polyester tape and 95 percent aluminum braid; covered by aluminum foil with grounding strip.
 - d. Color-coded PVC jacket.
 4. RG-6/U: NFPA 70, Type CATV or CM.
 - a. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 - b. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
 - c. Jacketed with black PVC or PE.
 - d. Suitable for indoor installations.
 5. RG59/U: NFPA 70, Type CATV.
 - a. No. 20 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 - b. Double shielded with 100 percent aluminum polyester tape and 40 percent aluminum braid.
 - c. PVC jacket.
 6. RG59/U (Plenum Rated): NFPA 70, Type CMP.
 - a. No. 20 AWG, solid, copper-covered steel conductor; foam fluorinated ethylene propylene insulation.
 - b. Double shielded with 100 percent aluminum-foil shield and 65 percent aluminum braid.
 - c. Copolymer jacket.
 7. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70, "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:
 - a. CATV Cable: Type CATV, or CATVP or CATVR, **as directed**.
 - b. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
 - c. CATV Riser Rated: Type CATVR; or CATVP, CATVR, or CATV, **as directed**, complying with UL 1666.
 - d. CATV Limited Rating: Type CATVX.
- H. Coaxial Cable Hardware
1. Coaxial-Cable Connectors: Type BNC, 75 ohms.
- I. Grounding
1. Comply with requirements in Division 26 Section "Grounding And Bonding For Electrical Systems" for grounding conductors and connectors.
 2. Comply with ANSI-J-STD-607-A.



- J. Identification Products
 - 1. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- K. Source Quality Control
 - 1. Testing Agency: Engage a qualified testing agency to evaluate cables.
 - 2. Factory test cables on reels according to TIA/EIA-568-B.1.
 - 3. Factory test UTP cables according to TIA/EIA-568-B.2.
 - 4. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.
 - 5. Cable will be considered defective if it does not pass tests and inspections.
 - 6. Prepare test and inspection reports.

1.3 EXECUTION

- A. Entrance Facilities
 - 1. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.
- B. Wiring Methods
 - 1. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, in attics, and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.
 - a. Install plenum cable in environmental air spaces, including plenum ceilings.
 - b. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway And Boxes For Electrical Systems".
 - 2. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
 - 3. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.
- C. Installation Of Pathways
 - 1. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A.
 - 2. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings". Drawings indicate general arrangement of pathways and fittings.
 - 3. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
 - 4. Comply with requirements in Division 26 Section "Raceway And Boxes For Electrical Systems" for installation of conduits and wireways.
 - 5. Install manufactured conduit sweeps and long-radius elbows whenever possible.
 - 6. Pathway Installation in Communications Equipment Rooms:
 - a. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
 - b. Install cable trays to route cables if conduits cannot be located in these positions.
 - c. Secure conduits to backboard when entering room from overhead.
 - d. Extend conduits 3 inches (76 mm) above finished floor.
 - e. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
 - 7. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.



D. Installation Of Cables

1. Comply with NECA 1.
2. General Requirements for Cabling:
 - a. Comply with TIA/EIA-568-B.1.
 - b. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - c. Install 110-style IDC termination hardware unless otherwise indicated.
 - d. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 - e. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - f. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
 - g. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
 - h. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 - i. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 - j. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
 - k. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
3. UTP Cable Installation:
 - a. Comply with TIA/EIA-568-B.2.
 - b. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
4. Optical Fiber Cable Installation:
 - a. Comply with TIA/EIA-568-B.3.
 - b. Cable may be terminated on connecting hardware that is rack or cabinet mounted.
5. Open-Cable Installation:
 - a. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 - b. Suspend UTP cable not in a wireway or pathway, a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1524 mm) apart.
 - c. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
6. Installation of Cable Routed Exposed under Raised Floors:
 - a. Install plenum-rated cable only.
 - b. Install cabling after the flooring system has been installed in raised floor areas.
 - c. Coil cable 6 feet (1800 mm) long not less than 12 inches (300 mm) in diameter below each feed point.
7. Outdoor Coaxial Cable Installation:
 - a. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
 - b. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches (915 mm).
8. Group connecting hardware for cables into separate logical fields.
9. Separation from EMI Sources:
 - a. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 - b. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:



- 1) Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - 2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
 - 3) Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
 - c. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - 1) Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
 - 2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
 - 3) Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
 - d. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - 1) Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - 2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
 - 3) Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
 - e. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
 - f. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).
- E. Firestopping
1. Comply with requirements in Division 07 Section "Penetration Firestopping".
 2. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
 3. Comply with BICSI TDMM, "Firestopping Systems" Article.
- F. Grounding
1. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
 2. Comply with ANSI-J-STD-607-A.
 3. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
 4. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.
- G. Identification
1. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".
 - a. Administration Class: **1 OR 2 OR 3 OR 4, as directed.**
 - b. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.
 2. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
 3. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class **2 OR Class 3 OR Class 4, as directed**, level of administration including optional identification requirements of this standard.
 4. Comply with requirements in Division 27 Section "Communications Horizontal Cabling" for cable and asset management software.
 5. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.



6. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.
 7. Cable and Wire Identification:
 - a. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
 - b. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
 - c. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
 - d. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - 1) Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.
 - 2) Label each unit and field within distribution racks and frames.
 - e. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
 8. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA 606-A, for the following:
 - a. Cables use flexible vinyl or polyester that flexes as cables are bent.
- H. Field Quality Control
1. Tests and Inspections:
 - a. Visually inspect UTP and optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
 - b. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - c. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
 - 1) Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - d. Optical Fiber Cable Tests:
 - 1) Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - 2) Link End-to-End Attenuation Tests:
 - a) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
 - b) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.



2. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
3. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
4. End-to-end cabling will be considered defective if it does not pass tests and inspections.
5. Prepare test and inspection reports.

END OF SECTION 26 05 19 16b



SECTION 26 05 19 16c - COMMUNICATIONS HORIZONTAL CABLING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for communications horizontal cabling. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Pathways.
 - b. UTP cabling.
 - c. 50/125 and 62.5/125-micrometer, optical fiber cabling.
 - d. Coaxial cable.
 - e. Multiuser telecommunications outlet assemblies.
 - f. Cable connecting hardware, patch panels, and cross-connects.
 - g. Telecommunications outlet/connectors.
 - h. Cabling system identification products.
 - i. Cable management system.

C. Definitions

1. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
2. BICSI: Building Industry Consulting Service International.
3. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel.
4. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.
5. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
6. EMI: Electromagnetic interference.
7. IDC: Insulation displacement connector.
8. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
9. LAN: Local area network.
10. MUTOA: Multiuser telecommunications outlet assembly, a grouping in one location of several telecommunications outlet/connectors.
11. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
12. RCDD: Registered Communications Distribution Designer.
13. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of longitudinal side rails and a bottom without ventilation openings.
14. Trough or Ventilated Cable Tray: A fabricated structure consisting of longitudinal side rails and a bottom having openings for the passage of air.
15. UTP: Unshielded twisted pair.

D. Horizontal Cabling Description

1. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.
 - a. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.



- b. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
- c. Bridged taps and splices shall not be installed in the horizontal cabling.
- d. Splitters shall not be installed as part of the optical fiber cabling.
- 2. A work area is approximately 100 sq. ft. (9.3 sq. m), and includes the components that extend from the telecommunications outlet/connectors to the station equipment.
- 3. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment. The maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) in the horizontal cross-connect.

E. Performance Requirements

- 1. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

F. Submittals

- 1. Product Data: For each type of product indicated.
- 2. Shop Drawings:
 - a. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
 - b. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
 - c. Cabling administration drawings and printouts.
 - d. Wiring diagrams to show typical wiring schematics, including the following:
 - 1) Cross-connects.
 - 2) Patch panels.
 - 3) Patch cords.
 - e. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
 - f. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements.
- 3. Samples: For workstation outlets, jacks, jack assemblies, in specified finish, one for each size and outlet configuration and faceplates for color selection and evaluation of technical features.
- 4. Qualification Data: For Installer, **as directed**, qualified layout technician, installation supervisor, and field inspector.
- 5. Source quality-control reports.
- 6. Field quality-control reports.
- 7. Maintenance Data.
- 8. Software and Firmware Operational Documentation:
 - a. Software operating and upgrade manuals.
 - b. Program Software Backup: On magnetic media or compact disk, complete with data files.
 - c. Device address list.
 - d. Printout of software application and graphic screens.

G. Quality Assurance

- 1. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - a. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings, and field testing program development by an RCDD.
 - b. Installation Supervision: Installation shall be under the direct supervision of Registered Technician **OR** Level 2 Installer, **as directed**, who shall be present at all times when Work of this Section is performed at Project site.
- 2. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.



- b. Smoke-Developed Index: 50 **OR** 450, **as directions**, or less.
 - 3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 4. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
 - 5. Grounding: Comply with ANSI-J-STD-607-A.
- H. Delivery, Storage, And Handling
 - 1. Test cables upon receipt at Project site.
 - a. Test optical fiber cables to determine the continuity of the strand end to end. Use optical fiber flashlight or optical loss test set.
 - b. Test optical fiber cables while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; including the loss value of each. Retain test data and include the record in maintenance data.
 - c. Test each pair of UTP cable for open and short circuits.
- I. Software Service Agreement
 - 1. Technical Support: Beginning with Final Completion, provide software support for two years.
 - 2. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Final Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - a. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.2 PRODUCTS

- A. Pathways
 - 1. General Requirements: Comply with TIA/EIA-569-A.
 - 2. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - a. Support brackets with cable tie slots for fastening cable ties to brackets.
 - b. Lacing bars, spools, J-hooks, and D-rings.
 - c. Straps and other devices.
 - 3. Cable Trays:
 - a. Cable Tray Materials: Metal, suitable for indoors, and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch (0.012 mm) thick **OR** hot-dip galvanizing, complying with ASTM A 123/A 123M, Grade 0.55, not less than 0.002165 inch (0.055 mm) thick, **as directed**.
 - 1) Basket Cable Trays: 6 inches (150 mm) wide and 2 inches (50 mm) deep. Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).
 - 2) Trough Cable Trays: Nominally 6 inches (150 mm) wide.
 - 3) Ladder Cable Trays: Nominally 18 inches (455 mm) wide, and a rung spacing of 12 inches (305 mm).
 - 4) Channel Cable Trays: One-piece construction, nominally 4 inches (100 mm) wide. Slot spacing shall not exceed 4-1/2 inches (115 mm) o.c.
 - 5) Solid-Bottom Cable Trays: One-piece construction, nominally 12 inches (305 mm) wide. Provide with **OR** without, **as directed**, solid covers.
 - 4. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway And Boxes For Electrical Systems". Flexible metal conduit shall not be used.
 - a. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.
- B. Backboards



1. Backboards: Plywood, fire-retardant treated, **as directed**, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements in Division 06 Section "Rough Carpentry" for plywood backing panels.

C. UTP Cable

1. Description: 100-ohm, 4-pair UTP, formed into 25-pair, binder groups covered with a blue thermoplastic jacket.
 - a. Comply with ICEA S-90-661 for mechanical properties.
 - b. Comply with TIA/EIA-568-B.1 for performance specifications.
 - c. Comply with TIA/EIA-568-B.2, Category 5e **OR** Category 6, **OR** Category 6e **as directed**.
 - d. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - 1) Communications, General Purpose: Type CM or CMG; or MPP, CMP, MPR, CMR, MP, or MPG, **as directed**.
 - 2) Communications, Plenum Rated: Type CMP or MPP, **as directed**, complying with NFPA 262.
 - 3) Communications, Riser Rated: Type CMR; or MPP, CMP, or MPR, **as directed**, complying with UL 1666.
 - 4) Communications, Limited Purpose: Type CMX; or MPP, CMP, MPR, CMR, MP, MPG, CM, or CMG, **as directed**.
 - 5) Multipurpose: Type MP or MPG; or MPP or MPR, **as directed**.
 - 6) Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
 - 7) Multipurpose, Riser Rated: Type MPR or MPP, **as directed**, complying with UL 1666.

D. UTP Cable Hardware

1. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
2. Connecting Blocks: 110-style IDC for Category 5e **OR** 110-style IDC for Category 6 **OR** 66-style IDC for Category 5e, **OR** 110-style IDC for Category 6e **as directed**. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.
3. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
 - a. Number of Terminals per Field: One for each conductor in assigned cables.
4. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
 - a. Number of Jacks per Field: One for each four-pair UTP cable indicated **OR** conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria, **as directed**.
5. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
6. Patch Cords: Factory-made, four-pair cables in 36-inch (900 mm) **OR** 48-inch (1200-mm), **as directed**, lengths; terminated with eight-position modular plug at each end.
 - a. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
 - b. Patch cords shall have color-coded boots for circuit identification.

E. Optical Fiber Cable

1. Description: Multimode, 50/125 **OR** 62.5/125, **as directed**, -micrometer, 24-fiber, nonconductive, **as directed**, tight buffer, optical fiber cable.
 - a. Comply with ICEA S-83-596 for mechanical properties.
 - b. Comply with TIA/EIA-568-B.3 for performance specifications.



- c. Comply with TIA/EIA-492AAAA-B **OR** TIA/EIA-492AAAA-A, **as directed**, for detailed specifications.
 - d. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
 - 1) General Purpose, Nonconductive: Type OFN or OFNG, or OFNR, OFNP, **as directed**.
 - 2) Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
 - 3) Riser Rated, Nonconductive: Type OFNR or OFNP, **as directed**, complying with UL 1666.
 - 4) General Purpose, Conductive: Type OFC or OFCG; or OFNG, OFN, OFCR, OFNR, OFCP, or OFNP, **as directed**.
 - 5) Plenum Rated, Conductive: Type OFCP or OFNP, **as directed**, complying with NFPA 262.
 - 6) Riser Rated, Conductive: Type OFCR; or OFNR, OFCP, or OFNP, **as directed**, complying with UL 1666.
 - e. Conductive cable shall be steel **OR** aluminum, **as directed**, armored type.
 - f. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
 - g. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
 - 2. Jacket:
 - a. Jacket Color: Aqua for 50/125-micrometer cable **OR** Orange for 62.5/125-micrometer cable, **as directed**.
 - b. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.
 - c. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).
- F. Optical Fiber Cable Hardware
- 1. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.
 - a. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.
 - 2. Patch Cords: Factory-made, dual-fiber cables in 36-inch (900-mm) lengths.
 - 3. Cable Connecting Hardware:
 - a. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
 - b. Quick-connect, simplex and duplex, Type SC **OR** Type ST **OR** Type LC **OR** Type MT-RJ, **as directed**, connectors. Insertion loss not more than 0.75 dB.
 - c. Type SFF connectors may be used in termination racks, panels, and equipment packages.
- G. Coaxial Cable
- 1. Cable Characteristics: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.
 - 2. RG-11/U: NFPA 70, Type CATV.
 - a. No. 14 AWG, solid, copper-covered steel conductor.
 - b. Gas-injected, foam-PE insulation.
 - c. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
 - d. Jacketed with sunlight-resistant, black PVC or PE.
 - e. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.
 - 3. RG59/U: NFPA 70, Type CATVR.
 - a. No. 20 AWG, solid, silver-plated, copper-covered steel conductor.
 - b. Gas-injected, foam-PE insulation.
 - c. Triple shielded with 100 percent aluminum polyester tape and 95 percent aluminum braid; covered by aluminum foil with grounding strip.
 - d. Color-coded PVC jacket.
 - 4. RG-6/U: NFPA 70, Type CATV or CM.



- a. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 - b. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
 - c. Jacketed with black PVC or PE.
 - d. Suitable for indoor installations.
- 5. RG59/U: NFPA 70, Type CATV.
 - a. No. 20 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 - b. Double shielded with 100 percent aluminum polyester tape and 40 percent aluminum braid.
 - c. PVC jacket.
- 6. RG59/U (Plenum Rated): NFPA 70, Type CMP.
 - a. No. 20 AWG, solid, copper-covered steel conductor; foam fluorinated ethylene propylene insulation.
 - b. Double shielded with 100 percent aluminum-foil shield and 65 percent aluminum braid.
 - c. Copolymer jacket.
- 7. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70 "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:
 - a. CATV Cable: Type CATV or CATVP or CATVR, **as directed**.
 - b. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
 - c. CATV Riser Rated: Type CATVR; or CATVP, CATVR, or CATV, **as directed**, complying with UL 1666.
 - d. CATV Limited Rating: Type CATVX.
- H. Coaxial Cable Hardware
 - 1. Coaxial-Cable Connectors: Type BNC, 75 ohms.
- I. Consolidation Points
 - 1. Description: Consolidation points shall comply with requirements for cable connecting hardware.
 - a. Number of Terminals per Field: One for each conductor in assigned cables.
 - b. Number of Connectors per Field:
 - 1) One for each four-pair UTP cable indicated.
 - 2) One for each four-pair conductor group of indicated cables, plus 25 percent spare positions.
 - c. Mounting: Recessed in ceiling **OR** Wall **OR** Desk **OR** Furniture, **as directed**.
 - d. NRTL listed as complying with UL 50 and UL 1863.
 - e. When installed in plenums used for environmental air, NRTL listed as complying with UL 2043.
- J. Multiuser Telecommunications Outlet Assembly (MUTOA)
 - 1. Description: MUTOAs shall meet the requirements for cable connecting hardware.
 - a. Number of Terminals per Field: One for each conductor in assigned cables.
 - b. Number of Connectors per Field:
 - 1) One for each four-pair UTP cable indicated.
 - 2) One for each four-pair conductor group of indicated cables, plus 25 percent spare positions.
 - c. Mounting: Recessed in ceiling **OR** Wall **OR** Desk **OR** Furniture, **as directed**.
 - d. NRTL listed as complying with UL 50 and UL 1863.
 - e. Label shall include maximum length of work area cords, based on TIA/EIA-568-B.1.
 - f. When installed in plenums used for environmental air, NRTL listed as complying with UL 2043.
- K. Telecommunications Outlet/Connectors
 - 1. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.
 - 2. Workstation Outlets: Two **OR** Four, **as directed**, -port-connector assemblies mounted in single or multigang faceplate.



- a. Plastic Faceplate: High-impact plastic. Coordinate color with Division 26 Section "Wiring Devices".
 - b. Metal Faceplate: Stainless steel **OR** Brass, **as directed**, complying with requirements in Division 26 Section "Wiring Devices".
 - c. For use with snap-in jacks accommodating any combination of UTP, optical fiber, and coaxial work area cords.
 - 1) Flush mounting jacks, positioning the cord at a 45-degree angle.
 - d. Legend:
 - 1) Factory labeled by silk-screening or engraving for stainless steel **OR** brass, **as directed**, faceplates.
OR
Machine printed, in the field, using adhesive-tape label.
OR
Snap-in, clear-label covers and machine-printed paper inserts.
 - L. Grounding
 - 1. Comply with requirements in Division 26 Section "Grounding And Bonding For Electrical Systems" for grounding conductors and connectors.
 - 2. Comply with ANSI-J-STD-607-A.
 - M. Identification Products
 - 1. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
 - 2. Comply with requirements in Division 26 Section "Identification For Electrical Systems".
 - N. Cable Management System
 - 1. Description: Computer-based cable management system, with integrated database and graphic, **as directed**, capabilities.
 - 2. Document physical characteristics by recording the network, TIA/EIA details, and connections between equipment and cable.
 - 3. Information shall be presented in database view, schematic plans, or technical drawings.
 - a. Microsoft Visio Professional or AutoCAD drawing software shall be used as drawing and schematic plans software.
 - 4. System shall interface with the following testing and recording devices:
 - a. Direct upload tests from circuit testing instrument into the personal computer.
 - b. Direct download circuit labeling into labeling printer.
 - O. Source Quality Control
 - 1. Testing Agency: Engage a qualified testing agency to evaluate cables.
 - 2. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.
 - 3. Factory test UTP cables according to TIA/EIA-568-B.2.
 - 4. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.
 - 5. Factory-sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.
 - 6. Cable will be considered defective if it does not pass tests and inspections.
 - 7. Prepare test and inspection reports.
- 1.3 EXECUTION
- A. Entrance Facilities
 - 1. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.
 - B. Wiring Methods



1. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, in attics, and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.
 - a. Install plenum cable in environmental air spaces, including plenum ceilings.
 - b. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway And Boxes For Electrical Systems".
2. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
3. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

C. Installation Of Pathways

1. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.
2. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings". Drawings indicate general arrangement of pathways and fittings.
3. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
4. Comply with requirements in Division 26 Section "Raceway And Boxes For Electrical Systems" for installation of conduits and wireways.
5. Install manufactured conduit sweeps and long-radius elbows whenever possible.
6. Pathway Installation in Communications Equipment Rooms:
 - a. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
 - b. Install cable trays to route cables if conduits cannot be located in these positions.
 - c. Secure conduits to backboard when entering room from overhead.
 - d. Extend conduits 3 inches (76 mm) above finished floor.
 - e. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
7. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

D. Installation Of Cables

1. Comply with NECA 1.
2. General Requirements for Cabling:
 - a. Comply with TIA/EIA-568-B.1.
 - b. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - c. Install 110-style IDC termination hardware unless otherwise indicated.
 - d. MUTOA shall not be used as a cross-connect point.
 - e. Consolidation points may be used only for making a direct connection to telecommunications outlet/connectors:
 - 1) Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
 - 2) Locate consolidation points for UTP at least 49 feet (15 m) from communications equipment room.
 - f. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 - g. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - h. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.



- i. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
- j. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
- k. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
- l. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
- m. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
3. UTP Cable Installation:
 - a. Comply with TIA/EIA-568-B.2.
 - b. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
4. Optical Fiber Cable Installation:
 - a. Comply with TIA/EIA-568-B.3.
 - b. Cable may be terminated on connecting hardware that is rack or cabinet mounted.
5. Open-Cable Installation:
 - a. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 - b. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1524 mm) apart.
 - c. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
6. Installation of Cable Routed Exposed under Raised Floors:
 - a. Install plenum-rated cable only.
 - b. Install cabling after the flooring system has been installed in raised floor areas.
 - c. Coil cable 6 feet (1800 mm) long not less than 12 inches (300 mm) in diameter below each feed point.
7. Outdoor Coaxial Cable Installation:
 - a. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
 - b. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches (915 mm).
8. Group connecting hardware for cables into separate logical fields.
9. Separation from EMI Sources:
 - a. Comply with BICSI TDMM and TIA/EIA-569-A for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 - b. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - 1) Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - 2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
 - 3) Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
 - c. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - 1) Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
 - 2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
 - 3) Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
 - d. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:



- 1) Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - 2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
 - 3) Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
 - e. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
 - f. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).
- E. Firestopping
1. Comply with requirements in Division 07 Section "Penetration Firestopping".
 2. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
 3. Comply with BICSI TDMM, "Firestopping Systems" Article.
- F. Grounding
1. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
 2. Comply with ANSI-J-STD-607-A.
 3. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
 4. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.
- G. Identification
1. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".
 - a. Administration Class: **1 OR 2 OR 3 OR 4, as directed.**
 - b. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.
 2. Using cable management system software specified in Part 2, develop Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable and label cable, jacks, connectors, and terminals to which it connects with same designation. At completion, cable and asset management software shall reflect as-built conditions.
 3. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
 4. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 **OR** Class 3 **OR** Class 4, **as directed**, level of administration, including optional identification requirements of this standard.
 5. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
 6. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.
 7. Cable and Wire Identification:
 - a. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.



- b. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
- c. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
- d. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - 1) Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
 - 2) Label each unit and field within distribution racks and frames.
- e. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- f. Uniquely identify and label work area cables extending from the MUTOA to the work area. These cables may not exceed the length stated on the MUTOA label.
- 8. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.
 - a. Cables use flexible vinyl or polyester that flex as cables are bent.

H. Field Quality Control

- 1. Tests and Inspections:
 - a. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
 - b. Visually confirm Category 5e **OR** Category 6, **OR** Category 6e **as directed**, marking of outlets, cover plates, outlet/connectors, and patch panels.
 - c. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - d. Test UTP backbone copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
 - 1) Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - e. Optical Fiber Cable Tests:
 - 1) Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - 2) Link End-to-End Attenuation Tests:
 - a) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
 - b) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.
 - f. UTP Performance Tests:
 - 1) Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:
 - a) Wire map.
 - b) Length (physical vs. electrical, and length requirements).
 - c) Insertion loss.



- d) Near-end crosstalk (NEXT) loss.
- e) Power sum near-end crosstalk (PSNEXT) loss.
- f) Equal-level far-end crosstalk (ELFEXT).
- g) Power sum equal-level far-end crosstalk (PSELFEXT).
- h) Return loss.
- i) Propagation delay.
- j) Delay skew.
- g. Optical Fiber Cable Performance Tests: Perform optical fiber end-to-end link tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.3.
- h. Coaxial Cable Tests: Conduct tests according to Division 27 Section "Master Antenna Television System".
- i. Final Verification Tests: Perform verification tests for UTP and optical fiber systems after the complete communications cabling and workstation outlet/connectors are installed.
 - 1) Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
 - 2) Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.
- 2. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- 3. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- 4. Prepare test and inspection reports.

END OF SECTION 26 05 19 16c



SECTION 26 05 19 16d - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for conductors and cables for electronic safety and security. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. UTP cabling.
 - b. 50/125 and 62.5/125-micrometer, multimode optical fiber cabling.
 - c. Coaxial cabling.
 - d. RS-232 cabling.
 - e. RS-485 cabling.
 - f. Low-voltage control cabling.
 - g. Control-circuit conductors.
 - h. Fire alarm wire and cable.
 - i. Identification products.

C. Definitions

1. BICSI: Building Industry Consulting Service International.
2. EMI: Electromagnetic interference.
3. IDC: Insulation displacement connector.
4. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
5. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).
6. RCDD: Registered Communications Distribution Designer.

D. Performance Requirements

1. Seismic Performance: Pathways shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

E. Submittals

1. Product Data: For each type of product indicated.
 - a. For coaxial cable, include the following installation data for each type used:
 - 1) Nominal OD.
 - 2) Minimum bending radius.
 - 3) Maximum pulling tension.
2. Shop Drawings: Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
 - a. Vertical and horizontal offsets and transitions.
 - b. Clearances for access above and to side of cable trays.
 - c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
3. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
4. Seismic Qualification Certificates: For pathways, accessories, and components, from manufacturer.



- a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
- b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
- c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- 5. Source quality-control reports.
- 6. Field quality-control reports.
- 7. Operation and Maintenance Data: For wire and cable to include in operation and maintenance manuals. Include the following:
 - a. Allowable pulling tension of cable.
 - b. Cable connectors and terminations recommended by the manufacturer.

F. Quality Assurance

- 1. Testing Agency Qualifications: An NRTL.
 - a. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
- 2. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 **OR** 450, **as directed**, or less.
- 3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Delivery, Storage, And Handling

- 1. Test cables upon receipt at Project site.
 - a. Test optical fiber cable to determine the continuity of the strand end to end. Use optical-fiber flashlight or optical loss test set.
 - b. Test optical fiber cable on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; include the loss value of each. Retain test data and include the record in maintenance data.
 - c. Test each pair of UTP cable for open and short circuits.

H. Project Conditions

- 1. Do not install conductors and cables that are wet, moisture damaged, or mold damaged.
 - a. Indications that wire and cables are wet or moisture damaged include, but are not limited to, discoloration and sagging of factory packing materials.
- 2. Environmental Limitations: Do not deliver or install UTP, optical fiber, and coaxial cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.2 PRODUCTS

A. Pathways

- 1. Support of Open Cabling: NRTL labeled for support of Category 5e **OR** Category 6, **OR** Category 6e **as directed**, cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - a. Support brackets with cable tie slots for fastening cable ties to brackets.
 - b. Lacing bars, spools, J-hooks, and D-rings.
 - c. Straps and other devices.
- 2. Cable Trays:



- a. Cable Tray Materials: Metal, suitable for indoors, and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch (0.012 mm) thick **OR** hot-dip galvanizing, complying with ASTM A 123/A 123M Grade 0.55, not less than 0.002165 inch (0.055 mm) thick, **as directed**.
 - 1) Basket Cable Trays: 6 inches (150 mm) wide and 2 inches (50 mm) deep, **as directed**. Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).
 - 2) Trough Cable Trays: Nominally 6 inches (150 mm), **as directed**, wide.
 - 3) Ladder Cable Trays: Nominally 18 inches (455 mm), **as directed**, wide, and a rung spacing of 12 inches (305 mm), **as directed**.
 - 4) Channel Cable Trays: One-piece construction, nominally 4 inches (100 mm), **as directed**, wide. Slot spacing shall not exceed 4-1/2 inches (115 mm) o.c.
 - 5) Solid-Bottom Cable Trays: One-piece construction, nominally 12 inches (305 mm), **as directed**, wide. Provide with **OR** without, **as directed**, solid covers.
 3. Conduit and Boxes: Comply with requirements in Division 16 Section "Raceways and Boxes." Flexible metal conduit shall not be used, **as directed**.
 4. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.
- B. Backboards
1. Backboards: Plywood, fire-retardant treated, **as directed**, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels in Division 06 Section "Rough Carpentry".
- C. UTP Cable
1. Description: 100-ohm, 4-pair UTP, covered with a blue thermoplastic jacket.
 - a. Comply with ICEA S-90-661 for mechanical properties.
 - b. Comply with TIA/EIA-568-B.1 for performance specifications.
 - c. Comply with TIA/EIA-568-B.2, Category 5e **OR** Category 6, **OR** Category 6e **as directed**.
 - d. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - 1) Communications, General Purpose: Type CM or CMG; **OR** MPP, CMP, MPR, CMR, MP, or MPG, **as directed**.
 - 2) Communications, Plenum Rated: Type CMP **OR** MPP, **as directed**, complying with NFPA 262.
 - 3) Communications, Riser Rated: Type CMR; **OR** MPP, CMP, or MPR, **as directed**, complying with UL 1666.
 - 4) Communications, Limited Purpose: Type CMX; **OR** MPP, CMP, MPR, CMR, MP, MPG, CM, or CMG, **as directed**.
 - 5) Multipurpose: Type MP or MPG; **OR** MPP or MPR, **as directed**.
 - 6) Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
 - 7) Multipurpose, Riser Rated: Type MPR **OR** MPP, **as directed**, complying with UL 1666.
- D. UTP Cable Hardware
1. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.
 2. Connecting Blocks: 110-style for Category 5e **OR** 110-style for Category 6 **OR** 66-style for Category 5e, **OR** 110-style for Category 6e **as directed**. Provide blocks for the number of cables terminated on the block, plus 25, **as directed**, percent spare. Integral with connector bodies, including plugs and jacks where indicated.
- E. Optical Fiber Cable
1. Description: Multimode, 50/125 **OR** 62.5/125, **as directed**,-micrometer, 24-fiber, **as directed**, nonconductive, **as directed**, tight buffer, optical fiber cable.



- a. Comply with ICEA S-83-596 for indoor cable OR ICEA S-87-640 for outside plant, as directed, for mechanical properties.
- b. Comply with TIA/EIA-568-B.3 for performance specifications.
- c. Comply with TIA-492AAAB **OR** TIA-492AAAA-A, **as directed**, for detailed specifications.
- d. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
 - 1) General Purpose, Nonconductive: Type OFN or OFNG, **OR** OFNR, OFNP, **as directed**.
 - 2) Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
 - 3) Riser Rated, Nonconductive: Type OFNR or OFNP, complying with UL 1666.
 - 4) General Purpose, Conductive: Type OFC or OFCG; **OR** OFNG, OFN, OFCR, OFNR, OFCP, or OFNP, **as directed**.
 - 5) Plenum Rated, Conductive: Type OFCP or OFNP, complying with NFPA 262.
 - 6) Riser Rated, Conductive: Type OFCR; or OFNR, OFCP, or OFNP, **as directed**, complying with UL 1666.
- e. Conductive cable shall be steel **OR** aluminum, **as directed**, armored type.
- f. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
- g. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
- 2. Jacket:
 - a. Jacket Color: Aqua for 50/125-micrometer cable **OR** Orange for 62.5/125-micrometer cable, **as directed**.
 - b. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-C.
 - c. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

F. Optical Fiber Cable Hardware

- 1. Cable Connecting Hardware: Meet the Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA-604-2-B, TIA-604-3-B, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
 - a. Quick-connect, simplex and duplex, Type SC **OR** Type ST **OR** Type LC **OR** Type MT-RJ, **as directed**, connectors. Insertion loss not more than 0.75 dB.
 - b. Type SFF connectors may be used in termination racks, panels, and equipment packages.

G. Coaxial Cable

- 1. General Coaxial Cable Requirements: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.
- 2. RG-11/U: NFPA 70, Type CATV.
 - a. No. 14 AWG, solid, copper-covered steel conductor.
 - b. Gas-injected, foam-PE insulation.
 - c. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
 - d. Jacketed with sunlight-resistant, black PVC or PE.
 - e. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.
- 3. RG59/U: NFPA 70, Type CATVR.
 - a. No. 20 AWG, solid, silver-plated, copper-covered steel conductor.
 - b. Gas-injected, foam-PE insulation.
 - c. Triple shielded with 100 percent aluminum polyester tape and 95 percent aluminum braid; covered by aluminum foil with grounding strip.
 - d. Color-coded PVC jacket.
- 4. RG-6/U: NFPA 70, Type CATV or CM.
 - a. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 - b. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
 - c. Jacketed with black PVC or PE.



- d. Suitable for indoor installations.
- 5. RG59/U: NFPA 70, Type CATV.
 - a. No. 20 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 - b. Double shielded with 100 percent aluminum polyester tape and 40 percent aluminum braid.
 - c. PVC jacket.
- 6. RG59/U (Plenum Rated): NFPA 70, Type CMP.
 - a. No. 20 AWG, solid, copper-covered steel conductor; foam fluorinated ethylene propylene insulation.
 - b. Double shielded with 100 percent aluminum-foil shield and 65 percent aluminum braid.
 - c. Copolymer jacket.
- 7. NFPA and UL Compliance: Coaxial cables shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655, and with NFPA 70 "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:
 - a. CATV Cable: Type CATV, **OR** CATVP or CATVR, **as directed**.
 - b. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
 - c. CATV Riser Rated: Type CATVR; **OR** CATVP, CATVR, or CATV, **as directed**, complying with UL 1666.
 - d. CATV Limited Rating: Type CATVX.
- H. Coaxial Cable Hardware
 - 1. Coaxial-Cable Connectors: Type BNC, 75 ohms.
- I. RS-232 Cable
 - 1. Standard Cable: NFPA 70, Type CM.
 - a. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
 - b. Polypropylene insulation.
 - c. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 - d. PVC jacket.
 - e. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
 - f. Flame Resistance: Comply with UL 1581.
 - 2. Plenum-Rated Cable: NFPA 70, Type CMP.
 - a. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
 - b. Plastic insulation.
 - c. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 - d. Plastic jacket.
 - e. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
 - f. Flame Resistance: Comply with NFPA 262.
- J. RS-485 Cable
 - 1. Standard Cable: NFPA 70, Type CM **OR** CMG, **as directed**.
 - a. Paired, 2 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors.
 - b. PVC insulation.
 - c. Unshielded.
 - d. PVC jacket.
 - e. Flame Resistance: Comply with UL 1581.
 - 2. Plenum-Rated Cable: NFPA 70, Type CMP.
 - a. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
 - b. Fluorinated ethylene propylene insulation.
 - c. Unshielded.
 - d. Fluorinated ethylene propylene jacket.
 - e. Flame Resistance: NFPA 262, Flame Test.
- K. Low-Voltage Control Cable



1. Paired Cable: NFPA 70, Type CMG.
 - a. 1 pair, twisted, No. 16 AWG, stranded (19x29) and No. 18 AWG, stranded (19x30) tinned copper conductors.
 - b. PVC insulation.
 - c. Unshielded.
 - d. PVC jacket.
 - e. Flame Resistance: Comply with UL 1581.
 2. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
 - a. 1 pair, twisted, No. 16 AWG, stranded (19x29) and No. 18 AWG, stranded (19x30) tinned copper conductors.
 - b. PVC insulation.
 - c. Unshielded.
 - d. PVC jacket.
 - e. Flame Resistance: Comply with NFPA 262.
- L. Control-Circuit Conductors
1. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, complying with UL 83, in raceway **OR** Type XHHN, complying with UL 44, in raceway, **as directed**.
 2. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, complying with UL 83, in raceway **OR** power-limited cable, complying with UL 83, concealed in building finishes **OR** power-limited tray cable, complying with UL 83, in cable tray **OR** Type XHHN, complying with UL 44, in raceway, **as directed**.
 3. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.
- M. Fire Alarm Wire And Cable
1. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
 2. Signaling Line Circuits: Twisted, shielded pair, not less than **OR** No. 18 AWG **OR** size as recommended by system manufacturer, **as directed**.
 - a. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a 2-hour rating.
 3. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
 - a. Low-Voltage Circuits: No. 16 AWG, minimum.
 - b. Line-Voltage Circuits: No. 12 AWG, minimum.
 - c. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket, **as directed**, with red identifier stripe, NRTL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.
- N. Identification Products
1. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
 2. Comply with requirements in Division 26 Section "Identification For Electrical Systems".
- O. Source Quality Control
1. Testing Agency: Engage a qualified testing agency to evaluate cables.
 2. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.
 3. Factory test UTP cables according to TIA/EIA-568-B.2.
 4. Factory test multimode optical fiber cables according to TIA-526-14-A and TIA/EIA-568-B.3.



5. Factory sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.
6. Cable will be considered defective if it does not pass tests and inspections.
7. Prepare test and inspection reports.

1.3 EXECUTION

A. Installation Of Pathways

1. Cable Trays: Comply with NEMA VE 2 and TIA-569-B.
2. Comply with TIA-569-B for pull-box sizing and length of conduit and number of bends between pull points.
3. Comply with requirements in Division 26 Section "Raceway And Boxes For Electrical Systems" for installation of conduits and wireways.
4. Install manufactured conduit sweeps and long-radius elbows whenever possible.
5. Pathway Installation in Equipment Rooms:
 - a. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
 - b. Install cable trays to route cables if conduits cannot be located in these positions.
 - c. Secure conduits to backboard when entering room from overhead.
 - d. Extend conduits 3 inches (75 mm) above finished floor.
 - e. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
6. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

B. Installation Of Hangers And Supports

1. Comply with requirements in Division 26 Section "Hangers And Supports For Electrical Systems" for installation of supports for pathways, conductors and cables.

C. Wiring Method

1. Install wiring in metal raceways and wireways. Conceal raceway except in unfinished spaces and as indicated. Minimum conduit size shall be 3/4 inch (21 mm). Control and data transmission wiring shall not share conduit with other building wiring systems.
2. Install wiring in raceways except in accessible indoor ceiling spaces and in interior hollow gypsum board partitions where cable may be used. Conceal raceways and wiring except in unfinished spaces and as indicated. Minimum conduit size shall be 3/4 inch (21 mm). Control and data transmission wiring shall not share conduit with other building wiring systems.
3. Install cable, concealed in accessible ceilings, walls, and floors when possible.
4. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Use lacing bars and distribution spools. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer. Install conductors parallel with or at right angles to sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

D. Installation Of Conductors And Cables

1. Comply with NECA 1.
2. Conductors: Size according to system manufacturer's written instructions unless otherwise indicated.
3. General Requirements for Cabling:
 - a. Comply with TIA/EIA-568-B.1.
 - b. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."



- c. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
- d. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
- e. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
- f. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
- g. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
- h. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
- 4. UTP Cable Installation: Install using techniques, practices, and methods that are consistent with Category 5e **OR** Category 6, **OR** Category 6e **as directed**, rating of components and that ensure Category 5e **OR** Category 6, **OR** Category 6e **as directed**, performance of completed and linked signal paths, end to end.
 - a. Comply with TIA/EIA-568-B.2.
 - b. Install 110-style IDC termination hardware unless otherwise indicated.
 - c. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
- 5. Optical Fiber Cable Installation:
 - a. Comply with TIA/EIA-568-B.3.
 - b. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.
- 6. Outdoor Coaxial Cable Installation:
 - a. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
 - b. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches (915 mm).
- 7. Open-Cable Installation:
 - a. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 - b. Suspend copper cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1525 mm) apart.
 - c. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- 8. Installation of Cable Routed Exposed under Raised Floors:
 - a. Install plenum-rated cable only.
 - b. Install cabling after the flooring system has been installed in raised floor areas.
 - c. Coil cable 72 inches (1830 mm) long shall be neatly coiled not less than 12 inches (300 mm) in diameter below each feed point.
- 9. Separation from EMI Sources:
 - a. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 - b. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - 1) Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - 2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
 - 3) Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (600 mm).



- c. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - 1) Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
 - 2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
 - 3) Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
 - d. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - 1) Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - 2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (75 mm).
 - 3) Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
 - e. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
 - f. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).
- E. Fire Alarm Wiring Installation
 - 1. Comply with NECA 1 and NFPA 72.
 - 2. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceway And Boxes For Electrical Systems".
 - a. Install plenum cable in environmental air spaces, including plenum ceilings.
 - b. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.
 - 3. Wiring Method:
 - a. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
 - b. Fire-Rated Cables: Use of 2-hour, fire-rated fire alarm cables, NFPA 70, Types MI and CI, is **OR** is not, **as directed**, permitted.
 - c. Signaling Line Circuits: Power-limited fire alarm cables may **OR** shall not, **as directed**, be installed in the same cable or raceway as signaling line circuits.
 - 4. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
 - 5. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
 - 6. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
 - 7. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.
 - 8. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.
- F. Power And Control-Circuit Conductors
 - 1. 120-V Power Wiring: Install according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables" unless otherwise indicated.
 - 2. Minimum Conductor Sizes:
 - a. Class 1 remote-control and signal circuits, No. 14 AWG.



- b. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
- c. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

G. Connections

- 1. Comply with requirements in Division 28 Section "Perimeter Security Systems" for connecting, terminating, and identifying wires and cables.
- 2. Comply with requirements in Division 28 Section "Intrusion Detection" for connecting, terminating, and identifying wires and cables.
- 3. Comply with requirements in Division 28 Section "Access Control" for connecting, terminating, and identifying wires and cables.
- 4. Comply with requirements in Division 28 Section "Video Surveillance" for connecting, terminating, and identifying wires and cables.
- 5. Comply with requirements in Division 28 Section "Plc Electronic Detention Monitoring And Control Systems" for connecting, terminating, and identifying wires and cables.
- 6. Comply with requirements in Division 28 Section(s) "Digital, Addressable Fire-alarm System" OR "Zoned (dc Loop) Fire-alarm System", **as directed**, for connecting, terminating, and identifying wires and cables.
- 7. Comply with requirements in Division 28 Section "Refrigerant Detection And Alarm" for connecting, terminating, and identifying wires and cables.

H. Firestopping

- 1. Comply with requirements in Division 07 Section "Penetration Firestopping".
- 2. Comply with TIA-569-B, "Firestopping" Annex A.
- 3. Comply with BICSI TDMM, "Firestopping Systems" Article.

I. Grounding

- 1. For communications wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- 2. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding And Bonding For Electrical Systems".

J. Identification

- 1. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".

K. Field Quality Control

- 1. Perform tests and inspections.
- 2. Tests and Inspections:
 - a. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
 - b. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - c. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross connection.
 - 1) Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - d. Optical Fiber Cable Tests:



- 1) Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- 2) Link End-to-End Attenuation Tests:
 - a) Multimode Link Measurements: Test at 850 or 1300 nm in 1 direction according to TIA-526-14-A, Method B, One Reference Jumper.
 - b) Attenuation test results for links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.
- e. Coaxial Cable Tests: Comply with requirements in Division 27 Section "Master Antenna Television System".
3. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.
4. End-to-end cabling will be considered defective if it does not pass tests and inspections.
5. Prepare test and inspection reports.

END OF SECTION 26 05 19 16d



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Task	Specification	Specification Description
26 05 19 16	26 05 19 13	Electrical Renovation
26 05 19 16	26 05 13 00	Undercarpet Cables



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SECTION 26 05 19 23 - MONORAILS WITH ELECTRIC POWERED HOISTS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for monorails with electric powered hoists. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. System Description

1. Provide a monorail system with electric powered hoist(s) and plain type (hand operated) **OR** hand chain operated **OR** electric powered, **as directed**, trolley(s) complete, tested and ready for operation. Monorails, hoist(s), trolley(s), equipment, materials, installation, examination, inspection, and workmanship shall be in accordance with the applicable requirements of NFPA 70, ASME/ANSI B30.11, ASME/ANSI B30.16, ASME HST-1M, ANSI/ASME HST-4M, and MMA MH27.1, with modifications specified herein. Reference in these publications to the "authority having jurisdiction" shall be interpreted to mean the "the Owner."

C. Submittals

1. Shop Drawings: Monorail system
2. Product Data: Monorail track system including switches, suspension system and other components; Electric wire rope hoist; Electric chain hoist; Trolley; Pendant pushbutton station; Electrification.
3. Design Data: Load and sizing calculations.
4. Test Reports
5. Certificates
6. Operation and Maintenance Data

D. Delivery, Storage, and Handling

1. Delivery and Storage: Inspect materials delivered to site for damage; unload and store with minimum handling. Store materials on-site in enclosures or under protective coverings. Protect materials not suitable for outdoor storage to prevent damage during periods of inclement weather, including subfreezing temperatures, precipitation, and high winds. Store materials susceptible to deterioration by direct sunlight under cover and avoid damage due to high temperatures. Do not store materials directly on ground. When special precautions are required, prominently and legibly stencil instructions for such precautions on outside of equipment or its crating.
2. Handling: Handle materials in such a manner as to ensure delivery to final location in undamaged condition. Make repairs to damaged materials at no cost to the Owner.

E. Quality Assurance

1. Certificates: Overload Test Certificate: Submit a statement that the monorail system can be periodically load tested to 125 percent (plus 5 minus 0) of rated load.
2. Drawings: Monorail System: Show the general arrangement of all components, clearances and principal dimensions, assemblies of hoist, trolley, track, track suspension system, and electrical schematic drawings.
3. Design Data: Load and Sizing Calculations: Submit calculations verifying the sizing of any track, track suspension device and additional supports which are not the monorail system manufacturer's standard cataloged product.

1.2 PRODUCTS



- A. Overhead Monorail System: Provide overhead monorail system conforming to MMA MH27.1, Class C, for indoor **OR** outdoor, **as directed**, service, with an electric wire rope or chain hoist mounted on a movable trolley. Trolley shall be plain type (hand operated) **OR** hand chain operated **OR** motor operated, **as directed**. Monorail system shall operate on AC voltage as required to meet project requirements, 60 Hz, single **OR** three, **as directed**, phase power source.
1. Capacity: The monorail system shall have a minimum rated capacity as required to meet project requirements. Mark the hoist capacity in pounds (kg) on both sides of the hoist or load block.
 2. Speeds: The hoist shall have two operating speeds, **unless directed otherwise**, and shall be capable of hoisting and lowering the rated load at a high speed of 20 feet per minute (fpm) (100 mm/s). The trolley shall have two operating speeds, **unless directed otherwise**, and shall be capable of moving the rated load at a high speed of 50 fpm **OR** 100 fpm, **as directed**, (250 mm/s **OR** 500 mm/s, **as directed**). Low speed(s) shall be one quarter to one third of high speed(s). Actual speed(s) shall be within plus or minus 15 percent of those specified.
 3. Material Limitations: Shafts, keys, couplings, sprockets, and chains shall be steel. All gears shall be steel except for worm gears, which shall be bronze or steel. Cast iron and aluminum used to support components of the hoist power transmission train shall be ductile.
 4. Safety: Comply with the mandatory and advisory safety requirements of ASME/ANSI B30.11, ASME/ANSI B30.16, and 29 CFR 1910.179.
- B. Monorail Track System: MMA MH27.1. Track beams shall be patented track sections fabricated by a manufacturer regularly engaged in production of this type of beam.
1. Track Suspension System: Monorail suspension shall be flexible **OR** rigid, **as directed**, type. Make bolted connections to supporting structure, excluding hanger rods, with ASTM A 325/A 325M bolts, ASTM A 563/A 563M nuts, and ASTM F 959/F 959M load indicator washers. ASTM A 325/A 325M bolts shall be fully pre-tensioned in accordance with AISC S329. Support monorail track system from the structural members shown. Provide additional supports as required to carry monorail track system loads to the structural members shown. Materials for additional supports shall conform to the material requirements contained in Division 05 Section "Structural Steel Framing".
- C. Electric Wire Rope Hoist: ANSI/ASME HST-4M, Class H3, except as modified herein. Hoist shall be double reeved, **unless directed otherwise**.
1. Hoisting Ropes: FS RR-W-410, improved or extra improved plow steel, regular lay, uncoated, 6 by 37 class construction, with an independent wire rope core. Provide proof of wire rope breaking strength test report.
 2. Sheaves: Sheaves shall be steel or ductile cast iron. Pitch diameter of running sheaves shall not be less than 16 times the rope diameter. Pitch diameter of non running sheaves shall not be less than 12 times the rope diameter.
 3. Drum: Drum shall be steel or ductile cast iron. Pitch diameter of the drum shall not be less than 18 times the rope diameter. Not less than two dead wraps of the hoisting rope shall remain on each anchorage when the hook is in its extreme low position.
- D. Electric Chain Hoist: ASME HST-1M, Class H3, except as modified herein. Provide load chain proof test.
- E. Trolley: Trolley shall meet all applicable requirements of MMA MH27.1, ASME HST-1M and ANSI/ASME HST-4M. Trolley shall have elastomeric bumpers to engage runway stops.
- F. Motors: NEMA MG 1. Hoist motor shall be single **OR** two, **as directed**, speed AC squirrel cage induction type. Trolley motor shall be single **OR** two, **as directed**, speed AC squirrel cage induction type. Motor insulation shall be Class B minimum. Provide totally enclosed non-ventilated (TENV) motor enclosures. Maximum motor speed shall not exceed 1800 RPM.



- G. Controls: Provide single **OR** two, **as directed**, speed magnetic control for the hoist. Provide single **OR** two, **as directed**, speed magnetic controls for the trolley. Provide reduced voltage starting, acceleration and deceleration for the trolley drive.
 - H. Limit Switches: Provide upper and lower limit switches which de-energize the hoist motor.
 - I. Brakes: Provide hoist with an electro-mechanical holding brake and a mechanical load brake, each capable of holding 130 percent of the rated hoist capacity. Hoist holding brake shall be capable of being released to test the load brake. Provide trolley with an electro-mechanical brake. Provide trolley brake with a minimum torque rating of 100 percent (for outdoor monorails) or 50 percent (for indoor monorails) of the drive motor rated torque. Trolley brake torque shall be adjustable down to 85 percent of its torque rating.
 - J. Load Block And Hook: Construct load blocks of steel. Provide forged steel, swivel type hook, with hook nut keyed to hook shank by means of a setscrew installed in a plane parallel to the longitudinal axis of the hook shank, or other similar easily removable securing device. Hook throat opening shall not be less than as required to meet project requirements. Provide hook with spring loaded steel safety latch for closing the hook throat opening. The hook and hook nut shall be unpainted. Permanently mark hook and hook nut with an identification number.
 - 1. Hook and Hook Nut Magnetic Particle Inspection: Magnetic particle inspect the hook and nut over the entire area in accordance with ASTM A 275/A 275M. Acceptance standard shall be no defects. A defect is defined as a linear indication that is greater than 1/8 inch (3 mm) long whose length is equal to or greater than three times its width.
 - K. Bearings: All bearings except those subject to a small rocker motion shall be anti-friction type. Bearings not considered lifetime lubricated by the manufacturer shall be provided with a means for lubrication.
 - L. Pendant Pushbutton Station: Hoist and trolley, **unless directed otherwise**, shall be controlled from a pendant pushbutton station. Arrange pushbuttons in accordance with ASME/ANSI B30.11 recommendations. Locate station 4 feet (1.2 m) above the finished floor
 - M. Electrification: Runway electrification shall be of the flat festooned type **OR** enclosed safety bar type, **as directed**, with four continuous copper conductors. Provide electrical work for the monorail system in accordance with NFPA 70.
 - N. Identification Plates: Provide identification plates of noncorrosive metal with clearly legible permanent lettering giving the manufacturer's name, model number, capacity in pounds, and other essential information or identification.
 - O. Painting System: Painting shall be manufacturers standard. Provide a primer and a finish coat. For outdoor monorail systems, blast clean all components prior to painting and prime with inorganic zinc type primer; finish coat shall be an epoxy formulated for marine environments. Paint coats shall be smooth and even, free of runs, sags, orange peel, or other defects.
- 1.3 EXECUTION:
- A. Erection And Installation: Erect and install the monorail system, complete in accordance with the approved submittals and in condition to perform the operational and acceptance tests.
 - B. Erection Services: Provide supervisory erection services from the monorail system manufacturer.
 - C. Field Quality Control
 - 1. Post-Erection Inspection: After erection, the Contractor and the the Owner shall jointly inspect the monorail and hoist systems and components to determine compliance with specifications and



approved submittals. The Contractor shall notify the the Owner 3 days before the inspection. Provide a report of the inspection indicating the monorail system is considered ready for operational tests

2. **Operational Tests:** After erection and inspection, test the hoist, and trolley as specified herein. Test the systems in service to determine that each component of the system operates as specified, is properly installed and adjusted, and is free from defects in material, manufacturer, installation, and workmanship. Rectify all deficiencies disclosed by testing and retest the system or component to prove the monorail system is operational. The Contractor shall furnish loads for testing, operating personnel, instruments, and all other necessary apparatus. The the Owner will furnish loads for testing; the Contractor shall receive and transport the loads from a location not more than 100 miles (161 km) from the job site and shall return them to that location after the tests have been completed.
3. **Test Data:** Record test data on appropriate test record forms suitable for retention for the life of the monorail system. Record operating and startup current measurements for electrical equipment (motors and coils) using appropriate instrumentation (i.e., clamp-on ammeters). Compare recorded values with design specifications or manufacturer's recommended values; abnormal differences (i.e., greater than 10 percent from manufacturer's or design values) shall be justified or appropriate adjustments performed. In addition, high temperatures or abnormal operation of any equipment or machinery shall be noted, investigated, and corrected. Record hoist and trolley speeds during each test cycle.
4. **Hook Test:** Measure hook for hook throat spread before and after load test. Establish a throat dimension base measurement by installing two tram points and measuring the distance between these tram points (plus or minus 1/64 inch (0.4 mm)). Record this base dimension. Measure the distance between tram points before and after load test. An increase in the throat opening by more than 5 percent from the base measurement shall be cause for rejection.
5. **No-Load Test**
 - a. **Hoist:** Raise the load hook the full operating lift distance and verify satisfactory operation of hoist, upper limit switch, lower limit switch, and the hoisting and lowering speeds. Operate the hoist at low and high speed in both directions.
 - b. **Trolley:** Operate trolley assembly the full length of the monorail in both directions. Operate trolley at low and high speed in each direction. Verify satisfactory operation and verify trolley speed. Operate all rail switches.
6. **Load Test: 125 Percent (plus 5 percent minus 0) of rated capacity**
 - a. **Hoist Static Test:** Raise test load approximately one foot above the floor and hold for 10 minutes. Observe load lowering that may occur which will indicate malfunction of hoisting component or brake. Lower the test load to the floor until the hoist line is slack.
 - b. **Hoist Dynamic Test:** Raise the test load to approximately 5 feet (1.5 m) above the floor using both speed points in the process. Lower the load back to the floor using both speed points. Stop the test load at least once while lowering at high speed and observe proper brake operation. Wait 5 minutes, then repeat the above cycle.
 - c. **Load Brake Test:** Raise test load approximately 5 feet (1.5 m). With the hoist controller in the neutral position, release the holding brake. The load brake should hold the test load. Again with the holding brake in the released position, start the test load down at low speed and return the controller to off position as the test load lowers. The load brake should prevent the test load from accelerating. NOTE: It is not necessary for the load brake to halt the downward motion of the test load.
 - d. **Loss of Power Test:** Raise the test load approximately 3 feet (1 m) and while lowering test load at low speed, cut main power to hoist. Load should stop.
 - e. **Trolley Test:** With test load hoisted to a height of one foot (300 mm) above the floor, operate trolley the full distance of the monorail in both directions using both speed points in the process. Observe for any malfunctioning of the trolley assembly and monorail system. Operate all rail switches.
 - f. **Rated Load Speed Test:** With the hoist loaded to rated capacity, raise and lower the load verifying that the hoisting and lowering speeds are provided as specified. With the hoist loaded to rated capacity, operate trolley along the monorail beam verifying that the trolley



speed is provided as specified. Further, verify that the trolley stops in each direction within a distance (in feet) equal to 10 percent of rated capacity high speed (in feet per minute) when initially travelling at high speed and carrying the rated capacity load. Record voltage, amperage, hoisting and lowering speeds, trolley travel speed, and motor speed for each motor.

END OF SECTION 26 05 19 23



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Task	Specification	Specification Description
26 05 23 00	26 05 13 00	Undercarpet Cables
26 05 23 00	26 05 19 16	Control-Voltage Electrical Power Cables



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SECTION 26 05 26 00 - GROUNDING AND BONDING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for grounding and bonding. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes methods and materials for grounding systems and equipment, plus the following special applications, **as directed**:
 - a. Overhead-lines grounding.
 - b. Underground distribution grounding.
 - c. Common ground bonding with lightning protection system.

C. Submittals

1. Product Data: For each type of product indicated.
2. Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
 - a. Test wells.
 - b. Ground rods.
 - c. Ground rings.
 - d. Grounding arrangements and connections for separately derived systems.
 - e. Grounding for sensitive electronic equipment.
3. Qualification Data: For qualified testing agency and testing agency's field supervisor.
4. Field quality-control test reports.
5. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation And Maintenance Data", include the following:
 - a. Instructions for periodic testing and inspection of grounding features at test wells **OR** ground rings **OR** grounding connections for separately derived systems, **as directed** based on NETA MTS **OR** NFPA 70B, **as directed**.
 - 1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
 - 2) Include recommended testing intervals.

D. Quality Assurance

1. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - a. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
3. Comply with UL 467 for grounding and bonding materials and equipment.

1.2 PRODUCTS

A. Conductors

1. Insulated Conductors: Copper **OR** Tinned-copper, **as directed**, wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
2. Bare Copper Conductors:



- a. Solid Conductors: ASTM B 3.
- b. Stranded Conductors: ASTM B 8.
- c. Tinned Conductors: ASTM B 33.
- d. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
- e. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
- f. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
- g. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
- 3. Bare Grounding Conductor and Conductor Protector for Wood Poles:
 - a. No. 4 AWG minimum, soft-drawn copper.
 - b. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir or cypress or cedar.
- 4. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 2 inches (6 by 50 mm), **as directed**, in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

B. Connectors

- 1. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- 2. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
 - a. Pipe Connectors: Clamp type, sized for pipe.
- 3. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- 4. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression **OR** exothermic-type wire terminals, **as directed**, and long-barrel, two-bolt connection to ground bus bar.

C. Grounding Electrodes

- 1. Ground Rods: Copper-clad **OR** Zinc-coated **OR** Stainless, **as directed**, steel, sectional type, **as directed**; 3/4 inch by 10 feet (19 mm by 3 m) **OR** 5/8 by 96 inches (16 by 2400 mm), **as directed**, in diameter.
- 2. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.
 - a. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches (1200 mm) long.
 - b. Backfill Material: Electrode manufacturer's recommended material.

1.3 EXECUTION

A. Applications

- 1. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
- 2. Underground Grounding Conductors: Install bare copper **OR** tinned-copper, **as directed**, conductor, No. 2/0 AWG minimum. Bury at least 24 inches (600 mm) below grade.
 - a. Bury at least 24 inches (600 mm) below grade.
 - b. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.
- 3. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection,



- with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
4. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - a. Install bus on insulated spacers 1 inch (25 mm), minimum, from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.
 - b. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.
 5. Conductor Terminations and Connections:
 - a. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - b. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
 - c. Connections to Ground Rods at Test Wells: Bolted connectors.
 - d. Connections to Structural Steel: Welded connectors.
- B. Grounding Overhead Lines
1. Comply with IEEE C2 grounding requirements.
 2. Install 2 parallel ground rods if resistance to ground by a single, ground-rod electrode exceeds 25 ohms.
 3. Drive ground rods until tops are 12 inches (300 mm) below finished grade in undisturbed earth.
 4. Ground-Rod Connections: Install bolted connectors for underground connections and connections to rods.
 5. Lightning Arrester Grounding Conductors: Separate from other grounding conductors.
 6. Secondary Neutral and Transformer Enclosure: Interconnect and connect to grounding conductor.
 7. Protect grounding conductors running on surface of wood poles with molding extended from grade level up to and through communication service and transformer spaces.
- C. Grounding Underground Distribution System Components
1. Comply with IEEE C2 grounding requirements.
 2. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.
 3. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.
 4. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation.
- D. Equipment Grounding
1. Install insulated equipment grounding conductors with all feeders and branch circuits.
 2. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - a. Feeders and branch circuits.
 - b. Lighting circuits.
 - c. Receptacle circuits.



- d. Single-phase motor and appliance branch circuits.
 - e. Three-phase motor and appliance branch circuits.
 - f. Flexible raceway runs.
 - g. Armored and metal-clad cable runs.
 - h. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
 - i. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
 - j. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.
3. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
 4. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
 5. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
 6. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
 7. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 - a. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6-by-50-by-300-mm) grounding bus.
 - b. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
 8. Metal and Wood Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

E. Installation

1. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
2. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
3. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
 - a. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.



- b. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- 4. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section "Underground Ducts And Raceways For Electrical Systems" and shall be at least 12 inches (300 mm) deep, with cover.
 - a. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- 5. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
 - a. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - b. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
 - c. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
- 6. Grounding and Bonding for Piping:
 - a. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - b. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - c. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- 7. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.
- 8. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.
- 9. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column **OR** indicated item, **as directed**, extending around the perimeter of building **OR** area or item indicated, **as directed**.
 - a. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
 - b. Bury ground ring not less than 24 inches (600 mm) from building foundation.
- 10. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG.
 - a. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
 - b. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

F. Labeling

- 1. Comply with requirements in Division 26 Section "Identification For Electrical Systems" for instruction signs. The label or its text shall be green.
- 2. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.
 - a. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."



- G. Field Quality Control
1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 2. Tests and Inspections:
 - a. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - b. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells.
 - 1) Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - 2) Perform tests by fall-of-potential method according to IEEE 81.
 - c. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
 3. Report measured ground resistances that exceed the following values:
 - a. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
 - b. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
 - c. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
 - d. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 **OR** 3, **as directed**, ohm(s).
 - e. Substations and Pad-Mounted Equipment: 5 ohms.
 - f. Manhole Grounds: 10 ohms.
 4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify the Owner promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26 00



Task	Specification	Specification Description
26 05 26 00	01 22 16 00	No Specification Required



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SECTION 26 05 29 00 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for hangers and supports for electrical systems. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Hangers and supports for electrical equipment and systems.
 - b. Construction requirements for concrete bases.

C. Definitions

1. EMT: Electrical metallic tubing.
2. IMC: Intermediate metal conduit.
3. RMC: Rigid metal conduit.

D. Performance Requirements

1. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
3. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
4. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

E. Submittals

1. Product Data: For the following:
 - a. Steel slotted support systems.
 - b. Nonmetallic slotted support systems.
2. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
 - a. Trapeze hangers. Include Product Data for components.
 - b. Steel slotted channel systems. Include Product Data for components.
 - c. Nonmetallic slotted channel systems. Include Product Data for components.
 - d. Equipment supports.
3. Welding certificates.

F. Quality Assurance

1. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. Comply with NFPA 70.

1.2 PRODUCTS

A. Support, Anchorage, And Attachment Components



1. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - a. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - b. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - c. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - d. Channel Dimensions: Selected for applicable load criteria.
2. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- (14-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c., in at least 1 surface.
 - a. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
 - b. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
 - c. Rated Strength: Selected to suit applicable load criteria.
3. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
4. Conduit and Cable Support Devices: Steel **OR** Steel and malleable-iron, **as directed**, hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
5. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
6. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
7. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - a. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - b. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel **OR** stainless steel, **as directed**, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - c. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - d. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - e. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - f. Toggle Bolts: All-steel springhead type.
 - g. Hanger Rods: Threaded steel.

B. Fabricated Metal Equipment Support Assemblies

1. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
2. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

1.3 EXECUTION

A. Application

1. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
2. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by **OR** scheduled in NECA 1, where its Table 1 lists maximum



- spacings less than stated in, **as directed**, NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
3. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - a. Secure raceways and cables to these supports with two-bolt conduit clamps **OR** single-bolt conduit clamps **OR** single-bolt conduit clamps using spring friction action for retention in support channel, **as directed**.
 4. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.
- B. Support Installation
1. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
 2. Raceway Support Methods: In addition to methods described in NECA 1, EMT **OR** IMC **OR** RMC, **as directed**, may be supported by openings through structure members, as permitted in NFPA 70.
 3. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
 4. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - a. To Wood: Fasten with lag screws or through bolts.
 - b. To New Concrete: Bolt to concrete inserts.
 - c. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - d. To Existing Concrete: Expansion anchor fasteners.
 - e. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
 - f. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts **OR** Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 **OR** Spring-tension clamps, **as directed**.
 - g. To Light Steel: Sheet metal screws.
 - h. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
 5. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.
- C. Installation Of Fabricated Metal Supports
1. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
 2. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
 3. Field Welding: Comply with AWS D1.1/D1.1M.
- D. Concrete Bases
1. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.



2. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-place Concrete".
3. Anchor equipment to concrete base.
 - a. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - b. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - c. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

E. Painting

1. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - a. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
2. Touchup: Comply with requirements in Division 07 OR Division 09 Section(s) "High-performance Coatings" **as directed**, for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
3. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29 00



SECTION 26 05 29 00a - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for vibration and seismic controls for electrical systems. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Isolation pads.
 - b. Spring isolators.
 - c. Restrained spring isolators.
 - d. Channel support systems.
 - e. Restraint cables.
 - f. Hanger rod stiffeners.
 - g. Anchorage bushings and washers.

C. Definitions

1. The IBC: International Building Code.
2. ICC-ES: ICC-Evaluation Service.
3. OSHPD: Office of Statewide Health Planning and Development for the State of California.

D. Performance Requirements

1. Seismic-Restraint Loading:
 - a. Site Class as Defined in the IBC: **A OR B OR C OR D OR E OR F, as directed.**
 - b. Assigned Seismic Use Group or Building Category as Defined in the IBC: **I OR II OR III, as directed.**
 - 1) Component Importance Factor: **1.0 OR 1.5, as directed.**
 - 2) Component Response Modification Factor: **1.5 OR 2.5 OR 3.5 OR 5.0, as directed.**
 - 3) Component Amplification Factor: **1.0 OR 2.5, as directed.**
 - c. Design Spectral Response Acceleration at Short Periods (0.2 Second): As required to meet Project requirements.
 - d. Design Spectral Response Acceleration at 1.0-Second Period: As required to meet Project requirements.

E. Submittals

1. Product Data: For the following:
 - a. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - b. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
 - 1) Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed.**
 - 2) Annotate to indicate application of each product submitted and compliance with requirements.
 - c. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.
2. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.



- a. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators and seismic restraints.
 - 1) Coordinate design calculations with wind-load calculations required for equipment mounted outdoors. Comply with requirements in other Division 22 for equipment mounted outdoors.
- b. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
- c. Field-fabricated supports.
- d. Seismic-Restraint Details:
 - 1) Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
 - 2) Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
 - 3) Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**, showing maximum ratings of restraint items and the basis for approval (tests or calculations).
- 3. Welding certificates.
- 4. Field quality-control test reports.

F. Quality Assurance

- 1. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- 2. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- 3. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
- 4. Comply with NFPA 70.

1.2 PRODUCTS

A. Vibration Isolators

- 1. Pads: Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
 - a. Resilient Material: Oil- and water-resistant neoprene **OR** rubber **OR** hermetically sealed compressed fiberglass, **as directed**.
- 2. Spring Isolators: Freestanding, laterally stable, open-spring isolators.
 - a. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - b. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - c. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - d. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.



- e. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- (6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
 - f. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
3. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.
 - a. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
 - b. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.
 - c. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - d. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - e. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - f. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
- B. Seismic-Restraint Devices
 1. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**.
 - a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
 2. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
 3. Restraint Cables: ASTM A 603 galvanized-steel **OR** ASTM A 492 stainless-steel, **as directed**, cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
 4. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections **OR** Reinforcing steel angle clamped, **as directed**, to hanger rod. Do not weld stiffeners to rods.
 5. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.
 6. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.
 7. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
 8. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.
 9. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.
- C. Factory Finishes



1. Finish:
 - a. Manufacturer's standard prime-coat finish ready for field painting.
 - b. Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
 - 1) Powder coating on springs and housings.
 - 2) All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
 - 3) Baked enamel or powder coat for metal components on isolators for interior use.
 - 4) Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

1.3 EXECUTION

A. Applications

1. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**.
2. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
3. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

B. Seismic-Restraint Device Installation

1. Equipment and Hanger Restraints:
 - a. Install restrained isolators on electrical equipment.
 - b. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
 - c. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**, providing required submittals for component.
2. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
3. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
4. Drilled-in Anchors:
 - a. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - b. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - c. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - d. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 - e. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - f. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.



- C. Accommodation Of Differential Seismic Motion
 - 1. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.
- D. Field Quality Control
 - 1. Tests and Inspections:
 - a. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - b. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 - c. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - d. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 - e. Test to 90 percent of rated proof load of device.
 - f. Measure isolator restraint clearance.
 - g. Measure isolator deflection.
 - h. Verify snubber minimum clearances.
 - i. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
 - 2. Remove and replace malfunctioning units and retest as specified above.
 - 3. Prepare test and inspection reports.
- E. Adjusting
 - 1. Adjust isolators after isolated equipment is at operating weight.
 - 2. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
 - 3. Adjust active height of spring isolators.
 - 4. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 26 05 29 00a



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Task	Specification	Specification Description
26 05 29 00	01 22 16 00	No Specification Required



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SECTION 26 05 33 00 - CSF RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this Outline Specification Section for Customer Service Facilities only. This Specification defines "level of quality" for Customer Service Facility construction and is intended as a guide to the Architect/Engineer preparing the Construction Documents.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.26 05 33 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal conduit.
 - 2. Flexible metal conduit.
 - 3. Liquidtight metal conduit.
 - 4. Electrical metallic tubing.
 - 5. Fittings and conduit bodies.
 - 6. Wall and ceiling outlet boxes.
 - 7. Pull and junction boxes.
 - 8. Cable trays.
 - 9. Floor boxes with covers (other uses).
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. As specified in Section 260500 - Common Work Results for Electrical.

1.2 REFERENCES

- A. As specified in Section 260500 - Common Work Results for Electrical.
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM A 123 - Specification for Zinc (Hot-Galvanized) Coatings on Iron and Steel Products.
- C. American National Standards Institute (ANSI):



1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
2. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
3. ANSI C80.5 - Rigid Aluminum Conduit.

D. National Electrical Manufacturers Association (NEMA):

1. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
2. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
3. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
4. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.
5. NEMA VE 1 - Metallic Cable Tray Systems.

1.3 SUBMITTALS

- A. As specified in Section 260500 - Common Work Results for Electrical.

1.4 SYSTEM DESCRIPTION

A. Design Requirements

1. Conduit Size: Latest edition of National Electrical Code - NFPA 70, unless indicated otherwise on Drawings.

1.5 QUALITY ASSURANCE

- A. As specified in Section 260500 - Common Work Results for Electrical.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Accept conduit on site. Contractor inspect for damage prior to acceptance.
- C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- D. Protect PVC conduit from sunlight.

PART 2 - PRODUCTS

2.1 CONDUIT REQUIREMENTS

- A. Where conduit is required by standards, codes, or required elsewhere, minimum size shall be as follows:
1. 1/2 inch for power and branch circuit wiring, unless indicated otherwise. All homerun conduits shall be 3/4 inch minimum.
 2. 3/4 inch for communications cable, unless indicated otherwise.
 3. 3/4 inch for low voltage, control, intercom, security and communications (other than telephone) unless indicated otherwise.



2.2 METAL CONDUIT

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 - 1. Allied Tube & Conduit, Harvey, IL (800) 882-5543.
 - 2. Wheatland Tube Co., Collinswood, NJ (800) 257-8182.
 - 3. Republic Wire & Cable, Rocky Mount, NC (800) 533-8198.
 - 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Rigid Galvanized Steel Conduit (GRC): ANSI C80.1, UL6.
- C. Intermediate Metal Conduit (IMC): UL1242.
- D. Fittings and Conduit Bodies: NEMA FB1 Material to match conduit.

2.3 FLEXIBLE METAL CONDUIT (FMC)

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 - 1. Hubbell, Millford, CT (203) 882-4800.
 - 2. Electriflex, Roselle, IL (800) 323-6174.
 - 3. O-Z/Gedney, Farmington, CT (860) 677-5541.
 - 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Description: Thick wall, interlocked steel and aluminum construction.
- C. Fittings: NEMA FB 1.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 - 1. Hubbell, Millford, CT (203) 882-4800.
 - 2. Electriflex, Roselle, IL (800) 323-6174.
 - 3. Anixter, Inc., Skokie, IL (800) ANIXTER.
 - 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Description: Thick wall, interlocked steel and aluminum construction with PVC jacket.
- C. Fittings: NEMA FB 1.

2.5 ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 - 1. Allied Tube & Conduit, Harvey, IL (800) 882-5543.
 - 2. Wheatland Tube Co., Collinswood, NJ (800) 257-8182.
 - 3. Republic Wire & Cable, Rocky Mount, NC (800) 533-8198.
 - 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.



- B. Description: ANSI C80.3; galvanized tubing.
- C. Fittings and Conduit Bodies: NEMA FB 1; steel set-screw type. Die-cut Zinc not permitted.

2.6 NONMETALLIC CONDUIT

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 - 1. Carlon, Cleveland, OH (800) 322-7566.
 - 2. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Description: NEMA TC 2; Schedule 40 PVC.
- C. Fittings and Conduit Bodies: NEMA TC 3.

2.7 FITTINGS

- A. Manufacturer: Raco, Inc., South Bend, IN (219) 234-7151.
 - 1. Subject to compliance with project requirements, one of the following manufacturers may also be provided:
 - a. Steel City.
 - b. O-Z/Gedney.
 - 2. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Conduits 1/2 inch thru 1 inch enter junction boxes, pull boxes, panels, cabinets, and gutters, provide the following:
 - 1. Rigid Conduit: Raco 1222, 1223, 1224.
 - 2. Flexible Metal Conduit: Raco 3302, 3303, 3304, 3305, 3306, 3308.
 - 3. Liquidtight Flexible Metal Conduit: Raco 3511, 3512, 3513, 3541, 3542, 3543.
- C. Conduits 1-1/4 inch and larger entering junction boxes, pull boxes, panels, cabinets, and gutters, provide Insulated throat type bushings.
- D. Provide threaded joint connectors and malleable iron no thread compression box connectors on rigid conduit. Do not provide fittings requiring set screws or indentor type applications including BM connectors.
- E. Provide only steel set-screw couplings and connectors on EMT conduit.

2.8 CONDUIT STRAPS AND HANGERS

- A. Strap Manufacturer: Raco, Inc., South Bend, IN (219) 234-7151
 - 1. Subject to compliance with project requirements, one of the following manufacturers may also be provided:
 - a. Steel City.
 - b. Unistrut.
 - 2. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.



- B. Hanger Manufacturer: Steel City/Thomas & Betts, Memphis, TN (800) 888-0211.
 - 1. Subject to compliance with project requirements, one of the following manufacturers may also be provided:
 - a. Unistrut.
 - b. Raco.
 - 2. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- C. Straps: Two hole push on stamped steel straps on surface areas such as concrete, masonry, wide flange beams, columns, and wood.
 - 1. Rigid Conduit: Raco 2232, 2233, 2234, 2235, 2336, 2238.
 - 2. Electrical Metallic Tubing: Raco 2092, 2093, 2094.
- D. Hangers: Lay-in pipe hanger.
 - 1. Conduits 1-1/4 Inch and Larger: Steel-City C-149.
- E. Trapeze Hangers for Conduits Grouped Together: Hangers consisting of all thread rods sized as required and Kingdorff channel.
 - 1. Steel City B-909, 1/2 inch x 1-7/8 inch (12 gauge) with single bolt channel pipe straps.
 - 2. Steel City C-105, C-105-AL, or C-106, (no wire permitted for anchoring conduit).

2.9 SEAL-OFF AND EXPANSION FITTINGS

- A. Seal-Off Fitting Manufacturer: Crouse-Hinds, Syracuse, NY (315) 477-5531.
 - 1. Subject to compliance with project requirements, one of the following manufacturers may also be provided:
 - a. Killark.
 - b. Appleton.
 - c. O.Z. Gedney
 - 2. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Expansion Fitting Manufacturer: OZ/Gedney, Farmington, CT (860) 677-5541
 - 1. Subject to compliance with project requirements, one of the following manufacturers may also be provided:
 - a. Crouse-Hinds.
 - b. Killark.
 - c. Appleton.
 - 2. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- C. Provide seal-off fittings where required by governing authority, code, or as indicated on Drawings.
 - 1. Vertical Runs: Crouse-Hinds Type EYS.
 - 2. Horizontal and Vertical Runs: Crouse-Hinds Type EZS.
 - 3. Elbows: Crouse-Hinds Type EYS.
 - 4. Sealing Compound: "Chico X" fiber and "Chico A".
- D. Provide expansion fittings in conduits where indicated on Drawings or where required to pass through expansion joints embedded in concrete.
 - 1. OZ Gedney Type AX.

2.10 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.



1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch male fixture studs where required.
2. Receptacle and Device Boxes - 4 inch square x 2-1/8 inch deep with raised single gang plaster ring unless indicated otherwise.
3. Switch Boxes: 2 inch x 4 inch x 2-1/8 inch deep unless indicated otherwise.
4. Communication Boxes: 4 inch square x 3 inch deep with raised single gang plaster ring unless indicated otherwise.

B. Cast Boxes: NEMA FB 1, Type FD, aluminum. Provide gasketed cover by box manufacturer. Provide threaded hubs.

C. Wall Plates for Finished Areas: Specified in Section 262726.

2.11 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

2.12 CABLE TRAY

A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:

1. Cable Management Solutions, Incorporated, Deer Park, NY (800) 308-6788.
2. Chalfant Cable Trays, Cleveland, OH (216) 521-7922.
3. GS Metals Corporation, Pinckneyville, IL (800) 851-9341.
4. Southwire Co., Carrollton, GA (800) 444-1700
5. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

B. Provide factory shop drawing submittals for each type of cable tray.

1. Show fabrication and installation details of cable tray, including plans, elevations and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths and fittings.
2. Seismic-Restraint Details: Signed and sealed by a qualified Professional Engineer, licensed in the state where Project is located, who is responsible for their preparation.
 - a. Design Calculations: Calculate requirements for selecting seismic restraints.
 - b. Detail fabrication, including anchorages and attachments to structure and to supported cable trays.

C. Description: NEMA VE 1, ladder tray, wire mesh tray or ventilated bottom trough tray as indicated on drawings.

D. Material: Aluminum.

E. NEMA Load/Span Class: 20C

F. Finish: Clear aluminum.

G. Inside Width and Depth: 12 inch wide and 6 inch deep minimum unless otherwise indicated on drawings.

H. Provide with compartment dividers as indicated on drawings. Same materials and finish as tray.

I. Straight Section Rung Spacing: 9 inches on center.



- J. Inside Radius of Fittings: 24 inches (minimum).
- K. Provide approved manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps. Utilize cable drop-out fittings or conduit elbows where cables enter or exit the cable tray. Obtain cable tray components from a single manufacturer.
- L. Engraved Nameplates: 1/2 inch high black letters on yellow laminated plastic nameplate, engraved with the following wording:

WARNING! DO NOT USE CABLE TRAY AS WALKWAY, LADDER, OR SUPPORT. USE ONLY AS MECHANICAL SUPPORT FOR CABLES AND TUBING!

2.13 FLOOR BOXES

- A. Type: Modular, flush-type dual-service units suitable for wiring method used. Provide dual-service units within carpeted areas only.
- B. Compartmentation: Barrier separates power and signal compartments.
- C. Housing Material: Die-cast aluminum, satin-finished.
- D. Power Receptacle: NEMA WD 6, Configuration 5-20R, ivory finish, unless otherwise indicated.
- E. Signal Outlet: Blank cover with bushed cable opening, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. As specified Section 260500 – Common Work Results for Electrical.
- B. Verification of Conditions:
 1. Verify routing and termination locations of conduit prior to rough-in.
 2. Verify device locations and mounting heights, prior to rough-in

3.2 INSTALLATION - RACEWAYS

- A. Install in accordance with the following schedule, unless indicated otherwise on Drawings: Plastic flexible PVC conduit shall not be permitted. Flexible metal conduit shall be permitted for electrical power and security wiring only and not permitted for fire alarm cables. Intermediate grade rigid conduit permitted where indicated below.
 1. Above Suspended Ceilings: Galvanized or sheradized thick wall rigid steel (GRC), or intermediate grade rigid steel (IMC), or electrical metallic tubing (EMT).
 2. Metal Stud Walls: Galvanized or sheradized thick wall rigid steel (GRC), intermediate grade rigid steel (IMC), or electrical metallic tubing (EMT).
 3. Exposed Interior Areas: Galvanized or sheradized thick wall rigid steel (GRC), intermediate grade rigid steel (IMC), electrical metallic tubing (EMT).
- B. Install conduit in accordance with NECA "Standard of Installation."



- C. Install nonmetallic conduit in accordance with manufacturer's instructions. Nonmetallic conduit shall only be used under slabs or direct buried in earth. Conduit penetrations through slab including elbows shall be galvanized rigid conduit.
- D. Conduit routing indicated on Drawings are approximate locations unless dimensioned. Route parallel and perpendicular to building construction for complete wiring system regardless whether exposed or concealed.
- E. Arrange supports to prevent misalignment during wiring installation.
- F. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- G. Group related conduits; support using conduit rack. Construct rack using approved steel channel, and provide space on each rack for 25 percent additional conduits.
- H. Fasten conduit supports to building structure and surfaces under provisions of this section.
- I. Do not support conduit with wire or perforated pipe straps in any type structure. Remove wire used for temporary supports. Steel tie wire may be used to anchor conduit down to reinforcing rods in concrete encasement only.
- J. Do not attach conduit or boxes to ceiling support wires. Boxes shall be independently supported.
- K. Arrange conduit to maintain headroom and present neat appearance. Maintain required clearance between conduit and other piping.
- L. Route all conduit whether exposed or concealed parallel and perpendicular to walls, ceilings, building structures, etc.
- M. Maintain required clearance between conduit and piping.
- N. Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.
- O. Cut EMT conduit square using saw or pipe cutter; de-burr cut ends and ream. Bring conduit to shoulder of fittings; fasten securely.
- P. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- Q. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes. Use Myers hub connectors on all conduit entering top or sides of all junction boxes, pull boxes, wiring gutters, exposed to weather.
- R. The number of bends per box shall comply with NFPA 70, Article 360. Conduit bends for "SCS" installation shall not exceed two 90 degree bends or exceed a total of 180 degrees of bend between pull boxes or conduit ends per ANSI/TIA/EIA/ 569-B. Pull boxes shall be sized per NEC codes per conduit installed. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender to fabricate or use factory elbows for bends in metal conduit larger than 2 inch size.
- S. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- T. Provide suitable fittings to accommodate expansion and deflection where conduit crosses control and expansion joints.



- U. Provide suitable nylon pull string or #14 AWG steel wire in each conduit excluding sleeves and nipples.
- V. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- W. Ground and bond conduit per NFPA 70.
- X. Coat all metallic conduit male threads with "General Electric" RTV silicone sealer where conduit is installed in exterior areas or in contact with concrete or earth.
- Y. Conduits shall be sized as indicated on Drawings. Where sizes are not indicated, conduit shall be sized per NFPA 70.
- Z. Cap all upturned conduits during construction rough-in to prevent moisture or debris from entering. Pull through each and every conduit a dry swab of sufficient size to remove any and all moisture.
- AA. Maximum length of flexible metal conduit (Greenfield), or flexible liquidtight shall be 5 feet.
- BB. Assure ground continuity on all branch circuitry conduits with two locknuts, one inside and one outside of all boxes, cabinets and gutters for rigid conduit. One locknut inside of all boxes, cabinets, and gutters for EMT.
- CC. Provide conduit supports as follows:
 1. Galvanized rigid thick wall conduit (GRC), intermediate grade rigid conduit (IMC) and electrical metallic conduit (EMC) within three feet of all outlet boxes, junction boxes, cabinets, gutters, or fittings. Horizontally anchored at 10 foot maximum intervals. Other spacings indicated on Drawings.
 2. Flexible metal conduit (Greenfield) and liquidtight flexible conduit (Sealtite), within 12 inches of all outlet boxes, junction boxes, cabinets, gutters, or fittings and bends or turns. Horizontally anchored at 4-1/2 foot intervals. 3/4 inch minimum size permitted.

3.3 INSTALLATION - BOXES

- A. Install boxes in accordance with NECA "Standard of Installation."
- B. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with NFPA 70.
- C. Set wall mounted boxes at elevations to accommodate mounting heights indicated or as required for specific project requirements. Orient boxes to accommodate wiring devices as specified in Section 262726.
- D. Electrical boxes are indicated on Drawings in approximate locations unless dimensioned. Adjust box location up to 10 feet if required to accommodate intended purpose with no additional cost to contract. Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes.
- E. Maintain headroom and present neat mechanical appearance.
- F. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only. Install pull boxes in freezer and dock area above bottom chord of structural joist. Pullboxes sized in excess of 12 inches shall be equipped with hinged and hasped covers.
- G. Install outlet and junction boxes within inaccessible ceiling spaces no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- H. Locate outlet boxes to allow luminaires positioned as indicated on Drawings.



- I. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- J. Locate flush mounted box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening. Use approved raised gang covers in masonry and stud walls.
- K. Flush mounted boxes shall not be mounted back-to-back in walls; provide minimum 6 inches separation. Provide minimum 24 inches separation in acoustic rated walls.
- L. Secure flush mounted box to interior wall and partition studs. Accurately position to allow for surface finish thickness. Use approved stamped steel bridges to fasten flush mounting outlet box between studs.
- M. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- N. Use approved adjustable steel channel fasteners spanning joist for hung ceiling outlet box.
- O. Provide factory sectioned multigang box where more than one adjacent device is to be mounted together. Sectional boxes shall not be permitted.

3.4 INSTALLATION - CABLE TRAYS

- A. Install trays level and plumb in accordance with manufacturer's published instructions.
- B. Install metallic cable tray in accordance with NEMA VE 1.
- C. Support cable trays as follows:
 - 1. Use anchors and fasteners as specified in Section 260500.
 - 2. Provide supports at each connection point and at the end of each run.
 - 3. Design supports including attachment to structure to carry the greater of calculated load multiplied by a factor of four or the calculated load plus 200 lb.
- D. Locate cable tray with sufficient space to permit access for installing cables.
- E. Make changes in directions and elevations using standard fittings. Use expansion connectors where required.
- F. Ground and bond cable tray under provisions of Section 260500.
 - 1. Provide continuity between tray components.
 - 2. Use anti-oxidant compound to prepare aluminum contact surfaces before assembly.
 - 3. Provide #2 AWG bare copper equipment grounding conductor through entire length of tray; bond to each section.
 - 4. Connections to tray may be made using mechanical connectors.
- G. Install warning signs at 50 feet on center along cable tray, located to be visible.

3.5 FIELD QUALITY CONTROL

- A. As specified Section 260500 - Common Work Results for Electrical.
- B. Inspect conduit installation, types, sizes, fittings and attachment to structure.
- C. Inspect box installation, locations, connection to conduit, and attachment to structure.
- D. Inspect cable tray installation, locations, connection to conduit, and attachment to structure.



3.6 ADJUSTING

- A. Adjust flush-mounted devices and nameplates to be plumb and flush with finished wall material.
- B. Install knockout closures in unused box openings.

3.7 CLEANING

- A. Clean interior of boxes to remove dust, debris, and other material.
- B. Clean exposed surfaces and restore finish like new.

USPS CSF Specifications issued: 10/1/2013
Last revised: 5/20/2011.

END OF SECTION



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SECTION 26 05 33 00 - MPF RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal conduit.
 - 2. Flexible metal conduit.
 - 3. Liquidtight metal conduit.
 - 4. Electrical metallic tubing.
 - 5. Fittings and conduit bodies.
 - 6. Wall and ceiling outlet boxes.
 - 7. Pull and junction boxes.
 - 8. Cable trays.
 - 9. Floor boxes with covers (other uses.)
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 281304 - Physical Access Control System.
 - 2. Section 281600 - Intrusion Detection.
 - 3. Section 282304 - Integrated Security and Investigative Platform (ISIP) CCTV System.
 - 4. Section 283100 - Fire Detection and Alarm.
 - 5. Section 230500 - Common Work Results for HVAC.
 - 6. Section 260500 - Common Work Results for Electrical: Supporting devices, electrical identification, grounding and bonding.
 - 7. Section 262726 - Wiring Devices: Wall plates in finished areas.
 - 8. Section 270500 - Common Work Results for Communication.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A 123 - Specification for Zinc (Hot-Galvanized) Coatings on Iron and Steel Products.
- B. American National Standards Institute (ANSI):
 - 1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
 - 2. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
 - 3. ANSI C80.5 - Rigid Aluminum Conduit.
- C. National Electrical Contractors Association (NECA):
 - 1. NECA "Standard of Installation."



- D. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
 - 2. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
 - 3. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
 - 4. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.
 - 5. NEMA VE 1 - Metallic Cable Tray Systems.
- E. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements
 - 1. Conduit Size: NFPA 70, unless indicated otherwise on Drawings.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Conform to requirements of NFPA 70.
 - 2. Provide products listed and classified by Underwriters Laboratories, Incorporated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Accept conduit on site. Contractor inspect for damage prior to acceptance.
- C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- D. Protect PVC conduit from sunlight.

PART 2 - PRODUCTS

2.1 CONDUIT REQUIREMENTS

- A. Where conduit is required by standards, codes, or required elsewhere, minimum size shall be as follows:
 - 1. 1/2 inch for power and branch circuit wiring, unless indicated otherwise. All homerun conduits shall be 3/4 inch, minimum.
 - 2. 3/4 inch for communications cable, unless indicated otherwise.
 - 3. 3/4 inch for low voltage, control, intercom, security and communications unless indicated otherwise.

2.2 METAL CONDUIT

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 - 1. Allied Tube & Conduit, Harvey, IL (800) 882-5543.
 - 2. Wheatland Tube Co., Collinswood, NJ (800) 257-8182.



3. Republic Wire & Cable, Rocky Mount, NC (800) 533-8198.
4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

- B. Rigid Galvanized Steel Conduit (GRC): ANSI C80.1, UL6.
- C. Intermediate Metal Conduit (IMC): UL1242.
- D. Fittings and Conduit Bodies: NEMA FB1 Material to match conduit.

2.3 FLEXIBLE METAL CONDUIT (FMC)

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 1. Hubbell, Millford, CT (203) 882-4800.
 2. Electriflex, Roselle, IL (800) 323-6174.
 3. O-Z/Gedney, Farmington, CT (860) 677-5541.
 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Description: Interlocked steel and aluminum construction.
- C. Fittings: NEMA FB 1.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 1. Hubbell, Millford, CT (203) 882-4800.
 2. Electriflex, Roselle, IL (800) 323-6174.
 3. Anixter, Inc., Skokie, IL (800) ANIXTER.
 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Description: Interlocked steel and aluminum construction with PVC jacket.
- C. Fittings: NEMA FB 1.

2.5 ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 1. Allied Tube & Conduit, Harvey, IL (800) 882-5543.
 2. Wheatland Tube Co., Collinswood, NJ (800) 257-8182.
 3. Republic Wire & Cable, Rocky Mount, NC (800) 533-8198.
 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Description: ANSI C80.3; galvanized tubing.
- C. Fittings and Conduit Bodies: NEMA FB 1; steel set-screw type. Die-cut Zinc not permitted.



2.6 NONMETALLIC CONDUIT

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 - 1. Carlon, Cleveland, OH (800) 322-7566.
 - 2. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Description: NEMA TC 2; Schedule 40 PVC.
- C. Fittings and Conduit Bodies: NEMA TC 3.

2.7 FITTINGS

- A. Manufacturer: Raco, Inc., South Bend, IN (219) 234-7151.
 - 1. Subject to compliance with project requirements, one of the following manufacturers may also be provided:
 - a. Steel City.
 - b. O-Z/Gedney.
 - 2. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Conduits 1/2 inch thru 1 inch enter junction boxes, pull boxes, panels, cabinets, and gutters, provide the following:
 - 1. Rigid Conduit: Raco 1222, 1223, 1224.
 - 2. Flexible Metal Conduit: Raco 3302, 3303, 3304, 3305, 3306, 3308.
 - 3. Liquidtight Flexible Metal Conduit: Raco 3511, 3512, 3513, 3541, 3542, 3543.
- C. Conduits 1-1/4 inch and larger entering junction boxes, pull boxes, panels, cabinets, and gutters, provide Insulated throat type bushings; Raco 1225, 1226, 1228, 1230, 1232, 1234, 1236.
- D. Provide threaded joint connectors and malleable iron no thread compression box connectors on rigid conduit. Do not provide fittings requiring set screws or indentor type applications including BM connectors.
- E. Provide only steel set-screw couplings and connectors on EMT conduit.

2.8 CONDUIT STRAPS AND HANGERS

- A. Strap Manufacturer: Raco, Inc., South Bend, IN (219) 234-7151
 - 1. Subject to compliance with project requirements, one of the following manufacturers may also be provided:
 - a. Steel City.
 - b. Unistrut.
 - 2. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Hanger Manufacturer: Steel City/Thomas & Betts, Memphis, TN (800) 888-0211.
 - 1. Subject to compliance with project requirements, one of the following manufacturers may also be provided:
 - a. Unistrut.
 - b. Raco.
 - 2. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.



- C. Straps: Two hole push on stamped steel straps on surface areas such as concrete, masonry, wide flange beams, columns, and wood.
 - 1. Rigid Conduit: Raco 2232, 2233, 2234, 2235, 2336, 2238.
 - 2. Electrical Metallic Tubing: Raco 2092, 2093, 2094.
- D. Hangers: Lay-in pipe hanger.
 - 1. Conduits 1-1/4 Inch and Larger: Steel-City C-149.
- E. Trapeze Hangers for Conduits Grouped Together: Hangers consisting of all thread rods sized as required and Kingdorff channel.
 - 1. Steel City B-909, 1/2 inch x 1-7/8 inch (12 gauge) with single bolt channel pipe straps.
 - 2. Steel City C-105, C-105-AL, or C-106, (no wire permitted for anchoring conduit).

2.9 SEAL-OFF AND EXPANSION FITTINGS

- A. Seal-Off Fitting Manufacturer: Crouse-Hinds, Syracuse, NY (315) 477-5531.
 - 1. Subject to compliance with project requirements, one of the following manufacturers may also be provided:
 - a. Killark.
 - b. Appleton.
 - c. O-Z/Gedney.
 - 2. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Expansion Fitting Manufacturer: OZ/Gedney, Farmington, CT (860) 677-5541
 - 1. Subject to compliance with project requirements, one of the following manufacturers may also be provided:
 - a. Crouse-Hinds.
 - b. Killark.
 - c. Appleton.
 - 2. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- C. Provide seal-off fittings where required by governing authority, code, or as indicated on Drawings.
 - 1. Vertical Runs: Crouse-Hinds Type EYS.
 - 2. Horizontal and Vertical Runs: Crouse-Hinds Type EZS.
 - 3. Elbows: Crouse-Hinds Type EYS.
 - 4. Sealing Compound: "Chico X" fiber and "Chico A".
- D. Provide expansion fittings in conduits where indicated on Drawings or where required to pass through expansion joints embedded in concrete.
 - 1. O-Z/Gedney Type AX.

2.10 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
 - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch male fixture studs where required.
 - 2. Receptacle and Device Boxes - 4 inch square x 2-1/8 inch deep with raised, single gang, plaster ring unless indicated otherwise.
 - 3. Switch Boxes: 2 inch x 4 inch x 2-1/8 inch deep, unless indicated otherwise.
 - 4. Communication Boxes: 4 inch square x 3 inch deep with raised gang plaster ring unless indicated otherwise.
- B. Cast Boxes: NEMA FB 1, Type FD, aluminum. Provide gasketed cover by box manufacturer. Provide threaded hubs.



- C. Wall Plates for Finished Areas: Specified in Section 262726.

2.11 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

2.12 CABLE TRAY

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 - 1. Chalfant Cable Trays, Cleveland, OH (216) 521-7922.
 - 2. Cable Management Solutions, Incorporated, Deer Park, NY (800) 308-6788.
 - 3. GS Metals Corporation, Pinckneyville, IL (800) 851-9341.
 - 4. Southwire Co., Carrollton, GA (800) 444-1700
 - 5. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Provide factory shop drawing submittals for each type of cable tray.
 - 1. Show fabrication and installation details of cable tray, including plans, elevations and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths and fittings.
 - 2. Seismic-Restraint Details: Signed and sealed by a qualified Professional Engineer, licensed in the state where Project is located, who is responsible for their preparation.
 - a. Design Calculations: Calculate requirements for selecting seismic restraints.
 - b. Detail fabrication, including anchorages and attachments to structure and to supported cable trays.
- C. Description: NEMA VE 1, ladder tray, wire mesh tray or solid bottom tray as indicated on drawings.
- D. Material: Steel or aluminum.
- E. NEMA Load/Span Class: 20C
- F. Finish: ASTM A 525, pre-galvanized or clear aluminum.
- G. Inside Width and Depth: Indicated on Drawings. Inside Radius of Fittings: 24 inches (minimum).
- H. Provide with compartment dividers as indicated on drawings. Same materials and finish as tray.
- I. Straight Section Rung Spacing: 9 inches on center (ladder tray only).
- J. Provide approved manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps. Obtain cable tray components from a single manufacturer.
- K. Engraved Nameplates: 1/2 inch high black letters on yellow laminated plastic nameplate, engraved with the following wording:

WARNING! DO NOT USE CABLE TRAY AS WALKWAY, LADDER, OR SUPPORT. USE ONLY AS
MECHANICAL SUPPORT FOR CABLES AND TUBING!



2.13 FLOOR BOXES

- A. Type: Modular, flush-type dual-service units suitable for wiring method used. Provide dual-service units within carpeted areas only.
- B. Compartmentation: Barrier separates power and signal compartments.
- C. Housing Material: Die-cast aluminum, satin-finished.
- D. Power Receptacle: NEMA WD 6, Configuration 5-20R, ivory finish, unless otherwise indicated.
- E. Signal Outlet: Blank cover with brushed cable opening, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify routing and termination locations of conduit prior to rough-in.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION - RACEWAYS

- A. Install in accordance with the following schedule, unless indicated otherwise on Drawings: Plastic flexible PVC conduit shall not be permitted. Flexible metal conduit shall be permitted for electrical power and security wiring only and not permitted for fire alarm cables. Intermediate grade rigid conduit permitted where indicated below.
 - 1. Above Suspended Ceilings: Galvanized or sheradized thick wall rigid steel (GRC), or intermediate grade rigid steel (IMC), or electrical metallic tubing (EMT).
 - 2. Metal Stud Walls: Galvanized or sheradized thick wall rigid steel (GRC), intermediate grade rigid steel (IMC), or electrical metallic tubing (EMT).
 - 3. Exposed Interior Areas: Galvanized or sheradized thick wall rigid steel (GRC), intermediate grade rigid steel (IMC), electrical metallic tubing (EMT).
- B. Install conduit in accordance with NECA "Standard of Installation."
- C. Install nonmetallic conduit in accordance with manufacturer's instructions. Nonmetallic conduit shall only be used under slabs or direct buried in earth. Conduit penetrations through slab including elbows shall be galvanized rigid conduit.
- D. Conduit routing indicated on Drawings are approximate locations unless dimensioned. Route parallel and perpendicular to building construction for complete wiring system regardless whether exposed or concealed.
- E. Arrange supports to prevent misalignment during wiring installation.



- F. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- G. Group related conduits; support using conduit rack. Construct rack using approved steel channel and provide space on each rack for 25 percent additional conduits.
- H. Fasten conduit supports to building structure and surfaces under provisions of this section.
- I. Do not support conduit with wire or perforated pipe straps in any type structure. Remove wire used for temporary supports. Steel tie wire may be used to anchor conduit down to reinforcing rods in concrete encasement only.
- J. Do not attach conduit or boxes to ceiling support wires. Boxes shall be independently supported.
- K. Arrange conduit to maintain headroom and present neat appearance. Maintain required clearance between conduit and piping.
- L. Route all conduit, whether exposed or concealed, parallel and perpendicular to walls, ceilings, building structures, etc.
- M. Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.
- N. Cut EMT conduit square using saw or pipecutter; de-burr cut ends and ream. Bring conduit to shoulder of fittings; fasten securely.
- O. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- P. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes. Use myers hub connectors on all conduit entering top or sides of all junction boxes, pull boxes, wiring gutters, exposed to weather.
- Q. The number of conduit bends per box shall comply with NFPA 70, Article 360. Conduit bends for "SCS" installation shall not exceed two 90 degree bends or exceed a total of 180 degrees of bend between pull boxes or conduit ends. Pull boxes shall be sized per NEC codes per conduit installed. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender to fabricate or use factory elbows for bends in metal conduit larger than 2 inch size.
- R. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- S. Provide suitable fittings to accommodate expansion and deflection where conduit crosses control and expansion joints.
- T. Provide suitable nylon pull string or #14 AWG steel wire in each conduit excluding sleeves and nipples.
- U. Ground and bond conduit per NFPA 70.
- V. Coat all metallic conduit with "General Electric" RTV silicone sealer where conduit is installed in exterior areas or in contact with concrete or earth.
- W. Conduits shall be sized as indicated on Drawings. Where sizes are not indicated, conduit shall be sized per NFPA 70.
- X. Cap all upturned conduits during construction rough-in to prevent moisture or debris from entering. Pull through each and every conduit a dry swab of sufficient size to remove any and all moisture.
- Y. Maximum length of flexible metal conduit (Greenfield), or flexible liquidtight shall be 5 feet.



- Z. Assure ground continuity on all branch circuitry conduits with two locknuts, one inside and one outside of all boxes, cabinets and gutters for rigid conduit. One locknut inside of all boxes, cabinets, and gutters for EMT.
- AA. Provide conduit supports as follows:
 - 1. Galvanized rigid thick wall conduit (GRC), intermediate grade rigid conduit (IMC) and electrical metallic conduit (EMT) within three feet of all outlet boxes, junction boxes, cabinets, gutters, or fittings. Horizontally anchored at 10 foot maximum intervals. Other spacings indicated on Drawings.
 - 2. Flexible metal conduit (Greenfield) and liquid-tight flexible metal conduit (sealtite), within 12 inches of all outlet boxes, junction boxes, cabinets, gutters, or fittings and bends or turns. Horizontally anchored at 4-1/2 foot intervals. 1/2 inch minimum size permitted.

3.3 INSTALLATION - BOXES

- A. Install boxes in accordance with NECA "Standard of Installation."
- B. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with NFPA 70.
- C. Set wall mounted boxes at elevations to accommodate mounting heights indicated or as required for specific project requirements. Orient boxes to accommodate wiring devices as specified in Section 262726.
- D. Electrical boxes are indicated on Drawings in approximate locations unless dimensioned. Adjust box location up to 10 feet if required to accommodate intended purpose with no additional cost to contract. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
- E. Maintain headroom and present neat mechanical appearance.
- F. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only. Install pull boxes in freezer and dock area above bottom chord of structural joist. Pullboxes sized in excess of 12 inches shall be equipped with hinged and hasped covers.
- G. Install outlet and junction boxes within inaccessible ceiling areas, no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- H. Locate outlet boxes to allow luminaires positioned as indicated on Drawings.
- I. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- J. Locate flush mounted box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening. Use approved raised gang covers in masonry and stud walls.
- K. Flush mounted boxes shall not be mounted back-to-back in walls; provide minimum 6 inches separation. Provide minimum 24 inches separation in acoustic rated walls.
- L. Secure flush mounted box to interior wall and partition studs. Accurately position to allow for surface finish thickness. Use approved stamped steel bridges to fasten box between studs.
- M. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- N. Use approved adjustable steel channel fasteners spanning joist for hung ceiling outlet box.
- O. Provide factory sectioned multi-gang boxes where more than one adjacent device is to be mounted. Sectional boxes shall not be permitted.



3.4 INSTALLATION - CABLE TRAYS

- A. Install trays level and plumb in accordance with manufacturer's published instructions.
- B. Install metallic cable tray in accordance with NEMA VE 2.
- C. Support cable trays as follows:
- D. Use anchors and fasteners as specified in Section 260500.
- E. Provide supports at each connection point and at the end of each run.
- F. Design supports including attachment to structure to carry the greater of calculated load multiplied by a factor of four or the calculated load plus 200 lb.
- G. Locate cable tray with sufficient space to permit access for installing cables.
- H. Make changes in directions and elevations using standard fittings. Use expansion connectors where required.
- I. Ground and bond cable tray under provisions of Section 260500.
- J. Provide continuity between tray components.
- K. Use anti-oxidant compound to prepare aluminum contact surfaces before assembly.
- L. Provide #2 AWG bare copper equipment grounding conductor through entire length of tray; bond to each section.
- M. Connections to tray may be made using mechanical connectors.
- N. Install warning signs at 50 feet on center along cable tray, located to be visible.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection.
- B. Inspect conduit installation, types, sizes, fittings and attachment to structure.
- C. Inspect box installation, locations, connection to conduit, and attachment to structure.
- D. Inspect cable tray installation, locations, connection to conduit, and attachment to structure.

3.6 ADJUSTING

- A. Adjust flush-mounting outlets to make front flush with finished wall material.
- B. Install knockout closures in unused box openings.

3.7 CLEANING

- A. Clean interior of boxes to remove dust, debris, and other material.
- B. Clean exposed surfaces and restore finish like new.



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Task	Specification	Specification Description
26 05 33 13	21 05 00 00	Common Work Results for Fire Suppression
26 05 33 13	22 12 23 26	Facility Fuel-Oil Piping
26 05 33 13	23 11 23 00	Facility Liquefied-Petroleum Gas Piping
26 05 33 13	26 05 19 13	Electrical Renovation
26 05 33 13	26 05 19 16a	Communications Equipment Room Fittings
26 05 33 13	26 05 19 16b	Communications Backbone Cabling
26 05 33 13	26 05 19 16c	Communications Horizontal Cabling
26 05 33 13	26 05 19 16d	Conductors and Cables for Electronic Safety and Security
26 05 33 16	26 05 19 13	Electrical Renovation
26 05 33 23	26 05 19 13	Electrical Renovation



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SECTION 26 05 36 00 - CABLE TRAYS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of cable trays. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes steel, aluminum, stainless-steel, and fiberglass cable trays and accessories.

C. Submittals

1. Product Data: Include data indicating dimensions and finishes for each type of cable tray indicated.
2. Shop Drawings: For each type of cable tray.
 - a. Show fabrication and installation details of cable tray, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.
 - b. Seismic-Restraint Details, **as directed**: Signed and sealed by a qualified professional engineer, licensed in the state where Project is located, who is responsible for their preparation.
 - 1) Design Calculations: Calculate requirements for selecting seismic restraints.
 - 2) Detail fabrication, including anchorages and attachments to structure and to supported cable trays.
3. Field quality-control reports.
4. Operation and Maintenance Data.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Comply with NFPA 70.

E. Delivery, Storage, And Handling

1. Steel cable tray, hot dip galvanized after fabrication, **OR** Aluminum cable tray **OR** Stainless-steel cable tray **OR** Fiberglass cable tray, **as directed** may be stored outside without cover, but shall be loosely stacked, elevated off the ground, and ventilated to prevent staining during storage.
2. Store indoors to prevent water or other foreign materials from staining or adhering to cable tray. Unpack and dry wet materials before storage.
3. Steel, mill galvanized **OR** electrogalvanized **OR** factory-primed, **as directed**, cable tray shall be stored in a well-ventilated, dry location. Unpack and dry wet materials before storage.
4. PVC-coated **OR** Field-painted, **as directed**, cable tray shall be stored indoors. Protect cable tray from scratching and marring of finish. Unpack and dry wet materials before storage.

1.2 PRODUCTS

A. Materials And Finishes

1. Cable Trays, Fittings, and Accessories: Steel, complying with NEMA VE 1.



- a. Factory-standard primer, ready for field painting; with cadmium-plated hardware according to ASTM B 766.
 - b. Mill galvanized before fabrication, complying with ASTM A 653/A 653M, G90 (Z275) coating; with hardware galvanized according to ASTM B 633 **OR** cadmium plated according to ASTM B 766, **as directed**.
 - c. Electrogalvanized before fabrication, complying with ASTM B 633; with hardware galvanized according to ASTM B 633.
 - d. Hot-dip galvanized after fabrication, complying with ASTM A 123/A 123M, Class B2; with chromium-zinc, ASTM F 1136, **OR** Type 316 stainless-steel, **as directed**, hardware.
 - e. PVC coating applied in a fluidized bed or by electrostatic spray; with chromium-zinc, ASTM F 1136 **OR** Type 316 stainless-steel, **as directed**, hardware.
 - f. Epoxy-resin paint over paint manufacturer's recommended primer and corrosion-inhibiting treatment; with cadmium-plated hardware according to ASTM B 766 **OR** Type 316 stainless-steel hardware, **as directed**.
2. Cable Trays, Fittings, and Accessories: Aluminum, complying with NEMA VE 1, Aluminum Association's Alloy 6063-T6 for rails, rungs, and cable trays, and Alloy 5052-H32 or Alloy 6061-T6 for fabricated parts; with chromium-zinc, ASTM F 1136, **OR** Type 316 stainless-steel, **as directed**, splice-plate fasteners, bolts, and screws
 3. Cable Trays, Fittings, and Accessories: Stainless steel, Type 304 **OR** 316, **as directed**, complying with NEMA VE 1.
 4. Cable Trays, Fittings, and Accessories: Fiberglass, complying with NEMA FG 1 and UL 568. Splice-plate fasteners, bolts, and screws shall be fiberglass-encapsulated stainless steel. Design fasteners so that no metal is visible when fully assembled and tightened. Fastener encapsulation shall not be damaged when torqued to manufacturer's recommended value.
 5. Sizes and Configurations: Refer to the Cable Tray Schedule on Drawings for specific requirements for types, materials, sizes, and configurations.
 - a. Center-hanger supports may be used only when specifically indicated.

B. Cable Tray Accessories

1. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.
2. Covers: Solid **OR** Louvered **OR** Ventilated-hat **OR** 2-in-3 pitch cover, **as directed**, type of same materials and finishes as cable tray.
3. Barrier Strips: Same materials and finishes as cable tray.
4. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

C. Warning Signs

1. Lettering: 1-1/2-inch- (40-mm-) high, black letters on yellow background with legend "WARNING! NOT TO BE USED AS WALKWAY, LADDER, OR SUPPORT FOR LADDERS OR PERSONNEL."
2. Materials and fastening are specified in Division 26 Section "Identification For Electrical Systems".

1.3 EXECUTION

A. Cable Tray Installation

1. Comply with recommendations in NEMA VE 2. Install as a complete system, including all necessary fasteners, hold-down clips, splice-plate support systems, barrier strips, hinged horizontal and vertical splice plates, elbows, reducers, tees, and crosses.
2. Remove burrs and sharp edges from cable trays.
3. Fasten cable tray supports to building structure and install seismic restraints, **as directed**.



- a. Design each fastener and support to carry load indicated by seismic requirements and to comply with seismic-restraint details according to Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
 - b. Place supports so that spans do not exceed maximum spans on schedules.
 - c. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.
 - d. Support bus assembly to prevent twisting from eccentric loading.
 - e. Manufacture center-hung support, designed for 60 percent versus 40 percent eccentric loading condition, with a safety factor of 3.
 - f. Locate and install supports according to NEMA FG 1 **OR** NEMA VE 1, **as directed**.
 4. Make connections to equipment with flanged fittings fastened to cable tray and to equipment. Support cable tray independent of fittings. Do not carry weight of cable tray on equipment enclosure.
 5. Install expansion connectors where cable tray crosses building expansion joint and in cable tray runs that exceed dimensions recommended in NEMA FG 1 **OR** NEMA VE 1, **as directed**. Space connectors and set gaps according to applicable standard.
 6. Make changes in direction and elevation using standard fittings.
 7. Make cable tray connections using standard fittings.
 8. Seal penetrations through fire and smoke barriers according to Division 07 Section "Penetration Firestopping".
 9. Sleeves for Future Cables: Install capped sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.
 10. Workspace: Install cable trays with enough space to permit access for installing cables.
 11. Install barriers to separate cables of different systems, such as power, communications, and data processing; or of different insulation levels, such as 600, 5000, and 15 000 V.
 12. After installation of cable trays is completed, install warning signs in visible locations on or near cable trays.
- B. Cable Installation
1. Install cables only when cable tray installation has been completed and inspected.
 2. Fasten cables on horizontal runs with cable clamps or cable ties as recommended by NEMA VE 2. Tighten clamps only enough to secure the cable, without indenting the cable jacket. Install cable ties with a tool that includes an automatic pressure-limiting device.
 3. On vertical runs, fasten cables to tray every 18 inches (457 mm). Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.
 4. In existing construction, remove inactive or dead cables from cable tray.
 5. Install covers after installation of cable is completed.
- C. Connections
1. Ground cable trays according to manufacturer's written instructions.
 2. Install an insulated equipment grounding conductor with cable tray, in addition to those required by NFPA 70.
- D. Field Quality Control
1. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements. Perform the following field quality-control survey:
 - a. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable tray, vibration, and thermal expansion and contraction conditions, which may cause or have caused damage.
 - b. Verify that the number, size, and voltage of cables in cable tray do not exceed that permitted by NFPA 70. Verify that communication or data-processing circuits are separated from power circuits by barriers.
 - c. Verify that there is no intrusion of such items as pipe, hangers, or other equipment that could damage cables.



- d. Remove deposits of dust, industrial process materials, trash of any description, and any blockage of tray ventilation.
 - e. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorquer in suspect areas.
 - f. Check for missing or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
 - g. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable tray.
- 2. Report results in writing.

E. Protection

- 1. Protect installed cable trays.
 - a. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.
 - b. Repair damage to PVC or paint finishes with matching touchup coating recommended by cable tray manufacturer.
 - c. Install temporary protection for cables in open trays to protect exposed cables from falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials until the risk of damage is over.

END OF SECTION 26 05 36 00



Task	Specification	Specification Description
26 05 39 00	26 05 19 13	Electrical Renovation
26 05 43 00	26 05 19 16a	Communications Equipment Room Fittings
26 05 43 00	26 05 19 16b	Communications Backbone Cabling
26 05 43 00	26 05 19 16c	Communications Horizontal Cabling
26 05 43 00	26 05 19 16d	Conductors and Cables for Electronic Safety and Security
26 05 53 00	26 05 19 13	Electrical Renovation
26 05 83 00	26 05 19 13	Electrical Renovation
26 05 83 00	26 05 13 00	Undercarpet Cables



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SECTION 26 06 23 00 - MPF LIGHTING CONTROL DEVICES**

NOTE TO SPECIFIER

Use this Specification Section for Mail Processing Facilities only. This Specification is intended as a guide to the Architect/Engineer preparing the Construction Documents.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS FACILITIES, THROUGH THE CONTRACTING OFFICER'S REPRESENTATIVE.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Lighting control system for Workroom.
 - 2. Lighting control system for Box Lobby
 - 3. Control of Interior/Exterior Lighting.
 - 4. Control of Administrative Area Lighting.
 - 5. [Daylighting controls.]
 - 6. Occupancy [and Photo] sensors
 - 7. Automatic receptacle control
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the work of this section. Additional requirements and information necessary to complete the work of this section may be found in other documents.
- C. Related Sections:
 - 1. Section 250504 - Building Automation System (BAS) General.
 - 2. Section 255104 - EEMS Integration.
 - 3. Section 259004 - Sequence of Operations.
 - 4. Section 260500 - Common Work Results for Electrical.
 - 5. Section 260533 - Raceway and Boxes for Electrical Systems.
 - 6. Section 265100 - Interior Lighting.
 - 7. Section 265600 - Exterior Lighting.
 - 8. Section 270500 - Common Work Results for Communication.
 - 9. Section 260800 - Commissioning of Electrical Systems.
 - 10. Section 019113 - General Commissioning Requirements.

1.2 REFERENCES

- A. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA ICS 1 - General Standards for Industrial Control and Systems.



- B. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code.
 - 2. NFPA 101 - Life Safety Code
- C. Codes and Standards:
 - 1. International Building Code / National Electrical Code.
 - 2. Occupational Safety and Health Agency Standards.
 - 3. Illuminating Engineering Society Handbook.
 - 4. ASHRAE Standard 90.1 – 2010.
 - 5. The International Energy Conservation Code.
- D. U.L. Standards:
 - 1. UL 916 Energy Management Equipment.

1.3 SUBMITTALS

- A. As specified in Section 260500 – Common Work Results for Electrical.
 - 1. Product Data: Data for each component of the lighting control system indicating electrical characteristics and connection requirements.
 - a. Lighting Control Panels and Components.
 - b. Low Voltage Relays.
 - c. Digital Control Switch.
 - d. Automatic Control Switch.
 - e. Photo-Sensor.
 - f. Occupancy Sensors.
 - g. [Daylighting Controls.]
 - h. Software.
 - 2. Shop Drawings: Indicate electrical characteristics and connection requirements, including layout of completed assemblies, interconnecting cabling, dimensions, and power requirements.
 - 3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products and components meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Project Record Documents: Accurately record the actual locations of Products.
 - 2. Operating Instructions: Document training by furnishing a sign-in sheet with a description on the training provided, instructors name and organization and those who received training. Refer to 017704 1.3, 1.4 and 1.5 for more specific training.

NOTE TO SPECIFIER

Modify section 1.4 below for a time clock based control system if, as determined by the Contracting Officer's Representative, a low voltage digital lighting control system is not cost effective.

1.4 SYSTEM DESCRIPTION

- A. It is the intent of this section of specifications to provide an integrated, energy saving, digital lighting control system including lighting control panels, mechanically held low voltage relays, components, etc. from a single manufacturer.



- B. The workroom lighting system shall be designed to achieve the required light levels for the four lighting groups described below.
1. Task Light Group (TLG): The lights in this group provide 50 fc of Task lighting for 1) Equipment operator stations and/or 2) Areas within a zone that require a higher light level for visual acuity. The TLG lighting is provided by luminaires located in task-specific areas apart from the normal Ambient Light Group grid pattern.
 - a. The control of luminaires in the TLG shall be achieved by the use of a digital Lighting Control System programmed to control each zone separately. Each zone shall have one or more manual override buttons on the wall that will turn the lights on for one hour when pressed. There will be one manual override circuit for each zone, controlling both ambient and task lighting simultaneously for that zone.
 - b. Manual Override Button. Each manual override button shall be mounted at 48" AFF to allow the lighting for the zone to be energized for one hour during "off schedule" times. When this button is activated all TLG and ALG lights in the zone shall be energized for one hour. This manual button will be mounted near the primary equipment operator or adjacent to the zone on the wall and labeled for easy identification. Provide pilot lighted buttons.
 2. Ambient Light Group (ALG): This group will provide 25 fc for operational zones where work is performed that requires less visual acuity than that needed for Task lighting. This will be the primary lighting provided for workroom activities.
 - a. Individual luminaires in each of the ALG zones shall be controlled by the same digital lighting control system utilizing the same manual override described in the Task Lighting Group (TLG) section. The ALG and TLG lighting groups within the same zone shall operate simultaneously.
 - b. Ambient lighting provided by ELG luminaires during normal power operation must be integrated into the ALG design. ELG luminaires will remain on when TLG and ALG zone lights are controlled off.
 3. Area of Travel Light Group (AOTLG): This lighting group requires a minimum average of 12.5 fc for areas of travel such as aisles and walkways when all other lights are turned off. The minimum average of 12.5 fc's shall be maintained at all times.
 4. Egress Lighting Group (ELG): Controlled "lights off" condition. This is a condition in which the lighting control system is turned off while the main processing equipment continues to run. Under these conditions, an average of 1 fc of light shall be provided throughout the workroom/platform floor until normal ambient lighting is restored. In order to maintain this level of lighting, the ELG luminaires shall not be controlled by the lighting control system.
- C. The functional characteristic of each luminaire within the workroom shall be as follows:
1. Lamp and ballast combinations within individual luminaires, groups of luminaires or at every other luminaire shall be controlled as zones to achieve the required lighting levels under different lighting conditions. Control solutions such as turning off every other luminaire or row of luminaires are acceptable.
 2. All luminaires shall be controlled by mechanically held, low voltage relays. In the event that the control panel fails, the relays shall remain in their current state and shall have the capability to be manually controlled at the control panel.
- D. The workroom lighting shall be divided into zones to allow for turning lights off in areas that are not actively running equipment or during scheduled lights off times. Each zone shall be wired to a pilot lighted low voltage switch on the wall adjacent to the zone that overrides zone timers and controls. When the button is pushed, lighting should come on for a period of one hour.
- E. The lighting control panel(s) will "stand alone" and control the time schedules for all zones that are connected. The lighting control panels shall communicate, log and furnish information about the operational characteristics of the system. The lighting control panel shall be capable of logging "run time" data per relay. The "BAS" shall aggregate and process this data. Data to be logged and reported shall include percentage of time lights are on for each Lighting Group, time sequence, clock hours on lamps by group to determine relamping schedules for groups other than ELG, number of hours in manual vs. scheduled time and others that may be needed to document the proper function of the control system. Time schedules will be password protected at multiple security levels. All of the data for



an entire facility should be available on a per zone or per facility basis, by accessing the system. The control panel(s) shall communicate this data to the Building Automation System (BAS) using BACNet protocol.

1. There will be available to the occupants of the space, one or more manual buttons that will allow the occupants to override the control sequence for one hour for maintenance, special schedules, cleaning, etc. The manual override system will only be for the zone that the buttons are located in, not for multiple zones. When the time has elapsed, the luminaires will return to their normal programmed state.
 2. Some of the lights within each zone shall blink, or give other visual warning approximately 5 minutes before they are about to time out. When the lights are not in the override condition, there shall be a green light on the control panel which is illuminated in order to show that the lights are not in the manual override state, as a maintenance aid for troubleshooting.
 3. Lighting Control Panel(s) and their functions must be accessible, and interactive with, the Building Automation System allowing changes to be made by the BAS without the need for a manufacturer's computer based front end. Note that initially, the "BAS" and "EEMS" systems may not be functional within the facility. The lighting control software shall therefore be utilized until these Building Automation Systems have been installed, interfaced and commissioned.
 4. The controller/computer shall configure/ reconfigure zones, set up schedules, and control groups of luminaires/lamps via low voltage digital relays to reside on the Building Automation System.
- F. The control of the exterior lighting shall be integrated within the digital lighting control system. Exterior lighting shall be energized by photo-sensor(s) and de-energized by time control functions.
1. The control of the exterior and building mounted signs shall operate similar to the exterior lighting control scheme, but shall utilize independent time schedules.
- G. The control of the lighting within the Administrative Areas shall be accomplished utilizing occupancy sensors or automatic control switches and branch circuits fed through the lighting control panels.
- H. Box Lobby Control System Performance Requirements:
1. 24 hour Box Lobby lighting shall be controlled through the low voltage relay system with an occupancy sensor override.
 2. All other Box Lobby's shall be provided with manual on/off controls interfaced with the low voltage relay system.
- I. Automatic receptacle control for those designated receptacles located within all offices, open offices and computer classrooms, shall be integrated within the lighting control system. These receptacles shall be controlled through low voltage relays and the time control functions of the lighting control panel(s).

NOTE TO SPECIFIER

Include paragraph 1.4 J. below for applications requiring automatic Daylighting Control.

- J. Daylighting automatic controls shall be provided for the rooms and spaces indicated on the drawings and provided as specified herein.

1.5 QUALITY ASSURANCE

- A. Single Source: Provide digital controllers, control relays, photocells, selector switches, time clocks, manual or digital override timer switches, control wiring, and accessories from integrated system supplier.
- B. Qualifications:
 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.



2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.
- C. Regulatory Requirements:
1. Conform to requirements of NFPA 70 and NFPA 101.
 2. Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.
 3. Comply with NEC, NEMA and FCC Emission requirements for Class A applications.
 4. UL Approvals: Relay panels and accessory devices are to be UL listed under UL 916 Energy Management Equipment. Configured to order or custom relay panels shall be UL Listed under UL 508, Industrial Control Panels.
- D. Testing:
1. Component Pretesting: All component and assemblies are to be pretested and burned-in prior to installation.
 2. System Checkout: A factory trained technician shall test each component in the system after installation to verify proper operation and confirm that the panel wiring and addressing conform to the wiring documentation. Submit check-out memo from factory representative.
 3. Functional testing of the lighting control system shall be provided by an independent commissioning authority in accordance with ASHRAE 90.1 - 2010. Refer to Section 260800 - Commissioning of Electrical Systems.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Section 016000 - Product Requirements: Transport, Handle, Store, and protect products.
 - B. Store products in clean, dry area; maintain temperature to NEMA ICS 1 requirements.
- 1.7 WARRANTY AND TECHNICAL SUPPORT
- A. Digital control system manufacturer shall provide five (5) years of technical support to the end users. Services shall include the reconfiguration of zones, schedule changes, additional training, etc., as needed, free of charge. This support may be provided in person, by phone, or through web-based communication tools.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering products which may be incorporated in the work include the following:
 1. Cooper Controls, Peachtree City, GA (800) 553-3879.
 2. Encelium Technologies, inc., Philadelphia, PA (267) 286-0336
 3. General Electric Company, Plainville, CT (800) 626-2000.
 4. Hubbell Building Automation, Inc, Austin, TX (888) 698-3242.
 5. Leviton, Little Neck, NY (800) 824-3005,
 6. Lightolier, Fall River, MA (508) 679-8131.
 7. Lighting Control & Design, Glendale, CA (800) 345-4448



8. Lutron Electronics, Co. Coopersburg, PA (800) 523-9466
9. Novitas, Culver City, CA (310) 568-9600.
10. Tork, Mount Vernon, NY (914) 664-3542.
11. WattStopper, Santa Clara, CA (800) 879-8585.

B. Section 016000 - Product Requirements: Product options and substitutions. Unless otherwise indicated, substitutions are permitted.

C. Interior Workroom Lighting Controls (No Substitutions)

1. Cooper Controls
2. Encelium
3. General Electric
4. Leviton
5. Lighting Control & Design
6. Lutron
7. WattStopper

2.2 LIGHTING CONTROL PANELS

A. Provide lighting control panels in the locations and capacities as indicated on the drawings. Each panel shall be of modular construction and consist of the following components:

1. Enclosure/Tub shall be NEMA 1 as indicated on the plans, sized to accept an interior with 1-8 relays, 1-24 relays and six (6) four pole contactors, or 1-48 relays with six (6) four pole contactors.
2. Cover shall be configured for [surface] [flush] wall mounting of the panel. The panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.
3. Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. The interior construction shall provide total isolation of high voltage (class 1) wiring from low voltage (class 2) wiring within the assembled panel. The interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. The panel interiors shall include the following features:
 - a. Provision for one or two optional control and automation cards.
 - b. Removable, plug-in terminal blocks with screw-less connections for all low voltage terminations.
 - c. Individual terminal block, override push button, and LED status light for each relay
 - d. Switch inputs associated with each relay and group channel shall support two or three wire, momentary or maintained contact switches.
 - e. Isolated contacts within each relay shall provide true relay state to the electronics. True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems.
 - f. Automatic sequenced operation of relays reduces impact on the electrical distribution system when large loads are controlled simultaneously.
 - g. Group, channel, and pattern control of relays shall be provided through a simple button-press interface within the panel. Any group of relays can be associated with a channel for direct on/off control or pattern (scene) control via a simple programming sequence using the relay and channel override push buttons and LED displays.
 - h. Relay group status for each channel shall be provided through bi-color operation of the LED indicators. Solid red indicates that all relays in the group are on, solid green indicates that the group is in a mixed state, and blinking green indicates that the relays have blink warned and are currently timing out.



- i. Each relay and channel terminal block shall provide a 24V pilot light signal. It shall be possible to configure the system for support for any Class 2 pilot light voltage with the use of an auxiliary power supply.
- j. Single pole, mechanically held relays with modular plug-in design. Relays shall provide the following ratings and features:
- k. Electrical:
 - 1) 20 amp ballast at 277V
 - 2) 20 amp tungsten at 120V
 - 3) 1.5 HP motor at 120V
 - 4) 14,000 amp short circuit current at 277V
- l. Mechanical:
 - 1) Individually replaceable, ½" KO mounting with removable Class 2 wire harness
 - 2) Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel
 - 3) Dual line and load terminals each support two #14 – #12 solid or stranded conductors
 - 4) Tested to 300,000 mechanical on/off cycles
 - 5) Isolated low voltage contacts provide for true relay status feedback and pilot light indication.
- m. Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.
- 4. The Dataline wire will be supplied by the equipment manufacturer and will include the manufacturer's name, catalog number printed on the wire jacket. The contractor, at its own expense, will replace an improper dataline wire.
- 5. Panels shall be digitally addressed and support bi-directional communication between each other and other intelligent field devices specified elsewhere.
- 6. Basis of Design: WattStopper LILM Series.

2.3 ADVANCED COMMUNICATIONS, INTEGRATION AND PC CONNECTIVITY

- A. Provide an advanced communications network that supports optional features like PC connectivity, TCP/IP connections, advanced programming system documentation, enhanced diagnostics, historical and runtime accumulation, and graphic programming and control.
 - 1. The system shall support the following advanced operating scenarios:
 - a. Adjustable override periods for after hour use based upon the day of the week.
 - b. Preemptive override before OFF to prevent blink warning and to start a new override time delay.
 - c. Allow common areas to remain ON when specific relays in a panel are ON. Egress timer starts a countdown when the last watched relay turns OFF.
 - d. Master Switch Control with blink option to provide a blink warning and five minute countdown for occupants when a master switch is turned OFF
 - 2. Communications
 - a. Each panel shall support RS232 twisted pair and optional RS-485 connections. Either protocol may be used for programming, monitoring, and control. The dataline shall allow simultaneous operation of multiple communications access points to support multiple operator terminals and communications with other building automation systems.
 - b. Each panel shall be capable of stand-alone automatic operation and the network shall achieve full distributed processing.
 - c. All programming shall be accomplished with a Windows based PC running compatible software package.
 - 3. Hardware Features
 - a. Each communication control card shall be capable of providing all logic, control, runtime data, status information, and communications functions for up to 48 relays in a panel.



- b. EEPROM power loss memory and clock holdup time: 30 days
 - c. Self-diagnostics: Automatic diagnostics on all memory, input/output card modules, relays, and dataline.
 - d. Clock: Digital with time, day of week, and date. Automatic leap year compensation. Programmable Daylight Savings Time and Standard Time adjustment.
- 4. WinControl Software
 - a. Schedules
 - 1) Each communication control card shall support up to 24 unique weekly schedules out of a total of 1,000 available per system. Each schedule shall allow up to eight events per day for a repeating seven day week.
 - 2) Up to 32 holidays may be defined for any specific date. On that date any of the three holiday schedules may be assigned.
 - 3) Relays may be programmed to switch to a different weekly schedule on any specific date, and then revert back to normal at another time. This allows for future schedule changes to be programmed ahead of time.
 - 4) "Spring Ahead" and "Fall Back" dates for daylight savings time changes may be entered full two years ahead. Software also supports the ability to "Auto fill" in the next two occurrences of each of these dates.
- 5. Time Delay / Blink Warning
 - a. Used during unoccupied periods, assignable for each relay.
 - 1) Time delays from 2 to 1,440 minutes.
 - 2) Blink Warning: 1-second OFF blink followed by a 5 minute grace period before OFF.
 - 3) An optional second blink warning one minute before OFF.
 - b. Operates automatically for all scheduled OFFs and time delay overrides.
 - c. Occupant overrides may be entered before the blink warning to prevent a scheduled blink and shutdown.
- 6. Analog Photo-Sensor Configuration
 - a. Enable any group switch card input (eight per group switch card) to act as an analog input into the panel for use with photocells or other analog devices
 - b. Select the photocell from list of available types including:
 - 1) Outdoor, 0 - 200 foot candles
 - c. Establish trigger parameters for each analog input with:
 - 1) Separate on and off set points
 - 2) Separate on and off time delays
 - 3) Load to be controlled by the input
- 7. A total of 32 sets of trigger parameters may be established per panel
- 8. Analog Photo-Sensor Monitoring
 - a. Actual foot candle light levels per photocell and the current trigger state of the loads may be read using the Operators Software specified in section 2.21.
- 9. Telephone Override
- 10. Each relay shall respond to up to eight different telephone override codes. Maximum of 9999 telephone codes can be programmed.
- 11. Runtime Counters for Each Relay
 - a. Cumulative runtime (up to 31 years) and number of cycles (up to 17 million) since last reset. User re-settable.
 - b. Daily runtime for the current day and each of the prior 40 days.
 - c. Monthly runtime for current and 14 prior months.
- 12. Activity Logs
 - a. Store previous relay events including the time, new state, and cause for the change in state.
 - b. Annunciate over the dataline and RS232 port when the table is 25%, 50%, 75% and 100% full.

B. Provide the following operator software features.



1. User programming and editing may be conducted both online or offline in a Windows based software application.
 2. Data shall be entered through a simple menu-driven user interface.
 3. The software shall simplify integration with other software products by allowing the lighting control manufacturer's components to be embedded into other Windows applications. These features shall include the following:
 - a. BACnet connectivity with optional WebLink.
 - b. Drag and Drop interface programming supported throughout the program.
 4. Basic operating software provides the following:
 - a. Site wiring documentation for all connected relay panels and system components.
 - b. English descriptions of each relay's circuit designation, circuit description, switch and calculated load.
 - c. RS232 and TCP/IP Connection to Lighting Control Panel
 - d. Monitor/Control all relays. Software shall show actual relay states, with an optional menu showing how and when the relay state occurred, and when next scheduled to change.
 - e. Simulate all functions.
 5. System Parameters
 - a. System software to be sized based appropriately for the system – 250, 500, 750 or unlimited relays. Any number of sites may be programmed from a single software package (based on hard drive space).
 - b. Passwords Matrix Features allowed per site.
 - c. User defines functions accessible for each password (Document, Program, Initialize, Transfer from PC, Transfer to PC, Control, Simulate/Test).
 - d. Configure software to automatically contact remote sites using a modem or I/P address.
 6. Other Features
 - a. Online help brings up a context sensitive help screen.
 - b. One step menu option to back up all site information to a backup drive.
 - c. The software shall include Trends and Relay Runtime Analysis that will allow the operator to analyze the operation of specific areas and identify those exceeding normal runtimes. Individual relays may be assigned a kWh weighted value or simply analyzed on a runtime basis. In both cases, the relays may be assigned to logical groups and plotted for the last 30 days or 12 months.
 7. System Design Capability
 - a. From the lighting control system software database, the software shall be able to automatically create a system single line drawing, panel schedules and specifications that can be exported in DXF format for use in standard CAD drawings.
- C. The Desktop "BAS" Computer work station (provided under Specification Section 250504) will provide monitoring, programming and control of the system.
- D. Ethernet Multi-User Connectivity – Weblink
1. System Description
 - a. A network appliance will provide multi-user, simultaneous access to the lighting system using standard TCP/IP and the WinControl software specified in paragraph B above.
 - b. All IT infrastructure that is required for connectivity shall be specified elsewhere and is not considered part of the lighting control system requirements.
 - c. The network appliance will include the following hardware:
 - 1) Ethernet, Serial and Parallel port
 - 2) Optional 56K BAUD internal modem
 - 3) Video graphics card
 2. Features
 - a. Multiple users (each with a licensed copy of WinControl) will be able to simultaneously connect to the IP address of the WebLink.
 - b. Users may be connected via an Intranet, or Internet depending upon network security limitations.



- c. Provide the capability to monitor the status of each relay and to override each relay using only a web browser
- d. A single user may connect using WinControl, via the internal modem of the WebLink.
- e. The WebLink will provide all the features of a direct connected site to the simultaneous users.
- 3. Events Scheduler Module (Schools, Retail and Event Centers)
 - a. 365 day event scheduling will allow "Events" to be defined as a series of commands to allow a preprogrammed timed sequence to occur by selecting the start time and stop time of the event. Events may be programmed as a repeating schedule with specific start and ending times or as one time scheduled events.
 - b. 365 day programming will simplify single day activities for schools, retail applications, or event centers. The schedules may be programmed up to two years in advance.
- 4. BACnet Integration with Building Automation System
 - a. Provide a BACnet IP connection as required for connectivity to the BAS
 - b. Each lighting control panel shall be exposed to the BAS as a BACnet Device with an individual BACnet Device ID.
 - c. The lighting control relays within each panel shall be exposed as BACnet Binary Output objects with read/write capability for control and status monitoring.
 - d. System group codes shall likewise be exposed as Binary Output objects and shall provide capability for a single command from the BAS to control multiple relays in multiple panels simultaneously via the lighting control network.
 - e. To facilitate a seamless integration with the BAS, the BACnet object Description Property fields shall be automatically populated with the relay, group code, and panel text descriptions from the lighting control system database as created by the WinControl software.

E. Realtime Color Graphics Software

- 1. System Description
 - a. Color graphics software, WinControl Graphics, shall allow a user to monitor and control the low voltage relays through a graphical color interface. The system will allow the user to create drawings through a graphics generator provided with the system. The system will control the relays in a real-time environment; i.e. all system changes will be communicated immediately through the color graphic screens.
 - b. The application will provide a visual representation of the floor plan, drawn to scale, with each fixture displayed on screen. Fixtures can automatically indicate the relay controlling them on screen. The software will include "fly overs" which will display fixture information when the mouse pointer is over a defined object on the screen.
 - c. The software will fully integrate with the base software; all system databases including wiring documentation and system runtime information will be available to the graphic software.
 - d. The software shall be based upon Microsoft's Component Object Model (COM) and shall support Active-X technology for integration.
 - e. The software shall include **(specify quantity if required)** ____ color graphic screens created by a factory authorized representative. These screens will be provided based on the Owner's requested illustrations.
- 2. Graphic Screen Features
 - a. The graphic software will allow full programming of the system from the animated graphic floor plans.
 - b. The operator will be able to zoom in and pan the floor plan for more detail.
 - c. The system shall be provided with a matrix password table to allow any user access to individual, selectable features.
 - d. Manual control of the relays, or simulation of system wide functions, shall be possible by a single click of the mouse.
 - e. Programmable "action spots" will allow an operator to pre-define commonly used manual control functions, or allow the operator to jump to other color graphic screens.



- f. System animation will support multi-ballast control of a fixture representing multi-level lighting, as well as animation for monitoring of fans or other "animated devices." Animation will also include a "Failure" definition to occur in event of relay failure.
 - g. Relay definitions and circuit numbers from the base software will be displayed on screen when requested by the user. Relay circuit numbers will be automatically displayed inside the fixture to provide useful information to the operator.
- 3. Graphic Screen Generation
 - a. Contractor shall provide CAD floor plans to the manufacturer for generation of graphic screens.
 - b. As-Built relay panel and reflected ceiling documentation must be provided to the manufacturer before graphic screen development can begin.

2.4 EIGHT CHANNEL DIGITAL PHOTOCONTROL MODULE

- A. Provide weatherproof Class 2 photo-sensor for measuring exterior light levels. The photocell shall be mounted facing north as indicated on the plans. The photo-sensor shall be connected to a photocontrol module mounted on the DIN rail inside the low voltage section of a lighting control panel and connected to the dataline communications wire.

2.5 DIGITAL DATALINE SWITCHES

- A. Intelligent digital switching shall be provided operating on the dual twisted pair communication wire. Switches shall be available in single, dual, quad, or octal (1-button, 2-button, 4-button, or 8-button) designs. The single, dual, and quad devices shall mount in a standard single-gang box, the octal version in a two-gang box.
 - 1. Each button shall be individually programmable. Programming of buttons shall not require the use of a computer or other programming device. It shall be possible to assign relays or channels to buttons using a simple button press interface. Each button can control any one of the following options:
 - a. Any individual relay in any single panel.
 - b. Any group of relays in any single panel.
 - c. Any group of relays in the system (via network clock, Automation Appliance, or WinControl software package).
 - 2. For applications that require pattern switching, buttons shall function as a scene control using an ON/OFF/Not Controlled pattern of relays instead of the normal All ON/OFF.
 - 3. Switches shall be constructed of non-breakable Lexan on all exposed parts and shall include a matching screw-less Lexan wall plate.
 - 4. Individual buttons shall have a removable clear cover to allow standard 9 mm (3/8 inch) labeling tape to be used to identify the controlled loads.
 - 5. Each switch shall use a bi-color LED pilot light for the individual buttons to indicate status of the controlled relay or group of relays. LED indications are Red for All ON, Green for Mixed State (some relays in the group ON and others OFF), and No LED for All OFF.
 - 6. Switch LED pilot lights shall flash green to indicate impending off sweep during the five-minute grace period following blink warning of the lights. Once the button is pressed, the LED will change to Red to acknowledge the occupant's override command to keep lights ON.
 - 7. Multiple dataline switches programmed to control the same relay or relay group shall indicate the same status automatically.
 - 8. Each switch shall also include a locator light illuminating the switch for easy location in the dark.
 - 9. The dual, quad, and octal switches shall all include a single master button that will override all relays controlled by the individual buttons OFF, or Restore them to their original state. Each switch's master button configuration can be altered to perform a Master ON/OFF, OFF only, or Disabled function if desired.
 - 10. Switches can be configured to follow a "Cleaning" scenario. This specific scenario shall prevent the cleaners from overriding OFF any relays previously turned ON by an occupant.



11. Each switch is available in a Key lock override version. Once a key is inserted, the individual buttons will function for five minutes.
12. Basis of Design: WattStopper #DCC2 or #LMSW Series.

2.6 ANALOG, DUAL TECHNOLOGY, SINGLE RELAY, WALL BOX OCCUPANCY SENSOR

- A. Provide flush mounted, single relay, wall box type occupancy sensor with the following features:
 1. The Occupancy Sensor Switch shall be a designer-style, multiple-detection technology, universal voltage occupancy sensing wall switch.
 2. Sensor shall be designed to accept and control universal voltage (120VAC to 277VAC, 60Hz.) and rated to control up to 1000-watt lighting loads.
 3. Sensor shall be a two-wire switch capable of handling the following loads:
 - a. Incandescent / Quartz Halogen
 - b. General Inductive
 - c. Cold Cathode / Neon
 - d. Electronic Low-Voltage
 - e. Magnetic Low-Voltage
 - f. Fluorescent Non-Dimming Ballasts
 4. Sensor shall have a viewing area of not less than one hundred seventy (170°) degrees at an axial distance of forty feet (40'), fifty feet (50') at 0 degrees, and shall have a total coverage area of not less than four-thousand square feet (4,000 Sq. Ft.) with an unobstructed view.
 5. Device shall be supplied with color-coordinated, self-sticking masking labels that reduce the field of view to 60, 90, or 120 degrees.
 6. Sensor shall utilize non-intrusive, passive detection technologies consisting of:
 - a. Passive Infrared (PIR) to read and detect occupants' body heat and movement, and;
 - b. Enhanced PIR with Digital Signal Processing (DSP) to read and detect occupancy throughout the entire space, and;
 - c. Photo detection to sense human motion and help differentiate this signal from other sources such as hot air vents.
 7. Under no circumstances shall the unit emit energy of any type into the space that can potentially interfere with electrical, electronic, or medical devices (i.e. hearing aids), etc.
 8. Each unit shall provide manual on/automatic off operation and accept on/off commands from an unlimited number of multi-location 3-way Remotes.
 9. Remote stations shall provide multi-location On / Off control of the switch using conventional 3-way wiring.
 10. Each unit shall be capable of 4 time-out methods to adapt to the space:
 - a. Manual fixed time (user definable) from 1 to 30 minutes.
 - b. Auto Time Out Calibration – Conservative Mode
 - c. Auto Time Out Calibration – Normal Mode
 - d. Auto Time Out Calibration – Aggressive Mode
 - e. In Auto Time Out Calibration Mode the unit shall automatically adapt the time out period to the occupancy patterns of the space to maximize energy savings while minimizing distraction to the user.
 11. The unit shall, when manually turned off by the user, continue to monitor the space, but will not turn on the lights. User shall be able to, at anytime, override this feature by manually turning on the lights.
 12. Each unit shall, at the user's discretion, be programmed (at the sensor) to automatically adapt its programming parameters to optimally set time delay according to the space's occupancy/vacancy patterns.
 13. The unit's operational/parameter programming shall be accomplished with the unit installed and operational without the need to remove the unit (or its faceplate) from its installed location.
 14. Each unit shall provide a LED indicator to provide indication when the sensor detects movement.
 15. Device shall offer the selection of three user-programmable warning tones before automatically turning Off. The unit shall also offer the ability, to the user, to turn off warning tones.



16. Device shall mount in a single gang wallbox and be gangable with other designer-style electrical devices and faceplates.
17. Each unit shall include a designer-style screwless, detachable color-coordinated faceplate in White, Ivory, or Light Almond.
18. The Sensor shall be UL Listed to U.S. and Canadian standards for a 120VAC to 277VAC capacity.
19. Basis of Design: Lightolier #ITS2U.

2.7 ANALOG DUAL TECHNOLOGY, DUAL RELAY, WALL BOX OCCUPANCY SENSOR

- A. Provide flush mounted, dual relay, wall box type occupancy sensor with the following features:
 1. The occupancy sensor switch shall be a designer style, multiple detection technology, universal voltage, occupancy sensing wall switch.
 2. Sensor shall be capable of detecting presence in the control area by detecting Doppler shifts in transmitted ultrasound and passive infrared heat changes. Sensor shall utilize Dual Sensing Verification Principal for coordination between ultrasonic and PIR technologies. Each sensing technology shall have a LED indicator that remains active at all times in order to very detection within the area to be controlled.
 3. Sensor shall feature a trigger mode where the end-user can choose which technology will activate the sensor. Selection of technologies for initial, maintain and re-trigger shall be done with DIP switches. Sensor shall have its trigger mode factory preset to allow for quick installation. In this default setting, both technologies must occur in order to initially activate lighting systems. Detection by either technology shall maintain lighting on, and detection by either technology shall turn lights back on after lights were turned off for 5 seconds or less in automatic mode and 30 seconds or less in manual mode.
 4. Sensor shall have 4 occupancy logic options for customized control to meet application needs.
 5. Ultrasonic sensing shall be volumetric in coverage with a frequency of 40 KHz. It shall utilize Advanced Signal Processing which automatically adjusts the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.
 6. The PIR technology shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens. The lens shall offer superior performance in the infrared wavelengths and filter short wavelength IR, such as those emitted by the sun and other visible light sources.
 7. Sensor shall utilize SmartSet™ technology to optimize automatic time delay to fit occupancy usage patterns. The use of SmartSet shall be selectable with a DIP switch.
 8. Sensor shall utilize Zero Crossing circuitry on both relays to reduce stress on relays and increase sensor life.
 9. Sensor shall utilize two relays capable of simultaneously controlling independent lighting loads or circuits. The secondary relay shall be isolated, allowing for two-circuit control.
 10. Sensor shall have no minimum load requirement and shall be capable of switching from 0 to 800 Watt solid-state LED; 0 to 800 Watt fluorescent or 1/6 hp at 120 VAC, 60 Hz; and 0 to 1200 Watt fluorescent at 277 VAC, 60 Hz.
 11. Sensor shall feature a walk-thru mode, where lights turn off 3 minutes after the area is initially occupied, if no motion is detected after the first 30 seconds, set by a DIP switch.
 12. Sensor shall cover up to 1,000 s.f. for walking motion with a field view of 180 degrees and shall have automatic-ON or manual-ON operation for both relays adjustable for each relay.
 13. The sensor shall act as a "service switch" to allow operation in the unlikely event of a failure and shall be able to control incandescent, magnetic low voltage, electronic low voltage, "LED" solid state, and fluorescent lighting loads
 14. Sensors shall have a built-in light level featuring simple, one-step daylighting setup that works from 8 to 180 footcandles.
 15. Wall switch sensor shall be a completely self contained control unit that replaces a standard toggle switch.
 16. To ensure quality and reliability, sensor shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%. Sensor shall have standard 5-year warranty and shall be UL and CUL listed.



17. Basis of Design: WattStopper #DW-200.

NOTE TO SPECIFIER

Certain room configurations or functions may require "ultrasonic sensing" in lieu of the preferred "dual technology detection". Edit paragraph 2.8 below, accordingly.

2.8 CEILING MOUNTED OCCUPANCY SENSOR

- A. Provide low voltage ceiling mounted, 360 degree, [dual technology] [ultrasonic] occupancy sensor with the following features.
1. The sensor shall be capable of detecting presence in the control area by detecting doppler shifts in transmitted ultrasound [and passive infrared heat] changes.
 2. [Sensor shall utilize Dual Sensing Verification Principle for coordination between ultrasonic and PIR technologies. Detection verification of both technologies must occur in order to activate lighting systems. Upon verification, detection by either shall hold lighting on.]
 3. Sensor shall have a retrigger feature in which detection [by either technology] shall retrigger the lighting system on within 5 seconds of being switched off.
 4. Ultrasonic sensing shall be volumetric in coverage with a frequency of 40 KHz. It shall utilize Advanced Signal Processing that automatically adjusts the detection threshold dynamically to compensate for changing levels of activity and airflow throughout controlled space.
 5. [The PIR technology shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens. The lens shall be Poly IR4 material to offer superior performance in the infrared wavelengths and filter short wavelength IR, such as those emitted by the sun and other visible light sources. The lens shall have grooves facing in to avoid dust and residue build up which affects IR reception.]
 6. To avoid false ON activations and to provide immunity to RFI and EMI, Detection Signature Analysis shall be used to examine the frequency, duration, and amplitude of a signal, to respond only to those signals caused by human motion.
 7. Sensors shall utilize SmartSet™ technology to optimize time delay and sensitivity settings to fit occupant usage patterns. The use of SmartSet shall be selectable with a DIP switch. Sensors shall have a time delay that is adjusted automatically (with the SmartSet setting) or shall have a fixed time delay of 5 to 30 minutes.
 8. Sensors shall feature a walk-through mode, where lights turn off 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds.
 9. Sensor shall have an LED indicator that remains active at all times in order to verify detection within the area to be controlled. The LED can be disabled for applications that require less sensor visibility.
 10. Sensor shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%. Sensors shall have standard 5 year warranty and shall be UL and CUL listed.
 11. Basis of Design: WattStopper [#DT-305] [#WT-2200].
 12. Provide universal voltage, power pack for 24 VDC operating voltage to the occupancy sensors. Power pack shall enable manual on, hold on, hold off and load shed for bi-level switching applications. Basis of Design: WattStopper BZ-150.

2.9 LINE VOLTAGE, AUTOMATIC CONTROL SWITCH

- A. Provide flush wall mounted automatic control switch with the following features.
1. The automatic control switch shall be a push button wall switch capable of on/off manual operation and shall also be capable of receiving automatic control signals through interrupting power to the circuit feeding the switch and load.



2. All automatic control signals to the switch shall be sent over the circuit wires feeding power to the switch and load. No additional control wiring to the switch shall be required to provide automatic signaling.
3. Control switch shall mount in a standard single gang or multi-gang wall box and shall fit behind a decorator style face plate. The control switch shall not protrude more than 1/8" from the wall and should blend in aesthetically.
4. Control switch shall have no minimum load requirement and shall be capable of switching from 0 to 1300 Watt incandescent and fluorescent @ 120 VAC - 60Hz, and 0-3000 Watt fluorescent @ 277 VAC - 60Hz
5. Control switch shall use an air gap relay for switching ballast, tungsten, general use and shall be compatible with all electronic ballasts and HID loads. Switch shall be capable of 3-way, 4-way, or multi-way switching.
6. Self-adjusting zero cross switching technology shall be used to protect from the effects of high inrush current and to increase switch/relay operation life.
7. Control switch shall have user adjustable settings for occupancy sensor/control panel operating mode, enable/disable audible beep, and enable/disable command on feature. Settings shall be made using the switch push button and configuration LEDs and shall not require the removal of the switch faceplate.
8. Lighting control panel operation shall include the capability of automatically shutting switches off, turning switches on, and delaying switches off.
9. Delay off operation shall provide a one or two second warning blink followed by a five minute delay time period before shutting off the lights. During the delay off period, the locator LED shall blink and, if enabled, an audible warning beep shall sound each minute for the first four minutes and each five seconds during the last minute of the delay time period. The delayed shut off may be canceled by pressing the front push button.
10. The switch shall not require a neutral, simplifying installation and shall feature terminal style wiring, which makes installation easier.
11. Control switch shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%. Control switch shall be UL and CUL listed and shall have a five (5) year warranty.
12. Basis of Design: WattStopper #AS-100.

NOTE TO SPECIFIER

Utilize single zone, analog, light level controllers for applications requiring minimal daylight control. Include paragraph 2.10 below for daylight harvesting applications requiring single zone control.

2.10 ANALOG DAYLIGHTING CONTROLLER

- A. Provide low voltage, ceiling mounted, daylighting photo-controller to control the space lighting when sufficient daylighting is present. Controllers shall have the following features:
 1. The light level controller shall be capable of detecting changes in lighting levels and shall utilize an internal photocell that measures light in a 100 degree angle cutting the unwanted light from bright sources outside of this cone.
 2. The light level controller shall be capable of controlling any type of lighting through use of power packs. Light level controller shall operate from a 24 volts DC power supply with a current draw of 22 milliamps.
 3. The light level controller shall be capable of turning lighting on and off for a single zone with an extended range of 1 to 1400 fc. The controller shall have an adjustable deadband feature with 25%, 50%, 75% or 100% in relation to the setpoints and shall have an adjustable time delay range of 3, 10, 15 or 30 minutes.
 4. The controller shall provide a connection for an optional low voltage, normally open momentary contact wall switch override or occupancy sensor interface.



5. The controllers shall be a microprocessor type with LED status indicator. Light level controller shall have full 5-year warranty.
6. Basis of Design: WattStopper #LS-102

NOTE TO SPECIFIER

Large daylighting control projects may require a multi-zone, digital lighting management control system networked using Cat. 5e cabling. Utilize paragraphs 2.11 thru 2.17 for projects where a digital, lighting management, control system has been justified by a Net Present Value (NPV) calculation.

2.11 DIGITAL WALL SWITCH OCCUPANCY SENSOR

- A. Provide wallbox mounted, dual technology, digital occupancy sensor with 1 or 2 switch buttons. Available in white, light almond, ivory, grey, red and black; compatible with decorator style, wall plates.
- B. Digital Occupancy Sensors shall provide scrolling LCD display for digital calibration and electronic documentation. Features include the following:
 1. Digital calibration and pushbutton programming for the following variables:
 - a. Sensitivity – 0-100% in 10% increments
 - b. Time delay – 1-30 minutes in 1 minute increments
 - c. Test mode – Five second time delay
 - d. Detection technology – PIR, ultrasonic or dual technology activation and/or re-activation.
 - e. Walk-through mode
 - f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photo sensors are included in the local management network.
 2. Two RJ-45 ports for connection to local management network.
 3. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool.
 4. Device Status LEDs to include:
 - a. PIR detection
 - b. Ultrasonic detection
 - c. Configuration mode
 - d. Load binding
 5. Assignment of occupancy sensor to a specific load within the room without the need for wiring or special tools.
 6. Assignment of local buttons to specific loads within the room without the need for wiring or special tools.
 7. Manual override of controlled loads.
- C. Low voltage momentary pushbuttons shall include the following features:
 1. Load/Scene Status LED on each switch button with the following characteristics:
 - a. Bi-level LED
 - 1) Dim locator level indicates power to switch
 - 2) Bright status level indicates that load or scene is active
 2. The following button attributes may be changed or selected using a wireless configuration tool:
 - a. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
 - b. Individual button function may be configured to Toggle, On only or Off only.
 - c. Switch buttons may be bound to any load on a room controller and are not load type dependant; each button may be bound to multiple loads.
- D. Basis of Design: WattStopper LMDW-100 Series.



2.12 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR

- A. Provide ceiling mounted, dual technology, digital occupancy sensor. Furnish the manufacturer's system which accommodates the square-foot coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors and accessories which suit the lighting and electrical system parameters.
- B. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features to include the following:
 - 1. Digital calibration and pushbutton programming for the following variables:
 - a. Sensitivity – 0-100% in 10% increments
 - b. Time delay – 1-30 minutes in 1 minute increments
 - c. Test mode – Five second time delay
 - d. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
 - e. Walk-through mode
 - f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photo sensors are included in the local management network.
 - 2. One or two RJ-45 port(s) for connection to local management network.
 - 3. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool.
 - 4. Device Status LEDs including:
 - a. PIR detection
 - b. Ultrasonic detection
 - c. Configuration mode
 - d. Load binding
 - 5. Assignment of occupancy sensor to a specific load within the room without the need for wiring or special tools.
 - 6. Manual override of controlled loads.
- C. Basis of Design: WattStopper LMDC-100 Series.

2.13 DIGITAL WALL SWITCHES

- A. Provide low voltage, momentary, pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration; available in white, light almond, ivory, grey, red and black; compatible with decorator style, wall plates. Wall switches shall include the following features:
 - 1. Two-way infrared (IR) transceiver for use with configuration remote controls.
 - 2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
 - 3. Configuration LED on each switch that blinks to indicate data transmission.
 - 4. Load/Scene Status LED on each switch button with the following characteristics:
 - a. Bi-level LED
 - 1) Dim locator level indicates power to switch
 - 2) Bright status level indicates that load or scene is active
 - 5. Two RJ-45 ports for connection to local management network.
- B. The following switch attributes may be changed or selected using a wireless configuration tool:
 - 1. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
 - 2. Individual button function may be configured to Toggle, On only or Off only.
 - 3. Switch buttons may be bound to any load on a room controller and are not load type dependant; each button may be bound to multiple loads.
- C. Basis of Design: WattStopper LMSW-100 Series.

2.14 DIGITAL ON/OFF ROOM CONTROLLERS

- A. Room Controllers automatically bind the room loads to the connected devices in the space without the use of any tools. Room Controllers shall be provided to match the room lighting load and control requirements. The controllers shall be simple to install and will not be equipped with, dip switches, potentiometers or require special configuration. The control units shall include the following features:
 1. Simple replacement – Using the default, automatic configuration capabilities, a room controller may be replaced with an off-the-shelf unit without requiring any configuration or setup.
 2. Device Status LEDs to indicate:
 - a. Data transmission
 - b. Device has power
 - c. Status for each load
 - d. Configuration status
 3. Quick installation features including:
 - a. Standard junction box mounting
 - b. Quick low voltage connections using standard RJ-45 patch cable
 4. Controller shall be plenum rated.
 5. Manual override and LED indication for each load
 6. Dual voltage (120/277 VAC, 60 Hz).
 7. Zero cross circuitry for each load.
- B. On/Off Room Controllers shall include:
 1. One or two relay configuration
 2. Efficient 150 mA switching power supply
 3. Three RJ-45 local management network ports
 4. Basis of Design: WattStopper LMRC-100 Series.

2.15 DIGITAL PHOTO SENSORS

- A. Digital photo sensors work with room controllers to provide automatic switching, bi-level, or tri-level daylight harvesting capabilities for any load type connected to a room controller. Closed loop photo sensors measure the ambient light in the space and control a single lighting zone. Open loop photo sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones. Photo sensors shall be interchangeable without the need for rewiring.
- B. Digital photo sensors shall include the following features:
 1. An internal photodiode that measures only within the visible spectrum, and has a response curve that closely matches the photopic curve. The photodiode shall not measure energy in either the ultraviolet or infrared spectrums. The photocell shall have a sensitivity of less than 5% for any wavelengths less than 400 nanometers or greater than 700 nanometers.
 2. Sensor light level range shall be from 1-6,553 footcandles (fc).
 3. The capability of ON/OFF, bi-level or tri-level switching, for each controlled zone, depending on the selection of room controller(s) and load binding to room controller(s).
 4. For switching daylight harvesting, the photo sensor shall provide a field-selectable deadband, or a separation, between the “ON Setpoint” and the “OFF Setpoint” that will prevent the lights from cycling excessively after they turn off.
 5. Optional wall switch override to allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise lighting levels for a selectable period of time or cycle of occupancy.
 6. Infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool.
 7. Configuration LED that blinks to indicate data transmission.
 8. status LED indicates test mode, override mode and load binding.
 9. Recessed switch to turn controlled load(s) ON and OFF.
 10. One RJ-45 port for connection to local management network.



11. Any load or group of loads in the room can be assigned to a daylighting zone
12. Each load within a daylighting zone can be individually enabled or disabled for discrete control.

- C. Closed loop digital photo sensors shall include the following additional features:
 1. An internal photodiode that measures light in a 100 degree angle, cutting off the unwanted light from bright sources outside of this cone.
 2. Automatic self-calibration, initiated from the photo sensor, a wireless configuration tool or a PC with appropriate software.
 3. Automatically establishes application-specific setpoints following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling.
 4. Basis of Design: WattStopper LMLS-400 Series.
- D. Open loop digital photo sensors include the following additional features:
 1. An internal photodiode that measures light in a 60 degree angle cutting off the unwanted light from the interior of the room.
 2. Automatically establishes application-specific setpoints following manual calibration using a wireless configuration tool or a PC with appropriate software. For switching operation, an adequate deadband between the ON and OFF setpoints for each zone shall prevent the lights from cycling.
 3. Each of the three discrete daylight zones can include any non overlapping group of loads in the room.
 4. Basis of Design: WattStopper LMLS-500 Series.

2.16 ROOM NETWORK (LOCAL MANAGEMENT NETWORK)

- A. The local management network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building. Digital room devices connect to the network using CAT 5e cables with RJ-45 connectors which provide both data and power to room devices. Features of the management network include:
 1. Plug n' Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
 2. Simple replacement of any device in the network with a standard off the shelf unit without requiring commissioning, configuration or setup.
 3. Push n' Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
 4. Two-way infrared communications for control configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.
- B. Basis of Design: Wattstopper DLM System.

2.17 CONFIGURATIONS TOOL

- A. A configuration tool facilitates optional customization of local management networks, and is used to set up open loop daylighting sensors. The wireless configuration tool shall feature infrared communications.
- B. Features and functionality of the wireless configuration tool shall include:
 1. Two-way infrared (IR) communication with network enabled devices, within a range of approximately 30 feet.
 2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
 3. Read, modify and send parameters for occupancy sensors, daylighting sensors, room controllers and buttons on digital wall switches.
 4. Save up to nine occupancy sensor setting profiles, and apply profiles to selected sensors.



5. Adjust or fine-tune daylighting settings established during auto-commissioning, and input light level data to complete commissioning of open loop daylighting controls.

C. Basis of Design: WattStopper LMCT-100 Series.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. As specified in Section 260500 – Common Work Results for Electrical.

3.2 INSTALLATION

- A. The Lighting Control System shall be installed and wired completely as shown on the plans by the contractor, who shall make all necessary wiring connections to external devices and equipment.
- B. The low voltage lighting control cabling in this building will be installed above ceilings without conduit. All communications cabling used throughout this project shall comply with the requirements as outlined in the National Electric Code (NEC) article 725. All cabling shall bear CMP and/or appropriate markings for the environment in which they are installed.
 1. Sealing of openings between floors, through fire rated and smoke walls, existing or created by the contractor for cable pass through shall be the responsibility of the contractor. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of the contractor's work. Any openings created by or for this contractor and left unused shall also be sealed as part of this work.
 2. Cabling routed exterior of the building, underground, through inaccessible ceilings or less than 8'-0" A.F.F. in the workroom shall be contained in conduit. Provide flush boxes within finished areas and factory boxes in unfinished areas. Provide 3/4" conduit risers with 90 degree bend and bushing for all wall mounted devices
- C. Accurate "as-built" drawings shall be furnished by the contractor to aid the Owner in programming. These should indicate the load controlled by each relay and the identification number for that relay. They should also identify the physical location of each switch connected to an input and the identification number of that input. Three sets of space plans or lighting plans shall be furnished by the contractor indicating which luminaires are controlled by each relay.

3.3 FIELD QUALITY CONTROL

- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. Perform operational testing on lighting control system to verify proper operation and field wiring connections.
- C. System Start Up and Commissioning
 1. Manufacturer shall provide a factory authorized technician to confirm proper installation and operation of all lighting control system components. The startup requirement is intended to verify that the digital switches and relay panels interact as a complete and operational system to meet the design intent.
 2. Lighting control devices and control systems shall be tested to ensure that control hardware and software are calibrated, adjusted, programmed, and in proper working condition in accordance with the construction documents and manufacturer's installation instructions.



- a. Provide functional performance testing as required by Section 260800 – Commissioning of Electrical Systems.
- D. System Training
 - 1. Manufacturer shall provide factory authorized technician to train owner personnel in the operation, programming and maintenance of the lighting control system including all occupancy sensors and daylighting controls.
- E. System Programming
 - 1. Manufacturer shall provide system programming including:
 - a. Wiring documentation.
 - b. Switch operation.
 - c. Telephone overrides.
 - d. Operating schedules.

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END OF SECTION 26 06 23 00



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SECTION 26 06 23 00 - CSF LIGHTING CONTROLS DEVICES**

NOTE TO SPECIFIER

Use this section for Customer Service Facilities where Lighting Controls are part of the Work or where illuminated exterior signage is used.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT WRITTEN DEVIATION FROM USPS HEADQUARTERS FACILITIES THROUGH THE CONTRACTING OFFICER'S REPRESENTATIVE.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Lighting control system for Workroom.
 - 2. Lighting control system for Box Lobby.
 - 3. Control of Interior/Exterior Lighting.
 - 4. Control of Administrative Area Lighting.
 - 5. [Daylighting controls.]
 - 6. Occupancy [and Photo] sensors.
 - 7. Automatic Receptacle Control.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the work of this section. Additional requirements and information necessary to complete the work of this section may be found in other documents.
- C. Related Sections:
 - 1. As specified in Section 260500 – Common Work Results for Electrical.
 - 2. Section 019113 - General Commissioning Requirements.
 - 3. Section 260800 - Commissioning of Electrical Systems.

1.2 REFERENCES

- A. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA ICS 1 - General Standards for Industrial Control and Systems.
- B. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code.
 - 2. NFPA 101 - Life Safety Code

- C. Codes and Standards:
 - 1. International Building Code / National Electrical Code.
 - 2. Occupational Safety and Health Agency Standards.
 - 3. Illuminating Engineering Society Handbook.
 - 4. ASHRAE Standard 90.1 – 2010.
 - 5. The International Energy Conservation Code.
- D. U.L. Standards:
 - 1. UL 916 Energy Management Equipment

1.3 SUBMITTALS

- A. As specified in Section 260500 - Common Work Results for Electrical.
 - 1. Product Data: Data for each component of the lighting control system indicating electrical characteristics and connection requirements.
 - a. Lighting Control Panels and Components
 - b. Low Voltage Relays.
 - c. Digital Control Switch.
 - d. Automatic Control Switch.
 - e. Photo Sensor.
 - f. Occupancy Sensors.
 - g. [\[Daylighting Controls.\]](#)
 - h. Software.
 - 2. Shop Drawings: Indicate electrical characteristics and connection requirements, including layout of completed assemblies, interconnecting cabling, dimensions, and power requirements.
 - 3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products and components meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Project Record Documents: Accurately record the actual locations of Products.
 - 2. Operating Instruction: Document training by furnishing a sign-in sheet with a description on the training provided, instructors name and organization and those who received training. Refer to 017704 1.3, 1.4 and 1.5 for more specific training.

NOTE TO SPECIFIER

Modify section 1.4 below for a time clock based control system if, as determined by the Contracting Officer's Representative, a low voltage digital lighting control system is not cost effective.

1.4 SYSTEM DESCRIPTION

- A. It is the intent of this section of specifications to provide an integrated, energy saving, digital lighting control system including lighting control panel, mechanically held low voltage relays, components, etc. from a single manufacturer.
- B. The workroom lighting system shall be designed to achieve the required lighting group levels as shown on the drawings.



- C. The functional characteristic of each fixture within the workroom [and enclosed platform] shall be as follows:
1. Lamp and ballast combinations within individual luminaires, groups of luminaires or at every other luminaire shall be controlled as zones to achieve the required lighting levels under different lighting conditions. Control solutions such as turning off every other luminaire or row of luminaires are acceptable.
 2. All luminaires shall be controlled by mechanically held, low voltage relays. In the event that the control panel fails, the relays shall remain in their current state and shall have the capability to be manually controlled at the control panel.
- D. The workroom lighting shall be divided into zones to allow for turning lights off in areas that are not active or during scheduled "lights off" times. Each zone shall be wired to a pilot lighted low voltage switch on the wall adjacent to the zone, that overrides zone timers and controls. When the button is pushed, high level lighting should come on for a period of three (3) hours.
- E. The lighting control panel will "stand alone" and control the time schedules for all zones that are connected. The lighting control panel shall communicate, log and furnish information about the operational characteristics of the system.
1. There will be available to the occupants of the space, one or more manual buttons that will allow the occupants to override the control sequence for three (3) hours for maintenance, special schedules, cleaning, etc. The manual override system will only be for the zone that the buttons are located in, not for multiple zones. When the time has elapsed, the luminaires will return to their normal programmed state.
 2. Some of the lights within each zone shall blink, or give other visual warning approximately 5 minutes before they are about to time out. When the lights are not in the override condition, as a maintenance aid for troubleshooting, there shall be a green light at each relay within the control panel which is illuminated in order to show that the lights are not in the manual override state.
 3. The lighting control panel shall configure/ reconfigure zones, set up schedules, and control groups of luminaires/lamps via low voltage digital relays.
- F. The control of the interior lighting shall be accomplished utilizing occupancy sensors or automatic control switches and branch circuits fed through the workroom lighting control system.
- G. The control of the exterior lighting shall be integrated within the digital lighting control system. Exterior lighting shall be energized by photo-sensor(s) and de-energized by time control functions.
1. The control of the exterior and building mounted signs shall operate similar to the exterior lighting control scheme, but shall utilize independent time schedules.
- H. Box Lobby Control System Performance Requirements:
1. 24 hour Box Lobby lighting shall be controlled through the low voltage relay system with an occupancy sensor override.
 2. All other Box Lobby spaces shall have manual on/off controls.
- I. Automatic receptacle control for those designated receptacles located within all offices, open offices and computer classrooms, shall be integrated within the lighting control system. These receptacles shall be controlled through low voltage relays and the time control functions of the lighting control panel(s).

NOTE TO SPECIFIER

Include paragraph 1.4 J. below for applications requiring automatic Daylighting Control.

- J. Daylighting automatic controls shall be provided for the rooms and spaces indicated on the drawings and provided as specified herein.

1.5 QUALITY ASSURANCE

- A. Single Source: Provide digital controllers, control relays, photocells, selector switches, time clocks, manual or digital override timer switches, control wiring, and accessories from integrated system supplier.
- B. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 - 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.
- C. Regulatory Requirements:
 - 1. Conform to requirements of NFPA 70 and NFPA 101.
 - 2. Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.
 - 3. Comply with NEC, NEMA and FCC Emission requirements for Class A applications.
 - 4. UL Approvals: Relay panels and accessory devices are to be UL listed under UL 916 Energy Management Equipment. Configured to order or custom relay panels shall be UL Listed under UL 508, Industrial Control Panels.
- D. Testing:
 - 1. Component Pretesting: All component and assemblies are to be pretested and burned-in prior to installation.
 - 2. System Checkout: A factory trained technician shall test each component in the system after installation to verify proper operation and confirm that the panel wiring and addressing conform to the wiring documentation. Submit check-out memo from factory representative.
 - 3. Functional testing of the lighting control system shall be provided by an independent commissioning authority in accordance with ASHRAE 90.1 – 2010. Refer to Section 260800 - Commissioning of Electrical Systems.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, Handle, Store, and Protect Products.
- B. Store products in clean, dry area; maintain temperature to NEMA ICS 1 requirements.

1.7 WARRANTY AND TECHNICAL SUPPORT

- A. Digital control system manufacturer shall provide two (2) years of technical support to the end users. Services shall include the reconfiguration of zones, schedule changes, additional training, etc., as needed, free of charge. This support may be provided in person, by phone, or through web-based communication tools.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, product numbers, and availability at time of Project Manual preparation for Project.



2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering products which may be incorporated in the Work include the following:
1. Cooper Controls, Peachtree City, GA (800) 553-3879.
 2. Encelium Technologies, Inc., Philadelphia, PA (267) 286-0336
 3. General Electric Company, Plainville, CT (800) 626-2000.
 4. Hubbell Building Automation, Inc, Austin, TX (888) 698-3242.
 5. Leviton, Little Neck, NY (800) 824-3005,
 6. Lightolier, Fall River, MA (508) 679-8131.
 7. Lighting Control & Design, Glendale, CA (800) 345-4448
 8. Lutron Electronics, Co. Coopersburg, PA (800) 523-9466
 9. Novitas, Culver City, CA (310) 568-9600.
 10. Tork, Mount Vernon, NY (914) 664-3542.
 11. WattStopper, Santa Clara, CA (800) 879-8585.
- B. Section 016000 - Product Requirements: Product options and substitutions. Unless otherwise noted, substitutions are permitted.
- C. INTERIOR WORKROOM LIGHTING CONTROLS (no substitutions)
1. Cooper Controls
 2. Encelium
 3. General Electric.
 4. Leviton.
 5. Lighting Control and Design.
 6. Lutron.
 7. WattStopper.

2.2 LIGHTING CONTROL PANEL(S)

- A. Provide lighting control panel capacities as indicated on the drawings. Panel(s) shall be of modular construction and consist of the following components:
1. Enclosure/Tub shall be NEMA 1 as indicated on the plans, sized to accept an interior with 1-8 relays, 1-24 relays and six (6) four pole contactors, or 1-48 relays with six (6) four pole contactors.
 2. Cover shall be configured for [surface](#) [flush](#) wall mounting of the panel. The panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.
 3. Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. The interior construction shall provide total isolation of high voltage (class 1) wiring from low voltage (class 2) wiring within the assembled panel. The interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable, mechanically held, latching type relays. The panel interiors shall include the following features:
 - a. Provision for one or two optional control and automation cards.
 - b. Removable, plug-in terminal blocks with screw-less connections for all low voltage terminations.
 - c. Individual terminal block, override push button, and LED status light for each relay
 - d. Switch inputs associated with each relay and group channel shall support two or three wire, momentary or maintained contact switches.
 - e. Isolated contacts within each relay shall provide true relay state to the electronics. True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems.
 - f. Automatic sequenced operation of relays reduces impact on the electrical distribution system when large loads are controlled simultaneously.

- g. Group, channel, and pattern control of relays shall be provided through a simple button-press interface within the panel. Any group of relays can be associated with a channel for direct on/off control or pattern (scene) control via a simple programming sequence using the relay and channel override push buttons and LED displays.
- h. Relay group status for each channel shall be provided through bi-color operation of the LED indicators. Solid red indicates that all relays in the group are on, solid green indicates that the group is in a mixed state, and blinking green indicates that the relays have blink warned and are currently timing out.
- i. Each relay and channel terminal block shall provide a 24V pilot light signal. It shall be possible to configure the system for support for any Class 2 pilot light voltage with the use of an auxiliary power supply.
- j. Single pole, mechanically held relays with modular plug-in design. Relays shall provide the following ratings and features:
- k. Electrical:
 - 1) 20 amp ballast at 277V
 - 2) 20 amp tungsten at 120V
 - 3) 1.5 HP motor at 120V
 - 4) 14,000 amp short circuit current at 277V
- l. Mechanical:
 - 1) Individually replaceable, ½" KO mounting with removable Class 2 wire harness
 - 2) Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel
 - 3) Dual line and load terminals each support two #14 – #12 solid or stranded conductors
 - 4) Tested to 300,000 mechanical on/off cycles
 - 5) Isolated low voltage contacts provide for true relay status feedback and pilot light indication.
- m. Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.
- 4. The Dataline wire will be supplied by the equipment manufacturer and will include the manufacturer's name, catalog number printed on the wire jacket. The contractor, at its own expense, will replace an improper dataline wire.
- 5. Panel(s) shall be digitally addressed and support bi-directional communication between [each other and] other intelligent field devices specified elsewhere.
- 6. Basis of Design: WattStopper LILM Series.

2.3 ADVANCED COMMUNICATIONS, INTEGRATION AND PC CONNECTIVITY

- A. Provide an advanced communications network that supports optional features (not specified herein) such as PC connectivity, TCP/IP connections, advanced programming system documentation, enhanced diagnostics, historical and runtime accumulation, and graphic programming and control.
 - 1. The system shall support the following advanced operating scenarios:
 - a. Adjustable override periods for after hour use based upon the day of the week.
 - b. Preemptive override before OFF to prevent blink warning and to start a new override time delay.
 - c. Allow common areas to remain ON when specific relays in a panel are ON. Egress timer starts a countdown when the last watched relay turns OFF.
 - d. Master Switch Control with blink option to provide a blink warning and five minute countdown for occupants when a master switch is turned OFF
 - 2. Communications
 - a. Panel(s) shall support RS232 twisted pair and optional RS-485 connections. Either protocol may be used for programming, monitoring, and control. The dataline shall allow



- simultaneous operation of multiple communications access points to support multiple operator terminals and communications with other building automation systems.
 - b. Panel(s) shall be capable of stand-alone automatic operation and the network shall achieve full distributed processing.
 - c. All programming shall be accomplished with a Windows based PC running compatible software package.
- 3. Hardware Features
 - a. Each communication control card shall be capable of providing all logic, control, runtime data, status information, and communications functions for up to 48 relays in a panel.
 - b. EEPROM power loss memory and clock holdup time: 30 days
 - c. Self-diagnostics: Automatic diagnostics on all memory, input/output card modules, relays, and dataline.
 - d. Clock: Digital with time, day of week, and date. Automatic leap year compensation. Programmable Daylight Savings Time and Standard Time adjustment.
- 4. Time Delay / Blink Warning
 - a. Used during unoccupied periods, assignable for each relay.
 - 1) Time delays from 2 to 1,440 minutes.
 - 2) Blink Warning: 1-second OFF blink followed by a 5 minute grace period before OFF.
 - 3) An optional second blink warning one minute before OFF.
 - b. Operates automatically for all scheduled OFFs and time delay overrides.
 - c. Occupant overrides may be entered before the blink warning to prevent a scheduled blink and shutdown.
- 5. Analog Photo-Sensor Configuration
 - a. Enable any group switch card input (eight per group switch card) to act as an analog input into the panel for use with photocells or other analog devices
 - b. Select the photocell from list of available types including:
 - 1) Outdoor, 0 - 200 foot candles
 - c. Establish trigger parameters for each analog input with:
 - 1) Separate on and off set points
 - 2) Separate on and off time delays
 - 3) Load to be controlled by the input
- 6. A total of 32 sets of trigger parameters may be established per panel
- 7. Analog Photo-Sensor Monitoring
 - a. Actual foot candle light levels per photocell and the current trigger state of the loads may be read using the Operators Software specified in section 2.21.
- 8. Telephone Override
- 9. Each relay shall respond to up to eight different telephone override codes. Maximum of 9999 telephone codes can be programmed.
- 10. Runtime Counters for Each Relay
 - a. Cumulative runtime (up to 31 years) and number of cycles (up to 17 million) since last reset. User re-settable.
 - b. Daily runtime for the current day and each of the prior 40 days.
 - c. Monthly runtime for current and 14 prior months.
- 11. Activity Logs
 - a. Store previous relay events including the time, new state, and cause for the change in state.
 - b. Annunciate over the dataline and RS232 port when the table is 25%, 50%, 75% and 100% full.

2.4 EIGHT CHANNEL DIGITAL PHOTOCONTROL MODULE

- A. Provide weatherproof Class 2 photo-sensor for measuring exterior light levels. The photo-sensor shall be mounted facing north as indicated on the plans. The photo-sensor shall be connected to a



photocontrol module mounted on the DIN rail inside the low voltage section of a lighting control panel and connected to the dataline communications wire.

2.5 DIGITAL DATALINE SWITCHES

- A. Intelligent digital switching shall be provided operating on the dual twisted pair communication wire. Switches shall be available in single, dual, quad, or octal (1-button, 2-button, 4-button, or 8-button) designs. The single, dual, and quad devices shall mount in a standard single-gang box, the octal version in a two-gang box.
 1. Each button shall be individually programmable. Programming of buttons shall not require the use of a computer or other programming device. It shall be possible to assign relays or channels to buttons using a simple button press interface. Each button can control any one of the following options:
 - a. Any individual relay in any single panel.
 - b. Any group of relays in any single panel.
 - c. Any group of relays in the system (via network clock, Automation Appliance, or WinControl software package).
 2. For applications that require pattern switching, buttons shall function as a scene control using an ON/OFF/Not Controlled pattern of relays instead of the normal All ON/OFF.
 3. Switches shall be constructed of non-breakable Lexan on all exposed parts and shall include a matching screw-less Lexan wall plate.
 4. Individual buttons shall have a removable clear cover to allow standard 9 mm (3/8 inch) labeling tape to be used to identify the controlled loads.
 5. Each switch shall use a bi-color LED pilot light for the individual buttons to indicate status of the controlled relay or group of relays. LED indications are Red for All ON, Green for Mixed State (some relays in the group ON and others OFF), and No LED for All OFF.
 6. Switch LED pilot lights shall flash green to indicate impending off sweep during the five-minute grace period following blink warning of the lights. Once the button is pressed, the LED will change to Red to acknowledge the occupant's override command to keep lights ON.
 7. Multiple dataline switches programmed to control the same relay or relay group shall indicate the same status automatically.
 8. Each switch shall also include a locator light illuminating the switch for easy location in the dark.
 9. The dual, quad, and octal switches shall all include a single master button that will override all relays controlled by the individual buttons OFF, or Restore them to their original state. Each switch's master button configuration can be altered to perform a Master ON/OFF, OFF Only, or Disabled function if desired.
 10. Switches can be configured to follow a "Cleaning" scenario. This specific scenario shall prevent the cleaners from overriding OFF any relays previously turned ON by an occupant.
 11. Each switch is available in a Key lock override version. Once a key is inserted, the individual buttons will function for five minutes.
 12. Basis of Design: WattStopper #DCC2 or #LMSW Series.

2.6 ANALOG, DUAL TECHNOLOGY, SINGLE RELAY, WALL BOX OCCUPANCY SENSOR

- A. Provide flush mounted, single relay, wall box type occupancy sensor with the following features:
 1. The Occupancy Sensor Switch shall be a designer-style, multiple-detection technology, universal voltage occupancy sensing wall switch.
 2. Sensor shall be designed to accept and control universal voltage (120VAC to 277VAC, 60Hz.) and rated to control up to 1000-watt lighting loads.
 3. Sensor shall be a two-wire switch capable of handling the following loads:
 - a. Quartz Halogen
 - b. General Inductive
 - c. Cold Cathode / Neon
 - d. Electronic Low-Voltage



- e. Magnetic Low-Voltage
- f. Fluorescent Non-Dimming Ballasts
- 4. Sensor shall have a viewing area of not less than one hundred seventy (170°) degrees at an axial distance of forty feet (40'), fifty feet (50') at 0 degrees, and shall have a total coverage area of not less than four-thousand square feet (4,000 Sq. Ft.) with an unobstructed view.
- 5. Device shall be supplied with color-coordinated, self-sticking masking labels that reduce the field of view to 60, 90, or 120 degrees.
- 6. Sensor shall utilize non-intrusive, passive detection technologies consisting of:
 - a. Passive Infrared (PIR) to read and detect occupants' body heat and movement, and;
 - b. Enhanced PIR with Digital Signal Processing (DSP) to read and detect occupancy throughout the entire space, and;
 - c. Photo detection to sense human motion and help differentiate this signal from other sources such as hot air vents.
- 7. Under no circumstances shall the unit emit energy of any type into the space that can potentially interfere with electrical, electronic, or medical devices (i.e. hearing aids), etc.
- 8. Each unit shall provide manual on/automatic off operation and accept on/off commands from an unlimited number of multi-location 3-way Remotes.
- 9. Remote stations shall provide multi-location On / Off control of the switch using conventional 3-way wiring.
- 10. Each unit shall be capable of 4 time-out methods to adapt to the space:
 - a. Manual fixed time (user definable) from 1 to 30 minutes.
 - b. Auto Time Out Calibration – Conservative Mode
 - c. Auto Time Out Calibration – Normal Mode
 - d. Auto Time Out Calibration – Aggressive Mode
 - e. In Auto Time Out Calibration Mode the unit shall automatically adapt the time out period to the occupancy patterns of the space to maximize energy savings while minimizing distraction to the user.
- 11. The unit shall, when manually turned off by the user, continue to monitor the space, but will not turn on the lights. User shall be able to, at anytime, override this feature by manually turning on the lights.
- 12. Each unit shall, at the user's discretion, be programmed (at the sensor) to automatically adapt its programming parameters to optimally set time delay according to the space's occupancy/vacancy patterns.
- 13. The unit's operational/parameter programming shall be accomplished with the unit installed and operational without the need to remove the unit (or its faceplate) from its installed location.
- 14. Each unit shall provide a LED indicator to provide indication when the sensor detects movement.
- 15. Device shall offer the selection of three user-programmable warning tones before automatically turning Off. The unit shall also offer the ability, to the user, to turn off warning tones.
- 16. Device shall mount in a single gang wallbox and be gangable with other designer-style electrical devices and faceplates.
- 17. Each unit shall include a designer-style screwless, detachable color-coordinated faceplate in White, Ivory, or Light Almond.
- 18. The Sensor shall be UL Listed to U.S. and Canadian standards for a 120VAC to 277VAC capacity.
- 19. Basis of Design: Lightolier #ITS2U.

2.7 ANALOG DUAL TECHNOLOGY, DUAL RELAY, WALL BOX OCCUPANCY SENSOR

- A. Provide flush mounted, dual relay, wall box type occupancy sensor with the following features:
 - 1. The occupancy sensor switch shall be a designer style, multiple detection technology, universal voltage, occupancy sensing wall switch.
 - 2. Sensor shall be capable of detecting presence in the control area by detecting Doppler shifts in transmitted ultrasound and passive infrared heat changes. Sensor shall utilize Dual Sensing Verification Principal for coordination between ultrasonic and PIR technologies. Each sensing

- technology shall have a LED indicator that remains active at all times in order to very detection within the area to be controlled.
3. Sensor shall feature a trigger mode where the end-user can choose which technology will activate the sensor. Selection of technologies for initial, maintain and re-trigger shall be done with DIP switches. Sensor shall have its trigger mode factory preset to allow for quick installation. In this default setting, both technologies must occur in order to initially activate lighting systems. Detection by either technology shall maintain lighting on, and detection by either technology shall turn lights back on after lights were turned off for 5 seconds or less in automatic mode and 30 seconds or less in manual mode.
 4. Sensor shall have 4 occupancy logic options for customized control to meet application needs.
 5. Ultrasonic sensing shall be volumetric in coverage with a frequency of 40 KHz. It shall utilize Advanced Signal Processing which automatically adjusts the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.
 6. The PIR technology shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens. The lens shall offer superior performance in the infrared wavelengths and filter short wavelength IR, such as those emitted by the sun and other visible light sources.
 7. Sensor shall utilize SmartSet™ technology to optimize automatic time delay to fit occupancy usage patterns. The use of SmartSet shall be selectable with a DIP switch.
 8. Sensor shall utilize Zero Crossing circuitry on both relays to reduce stress on relays and increase sensor life.
 9. Sensor shall utilize two relays capable of simultaneously controlling independent lighting loads or circuits. The secondary relay shall be isolated, allowing for two-circuit control.
 10. Sensor shall have no minimum load requirement and shall be capable of switching from 0 to 800 Watt solid-state LED; 0 to 800 Watt fluorescent or 1/6 hp at 120 VAC, 60 Hz; and 0 to 1200 Watt fluorescent at 277 VAC, 60 Hz.
 11. Sensor shall feature a walk-thru mode, where lights turn off 3 minutes after the area is initially occupied, if no motion is detected after the first 30 seconds, set by a DIP switch.
 12. Sensor shall cover up to 1,000 s.f. for walking motion with a field view of 180 degrees and shall have automatic-ON or manual-ON operation for both relays adjustable for each relay.
 13. The sensor shall act as a "service switch" to allow operation in the unlikely event of a failure and shall be able to control incandescent, magnetic low voltage, electronic low voltage, "LED" solid state, and fluorescent lighting loads
 14. Sensors shall have a built-in light level featuring simple, one-step daylighting setup that works from 8 to 180 footcandles.
 15. Wall switch sensor shall be a completely self contained control unit that replaces a standard toggle switch.
 16. To ensure quality and reliability, sensor shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%. Sensor shall have standard 5-year warranty and shall be UL and CUL listed.
 17. Basis of Design: WattStopper #DW-200.

NOTE TO SPECIFIER

Certain room configurations or functions may require "ultrasonic" sensing in lieu of the preferred "dual technology" detection. Edit paragraph 2.8 below accordingly.

2.8 CEILING MOUNTED OCCUPANCY SENSOR

- A. Provide low voltage, ceiling mounted, 360 degree, [dual technology] [ultrasonic] occupancy sensor with the following features.
 1. The sensor shall be capable of detecting presence in the control area by detecting doppler shifts in transmitted ultrasound [and passive infrared heat changes].



2. [Sensor shall utilize Dual Sensing Verification Principle for coordination between ultrasonic and PIR technologies. Detection verification of both technologies must occur in order to activate lighting systems. Upon verification, detection by either shall hold lighting on.]
3. Sensor shall have a retrigger feature in which detection [by either technology] shall retrigger the lighting system on within 5 seconds of being switched off.
4. Ultrasonic sensing shall be volumetric in coverage with a frequency of 40 KHz. It shall utilize Advanced Signal Processing that automatically adjusts the detection threshold dynamically to compensate for changing levels of activity and airflow throughout controlled space.
5. [The PIR technology shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens. The lens shall be Poly IR4 material to offer superior performance in the infrared wavelengths and filter short wavelength IR, such as those emitted by the sun and other visible light sources. The lens shall have grooves facing in to avoid dust and residue build up which affects IR reception.]
6. To avoid false ON activations and to provide immunity to RFI and EMI, Detection Signature Analysis shall be used to examine the frequency, duration, and amplitude of a signal, to respond only to those signals caused by human motion.
7. Sensors shall utilize SmartSet™ technology to optimize time delay and sensitivity settings to fit occupant usage patterns. The use of SmartSet shall be selectable with a DIP switch. Sensors shall have a time delay that is adjusted automatically (with the SmartSet setting) or shall have a fixed time delay of 5 to 30 minutes.
8. Sensors shall feature a walk-through mode, where lights turn off 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds.
9. Sensor shall have an LED indicator that remains active at all times in order to verify detection within the area to be controlled. The LED can be disabled for applications that require less sensor visibility.
10. Sensor shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%. Sensors shall have standard 5 year warranty and shall be UL and CUL listed.
11. Basis of Design: WattStopper [#DT-305] [#WT-2200].
12. Provide universal voltage, power pack for 24 VDC operating voltage to the occupancy sensors. Power pack shall enable manual on, hold on, hold off and load shed for bi-level switching applications. Basis of Design: WattStopper BZ-150.

2.9 LINE VOLTAGE, AUTOMATIC CONTROL SWITCH

- A. Provide flush wall mounted automatic control switch with the following features.
 1. The automatic control switch shall be a push button wall switch capable of on/off manual operation and shall also be capable of receiving automatic control signals through interrupting power to the circuit feeding the switch and load.
 2. All automatic control signals to the switch shall be sent over the circuit wires feeding power to the switch and load. No additional control wiring to the switch shall be required to provide automatic signaling.
 3. Control switch shall mount in a standard single gang or multi-gang wall box and shall fit behind a decorator style face plate. The control switch shall not protrude more than 1/8" from the wall and should blend in aesthetically.
 4. Control switch shall have no minimum load requirement and shall be capable of switching from 0 to 1300 Watt incandescent and fluorescent @ 120 VAC - 60Hz, and 0-3000 Watt fluorescent @ 277 VAC - 60Hz
 5. Control switch shall use an air gap relay for switching ballast, tungsten, general use and shall be compatible with all electronic ballasts and HID loads. Switch shall be capable of 3-way, 4-way, or multi-way switching.
 6. Self-adjusting zero cross switching technology shall be used to protect from the effects of high inrush current and to increase switch/relay operation life.

7. Control switch shall have user adjustable settings for occupancy sensor/control panel operating mode, enable/disable audible beep, and enable/disable command on feature. Settings shall be made using the switch push button and configuration LEDs and shall not require the removal of the switch faceplate.
8. Lighting control panel operation shall include the capability of automatically shutting switches off, turning switches on, and delaying switches off.
9. Delay off operation shall provide a one or two second warning blink followed by a five minute delay time period before shutting off the lights. During the delay off period, the locator LED shall blink and, if enabled, an audible warning beep shall sound each minute for the first four minutes and each five seconds during the last minute of the delay time period. The delayed shut off may be canceled by pressing the front push button.
10. The switch shall not require a neutral, simplifying installation and shall feature terminal style wiring, which makes installation easier.
11. Control switch shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%. Control switch shall be UL and CUL listed and shall have a five (5) year warranty.
12. Basis of Design: WattStopper #AS-100.

NOTE TO SPECIFIER

Utilize single zone, analog, light level controllers for applications requiring minimal daylight control. Include paragraph 2.10 below for daylight harvesting applications requiring single zone control.

2.10 ANALOG DAYLIGHTING CONTROLLER

- A. Provide low voltage, ceiling mounted, daylighting photo-controller to control the space lighting when sufficient daylighting is present. Controllers shall have the following features:
 1. The light level controller shall be capable of detecting changes in lighting levels and shall utilize an internal photocell that measures light in a 100 degree angle cutting the unwanted light from bright sources outside of this cone.
 2. The light level controller shall be capable of controlling any type of lighting through use of power packs. Light level controller shall operate from a 24 volts DC power supply with a current draw of 22 milliamps.
 3. The light level controller shall be capable of turning lighting on and off for a single zone with an extended range of 1 to 1400 fc. The controller shall have an adjustable deadband feature with 25%, 50%, 75% or 100% in relation to the setpoints and shall have an adjustable time delay range of 3, 10, 15 or 30 minutes.
 4. The controller shall provide a connection for an optional low voltage, normally open momentary contact wall switch override or occupancy sensor interface.
 5. The controllers shall be a microprocessor type with LED status indicator. Light level controller shall have full 5-year warranty.
 6. Basis of Design: WattStopper #LS-102

PART 3 - EXECUTION

3.1 EXAMINATION

- A. As specified in Section 260500 – Common Work Results for Electrical.

3.2 INSTALLATION



- A. The Lighting Control System shall be installed and wired completely as shown on the plans by the contractor, who shall make all necessary wiring connections to external devices and equipment.
- B. The low voltage lighting control cabling in this building will be installed above ceilings without conduit. All communications cabling used throughout this project shall comply with the requirements as outlined in the National Electric Code (NEC) article 725. All cabling shall bear CMP and/or appropriate markings for the environment in which they are installed.
 - 1. Sealing of openings between floors, through fire rated and smoke walls, existing or created by the contractor for cable pass through shall be the responsibility of the contractor. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of the contractor's work. Any openings created by or for this contractor and left unused shall also be sealed as part of this work.
 - 2. Cabling routed exterior of the building, underground, through inaccessible ceilings or less than 8'-0" A.F.F. in the workroom shall be contained in conduit. Provide flush boxes within finished areas and factory boxes in unfinished areas. Provide 3/4" conduit risers with 90 degree bend and bushing for all wall mounted devices
- C. Accurate "as-built" drawings shall be furnished by the contractor to aid the Owner in programming. These should indicate the load controlled by each relay and the identification number for that relay. They should also identify the physical location of each switch connected to an input and the identification number of that input. Three sets of space plans or lighting plans shall be furnished by the contractor indicating which luminaires are controlled by each relay.

3.3 FIELD QUALITY CONTROL

- A. As specified in Section 260500 - Common Work Results for Electrical.
- B. Perform operational testing on lighting control system to verify proper operation and field wiring connections.
- C. System Start Up and Commissioning
 - 1. Manufacturer shall provide a factory authorized technician to confirm proper installation and operation of all lighting control system components. The startup requirement is intended to verify that the digital switches and relay panels interact as a complete and operational system to meet the design intent.
 - 2. Lighting control devices and control systems shall be tested to ensure that control hardware and software are calibrated, adjusted, programmed, and in proper working condition in accordance with the construction documents and manufacturer's installation instructions.
 - a. Provide functional performance testing as required by Section 260800 – Commissioning of Electrical Systems
- D. System Training
 - 1. Manufacturer shall provide factory authorized technician to train owner personnel in the operation, programming and maintenance of the lighting control system including all occupancy sensors and daylighting controls.
- E. System Programming
 - 1. Manufacturer shall provide system programming including:
 - a. Wiring documentation.
 - b. Switch operation.
 - c. Operating schedules.



Last revised: 4/16/2014

END OF SECTION 26 06 23 00



SECTION 26 06 23 00 - R&A LIGHTING CONTROL DEVICES (MPF)**

NOTE TO SPECIFIER

Use this Specification Section for Repair and Alteration projects that have justified luminaire level lighting controls via the "LCCA" and have attained approval from the Contracting Officer's Representative. This Specification defines "level of quality" for luminaire level lighting controls. It is intended as a guide to the Architect/Engineer preparing the Construction Documents and shall not to be used as a construction specification.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THIS PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS FACILITIES, THROUGH THE CONTRACTING OFFICER'S REPRESENTATIVE.**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Lighting control system for Workroom.
2. Lighting control system for Box Lobby
3. Control of Interior/Exterior Lighting.
4. Control of Administrative Area Lighting.
5. [\[Daylighting controls.\]](#)
6. Occupancy [\[Photo\]](#) sensors.
7. Automatic receptacle control.

B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the work of this section. Additional requirements and information necessary to complete the work of this section may be found in other documents.

C. Related Sections:

1. Section 250504 - Building Automation System (BAS) General.
2. Section 255104 – EEMS Integration.
3. Section 259004 - Sequence of Operation.
4. Section 260500 - Common Work Results for Electrical.
5. Section 260533 - Raceway and Boxes for Electrical Systems.
6. Section 265100 - Interior Lighting
7. Section 265600 - Exterior Lighting
8. Section 270500 - Common Work Results for Communications.
9. Section 260800 - Commissioning of Electrical Systems.
10. Section 019113 - General Commissioning Requirements.

1.2 REFERENCES

A. National Electrical Manufacturers Association (NEMA):

1. NEMA ICS 1 - General Standards for Industrial Control and Systems.

B. National Fire Protection Association (NFPA):

1. NFPA 70 - National Electrical Code.
2. NFPA 101 - Life Safety Code

C. Codes and Standards:

1. International Building Code / National Electrical Code
2. Occupational Safety and Health Agency Standards
3. Illuminating Engineering Society Handbook
4. ASHRAE Standard 90.1 – 2010.
5. The International Energy Conservation Code.

1.3 SUBMITTALS

A. As specified in Section 260500 - Common Work Results for Electrical.

1. Product Data: Data for each component specified indicating electrical characteristics and connection requirements.
 - a. Lighting Control Panels and Components.
 - b. Low Voltage Relays.
 - c. Digital Control Switch.
 - d. Automatic Control Switch.
 - e. Photo-Sensor.
 - f. Occupancy Sensors.
 - g. [\[Daylighting Controls.\]](#)
 - h. Software.
2. Shop Drawings: Indicate electrical characteristics and connection requirements, including layout of completed assemblies, interconnecting cabling, dimensions, and power requirements.
3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products and components meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.

1. Project Record Documents: Accurately record the actual locations of Products.
2. Operating Instructions: Document training by furnishing a sign-in sheet with a description on the training provided, instructors name and organization and those who received training. Refer to 017704 1.3, 1.4 and 1.5 for more specific training.

1.4 SYSTEM DESCRIPTION

NOTE TO SPECIFIER

Modify sections below for a time clock based control system if, as determined by the Contracting Officer's Representative, a high-end lighting control system is not cost effective.

- A. It is the intent of this section of specifications to provide an integrated, energy saving, digital lighting control system including lighting controllers, digital low voltage relays, components, etc. from a single manufacturer.



- B. The workroom lighting system shall be designed to achieve the required light levels for the four lighting groups described below.
1. Task Light Group (TLG): The lights in this group provide 50 fc of Task lighting for 1) Equipment operator stations and/or 2) Areas within a zone that require a higher light level for visual acuity. The TLG lighting is provided by luminaires located in task-specific areas apart from the normal Ambient Light Group grid pattern.
 - a. The control of luminaires in the TLG shall be achieved by the use of a digital Lighting Control System programmed to control each zone separately. Each zone shall have one or more manual override buttons on the wall that will turn the lights on for one hour when pressed. There will be one manual override circuit for each zone, controlling both ambient and task lighting simultaneously for that zone.
 - b. Manual Override Button. Each manual override button shall be mounted at 48" AFF to allow the lighting for the zone to be energized for one hour during "off schedule" times. When this button is activated all TLG and ALG lights in the zone shall be energized for one hour. This manual button will be mounted near the primary equipment operator or adjacent to the zone on the wall and labeled for easy identification. Provide pilot lighted buttons.
 2. Ambient Light Group (ALG): This group will provide 25 fc for operational zones where work is performed that requires less visual acuity than that needed for Task lighting. This will be the primary lighting provided for workroom activities.
 - a. Individual Luminaires in each of the ALG zones shall be controlled by the same digital lighting control system utilizing the same manual override described in the Task Lighting Group (TLG) section. The ALG and TLG lighting groups within the same zone shall operate simultaneously.
 - b. Ambient lighting provided by ELG luminaires during normal power operation must be integrated into the ALG design. ELG luminaires will remain on when TLG and ALG zone lights are controlled off.
 3. Area of Travel Light Group (AOTLG): This lighting group requires a minimum average of 12.5 fc for areas of travel such as aisles and walkways when all other lights are turned off. The minimum average of 12.5 fc's shall be maintained at all times.
 4. Egress Lighting Group (ELG): Controlled "lights off" condition. This is a condition in which the lighting control system is turned off while the main processing equipment continues to run. Under these conditions, an average of 1 fc of light shall be provided throughout the workroom/platform floor until normal ambient lighting is restored. In order to maintain this level of lighting, the ELG luminaires shall not be controlled by the lighting control system.
- C. The functional characteristic of each luminaire within the workroom shall be as follows:
1. Lamp and ballast combinations within individual luminaires, groups of luminaires or at every other luminaire shall be controlled as zones to achieve the required lighting levels under different lighting conditions. Control solutions such as turning off every other luminaire or row of luminaires are acceptable.
 2. All luminaires shall be controlled by mechanically held, low voltage relays. In the event that the control panel fails, the relays shall remain in their current state and shall have the capability to be manually controlled at the control panel.
- D. The workroom lighting shall be divided into zones to allow for turning lights off in areas that are not actively running equipment. Each zone shall be wired to a pilot lighted low voltage switch on the wall adjacent to the zone, that overrides zone timers and controls. When the button is pushed, lighting should come on for a period of one hour.
- E. The lighting control panel(s) will "stand alone" and control the time schedules for all zones that are connected. The lighting control panels shall communicate, log and furnish information about the operational characteristics of the system. The lighting control panel shall be capable of logging "run time" data per relay. The "BAS" shall aggregate and process this data. Data to be logged and reported shall include percentage of time lights are on for each Lighting Group, time sequence, clock hours on lamps by group to determine relamping schedules for groups other than ELG, number of hours in

manual vs. scheduled time and others that may be needed to document the proper function of the control system. Time schedules will be password protected at multiple security levels. All of the data for an entire facility should be available on a per zone or per facility basis, by accessing the system. The control panel(s) shall communicate this data to the Building Automation System (BAS) using BACNet protocol.

1. There will be available to the occupants of the space, one or more manual buttons that will allow the occupants to override the control sequence for one hour for maintenance, special schedules, cleaning, etc. The manual override system will only be for the zone that the buttons are located in, not for multiple zones. When the time has elapsed, the fixtures luminaires will return to their normal programmed state.
 2. Some of the lights within each zone shall blink, or give other visual warning approximately 5 minutes before they are about to time out. When the lights are not in the override condition, there shall be a green light on the control panel which is illuminated in order to show that the lights are not in the manual override state, as a maintenance aid for troubleshooting.
 3. Lighting Control Panel(s) and their functions must be accessible, and interactive with, the Building Automation System allowing changes to be made by the BAS without the need for a manufacturer's computer based front end. Note that initially, the "BAS" and "EEMS" systems may not be functional within the facility. The lighting control software shall therefore be utilized until these Building Automation Systems have been installed, interfaced and commissioned.
 4. The controller/computer shall configure/ reconfigure zones, set up schedules, and control groups of luminaires/lamps via low voltage digital relays to reside on the Building Automation System.
- F. The control of the exterior lighting shall be integrated within the digital lighting control system. Exterior lighting shall be energized by photo-sensor(s) and de-energized by time control functions.
1. The control of the exterior and building mounted signs shall operate similar to the exterior lighting control scheme, but shall utilize independent time schedules.
- G. The control of the lighting within the Administrative Areas shall be accomplished utilizing occupancy sensors or automatic control switches and branch circuits fed through the lighting control panels.

NOTE TO SPECIFIER

Provide a lighting photometric plan based on the requirement of MPFDC section 5-3.1.

- H. Box Lobby Control System Performance Requirements:
1. 24 hour Box Lobby lighting shall be controlled through the low voltage relay system with an occupancy sensor override.
 2. All other Box Lobby's shall be provided with manual on/off controls interfaced with the low voltage relay system.
- I. Automatic receptacle control for those designated receptacles located within all offices, open offices and computer classrooms, shall be integrated within the lighting control system. These receptacles shall be controlled through low voltage relays and the time control functions of the lighting control panel(s).

NOTE TO SPECIFIER

Include paragraph 1.4 J. below for applications requiring automatic Daylighting Control.

- J. Daylighting automatic controls shall be provided for the rooms and spaces indicated on the drawings and provided as specified herein.

1.5 QUALITY ASSURANCE



- A. Single Source: Provide digital controllers, control relays, photocells, selector switches, time clocks, manual or digital override timer switches, control wiring, and accessories from integrated system supplier.
 - B. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 - 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.
 - C. Regulatory Requirements:
 - 1. Conform to requirements of NFPA 70 and NFPA 101.
 - 2. Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.
 - 3. Comply with NEC, NEMA and FCC Emission requirements for Class A applications.
 - 4. UL Approvals: Relay panels and accessory devices are to be UL listed under UL 916 Energy Management Equipment. Configured to order or custom relay panels shall be UL Listed under UL 508, Industrial Control Panels.
 - D. Testing:
 - 1. Component Pretesting: All component and assemblies are to be pretested and burned-in prior to installation.
 - 2. System Checkout: A factory trained technician shall test each component in the system after installation to verify proper operation and confirm that the panel wiring and addressing conform to the wiring documentation. Submit check-out memo from factory representative.
 - 3. Functional testing of the lighting control system shall be provided by an independent commissioning authority in accordance with ASHRAE 90.1 - 2010. Refer to Section 260800 - Commissioning of Electrical Systems.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Section 016000 - Product Requirements: Transport, Handle, Store, and protect products.
 - B. Store products in clean, dry area; maintain temperature to NEMA ICS 1 requirements.
- 1.7 WARRANTY AND TECHNICAL SUPPORT
- A. Digital Control System manufacturer shall provide five (5) years of technical support to the end users. Services shall include the reconfiguration of zones, schedule changes, additional training, etc., as needed, free of charge. This support may be provided in person, by phone, or through web-based communication tools.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering products which may be incorporated in the work include the following:
 - 1. Cooper Controls, Peachtree City, GA (800) 553-3879.
 - 2. Encelium Technologies, inc., Philadelphia, PA (267) 286-0336.
 - 3. General Electric Company, Plainville, CT (800) 626-2000.
 - 4. Hubbell Building Automation, Inc, Austin, TX (888) 698-3242.
 - 5. Leviton, Little Neck, NY (800) 824-3005.
 - 6. Lighting Control & Design, Glendale, CA (800) 345-4448
 - 7. Lightolier, Fall River, MA (508) 679-8131.
 - 8. Lutron Electronics, Co. Coopersburg, PA (800) 523-9466.
 - 9. Novitas, Culver City, CA (310) 568-9600.
 - 10. Tork, Mount Vernon, NY (914) 664-3542.
 - 11. Watt Stopper, Santa Clara, CA (800) 879-8585.
- B. Section 016000 - Product Requirements: Product options and substitutions. Unless otherwise indicated, substitutions are permitted.
- C. INTERIOR WORKROOM LIGHTING CONTROLS (No Substitutions)
 - 1. Cooper Controls
 - 2. Encelium
 - 3. General Electric
 - 4. Leviton
 - 5. Lighting Control & Design
 - 6. Lutron
 - 7. WattStopper

2.2 LIGHTING CONTROL PANELS

- A. Provide lighting control panels in the locations and capacities as indicated on the drawings. Each panel shall be of modular construction and consist of the following components:
 - 1. Enclosure/Tub shall be NEMA 1 as indicated on the plans, sized to accept an interior with 1-8 relays, 1-24 relays and six (6) four pole contactors, or 1-48 relays with six (6) four pole contactors.
 - 2. Cover shall be configured for [surface] [flush] wall mounting of the panel. The panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.
 - 3. Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. The interior construction shall provide total isolation of high voltage (class 1) wiring from low voltage (class 2) wiring within the assembled panel. The interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. The panel interiors shall include the following features:
 - a. Provision for one or two optional control and automation cards.
 - b. Removable, plug-in terminal blocks with screw-less connections for all low voltage terminations.
 - c. Individual terminal block, override push button, and LED status light for each relay
 - d. Switch inputs associated with each relay and group channel shall support two or three wire, momentary or maintained contact switches.
 - e. Isolated contacts within each relay shall provide true relay state to the electronics. True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems.
 - f. Automatic sequenced operation of relays reduces impact on the electrical distribution system when large loads are controlled simultaneously.
 - g. Group, channel, and pattern control of relays shall be provided through a simple button-press interface within the panel. Any group of relays can be associated with a channel for direct on/off control or pattern (scene) control via a simple programming sequence using the relay and channel override push buttons and LED displays.



- h. Relay group status for each channel shall be provided through bi-color operation of the LED indicators. Solid red indicates that all relays in the group are on, solid green indicates that the group is in a mixed state, and blinking green indicates that the relays have blink warned and are currently timing out.
- i. Each relay and channel terminal block shall provide a 24V pilot light signal. It shall be possible to configure the system for support for any Class 2 pilot light voltage with the use of an auxiliary power supply.
- j. Single pole, mechanically held relays with modular plug-in design. Relays shall provide the following ratings and features:
- k. Electrical:
 - 1) 20 amp ballast at 277V
 - 2) 20 amp tungsten at 120V
 - 3) 1.5 HP motor at 120V
 - 4) 14,000 amp short circuit current at 277V
- l. Mechanical:
 - 1) Individually replaceable, ½" KO mounting with removable Class 2 wire harness
 - 2) Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel
 - 3) Dual line and load terminals each support two #14 – #12 solid or stranded conductors
 - 4) Tested to 300,000 mechanical on/off cycles
 - 5) Isolated low voltage contacts provide for true relay status feedback and pilot light indication.
- m. Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.
- 4. The Dataline wire will be supplied by the equipment manufacturer and will include the manufacturer's name, catalog number printed on the wire jacket. The contractor, at its own expense, will replace an improper dataline wire.
- 5. Panels shall be digitally addressed and support bi-directional communication between each other and other intelligent field devices specified elsewhere.
- 6. Basis of Design: WattStopper LILM Series.

2.3 ADVANCED COMMUNICATIONS, INTEGRATION AND PC CONNECTIVITY

- A. Provide an advanced communications network that supports optional features like PC connectivity, TCP/IP connections, advanced programming system documentation, enhanced diagnostics, historical and runtime accumulation, and graphic programming and control.
 - 1. The system shall support the following advanced operating scenarios:
 - a. Adjustable override periods for after hour use based upon the day of the week.
 - b. Preemptive override before OFF to prevent blink warning and to start a new override time delay.
 - c. Allow common areas to remain ON when specific relays in a panel are ON. Egress timer starts a countdown when the last watched relay turns OFF.
 - d. Master Switch Control with blink option to provide a blink warning and five minute countdown for occupants when a master switch is turned OFF
 - 2. Communications
 - a. Each panel shall support RS232 twisted pair and optional RS-485 connections. Either protocol may be used for programming, monitoring, and control. The dataline shall allow simultaneous operation of multiple communications access points to support multiple operator terminals and communications with other building automation systems.
 - b. Each panel shall be capable of stand-alone automatic operation and the network shall achieve full distributed processing.

- c. All programming shall be accomplished with a Windows based PC running compatible software package.
- 3. Hardware Features
 - a. Each communication control card shall be capable of providing all logic, control, runtime data, status information, and communications functions for up to 48 relays in a panel.
 - b. EEPROM power loss memory and clock holdup time: 30 days
 - c. Self-diagnostics: Automatic diagnostics on all memory, input/output card modules, relays, and dataline.
 - d. Clock: Digital with time, day of week, and date. Automatic leap year compensation. Programmable Daylight Savings Time and Standard Time adjustment.
- 4. WinControl Software
 - a. Schedules
 - 1) Each communication control card shall support up to 24 unique weekly schedules out of a total of 1,000 available per system. Each schedule shall allow up to eight events per day for a repeating seven day week.
 - 2) Up to 32 holidays may be defined for any specific date. On that date any of the three holiday schedules may be assigned.
 - 3) Relays may be programmed to switch to a different weekly schedule on any specific date, and then revert back to normal at another time. This allows for future schedule changes to be programmed ahead of time.
 - 4) "Spring Ahead" and "Fall Back" dates for daylight savings time changes may be entered full two years ahead. Software also supports the ability to "Auto fill" in the next two occurrences of each of these dates.
- 5. Time Delay / Blink Warning
 - a. Used during unoccupied periods, assignable for each relay.
 - 1) Time delays from 2 to 1,440 minutes.
 - 2) Blink Warning: 1-second OFF blink followed by a 5 minute grace period before OFF.
 - 3) An optional second blink warning one minute before OFF.
 - b. Operates automatically for all scheduled OFFs and time delay overrides.
 - c. Occupant overrides may be entered before the blink warning to prevent a scheduled blink and shutdown.
- 6. Analog Photo-Sensor Configuration
 - a. Enable any group switch card input (eight per group switch card) to act as an analog input into the panel for use with photocells or other analog devices
 - b. Select the photocell from list of available types including:
 - 1) Outdoor, 0 - 200 foot candles
 - c. Establish trigger parameters for each analog input with:
 - 1) Separate on and off set points
 - 2) Separate on and off time delays
 - 3) Load to be controlled by the input
- 7. A total of 32 sets of trigger parameters may be established per panel
- 8. Analog Photo-Sensor Monitoring
 - a. Actual foot candle light levels per photocell and the current trigger state of the loads may be read using the Operators Software specified in section 2.21.
- 9. Telephone Override
- 10. Each relay shall respond to up to eight different telephone override codes. Maximum of 9999 telephone codes can be programmed.
- 11. Runtime Counters for Each Relay
 - a. Cumulative runtime (up to 31 years) and number of cycles (up to 17 million) since last reset. User re-settable.
 - b. Daily runtime for the current day and each of the prior 40 days.
 - c. Monthly runtime for current and 14 prior months.
- 12. Activity Logs
 - a. Store previous relay events including the time, new state, and cause for the change in state.



- b. Annunciate over the dataline and RS232 port when the table is 25%, 50%, 75% and 100% full.
- B. Provide the following operator software features.
 1. User programming and editing may be conducted both online or offline in a Windows based software application.
 2. Data shall be entered through a simple menu-driven user interface.
 3. The software shall simplify integration with other software products by allowing the lighting control manufacturer's components to be embedded into other Windows applications. These features shall include the following:
 - a. BACnet connectivity with optional WebLink.
 - b. Drag and Drop interface programming supported throughout the program.
 4. Basic operating software provides the following:
 - a. Site wiring documentation for all connected relay panels and system components.
 - b. English descriptions of each relay's circuit designation, circuit description, switch and calculated load.
 - c. RS232 and TCP/IP Connection to Lighting Control Panel
 - d. Monitor/Control all relays. Software shall show actual relay states, with an optional menu showing how and when the relay state occurred, and when next scheduled to change.
 - e. Simulate all functions.
 5. System Parameters
 - a. System software to be sized based appropriately for the system – 250, 500, 750 or unlimited relays. Any number of sites may be programmed from a single software package (based on hard drive space).
 - b. Passwords Matrix Features allowed per site.
 - c. User defines functions accessible for each password (Document, Program, Initialize, Transfer from PC, Transfer to PC, Control, Simulate/Test).
 - d. Configure software to automatically contact remote sites using a modem or I/P address.
 6. Other Features
 - a. Online help brings up a context sensitive help screen.
 - b. One step menu option to back up all site information to a backup drive.
 - c. The software shall include Trends and Relay Runtime Analysis that will allow the operator to analyze the operation of specific areas and identify those exceeding normal runtimes. Individual relays may be assigned a kWh weighted value or simply analyzed on a runtime basis. In both cases, the relays may be assigned to logical groups and plotted for the last 30 days or 12 months.
 7. System Design Capability
 - a. From the lighting control system software database, the software shall be able to automatically create a system single line drawing, panel schedules and specifications that can be exported in DXF format for use in standard CAD drawings.
- C. The Desktop "BAS" Computer work station (provided under Specification Section 250504) will provide monitoring, programming and control of the system.
- D. Ethernet Multi-User Connectivity – Weblink
 1. System Description
 - a. A network appliance will provide multi-user, simultaneous access to the lighting system using standard TCP/IP and the WinControl software specified in paragraph B above.
 - b. All IT infrastructure that is required for connectivity shall be specified elsewhere and is not considered part of the lighting control system requirements.
 - c. The network appliance will include the following hardware:
 - 1) Ethernet, Serial and Parallel port
 - 2) Optional 56K BAUD internal modem
 - 3) Video graphics card
 2. Features

- a. Multiple users (each with a licensed copy of WinControl) will be able to simultaneously connect to the IP address of the WebLink.
 - b. Users may be connected via an Intranet, or Internet depending upon network security limitations.
 - c. Provide the capability to monitor the status of each relay and to override each relay using only a web browser
 - d. A single user may connect using WinControl, via the internal modem of the WebLink.
 - e. The WebLink will provide all the features of a direct connected site to the simultaneous users.
 3. Events Scheduler Module (Schools, Retail and Event Centers)
 - a. 365 day event scheduling will allow "Events" to be defined as a series of commands to allow a preprogrammed timed sequence to occur by selecting the start time and stop time of the event. Events may be programmed as a repeating schedule with specific start and ending times or as one time scheduled events.
 - b. 365 day programming will simplify single day activities for schools, retail applications, or event centers. The schedules may be programmed up to two years in advance.
 4. BACnet Integration with Building Automation System
 - a. Provide a BACnet IP connection as required for connectivity to the BAS
 - b. Each lighting control panel shall be exposed to the BAS as a BACnet Device with an individual BACnet Device ID.
 - c. The lighting control relays within each panel shall be exposed as BACnet Binary Output objects with read/write capability for control and status monitoring.
 - d. System group codes shall likewise be exposed as Binary Output objects and shall provide capability for a single command from the BAS to control multiple relays in multiple panels simultaneously via the lighting control network.
 - e. To facilitate a seamless integration with the BAS, the BACnet object Description Property fields shall be automatically populated with the relay, group code, and panel text descriptions from the lighting control system database as created by the WinControl software.
- E. Realtime Color Graphics Software
1. System Description
 - a. Color graphics software, WinControl Graphics, shall allow a user to monitor and control the low voltage relays through a graphical color interface. The system will allow the user to create drawings through a graphics generator provided with the system. The system will control the relays in a real-time environment; i.e. all system changes will be communicated immediately through the color graphic screens.
 - b. The application will provide a visual representation of the floor plan, drawn to scale, with each fixture displayed on screen. Fixtures can automatically indicate the relay controlling them on screen. The software will include "fly overs" which will display fixture information when the mouse pointer is over a defined object on the screen.
 - c. The software will fully integrate with the base software; all system databases including wiring documentation and system runtime information will be available to the graphic software.
 - d. The software shall be based upon Microsoft's Component Object Model (COM) and shall support Active-X technology for integration.
 - e. The software shall include **(specify quantity if required)** ____ color graphic screens created by a factory authorized representative. These screens will be provided based on the Owner's requested illustrations.
 2. Graphic Screen Features
 - a. The graphic software will allow full programming of the system from the animated graphic floor plans.
 - b. The operator will be able to zoom in and pan the floor plan for more detail.
 - c. The system shall be provided with a matrix password table to allow any user access to individual, selectable features.



- d. Manual control of the relays, or simulation of system wide functions, shall be possible by a single click of the mouse.
 - e. Programmable "action spots" will allow an operator to pre-define commonly used manual control functions, or allow the operator to jump to other color graphic screens.
 - f. System animation will support multi-ballast control of a fixture representing multi-level lighting, as well as animation for monitoring of fans or other "animated devices." Animation will also include a "Failure" definition to occur in event of relay failure.
 - g. Relay definitions and circuit numbers from the base software will be displayed on screen when requested by the user. Relay circuit numbers will be automatically displayed inside the fixture to provide useful information to the operator.
3. Graphic Screen Generation
- a. Contractor shall provide CAD floor plans to the manufacturer for generation of graphic screens.
 - b. As-Built relay panel and reflected ceiling documentation must be provided to the manufacturer before graphic screen development can begin.

2.4 EIGHT CHANNEL DIGITAL PHOTOCONTROL MODULE

- A. Provide weatherproof Class 2 photo-sensor for measuring exterior light levels. The photocell shall be mounted facing north as indicated on the plans. The photo-sensor shall be connected to a photocontrol module mounted on the DIN rail inside the low voltage section of a lighting control panel and connected to the dataline communications wire.

2.5 DIGITAL DATALINE SWITCHES

- A. Intelligent digital switching shall be provided operating on the dual twisted pair communication wire. Switches shall be available in single, dual, quad, or octal (1-button, 2-button, 4-button, or 8-button) designs. The single, dual, and quad devices shall mount in a standard single-gang box, the octal version in a two-gang box.
 - 1. Each button shall be individually programmable. Programming of buttons shall not require the use of a computer or other programming device. It shall be possible to assign relays or channels to buttons using a simple button press interface. Each button can control any one of the following options:
 - a. Any individual relay in any single panel.
 - b. Any group of relays in any single panel.
 - c. Any group of relays in the system (via network clock, Automation Appliance, or WinControl software package).
 - 2. For applications that require pattern switching, buttons shall function as a scene control using an ON/OFF/Not Controlled pattern of relays instead of the normal All ON/OFF.
 - 3. Switches shall be constructed of non-breakable Lexan on all exposed parts and shall include a matching screw-less Lexan wall plate.
 - 4. Individual buttons shall have a removable clear cover to allow standard 9 mm (3/8 inch) labeling tape to be used to identify the controlled loads.
 - 5. Each switch shall use a bi-color LED pilot light for the individual buttons to indicate status of the controlled relay or group of relays. LED indications are Red for All ON, Green for Mixed State (some relays in the group ON and others OFF), and No LED for All OFF.
 - 6. Switch LED pilot lights shall flash green to indicate impending off sweep during the five-minute grace period following blink warning of the lights. Once the button is pressed, the LED will change to Red to acknowledge the occupant's override command to keep lights ON.
 - 7. Multiple dataline switches programmed to control the same relay or relay group shall indicate the same status automatically.
 - 8. Each switch shall also include a locator light illuminating the switch for easy location in the dark.
 - 9. The dual, quad, and octal switches shall all include a single master button that will override all relays controlled by the individual buttons OFF, or Restore them to their original state. Each

switch's master button configuration can be altered to perform a Master ON/OFF, OFF Only, or Disabled function if desired.

10. Switches can be configured to follow a "Cleaning" scenario. This specific scenario shall prevent the cleaners from overriding OFF any relays previously turned ON by an occupant.
11. Each switch is available in a Key lock override version. Once a key is inserted, the individual buttons will function for five minutes.
12. Basis of Design: WattStopper #DCC2 or #LMSW Series.

2.6 ANALOG, DUAL TECHNOLOGY, SINGLE RELAY, WALL BOX OCCUPANCY SENSOR

- A. Provide flush mounted, single relay, wall box type occupancy sensor with the following features:
 1. The Occupancy Sensor Switch shall be a designer-style, multiple-detection technology, universal voltage occupancy sensing wall switch.
 2. Sensor shall be designed to accept and control universal voltage (120VAC to 277VAC, 60Hz.) and rated to control up to 1000-watt lighting loads.
 3. Sensor shall be a two-wire switch capable of handling the following loads:
 - a. Incandescent / Quartz Halogen
 - b. General Inductive
 - c. Cold Cathode / Neon
 - d. Electronic Low-Voltage
 - e. Magnetic Low-Voltage
 - f. Fluorescent Non-Dimming Ballasts
 4. Sensor shall have a viewing area of not less than one hundred seventy (170°) degrees at an axial distance of forty feet (40'), fifty feet (50') at 0 degrees, and shall have a total coverage area of not less than four-thousand square feet (4,000 Sq. Ft.) with an unobstructed view.
 5. Device shall be supplied with color-coordinated, self-sticking masking labels that reduce the field of view to 60, 90, or 120 degrees.
 6. Sensor shall utilize non-intrusive, passive detection technologies consisting of:
 - a. Passive Infrared (PIR) to read and detect occupants' body heat and movement, and;
 - b. Enhanced PIR with Digital Signal Processing (DSP) to read and detect occupancy throughout the entire space, and;
 - c. Photo detection to sense human motion and help differentiate this signal from other sources such as hot air vents.
 7. Under no circumstances shall the unit emit energy of any type into the space that can potentially interfere with electrical, electronic, or medical devices (i.e. hearing aids), etc.
 8. Each unit shall provide manual on/automatic off operation and accept on/off commands from an unlimited number of multi-location 3-way Remotes.
 9. Remote stations shall provide multi-location On / Off control of the switch using conventional 3-way wiring.
 10. Each unit shall be capable of 4 time-out methods to adapt to the space:
 - a. Manual fixed time (user definable) from 1 to 30 minutes.
 - b. Auto Time Out Calibration – Conservative Mode
 - c. Auto Time Out Calibration – Normal Mode
 - d. Auto Time Out Calibration – Aggressive Mode
 - e. In Auto Time Out Calibration Mode the unit shall automatically adapt the time out period to the occupancy patterns of the space to maximize energy savings while minimizing distraction to the user.
 11. The unit shall, when manually turned off by the user, continue to monitor the space, but will not turn on the lights. User shall be able to, at anytime, override this feature by manually turning on the lights.
 12. Each unit shall, at the user's discretion, be programmed (at the sensor) to automatically adapt its programming parameters to optimally set time delay according to the space's occupancy/vacancy patterns.
 13. The unit's operational/parameter programming shall be accomplished with the unit installed and operational without the need to remove the unit (or its faceplate) from its installed location.



14. Each unit shall provide a LED indicator to provide indication when the sensor detects movement.
15. Device shall offer the selection of three user-programmable warning tones before automatically turning Off. The unit shall also offer the ability, to the user, to turn off warning tones.
16. Device shall mount in a single gang wallbox and be gangable with other designer-style electrical devices and faceplates.
17. Each unit shall include, a designer-style screwless, detachable color-coordinated faceplate in White, Ivory, or Light Almond.
18. The Sensor shall be UL Listed to U.S. and Canadian standards for a 120VAC to 277VAC capacity.
19. Basis of Design: Lightolier #ITS2U.

2.7 ANALOG DUAL TECHNOLOGY, DUAL RELAY, WALL BOX OCCUPANCY SENSOR

A. Provide flush mounted, dual relay, wall box type occupancy sensor with the following features:

1. The occupancy sensor switch shall be a designer style, multiple detection technology, universal voltage, occupancy sensing wall switch.
2. Sensor shall be capable of detecting presence in the control area by detecting Doppler shifts in transmitted ultrasound and passive infrared heat changes. Sensor shall utilize Dual Sensing Verification Principal for coordination between ultrasonic and PIR technologies. Each sensing technology shall have a LED indicator that remains active at all times in order to very detection within the area to be controlled.
3. Sensor shall feature a trigger mode where the end-user can choose which technology will activate the sensor. Selection of technologies for initial, maintain and re-trigger shall be done with DIP switches. Sensor shall have its trigger mode factory preset to allow for quick installation. In this default setting, both technologies must occur in order to initially activate lighting systems. Detection by either technology shall maintain lighting on, and detection by either technology shall turn lights back on after lights were turned off for 5 seconds or less in automatic mode and 30 seconds or less in manual mode.
4. Sensor shall have 4 occupancy logic options for customized control to meet application needs.
5. Ultrasonic sensing shall be volumetric in coverage with a frequency of 40 KHz. It shall utilize Advanced Signal Processing which automatically adjusts the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.
6. The PIR technology shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens. The lens shall offer superior performance in the infrared wavelengths and filter short wavelength IR, such as those emitted by the sun and other visible light sources.
7. Sensor shall utilize SmartSet™ technology to optimize automatic time delay to fit occupancy usage patterns. The use of SmartSet shall be selectable with a DIP switch.
8. Sensor shall utilize Zero Crossing circuitry on both relays to reduce stress on relays and increase sensor life.
9. Sensor shall utilize two relays capable of simultaneously controlling independent lighting loads or circuits. The secondary relay shall be isolated, allowing for two-circuit control.
10. Sensor shall have no minimum load requirement and shall be capable of switching from 0 to 800 Watt solid-state LED; 0 to 800 Watt fluorescent or 1/6 hp at 120 VAC, 60 Hz; and 0 to 1200 Watt fluorescent at 277 VAC, 60 Hz.
11. Sensor shall feature a walk-thru mode, where lights turn off 3 minutes after the area is initially occupied, if no motion is detected after the first 30 seconds, set by a DIP switch.
12. Sensor shall cover up to 1,000 s.f. for walking motion with a field view of 180 degrees and shall have automatic-ON or manual-ON operation for both relays adjustable for each relay.
13. The sensor shall act as a "service switch" to allow operation in the unlikely event of a failure and shall be able to control incandescent, magnetic low voltage, electronic low voltage, "LED" solid state, and fluorescent lighting loads
14. Sensors shall have a built-in light level featuring simple, one-step daylighting setup that works from 8 to 180 footcandles.
15. Wall switch sensor shall be a completely self contained control unit that replaces a standard toggle switch.

16. To ensure quality and reliability, sensor shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%. Sensor shall have standard 5-year warranty and shall be UL and CUL listed.
17. Basis of Design: WattStopper #DW-200.

NOTE TO SPECIFIER

Certain room configurations or functions may require "ultrasonic sensing" in lieu of the preferred "dual technology detection". Edit paragraph 2.8 below, accordingly.

2.8 CEILING MOUNTED OCCUPANCY SENSOR

- A. Provide low voltage ceiling mounted, 360 degree, [dual technology][ultrasonic] occupancy sensor with the following features.
 1. The sensor shall be capable of detecting presence in the control area by detecting doppler shifts in transmitted ultrasound [and passive infrared heat] changes.
 2. Sensor shall utilize Dual Sensing Verification Principle for coordination between ultrasonic and PIR technologies. Detection verification of both technologies must occur in order to activate lighting systems. Upon verification, detection by either shall hold lighting on.
 3. Sensor shall have a retrigger feature in which detection [by either technology] shall retrigger the lighting system on within 5 seconds of being switched off.
 4. Ultrasonic sensing shall be volumetric in coverage with a frequency of 40 KHz. It shall utilize Advanced Signal Processing that automatically adjusts the detection threshold dynamically to compensate for changing levels of activity and airflow throughout controlled space.
 5. [The PIR technology shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens. The lens shall be Poly IR4 material to offer superior performance in the infrared wavelengths and filter short wavelength IR, such as those emitted by the sun and other visible light sources. The lens shall have grooves facing in to avoid dust and residue build up which affects IR reception.]
 6. To avoid false ON activations and to provide immunity to RFI and EMI, Detection Signature Analysis shall be used to examine the frequency, duration, and amplitude of a signal, to respond only to those signals caused by human motion.
 7. Sensors shall utilize SmartSet™ technology to optimize time delay and sensitivity settings to fit occupant usage patterns. The use of SmartSet shall be selectable with a DIP switch. Sensors shall have a time delay that is adjusted automatically (with the SmartSet setting) or shall have a fixed time delay of 5 to 30 minutes.
 8. Sensors shall feature a walk-through mode, where lights turn off 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds.
 9. Each sensing technology shall have an LED indicator that remains active at all times in order to verify detection within the area to be controlled. The LED can be disabled for applications that require less sensor visibility.
 10. Sensor shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%. Sensors shall have standard 5 year warranty and shall be UL and CUL listed.
 11. Basis of Design: WattStopper [#DT-305][#WT-2200].
 12. Provide universal voltage, power pack for 24 VDC operating voltage to the occupancy sensors. Power pack shall enable manual on, hold on, hold off and load shed for bi-level switching applications. Basis of Design: WattStopper BZ-150.

2.9 LINE VOLTAGE, AUTOMATIC CONTROL SWITCH



- A. Provide flush wall mounted automatic control switch with the following features.
1. The automatic control switch shall be a push button wall switch capable of on/off manual operation and shall also be capable of receiving automatic control signals through interrupting power to the circuit feeding the switch and load.
 2. All automatic control signals to the switch shall be sent over the circuit wires feeding power to the switch and load. No additional control wiring to the switch shall be required to provide automatic signaling.
 3. Control switch shall mount in a standard single gang or multi-gang wall box and shall fit behind a decorator style face plate. The control switch shall not protrude more than 1/8" from the wall and should blend in aesthetically.
 4. Control switch shall have no minimum load requirement and shall be capable of switching from 0 to 1300 Watt incandescent and fluorescent @ 120 VAC - 60Hz, and 0-3000 Watt fluorescent @ 277 VAC - 60Hz
 5. Control switch shall use an air gap relay for switching ballast, tungsten, general use and shall be compatible with all electronic ballasts and HID loads. Switch shall be capable of 3-way, 4-way, or multi-way switching.
 6. Self-adjusting zero cross switching technology shall be used to protect from the effects of high inrush current and to increase switch/relay operation life.
 7. Control switch shall have user adjustable settings for occupancy sensor/control panel operating mode, enable/disable audible beep, and enable/disable command on feature. Settings shall be made using the switch push button and configuration LEDs and shall not require the removal of the switch faceplate.
 8. Lighting control panel operation shall include the capability of automatically shutting switches off, turning switches on, and delaying switches off.
 9. Delay off operation shall provide a one or two second warning blink followed by a five minute delay time period before shutting off the lights. During the delay off period, the locator LED shall blink and, if enabled, an audible warning beep shall sound each minute for the first four minutes and each five seconds during the last minute of the delay time period. The delayed shut off may be canceled by pressing the front push button.
 10. The switch shall not require a neutral, simplifying installation and shall feature terminal style wiring, which makes installation easier.
 11. Control switch shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%. Control switch shall be UL and CUL listed and shall have a five (5) year warranty.
 12. Basis of Design: WattStopper #AS-100.

NOTE TO SPECIFIER

Utilize single zone, analog, light level controllers for applications requiring minimal daylight control. Include paragraph 2.10 below for daylight harvesting applications requiring single zone control.

2.10 ANALOG DAYLIGHTING CONTROLLER

- A. Provide low voltage, ceiling mounted, daylighting photo-controller to control the space lighting when sufficient daylighting is present. Controllers shall have the following features:
1. The light level controller shall be capable of detecting changes in lighting levels and shall utilize an internal photocell that measures light in a 100 degree angle cutting the unwanted light from bright sources outside of this cone.
 2. The light level controller shall be capable of controlling any type of lighting through use of power packs. Light level controller shall operate from a 24 volts DC power supply with a current draw of 22 milliamps.
 3. The light level controller shall be capable of turning lighting on and off for a single zone with an extended range of 1 to 1400 fc. The controller shall have an adjustable deadband feature with

- 25%, 50%, 75% or 100% in relation to the setpoints and shall have an adjustable time delay range of 3, 10, 15 or 30 minutes.
4. The controller shall provide a connection for an optional low voltage, normally open momentary contact wall switch override or occupancy sensor interface.
 5. The controllers shall be a microprocessor type with LED status indicator. Light level controller shall have full 5-year warranty.
 6. Basis of Design: WattStopper #LS-102

NOTE TO SPECIFIER

Large daylighting control projects may require a multi-zone, digital lighting management control system networked using Cat. 5e cabling. Utilize paragraphs 2.11 thru 2.17 for projects where a digital, lighting management, control system has been justified by a Net Present Value (NPV) calculation.

2.11 DIGITAL WALL SWITCH OCCUPANCY SENSOR

- A. Provide wallbox mounted, dual technology, digital occupancy sensor with 1 or 2 switch buttons. Available in white, light almond, ivory, grey, red and black; compatible with decorator style, wall plates.
- B. Digital Occupancy Sensors shall provide scrolling LCD display for digital calibration and electronic documentation. Features include the following:
 1. Digital calibration and pushbutton programming for the following variables:
 - a. Sensitivity – 0-100% in 10% increments
 - b. Time delay – 1-30 minutes in 1 minute increments
 - c. Test mode – Five second time delay
 - d. Detection technology – PIR, ultrasonic or dual technology activation and/or re-activation.
 - e. Walk-through mode
 - f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photo sensors are included in the local management network.
 2. Two RJ-45 ports for connection to local management network.
 3. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool.
 4. Device Status LEDs to include:
 - a. PIR detection
 - b. Ultrasonic detection
 - c. Configuration mode
 - d. Load binding
 5. Assignment of occupancy sensor to a specific load within the room without the need for wiring or special tools.
 6. Assignment of local buttons to specific loads within the room without the need for wiring or special tools.
 7. Manual override of controlled loads.
- C. Low voltage momentary pushbuttons shall include the following features:
 1. Load/Scene Status LED on each switch button with the following characteristics:
 - a. Bi-level LED
 - 1) Dim locator level indicates power to switch
 - 2) Bright status level indicates that load or scene is active
 2. The following button attributes may be changed or selected using a wireless configuration tool:
 - a. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
 - b. Individual button function may be configured to Toggle, On only or Off only.



- c. Switch buttons may be bound to any load on a room controller and are not load type dependant; each button may be bound to multiple loads.

D. Basis of Design: WattStopper LMDW-100 Series.

2.12 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR

- A. Provide ceiling mounted, dual technology, digital occupancy sensor. Furnish the manufacturer's system which accommodates the square-foot coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors and accessories which suit the lighting and electrical system parameters.
- B. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features to include the following:
 - 1. Digital calibration and pushbutton programming for the following variables:
 - a. Sensitivity – 0-100% in 10% increments
 - b. Time delay – 1-30 minutes in 1 minute increments
 - c. Test mode – Five second time delay
 - d. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
 - e. Walk-through mode
 - f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photo sensors are included in the local management network.
 - 2. One or two RJ-45 port(s) for connection to local management network.
 - 3. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool.
 - 4. Device Status LEDs including:
 - a. PIR detection
 - b. Ultrasonic detection
 - c. Configuration mode
 - d. Load binding
 - 5. Assignment of occupancy sensor to a specific load within the room without the need for wiring or special tools.
 - 6. Manual override of controlled loads.
- C. Basis of Design: WattStopper LMDC-100 Series.

2.13 DIGITAL WALL SWITCHES

- A. Provide low voltage, momentary, pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration; available in white, light almond, ivory, grey, red and black; compatible with decorator style, wall plates. Wall switches shall include the following features:
 - 1. Two-way infrared (IR) transceiver for use with configuration remote controls.
 - 2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
 - 3. Configuration LED on each switch that blinks to indicate data transmission.
 - 4. Load/Scene Status LED on each switch button with the following characteristics:
 - a. Bi-level LED
 - 1) Dim locator level indicates power to switch
 - 2) Bright status level indicates that load or scene is active
 - 5. Two RJ-45 ports for connection to local management network.
- B. The following switch attributes may be changed or selected using a wireless configuration tool:
 - 1. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).

2. Individual button function may be configured to Toggle, On only or Off only.
3. Switch buttons may be bound to any load on a room controller and are not load type dependant; each button may be bound to multiple loads.

C. Basis of Design: WattStopper LMSW-100 Series.

2.14 Digital on/off ROOM CONTROLLERS

- A. Room Controllers automatically bind the room loads to the connected devices in the space without the use of any tools. Room Controllers shall be provided to match the room lighting load and control requirements. The controllers shall be simple to install and will not be equipped with, dip switches, potentiometers or require special configuration. The control units shall include the following features:
1. Simple replacement – Using the default, automatic configuration capabilities, a room controller may be replaced with an off-the-shelf unit without requiring any configuration or setup.
 2. Device Status LEDs to indicate:
 - a. Data transmission
 - b. Device has power
 - c. Status for each load
 - d. Configuration status
 3. Quick installation features including:
 - a. Standard junction box mounting
 - b. Quick low voltage connections using standard RJ-45 patch cable
 4. Controller shall be plenum rated.
 5. Manual override and LED indication for each load
 6. Dual voltage (120/277 VAC, 60 Hz).
 7. Zero cross circuitry for each load.
- B. On/Off Room Controllers shall include:
1. One or two relay configuration
 2. Efficient 150 mA switching power supply
 3. Three RJ-45 local management network ports
 4. Basis of Design: WattStopper LMRC-100 Series.

2.15 DIGITAL PHOTO SENSORS

- A. Digital photo sensors work with room controllers to provide automatic switching, bi-level, or tri-level daylight harvesting capabilities for any load type connected to a room controller. Closed loop photo sensors measure the ambient light in the space and control a single lighting zone. Open loop photo sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones. Photo sensors shall be interchangeable without the need for rewiring.
- B. Digital photo sensors shall include the following features:
1. An internal photodiode that measures only within the visible spectrum, and has a response curve that closely matches the photopic curve. The photodiode shall not measure energy in either the ultraviolet or infrared spectrums. The photocell shall have a sensitivity of less than 5% for any wavelengths less than 400 nanometers or greater than 700 nanometers.
 2. Sensor light level range shall be from 1-6,553 footcandles (fc).
 3. The capability of ON/OFF, bi-level or tri-level switching, for each controlled zone, depending on the selection of room controller(s) and load binding to room controller(s).
 4. For switching daylight harvesting, the photo sensor shall provide a field-selectable deadband, or a separation, between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling excessively after they turn off.



5. Optional wall switch override to allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise lighting levels for a selectable period of time or cycle of occupancy.
 6. Infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool.
 7. Configuration LED that blinks to indicate data transmission.
 8. status LED indicates test mode, override mode and load binding.
 9. Recessed switch to turn controlled load(s) ON and OFF.
 10. One RJ-45 port for connection to local management network.
 11. Any load or group of loads in the room can be assigned to a daylighting zone
 12. Each load within a daylighting zone can be individually enabled or disabled for discrete control.
- C. Closed loop digital photo sensors shall include the following additional features:
1. An internal photodiode that measures light in a 100 degree angle, cutting off the unwanted light from bright sources outside of this cone.
 2. Automatic self-calibration, initiated from the photo sensor, a wireless configuration tool or a PC with appropriate software.
 3. Automatically establishes application-specific setpoints following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling.
 4. Basis of Design: WattStopper LMLS-400 Series.
- D. Open loop digital photo sensors include the following additional features:
1. An internal photodiode that measures light in a 60 degree angle cutting off the unwanted light from the interior of the room.
 2. Automatically establishes application-specific setpoints following manual calibration using a wireless configuration tool or a PC with appropriate software. For switching operation, an adequate deadband between the ON and OFF setpoints for each zone shall prevent the lights from cycling.
 3. Each of the three discrete daylight zones can include any non overlapping group of loads in the room.
 4. Basis of Design: WattStopper LMLS-500 Series.

2.16 ROOM NETWORK (LOCAL Management Network)

- A. The local management network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building. Digital room devices connect to the network using CAT 5e cables with RJ-45 connectors which provide both data and power to room devices. Features of the management network include:
1. Plug n' Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
 2. Simple replacement of any device in the network with a standard off the shelf unit without requiring commissioning, configuration or setup.
 3. Push n' Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
 4. Two-way infrared communications for control configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.
- B. Basis of Design: WattStopper DLM System.

2.17 CONFIGURATIONS TOOL

- A. A configuration tool facilitates optional customization of local management networks, and is used to set up open loop daylighting sensors. The wireless configuration tool shall feature infrared communications.
- B. Features and functionality of the wireless configuration tool shall include:
 - 1. Two-way infrared (IR) communication with network enabled devices, within a range of approximately 30 feet.
 - 2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
 - 3. Read, modify and send parameters for occupancy sensors, daylighting sensors, room controllers and buttons on digital wall switches.
 - 4. Save up to nine occupancy sensor setting profiles, and apply profiles to selected sensors.
 - 5. Adjust or fine-tune daylighting settings established during auto-commissioning, and input light level data to complete commissioning of open loop daylighting controls.
- C. Basis of Design: WattStopper LMCT-100 Series.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. As specified in Section 260500 - Common Work Results for Electrical.
- B.

3.2 INSTALLATION

- A. The Lighting Control System shall be installed and wired completely as shown on the plans by the contractor, who shall make all necessary wiring connections to external devices and equipment.
- B. The low voltage lighting control cabling in this building will be installed above ceilings without conduit. All communications cabling used throughout this project shall comply with the requirements as outlined in the National Electric Code (NEC) article 725. All cabling shall bear CMP and/or appropriate markings for the environment in which they are installed.
 - 1. Sealing of openings between floors, through fire rated and smoke walls, existing or created by the contractor for cable pass through shall be the responsibility of the contractor. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of the contractor's work. Any openings created by or for this contractor and left unused shall also be sealed as part of this work.
 - 2. Cabling routed exterior of the building, underground, through inaccessible ceilings or less than 8'-0" A.F.F. in the workroom shall be contained in conduit. Provide flush boxes within finished areas and factory boxes in unfinished areas. Provide 3/4" conduit risers with 90 degree bend and bushing for all wall mounted devices. Install system and components in accordance with manufacturer's published instructions.
- C. Accurate "as-built" drawings shall be furnished by the contractor to aid the Owner in programming. These should indicate the load controlled by each relay and the identification number for that relay. They should also identify the physical location of each switch connected to an input and the identification number of that input. Three sets of space plans or lighting plans shall be furnished by the contractor indicating which luminaires are controlled by each relay

3.3 FIELD QUALITY CONTROL



- A. As specified in Section 260500 - Common Work Results for Electrical.
- B. Perform operational testing on lighting control system to verify proper operation and field wiring connections.
- C. System Start Up and Commissioning
 - 1. Manufacturer shall provide a factory authorized technician to confirm proper installation and operation of all lighting control system components. The startup requirement is intended to verify that the digital switches and relay panels interact as a complete and operational system to meet the design intent.
 - 2. Manufacturer to provide a written statement verifying that the system meets the above requirements Lighting control devices and control systems shall be tested to ensure that control hardware and software are calibrated, adjusted, programmed, and in proper working condition in accordance with the construction documents and manufacturer's installation instructions.
 - a. Provide functional performance testing as required by Section 260800 – Commissioning of Electrical Systems.
- D. System Training
 - 1. Manufacturer shall provide factory authorized technician to train owner personnel in the operation, programming and maintenance of the lighting control system including all occupancy sensors and daylighting controls.
- E. System Programming
 - 1. Manufacturer shall provide system programming including:
 - a. Wiring documentation.
 - b. Switch operation.
 - c. Telephone overrides.
 - d. Operating schedules.

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END OF SECTION 26 06 23 00



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SECTION 26 08 00 00 - MPF COMMISSIONING OF ELECTRICAL SYSTEMS

NOTE TO SPECIFIER

Use this Specification Section for Mail Processing Facilities only. This Specification is intended as a guide to the Architect/Engineer preparing the Construction Documents. The degree of electrical commissioning that will be required for the project shall be specified by the Contracting Officer's Representative. Interior and exterior lighting systems and controls for Mail Processing Facilities is a standard commissioning requirement. Other mission critical systems may be commissioned if required by the Contracting Officer's Representative.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT AN APPROVED, WRITTEN DEVIATION FROM USPS HEADQUARTERS FACILITIES SUBMITTED THROUGH THE CONTRACTING OFFICER'S REPRESENTATIVE.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.26 08 00 00

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Systems and equipment testing and start-up.
- B. Validation of proper and thorough installation of Division 26 systems and equipment.
- C. Functional performance testing of electrical systems.
- D. Documentation of tests, procedures, and installations.
- E. Coordination of Training Events.
- F. Generic Start-Up Procedures for electrical systems and equipment.

1.2 SCOPE

NOTE TO SPECIFIER

The following electrical systems shall be customized and/or selected for each specific project. Select the applicable system and submit to USPS Headquarters Facilities through the Contracting Officer's Representative.

- A. The following equipment and/or systems shall be commissioned if in compliance with the guidelines provided in Specification 019113, or with Contracting Officer approval:
 - 1. Interior And Exterior Lighting Systems And Control – Per ASHRAE 90.1 – 2010, 9.4.4.
 - 2. [Fire Alarm System]
 - 3. [Electrical Distribution System Wiring]
 - 4. [Electrical Advanced Metering]
 - 5. [Paging System]
 - 6. [Security/Access Control CCTV System]
 - 7. [Medium Voltage Switchgear And Unit Substations]
 - 8. [Generators And Emergency Power Distribution System]
 - 9. [Automatic Transfer Switches]



10. [Physical Access Control System]

1.3 GENERAL DESCRIPTION

- A. Commissioning (Cx) is the process of ensuring that all building systems are installed and perform interactively according to the design intent; that systems are efficient and cost effective and meet the USPS's operational needs; that the installation is adequately documented; and that the Operators are adequately trained. It serves as a tool to minimize post-occupancy operational problems. It establishes testing and communication protocols in an effort to advance the building systems from installation to full dynamic operation and optimization.
- B. The USPS shall retain an independent Commissioning Authority (CxA) to provide Commissioning Services through their preapproved vendors.
- C. Commissioning Authority (CxA) shall work with the Contractor and Engineer to direct and oversee the Cx process and perform functional performance testing.
- D. This Section outlines the Cx procedures specific to the Contractor's electrical responsibilities. Requirements common to all work are described in Specification section 019113.

1.4 RELATED WORK AND DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section
- B. Commissioning Plan: The Cx Plan shall be available for reference as it outlines responsibilities outside of the Construction Contract. It provides the Contractor and the USPS an understanding of the planned commissioning activities for that project.
- C. Section 013300 - Submittal Procedures: Stipulates additional copies of submittals to be submitted and refers to other sections for additional submittal requirements related to Cx.
- D. Section 017704 - Closeout Procedures and Training: Defines the milestones in completion incorporating the Cx process.
- E. Section 019113 – General Commissioning Requirements: Specifies the general facility commissioning procedures common across all Divisions and the Contractor's responsibilities for the commissioning process.
- F. Individual Specification Sections: Individual sections stipulate installation, start-up, warranty, O&M documentation, and training requirements for the system or device specified in the Section.
- G. Section 250804 – Building Automation System Commissioning: Details the commissioning procedures specific to the BAS.

1.5 REFERENCE STANDARDS

- A. AABC Commissioning Group (ACG)
- B. NEBB – Procedures for Building Systems Commissioning
- C. National Electric Code (NEC)
- D. American Society for Testing and Materials (ASTM)



- E. Electronics Industry Association/Telecommunications Industry Association (EIA/TIA)
- F. Illuminating Engineering Society (IES)
- G. Institute of Electrical and Electronics Engineers (IEEE)
- H. International Electrical Testing Association (NETA)
- I. National Electrical Manufacturers Associates (NEMA)
- J. National Fire Protection Association (NFPA)
- K. Underwriters Laboratory, Inc. (UL)

1.6 RELATED WORK AND DOCUMENTATION

- A. As required in Specification 019113 and the following as they apply to the commissioning of equipment:
 - 1. Factory Test Reports: Contractor shall provide any factory testing documentation or certified test reports required by the specifications. These shall be provided prior to Acceptance Phase. Factory Test Reports should be provided in pdf electronic format. These include but are not limited to:
 - a. Field Testing Agency Reports: Provide all documentation of work done by independent testing agencies required by the contract documents. These shall be provided prior to Acceptance Phase. Field Testing Agency Reports should be provided in pdf electronic format.

1.7 COORDINATION MANAGEMENT PROTOCOLS

- A. Coordination responsibilities and management protocols relative to Cx are initially defined in Section 019113 and the Commissioning Plan, but shall be refined and documented in the Construction Phase Cx Kick-Off meeting. Contractor shall have input in the protocols and all Parties will commit to scheduling obligations. The CxA will record and distribute.

1.8 CONTRACTOR RESPONSIBILITIES

- A. Refer to Section 019113: Detailed Contractor responsibilities common to all Divisions are specified in Section 019113. The following are additional responsibilities or notable responsibilities specific to the electrical systems.
- B. Construction Phase
 - 1. Coordinate the work of the Electrical Testing Agency and the Cx requirements, as required.
 - 2. Provide skilled technicians qualified to perform the work required.
 - 3. Provide factory-trained and authorized technicians where required by the Contract Documents.
 - 4. Prepare and submit required draft Start-Up Procedures and submit along with the manufacturer's application, installation and start-up information.
 - 5. Provide assistance to the CxA in preparation of the specific Functional Performance Test (FPT) procedures. Contractors, subcontractors and vendors shall review FPT procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.
 - 6. Thoroughly complete and inspect installation of systems and equipment as detailed throughout Contract Documents, as required by reference or industry standards, and as specifically indicated elsewhere this Section.



7. Record Start-up Procedures on start-up procedure forms and certify that the systems and equipment have been started and or tested in accordance with the requirements specified above. Each task or item shall be indicated with the Party actually performing the task or procedure.

C. Acceptance Phase

1. Assist CxA in functional performance testing. Assistance will generally include the following:
 - a. Manipulate systems and equipment to facilitate testing (as dictated in Section 019110 and the Cx Plan; in some cases this will entail only an initial sample).

D. Warranty Phase

1. Maintain record documentation of any configurations, set ups, parameters etc, that change throughout the period.
 - a. Provide representative for off season testing as required by CxA.
 - b. Respond to Warranty issues as required by Division 1 and the General Conditions.

1.9 START-UP PROCEDURES AND DOCUMENTATION

- A. Refer to Section 019113 and as detailed in Part 3 – Execution.

1.10 INDEPENDENT ELECTRICAL TESTING AGENCY

- A. The Independent Electrical Testing Agency shall be provided under the construction specifications and therefore included with the bid. Many of the aspects of the start-up and functional performance testing indicated herein will be accomplished under the respective section and witnessed by the CxA at the indicated sample rate. CxA will include applicable test results in the functional performance testing record.

1.11 FUNCTIONAL PERFORMANCE TESTING

- A. For applicable systems and equipment, Contractor shall participate in the initial samples of Functional Performance Testing as stipulated in Section 019113 and the Commissioning Plan.

1.12 FPT ACCEPTANCE CRITERIA

- A. Acceptance criteria for tests are indicated in the specification Sections applicable to the systems being tested. Generally, unless indicated otherwise, the criteria for acceptance will be that specified with the individual system, equipment, component, or device, which in general conform to NFPA 70B and International Electrical Testing Association (NETA) testing specifications NETA ATS-2003.

1.13 TRAINING

- A. Contractors, subcontractor, vendors, and other applicable Parties shall prepare and conduct training sessions on the installed systems and equipment they are responsible for per the requirements of Section 019113 and the individual Specifications.

1.14 O&M MANUAL CONTENT - PREPARATION AND LOGISTICS

- A. Refer to Section 019113 and the individual Specifications.



PART 2 - PRODUCTS

2.1 INSTRUMENTATION

- A. All testing equipment used by any Party shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply: All equipment shall be calibrated according to the manufacturer's recommended intervals. Calibration tags shall be affixed or certificates readily available.
- B. Testing Instrumentation: Contractor shall provide all instrumentation necessary for tests for which they are responsible. CxA will provide standard instrumentation for measuring medium and low voltage electrical voltage, current, power factor, power, and THD. CxA will provide receptacle testers for normal and GFI receptacle tests. Contractor shall provide all other instrumentation required to accomplish the specified testing.
- C. Contractor shall provide infrared scanning equipment when required by the contract documents. Infrared scanning equipment shall be an AGA (or approved equal) thermovision set capable of viewing an entire bus or equipment assembly at one time and have a sensitivity of 0.2 degree C with a liquid nitrogen reference.
- D. Contractor shall provide Amprobe DM-III Multitest F power quality recorder/data logger or approved equal.

PART 3 - EXECUTION

3.1 START-UP PROCEDURES

- A. This Section outlines 'generic' or minimally acceptable Start-Up Procedures. These items shall provide a minimum or guideline for required Contractor development of Start-Up Procedures. Contractor shall synthesize these minimum requirements along with their own internal quality control practices, those of the manufacturer, and any applicable codes and standards to develop specific and itemized Start-Up Procedures specific to the equipment and systems installed on this project.
- B. Refer to NETA which is referenced in several Division 26 sections which outline electrical related testing required.

NOTE TO SPECIFIER

The following procedures must be customized and/or selected for each specific project.

- C. The following start up verifications/procedures are common to all systems
 - 1. Checkout shall proceed from devices to the components to the systems.
 - 2. Verify labeling is affixed per spec and visible
 - 3. Verify prerequisite procedures are done.
 - 4. Inspect for damage and ensure none is present.
 - 5. Verify system is applied per the manufacturer's recommendations
 - 6. Verify system has been started up per the manufacturer's recommendations
 - 7. Verify that access is provided for inspection, operation and repair
 - 8. Verify that access is provided for replacement of the equipment
 - 9. Verify the record drawings, submittal data and O&M documentation accurately reflect the installed systems
 - 10. Verify all gages and test reports are provided as required by contract documents and manufacturer's recommendations
 - 11. Verify all recorded nameplate data is accurate



12. Installation is done to ensure safe operation and maintenance.
13. Verify specified replacement material/attic stock has been provided as required by the Construction Documents
14. Verify all rotating parts are properly lubricated
15. Verify all monitoring and ensure all alarms are active and set per USPS's requirements

3.2 LIGHTING AND LIGHTING CONTROLS

- A. General: Refer to the quality control requirements listed in section 019113 – General Commissioning Requirements for additional checks and tests. These shall be included in the tests used for this project.

NOTE TO SPECIFIER

The following procedures must be customized and/or selected for each specific project.

- B. Functional Testing. . Lighting control devices and control systems shall be tested to ensure that control hardware and software are calibrated, adjusted, programmed, and in proper working condition in accordance with the construction documents and manufacturer's installation instructions. When occupant sensors, time switches, programmable schedule controls, or photo sensors are installed, at a minimum, the following procedures shall be performed:
1. Confirm that the placement, sensitivity and time-out adjustments for occupant sensors yield acceptable performance, lights turn off only after space is vacated and do not turn on unless space is occupied.
 2. Confirm that the time switches and programmable schedule controls are programmed to turn the lights off.
 3. Confirm that photo sensor controls reduce electric light levels based on the amount of usable daylight in the space as specified.
 4. Check the lighting systems and ensure that the all luminaries and lamps are operational and fixtures are clean.
 5. Measure lighting levels after lamps have been 'burned in' for at least 100 hours. Check lighting levels to ensure compliance with the design requirements for the respective zones, if applicable.
 6. Check operational and override switches to ensure the proper operation of timing circuits.
 7. Check lighting schedules to ensure they are programmed per the documentation and in accordance with the required lighting zones, if applicable.
 8. Measure the connected loads in current and watts on each controlled circuit.
 9. Check full load current on all breakers serving controlled lighting to ensure that the breaker is properly sized.
 10. Verify the correct operation of all control devices (contactors, relays, time clocks, control interface relays, etc.).
 11. Check full load current on all control device contacts serving controlled lighting to ensure that the contact rating is properly sized.

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END OF SECTION



SECTION 26 08 00 00 - CSF COMMISSIONING OF ELECTRICAL SYSTEMS

NOTE TO SPECIFIER

Use this Specification Section for larger Customer Service Facilities only. This Specification is intended as a guide to the Architect/Engineer preparing the Construction Documents. The degree of electrical commissioning that will be required for the project shall be specified by the Contracting Officer. Lighting systems and controls for Customer Service Facilities larger than 20,000 sq. ft. is a standard commissioning requirement. Other mission critical systems may be commissioned if required by the Contracting Officer.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT AN APPROVED, WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN & CONSTRUCTION SUBMITTED THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.26 08 00 00

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Systems and equipment testing and start-up.
- B. Validation of proper and thorough installation of Division 26 systems and equipment.
- C. Functional performance testing of electrical systems.
- D. Documentation of tests, procedures, and installations.
- E. Coordination of Training Events.
- F. Generic Start-Up Procedures for electrical systems and equipment.

1.2 SCOPE

NOTE TO SPECIFIER

The following electrical systems shall be customized and/or selected for each specific project. Select the applicable system and submit to USPS headquarters design and construction, through the Contracting Officer.

- A. The following electrical equipment and/or systems may be commissioned if in compliance with the guidelines provided in Specification 019113, or with Contracting Officer approval:
 - 1. Lighting and Lighting Control System
 - 2. [Fire Alarm System]
 - 3. [Electrical Distribution System Wiring]
 - 4. [Electrical Advanced Metering]
 - 5. [Paging System]
 - 6. [Security / Physical Access Control CCTV System]



1.3 GENERAL DESCRIPTION

- A. Commissioning (Cx) is the process of ensuring that all building systems are installed and perform interactively according to the design intent; that systems are efficient and cost effective and meet the USPS's operational needs; that the installation is adequately documented; and that the Operators are adequately trained. It serves as a tool to minimize post-occupancy operational problems. It establishes testing and communication protocols in an effort to advance the building systems from installation to full dynamic operation and optimization.
- B. The USPS shall retain an independent Commissioning Authority (CxA) to provide Commissioning Services through their preapproved vendors.
- C. Commissioning Authority (CxA) shall work with the Contractor and Engineer to direct and oversee the Cx process and perform functional performance testing.
- D. This Section outlines the Cx procedures specific to the Contractor's electrical responsibilities. Requirements common to all work are described in Specifications 019113.

1.4 RELATED WORK AND DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section
- B. Commissioning Plan: The Cx Plan shall be available for reference as it outlines responsibilities outside of the Construction Contract. It provides the Contractor and the USPS an understanding of the planned commissioning activities for that project.
- C. Section 013300 - Submittal Procedures: Stipulates additional copies of submittals to be submitted and refers to other sections for additional submittal requirements related to Cx.
- D. Section 017704 - Closeout Procedures and Training: Defines the milestones in completion incorporating the Cx process.
- E. Section 019113 – General Commissioning Requirements: Specifies the general facility commissioning procedures common across all Divisions and the Contractor's responsibilities for the commissioning process.
- F. Individual Specification Sections: Individual sections stipulate installation, start-up, warranty, O&M documentation, and training requirements for the system or device specified in the Section.
- G. Section 250804 – Building Automation System Commissioning: Details the commissioning procedures specific to the BAS.

1.5 REFERENCE STANDARDS

- A. AABC Commissioning Group (ACG)
- B. NEBB – Procedures for Building Systems Commissioning
- C. National Electric Code (NEC)
- D. American Society for Testing and Materials (ASTM)
- E. Electronics Industry Association/Telecommunications Industry Association (EIA/TIA)



- F. Illuminating Engineering Society (IES)
- G. Institute of Electrical and Electronics Engineers (IEEE)
- H. International Electrical Testing Association (NETA)
- I. National Electrical Manufacturers Associates (NEMA)
- J. National Fire Protection Association (NFPA)
- K. Underwriters Laboratory, Inc. (UL)

1.6 DOCUMENTATION

- A. As required in Specification 019113 and the following as they apply to the commissioning of equipment:
 - 1. Factory Test Reports: Contractor shall provide any factory testing documentation or certified test reports required by the specifications. These shall be provided prior to Acceptance Phase. Factory Test Reports should be provided in pdf electronic format. These include but are not limited to:
 - a. Field Testing Agency Reports: Provide all documentation of work done by independent testing agencies required by the contract documents. These shall be provided prior to Acceptance Phase. Field Testing Agency Reports should be provided in pdf electronic format.

1.7 COORDINATION MANAGEMENT PROTOCOLS

- A. Coordination responsibilities and management protocols relative to Cx are initially defined in Section 019113 and the Commissioning Plan, but shall be refined and documented in the Construction Phase Cx Kick-Off meeting. Contractor shall have input in the protocols and all Parties will commit to scheduling obligations. The CxA will record and distribute.

1.8 CONTRACTOR RESPONSIBILITIES

- A. Refer to Section 019113: Detailed Contractor responsibilities common to all Divisions are specified in Section 019113. The following are additional responsibilities or notable responsibilities specific to the electrical systems.
- B. Construction Phase
 - 1. Coordinate the work of the Electrical Testing Agency and the Cx requirements, as required.
 - 2. Provide skilled technicians qualified to perform the work required.
 - 3. Provide factory-trained and authorized technicians where required by the Contract Documents.
 - 4. Prepare and submit required draft Start-Up Procedures and submit along with the manufacturer's application, installation and start-up information.
 - 5. Provide assistance to the CxA in preparation of the specific Functional Performance Test (FPT) procedures. Contractors, subcontractors and vendors shall review FPT procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.
 - 6. Thoroughly complete and inspect installation of systems and equipment as detailed throughout Contract Documents, as required by reference or industry standards, and as specifically indicated elsewhere this Section.
 - 7. Record Start-up Procedures on start-up procedure forms and certify that the systems and equipment have been started and or tested in accordance with the requirements specified above. Each task or item shall be indicated with the Party actually performing the task or procedure.



- C. Acceptance Phase
 - 1. Assist CxA in functional performance testing. Assistance will generally include the following:
 - a. Manipulate systems and equipment to facilitate testing (as dictated in Section 019110 and the Cx Plan; in some cases this will entail only an initial sample).
- D. Warranty Phase
 - 1. Maintain record documentation of any configurations, set ups, parameters etc, that change throughout the period.
 - a. Provide representative for off season testing as required by CxA.
 - b. Respond to Warranty issues as required by Division 1 and the General Conditions.

1.9 START-UP PROCEDURES AND DOCUMENTATION

- A. Refer to Section 019113 and as detailed in PART 3 - EXECUTION below.

1.10 INDEPENDENT ELECTRICAL TESTING AGENCY

- A. The Independent Electrical Testing Agency shall be provided under the construction specifications and therefore included with the bid. Many of the aspects of the start-up and functional performance testing indicated herein will be accomplished under the respective section and witnessed by the CxA at the indicated sample rate. CxA will include applicable test results in the functional performance testing record.

1.11 FUNCTIONAL PERFORMANCE TESTING

- A. For applicable systems and equipment, Contractor shall participate in the initial samples of Functional Performance Testing as stipulated in Section 019113 and the Commissioning Plan.

1.12 FPT ACCEPTANCE CRITERIA

- A. Acceptance criteria for tests are indicated in the specification Sections applicable to the systems being tested. Generally, unless indicated otherwise, the criteria for acceptance will be that specified with the individual system, equipment, component, or device, which in general conform to NFPA 70B and International Electrical Testing Association (NETA) testing specifications NETA ATS-2003.

1.13 TRAINING

- A. Contractors, subcontractor, vendors, and other applicable Parties shall prepare and conduct training sessions on the installed systems and equipment they are responsible for per the requirements of Section 019113 and the individual Specifications.

1.14 O&M MANUAL CONTENT - PREPARATION AND LOGISTICS

- A. Refer to Section 019113 and the individual Specifications.



PART 2 - PRODUCTS

2.1 INSTRUMENTATION

- A. All testing equipment used by any Party shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply: All equipment shall be calibrated according to the manufacturer's recommended intervals. Calibration tags shall be affixed or certificates readily available.
- B. Testing Instrumentation: Contractor shall provide all instrumentation necessary for tests for which they are responsible. CxA will provide standard instrumentation for measuring medium and low voltage electrical voltage, current, power factor, power, and THD. CxA will provide receptacle testers for normal and GFI receptacle tests. Contractor shall provide all other instrumentation required to accomplish the specified testing.
- C. Contractor shall provide infrared scanning equipment when required by the contract documents. Infrared scanning equipment shall be an AGA (or approved equal) thermovision set capable of viewing an entire bus or equipment assembly at one time and have a sensitivity of 0.2°C with a liquid nitrogen reference.
- D. Contractor shall provide Amprobe DM-III Multitest F power quality recorder/data logger or approved equal.

PART 3 - EXECUTION

3.1 START-UP PROCEDURES

- A. This Section outlines 'generic' or minimally acceptable Start-Up Procedures. These items shall provide a minimum or guideline for required Contractor development of Start-Up Procedures. Contractor shall synthesize these minimum requirements along with their own internal quality control practices, those of the manufacturer, and any applicable codes and standards to develop specific and itemized Start-Up Procedures specific to the equipment and systems installed on this project.
- B. Refer to NETA which is referenced in several Division 26 sections which outline electrical related testing required.

NOTE TO SPECIFIER

The following procedures must be customized and/or selected for each specific project.

- C. The following start up verifications/procedures are common to all systems
 - 1. Checkout shall proceed from devices to the components to the systems.
 - 2. Verify labeling is affixed per spec and visible
 - 3. Verify prerequisite procedures are done.
 - 4. Inspect for damage and ensure none is present.
 - 5. Verify system is applied per the manufacturer's recommendations
 - 6. Verify system has been started up per the manufacturer's recommendations
 - 7. Verify that access is provided for inspection, operation and repair
 - 8. Verify that access is provided for replacement of the equipment
 - 9. Verify the record drawings, submittal data and O&M documentation accurately reflect the installed systems
 - 10. Verify all gages and test reports are provided as required by contract documents and manufacturer's recommendations
 - 11. Verify all recorded nameplate data is accurate



12. Installation is done to ensure safe operation and maintenance.
13. Verify specified replacement material/attic stock has been provided as required by the Construction Documents
14. Verify all rotating parts are properly lubricated
15. Verify all monitoring and ensure all alarms are active and set per USPS requirements

3.2 LIGHTING AND LIGHTING CONTROLS

- A. General: Refer to the quality control requirements listed in section 019113 – General Commissioning Requirements for additional checks and tests. These shall be included in the tests used for this project.
- B. Functional Testing. Perform the following:
 1. Measure the connected loads in current and watts on each controlled circuit.
 2. Verify the correct operation of all control devices (contactors, relays, time clocks, control interface relays, etc.).
 3. Check full load current on all breakers serving controlled lighting to ensure that the breaker is properly sized.
 4. Check full load current on all control device contacts serving controlled lighting to ensure that the contact rating is properly sized.
 5. Check the lighting systems and ensure that the all luminaries and lamps are operational and fixtures are clean.
 6. Measure lighting levels after lamps have been 'burned in' for at least 100 hours. Check lighting levels to ensure compliance with the design requirements for the respective zones, if applicable.
 7. Check occupancy sensor placement, if used, and test reliability of activation/deactivation.
 8. Test photo-sensors, if used, for functionality and accuracy.
 9. Check operational and override switches to ensure the proper operation of timing circuits.
 10. Check lighting schedules to ensure they are programmed per the documentation and in accordance with the required lighting zones, if applicable.

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END OF SECTION



SECTION 26 09 23 00 - ELECTRICAL POWER MONITORING AND CONTROL

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for electrical power monitoring and control. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following for monitoring and control of electrical power system:
 - a. PC-based workstation(s) and software.
 - b. Communication network and interface modules for RS-232; RS-485, Modbus TCP/IP; and IEEE 802.3 data transmission protocols.

C. Definitions

1. Ethernet: Local area network based on IEEE 802.3 standards.
2. Firmware: Software (programs or data) that has been written onto read-only memory (ROM). Firmware is a combination of software and hardware. Storage media with ROMs that have data or programs recorded on them are firmware.
3. HTML: Hypertext markup language.
4. I/O: Input/output.
5. KB: Short for kilobyte. When used to describe data storage, "KB" represents 1024 bytes.
6. KY Pulse: A term used by the metering industry to describe a method of measuring consumption of electricity that is based on a relay changing status in response to the rotation of the disk in the meter.
7. LAN: Local area network; sometimes plural as "LANs."
8. LCD: Liquid crystal display.
9. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or remote-control, signaling and power-limited circuits.
10. Modbus TCP/IP: An open protocol for exchange of process data.
11. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.
12. PC: Personal computer; sometimes plural as "PCs."
13. rms: Root-mean-square value of alternating voltage, which is the square root of the mean value of the square of the voltage values during a complete cycle.
14. RS-232: A TIA standard for asynchronous serial data communications between terminal devices.
15. RS-485: A TIA standard for multipoint communications using two twisted-pairs.
16. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.
17. THD: Total harmonic distortion.
18. UPS: Uninterruptible power supply; used both in singular and plural context.
19. WAN: Wide area network.

D. Submittals

1. Product Data: For each type of product indicated.
 - a. Attach copies of approved Product Data submittals for products (such as switchboards and switchgear) that describe power monitoring and control features to illustrate coordination among related equipment and power monitoring and control.
2. Shop Drawings: For power monitoring and control equipment. Include plans, elevations, sections, details, and attachments to other work.
 - a. Outline Drawings: Indicate arrangement of components and clearance and access requirements.



- b. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.
 - c. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - d. Wiring Diagrams: Power, signal, and control wiring. Coordinate nomenclature and presentation with a block diagram.
 - e. UPS sizing calculations for workstation.
 3. Software and Firmware Operational Documentation:
 - a. Self-study guide describing the process for setting equipment's network address; setting Owner's options; procedures to ensure data access from any PC on the network, using a standard Web browser; and recommended firewall setup.
 - b. Software operating and upgrade manuals.
 - c. Software Backup: On a magnetic media or compact disc, complete with Owner-selected options.
 - d. Device address list and the set point of each device and operator option, as set in applications software.
 - e. Graphic file and printout of graphic screens and related icons, with legend.
 4. Software Upgrade Kit: For Owner to use in modifying software to suit future power system revisions or power monitoring and control revisions.
 5. Software licenses and upgrades required by and installed for operating and programming digital and analog devices.
 6. Field quality-control test reports.
 7. Operation and Maintenance Data: For power monitoring and control units, to include in emergency, operation, and maintenance manuals. Include the following:
 - a. Operating and applications software documentation.
 - b. Software licenses.
 - c. Software service agreement.
 - d. PC installation and operating documentation, manuals, and software for the PC and all installed peripherals. Software shall include system restore, emergency boot diskettes, and drivers for all installed hardware. Provide separately for each PC.
 - e. Hard copies of manufacturer's specification sheets, operating specifications, design guides, user's guides for software and hardware, and PDF files on CD-ROM of the hard-copy submittal.
 8. Other Informational Submittals:
 - a. System installation and setup guides, with data forms to plan and record options and setup decisions.
- E. Quality Assurance
 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- F. Software Service Agreement
 1. Technical Support: Beginning with Final Completion, provide software support for two years.
 2. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Final Completion. Upgrading software shall include the operating systems. Upgrade shall include new or revised licenses for use of software.
 - a. Provide 30-day notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.



1.2 PRODUCTS

A. Functional Description

1. Instrumentation and Recording Devices: Monitor and record load profiles and chart energy consumption patterns.
 - a. Calculate and Record the Following:
 - 1) Load factor.
 - 2) Peak demand periods.
 - 3) Consumption correlated with facility activities.
 - b. Measure and Record Metering Data for the Following:
 - 1) Electricity.
 - 2) Domestic water.
 - 3) Natural gas.
2. Software: Calculate allocation of utility costs.
 - a. Automatically Import Energy Usage Records to Allocate Energy Costs for the Following:
 - 1) At least 15 departments.
 - 2) At least 30 tenants.
 - 3) At least five processes.
 - 4) At least five buildings.
 - b. Verify utility bills and analyze alternate energy rates, **as directed**.
3. Power Quality Monitoring: Identify power system anomalies and measure, display, and record trends and alarms of the following power quality parameters:
 - a. Voltage regulation and unbalance.
 - b. Continuous three-phase rms voltage.
 - c. Periodic max./min./avg. samples.
 - d. Harmonics.
 - e. Voltage excursions.
4. Emergency Load Shedding. Preserve critical loads or avoid total shutdown due to unforeseen loss of power sources according to the following logic:
 - a. Determine system topology.
 - b. Evaluate remaining loads and sources.
 - c. Shed loads in less than 100 ms.
5. Demand Management:
 - a. Peaking or co-generator control.
 - b. Load interlocking.
 - c. Load shedding.
 - d. Load trimming.
6. System: Report equipment status and power system control.

B. System Requirements

1. Monitoring and Control System: Include PC-based workstation **OR** multiple PC-based workstations **OR** multiple PC-based workstations with graphics capability and Web access, **as directed**, with its operating system and application software, connected to data transmission network.
2. Surge Protection: For external wiring of each conductor entry connection to components to protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads.
 - a. Minimum Protection for Power Lines 120 V and More: Auxiliary panel suppressors complying with requirements in Division 26 Section "Transient-voltage Suppression For Low-voltage Electrical Power Circuits".
 - b. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Lines: Comply with requirements as recommended by manufacturer for type of line being protected.
3. Addressable Devices: All transmitters and receivers shall communicate unique device identification and status reports to monitoring and control clients.



4. BAS Interface: Provide factory-installed hardware and software to enable the BAS to monitor, display, and record data for use in processing reports.
 - a. Hardwired Monitoring Points: Electrical power demand (kilowatts), electrical power consumption (kilowatt-hours), power factor, **as directed**.
OR
 ASHRAE 135 (BACnet) **OR** LonTalk **OR** Modbus **OR** Industry-accepted, open-protocol, **as directed**, communication interface with the BAS shall enable the BAS operator to remotely monitor meter information from a BAS operator workstation. Control features and monitoring points displayed locally at metering panel shall be available through the BAS.

C. Operating System

1. Software: Configured to run on a portable laptop computer, a single PC, or a palm computer, with capability for accessing a single meter at a time. System is not connected to a LAN. Modbus TCP/IP, RS-232, and RS-485 digital communications.
OR
 Software: Configured to run on a single PC, with capability for accessing multiple devices simultaneously. Modbus TCP/IP, RS-232, and RS-485 digital communications.
OR
 Software: Configured for a server and multiple client PCs, each with capability for accessing multiple devices simultaneously. Ethernet, Modbus TCP/IP, RS-232, and RS-485 digital communications.
OR
 Software: Configured for a server and multiple client PCs, each with capability for accessing multiple devices simultaneously. Software shall include interactive graphics client and shall be Web enabled. Workstations and portable computers shall not require any software except for an Internet browser to provide connectivity and full functionality. Include a firewall recommended by manufacturer. 100 Base-T Ethernet, Modbus TCP/IP RS-232, and RS-485 digital communications.
2. Operating System Software: Based on 32-bit, Microsoft Windows workstation operating system. Software shall have the following features:
 - a. Multiuser and multitasking to allow independent activities and monitoring to occur simultaneously at different workstations.
 - b. Graphical user interface to show pull-down menus and a menu tree format.
 - c. Capability for future additions within the indicated system size limits.
3. Peer Computer Control Software: Shall detect a failure of workstation and associated server, **as directed**, and shall cause other workstation and associated server, **as directed**, to assume control of all system functions without interruption of operation. Drivers shall be provided in both central computers to support this mode of operation.

D. Applications Software

1. Basic Requirements:
 - a. Fully compatible with and based on the approved operating system.
 - b. Password-protected operator login and access; three levels, minimum.
 - c. Password-protected setup functions.
 - d. Context sensitive on-line help.
 - e. Capability of creating, deleting, and copying files; and automatically maintaining a directory of all files, including size and location of each sequential and random-ordered record.
 - f. Capability for importing custom icons into graphic views to represent alarms and I/O devices.
 - g. Automatic and encrypted backups for database and history; automatically stored at central control PC **OR** selected workstation, **as directed**, and encrypted with a nine-character alphanumeric password, which must be used to restore or read data contained in backup.
 - h. Operator audit trail for recording and reporting all changes made to user-defined system options.
2. Workstation Server Functions:



- a. Support other client PCs on the LAN and WAN, **as directed**.
 - b. Maintain recorded data in databases accessible from other PCs on the LAN and WAN, **as directed**.
3. Data Formats:
 - a. User-programmable export and import of data to and from commonly used Microsoft Windows spreadsheet, database, billing, and other applications; using dynamic data exchange technology.
 - b. Option to convert reports and graphics to HTML format.
 - c. Interactive graphics.
 - d. Option to send preprogrammed or operator designed e-mail reports.
4. Metered Data: Display metered values in real time.
5. Remote Control:
 - a. Display circuit-breaker status and allow breaker control.
 - b. User defined with load-shedding automatically initiated and executed schemes responding to programmed time schedules, set points of metered demands, utility contracted load shedding, or combinations of these.
6. Equipment Documentation: Database for recording of equipment ratings and characteristics; with capability for graphic display on monitors.
7. Graphics: Interactive color-graphics platform with pull-down menus and mouse-driven generation of power system graphics, in formats widely used for such drafting; to include the following:
 - a. Site plan.
 - b. Floor plans.
 - c. Equipment elevations.
 - d. Single-line diagrams.
8. User-Defined Monitoring and Control Events: Display and record with date and time stamps accurate to 0.1 second, and including the following:
 - a. Operator log on/off.
 - b. Attempted operator log on/off.
 - c. All alarms.
 - d. Equipment operation counters.
 - e. Out-of-limit, pickup, trip, and no-response events.
9. Trending Reports: Display data acquired in real-time from different meters or devices, in historical format over user-defined time; unlimited as to interval, duration, or quantity of trends.
 - a. Spreadsheet functions of sum, delta, percent, average, mean, standard deviation, and related functions applied to recorded data.
 - b. Charting, statistical, and display functions of standard Windows-based spreadsheet.
10. Alarms: Display and record alarm messages from discrete input and controls outputs, according to user programmable protocol.
 - a. Functions requiring user acknowledgment shall run in background during computer use for other applications and override other presentations when they occur.
11. Waveform Data: Display and record waveforms on demand or automatically on an alarm or programmed event; include the graphic displays of the following, based on user-specified criteria:
 - a. Phase voltages, phase currents, and residual current.
 - b. Overlay of three-phase currents, and overlay each phase voltage and current.
 - c. Waveforms ranging in length from 2 cycles to 5 minutes.
 - d. Disturbance and steady-state waveforms up to 512 points per cycle.
 - e. Transient waveforms up to 83,333 points per cycle on 60-Hz base.
 - f. Calculated waveform on a minimum of four cycles of data of the following:
 - 1) THD.
 - 2) rms magnitudes.
 - 3) Peak values.
 - 4) Crest factors.
 - 5) Magnitude of individual harmonics.
12. Data Sharing: Allow export of recorded displays and tabular data to third-party applications software.
13. Tenant or Activity Billing Software:



- a. Automatically compute and prepare tenant bills **OR** activity demand and energy-use statements, **as directed**, based on metering of energy use and peak demand integrated over user-defined interval.
- b. Intervals shall be same as used by electric utilities, including current vendor.
- c. Import metered data from saved records that were generated by metering and monitoring software.
- d. Maintain separate directory for each tenant's historical billing information.
- e. Prepare summary reports in user-defined formats and time intervals.
- 14. Reporting: User commands initiate the reporting of a list of current alarm, supervisory, and trouble conditions in system or a log of past events.
 - a. Print a record of user-defined alarm, supervisory, and trouble events on workstation printer.
 - b. Sort and report by device name and by function.
 - c. Report type of signal (alarm, supervisory, or trouble), description, date, and time of occurrence.
 - d. Differentiate alarm signals from other indications.
 - e. When system is reset, report reset event with same information concerning device, location, date, and time.

E. Communication Components And Networks

- 1. Transient Voltage Surge Suppression and Electromagnetic-Interference Immunity: Include in solid-state equipment. Comply with IEEE C37.90.
- 2. Network Configuration: High-speed, multi-access, open nonproprietary, industry standard communication protocol; LANs complying with EIA 485, 100 Base-T Ethernet, and Modbus TCP/IP.

F. Power Monitors

- 1. Separately mounted, permanently installed instrument for power monitoring and control.
 - a. Enclosure: NEMA 250, Type 1 **OR** 12, **as directed**.
- 2. Environmental Conditions: System components shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 - a. Indoor installation in non-air-conditioned **OR** nontemperature-controlled, **as directed**, spaces that have environmental controls to maintain ambient conditions of 0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing.
- 3. rms Real-Time Measurements:
 - a. Current: Each phase, neutral, average of three phases, percent unbalance.
 - b. Voltage: Line-to-line each phase, line-to-line average of three phases, line-to-neutral each phase, line-to-neutral average of three phases, line-to-neutral percent unbalance.
 - c. Power: Per phase and three-phase total.
 - d. Reactive Power: Per phase and three-phase total.
 - e. Apparent Power: Per phase and three-phase total.
 - f. Power Factor: Per phase and three-phase total.
 - g. Displacement Power Factor: Per phase and three-phase total.
 - h. Frequency.
 - i. THD: Current and voltage.
 - j. Accumulated Energy: Real kWh, reactive kVARh, apparent kVAh (signed/absolute).
 - k. Incremental Energy: Real kWh, reactive kVARh, apparent kVAh (signed/absolute).
 - l. Conditional Energy: Real kWh, reactive kVARh, apparent kVAh (signed/absolute).
- 4. Demand Current Calculations, per Phase, Three-Phase Average and Neutral:
 - a. Present.
 - b. Running average.
 - c. Last completed interval.
 - d. Peak.
- 5. Demand Real Power Calculations, Three-Phase Total:



- a. Present.
- b. Running average.
- c. Last completed interval.
- d. Predicted.
- e. Peak.
- f. Coincident with peak kVA demand.
- g. Coincident with kVAR demand.
6. Demand Reactive Power Calculations, Three-Phase Total:
 - a. Present.
 - b. Running average.
 - c. Last completed interval.
 - d. Predicted.
 - e. Peak.
 - f. Coincident with peak kVA demand.
 - g. Coincident with kVAR demand.
7. Demand Apparent Power Calculations, Three-Phase Total:
 - a. Present.
 - b. Running average.
 - c. Last completed interval.
 - d. Predicted.
 - e. Peak.
 - f. Coincident with peak kVA demand.
 - g. Coincident with kVAR demand.
8. Average Power Factor Calculations, Demand Coincident, Three-Phase Total:
 - a. Last completed interval.
 - b. Coincident with kW peak.
 - c. Coincident with kVAR peak.
 - d. Coincident with kVA peak.
9. Power Analysis Values:
 - a. THD, Voltage and Current: Per phase, three phase, and neutral.
 - b. Displacement Power Factor: Per phase, three phase.
 - c. Fundamental Voltage, Magnitude and Angle: Per phase.
 - d. Fundamental Currents, Magnitude and Angle: Per phase.
 - e. Fundamental Real Power: Per phase, three phase.
 - f. Fundamental Reactive Power: Per phase.
 - g. Harmonic Power: Per phase, three phase.
 - h. Phase rotation.
 - i. Unbalance: Current and voltage.
 - j. Harmonic Magnitudes and Angles for Current and Voltages: Per phase, up to 31st **OR** 63rd, **as directed**, harmonic.
10. Power Demand Calculations: According to one of the following calculation methods, selectable by the user:
 - a. Thermal Demand: Sliding window updated every second for the present demand and at end of the interval for the last interval. Adjustable window that can be set in 1-minute intervals, from 1 to 60 minutes.
 - b. Block Interval with Optional Subintervals: Adjustable for 1-minute intervals, from 1 to 60 minutes. User-defined parameters for the following block intervals:
 - 1) Sliding block that calculates demand every second, with intervals less than 15 minutes, and every 15 seconds with an interval between 15 and 60 minutes.
 - 2) Fixed block that calculates demand at end of the interval.
 - 3) Rolling block subinterval that calculates demand at end of each subinterval and displays it at end of the interval.
 - c. Demand Calculation Initiated by a Synchronization Signal:
 - 1) Signal is a pulse from an external source. Demand period begins with every pulse. Calculation shall be configurable as either a block or rolling block calculation.



- 2) Signal is a communication signal. Calculation shall be configurable as either a block or rolling block calculation.
- 3) Demand can be synchronized with clock in the power meter.
11. Sampling:
 - a. Current and voltage shall be digitally sampled at a rate high enough to provide accuracy to 63rd harmonic of 60-Hz fundamental.
 - b. Power monitor shall provide continuous sampling at a rate of 128 samples per cycle on all voltage and current channels in the meter.
12. Minimum and Maximum Values: Record monthly minimum and maximum values, including date and time of record. For three-phase measurements, identify phase of recorded value. Record the following parameters:
 - a. Line-to-line voltage.
 - b. Line-to-neutral voltage.
 - c. Current per phase.
 - d. Line-to-line voltage unbalance.
 - e. Line-to-neutral voltage unbalance.
 - f. Power factor.
 - g. Displacement power factor.
 - h. Total power.
 - i. Total reactive power.
 - j. Total apparent power.
 - k. THD voltage L-L.
 - l. THD voltage L-N.
 - m. THD current.
 - n. Frequency.
13. Harmonic Calculation: Display and record the following:
 - a. Harmonic magnitudes and angles for each phase voltage and current through 31st **OR** 63rd, **as directed**, harmonic. Calculate for all three phases, current and voltage, and residual current. Current and voltage information for all phases shall be obtained simultaneously from same cycle.
 - b. Harmonic magnitude reported as a percentage of the fundamental or as a percentage of rms values, as selected by user.
14. Current and Voltage Ratings:
 - a. Designed for use with current inputs from standard instrument current transformers with 5-A secondary and shall have a metering range of 0-10 A.
 - b. Withstand ratings shall be not less than 15 A, continuous; 50 A, lasting over 10 seconds, no more frequently than once per hour; 500 A, lasting 1 second, no more frequently than once per hour.
 - c. Designed for use with voltage inputs from standard instrument potential transformers with a 120-V secondary.
15. Accuracy:
 - a. Comply with ANSI C12.20, Class 0.5; and IEC 60687, Class 0.5 for revenue meters.
 - b. Accuracy from Light to Full Rating:
 - 1) Power: Accurate to 0.25 percent of reading, plus 0.025 percent of full scale.
 - 2) Voltage and Current: Accurate to 0.075 percent of reading, plus 0.025 percent of full scale.
 - 3) Power Factor: Plus or minus 0.002, from 0.5 leading to 0.5 lagging.
 - 4) Frequency: Plus or minus 0.01 Hz at 45 to 67 Hz.
16. Waveform Capture:
 - a. Capture and store steady-state waveforms of voltage and current channels; initiated manually. Each capture shall be for 3 cycles, 128 data points for each cycle, allowing resolution of harmonics to 31st harmonic of basic 60 Hz.
 - b. Store captured waveforms in internal nonvolatile memory; available for PC display, archiving, and analysis.
17. Input: One digital input signal(s).



- a. Normal mode for on/off signal.
- b. Demand interval synchronization pulse, accepting a demand synchronization pulse from a utility demand meter.
- c. Conditional energy signal to control conditional energy accumulation.
- 18. Outputs:
 - a. Operated either by user command sent via communication link, or set to operate in response to user-defined alarm or event.
 - b. Closed in either a momentary or latched mode as defined by user.
 - c. Each output relay used in a momentary contact mode shall have an independent timer that can be set by user.
 - d. One digital KY pulse to a user-definable increment of energy measurement. Output ratings shall be up to 120-V ac, 300-V dc, 50 mA, and provide 3500-V rms isolation.
 - e. One relay output module(s), providing a load voltage range from 20- to 240-V ac or from 20- to 30-V dc, supporting a load current of 2 A.
 - f. Output Relay Control:
 - 1) Relay outputs shall operate either by user command sent via communication link or in response to user-defined alarm or event.
 - 2) Normally open and normally closed contacts, field configured to operate as follows:
 - a) Normal contact closure where contacts change state for as long as signal exists.
 - b) Latched mode when contacts change state on receipts of a pickup signal; changed state is held until a dropout signal is received.
 - c) Timed mode when contacts change state on receipt of a pickup signal; changed state is held for a preprogrammed duration.
 - d) End of power demand interval when relay operates as synchronization pulse for other devices.
 - e) Energy Pulse Output: Relay pulses quantities used for absolute kWh, absolute kVARh, kVAh, kWh In, kVARh In, kWh Out, and kVARh Out.
 - f) Output controlled by multiple alarms using Boolean-type logic.
- 19. Onboard Data Logging:
 - a. Store logged data, alarms, events, and waveforms in 80 **OR** 800, **as directed**, KB of onboard nonvolatile memory.
 - b. Stored Data:
 - 1) Billing Log: User configurable; data shall be recorded every 15 minutes, identified by month, day, and 15-minute interval. Accumulate 24 months of monthly data, 32 days of daily data, and between 2 to 52 days of 15-minute interval data, depending on number of quantities selected.
 - 2) Custom Data Logs: One **OR** Three, **as directed**, user-defined log(s) holding up to 96 parameters. Date and time stamp each entry to the second and include the following user definitions:
 - a) Schedule interval.
 - b) Event definition.
 - c) Configured as "fill-and-hold" or "circular, first-in first-out."
 - 3) Alarm Log: Include time, date, event information, and coincident information for each defined alarm or event.
 - 4) Waveform Log: Store captured waveforms configured as "fill-and-hold" or "circular, first-in first-out."
 - c. Default values for all logs shall be initially set at factory, with logging to begin on device power up.
- 20. Alarms.
 - a. User Options:
 - 1) Define pickup, dropout, and delay.
 - 2) Assign one of four severity levels to make it easier for user to respond to the most important events first.
 - 3) Allow for combining up to four alarms using Boolean-type logic statements for outputting a single alarm.

- b. Alarm Events:
 - 1) Over/undercurrent.
 - 2) Over/undervoltage.
 - 3) Current imbalance.
 - 4) Phase loss, current.
 - 5) Phase loss, voltage.
 - 6) Voltage imbalance.
 - 7) Over kW demand.
 - 8) Phase reversal.
 - 9) Digital input off/on.
 - 10) End of incremental energy interval.
 - 11) End of demand interval.
 - 21. Control Power: 90- to 457-V ac or 100- to 300-V dc.
 - 22. Communications:
 - a. Power monitor shall be permanently connected to communicate via Modbus TCP via a 100 Base-T Ethernet **OR** RS-485 Modbus TCP/IP, **as directed**.
 - b. Local plug-in connections shall be for RS-232 and 100 Base-T Ethernet.
 - 23. Display Monitor:
 - a. Backlighted LCD to display metered data with touch-screen **OR** touch-pad, **as directed**, selecting device.
 - b. Touch-screen display shall be a minimum 12-inch diagonal, resolution of 800 by 600 RGB pixels, 256 colors; NEMA 250, Type 1 display enclosure.
 - c. Display four values on one screen at same time.
 - 1) Current, per phase rms, three-phase average and neutral, **as directed**.
 - 2) Voltage, phase to phase, phase to neutral, and three-phase averages of phase to phase and phase to neutral.
 - 3) Real power, per phase and three-phase total.
 - 4) Reactive power, per phase and three-phase total.
 - 5) Apparent power, per phase and three-phase total.
 - 6) Power factor, per phase and three-phase total.
 - 7) Frequency.
 - 8) Demand current, per phase and three-phase average.
 - 9) Demand real power, three-phase total.
 - 10) Demand apparent power, three-phase total.
 - 11) Accumulated energy (MWh and MVARh).
 - 12) THD, current and voltage, per phase.
 - d. Reset: Allow reset of the following parameters at the display:
 - 1) Peak demand current.
 - 2) Peak demand power (kW) and peak demand apparent power (kVA).
 - 3) Energy (MWh) and reactive energy (MVARh).
- G. Standalone, Web-Enabled Monitoring And Control Instrument
 - 1. Separately mounted, permanently installed instrument for power monitoring and control.
 - a. Enclosure: NEMA 250, Type 1 **OR** 12, **as directed**.
 - 2. Environmental Conditions: System components shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability.
 - a. Indoor installation in non-air-conditioned **OR** nontemperature-controlled, **as directed**, spaces that have environmental controls to maintain ambient conditions of 0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing.
 - 3. Power-Distribution Equipment Monitor: Web enabled, with integral network port and embedded Web server with factory-configured firmware and HTML-formatted Web pages for viewing of power monitoring and equipment status information from connected devices equipped with digital communication ports.



4. LAN Connectivity: Multipoint, RS-485 Modbus serial communication network, interconnecting all breaker trip units, protective relays, drives, and metering devices equipped with communications. Serial communication network connected to Ethernet server that functions as a gateway and server, providing data access via 10 Base-T **OR** 100 Base-T **OR** 100 Base-FX, **as directed**, LAN.
5. Communication Devices within the Equipment: Addressed at factory and tested to verify reliable communication with network server.
6. Server Configuration:
 - a. Initial network parameters set using a standard Web browser. Connect via a local operator interface, or an RJ-45 port accessible from front of equipment.
 - b. Network server shall be factory programmed with embedded HTML-formatted Web pages that are user configurable and that provide detailed communication diagnostic information for serial and Ethernet ports as status of RS-485 network; with internal memory management information pages for viewing using a standard Web browser.
 - c. Login: Password protected; password administration accessible from the LAN using a standard Web browser.
 - d. Operating Software: Suitable for local access; firewall protected.
7. Data Access:
 - a. Network server shall include embedded HTML pages providing real-time information from devices connected to RS-485 network ports via a standard Web browser.
8. Equipment Monitoring Options: Login shall be followed by a main menu for selecting summary Web pages that follow.
9. Summary Web pages shall be factory configured to display the following information for each communicating device within the power equipment lineup:
 - a. User-Configured Custom Home Page: Provide for the lineup, showing status-at-a-glance of key operating values, **as directed**.
 - b. Circuit Summary Page: Circuit name, three-phase average rms current, power (kW), power factor, and breaker status.
 - c. Load Current Summary Page: Circuit name, Phase A, B, and C rms current values.
 - d. Demand Current Summary Page: Circuit name, Phase A, B, and C average demand current values.
 - e. Power Summary Page: Circuit name, present demand power (kW), peak demand power (kW), and recorded time and date.
 - f. Energy Summary Page: Circuit name, energy (kWh), reactive energy (kVARh), and time/date of last reset.
 - g. Transformer Status Page: Transformer tag, coil temperatures, and cooling fan status.
 - h. Motor-Control Center Status Page: Circuit name, three-phase average rms current, thermal capacity (percentage), and drive output frequency (Hz) contactor status.
 - i. Specific Device Pages: Each individual communicating device shall display detailed, real-time information, as appropriate for device type.
 - 1) Display historical energy data that shall be logged automatically for each device, as appropriate for device type.
 - 2) Display historical data logged from each device in graphical time-trend plots. Value to be displayed on time-trend plot shall be user selectable. Time interval to be displayed on scale shall be for previous day or week.
 - j. Export historical energy data to a PC or workstation through network using FTP (File Transfer Protocol). Format exported data in a CSV (Comma Separated Variable) file format for importing into spreadsheet applications.
10. Communications:
 - a. Power monitor: Permanently connected to communicate via RS-485 Modbus TCP/IP **OR** Modbus TCP via an 100 Base-T Ethernet, **as directed**.
 - b. Local Plug-in Connections: RS-232 and 100 Base-T Ethernet.
 - c. Monitor Display: Backlighted LCD to display metered data with touch-screen **OR** touch-pad, **as directed**, selecting device.

H. Workstation Hardware



1. Environmental Conditions: System components shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 - a. Indoor installation in spaces that have environmental controls to maintain ambient conditions of 36 to 122 deg F (2 to 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing.
2. Computer: Standard unmodified PC of modular design. CPU word size shall be 32 bytes or larger; CPU operating speed shall be at least 66 MHz **OR** GHz, **as directed**.
 - a. Memory: 256 MB of usable installed memory, expandable to a minimum of 1024 MB without additional chassis or power supplies.
 - b. Real-Time Clock:
 - 1) Accuracy: Plus or minus 1 minute per month.
 - 2) Time Keeping Format: 24-hour time format including seconds, minutes, hours, date, day, and month; automatic reset by software.
 - 3) Clock shall function for one year without power.
 - 4) Provide automatic time correction once every 24 hours by synchronizing clock with the Time Service Department of the U.S. Naval Observatory.
 - c. Serial Ports: Two RS-232-F serial ports for general use, with additional ports as required. Data transmission rates shall be selectable under program control.
 - d. Parallel Port: Enhanced.
 - e. LAN Adapter Card: 10/100-Mbps PCI bus, internal network interface card.
 - f. Sound Card: For playback and recording of digital WAV sound files associated with audible warning and alarm functions.
 - g. Color Monitor: PC compatible, not less than 18 inches (455 mm), LCD type, with a minimum resolution of 1280 by 1024 pixels, noninterlaced, and a maximum dot pitch of 0.28 mm.
 - h. Keyboard: Minimum of 64 characters, standard ASCII character set based on ANSI INCITS 154.
 - i. Mouse: Standard, compatible with installed software.
 - j. Disk Storage: Include the following, each with appropriate controller:
 - 1) Minimum 80-GB hard disk, maximum average access time of 10 ms.
 - 2) Floppy Disk Drive: High density, 3-1/2-inch (90-mm) size.
 - 3) PCMCIA slot with removable 500-MB media.
 - 4) 100-MB Iomega Zip drive.
 - 5) 250-MB Iomega Jaz drive.
 - k. Magnetic Tape System, **as directed**: 4-mm cartridge magnetic tape system with minimum 2 **OR** 4 **OR** 12 **OR** 20, **as directed**, -GB formatted capacity per tape. Provide 10 tapes, each in a rigid cartridge with spring-loaded cover and operator-selectable write-protect feature.
 - l. Modem: 56,600 bps, full duplex for asynchronous communications. With error detection, auto answer/autodial, and call-in-progress detection. Modem shall comply with requirements in ITU-T v.34, ITU-T v.42, ITU-T v.42 Appendix VI for error correction, and ITU-T v.42 BIS for data compression standards; and shall be suitable for operating on unconditioned voice-grade telephone lines complying with 47 CFR 68.
 - m. Audible Alarm: Manufacturer's standard.
 - n. CD-ROM Drive:
 - 1) Nominal Storage Capacity: 650 MB.
 - 2) Data Transfer Rate: 1.2 Mbps.
 - 3) Average Access Time: 150 ms.
 - 4) Cache Memory: 256 KB.
 - 5) Data Throughput: 1 MB/second, minimum.
 - o. Report Printer: Minimum resolution 600 dpi laser printer.
 - 1) Connected to central station and designated workstations.
 - 2) RAM: 2 MB, minimum.
 - 3) Printing Speed: Minimum 12 pages per minute.



- 4) Paper Handling: Automatic sheet feeder with 250-sheet paper cassette and with automatic feed.
- p. Interface: Bidirectional parallel and universal serial bus.
- q. LAN Adapter Card: 10/100-Mbps internal network interface card.
3. Redundant Central Computer: Connected in a hot standby, peer configuration; automatically maintains copies of system software, application software, and data files. System transactions and other activities that alter system data files shall be updated to system files of redundant computer in near real-time. If central computer fails, redundant computer shall assume control immediately and automatically.
4. UPS: Self-contained; complying with requirements in Division 26 Section "Static Uninterruptible Power Supply".
 - a. Size: Provide a minimum of 6 hours of operation of workstation station equipment, including 2 hours of alarm printer operation, **as directed**.
 - b. Batteries: Sealed, valve regulated, recombinant, lead calcium.
 - c. Accessories:
 - 1) Transient voltage suppression.
 - 2) Input-harmonics reduction.
 - 3) Rectifier/charger.
 - 4) Battery disconnect device.
 - 5) Static bypass transfer switch.
 - 6) Internal maintenance bypass/isolation switch.
 - 7) External maintenance bypass/isolation switch.
 - 8) Output isolation transformer.
 - 9) Remote UPS monitoring.
 - 10) Battery monitoring.
 - 11) Remote battery monitoring.
- I. RS-232 ASCII Interface
 1. ASCII interface shall allow RS-232 connections to be made between a meter or circuit monitor operating as the host PC and any equipment that will accept RS-232 ASCII command strings, such as local display panels **OR** dial-up modems **OR** alarm transmitters, **as directed**.
 2. Pager System Interface: Alarms shall be able to activate a pager system with customized message for each input alarm.
 - a. RS-232 output shall be capable of connection to a pager interface that can be used to call a paging system or service and send a signal to a portable pager. System shall allow an individual alphanumeric message per alarm input to be sent to paging system. This interface shall support both numeric and alphanumeric pagers.
 3. Alarm System Interface:
 - a. RS-232 output shall be capable of transmitting alarms from other monitoring and alarm systems to workstation software.
 4. Cables:
 - a. PVC-Jacketed, RS-232 Cable: Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, polypropylene insulation, and individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage; PVC jacket. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
 - 1) NFPA 70, Type CM.
 - 2) Flame Resistance: UL 1581, Vertical Tray.
 - b. Plenum-Type, RS-232 Cable: Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, plastic insulation, and individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage; plastic jacket. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
 - 1) NFPA 70, Type CMP.
 - 2) Flame Resistance: NFPA 262, Flame Test.
- J. LAN Cables
 1. Comply with Division 27 Section "Communications Horizontal Cabling".



2. RS-485 Cable:
 - a. PVC-Jacketed, RS-485 Cable: Paired, 2 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors, PVC insulation, unshielded, PVC jacket, and NFPA 70, Type CMG.
 - b. Plenum-Type, RS-485 Cable: Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, unshielded, and fluorinated-ethylene-propylene jacket, and NFPA 70, Type CMP.
3. Unshielded Twisted Pair Cables: Category 5e **OR** 6, **as directed**, as specified for horizontal cable for data service in Division 27 Section "Communications Horizontal Cabling".

K. Low-Voltage Wiring

1. Low-Voltage Control Cable: Multiple conductor, color-coded, No. 20 AWG copper, minimum.
 - a. Sheath: PVC; except in plenum-type spaces, use sheath listed for plenums.
 - b. Ordinary Switching Circuits: Three conductors, unless otherwise indicated.
 - c. Switching Circuits with Pilot Lights or Locator Feature: Five conductors, unless otherwise indicated.

1.3 EXECUTION

A. Cabling

1. Comply with NECA 1.
2. Install cables and wiring according to requirements in Division 27 Section "Communications Horizontal Cabling".
3. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters. Conceal raceway and wiring except in unfinished spaces.
OR
Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use NRTL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.
4. Install LAN cables using techniques, practices, and methods that are consistent with specified category rating of components and that ensure specified category performance of completed and linked signal paths, end to end.
5. Install cables without damaging conductors, shield, or jacket.

B. Identification

1. Identify components and power and control wiring according to Division 26 Section "Identification For Electrical Systems".
2. Label each power monitoring and control module with a unique designation.

C. Grounding

1. Comply with IEEE 1100, "Power and Grounding Sensitive Electronic Equipment."

D. Field Quality Control

1. Perform tests and inspections and prepare test reports.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Tests and Inspections:
 - a. Electrical Tests: Use caution when testing devices containing solid-state components.
 - b. Continuity tests of circuits.
 - c. Operational Tests: Set and operate controls at workstation and at monitored and controlled devices to demonstrate their functions and capabilities. Use a methodical sequence that cues and reproduces actual operating functions as recommended by



manufacturer. Submit sequences for approval. Note response to each test command and operation. Note time intervals between initiation of alarm conditions and registration of alarms at central-processing workstation.

- 1) Coordinate testing required by this Section with that required by Sections specifying equipment being monitored and controlled.
 - 2) Test LANs according to requirements in Division 27 Section "Communications Horizontal Cabling".
 - 3) System components with battery backup shall be operated on battery power for a period of not less than 10 percent of calculated battery operating time.
 - 4) Verify accuracy of graphic screens and icons.
 - 5) Metering Test: Load feeders, measure loads on feeder conductor with an rms reading clamp-on ammeter, and simultaneously read indicated current on the same phase at central-processing workstation. Record and compare values measured at the two locations. Resolve discrepancies greater than 5 percent and record resolution method and results.
 - 6) Record metered values, control settings, operations, cues, time intervals, and functional observations and submit test reports printed by workstation printer.
3. Correct deficiencies, make necessary adjustments, and retest. Verify that specified requirements are met.
 4. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.
 5. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.
 6. Remove and replace malfunctioning devices and circuits and retest as specified above.

E. Demonstration

1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain systems.
 - a. Train Owner's management and maintenance personnel in interpreting and using monitoring displays and in configuring and using software and reports. Include troubleshooting, servicing, adjusting, and maintaining equipment. Provide a minimum of 12 hours' training.
 - b. Training Aid: Use approved final versions of software and maintenance manuals as training aids.

END OF SECTION 26 09 23 00



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SECTION 26 09 23 00a - MOTOR-CONTROL CENTERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for motor-control centers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes MCCs for use with ac circuits rated 600 V and less and having the following factory-installed components:
 - a. Incoming main lugs and OCPDs.
 - b. Full-voltage magnetic controllers.
 - c. Reduced-voltage magnetic controllers.
 - d. Reduced-voltage, solid-state controllers.
 - e. Multispeed controllers.
 - f. VFCs.
 - g. Feeder-tap units.
 - h. TVSS.
 - i. Instrumentation.
 - j. Auxiliary devices.

C. Definitions

1. BAS: Building automation system.
2. CE: Conformance Europeene (European Compliance).
3. CPT: Control power transformer.
4. EMI: Electromagnetic interference.
5. GFCI: Ground fault circuit interrupting.
6. IGBT: Insulated-gate bipolar transistor.
7. LAN: Local area network.
8. LED: Light-emitting diode.
9. MCC: Motor-control center.
10. MCCB: Molded-case circuit breaker.
11. MCP: Motor-circuit protector.
12. NC: Normally closed.
13. NO: Normally open.
14. OCPD: Overcurrent protective device.
15. PCC: Point of common coupling.
16. PID: Control action, proportional plus integral plus derivative.
17. PT: Potential transformer.
18. PWM: Pulse-width modulated.
19. RFI: Radio-frequency interference.
20. SCR: Silicon-controlled rectifier.
21. TDD: Total demand (harmonic current) distortion.
22. THD(V): Total harmonic voltage demand.
23. TVSS: Transient voltage surge suppressor.
24. VFC: Variable-frequency controller.

D. Performance Requirements

1. Seismic Performance: MCCs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.



- a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

E. Submittals

1. Product Data: For each type of controller and each type of MCC. Include shipping and operating weights, features, performance, electrical ratings, operating characteristics, and furnished specialties and accessories.
2. LEED Submittals:
 - a. Product Data for Credit EA 5: For continuous metering equipment for energy consumption.
3. Shop Drawings: For each MCC, manufacturer's approval, custom and production drawings as defined in UL 845. In addition to requirements specified in UL 845, include dimensioned plans, elevations, and sections; and conduit entry locations and sizes, mounting arrangements, and details, including required clearances and service space around equipment.
 - a. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - 1) Each installed unit's type and details.
 - 2) Factory-installed devices.
 - 3) Enclosure types and details.
 - 4) Nameplate legends.
 - 5) Short-circuit current (withstand) rating of complete MCC, and for bus structure and each unit.
 - 6) Features, characteristics, ratings, and factory settings of each installed controller and feeder device, and installed devices.
 - 7) Specified optional features and accessories.
 - b. Schematic and Connection Wiring Diagrams: For power, signal, and control wiring for each installed controller.
 - c. Nameplate legends.
 - d. Vertical and horizontal bus capacities.
 - e. Features, characteristics, ratings, and factory settings of each installed unit.
4. Harmonic Analysis Study and Report: Comply with IEEE 399 and NETA Acceptance Testing Specification; identify the effects of nonlinear loads and their associated harmonic contributions on the voltages and currents throughout the electrical system. Analyze possible **OR** designated, **as directed**, operating scenarios, including recommendations for VFC input filtering to limit TDD and THD(V) at each VFC **OR** at the defined PCC, **as directed**, to specified levels.
5. Standard Drawings: For each MCC, as defined in UL 845.
6. Production Drawings: For each MCC, as defined in UL 845.
7. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around MCCs where pipe and ducts are prohibited. Show MCC layout and relationships between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.
8. Seismic Qualification Certificates: For MCCs, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
9. Qualification Data: For qualified testing agency.
10. Product Certificates: For each MCC, from manufacturer.
11. Source quality-control reports.
12. Field quality-control reports.
13. Operation and Maintenance Data: For MCCs, all installed devices, and components to include in emergency, operation, and maintenance manuals. Include the following:



- a. Manufacturer's Record Drawings: As defined in UL 845. In addition to requirements specified in UL 845, include field modifications and field-assigned wiring identification incorporated during construction by manufacturer, Contractor, or both.
 - b. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
 - c. Manufacturer's written instructions for setting field-adjustable overload relays.
 - d. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage, solid-state controllers.
 - e. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
 - f. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.
 14. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.
 15. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.
 16. Warranty: Sample of special warranty.
- F. Quality Assurance
1. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - a. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
 2. Source Limitations: Obtain MCCs and controllers of a single type from single source from single manufacturer.
 3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 4. Comply with NFPA 70.
 5. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
- G. Delivery, Storage, And Handling
1. Deliver MCCs in shipping splits of lengths that can be moved past obstructions in delivery paths.
 2. Handle MCCs according to the following:
 - a. NEMA ICS 2.3, "Instructions for the Handling, Installation, Operation, and Maintenance of Motor Control Centers Rated Not More Than 600 Volts."
 - b. NECA 402, "Recommended Practice for Installing and Maintaining Motor Control Centers."
 3. If stored in space that is not permanently enclosed and air conditioned, remove loose packing and flammable materials from inside MCCs; install temporary electric heating, with at least 250 W per vertical section **OR** connect factory-installed space heaters to temporary electrical service, **as directed**.
- H. Project Conditions
1. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Less than 0 deg F (minus 18 deg C) or exceeding 104 deg F (40 deg C), with an average value exceeding 95 deg F (35 deg C) over a 24-hour period.
 - b. Ambient Storage Temperature: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C).
 - c. Humidity: Less than 95 percent (noncondensing).
 - d. Altitude: Exceeding 6600 feet (2000 m), or 3300 feet (1000 m) if MCC includes solid-state devices.
 2. Interruption of Existing Electrical Service or Distribution Systems: Do not interrupt electrical service to, or distribution systems within, a facility occupied by Owner or others unless permitted



under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:

- a. Notify Owner no fewer than two days in advance of proposed interruption of electrical service.
 - b. Indicate method of providing temporary electrical service.
 - c. Do not proceed with interruption of electrical service without Owner's written permission.
 - d. Comply with NFPA 70E.
3. Product Selection for Restricted Space: Drawings indicate maximum dimensions for MCCs, including clearances between MCCs and adjacent surfaces and other items.

I. Coordination

1. Coordinate sizes and locations of concrete bases. Cast anchor-bolt inserts into bases.
2. Coordinate features of MCCs, installed units, and accessory devices with remote pilot devices and control circuits to which they connect.
3. Coordinate features, accessories, and functions of each MCC, each controller, and each installed unit with ratings and characteristics of supply circuits, motors, required control sequences, and duty cycle of motors and loads.

J. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace TVSS **OR** VFCs, **as directed**, that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period: Five years from date of Final Completion.

1.2 PRODUCTS

A. Manufactured Units

1. General Requirements for MCCs: Comply with NEMA ICS 18 and UL 845, **as directed**.

B. Functional Features

1. Description: Modular arrangement of main units, controller units, control devices, feeder-tap units, instruments, metering, auxiliary devices, and other items mounted in vertical sections of MCC.
2. Controller Units: Combination controller units.
 - a. Install units up to and including Size 3 on drawout mountings with connectors that automatically line up and connect with vertical-section buses while being racked into their normal, energized positions.
 - b. Equip units in Type B and Type C MCCs with pull-apart terminal strips for external control connections.
3. Feeder-Tap Units: Through 225-A rating shall have drawout mountings with connectors that automatically line up and connect with vertical-section buses while being racked into their normal, energized positions.
4. Future Units: Compartments fully bused and equipped with guide rails or equivalent, ready for insertion of drawout units.
5. Spare Units: Installed in compartments indicated "spare."

C. Incoming Mains

1. Incoming Mains Location: Top and bottom, **as directed**.
2. Main Lugs Only: Conductor connectors suitable for use with conductor material and sizes.
 - a. Material: Tin-plated aluminum **OR** Hard-drawn copper, 98 percent conductivity, **as directed**.
 - b. Main and Neutral Lugs: Compression **OR** Mechanical, **as directed**, type.
3. MCCB: Comply with UL 489, with series-connected rating **OR** interrupting capacity, **as directed**, to meet available fault currents.



- a. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - b. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - c. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replaceable electronic trip; and the following field-adjustable settings:
 - 1) Instantaneous trip.
 - 2) Long- and short-time pickup levels.
 - 3) Long- and short-time time adjustments.
 - 4) Ground-fault pickup level, time delay, and I^2t response.
 - d. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 - e. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
 - f. MCCB Features and Accessories:
 - 1) Standard frame sizes, trip ratings, and number of poles.
 - 2) Lugs: Mechanical **OR** Compression, **as directed**, style, suitable for number, size, trip ratings, and conductor material.
 - 3) Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - 4) Ground-Fault Protection: Integrally mounted **OR** Remote-mounted, **as directed**, relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - 5) Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
 - 6) Communication Capability: Circuit-breaker-mounted **OR** Universal-mounted **OR** Integral **OR** Din-rail-mounted, **as directed**, communication module with functions and features compatible with power monitoring and control system specified in Division 16 Section "Electrical Power Monitoring and Control."
 - 7) Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 **OR** 75, **as directed**, percent of rated voltage.
 - 8) Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 - 9) Auxiliary Contacts: One SPDT switch **OR** Two SPDT switches, **as directed**, with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 - 10) Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
4. Insulated-Case Circuit Breaker: 80 **OR** 100, **as directed**, percent rated, sealed, insulated-case power circuit breaker with interrupting capacity rating to meet available fault current.
- a. Fixed **OR** Drawout, **as directed**, circuit-breaker mounting.
 - b. Two-step, stored-energy closing.
 - c. Standard **OR** Full, **as directed**, -function, microprocessor-based trip units with interchangeable rating plug, trip indicators, and the following field-adjustable settings:
 - 1) Instantaneous trip.
 - 2) Long- and short-time time adjustments.
 - 3) Ground-fault pickup level, time delay, and I^2t response.
 - d. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
 - e. Remote trip indication and control.
 - f. Communication Capability: Integral communication module with functions and features compatible with power monitoring and control system specified in Division 16 Section "Electrical Power Monitoring and Control."



- g. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
- h. Control Voltage: 40-V dc **OR** 125-V dc **OR** 250-V dc **OR** 120-V ac, **as directed**.

D. Combination Controllers

1. Full-Voltage Controllers:
 - a. General Requirements for Full-Voltage Enclosed Controllers: Comply with NEMA ICS 2, general purpose, Class A.
 - b. Magnetic Controllers: Full voltage, across the line, electrically held.
 - 1) Configuration: Nonreversing and reversing.
2. Reduced-Voltage Magnetic Controllers:
 - a. General Requirements for Reduced-Voltage Magnetic Controllers: Comply with NEMA ICS 2, general purpose, Class A; closed transition; adjustable time delay on transition.
 - b. Reduced-Voltage Magnetic Controllers: Reduced voltage, electrically held.
 - 1) Configuration:
 - a) Wye-Delta Controller: Four contactors, with a three-phase starting resistor/reactor bank.
 - b) Part-Winding Controller: Separate START and RUN contactors, field-selectable for one-half or two-thirds winding start mode, with either six- or nine-lead motors; with separate overload relays for starting and running sequences.
 - c) Autotransformer Reduced-Voltage Controller: Medium-duty service, with integral overtemperature protection; taps for starting at 50, 65, and 80 percent of line voltage; two START and one RUN contactors.
3. Reduced-Voltage, Solid-State Controllers:
 - a. General Requirements for Reduced-Voltage, Solid-State Controllers: Comply with UL 508.
 - b. Reduced-Voltage, Solid-State Controllers: An integrated unit with power SCRs, heat sink, microprocessor logic board, door-mounted digital display and keypad, bypass contactor, and overload relay; suitable for use with NEMA MG 1, Design B, polyphase, medium-induction motors.
 - 1) Configuration: Standard duty **OR** Severe duty, **as directed**; nonreversible **OR** reversible, **as directed**.
 - 2) Starting Mode: Voltage ramping **OR** Current limit **OR** Torque control **OR** Torque control with voltage boost, **as directed**; field selectable, **as directed**.
 - 3) Stopping Mode: Coast to stop **OR** Adjustable torque deceleration **OR** Adjustable braking, **as directed**; field selectable, **as directed**.
 - 4) Shorting (Bypass) Contactor: Operates automatically when full voltage is applied to motor, and bypasses the SCRs. Solid-state controller protective features shall remain active when the shorting contactor is in the bypass mode.
 - 5) Shorting and Input Isolation, **as directed**, Contactor Coils: Pressure-encapsulated type; manufacturer's standard operating voltage, matching control power or line voltage, depending on contactor size and line-voltage rating. Provide coil transient suppressors, **as directed**.
 - 6) Logic Board: Identical for all ampere ratings and voltage classes, with environmental protective coating.
 - 7) Adjustable acceleration-rate control using voltage or current ramp, and adjustable starting torque control with up to 400 percent current limitation for 20 seconds.
 - 8) SCR bridge shall consist of at least two SCRs per phase, providing stable and smooth acceleration with **OR** without, **as directed**, external feedback from the motor or driven equipment.
 - 9) Keypad, front accessible; for programming the controller parameters, functions, and features; shall be manufacturer's standard and include not less than the following functions:
 - a) Adjusting motor full-load amperes, as a percentage of the controller's rating.



- b) Adjusting current limitation on starting, as a percentage of the motor full-load current rating.
 - c) Adjusting linear acceleration and deceleration ramps, in seconds.
 - d) Initial torque, as a percentage of the nominal motor torque.
 - e) Adjusting torque limit, as a percentage of the nominal motor torque.
 - f) Adjusting maximum start time, in seconds.
 - g) Adjusting voltage boost, as a percentage of the nominal supply voltage.
 - h) Selecting stopping mode, and adjusting parameters.
 - i) Selecting motor thermal-overload protection class between 5 and 30.
 - j) Activating and de-activating protection modes.
 - k) Selecting or activating communications modes.
- 10) Digital display, front accessible; for showing motor, controller, and fault status; shall be manufacturer's standard and include not less than the following:
 - a) Controller Condition: Ready, starting, running, stopping.
 - b) Motor Condition: Amperes, voltage, power factor, power, and thermal state.
 - c) Fault Conditions: Controller thermal fault, motor overload alarm and trip, motor underload, overcurrent, shorted SCRs, line or phase loss, phase reversal, and line frequency over or under normal.
- 11) Controller Diagnostics and Protection:
 - a) Microprocessor-based thermal protection system for monitoring SCR and motor thermal characteristics, and providing controller overtemperature and motor overload alarm and trip; settings selectable via the keypad.
 - b) Protection from line-side reverse phasing; line-side and motor-side phase loss; motor jam, stall, and underload conditions; and line frequency over or under normal.
 - c) Input isolation contactor that opens when the controller diagnostics detect a faulted solid-state component, or when the motor is stopped.
OR
 Shunt trip that opens the disconnecting means when the controller diagnostics detect a faulted solid-state component.
- 12) Remote Output Features:
 - a) All outputs prewired to terminal blocks.
 - b) Form C status contacts that change state when controller is running.
 - c) Form C alarm contacts that change state when a fault condition occurs.
- 13) Optional Features:
 - a) Analog output for field-selectable assignment of motor operating characteristics; 0 to 10-V dc **OR** 4 to 20-mA dc, **as directed**.
 - b) Additional field-assignable Form C contacts for alarm outputs.
 - c) Surge suppressors in solid-state power circuits providing three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
 - d) Full-voltage bypass contactor operating automatically **OR** manually, with NORMAL/BYPASS selector switch, **as directed**. Power contacts shall be totally enclosed, double break, and silver-cadmium oxide; and assembled to allow inspection and replacement without disturbing line or load wiring.
- 4. Multispeed Magnetic Controllers:
 - a. General Requirements for Multispeed Magnetic Controllers: Comply with NEMA ICS 2, general purpose, Class A.
 - b. Multispeed Magnetic Controllers: Two speed, full voltage, across the line, electrically held. Compelling relay to ensure that motor will start only at low speed.
 - 1) Configuration: Nonreversing **OR** Reversing, **as directed**; consequent pole **OR** two winding, **as directed**.
 - 2) Compelling relays shall ensure that motor starts only at low speed.
 - 3) Accelerating timer relays shall ensure properly timed acceleration through speeds lower than that selected.



- 4) Decelerating timer relays shall ensure automatically timed deceleration through each speed.
- 5) Antiplugging timer relays shall ensure a time delay when transferring from FORWARD to REVERSE and back.
5. Disconnecting Means and OCPDs:
 - a. Fusible Disconnecting Means:
 - 1) NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate Class J **OR** Class L, **as directed**, fuses.
 - 2) Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - 3) Auxiliary Contacts: NO/NC, arranged to activate before switch blades open.
 - b. MCP Disconnecting Means:
 - 1) UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
 - 2) Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - 3) Auxiliary contacts "a" and "b" arranged to activate with MCP handle.
 - 4) NC **OR** NO, **as directed**, alarm contact that operates only when MCP has tripped.
 - 5) Current-limiting module to increase controller short-circuit current (withstand) rating to 100 kA.
 - c. MCCB Disconnecting Means:
 - 1) UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
 - 2) Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 3) Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - 4) Auxiliary contacts "a" and "b" arranged to activate with MCCB handle.
 - 5) NC **OR** NO, **as directed**, alarm contact that operates only when MCCB has tripped.
 - d. Molded-Case Switch Disconnecting Means:
 - 1) UL 489, NEMA AB 1, and NEMA AB 3, with in-line fuse block for Class J or L power fuses (depending on ampere rating), providing an interrupting capacity to comply with available fault currents; MCCB with fixed, high-set instantaneous trip only.
 - 2) Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - 3) Auxiliary contacts "a" and "b" arranged to activate with molded-case switch handle.
 - 4) NC **OR** NO, **as directed**, alarm contact that operates only when molded-case switch has tripped.
6. Overload Relays:
 - a. Melting-Alloy Overload Relays:
 - 1) Inverse-time-current characteristic.
 - 2) Class 10 **OR** Class 20 **OR** Class 30, **as directed**, tripping characteristic.
 - 3) Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
 - b. Bimetallic Overload Relays:
 - 1) Inverse-time-current characteristic.
 - 2) Class 10 **OR** Class 20 **OR** Class 30, **as directed**, tripping characteristic.
 - 3) Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
 - 4) Ambient compensated.
 - 5) Automatic resetting.
 - c. Solid-State Overload Relays:
 - 1) Switch or dial selectable for motor running overload protection.



- 2) Sensors in each phase.
- 3) Class 10 **OR** Class 20 **OR** Class 10/20 selectable, **as directed**, tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
 - a) Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
 - b) Analog communication module.
- d. NC **OR** NO, **as directed**, isolated overload alarm contact.
- e. External overload reset push button.
- 7. Control Power:
 - a. Control Circuits: 24 **OR** 120, **as directed**, -V ac; obtained from integral CPT, with primary and secondary fuses, with CPT **OR** control power source, **as directed**, of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
 - 1) CPT Spare Capacity: 50 **OR** 100 **OR** 200, **as directed**, VA.

E. VFCS

- 1. General Requirements for VFCs: Comply with NEMA ICS 7, NEMA ICS 61800-2, and UL 508C, **as directed**.
- 2. Application: Constant torque and variable torque, **as directed**.
- 3. VFC Description: Variable-frequency power converter (rectifier, dc bus, and IGBT PWM inverter) factory packaged in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.
 - a. Units suitable for operation of NEMA MG 1, Design A and Design B motors as defined by NEMA MG 1, Section IV, Part 30, "Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both."
 - b. Units suitable for operation of inverter-duty motors as defined by NEMA MG 1, Section IV, Part 31, "Definite-Purpose Inverter-Fed Polyphase Motors."
 - c. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.
 - d. Listed and labeled for single-phase use by an NRTL acceptable to authorities having jurisdiction.
- 4. Design and Rating: Match load type such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.
- 5. Output Rating: Three-phase; 10 to 60 Hz, with voltage proportional to frequency throughout voltage range **OR** 66 Hz, with torque constant as speed changes, **as directed**; maximum voltage equals input voltage.
- 6. Unit Operating Requirements:
 - a. Input AC Voltage Tolerance: Plus 10 and minus 10 **OR** 15, **as directed**, percent of VFC input voltage rating.
 - b. Input AC Voltage Unbalance: Not exceeding 3 **OR** 5, **as directed**, percent.
 - c. Input Frequency Tolerance: Plus or minus 3 percent of VFC frequency rating.
 - d. Minimum Efficiency: 96 **OR** 97, **as directed**, percent at 60 Hz, full load.
 - e. Minimum Displacement Primary-Side Power Factor: 96 **OR** 98, **as directed**, percent under any load or speed condition.
 - f. Overload Capability: 1.1 **OR** 1.5, **as directed**, times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.
 - g. Starting Torque: Minimum of 100 percent of rated torque from 3 to 60 Hz.
 - h. Speed Regulation: Plus or minus 5 **OR** 10, **as directed**, percent.
 - i. Output Carrier Frequency: Selectable; 0.5 to 15 kHz.
 - j. Stop Modes: Programmable; includes fast, free-wheel, and dc injection braking.
- 7. Inverter Logic: Microprocessor based, 16 **OR** 32, **as directed**, bit, isolated from all power circuits.



8. Isolated Control Interface: Allows VFCs to follow remote-control signal over a minimum 40:1 speed range.
 - a. Signal: Electrical.
OR
Signal: Pneumatic.
9. Internal Adjustability Capabilities:
 - a. Minimum Speed: 5 to 25 percent of maximum rpm.
 - b. Maximum Speed: 80 to 100 percent of maximum rpm.
 - c. Acceleration: 0.1 to 999.9 seconds.
 - d. Deceleration: 0.1 to 999.9 seconds.
 - e. Current Limit: 30 to a minimum of 150 percent of maximum rating.
10. Self-Protection and Reliability Features:
 - a. Input transient protection by means of surge suppressors to provide three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
 - b. Loss of Input Signal Protection: Selectable response strategy including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.
 - c. Under- and overvoltage trips.
 - d. Inverter overcurrent trips.
 - e. VFC and Motor Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFCs and motor thermal characteristics, and for providing VFC overtemperature and motor overload alarm and trip; settings selectable via the keypad; NRTL approved.
 - f. Critical frequency rejection, with three selectable, adjustable deadbands.
 - g. Instantaneous line-to-line and line-to-ground overcurrent trips.
 - h. Loss-of-phase protection.
 - i. Reverse-phase protection.
 - j. Short-circuit protection.
 - k. Motor overtemperature fault.
11. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.
12. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.
13. Bidirectional Autospeed Search: Capable of starting VFC into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.
14. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.
15. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
16. Integral Input Disconnecting Means and OCPD: NEMA AB 1, instantaneous-trip circuit breaker **OR** NEMA AB 1, molded-case switch, with power fuse block and current-limiting fuses **OR** NEMA AB 1, thermal-magnetic circuit breaker **OR** NEMA KS 1, nonfusible switch, with power fuse block and current-limiting fuses **OR** NEMA KS 1, fusible switch, **as directed**, with pad-lockable, door-mounted handle mechanism.
 - a. Disconnect Rating (for VFCs without bypass systems): Not less than 115 percent of VFC input current rating.
 - b. Disconnect Rating (for VFCs with bypass systems): Not less than 115 percent of NFPA 70 motor full-load current rating or VFC input current rating, whichever is larger.
 - c. Auxiliary Contacts: NO/NC, arranged to activate before switch blades open.
 - d. Auxiliary contacts "a" and "b" arranged to activate with circuit-breaker handle.
 - e. NC **OR** NO, **as directed**, alarm contact that operates only when circuit breaker has tripped.



F. VFC Controls And Indication

1. Status Lights: Door-mounted LED indicators displaying the following conditions:
 - a. Power on.
 - b. Run.
 - c. Overvoltage.
 - d. Line fault.
 - e. Overcurrent.
 - f. External fault.
2. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.
 - a. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.
 - b. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: View only; view and operate; and view, operate, and service.
 - 1) Control Authority: Supports at least four conditions: Off, local manual control at VFC, local automatic control at VFC, and automatic control through a remote source.
3. Historical Logging Information and Displays:
 - a. Running log of total power versus time.
 - b. Total run time.
 - c. Fault log, maintaining last four faults with time and date stamp for each.
4. Indicating Devices: Digital display and additional readout devices as required, mounted flush in VFC door and connected to display VFC parameters, including, but not limited to:
 - a. Output frequency (Hz).
 - b. Motor speed (rpm).
 - c. Motor status (running, stop, fault).
 - d. Motor current (amperes).
 - e. Motor torque (percent).
 - f. Fault or alarming status (code).
 - g. PID feedback signal (percent).
 - h. DC-link voltage (V dc).
 - i. Set point frequency (Hz).
 - j. Motor output voltage (V ac).
5. Control Signal Interfaces:
 - a. Electric Input Signal Interface:
 - 1) A minimum of two programmable analog inputs: 0- to 10-V dc **OR** 4- to 20-mA dc **OR** Operator-selectable "x"- to "y"-mA dc, **as directed**.
 - 2) A minimum of six multifunction programmable digital inputs.
 - b. Pneumatic Input Signal Interface: 3 to 15 psig (20 to 104 kPa).
 - c. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BAS or other control systems:
 - 1) 0- to 10-V dc.
 - 2) 4- to 20-mA dc.
 - 3) Potentiometer using up/down digital inputs.
 - 4) Fixed frequencies using digital inputs.
 - d. Output Signal Interface: A minimum of one programmable analog output signal(s) (0- to 10-V dc **OR** 4- to 20-mA dc **OR** operator-selectable "x"- to "y"-mA dc, **as directed**), which can be configured for any of the following:
 - 1) Output frequency (Hz).
 - 2) Output current (load).
 - 3) DC-link voltage (V dc).
 - 4) Motor torque (percent).
 - 5) Motor speed (rpm).
 - 6) Set point frequency (Hz).



- e. Remote Indication Interface: A minimum of two programmable dry-circuit relay outputs (120-V ac, 1 A) for remote indication of the following:
 - 1) Motor running.
 - 2) Set point speed reached.
 - 3) Fault and warning indication (overtemperature or overcurrent).
 - 4) PID high- or low-speed limits reached.
 6. PID Control Interface: Provides closed-loop set point, differential feedback control in response to dual feedback signals. Allows for closed-loop control of fans and pumps for pressure, flow, or temperature regulation.
 - a. Number of Loops: One **OR** Two, **as directed**.
 7. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display VFC status and alarms and energy usage, **as directed**. Allows VFC to be used with an external system within a multidrop LAN configuration; settings retained within VFC's nonvolatile memory.
 - a. Network Communications Ports: Ethernet and RS-422/485.
 - b. Embedded BAS Protocols for Network Communications: ASHRAE 135 BACnet **OR** Echelon LonWorks **OR** Ethernet TCP/IP **OR** Johnson Metasys N2 **OR** Modbus/Memobus **OR** Siemens System 600 APOGEE, **as directed**; protocols accessible via the communications ports.
- G. VFC Line Conditioning And Filtering
1. Input Line Conditioning: Based on the harmonic analysis study and report, provide input filtering, as required, to limit TDD at input terminals of VFCs to less than 5 **OR** 8, **as directed**, percent and THD(V) to 3 **OR** 5, **as directed**, percent.
 2. Input Line Conditioning: Based on the harmonic analysis study and report, provide input filtering, as required, to limit TDD and THD(V) at the defined PCC per IEEE 519.
 3. Input Line Conditioning: **<Insert requirements>**.
 4. VFC Output Filtering: **<Insert requirements>**.
 5. EMI/RFI Filtering: CE marked; certify compliance with IEC 61800-3 for Category C2.
- H. VFC Bypass Systems
1. Bypass Operation: Safely transfers motor between power converter output and bypass circuit, manually, automatically, or both. Selector switches set modes, and indicator lights indicate mode selected. Unit is capable of stable operation (starting, stopping, and running) with motor completely disconnected from power converter.
 2. Bypass Mode: Manual operation only; requires local operator selection at VFC. Transfer between power converter and bypass contactor and retransfer shall only be allowed with the motor at zero speed.
OR
 Bypass Mode: Field-selectable automatic or manual, allows local and remote transfer between power converter and bypass contactor and retransfer, either via manual operator interface or automatic control system feedback.
 3. Bypass Controller: Two-contactor-style bypass allows motor operation via the power converter or the bypass controller; with input isolating switch and barrier arranged to isolate the power converter and permit safe troubleshooting and testing, both energized and de-energized, while motor is operating in bypass mode, **as directed**.
 - a. Bypass Contactor: Load-break, IEC **OR** NEMA, **as directed**, -rated contactor.
 - b. Output Isolating Contactor: Non-load-break, IEC **OR** NEMA, **as directed**, -rated contactor.
 - c. Isolating Switch: Non-load-break switch arranged to isolate power converter and permit safe troubleshooting and testing of the power converter, both energized and de-energized, while motor is operating in bypass mode; pad-lockable, door-mounted handle mechanism.**OR**
 Bypass Controller: Three-contactor-style bypass allows motor operation via the power converter or the bypass controller; with input isolating switch and barrier, **as directed**, arranged to isolate



- the power converter input and output and permit safe testing and troubleshooting of the power converter, both energized and de-energized, while motor is operating in bypass mode.
- a. Bypass Contactor: Load-break, IEC **OR** NEMA, **as directed**, -rated contactor.
 - b. Input and Output Isolating Contactors: Non-load-break, IEC **OR** NEMA, **as directed**, -rated contactors.
 - c. Isolating Switch: Non-load-break switch arranged to isolate power converter and permit safe troubleshooting and testing of the power converter, both energized and de-energized, while motor is operating in bypass mode; pad-lockable, door-mounted handle mechanism.
4. Bypass Contactor Configuration: Full-voltage (across-the-line) **OR** Reduced-voltage (autotransformer), **as directed**, type.
 - a. NORMAL/BYPASS selector switch.
 - b. HAND/OFF/AUTO selector switch.
 - c. NORMAL/TEST Selector Switch: Allows testing and adjusting of VFC while the motor is running in the bypass mode.
 - d. Contactor Coils: Pressure-encapsulated type with coil transient suppressors, **as directed**.
 - 1) Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
 - 2) Power Contacts: Totally enclosed, double break, and silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
 - e. Control Circuits: 120-V ac; obtained from integral CPT, with primary and secondary fuses **as directed**, with CPT **OR** control power source, **as directed**, of sufficient capacity to operate all integral devices and remotely located pilot, indicating, and control devices.
 - f. CPT Spare Capacity: 50 **OR** 100 **OR** 200, **as directed**, VA.
 5. Overload Relays: NEMA ICS 2.
 - a. Melting-Alloy Overload Relays:
 - 1) Inverse-time-current characteristic.
 - 2) Class 10 **OR** Class 20 **OR** Class 30, **as directed**, tripping characteristic.
 - 3) Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
 - b. Bimetallic Overload Relays:
 - 1) Inverse-time-current characteristic.
 - 2) Class 10 **OR** Class 20 **OR** Class 30, **as directed**, tripping characteristic.
 - 3) Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
 - 4) Ambient compensated.
 - 5) Automatic resetting.
 - c. Solid-State Overload Relays:
 - 1) Switch or dial selectable for motor-running overload protection.
 - 2) Sensors in each phase.
 - 3) Class 10 **OR** Class 20 **OR** Class 10/20 selectable, **as directed**, tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
 - 4) Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
 - 5) Analog communication module.
 - 6) NC **OR** NO, **as directed**, isolated overload alarm contact.
 - 7) External overload reset push button.
- I. Optional VFC Features
1. Multiple-Motor Capability: VFC suitable for variable-speed service to multiple motors. Overload protection shuts down VFC and motors served by it, and generates fault indications, when overload protection activates.
 - a. Configure to allow two or more motors to operate simultaneously at the same speed; separate overload relay for each controlled motor.



- b. Configure to allow two motors to operate separately; operator selectable via local or remote switch or contact closures; single overload relay for both motors; separate output magnetic contactors for each motor.
 - c. Configure to allow two motors to operate simultaneously and in a lead/lag mode, with one motor operated at variable speed via the power converter and the other at constant speed via the bypass controller; separate overload relay for each controlled motor.
- 2. Damper control circuit with end of travel feedback capability.
- 3. Sleep Function: Senses a minimal deviation of a feedback signal and stops the motor. On an increase in speed-command signal deviation, VFC resumes normal operation.
- 4. Motor Preheat Function: Preheats motor when idle to prevent moisture accumulation in the motor.
- 5. Firefighter's Override (Smoke Purge) Input: On a remote contact closure from the firefighter's control station **OR** smoke-control fan controller, **as directed**, this password-protected input:
 - a. Overrides all other local and external inputs (analog/digital, serial communication, and all keypad commands).
 - b. Forces VFC to operate motor, without any other run or speed command, at a field-adjustable, preset speed.
OR
Forces VFC to transfer to Bypass Mode and operate motor at full speed.
 - c. Causes display of Override Mode on the VFC display.
 - d. Reset VFC to normal operation on removal of override signal automatically **OR** manually, **as directed**.
- 6. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.
- 7. Remote digital operator kit.
- 8. Communication Port: RS-232 port, USB 2.0 port, or equivalent connection capable of connecting a printer and a notebook computer.

J. Feeder-Tap Units

- 1. MCCB: Comply with UL 489, with series-connected rating **OR** interrupting capacity, **as directed**, to meet available fault currents.
 - a. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - b. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - c. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replaceable electronic trip; and the following field-adjustable settings:
 - 1) Instantaneous trip.
 - 2) Long- and short-time pickup levels.
 - 3) Long- and short-time time adjustments.
 - 4) Ground-fault pickup level, time delay, and I^2t response.
 - d. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 - e. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
 - f. MCCB Features and Accessories:
 - 1) Standard frame sizes, trip ratings, and number of poles.
 - 2) Lugs: Mechanical **OR** Compression, **as directed**, style, suitable for number, size, trip ratings, and conductor material.
 - 3) Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.



- 4) Ground-Fault Protection: Integrally mounted **OR** Remote-mounted, **as directed**, relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
- 5) Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
- 6) Communication Capability: Circuit-breaker-mounted **OR** Universal-mounted **OR** Integral **OR** Din-rail-mounted, **as directed**, communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring And Control".
- 7) Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 **OR** 75, **as directed**, percent of rated voltage.
- 8) Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
- 9) Auxiliary Contacts: One SPDT switch **OR** Two SPDT switches, **as directed**, with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
- 10) Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
2. Fusible Switch: NEMA KS 1, Type HD, clips to accommodate specified fuses with lockable handle.
3. Fuses are specified in Division 26 Section "Fuses".

K. Transient Voltage Suppression Devices

1. Surge Protection Device Description: IEEE C62.41-compliant, integrally mounted, wired-in **OR** plug-in **OR** bolt-on, **as directed**, solid-state, parallel-connected, modular (with field-replaceable modules) **OR** non-modular, **as directed**, type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the MCC short-circuit rating, and with the following features and accessories:
 - a. Fuses, rated at 200-kA interrupting capacity.
 - b. Fabrication using bolted compression lugs for internal wiring.
 - c. Integral disconnect switch.
 - d. Redundant suppression circuits.
 - e. Redundant replaceable modules.
 - f. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 - g. LED indicator lights for power and protection status.
 - h. Audible alarm, with silencing switch, to indicate when protection has failed.
 - i. Form-C contacts rated at 5 A and 250-V ac, one NO and one NC, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
 - j. Four **OR** Six, **as directed**, -digit, transient-event counter set to totalize transient surges.
2. Peak Single-Impulse Surge Current Rating: 160 kA per mode/320 kA per phase **OR** 120 kA per mode/240 kA per phase **OR** 80 kA per mode/160 kA per phase, **as directed**.
3. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
4. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 **OR** 208Y/120 **OR** 600Y/347, **as directed**, -V, three-phase, four-wire circuits shall be as follows:
 - a. Line to Neutral: 800 V for 480Y/277 **OR** 400 V for 208Y/120 **OR** 1200 V for 600Y/347, **as directed**.
 - b. Line to Ground: 800 V for 480Y/277 **OR** 400 V for 208Y/120 **OR** 1200 V for 600Y/347, **as directed**.
 - c. Neutral to Ground: 800 V for 480Y/277 **OR** 400 V for 208Y/120 **OR** 1200 V for 600Y/347, **as directed**.

OR

Protection modes and UL 1449 SVR for 240/120-V, three-phase, four-wire circuits with high leg shall be as follows:



- a. Line to Neutral: 400 V, 800 V from high leg.
- b. Line to Ground: 400 V.
- c. Neutral to Ground: 400 V.

OR

Protection modes and UL 1449 SVR for 240-, 480-, or 600-V, three-phase, three-wire, delta circuits shall be as follows:

- a. Line to Line: 2000 V for 480 V **OR** 1000 V for 240 V **OR** 2500 V for 600 V, **as directed**.
- b. Line to Ground: 1500 V for 480 V **OR** 800 V for 240 V **OR** 2500 V for 600 V, **as directed**.

L. Instrumentation

1. Instrument Transformers (for Owner metering): IEEE C57.13, NEMA EI 21.1, and the following:
 - a. PTs: IEEE C57.13; 120 V, 60 Hz, single **OR** tapped **OR** double, **as directed**, secondary; disconnecting type with integral fuse mountings. Burden and accuracy shall be consistent with connected metering and relay devices.
 - b. Current Transformers: IEEE C57.13; 5 A, 60 Hz, secondary; wound **OR** bushing **OR** bar or window, **as directed**, type; single **OR** double, **as directed**, secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
 - c. CPTs: Dry type, mounted in separate compartments for units larger than 3 kVA.
 - d. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.
2. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:
 - a. Listed or recognized by a nationally recognized testing laboratory.
 - b. Inputs from sensors or 5-A current-transformer secondaries, and potential terminals rated to 600 V.
 - c. Switch-selectable digital display of the following values with the indicated maximum accuracy tolerances:
 - 1) Phase Currents, Each Phase: Plus or minus 1 percent.
 - 2) Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
 - 3) Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
 - 4) Three-Phase Real Power (Megawatts): Plus or minus 2 percent.
 - 5) Three-Phase Reactive Power (Megavars): Plus or minus 2 percent.
 - 6) Power Factor: Plus or minus 2 percent.
 - 7) Frequency: Plus or minus 0.5 percent.
 - 8) Accumulated Energy, Megawatt Hours: Plus or minus 2 percent; accumulated values unaffected by power outages up to 72 hours.
 - 9) Megawatt Demand: Plus or minus 2 percent; demand interval programmable from five to 60 minutes.
 - 10) Contact devices to operate remote impulse-totalizing demand meter.
 - d. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.
3. Ammeters, Voltmeters, and Power-Factor Meters: ANSI C39.1.
 - a. Meters: 4-inch (100-mm) diameter or 6 inches (150 mm) square, flush or semiflush, with antiparallax 250-degree scale and external zero adjustment.
 - b. Voltmeters: Cover an expanded-scale range of nominal voltage plus 10 percent.
4. Instrument Switches: Rotary type with off position.
 - a. Voltmeter Switches: Permit reading of all phase-to-phase voltages and phase-to-neutral voltages where a neutral is included.
 - b. Ammeter Switches: Permit reading of current in each phase and maintain current-transformer secondaries in a closed-circuit condition at all times.



5. Feeder Ammeters: 2-1/2-inch (64-mm) minimum size with 90- or 120-degree scale. Meter and transfer device with off position, located on overcurrent device door for feeder circuits, unless otherwise indicated.
 6. Watt-Hour Meters and Wattmeters:
 - a. Comply with ANSI C12.1.
 - b. Three-phase induction type with two stators, each with current and potential coil, rated 5 A, 120 V, 60 Hz.
 - c. Suitable for connection to three- and four-wire circuits.
 - d. Potential indicating lamps.
 - e. Adjustments for light and full load, phase balance, and power factor.
 - f. Four-dial clock register.
 - g. Integral demand indicator.
 - OR**
 - h. Contact devices to operate remote impulse-totalizing demand meter.
 - i. Ratchets to prevent reverse rotation.
 - j. Removable meter with drawout test plug.
 - k. Semiflush mounted case with matching cover.
 - l. Appropriate multiplier tag.
 7. Impulse-Totalizing Demand Meter:
 - a. Comply with ANSI C12.1.
 - b. Suitable for use with MCC watt-hour meter, including two-circuit totalizing relay.
 - c. Cyclometer.
 - d. Four-dial, totalizing kilowatt-hour register.
 - e. Positive chart drive mechanism.
 - f. Capillary pen holding a minimum of one month's ink supply.
 - g. Roll chart with minimum 31-day capacity; appropriate multiplier tag.
 - h. Capable of indicating and recording five **OR** 15 **OR** 30, **as directed**, -minute integrated demand of totalized system.
- M. MCC Control Power
1. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from CPT.
OR
Control Circuits: 120-V ac, supplied from remote branch circuit.
 2. Electrically Interlocked Main and Tie Circuit Breakers: Two CPTs in separate compartments, with interlocking relays, connected to the primary side of each CPT at the line side of the associated main circuit breaker. 120-V secondaries connected through automatic transfer relays to ensure a fail-safe automatic transfer scheme.
 3. Control Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.
 4. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.
- N. Enclosures
1. Indoor Enclosures: Freestanding steel cabinets unless otherwise indicated. NEMA 250, Type 1 **OR** Type 1A **OR** Type 2 **OR** Type 12, **as directed**, unless otherwise indicated to comply with environmental conditions at installed location.
 2. Space Heaters: Factory-installed electric space heaters of sufficient wattage in each vertical section to maintain enclosure temperature above expected dew point.
 - a. Space-Heater Control: Thermostats to maintain temperature of each section above expected dew point **OR** Manual switching of branch-circuit protective device, **as directed**.
 - b. Space-Heater Power Source: Transformer, factory installed in MCC **OR** 120-V external branch circuit, **as directed**.
 3. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray **OR** custom color, **as directed**, finish over a rust-inhibiting primer on treated metal surface.



4. Outdoor Enclosures: Type 3R, non-walk-in aisle **OR** Type 3R, with interior-lighted walk-in aisle, **as directed**.
 - a. Finish: Factory-applied finish in manufacturer's standard **OR** custom, **as directed**, color; undersurfaces treated with corrosion-resistant undercoating.
 - b. Enclosure: Flat **OR** Downward, rearward sloping, **as directed**, roof; bolt-on rear covers **OR** rear hinged doors, **as directed**, for each section, with provisions for padlocking.
 - c. Doors: Personnel door at each end of aisle, minimum width of 30 inches (762 mm); opening outwards; with panic hardware and provisions for padlocking **OR** cylinder lock, **as directed**.
 - d. Accessories: Fluorescent lighting fixtures, ceiling mounted; wired to a three-way light switch at each end of aisle; GFCI duplex receptacle; emergency battery pack lighting fixture installed on wall of aisle midway between personnel doors.
 - e. Walk-in Aisle Heating and Ventilating:
 - 1) Factory-installed electric unit heater(s), wall or ceiling mounted, with integral thermostat and disconnect and with capacities to maintain switchboard interior temperature of 40 deg F (5 deg C) with outside design temperature of 104 deg F (40 deg C).
 - 2) Factory-installed exhaust fan with capacities to maintain switchboard interior temperature of 100 deg F (38 deg C) with outside design temperature of 23 deg F (minus 5 deg C).
 - 3) Ventilating openings complete with replaceable fiberglass air filters, **as directed**.
 - 4) Thermostat: Single stage; wired to control heat and exhaust fan.
 - f. Power for Space Heaters, Ventilation, Lighting, and Receptacle: Include a CPT within the switchboard. Supply voltage shall be 120 **OR** 120/240 **OR** 120/208, **as directed**, -V ac.
OR
Power for space heaters, ventilation, lighting, and receptacle provided by a remote source.
5. Compartments: Modular; individual lift-off, **as directed**, doors with concealed hinges and quick-captive screw fasteners. Interlocks on units requiring disconnecting means in off position before door can be opened or closed, except by operating a permissive release device.
6. Interchangeability: Compartments constructed to allow for removal of units without opening adjacent doors, disconnecting adjacent compartments, or disturbing operation of other units in MCC; same size compartments to permit interchangeability and ready rearrangement of units, such as replacing three single units with a unit requiring three spaces, without cutting or welding.
7. Wiring Spaces:
 - a. Vertical wireways in each vertical section for vertical wiring to each unit compartment; supports to hold wiring in place.
 - b. Horizontal wireways in bottom **OR** top **OR** bottom and top, **as directed**, of each vertical section for horizontal wiring between vertical sections; supports to hold wiring in place.

O. Auxiliary Devices

1. General Requirements for Control-Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.
 - a. Push Buttons, Pilot Lights, and Selector Switches: Heavy **OR** Standard, **as directed**, -duty, oiltight, **as directed**, type.
 - 1) Push Buttons: Covered **OR** Lockable **OR** Recessed **OR** Shielded **OR** Shrouded **OR** Unguarded, **as directed**, types; maintained **OR** momentary, **as directed**, contact unless otherwise indicated.
 - 2) Pilot Lights: Incandescent **OR** LED **OR** Neon **OR** Resistor **OR** Transformer, **as directed**, types; <Insert color(s)>; push to test, **as directed**.
 - 3) Selector Switches: Rotary type.
 - b. Elapsed-Time Meters: Heavy duty with digital readout in hours; nonresettable **OR** resettable, **as directed**.
 - c. Meters: Panel type, 2-1/2-inch (64-mm) minimum size with 90- or 120-degree scale and plus or minus 2 percent accuracy with selector switches having an off position.
2. NC **OR** NO **OR** Reversible NC/NO, **as directed**, contactor auxiliary contact(s).



3. Control Relays: Auxiliary and adjustable pneumatic **OR** solid-state, **as directed**, time-delay relays.
 4. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.
 5. Space heaters, with NC auxiliary contacts, to mitigate condensation in enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.
 6. Sun shields installed on fronts, sides, and tops of enclosures installed outdoors and subject to direct and extended sun exposure.
 7. Cover gaskets for Type 1 enclosures.
 8. Terminals for connecting power factor correction capacitors to the line **OR** load, **as directed**, side of overload relays.
 9. Spare control-wiring terminal blocks; unwired **OR** wired, **as directed**.
 10. Spare-Fuse Cabinet: Identified and compartmented steel box **OR** cabinet with hinged lockable door, **as directed**.
- P. Characteristics And Ratings
1. Wiring: NEMA ICS 18, Class I **OR** Class I-S, **as directed**, Type A **OR** Type B, for starters above Size 3 **OR** Type B-D, for starter Size 3 and below **OR** Type B-T, for starter Size 3 and below **OR** Type C, **as directed**.
OR
Wiring: NEMA ICS 18, Class II **OR** Class II-S, **as directed**, Type B, for starters above Size 3 **OR** Type B-D, for starter Size 3 and below **OR** Type B-T, for starter Size 3 and below **OR** Type C, **as directed**.
 2. Control and Load Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.
 3. Nominal System Voltage: 480 V, three phase, three wire **OR** 480Y/277 V, three phase, four wire, **as directed**.
OR
Nominal System Voltage: 208 V, three phase, three wire **OR** 208/120 V, three phase, four wire, **as directed**.
 4. Short-Circuit Current Rating for Each Unit: Combination series rated **OR** Fully rated, **as directed**; 22 **OR** 42 **OR** 65 **OR** 100, **as directed**, kA.
 5. Short-Circuit Current Rating of MCC: Combination series rated **OR** Fully rated, **as directed**, with its main overcurrent device; 22 **OR** 42 **OR** 65 **OR** 100, **as directed**, kA.
 6. Environmental Ratings:
 - a. Ambient Temperature Rating: Not less than 0 deg F (minus 18 deg C) and not exceeding 104 deg F (40 deg C), with an average value not exceeding 95 deg F (35 deg C) over a 24-hour period.
 - b. Ambient Storage Temperature Rating: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C)
 - c. Humidity Rating: Less than 95 percent (noncondensing).
 - d. Altitude Rating: Not exceeding 6600 feet (2000 m), or 3300 feet (1000 m) if MCC includes solid-state devices.
 7. Main-Bus Continuous Rating: 600 **OR** 800 **OR** 1000 **OR** 1200 **OR** 1600 **OR** 2000, **as directed**, A.
 8. Vertical-Bus Minimum, **as directed**, Continuous Rating: 300 **OR** 600 **OR** 1200, **as directed**, A.
 9. Horizontal and Vertical Bus Bracing (Short-Circuit Current Rating): Match MCC short-circuit current rating.
 10. Main Horizontal and Equipment Ground Buses: Uniform capacity for entire length of MCC's main and vertical sections. Provide for future extensions from both ends, **as directed**. Brace bus extensions for busway feeder bus, **as directed**.
 11. Vertical Phase and Equipment Ground Buses: Uniform capacity for entire usable height of vertical sections, except for sections incorporating single units.



12. Phase- and Neutral-, **as directed**, Bus Material: Hard-drawn copper of 98 percent conductivity, silver **OR** tin, **as directed**, plated.
OR
Phase- and Neutral-, **as directed**, Bus Material: Tin-plated, high-strength, electrical-grade aluminum alloy.
13. Neutral Buses: 50 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical **OR** compression, **as directed**, connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus, **as directed**.
OR
Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical **OR** compression, **as directed**, connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus, **as directed**.
14. Ground Bus: Minimum size required by UL 845, hard-drawn copper of 98 percent conductivity, equipped with mechanical **OR** compression, **as directed**, connectors for feeder and branch-circuit equipment grounding conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run, **as directed**.
15. Front-Connected, Front-Accessible MCCs:
 - a. Main Devices: Drawout **OR** Fixed, **as directed**, mounted.
 - b. Controller Units: Drawout and fixed, **as directed**, mounted.
 - c. Feeder-Tap Units: Drawout and fixed, **as directed**, mounted.
 - d. Sections front and rear aligned.
16. Utility Metering Compartment: Fabricated, barrier compartment and section complying with utility company's requirements; hinged sealed door; buses provisioned for mounting utility company's current transformers and potential transformers or potential taps as required by utility company. If separate vertical section is required for utility metering, match and align with basic MCC. Provide service entrance label and necessary applicable service entrance features.
17. Owner Metering Compartment: A separate customer metering compartment and section with front hinged door, metering, and current transformers for each meter. Current transformer secondary wiring shall be terminated on shorting-type terminal blocks. Include potential transformers having primary and secondary fuses with disconnecting means and secondary wiring terminated on terminal blocks, **as directed**.
18. Bus Transition and Incoming Pull Sections: Matched and aligned with basic MCC.
19. Pull Box on Top of an MCC:
 - a. Adequate ventilation to maintain temperature in pull box within same limits as MCC.
 - b. Set back from front to clear circuit-breaker removal mechanism.
 - c. Removable covers forming top, front, and sides. Top covers at rear easily removable for drilling and cutting.
 - d. Insulated bottom of fire-resistive material with separate holes for cable drops into MCC.
 - e. Cable supports arranged to facilitate cabling and adequate to support cables, including those for future installation.
 - f. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.
20. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of unit.
21. Bus-Bar Insulation: Factory-applied, flame-retardant, tape wrapping of individual bus bars or flame-retardant, spray-applied insulation. Minimum insulation temperature rating of 105 deg C.
22. Fungus Proofing: Permanent fungicidal treatment for OCPDs and other components including instruments and instrument transformers.

Q. Source Quality Control

1. MCC Testing: Inspect and test MCCs according to requirements in NEMA ICS 18.
2. VFC Testing: Test and inspect VFCs according to requirements in NEMA ICS 61800-2.
 - a. Test each VFC while connected to its specified motor **OR** a motor that is comparable to that for which the VFC is rated, **as directed**.



- b. Verification of Performance: Rate VFCs according to operation of functions and features specified.
3. MCCs will be considered defective if they do not pass tests and inspections.
4. Prepare test and inspection reports.

1.3 EXECUTION

A. Examination

1. Examine areas and surfaces to receive MCCs, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of the Work.
2. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Harmonic Analysis Study

1. Perform a harmonic analysis study to identify the effects of nonlinear loads and their associated harmonic contributions on the voltages and currents throughout the electrical system. Analyze possible **OR** designated, **as directed**, operating scenarios, including recommendations for VFC input filtering to limit TDD and THD(V) at the defined PCC to specified levels.
2. Prepare a harmonic analysis study report complying with IEEE 399 and NETA Acceptance Testing Specification.

C. Installation

1. Coordinate layout and installation of MCCs with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
2. Floor-Mounting Controllers: Install MCCs on 4-inch (100-mm) nominal thickness concrete base. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Seismic Bracing: Comply with requirements specified in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
4. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
5. Install fuses in each fusible switch.
6. Install fuses in control circuits if not factory installed. Comply with requirements in Division 26 Section "Fuses".
7. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.
8. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.
9. Install power factor correction capacitors. Connect to the line **OR** load, **as directed**, side of overload relays. If connected to the load side of overload relays, adjust overload heater sizes to accommodate the reduced motor full-load currents.
10. Comply with NECA 1.

D. Identification

1. Comply with requirements in Division 26 Section "Identification For Electrical Systems" for identification of MCC, MCC components, and control wiring.



- a. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - b. Label MCC and each cubicle with engraved nameplate.
 - c. Label each enclosure-mounted control and pilot device.
 - d. Mark up a set of manufacturer's connection wiring diagrams with field-assigned wiring identifications and return to manufacturer for inclusion in Record Drawings.
 2. Operating Instructions: Frame printed operating instructions for MCCs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of MCCs.
- E. Control Wiring Installation
1. Install wiring between enclosed controllers **OR** master terminal boards, **as directed**, and remote devices and facility's BAS **OR** and facility's central-control system, **as directed**. Comply with requirements in Division 26 Section "Control-voltage Electrical Power Cables".
 2. Bundle, train, and support wiring in enclosures.
 3. Connect selector switches and other automatic-control selection devices where applicable.
 - a. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
 - b. Connect selector switches within enclosed controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.
- F. Connections
1. Comply with requirements for installation of conduit in Division 26 Section "Raceway And Boxes For Electrical Systems". Drawings indicate general arrangement of conduit, fittings, and specialties.
 2. Comply with requirements in Division 26 Section "Grounding And Bonding For Electrical Systems".
- G. Field Quality Control
1. Perform tests and inspections.
 2. Acceptance Testing Preparation:
 - a. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
 - b. Test continuity of each circuit.
 3. Tests and Inspections:
 - a. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
 - b. Test insulation resistance for each enclosed controller element, component, connecting motor supply, feeder, and control circuits.
 - c. Test continuity of each circuit.
 - d. Verify that voltages at controller locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Owner before starting the motor(s).
 - e. Test each motor for proper phase rotation.
 - f. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - g. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - h. Perform the following infrared (thermographic) scan tests and inspections and prepare reports:
 - 1) Initial Infrared Scanning: After Final Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each multipole enclosed controller. Remove front panels so joints and connections are accessible to portable scanner.
 - 2) Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each multipole enclosed controller 11 months after date of Final Completion.



- 3) Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - i. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
 - j. Mark up a set of manufacturer's drawings with all field modifications incorporated during construction and return to manufacturer for inclusion in Record Drawings.
 4. Enclosed controllers will be considered defective if they do not pass tests and inspections.
 5. Prepare test and inspection reports, including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- H. Startup Service
1. Perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.
- I. Adjusting
1. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
 2. Adjust overload relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.
 3. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to six times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Owner before increasing settings.
 4. Set the taps on reduced-voltage autotransformer controllers at 50 **OR** 65 **OR** 80, **as directed**, percent.
 5. Set field-adjustable switches and program microprocessors for required start and stop sequences in reduced-voltage, solid-state controllers.
 6. Program microprocessors in VFCs for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Final Completion.
 7. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study".
- J. Protection
1. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.
 2. Replace controllers whose interiors have been exposed to water or other liquids prior to Final Completion.
- K. Demonstration
1. Train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers, and to use and reprogram microprocessor-based, reduced-voltage, solid-state controllers, **as directed**.

END OF SECTION 26 09 23 00a



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SECTION 26 09 23 00b - CENTRAL DIMMING CONTROLS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for central dimming controls. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes microprocessor-based central dimming controls with the following components:
 - a. Control network.
 - b. Master-control stations.
 - c. Partitioned-space master-control stations.
 - d. Wall stations.
 - e. Dimmer cabinets.
 - f. Manual switches and plates for controlling dimmers.

C. Definitions

1. Fade Override: The ability to temporarily set fade times to zero for all lighting scenes.
2. Fade Rate: The time it takes each zone to arrive at the next scene, dependent on the degree of change in lighting level.
3. Fade Time: The time it takes all zones to fade from one lighting scene to another, with all zones arriving at the next scene at the same time.
4. Low Voltage: As defined in NFPA 70, term for circuits and equipment operating at less than 50 V or for remote-control, signaling, and power-limited circuits.
5. Scene: The lighting effect created by adjusting several zones of lighting to the desired intensity.
6. SCR: Silicon-controlled rectifier.
7. Zone: A fixture or group of fixtures controlled simultaneously as a single entity. Also known as a "channel."

D. Submittals

1. Product Data: For each type of product indicated.
 - a. For central dimming controls; include elevation, features, characteristics, and labels.
 - b. For dimmer panels; include dimensions, features, dimmer characteristics, ratings, and directories.
 - c. Device plates, plate color, and material.
 - d. Ballasts and lamp combinations compatible with dimmer controls.
 - e. Sound data including results of operational tests of central dimming controls.
 - f. Operational documentation for software and firmware.
2. Shop Drawings: Detail assemblies of standard components, custom assembled for specific application on Project. Indicate dimensions, weights, arrangement of components, and clearance and access requirements.
 - a. Include elevation views of front panels of control and indicating devices and control stations.
 - b. Wiring Diagrams: Power, signal, and control wiring.
3. Samples: For master-control stations, partitioned-space master-control stations, wall stations, dimmer cabinets, and faceplates with factory-applied color finishes and technical features.
 - a. Operation and Maintenance Data: For central dimming controls with remote-mounting dimmers to include in emergency, operation, and maintenance manuals.
4. Warranty: Special warranty specified in this Section.



E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Comply with 47 CFR 15, Subparts A and B, for Class A digital devices.
3. Comply with NFPA 70.

F. Warranty

1. Manufacturer's standard form in which manufacturer agrees to repair or replace components of central dimming controls that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Damage from transient voltage surges.
 - b. Warranty Period: Cost to repair or replace any parts for two years from date of Final Completion.
 - c. Extended Warranty Period: Cost of replacement parts (materials only, f.o.b. the nearest shipping point to Project site), for eight years, that failed in service due to transient voltage surges.

G. Software Service Agreement

1. Services in this Article may not be allowed for publicly funded projects.
2. Technical Support: Beginning with Final Completion, provide software support for two years.
3. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Final Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - a. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.2 PRODUCTS

A. General System Requirements

1. Compatibility: Dimming control components shall be compatible with other elements of lighting fixtures, ballasts, transformers, and lighting controls.
2. Line-Voltage Surge Suppression: Factory installed as an integral part of 120- and 277-V ac, solid-state dimmers and control panels.
 - a. Alternative Line-Voltage Surge Suppression: Comply with requirements in Division 26 Section "Transient-voltage Suppression For Low-voltage Electrical Power Circuits" for Category A **OR** B, **as directed**, locations.
3. Dimmers and Dimmer Modules: Comply with UL 508.
 - a. Audible Noise and Radio-Frequency Interference Suppression: Solid-state dimmers shall operate smoothly over their operating ranges without audible lamp or dimmer noise or radio-frequency interference. Modules shall include integral or external filters to suppress audible noise and radio-frequency interference.
 - b. Dimmer or Dimmer-Module Rating: Not less than 125 percent of connected load unless otherwise indicated.

B. System Description

1. Description: Microprocessor-based, solid-state controls consisting of control stations and a separately mounted dimmer cabinet.
 - a. Operation: Change variable dimmer settings of indicated number of zones simultaneously from one preset scene to another when a rocker switch **OR** pushbutton **OR** slider, **as directed**, is operated.
 - b. System control shall include master station(s), wall stations, and dimmer panels.
 - c. Each zone shall be configurable to control the following light sources:



- 1) Fluorescent lamps with electronic **OR** magnetic, **as directed**, ballasts.
 - 2) Line-voltage incandescent lamps.
 - 3) Low-voltage incandescent lamps.
 - 4) Cold cathode lamps.
 - 5) Non-dimmed loads.
 - 6) LED lamps.
 - d. Control of each zone shall interface with controls for the following accessory functions:
 - 1) Curtains and drapes.
 - 2) Blackout curtains.
 - 3) Projector screens.
 - 4) Motorized partitions.
 - 5) Manually positioned partitions.
 - e. Memory: Retain preset scenes and fade settings through power failures for at least 90 days by retaining physical settings of controls or by an on-board, automatically recharged battery.
- C. Control Network
1. Dimmers shall receive signals from control stations that are linked to dimmer cabinet with a common network data cable.
 2. Functions of network control stations shall be set up at master station that include the number and arrangement of scene presets, zones, and fade times at wall stations.
 - a. Control Voltage: 24- or 10-V dc.
 - b. Comply with USITT AMX 192 **OR** USITT DMX 512, **as directed**, for data transmission.
- D. Master-Control Stations
1. Functions and Features:
 - a. Control adjustment of the lighting level for each scene of each zone, and adjustment of fade-time setting for each scene change from one preset scene to another. Controls shall use analog manual sliders **OR** digital rocker switches with LCD graphic display of light level, **as directed**.
 - b. Master channel shall raise and lower lighting level of all zones.
 - c. Fade rate for each scene shall be adjustable from zero to 60 seconds.
 - d. Fade override control for each scene.
 - e. Recall each preset scene and allow adjustment of zone controls associated with that scene.
 - f. Lockout switch to prevent changes when set.
 - g. On and off scene controls for non-dim channel contactors.
 - h. Emergency-control pushbutton to bypass all controls, turning all dimmers to full bright and turning on non-dim channel contactors.
 - i. Master on and off switch; off position enables housekeeping controls.
 - j. Housekeeping controls to turn on selected lighting fixtures for housekeeping functions.
 - k. Pushbuttons for accessory functions.
 - l. Enable and disable wall stations.
 - m. Communications link to other master stations.
 - n. Provide for connecting a portable computer to program the master station.
 - o. Rear-illuminate all scene-select buttons.
 - p. Show lighting-level setting and fade-rate setting graphically using LEDs or backlighted bargraph indicator.
 2. Mounting: Single, flush wall box with manufacturer's standard faceplate with hinged transparent locking cover, **as directed**.
- E. Partitioned-Space Master-Control Station
1. Functions and Features:
 - a. Automatically combine and separate lighting and accessory function controls as spaces are configured with movable partitions; with controls for adjustment of the lighting level for



- each scene of each dimmer, and adjustment of fade-rate setting for each scene change from one preset scene to another.
- b. Master controls shall accommodate partitioning the space into six adjacent rooms.
- c. Manual controls to set up six scenes for each room. Include wall stations in each room to control scenes.
- d. Master channel to raise and lower the lighting level of all zones.
- e. Adjustable fade rate for each scene from zero to 60 seconds.
- f. Fade override control for each scene.
- g. On and off scene controls for non-dim channel contactors.
- h. Emergency-control pushbutton to bypass all controls, turning all dimmers to full bright and turning on non-dim channel contactors.
- i. Master on and off switch; off position enables housekeeping controls.
- j. Housekeeping controls to turn on selected lighting fixtures for housekeeping functions.
- k. Pushbuttons for accessory functions.
- l. Provide for connecting a portable computer to program the master station.
- m. Rear-illuminate all scene-select buttons.
- n. Show lighting-level setting and fade-rate setting graphically using LEDs or backlighted bar-graph indicator.
- 2. Custom Graphics. Include a graphical display of room configurations and the names for each. Indicate the current spaces configuration with LCD graphic or LED-illuminated indicators, and show which wall stations are active. Inactive wall stations shall be automatically deactivated.
- 3. Mounting: Single, flush wall box with manufacturer's standard faceplate with hinged transparent locking cover, **as directed**.

F. Wall Stations

- 1. Functions and Features:
 - a. Wall stations shall function as a submaster to a master station, containing limited control of selected scenes of the master station.
 - b. Controls to adjust the lighting level of each dimmer for each scene, and the fade time setting for each scene change from one preset scene to another.
 - c. Numbered pushbuttons to select scenes.
 - d. Off switch to turn master station off. Operating the off switch at any remote station shall automatically turn on selected housekeeping lighting, **as directed**.
 - e. On switch turns all scenes of master station to full bright.
 - f. Pushbutton controls for accessory functions.
- 2. Mounting: Flush, wall box with manufacturer's standard faceplate.
- 3. Hand-held Cordless Control: Scene-select and accessory function pushbuttons using infrared **OR** radio-frequency, **as directed**, transmission.

G. Dimmer Cabinets

- 1. Factory wired, convection cooled without fans, with barriers to accommodate 120- and 277-V feeders and suitable to control designated lighting equipment or accessory functions.
- 2. Ambient Conditions:
 - a. Temperature: 60 to 95 deg F (15 to 35 deg C).
 - b. Relative Humidity: 10 to 90 percent, noncondensing.
 - c. Filtered air supply.
- 3. Dimmer Cabinet Assembly: NRTL listed and labeled.
- 4. Cabinet Type: Plug in, modular, and accepting dimmers of each specified type in any plug-in position.
 - a. Integrated Fault-Current Rating: 10,000-A RMS symmetrical.
- 5. Lighting Dimmers: Solid-state SCR dimmers.
 - a. Primary Protection: Magnetic or thermal-magnetic circuit breaker, also serving as the disconnecting means.
 - b. Dimmer response to control signal shall follow the "Square Law Dimming Curve" specified in IESNA's "IESNA Lighting Handbook."



- c. Dimming Range: 0 to 100 percent, full output voltage not less than 98 percent of line voltage.
 - d. Dimmed circuits shall be filtered to provide a minimum 350-mic.sec. current-rise time at a 90-degree conduction angle and 50 percent of rated dimmer capacity. Rate of current rise shall not exceed 30 mA/mic.sec., measured from 10 to 90 percent of load-current waveform.
 - e. Protect controls of each dimmer with a fuse and transient voltage surge suppression, **as directed**.
 6. Non-dim modules shall include relays with contacts rated to switch 20-A tungsten-filament load at 120-V ac and 20-A electronic ballast load at 277-V ac.
 7. Accessory function control modules shall be compatible with requirement of the accessory being controlled.
 8. Digital Control Network:
 - a. Dimmers shall receive digital signals from digital network control stations that are linked to the dimmer cabinet with a common network data cable.
 - b. Functions of digital network control stations shall be set up at the dimmer cabinet's electronic controls that include indicated number and arrangement of scene presets, channels, and fade times.
 9. Emergency Power Transfer Switch: Comply with UL 1008; factory prewired and pretested to automatically transfer load circuits from normal to emergency power supply when normal supply fails.
 - a. Transfer from normal to emergency supply when normal-supply voltage drops to 55 percent or less.
 - b. Retransfer immediately to normal on failure of emergency supply and after an adjustable time-delay of 10 to 90 seconds on restoration of normal supply while emergency supply is available.
 - c. Integrated Fault-Current Rating: Same value as listed for the panel.
 - d. Test Switch: Simulate failure of normal supply to test controls associated with transfer scheme.
 - e. Fabricate and test dimmer boards to withstand seismic forces defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
- H. Portable Computer
1. Description: As recommended by master-control station manufacturer, to program master station and associated wall stations, and all interconnected master stations, **as directed**. Portable computer shall be laptop style with a battery runtime of at least two hours. Display shall be an 11-inch (280-mm) interactive-matrix LCD and shall have required hardware, firmware, and software to program specified control functions of master-control stations.
 2. Software shall be configured and customized by master-station manufacturer.
- I. Manual Switches And Plates
1. Switches: Modular, momentary pushbutton, low-voltage type.
 - a. Color: White unless otherwise indicated.
 - b. Integral Pilot Light: Indicate when circuit is on. Use where indicated.
 - c. Locator Light: Internal illumination.
 - d. Wall Plates: Comply with requirements in Division 26 Section "Wiring Devices" for materials, finish, and color. Use multigang plates if more than one switch is indicated at a location.
 - e. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.
- J. Conductors And Cables
1. Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-voltage Electrical Power Conductors And Cables".



2. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 **OR** 22 **OR** 24, **as directed**, AWG. Comply with requirements in Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
3. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 **OR** 16 **OR** 18, **as directed**, AWG. Comply with requirements in Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
4. Unshielded, Twisted-Pair Data Cable: Category 5e **OR** 6, **as directed**. Comply with requirements in Division 27 Section "Communications Horizontal Cabling".

1.3 EXECUTION

A. Wiring Installation

1. Comply with NECA 1.
2. Wiring Method:
 - a. Comply with requirements in Division 26 Section "Low-voltage Electrical Power Conductors And Cables"
 - b. Install unshielded, twisted-pair cable for control and signal transmission conductors, complying with Division 27 Section "Communications Horizontal Cabling".
 - c. Minimum conduit size shall be 1/2 inch (13 mm).
3. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
4. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
5. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
6. Install dimmer cabinets for each zone.

B. Identification

1. Comply with requirements in Division 26 Section "Identification For Electrical Systems" for identifying components and power and control wiring.
2. Label each dimmer module with a unique designation.
3. Label each scene control button with approved scene description.

C. Field Quality Control

1. Perform tests and inspections and prepare test reports.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Tests and Inspections:
 - a. Continuity tests of circuits.
 - b. Operational Test: Set and operate controls to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.
 - 1) Include testing of dimming control equipment under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.
 - c. Emergency Power Transfer: Test listed functions.
3. Remove and replace malfunctioning dimming control components and retest as specified above.
4. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.
5. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

D. Demonstration



1. Engage a factory-authorized service representative to train **OR** Train, **as directed**, Owner's maintenance personnel to adjust, operate, and maintain central dimming controls. Laptop portable computer shall be used in training, **as directed**.
2. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control system specified in Division 26 Section "Network Lighting Controls".

END OF SECTION 26 09 23 00b



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SECTION 26 09 23 00c - MODULAR DIMMING CONTROLS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for modular dimming controls. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Manual modular dimming controls.
 - b. Integrated, multipreset modular dimming controls.

C. Definitions

1. Fade Rate: The time it takes each zone to arrive at the next scene, dependent on the degree of change in lighting level.
2. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling and power-limited circuits.
3. Scene: The lighting effect created by adjusting several zones of lighting to the desired intensity.
4. SCR: Silicon-controlled rectifier.
5. Zone: A fixture or group of fixtures controlled simultaneously as a single entity. Also known as a "channel."

D. Submittals

1. Product Data: For each type of product indicated.
 - a. For modular dimming controls; include elevation, dimensions, features, characteristics, ratings, and labels.
 - b. Device plates and plate color and material.
 - c. Ballasts and lamp combinations compatible with dimmers.
 - d. Wiring Diagrams: Power, signal, and control wiring.
2. Samples: For master and remote-control stations, and faceplates with factory-applied color finishes and technical features.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Comply with NFPA 70.

1.2 PRODUCTS

A. General Dimming Device Requirements

1. Compatibility: Dimming control components shall be compatible with other elements of lighting fixtures, ballasts, transformers, and lighting controls.
2. Dimmers and Dimmer Modules: Comply with UL 508.
 - a. Audible Noise and Radio-Frequency Interference Suppression: Solid-state dimmers shall operate smoothly over their operating ranges without audible lamp or dimmer noise or radio-frequency interference. Modules shall include integral or external filters to suppress audible noise and radio-frequency interference.
 - b. Dimmer or Dimmer-Module Rating: Not less than 125 percent of connected load unless otherwise indicated.



B. Manual Modular Multiscene Dimming Controls

1. Description: Factory-fabricated equipment providing manual modular dimming control consisting of a wall-box-mounted, master-scene controller and indicated number of wall-box zone stations. Controls and dimmers shall be integrated for mounting in one-, two-, or three-gang wall box under a single wall plate. Each zone station shall be adjustable to indicated number of scenes, which shall be recorded on the zone controller.
2. Operation: Automatically change variable dimmer settings of indicated number of zones simultaneously from one preset scene to another when a push button is operated.
3. Each manual modular multiscene dimming controller shall include a master control and remote controls.
4. Each zone shall be configurable to control the following:
 - a. Fluorescent lamps with electronic **OR** magnetic, **as directed**, ballasts.
 - b. Incandescent lamps.
 - c. Low-voltage incandescent lamps.
5. Memory: Retain preset scenes through power failures for at least seven days.
6. Device Plates: Style, material, and color shall comply with Division 26 Section "Wiring Devices".
7. Master-Scene Controller: Suitable for mounting in a single flush wall box.
 - a. Switches: Master off, group dim, group bright, and selectors for each scene.
 - b. LED indicator lights, one associated with each scene switch, and one for the master off switch.
8. Fluorescent Zone Dimmer: Suitable for operating lighting fixtures and ballasts specified in Division 26 Section "Interior Lighting", and arranged to dim number of scenes indicated for the master-scene controller. Scene selection is at the master-scene controller for setting light levels of each zone associated with scene.
 - a. Switch: Rocker **OR** Slider, **as directed**, style for setting the light level for each scene.
 - b. LED indicator lights, one associated with each scene.
 - c. Electrical Rating: 1000 **OR** 2000, **as directed**, VA, 120 V.
9. Incandescent Zone Dimmer: Suitable for operating incandescent lamps at line-voltage or low-voltage lamps connected to a transformer and arranged to dim number of scenes indicated for the master-scene controller. Scene selection shall be at the master-scene controller for setting light levels of each zone associated with scene.
 - a. Switch: Rocker **OR** Slider, **as directed**, style for setting the light level for each scene.
 - b. LED indicator lights, one associated with each scene.
 - c. Voltage Regulation: Dimmer shall maintain a constant light level, with no visible flicker, when the source voltage varies plus or minus 2 percent in RMS voltage.

C. Integrated, Multipreset Modular Dimming Controls

1. Indicate number of wall-box, remote-control stations.
2. Description: Factory-fabricated, microprocessor-based, solid-state controls providing manual dimming control consisting of a master station and multiple wall-box, remote-control stations.
3. Operation: Automatically changes variable dimmer settings of indicated number of zones simultaneously from one preset scene to another when a push button is operated.
4. Each zone shall be configurable to control the following:
 - a. Fluorescent lamps with electronic **OR** magnetic, **as directed**, ballasts.
 - b. Incandescent lamps.
 - c. Low-voltage incandescent lamps.
5. Memory: Retain preset scenes and fade settings through power failures by retaining physical settings of controls.
6. Master Station:
 - a. Contains control panel and multiple control and dimmer modules.
 - b. Controls and commands adjustment of each dimmer-zone setting for each scene change from one preset scene to another.
 - 1) Master zone raises and lowers lighting level.
 - 2) Adjustable fade rate for each scene from 1 to 60 seconds.
 - c. Rear-illuminated, scene-select buttons.



- d. Lighting-level setting and fade-rate setting shall be graphically shown using LEDs or backlighted bar-graph indicator.
 - e. Mounting: Flush wall box with manufacturer's standard faceplate.
- 7. Remote-Control Stations:
 - a. Numbered push buttons to select scenes.
 - b. Off switch to turn master station off. Operating the off switch at any remote station shall automatically turn on selected housekeeping lighting, **as directed**.
 - c. On switch turns all scenes of master station to full bright.
 - d. Control Wiring: NFPA 70, Class 2.
 - e. Mounting: Single flush wall box with manufacturer's standard faceplate.
- 8. Infrared Remote-Control Station: Same functions as for standard remote-control station, except that functions are input by a hand-held infrared transmitter.
- 9. Dimmers: Modular, plug-in type, with circuit breaker to protect the dimmer and branch circuit.
 - a. Dimming Circuit: Two SCR dimmers, in inverse parallel configuration.
 - b. Dimming Curve: Modified "square law" as specified in IESNA's "IESNA Lighting Handbook"; control voltage is 0- to 10-V dc.
 - c. Dimming Range: 0 to 100 percent, full output voltage not less than 98 percent of line voltage.
 - d. Voltage Regulation: Dimmer shall maintain a constant light level, with no visible flicker, when the source voltage varies plus or minus 2 percent in RMS voltage.
 - e. Short-Circuit Rating: 10 kA for 120 V, 14 kA for 277 V.
- D. Conductors And Cables
 - 1. Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
 - 2. Class 2 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 **OR** 22 **OR** 24, **as directed**, AWG. Comply with requirements in Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

1.3 EXECUTION

- A. Wiring Installation
 - 1. Comply with NECA 1.
 - 2. Wiring Method: Comply with requirements in Division 26 Section "Low-voltage Electrical Power Conductors And Cables". Minimum conduit size shall be 1/2 inch (13 mm).
 - 3. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
 - 4. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
 - 5. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- B. Identification
 - 1. Comply with requirements in Division 26 Section "Identification For Electrical Systems" for identifying components and power and control wiring.
 - 2. Label each dimmer module with a unique designation.
 - 3. Label each scene control button with approved scene description.
- C. Field Quality Control
 - 1. Perform tests and inspections and prepare test reports.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.



2. Tests and Inspections:
 - a. Continuity tests of circuits.
 - b. Operational Test: Set and operate controls to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.
 - 1) Include testing of modular dimming control equipment under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.
3. Remove and replace malfunctioning modular dimming control components and retest as specified above.
4. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.
5. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

D. Demonstration

1. Engage a factory-authorized service representative to train **OR** Train, **as directed**, Owner's maintenance personnel to adjust, operate, and maintain modular dimming controls. Laptop portable computer shall be used in training, **as directed**.
2. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control system specified in Division 26 Section "Network Lighting Controls".

END OF SECTION 26 09 23 00c



SECTION 26 11 16 00 - SWITCHGEAR

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for switchgear. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes metal-enclosed, low-voltage power circuit-breaker switchgear rated 1000 V and less for use in ac systems.

C. Definitions

1. ATS: Acceptance Testing Service.
2. GFCI: Ground-fault circuit interrupter.

D. Submittals

1. Product Data: For each type of switchgear, circuit breaker, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
2. Shop Drawings: For each type of switchgear and related equipment.
 - a. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Include the following:
 - b. Wiring Diagrams: Power, signal, and control wiring.
3. Coordination Drawings: Floor plans showing dimensioned layout, required working clearances, and required area above and around switchgear where pipe and ducts are prohibited. Show switchgear layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.
4. Samples: Representative portion of mimic bus with specified finish. Manufacturer's color charts showing colors available for mimic bus.
5. Manufacturer Seismic Qualification Certification: Submit certification that switchgear, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
6. Field quality-control test reports.
7. Updated mimic-bus diagram reflecting field changes after final switchgear load connections have been made, for record.
8. Operation and Maintenance Data: For switchgear and components to include in emergency, operation, and maintenance manuals. Include the following:
 - a. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - b. Time-current curves, including selectable ranges for each type of overcurrent protective device.

E. Quality Assurance

1. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - a. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.



2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
3. Comply with NFPA 70.

F. Delivery, Storage, And Handling

1. Deliver switchgear in sections of lengths that can be moved past obstructions in delivery path.
2. Store switchgear indoors in clean dry space with uniform temperature to prevent condensation. Protect switchgear from exposure to dirt, fumes, water, corrosive substances, and physical damage.
3. If stored in areas subjected to weather, cover switchgear to provide protection from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside switchgear; install electric heating (250 W per section) to prevent condensation.

G. Project Conditions

1. Installation Pathway: Remove and replace building components and structures to provide pathway for moving switchgear into place.
2. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service.
3. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchgear, including clearances between switchgear, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
4. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding 40 deg C.
 - b. Altitude: Not exceeding 6600 feet (2010 m).

1.2 PRODUCTS

A. Ratings

1. Nominal System Voltage: 480 V, 3 wire **OR** 480/277 V, 4 wire **OR** 240 V, 3 wire **OR** 208/120 V, 4 wire, **as directed**, 60 Hz.
2. Main-Bus Continuous: 4000 **OR** 3200 **OR** 2000 **OR** 1600, **as directed**, A.
3. Short-Time and Short-Circuit Current: Match rating of highest-rated circuit breaker in switchgear assembly.

B. Fabrication

1. Factory assembled and tested and complying with IEEE C37.20.1.
2. Indoor Enclosure Material: Steel.
3. Outdoor Enclosure Material: Galvanized steel.
4. Outdoor Enclosure Fabrication Requirements: Weatherproof; integral structural-steel base frame with factory-applied asphaltic undercoating; and each compartment equipped with the following features:
 - a. Structural design and anchorage adequate to resist loads imposed by 125-mph (200-km/h), **as directed**, wind.
 - b. Space heater operating at one-half or less of rated voltage, sized to prevent condensation.
 - c. Louvers equipped with insect and rodent screen and filter; arranged to permit air circulation while excluding insects, rodents, and exterior dust.
 - d. Hinged front door with padlocking provisions.
 - e. Interior light with switch.
 - f. Weatherproof duplex receptacle.



- g. Common internal aisle of sufficient width to permit protective-device withdrawal, disassembly, and servicing in aisle.
 - h. Aisle access doors with outside padlocking provisions and interior panic latches.
 - i. Aisle space heaters operating at one-half or less of rated voltage, thermostatically controlled.
 - j. Vaporproof fluorescent aisle lights with low-temperature ballasts, controlled by wall switch at each entrance.
 - k. GFCI duplex receptacles, a minimum of two, located in aisle.
 - l. Aisle ventilation louvers equipped with insect and rodent screen and filter and arranged to permit air circulation while excluding insects, rodents, and exterior dust.
5. Finish: IEEE C37.20.1, manufacturer's standard gray finish over a rust-inhibiting primer on phosphatizing-treated metal surfaces.
 6. Section barriers between main and tie circuit-breaker compartments shall be extended to rear of section.
 7. Bus isolation barriers shall be arranged to isolate line bus from load bus at each main and tie circuit breaker.
 8. Circuit-breaker compartments shall be equipped to house drawout-type circuit breakers and shall be fitted with hinged outer doors.
 9. Fabricate enclosure with removable, hinged, rear cover panels to allow access to rear interior of switchgear.
 10. Auxiliary Compartments: Match and align with basic switchgear assembly. Include the following:
 - a. Utility metering compartment that complies with utility company requirements.
 - b. Bus transition sections.
 - c. Incoming-line pull sections.
 - d. Hinged front panels for access to metering, accessory, and blank compartments.
 - e. Pull box on top of switchgear for extra room for pulling cable, with removable top, front, and side covers and ventilation provisions adequate to maintain air temperature in pull box within same limits as switchgear.
 - 1) Set pull box back from front to clear circuit-breaker lifting mechanism.
 - 2) Bottom: Insulating, fire-resistant material with separate holes for cable drops into switchgear.
 - 3) Cable Supports: Arranged to ease cabling and adequate to support cables indicated, including those for future installation.
 11. Bus bars connect between vertical sections and between compartments. Cable connections are not permitted.
 - a. Main Phase Bus: Uniform capacity the entire length of assembly.
 - b. Neutral Bus: 50 **OR** 100, **as directed**, percent of phase-bus ampacity, except as indicated. Equip bus with pressure-connector terminations for outgoing circuit neutral conductors. Include braces for neutral-bus extensions for busway feeders.
 - c. Vertical Section Bus Size: Comply with IEEE C37.20.1, including allowance for spare circuit breakers and spaces for future circuit breakers.
 - d. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent minimum conductivity, with copper feeder circuit-breaker line connections.
OR
 Phase- and Neutral-Bus Material: Silver- or tin-plated, high-strength, electrical-grade aluminum alloy, with copper or tin-plated aluminum circuit-breaker line connections.
OR
 Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent minimum conductivity or tin-plated, high-strength, electrical-grade aluminum alloy.
 - e. Use silver-plated copper or tin-plated aluminum for connecting circuit-breaker line to aluminum bus.
 - f. Use copper for connecting circuit-breaker line to copper bus.
 - g. Contact Surfaces of Buses: Silver plated.
 - h. Feeder Circuit-Breaker Load Terminals: Silver-plated copper bus extensions equipped with pressure connectors for outgoing circuit conductors.



- i. Ground Bus: Hard-drawn copper of 98 percent minimum conductivity, with pressure connector for feeder and branch-circuit ground conductors, minimum size 1/4 by 2 inches (6 by 50 mm).
- j. Supports and Bracing for Buses: Adequate strength for indicated short-circuit currents.
- k. Neutral bus equipped with pressure-connector terminations for outgoing circuit neutral conductors. Neutral-bus extensions for busway feeders are braced.
- l. Neutral Disconnect Link: Bolted, uninsulated, 1/4-by-2-inch (6-by-50-mm) copper bus, arranged to connect neutral bus to ground bus.
- m. Provide for future extensions from either end of main phase, neutral, and ground bus by means of predrilled bolt-holes and connecting links.
- n. Bus-Bar Insulation: Individual bus bars wrapped with factory-applied, flame-retardant tape or spray-applied, flame-retardant insulation.
 - 1) Sprayed Insulation Thickness: 3 mils (0.08 mm), minimum.
 - 2) Bolted Bus Joints: Insulate with secure joint covers that can easily be removed and reinstalled.

C. Components

- 1. Instrument Transformers: Comply with IEEE C57.13.
 - a. Potential Transformers: Secondary-voltage rating of 120 V and NEMA accuracy class of 0.3 with burdens of W, X, and Y.
 - b. Current Transformers: Ratios as indicated; burden and accuracy class suitable for connected relays, meters, and instruments.
- 2. Multifunction Digital-Metering Monitor: UL-listed or -recognized, microprocessor-based unit suitable for three- or four-wire systems and with the following features:
 - a. Inputs from sensors or 5-A current-transformer secondaries, and potential terminals rated to 600 V.
 - b. Switch-selectable digital display of the following:
 - 1) Phase Currents, Each Phase: Plus or minus 1 percent.
 - 2) Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
 - 3) Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
 - 4) Three-Phase Real Power: Plus or minus 2 percent.
 - 5) Three-Phase Reactive Power: Plus or minus 2 percent.
 - 6) Power Factor: Plus or minus 2 percent.
 - 7) Frequency: Plus or minus 0.5 percent.
 - 8) Integrated Demand, with Demand Interval Selectable from 5 to 60 Minutes: Plus or minus 2 percent.
 - 9) Accumulated energy, in megawatt hours (joules), plus or minus 2 percent; stored values unaffected by power outages for up to 72 hours.
 - c. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.
- 3. Analog Instruments: Rectangular, 4-1/2-inch (115-mm) square, accurate within 1 percent, semiflush mounting, with antiparallax 250-degree scale and external zero adjustment, complying with ANSI C39.1.
 - a. Voltmeters: Cover an expanded scale range of normal voltage plus 10 percent.
 - b. Voltmeter Selector Switch: Rotary type with off position to provide readings of phase-to-phase and phase-to-neutral voltages.
 - c. Ammeters: Cover an expanded scale range of bus rating plus 10 percent.
 - d. Ammeter Selector Switch: Permits current reading in each phase and keeps current-transformer secondary circuits closed in off position.
 - e. Locate meter and selector switch on circuit-breaker compartment door for indicated feeder circuits only.
 - f. Watt-Hour Meters: Flush- or semiflush-mounting type, 5 A, 120 V, 3 phase, 3 wire; with 3 elements, 15-minute indicating demand register, and provision for testing and adding pulse initiation.



- g. Recording Demand Meter: Usable as totalizing relay or indicating and recording maximum demand meter with 15-minute interval.
 - 1) Operation: Meter counts and records a succession of pulses entering two channels.
 - 2) Housing: Drawout, back-connected case arranged for semiflush mounting.
 - 4. Relays: Comply with IEEE C37.90, types and settings as indicated; with test blocks and plugs.
 - 5. Surge Arresters: Distribution class, metal-oxide-varistor type. Comply with IEEE C62.11 and NEMA LA 1.
 - a. Install in cable termination compartments and connect in each phase of circuit.
 - b. Coordinate rating with circuit voltage.
 - 6. Provision for Future Devices: Equip compartments with rails, mounting brackets, supports, necessary appurtenances, and bus connections.
 - 7. Fungus Proofing: Permanent fungicidal treatment for switchgear interior, including instruments and instrument transformers.
 - 8. Control Power Supply: Control power transformer supplying 120-V control circuits through secondary disconnect devices. Include the following features:
 - a. Dry-type transformers, in separate compartments for units larger than 3 kVA, including primary and secondary fuses.
 - b. Two control power transformers in separate compartments with necessary interlocking relays; each transformer connected to line side of associated main circuit breaker.
 - 1) Secondary windings connected through a relay or relays to control bus to effect an automatic transfer scheme.
 - 2) Secondary windings connected through an internal automatic transfer switch to switchgear control power bus.
 - c. Control Power Fuses: Primary and secondary fuses with current-limiting and overload protection.
 - d. Fuses are specified in Division 26 Section "Fuses".
 - 9. Control Wiring: Factory installed, complete with bundling, lacing, and protection; and complying with the following:
 - a. Flexible conductors for No. 8 AWG and smaller, for conductors across hinges and for conductors for interconnections between shipping units.
 - b. Conductors sized according to NFPA 70 for duty required.
- D. Circuit Breakers
- 1. Description: Comply with IEEE C37.13.
 - 2. Ratings: As indicated for continuous, interrupting, and short-time current ratings for each circuit breaker; voltage and frequency ratings same as switchgear.
 - 3. Operating Mechanism: Mechanically and electrically trip-free, stored-energy operating mechanism with the following features:
 - a. Normal Closing Speed: Independent of both control and operator.
 - b. Slow Closing Speed: Optional with operator for inspection and adjustment.
 - c. Stored-Energy Mechanism: Manually charged **OR** Electrically charged, with optional manual charging, **as directed**.
 - d. Operation counter.
 - 4. Trip Devices: Solid-state, overcurrent trip-device system consisting of one or two current transformers or sensors per phase, a release mechanism, and the following features:
 - a. Functions: Long-time-delay, short-time-delay, and instantaneous-trip functions, independent of each other in both action and adjustment.
 - b. Temperature Compensation: Ensures accuracy and calibration stability from minus 5 to plus 40 deg C.
 - c. Field-adjustable, time-current characteristics.
 - d. Current Adjustability: Dial settings and rating plugs on trip units or sensors on circuit breakers, or a combination of these methods.
 - e. Three bands, minimum, for long-time- and short-time-delay functions; marked "minimum," "intermediate," and "maximum."
 - f. Pickup Points: Five minimum, for long-time- and short-time-trip functions. Equip short-time-trip function for switchable I^2t operation.



- g. Pickup Points: Five minimum, for instantaneous-trip functions.
- h. Ground-fault protection with at least three short-time-delay settings and three trip-time-delay bands; adjustable current pickup. Arrange to provide protection for the following:
 - 1) Three-wire circuit or system.
 - 2) Four-wire circuit or system.
 - 3) Four-wire, double-ended substation.
- i. Trip Indication: Labeled, battery-powered lights or mechanical targets on trip device to indicate type of fault.
- 5. Auxiliary Contacts: For interlocking or remote indication of circuit-breaker position, with spare auxiliary switches and other auxiliary switches required for normal circuit-breaker operation, quantity as indicated. Each consists of two Type "a" and two Type "b" stages (contacts) wired through secondary disconnect devices to a terminal block in stationary housing.
- 6. Drawout Features: Circuit-breaker mounting assembly equipped with a racking mechanism to position circuit breaker and hold it rigidly in connected, test, and disconnected positions. Include the following features:
 - a. Interlocks: Prevent movement of circuit breaker to or from connected position when it is closed, and prevent closure of circuit breaker unless it is in connected, test, or disconnected position.
 - b. Circuit-Breaker Positioning: An open circuit breaker may be racked to or from connected, test, and disconnected positions only with the associated compartment door closed unless live parts are covered by a full dead-front shield. An open circuit breaker may be manually withdrawn to a position for removal from the structure with the door open. Status for connection devices for different positions includes the following:
 - 1) Test Position: Primary disconnect devices disengaged, and secondary disconnect devices and ground contact engaged.
 - 2) Disconnected Position: Primary and secondary devices and ground contact disengaged.
- 7. Arc Chutes: Readily removable from associated circuit breaker when it is in disconnected position, and arranged to permit inspection of contacts without removing circuit breaker from switchgear.
- 8. Padlocking Provisions: For installing at least three padlocks on each circuit breaker to secure its enclosure and prevent movement of drawout mechanism.
- 9. Operating Handle: One for each circuit breaker capable of manual operation.
- 10. Electric Close Button: One for each electrically operated circuit breaker.
- 11. Mechanical Interlocking of Circuit Breakers: Uses a mechanical tripping lever or equivalent design and electrical interlocks.
- 12. Key Interlocks: Arranged so keys are attached at devices indicated. Mountings and hardware are included where future installation of key-interlock devices is indicated.
- 13. Undervoltage Trip Devices: Instantaneous, with adjustable pickup voltage **OR** Adjustable time-delay and pickup voltage, **as directed**.
- 14. Shunt-Trip Devices: Where indicated.
- 15. Fused Circuit Breakers: Circuit breaker and fuse combinations complying with requirements for circuit breakers and trip devices and with the following:
 - a. Fuses: NEMA FU 1, Class L current limiting, sized to coordinate with and protect associated circuit breaker.
 - b. Circuit Breakers with Frame Size 1600 A and Smaller: Fuses on line side of associated circuit breaker, on a common drawout mounting, arranged so fuses are accessible only when circuit breaker is in disconnected position.
 - c. Circuit Breakers with Frame Sizes More Than 1600 A: Fuses and circuit breakers may be installed in separate compartments on separate drawout mountings. Fuse drawout element is interlocked with associated power circuit breaker to prevent drawing out fuse element unless circuit breaker is in open position.
 - d. Open-Fuse Trip Device: Positive means of tripping and holding circuit breaker in open position when a fuse opens. Open-fuse status is indicated at front of circuit breaker or fuse drawout element.



16. Indicating Lights: To indicate circuit breaker is open or closed, for main and bus tie circuit breakers interlocked either with each other or with external devices.

E. Accessories

1. Accessory Set: Furnish tools and miscellaneous items required for circuit-breaker and switchgear test, inspection, maintenance, and operation.
 - a. Racking handle to manually move circuit breaker between connected and disconnected positions.
 - b. Portable test set for testing all functions of circuit-breaker, solid-state trip devices without removal from switchgear.
 - c. Relay and meter test plugs suitable for testing switchgear meters and switchgear class relays.
2. Circuit-Breaker Removal Apparatus: Portable, floor-supported, roller-base, elevating carriage arranged for moving circuit breakers in and out of compartments.
3. Circuit-Breaker Removal Apparatus: Overhead-circuit-breaker lifting device, track mounted at top front of switchgear and complete with hoist and lifting yokes matching each size of drawout circuit breaker installed.
4. Spare-Fuse Cabinet: Identified and compartmented steel box or cabinet with lockable door.
5. Storage for Manual: Include a rack or holder, near the operating instructions, for a copy of maintenance manual.

F. Identification

1. Mimic Bus: Continuous mimic bus, arranged in single-line diagram format, using symbols and lettered designations consistent with approved mimic-bus diagram.
 - a. Mimic-bus segments coordinated with devices in switchgear sections to which applied, to produce a concise visual presentation of principal switchgear components and connections.
 - b. Medium: Painted graphics, as selected by Architect.
 - c. Color: Contrasting with factory-finish background; as selected by Architect from manufacturer's full range.
2. System Power Riser Diagrams: Depict power sources, feeders, distribution components, and major loads. Include as-built data for low-voltage power switchgear and connections as follows:
 - a. Frame size of each circuit breaker.
 - b. Trip rating for each circuit breaker.
 - c. Conduit and wire size for each feeder.

1.3 EXECUTION

A. Installation

1. Comply with applicable portions of NECA 400.
2. Anchor switchgear assembly to 4-inch (100-mm), channel-iron floor sill embedded in floor **OR** concrete base, **as directed**, and attach by bolting.
 - a. Sills: Select to suit switchgear; level and grout flush into floor **OR** concrete base, **as directed**.
 - b. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Division 26 Section "Hangers And Supports For Electrical Systems" for seismic-restraint requirements.
 - c. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 3 inches (75 mm) in all directions beyond the maximum dimensions of switchgear unless otherwise indicated or unless required for seismic anchor support. Construct concrete bases according to Division 26 Section "Hangers And Supports For Electrical Systems".
3. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, brackets, and temporary blocking of moving parts from switchgear units and components.



- B. Identification
1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification For Electrical Systems".
 2. Diagram and Instructions:
 - a. Frame and mount under clear acrylic plastic on the front of switchgear.
 - 1) Operating Instructions: Printed basic instructions for switchgear, including control and key-interlock sequences and emergency procedures.
 - 2) System Power Riser Diagrams: Depict power sources, feeders, distribution components, and major loads.
 - b. Storage for Maintenance: Include a rack or holder, near the operating instructions, for a copy of maintenance manual.
- C. Connections
1. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 2. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
- D. Field Quality Control
1. Prepare for acceptance tests as follows:
 - a. Test insulation resistance for each switchgear bus, component, connecting supply, feeder, and control circuit.
 - b. Test continuity of each circuit.
 2. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:
 - a. Inspect switchgear installation, including wiring, components, connections, and equipment. Test and adjust components and equipment.
 - b. Verify that electrical control wiring installation complies with manufacturer's submittal by means of point-to-point continuity testing. Verify that wiring installation complies with requirements in Division 22.
 - c. Complete installation and startup checks according to manufacturer's written instructions.
 - d. Assist in field testing of equipment including pretesting and adjusting of equipment and components.
 - e. Report results in writing.
 3. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
 - a. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters. Perform NETA tests and inspections for each of the following NETA categories:
 - 1) Switchgear.
 - 2) Circuit breakers.
 - 3) Protective relays.
 - 4) Instrument transformers.
 - 5) Metering and instrumentation.
 - 6) Ground-fault systems.
 - 7) Battery systems.
 - 8) Surge arresters.
 - 9) Capacitors.
 - b. Remove and replace malfunctioning units and retest as specified above.
 4. Infrared Scanning: After Final Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchgear. Remove front and rear panels so joints and connections are accessible to portable scanner.
 - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchgear 11 months after date of Final Completion.



- b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - c. Record of Infrared Scanning: Prepare a certified report that identifies switchgear checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- E. Adjusting
 - 1. Set field-adjustable, protective-relay trip characteristics according to results in Division 26 Section "Overcurrent Protective Device Coordination Study".
 - 2. Set field-adjustable, protective-relay trip characteristics.
- F. Cleaning
 - 1. On completion of installation, inspect interior and exterior of switchgear. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.
- G. Protection
 - 1. Temporary Heating: Apply temporary heat to switchgear, according to manufacturer's written instructions, throughout periods when switchgear environment is not controlled for temperature and humidity within manufacturer's stipulated service conditions.

END OF SECTION 26 11 16 00



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SECTION 26 11 16 00A - MPF SECONDARY UNIT SUBSTATIONS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

This specification shall be utilized only upon written approval from USPS Headquarters, submitted through the Contracting Officer.

PART 1 - GENERAL

1.1 SUMMARY

- A. This specification provides the technical requirements for an indoor secondary unit substation complete from the incoming line terminals to the outgoing feeder terminals. The contractor shall provide and install all components as specified herein and shown on related electrical drawings.
- B. Related Documents: The Contract Documents, as defined in Section 011000 – Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Section include the following:
 - 1. Section 019113 - General Commissioning Requirements.
 - 2. Section 260500 - Common Work Results for Electrical.
 - 3. Section 260800 - Commissioning of Electrical Systems.
 - 4. Section 261216 - Dry-Type Medium-Voltage Transformers
 - 5. Section 261313 - Medium Voltage Circuit Breaker Switchgear.
 - 6. Section 261317 - Medium-Voltage Interrupter Switchgear.
 - 7. Section 261414 - Infrared Viewing Panes (IR Windows)
 - 8. Section 262413 - Switchboards.
 - 9. Section 337173 - Electrical Utility Services.

1.2 SUBMITTALS

- A. Submit shop drawings and product data for approval and final documentation in the quantities listed according to the Conditions of the Contract. All submittals shall be identified by customer name, customer location and customer order number.
- B. Documents for Approval: One-line diagrams, dimensioned plans, sections and elevations showing minimum clearances, installed devices, major features, nameplate legends and bills of material.
- C. Final Documents: Record documentation to include those in 1.4B and wiring diagrams, single-line and three-line diagrams of switchgear bus and component connections, product data of accessories or parts not previously described in the drawings, list of recommended spare parts and instruction and installation manuals



- D. Product Data: Include features, characteristics and ratings of switches, fuses and other components, time-current characteristic curves for power fuses and any overcurrent devices.
- E. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components and location and size of each field connection. Include the following:
 - 1. Enclosure type and details.
 - 2. Nameplate legends.
 - 3. Bus configuration with size and number of conductors in each bus run, including phase, neutral and ground conductors of main and branch buses.
 - 4. Current ratings of buses.
 - 5. Short-time and short-circuit ratings of switchgear assembly.
 - 6. Mimic bus diagram.
 - 7. Wiring Diagrams: Detail wiring for power, signal and control systems and differentiate between manufacturer-installed and field-installed wiring. Submit shop drawings and product data for approval and final documentation in the quantities listed according to the Conditions of the Contract. All transmittals shall be identified by customer name, customer location and customer order number.

1.3 RELATED STANDARDS

- A. Comply with requirements of latest revisions of applicable industry standards, specifically including the following:
 - 1. ANSI/IEEE
 - 2. NEMA
 - 3. UL

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Engage a firm with at least 10 years experience in manufacturing switchgear.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from potential damage from weather and construction operations. Store so condensation will not form on or in switchgear and if necessary, apply temporary heat where required to obtain suitable service conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 - 1. Eaton Corporation, Cutler-Hammer Products, Pittsburg, PA (800) 525-2000.
 - 2. General Electric Company (800) 626-2000.
 - 3. Siemens Energy and Automation, Alpharetta, GA (800) 964-4114.
 - 4. Square D Company, Palatine, IL (800) 392-8781.
 - 5. No substitutions permitted.



2.2 GENERAL REQUIREMENTS

- A. Construction/Components:
 - 1. The unit substation shall consist of:
 - a. Medium Voltage Interrupter Switch per Specification Section 261317
 - b. Cast Coil Unit Substation Transformer per Specification Section 261216.
 - c. Low Voltage Switchboard per Specification Section 262413.

2.3 INFRARED VIEWING PANES (IR WINDOWS)

- A. Infrared viewing panes (windows) shall be provided for the medium voltage interrupter switches, switchboard and transformers. Refer to specification sections 261414, 261317, 262413 and 261216, respectively.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Electrical contractor to install metal-clad switchgear in accordance with manufacturer's written instructions and the following specifications.
- B. Install and anchor switchgear in accordance with manufacturer's instructions.
- C. Tighten bus joints, electrical connectors and terminals according to manufacturer's published torque-tightening values. Install equipment grounding conductors for switchgear with ground continuity to main electrical ground bus.
- D. Provide 4" high concrete housekeeping pad below unit substation.

3.2 ADJUSTMENTS AND CLEANING

- A. Manufacturer's Field Services: Engage a factory-authorized service representative to inspect field-assembled components, installation and connection of switchgear; and to pretest and adjust switchgear components. Report results in writing.
- B. Set field-adjustable, protective-relay trip characteristics.
- C. Clean exposed surfaces using manufacturer recommended materials and methods. Touch-up damaged coating and finishes using non-abrasive materials and methods recommended by manufacturer. Eliminate all visible evidence of repair.

3.3 TESTING

- A. Testing: After installing switchgear and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
- B. Procedures: Perform inspections and tests specified below. Report values that do not meet manufacturer's written recommendations. Certify compliance with test parameters.
 - 1. Switchgear: Perform inspections and tests stated in NETA ATS, Section 7.1.
 - 2. Instrument Transformers: Perform inspections and tests stated in NETA ATS, Section 7.10.
 - 3. Metering and Instrumentation: Perform inspections and tests stated in NETA ATS, Section 7.11.
 - 4. Ground-Fault Systems: Perform inspections and tests stated in NETA ATS, Section 7.14.



5. Battery Systems: Perform inspections and tests stated in NETA ATS, Section 7.18.
6. Surge Arresters: Perform inspections and tests stated in NETA ATS, Section 7.19.
7. Remove and replace malfunctioning units with new units and retest.

3.4 WARRANTY

- A. Equipment manufacturer warrants that all goods supplied are free of non-conformities in workmanship and materials for [12 months] [18 months] from date of initial operation.

3.5 STARTUP SERVICES

- A. Engage a factory-authorized service representative to perform startup service.
- B. Train Owner's maintenance personnel on procedures and schedules for energizing and de-energizing, troubleshooting, servicing and maintaining equipment and schedules
- C. Verify that switchgear is installed and connected according to the Contract Documents.
- D. Verify that electrical control wiring installation complies with manufacturer's submittal by means of point-to-point continuity testing.
- E. Complete installation and startup checks according to manufacturer's written instructions.

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END OF SECTION 26 11 16 00a



SECTION 26 12 13 00 - LOW-VOLTAGE TRANSFORMERS

1.1 GENERAL

- A. Description Of Work
 - 1. This specification covers the furnishing and installation of materials for low-voltage transformers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.
- B. Summary
 - 1. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:
 - a. Distribution transformers.
 - b. Buck-boost transformers.
- C. Submittals
 - 1. Product Data: For each product indicated.
 - 2. Shop Drawings: Indicate dimensions and weights.
 - a. Wiring Diagrams: Power, signal, and control wiring.
 - 3. Manufacturer Seismic Qualification Certification: Submit certification that transformers, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
 - 4. Field quality-control test reports.
 - 5. Operation and maintenance data.
- D. Quality Assurance
 - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 2. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."
- E. Delivery, Storage, And Handling
 - 1. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.2 PRODUCTS

- A. General Transformer Requirements
 - 1. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
 - 2. Cores: Grain-oriented, non-aging silicon steel.
 - 3. Coils: Continuous windings without splices except for taps.
 - a. Internal Coil Connections: Brazed or pressure type.
 - b. Coil Material: Aluminum **OR** Copper, **as directed**.
- B. Distribution Transformers
 - 1. Comply with NEMA ST 20, and list and label as complying with UL 1561.
 - 2. Provide transformers that are constructed to withstand seismic forces specified in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
 - 3. Cores: One leg per phase.
 - 4. Enclosure: Ventiladed **OR** Totally enclosed, nonventilated, **as directed**, NEMA 250, Type 2.



- a. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
5. Enclosure: Ventilated **OR** Totally enclosed, nonventilated, **as directed**, NEMA 250, Type 3R **OR** Type 4X, stainless steel, **as directed**.
 - a. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
6. Transformer Enclosure Finish: Comply with NEMA 250.
 - a. Finish Color: Gray **OR** ANSI 49 gray **OR** ANSI 61 gray, **as directed**.
7. Taps for Transformers Smaller Than 3 kVA: None **OR** One 5 percent tap above normal full capacity, **as directed**.
8. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity **OR** Two 5 percent taps below rated voltage, **as directed**.
9. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity **OR** Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity, **as directed**.
10. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 **OR** 115 **OR** 80, **as directed**, deg C rise above 40 deg C ambient temperature.
11. Energy Efficiency for Transformers Rated 15 kVA and Larger:
 - a. Complying with NEMA TP 1, Class 1 efficiency levels.
 - b. Tested according to NEMA TP 2.
12. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.
 - a. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
 - b. Indicate value of K-factor on transformer nameplate.
13. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.
14. Wall Brackets: Manufacturer's standard brackets.
15. Fungus Proofing: Permanent fungicidal treatment for coil and core.
16. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.

C. Buck-Boost Transformers

1. Description: Self-cooled, two-winding dry type, rated for continuous duty and with wiring terminals suitable for connection as autotransformer. Transformers shall comply with NEMA ST 1 and shall be listed and labeled as complying with UL 506 or UL 1561.
2. Enclosure: Ventilated, NEMA 250, Type 2.
 - a. Finish Color: Gray **OR** ANSI 49 gray **OR** ANSI 61 gray, **as directed**.

D. Identification Devices

1. Nameplates: Engraved, laminated-plastic or metal nameplate. Nameplates are specified in Division 26 Section "Identification For Electrical Systems".

1.3 EXECUTION

A. Installation

1. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.
 - a. Brace wall-mounting transformers as specified in Division 26 Section "Hangers And Supports For Electrical Systems".
2. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions, seismic codes applicable to Project, **as directed**, and requirements in Division 26 Section "Hangers And Supports For Electrical Systems".

B. Field Quality Control



1. Perform tests and inspections.
 2. Tests and Inspections:
 - a. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - b. Infrared Scanning: Two months after Final Completion, perform an infrared scan of transformer connections.
 - 1) Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
 - 2) Perform 2 follow-up infrared scans of transformers, one at 4 months and the other at 11 months after Final Completion.
 - 3) Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.
- C. Adjusting
1. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
 2. Connect buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.
 3. Output Settings Report: Prepare a written report recording output voltages and tap settings.
- D. Cleaning
1. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 26 12 13 00



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SECTION 26 12 16 00 - MPF DRY-TYPE, MEDIUM-VOLTAGE TRANSFORMERS

NOTE TO SPECIFIER

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NOTE TO SPECIFIER

This specification shall be utilized only upon written approval from USPS Headquarters, submitted through the Contracting Officer.

PART 1 - GENERAL

1.1 SUMMARY

- A. This specification provides the technical requirements for the design, manufacture and test of cast coil-type secondary unit substation transformers. Provide all accessories and equipment as described herein and shown on Project Drawings as necessary for a complete installation.
- B. Related Documents: The Contract Documents, as defined in Section 011000 – Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Section include the following:
 - 1. Section 019113 - General Commissioning Requirements.
 - 2. Section 260500 - Common Work Results for Electrical.
 - 3. Section 260800 - Commissioning of Electrical Systems.
 - 4. Section 261116 - Secondary Unit Substations.
 - 5. Section 261313 - Medium Voltage Circuit Breaker Switchgear.
 - 6. Section 261317 - Medium-Voltage Interrupter Switchgear..
 - 7. Section 261414 - Infrared Viewing Panes (IR Windows)
 - 8. Section 262413 – Switchboards.
 - 9. Section 337173 - Electrical Utility Services.

1.2 SUBMITTALS

- A. The manufacturer shall provide the following information for review and evaluation by the Engineer:
 - 1. Shop Drawings showing outline nameplate and connection diagrams.
- B. Manufacturer shall provide final, as- built drawings, recording the actual circuiting of panels. Installation, Operation and Maintenance manuals shall also be supplied.



1.3 RELATED STANDARDS

- A. The ventilated dry-type transformers and protection devices in this specification are designed and manufactured according to latest revision of the following standards.
 - 1. ANSI C57.12.01, General Requirements for Dry-Type Distribution and Power Transformers Including Those with Solid Cast and / or Resin-Encapsulated Windings
 - 2. ANSI C57.12.91, Test Code for Dry-Type Distribution and Power Transformers
 - 3. ANSI N45.2-1977
 - 4. CSA Z 299.3
 - 5. ISO 9001
 - 6. NRC 10CFR50 Appendix B
 - 7. MIL-I-45208A
 - 8. NEMA ST 20, Dry Type Transformers for General Applications
 - 9. UL 1561 and 1562

1.4 QUALITY ASSURANCE

- A. The manufacturer shall have a well-documented quality assurance program, which includes procedures for all activities in order entry, design, material procurement, manufacturing processes, testing, shipping and post shipment. The manufacturer shall have specialized in the design, manufacture and assembly of dry-type distribution transformers for a minimum of 10 years. The transformer shall be manufactured by a company, which is certified ISO 9001, for design and manufacture of Power Cast Coil Dry-Type Transformers.
- B. The test floor shall have documented calibration program. All equipment shall receive regular calibrations. Calibration standards shall be traceable to National Bureau of Standards. Records of all equipment calibration shall be made available to the Buyer upon request. Measured values of electric power, voltage, current, resistance and temperatures are used in the calculations of reported data. To ensure sufficient accuracy in the measured and calculated data the test system accuracy requirements listed in ANSI C57.12.01 Table 3 shall be met as a minimum.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Handle and store equipment in accordance with manufacturer's Installation and Maintenance Manuals. One (1) copy of this document to be provided with the equipment at time of shipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 - 1. Eaton Corporation, Cutler-Hammer Products, Pittsburg, PA (800) 525-2000.
 - 2. General Electric Company (800) 626-2000.
 - 3. Siemens Energy and Automation, Alpharetta, GA (800) 964-4114.
 - 4. Square D Company, Palatine, IL (800) 392-8781.
 - 5. No substitutions permitted.

2.2 TECHNICAL REQUIREMENTS

- A. Construction



1. The transformer shall be vacuum cast epoxy resin construction and shall be mounted in a suitably ventilated indoor enclosure.
 2. The transformer shall be rated _____ kVA with a primary voltage of _____ kV [delta] [wye] connected and have a BIL rating of _____ kV and a secondary voltage of 277/480V wye connected and have a BIL rating of _____ kV.
 3. The transformer is to have an impedance of _____ %IZ (per manufacture's standards.)
 4. Primary terminations shall be bus connection inside transformer enclosure for close-coupling to high voltage load interrupter switch.
 5. Secondary terminations shall be bus connection inside transformer enclosure for close-coupling to the low voltage switchgear.
 6. Primary and secondary coordination bus assemblies, as required for connection to associated switchgear are to be of bolted construction.
- B. Core Design
1. The transformer core shall be constructed of high-grade non-aging silicon steel laminations with high magnetic permeability and low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point. A step-lap mitered core joint shall be used to minimize losses, exciting currents and sound levels. The core laminations shall be clamped together with heavy steel members. The finished core and clamping structure shall be coated to protect against corrosion.
- C. Temperature Rise
1. The average temperature rise of the transformer windings shall be rated at 80 degree C and shall be built utilizing Class 180 degree C turn insulations, regardless of the temperature rise specified. The insulating system used, including epoxy, shall be rated 180 degree C or higher. The transformer shall not exceed the specified temperature rise when the unit is operated continuously at full nameplate rating. The transformer shall be capable of carrying 100% of the nameplate rating in a 30 degree C average, not to exceed 40 degree C maximum ambient in any 24 hour period.
 2. The transformer shall be capable of continuous operation at 17% above nameplate rating. This overload capability shall be achieved on the AA and FA rating and will be accomplished by allowing the transformers' ultimate rise to be 115 degree C. Customer specification must define the high capacity overloads.
- D. Coil Design
1. The high voltage and low voltage windings shall be constructed using copper conductors. The high voltage and low voltage windings shall be vacuum cast in epoxy in a metal mold utilizing a proven casting process that insures the absence of voids. The vacuum cast coils shall also be reinforced with fiberglass mat.
 2. The transformer shall be constructed of individually cast primary and secondary coils, coaxially mounted. The low voltage windings shall be wound separately and of pressure injected, vacuum cast or hermetically sealed construction with foil or sheet conductors. The low voltage coils shall be hermetically sealed with epoxy and the coil shall be blocked radially to the core to ensure short circuit integrity.
 3. The finished primary and secondary coil must be hermetically sealed in epoxy utilizing a proven manufacturing system that demonstrates its ability to minimize hot spots and partial discharge. An induced partial discharge test shall be performed on each winding. The induced partial discharge test shall be performed by measuring partial discharge levels beginning at 80% rated voltage and continuing in 10% step increments through 200% rated voltage. Partial discharge inception and extinction levels are defined as levels above 10 Pico-Coulombs and shall be recorded. Acceptance criteria is Partial discharge extinction at or above 120% rated voltage. The low voltage windings shall be wound separately and if not vacuum cast like the high voltage winding, shall be hermetically sealed in epoxy.
 4. Taps
 - a. Transformer primary winding shall have four 2-1/2 percent full capacity taps; two above and two below rated nominal voltage. No load tap connections shall be made by re-connectable links on the face of the primary winding and shall be located behind



removable panels on the front of transformer enclosure. Taps shall be for de-energized operation only.

- E. Dielectric Withstand
 - 1. The impulse rating of the transformer must equal or exceed the basic impulse level specified by ANSI for the applicable voltage class. The basic impulse level shall be inherent to the winding design and is to be obtained without the use of supplemental surge arrestors.
- F. Vibration Isolation
 - 1. The transformer shall have vibration isolation pads installed between core and coil assembly and enclosure base structures to prevent the transmission of structure borne vibration.
- G. Enclosure
 - 1. The enclosure shall be constructed of heavy gauge sheet steel and shall be finished in ANSI 61 paint color, applied using an electrostatically deposited dry powder paint system. All ventilating openings shall be in accordance with NEMA and NEC standards for ventilated enclosures. The base of the enclosure shall be furnished with ground pads located on opposite diagonal corners. The base shall have jacking pads and shall be constructed of heavy steel members to permit skidding or rolling in any direction. The core shall be visibly grounded to the enclosure frame by means of a flexible grounding strap.
 - 2. Transformer shall be certified to meet Uniform Building Code (UBC) Zone [1] [2] [3] [4] seismic requirements with seismic table validation.
- H. Nameplate
 - 1. Transformer shall be furnished with a non-corrosive diagrammatic nameplate per ANSI C57.12.01, permanently attached with non-corrosive hardware. The diagrammatic nameplate shall include the name of the transformer supplier as well as the location where the transformer was manufactured and tested.
- I. Forced Air Cooling
 - 1. Forced air cooling, when required, shall increase the continuous self-cooled rating of the transformer by 33 1/3%. The FA increase shall be possible with forced cooling without exceeding the specified maximum temperature rise. The forced air cooling shall be regulated automatically by sensors placed in the low voltage winding's air ducts. Forced air cooling shall include: three phase electronic digital temperature monitor, fans, control wiring, control panel with test switch, indicating lights, alarm and alarm silencing switch.

2.3 FACTORY TESTING

- A. After completion, each transformer shall undergo the following routine production tests per ANSI C57.12.01 and ANSI C57.12.91. Testing shall be accomplished using calibrated test equipment, which have recorded accuracy traceable to National Institute of Standards Technologies (NIST). Certification of Calibration shall be provided with test reports if requested.
- B. In addition to routine testing a 100% QC Impulse Test shall be performed on each transformer furnished.
- C. Routine Tests:
 - 1. Megger
 - 2. Ratio
 - 3. Resistance
 - 4. Phase relation
 - 5. Load Loss, Impedance and Regulation
 - 6. No Load Loss and Excitation Current
 - 7. Applied Potential Test



8. Induced Potential Test

- D. A temperature rise test shall be performed on the first unit of each new design. The core and coil design and construction techniques shall be verified by a full short circuit test on similar or larger units in accordance with applicable ANSI standards.
- E. Provide certified production test reports for all manufactured transformers.

2.4 INFRARED VIEWING PANES (IR WINDOWS)

- A. Typically, the high voltage and primary tap connections are located on the high voltage side of a power transformer. A single, opaque, rectangular window (9 inch W x 5 inch H) shall be provided to view the high voltage power and tap connections on this side of the transformer. The secondary (low voltage) connections are typically made by bolted connections at the low voltage end of the transformer. A single, opaque, rectangular window (9 inch W x 5 inch H) shall be provided at the secondary side of the transformer to view these bolted connections. Refer to specification section 261414.
- B. Acceptable installers:
 - 1. IR viewing panes shall be factory installed by the switchgear manufacturer or field installed by a certified installer, as recommended by the IR viewing pane manufacturer.
 - 2. Installer shall be factory certified and trained by the IR viewing pane manufacturer.

2.5 ACCESSORIES

- A. Standard transformer accessories shall include:
 - 1. Diagrammatic aluminum nameplate
 - 2. Step-lap mitered core
 - 3. Provisions for lifting core and coil assembly
 - 4. Base equipped with jacking pads and designed for rolling or skidding enclosure in any direction
 - 5. NEMA 1 heavy-gauge ventilated enclosure with removable panels front and rear
 - 6. Four (4) full-capacity taps on HV winding, rated 2 ½%, 2-FCAN and 2-FCBN
- B. Documentation for Owner's review:
 - 1. Outline, nameplate and connection diagram drawings.
 - 2. Installation/Operation/Maintenance Manual
 - 3. Certified Production Test Report(s) containing minimum information per ANSI C57.12.91

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install transformer as shown on Project Drawings and in accordance with manufacturer's Instruction/Installation Manual.
- B. Provide concrete pad with sufficient structural support and in accordance with local codes and standards. Concrete pad requirements should be coordinated with transformer manufacturer.
- C. Grounding shall be per Project Drawings and in accordance with codes and standards and in compliance with the NEC.



3.2 ADJUSTMENTS AND CLEANING

- A. Remove debris from job site and wipe dust and dirt from all components.
- B. Repaint marred and scratched surfaces with touch up paint to match original finish.

3.3 TESTING

- A. Field-testing will be conducted at the expense of the Contractor for final acceptance.

3.4 WARRANTY

- A. Equipment manufacturer warrants that all goods supplied are free of non-conformities in workmanship and materials for [12 months] [18 months] from date of initial operation.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 8/29/2013

END OF SECTION 26 12 16 00



Task	Specification	Specification Description
26 12 16 00	26 12 13 00	Low-Voltage Transformers
26 12 19 00	26 12 13 00	Low-Voltage Transformers



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SECTION 26 13 13 00 - MPF METAL-CLAD MEDIUM VOLTAGE CIRCUIT BREAKER SWITCHGEAR

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

This specification shall be utilized only upon written approval from USPS Headquarters, submitted through the Contracting Officer.

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes medium voltage metal-clad circuit breaker switchgear and its associated auxiliary equipment. The equipment shall consist of indoor switchgear with horizontal drawout, vacuum circuit breakers.
- B. Related Documents: The Contract Documents, as defined in Section 011000 – Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 260500 - Common Work Results for Electrical.
 - 2. Section 261414 - Infrared Viewing Panes (IR Windows).
 - 3. Section 337173 - Electrical Utility Services.
 - 4. Section 260800 - Commissioning of Electrical Systems.
 - 5. Section 019113 - General Commissioning Requirements.

1.2 REFERENCES

- A. The metal-clad switchgear and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of NEMA SG-4 and SG-5, including, but not limited to, ANSI/IEEE 37.20.2.

1.3 SUBMITTALS

- A. Submit shop drawings and product information for approval and final documentation in the quantities listed according to the Conditions of the Contract. All transmittals shall be identified by purchaser name, purchaser location and purchaser's order number.
- B. Approval documents shall include:

MPF METAL-CLAD MEDIUM VOLTAGE CIRCUIT BREAKER
SWITCHGEAR



1. General arrangement drawing showing dimensioned elevation and floor plan, foundation details and one-line diagram
2. Panel arrangement drawing showing layout of devices on the panel doors
3. Three-line diagrams
4. Schematics
5. Nameplate engraving drawings
6. Electrical bill of material

C. Final documents shall include:

1. Documents listed in 1.03.B above
2. Wiring diagrams
3. Recommended spare parts list for start-up support
4. Instruction manual

1.4 QUALITY ASSURANCE

- A. Manufacturer qualifications: The bidder must have at least 15 years experience in manufacturing medium voltage metal-clad switchgear and circuit breakers. The manufacturer of the metal-clad switchgear assembly shall also be the manufacturer of the circuit breakers.
- B. Comply with requirements of latest revisions of applicable industry standards, specifically including the following:
 1. ANSI/IEEE C37.20.2 - Metal-Clad Switchgear
 2. ANSI/IEEE C37.04 - Rating Structure for High Voltage Circuit Breakers
 3. ANSI/IEEE C37.06 - Preferred Ratings for High Voltage Circuit Breakers
 4. ANSI/IEEE C37.90 - Relays and Relay Systems
- C. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.
- D. The equipment and major components shall be suitable for and certified to meet all applicable seismic requirements of Uniform Building Code (UBC) for zone 4 application. Guidelines for the installation consistent with these requirements shall be provided by the switchgear manufacturer and based upon testing of representative equipment. The test response spectrum shall be based upon a 5% minimum damping factor, UBC a peak of 2.15g's (3.2-11 Hz), and a ZPA of 0.8g's applied at the base of the equipment. The tests shall fully envelop this response spectrum for all equipment natural frequencies up to at least 35 Hz.
- E. The following minimum mounting and installation guidelines shall be met, unless specifically modified by the above references standards.
 1. The Contractor shall provide equipment anchorage details, coordinated with the equipment mounting provision. Mounting recommendations shall be provided by the manufacturer based upon approved shake table tests used to verify the seismic design of the equipment.
 2. The equipment manufacturer shall certify that the equipment can withstand, that is, function following the seismic event, including both vertical and lateral required response spectra as specified in above codes.
 3. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment. Seismic qualification shall be considered achieved when the capability of the equipment, meets or exceeds the specified response spectra.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver in convenient shipping groups. Shipping groups shall not exceed fifteen feet in length.



- B. Circuit breakers shall be shipped inside their respective cells.
- C. The accessory cabinet shall be shipped attached to the switchgear.
- D. Bus bars with associated hardware for connections between shipping groups shall be shipped inside one of the units in which shall be installed.
- E. Contractor shall store the equipment in accordance with manufacturer's recommendations.
- F. Contractor shall install temporary heaters, if necessary, to prevent condensation during storage.
- G. Contractor shall handle and move the switchgear in accordance with manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 - 1. Eaton Corporation, Cutler-Hammer Products, Pittsburg, PA (800) 525-2000.
 - 2. General Electric Company (800) 626-2000.
 - 3. Siemens Energy and Automation, Alpharetta, GA (800) 964-4114.
 - 4. Square D Company, Palatine, IL (800) 392-8781.
 - 5. No substitutions permitted.

2.2 RATINGS

- A. System configuration: The switchgear shall be suitable for application in three-phase, 60 Hz, grounded-neutral system.
- B. Electrical ratings:
 - 1. Circuit breaker and switchgear ratings shall be based on [MVA class and ANSI/IEEE C37.04-1979] or ["constant kA" ratings and ANSI/IEEE C37.04-1999]. [The first six are MVA class and the second eight are constant kA rated.] [Choose one of the 14 categories. Delete the other 13.]
 - a. [Interrupting class: 250 MVA
 - 1) Maximum design voltage (V): 4.76 kV
 - 2) Impulse withstand voltage: 60 kV
 - 3) Interrupting current (I) at maximum design voltage: 29 kA
 - 4) Voltage range factor (K): 1.24
 - 5) Maximum design voltage divided by K: 3.85 kV
 - 6) Interrupting current (IK) at V/K: 36 kA
 - 7) Short-time withstand current: 36 kA
 - 8) Momentary withstand and closing and latching current: 58 kA rms and 97 kA peak]
 - b. [Interrupting class: 350 MVA
 - 1) Maximum design voltage (V): 4.76 kV
 - 2) Impulse withstand voltage: 60 kV
 - 3) Interrupting current (I) at maximum design voltage: 41 kA
 - 4) Voltage range factor (K): 1.19
 - 5) Maximum design voltage divided by K: 4.0 kV
 - 6) Interrupting current (IK) at V/K: 49 kA
 - 7) Short-time withstand current: 49 kA
 - 8) Momentary withstand and closing and latching current: 78 kA rms and 132 kA peak]
 - c. [Interrupting class: 500 MVA

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SWITCHGEAR



- 1) Maximum design voltage (V): 8.25 kV
- 2) Impulse withstand voltage: 95 kV
- 3) Interrupting current (I) at maximum design voltage: 33 kA
- 4) Voltage range factor (K): 1.25
- 5) Maximum design voltage divided by K: 6.6 kV
- 6) Interrupting current (IK) at V/K: 41 kA
- 7) Short-time withstand current: 41 kA
- 8) Momentary withstand and closing and latching current: 66 kA rms and 111 kA peak]
- d. [Interrupting class: 500 MVA
 - 1) Maximum design voltage (V): 15 kV
 - 2) Impulse withstand voltage: 95 kV
 - 3) Interrupting current (I) at maximum design voltage: 18 kA
 - 4) Voltage range factor (K): 1.3
 - 5) Maximum design voltage divided by K: 11.5 kV
 - 6) Interrupting current (IK) at V/K: 23 kA
 - 7) Short-time withstand current: 23 kA
 - 8) Momentary withstand and closing and latching current: 37 kA rms and 62 kA peak]
- e. [Interrupting class: 750 MVA
 - 1) Maximum design voltage (V): 15 kV
 - 2) Impulse withstand voltage: 95 kV
 - 3) Interrupting current (I) at maximum design voltage: 28 kA
 - 4) Voltage range factor (K): 1.3
 - 5) Maximum design voltage divided by K: 11.5 kV
 - 6) Interrupting current (IK) at V/K: 36 kA
 - 7) Short-time withstand current: 36 kA
 - 8) Momentary withstand and closing and latching current: 58 kA rms and 97 kA peak]
- f. [Interrupting class: 1000 MVA
 - 1) Maximum design voltage (V): 15 kV
 - 2) Impulse withstand voltage: 95 kV
 - 3) Interrupting current (I) at maximum design voltage: 37 kA
 - 4) Voltage range factor (K): 1.3
 - 5) Maximum design voltage divided by K: 11.5 kV
 - 6) Interrupting current (IK) at V/K: 48 kA
 - 7) Short-time withstand current: 48 kA
 - 8) Momentary withstand and closing and latching current: 77 kA rms and 130 kA peak]
- g. [Interrupting class: 40 kA
 - 1) Maximum design voltage (V): 4.76 kV
 - 2) Impulse withstand voltage: 60 kV
 - 3) Interrupting current (I) at maximum design voltage: 40 kA
 - 4) Voltage range factor (K): 1.0
 - 5) Short-time withstand current: 40 kA
 - 6) Momentary withstand and closing and latching current: 62 kA rms and 104 kA peak]
- h. [Interrupting class: 50 kA
 - 1) Maximum design voltage (V): 4.76 kV
 - 2) Impulse withstand voltage: 60 kV
 - 3) Interrupting current (I) at maximum design voltage: 50 kA
 - 4) Voltage range factor (K): 1.0
 - 5) Short-time withstand current: 50 kA
 - 6) Momentary withstand and closing and latching current: [78 kA] rms and [130 kA] peak]
- i. [Interrupting class: 63 kA
 - 1) 1.) Maximum design voltage (V): 4.76 kV
 - 2) 2.) Impulse withstand voltage: 60 kV
 - 3) 3.) Interrupting current (I) at maximum design voltage: 63 kA



- 4) 4.) Voltage range factor (K): 1.0
- 5) 5.) Short-time withstand current: 63 kA
- 6) 6.) Momentary withstand and closing and latching current: 98 kA rms and 164 kA peak]
- j. [Interrupting class: 40 kA
 - 1) Maximum design voltage (V): 8.25 kV
 - 2) Impulse withstand voltage: 95 kV
 - 3) Interrupting current (I) at maximum design voltage: 40 kA
 - 4) Voltage range factor (K): 1.0
 - 5) Short-time withstand current: 40 kA
 - 6) Momentary withstand and closing and latching current: 62 kA rms and 104 kA peak]
- k. [Interrupting class: 25 kA
 - 1) Maximum design voltage (V): 15 kV
 - 2) Impulse withstand voltage: 95 kV
 - 3) Interrupting current (I) at maximum design voltage: 25 kA
 - 4) Voltage range factor (K): 1.0
 - 5) Short-time withstand current: 25 kA
 - 6) Momentary withstand and closing and latching current: 39 kA rms and 65 kA peak]
- l. l. [Interrupting class: 40 kA
 - 1) 1.) Maximum design voltage (V): 15 kV
 - 2) 2.) Impulse withstand voltage: 95 kV
 - 3) 3.) Interrupting current (I) at maximum design voltage: 40 kA
 - 4) 4.) Voltage range factor (K): 1.0
 - 5) 5.) Short-time withstand current: 40 kA
 - 6) 6.) Momentary withstand and closing and latching current: 62 kA rms and 104 kA peak]
- m. [Interrupting class: 50 kA
 - 1) Maximum design voltage (V): 15 kV
 - 2) Impulse withstand voltage: 95 kV
 - 3) Interrupting current (I) at maximum design voltage: 50 kA
 - 4) Voltage range factor (K): 1.0
 - 5) Short-time withstand current: 50 kA
 - 6) Momentary withstand and closing and latching current: 78 kA rms and 130 kA peak]
- n. [Interrupting class: 63 kA
 - 1) Maximum design voltage (V): 15 kV
 - 2) Impulse withstand voltage: 95 kV
 - 3) Interrupting current (I) at maximum design voltage: 63 kA
 - 4) Voltage range factor (K): 1.0
 - 5) Short-time withstand current: 63 kA
 - 6) Momentary withstand and closing and latching current: 98 kA rms and 164 kA peak]
- 2. Circuit breaker rated interrupting time [five-cycles] [three-cycles].
- 3. Switchgear main bus continuous current [1200 A] [2000 A] [3000 A] [4000 A].

2.3 SWITCHGEAR GENERAL CONSTRUCTION

- A. The switchgear enclosure shall be of metal-clad construction as described in ANSI/IEEE standards.
- B. The switchgear shall be factory assembled into convenient shipping groups and tested. The switchgear shall be of a coordinated design so shipping groups shall be easily connected together at the site into a continuous lineup. Necessary shipping split connecting busbars, boots and hardware shall be furnished and shall be attached to the switchgear in the approximate locations where they shall be needed.
- C. The switchgear assembly shall consist of one or more vertical sections, each of which shall have a main bus compartment and two vertically stacked equipment cells. The cells shall be arranged for circuit



breakers or auxiliary devices or shall be blank as indicated in the detailed specification. Each vertical section shall be provided with a low voltage devices compartment located between the upper and lower cells at the front of the equipment.

- D. Each main bus compartment shall contain copper bus bars silver-plated at electrical connection points, three-phase, three-wire, fully insulated with fluidized bed epoxy coating or equivalent. Sleeve type insulation shall not be permitted. Bus connection joints shall be insulated with preformed PVC boots held together with nylon hardware for easy installation and removal during servicing. Copper bus bars shall be bead-blasted prior to applying epoxy coating to assure a proper bond between the epoxy and the bus bar, eliminating partial discharges. Each bus segment shall be individually high-potential tested prior to assembly. Taped joints are not permitted except in unusual joint configurations. The ground bus shall be bare silver-plated copper; at least ¼ by two inches and shall extend the full length of switchgear.
- E. Each circuit breaker compartment shall contain a racking mechanism, circuit breaker operated (not racking mechanism operated) automatic shutters and safety interlocks. Provide additional remote racking device for enhanced safety.
- F. Each circuit breaker cell shall also include:
 - 1. Hinged front panel.
 - 2. Primary and secondary disconnecting devices.
 - 3. Control circuit cutout device.
 - 4. Terminal blocks, control wiring and control power buses.
 - 5. Manual latch to retain circuit breaker in withdrawn position.
 - 6. Side wall mounted sliding type secondary disconnects to facilitate inspection of mating of contact from the front and easy accessibility for troubleshooting. Secondary disconnects using plug and socket arrangement with umbilical cord, as well as disconnects not visible for inspection, are not permitted.
 - 7. Provision shall be made for closed door racking with a manual racking handle. Mechanical position indication shall be visible with door closed.
 - 8. Racking mechanism shall be simple to install and operate. Racking mechanism using a chain to transmit motion from one side to the other side is not permitted. Provision for installing up to three padlocks shall be integral with the racking mechanism to insure positive position locking of the circuit breaker.
- G. Each auxiliary cell shall include the following:
 - 1. Hinged front panel, suitable for relays and instruments
 - 2. Necessary terminal blocks, control wiring and control power buses
 - 3. Device markers
- H. Switchgear construction shall facilitate floor roll-out of circuit breakers in the lower cells. Guide channels shall be provided for smooth circuit breaker roll-in.
- I. Each vertical indoor section shall be approximately 36" width x 98.5" depth x 95.25" height.
- J. The steel used in the structure and panels shall be chemically cleaned, hot phosphate treated, rinsed and oven-dried and shall be given an electrostatically applied coat of ANSI 61 polyester paint.
- K. Low voltage device panel located inside the circuit breaker or auxiliary cells shall be painted high-gloss white for better visibility and ease of maintenance.
 - 1. Enclosure: The indoor enclosure shall be constructed of bolted sheet steel material.



2.4 COMPONENTS

- A. Instrument transformers: Comply with ANSI/IEEE C57.13 and ANSI/IEEE C37.20.2.
 1. Voltage transformers (VTs): Secondary voltage rating of 120 V and accuracy class of 0.3 with burdens of W, X and Y. The VTs shall be mounted on a rollout tray. Each tray must accommodate up to three VTs, with integrally mounted primary fuses. The auxiliary cell shall be equipped with automatic shutters and grounding fingers that remove any static charge from the windings before allowing operator access to the VTs.
 2. Current transformers (CTs): Ratios as indicated; burden and accuracy class as per ANSI, suitable for connected relays, meters and instruments. The CTs shall be bushing mounted. Each circuit breaker bushing shall be able to accommodate two standard accuracy CTs or one high accuracy CT. The CT secondary wiring shall be connected to shorting terminal blocks with ring tongue terminations.
 3. AC control power shall be furnished from:
 - a. An internally mounted dry-type transformer, including primary and secondary fuses. Control Power Transformer (CPT) shall be [15 kVA single-phase] [25 kVA single-phase] [50 kVA single-phase] [15 kVA three-phase] [30 kVA three-phase] [45 kVA three-phase]. Up to 15 kVA single-phase the CPT with its primary fuses shall be mounted on the drawout tray. Above 15 kVA single-phase the primary fuses shall be drawout tray mounted and the CPT shall be fixed mounted in the rear of the section.
 4. Suitable automatic transfer scheme is required when control power transformers are provided on the incoming side of the main circuit breakers in double-ended installations, to transfer the secondary load should one incoming supply fail.
- B. Multifunction digital-meters shall be UL-Listed or UL-Recognized, microprocessor-based units suitable for three- or four-wire systems. Units shall be mounted on the instrument compartment door and as follows:
 1. For incoming monitoring for main circuit breakers, multifunction power meter with Modbus communication protocol shall be provided.
 2. For feeder circuit breakers, multifunction power meter with Modbus communication protocol shall be provided.
- C. Multifunction protective relaying. Microprocessor-based three-phase relays shall be UL-Listed or UL-Recognized and shall be provided as follows:
 1. Main circuit breakers
 - a. The relays shall be Siemens 7SJ63 or 7SJ64 bay controller or equivalent. The relays shall include the following protection functions: 50/51, 50N/51N, 67/67N, 27, 59, 81O/U and 25 (7SJ64 only).
 - b. The relays shall provide monitoring of the CT and VT circuits and alarm on circuit failure.
 - c. The relays shall provide a graphic mimic display visually indicating the position (open/closed) of the circuit breaker, protection function trip and metering data. Unlimited user-configurable Human Machine Interface (HMI) screens shall allow the user to create unique single line displays with a simple tool or from an existing library.
 - d. The relays shall provide key locking to prevent unauthorized switching either local or remote.
 - e. The relays shall be capable of internally performing main-tie-main auto-transfer and auto-restore functions.
 - f. The relays shall have programmable logic capabilities to permit use in protection and control systems. Programming software must be compliant with IEC 61131 standard for PLC programming.
 - g. The relays shall have a modular communications processor to permit field change between Modbus RTU, Profibus-DP, Profibus-FMS, DNP3.0, IEC 60870-5-103 and IEC 61850 protocols. The relays shall be able to support either RS-485 or fiber optic communications.



- h. The relays shall provide complete sequence-of-events recording, time stamped in milliseconds. The relays shall provide oscillography (waveform) capture, with configurable pre- and post-fault data capture times.
- i. i. The relays binary inputs shall be provided with chatter blocking and filter time. The chatter blocking shall effectively block a binary input indication and prevent the generation of indications when the signal cannot be interpreted. The filter time indicates how long a signal must be present before it shall be interpreted as an indication. This shall serve to suppress short, intermittent changes. These two features shall be available and settable separately for each binary input indication.
- j. j. The relays shall provide four protection settings groups. Setting group changes shall be available locally through front function key and binary input; remotely through operator or service communication interface using a personal computer and via system interface (Profibus, Modbus, etc.).
- 2. Bus protection – full differential
 - a. The relays shall be Siemens 7UT613 or equivalent. The relay shall be low-impedance percentage differential relays.
 - b. The relays shall have three restraint winding inputs.
 - c. The relays shall have a through-fault restraint setting to prevent tripping due to high current external faults.
 - d. The relays shall have a CT monitoring element to block differential trip if a CT secondary circuit has failed and shall provide alarm function.
 - e. The relays shall provide complete sequence-of-events recording, time stamped in milliseconds. The relays shall provide oscillography (waveform) capture, with configurable pre- and post-fault data capture times.
 - f. The relay shall have the capability to be applied as single-phase bus relays.
 - g. The relays shall have modular communication for simple integration into SCADA systems. The communication protocol shall be Modbus RTU.
- 3. Feeder protection with communications
 - a. The relays shall provide the following functions: 50/51, 50N/51N, 67, 64, 87N, 37, 49, 46, 27, 59, 81O/U, 50BF, 46, 47, 25, 79 and 21FL.
 - b. The relays shall monitor the CT circuits and alarm on circuit failure.
 - c. The relays shall be capable of being used in a reverse interlocking bus protection scheme.
 - d. The relays shall have nine programmable function keys to replace control switches.
 - e. The relays shall have programmable logic capabilities to permit use in protection and control systems. Programming software shall be compliant with IEC 61131 standard for PLC programming.
 - f. f. The relays shall have a modular communications processor to permit field change between IEC 61850, Modbus RTU, Profibus-DP, DNP3.0 and IEC 60870-5-103 protocols. The relays shall be able to support either RS-485 or fiber optic communications.
 - g. All relay terminal blocks including CT blocks shall be pluggable to ensure ease of relay replacement and maintenance testing.
 - h. The housing shall be a sealed dust proof environment for the relay internal electronics. Head build up must be dissipated through the surface area of the steel enclosure. The relays thus shall maintain their tested insulation characteristic standards per IEC, IEEE, even if deployed in harsh dusty environments.
 - i. The relays must provide 20 flexible functions that shall be used to create additional protection functions to maximize application flexibility.
- 4. Feeder protection – motor protection with communications
 - a. The relays shall be Siemens 7SK80 protective relay or equivalent. The relays shall provide the following protection functions: 50/51, 50N/51N, 67N, 67Ns, 50Ns, 59N/64, 37, 48, 66, 14, 51M, 49, 46, 27, 59, 81O/U, 50BF, 46 and 47.
 - b. The relays shall have five RTD inputs.
 - c. The relays shall have the option to connect 12 additional RTD inputs through an Ethernet connection.



- d. The relays shall provide trip circuit supervision of the feeder circuit breaker and alarm on trip circuit failure.
- e. The relays shall be capable of being used in a reverse (zone) interlocking bus protection scheme.
- f. The relays shall provide logic programmability to create starting schemes. For example, reduced voltage starting.
- g. The relays shall provide logic programmability to create failsafe tripping logic.
- h. The relays shall have nine programmable function keys to replace control switches.
- i. The relays shall have programmable logic capabilities to permit use in protection and control systems. Programming software must be compliant with IEC 61131 standard for PLC programming.
- j. The relays shall have a modular communications processor to permit field change between IEC 61850, Modbus RTU, Profibus-DP, DNP3.0 and IEC 60870-5-103 protocols. The relays shall be able to support either RS-485 or fiber optic communications.
- k. All relay connectors including CT connectors shall be pluggable to ensure ease of relay replacement and maintenance testing.
- l. The housing shall be a sealed dust proof environment for the relays internal electronics. Heat build up must be dissipated through the surface area of the steel enclosure. The relays thus shall maintain their tested insulation characteristic standards per IEC, IEEE, even if deployed in harsh dusty environments.
- m. The relays shall provide 20 flexible functions that can be used to create additional protection functions to maximize application flexibility.
- 5. Feeder protection – transformer protection
 - a. The transformer differential protection relays shall be Siemens 7UT61 or equivalent. The relays shall provide the following protection functions: 87, 87N, 50/51, 50/51G, 49, 46 and 50BF.
 - b. The transformer differential relays shall have a through-fault restraint setting to prevent tripping due to high current external faults.
- 6. [Generator circuit breaker protection – Simple overcurrent with communications
 - a. The relays shall be Siemens 7UM623 series. The relays shall provide the following protection functions: 59, 51V, 81, 27, 32/32R, 40, 87G, 46 and 51G.
 - b. The relays shall provide current differential protection for the generators.
 - c. The relays shall monitor the CT and VT circuits and alarm on circuit failure.
 - d. The relays shall have programmable logic capabilities to permit use in protection and control systems. Programming software shall be compliant with IEC 61131 standard for PLC programming.
 - e. The relays shall recognize and alarm CT open circuit or short circuit conditions.
 - f. The relays shall support either RS-485 or fiber optic communications.
 - g. The relays shall have modular communication for simple integration into SCADA systems. The communication protocol shall be Modbus RTU.]
- 7. Software / data information – relay software
 - a. The relay shall be configured through Windows based software current up to Windows XP Pro.
 - b. The relays shall provide complete sequence-of-events recording, time stamped in milliseconds under all conditions. The relays shall provide oscillography (waveform) capture, with configurable pre- and post-fault data capture times. All internally and externally generated binary values shall be configurable to appear in the custom generated fault. Information containing time, date, interrupted current amps per phase, time in pickup, trip open, close or user programmed status points, etc., shall be displayed.
 - c. Logging of system and protective events, last 200 events (accessible via front RS-232 communications port and rear service communications port used to connect to a personal computer having an RS-232 port or USB via conversion).
 - d. Log of last eight faults (maximum five second record time) containing date and time stamps, pickup and tripping signals, interrupted current amps, voltage, etc. The analog



- quantities displayed in the oscillography shall have the option for viewing in either primary or secondary quantities.
 - e. Fault records shall be in the industry standard Comtrade format that shall be imported or exported.
 - f. The relay shall provide four protection settings groups. Setting group changes shall be available locally through front function key and binary input; remotely through operator or service communication interface using a personal computer and via system interface (Profibus DP, Modbus RTU, DNP3.0, IEC, etc.).
 - g. All logging settings, annunciations, fault records, Binary I/O and LED assignments must have easy to print options and easy file transfer capabilities.
 - h. Relay software shall have feature for archiving or retrieving an entire project that includes all subfolders and relay files in one simple to use feature.
 - i. A measurement supervision feature shall be providing for monitoring external current and voltage transformers connected to the relay.
 - j. The software shall have the capability of entering the settings in both primary and secondary quantities.
 - k. The current transformer polarities shall be reversible using a setting in the software when it becomes necessary.
 - l. The software shall include a commissioning tool for all hardware (BI/BO/LEDs) and SCADA mapped points.
 - m. The software shall be compatible with earlier version relay firmware releases.
 - n. The software shall have a capability to assign an IP address to the relay allowing for a web browser commissioning tool feature to view relay information online.
- D. Provision for future circuit breakers: Equip compartments designated as “future” with rails, mounting brackets, supports, primary bushings, shutters and bus connections.
- E. Control wiring: Factory installed, complete with bundling and protection where necessary and complying with the following:
1. Extra-flexible conductors for wires across hinges and for interconnections between shipping units. Control and secondary wiring shall be at least No. 14 AWG.
 2. Conductors sized according to NFPA 70.
 3. Internal wiring shall be carried in inter-unit wiring area, which protects the wires. The wires shall be bundled, tie-wrapped and secured to metal anchors. Wire ties with self sticking tape shall not be permitted.

2.5 VACUUM CIRCUIT BREAKERS

- A. Vacuum circuit breakers: Drawout mounted units using three individual vacuum interrupters and including the following features:
1. Circuit breaker design shall operate at rated voltage to interrupt fault current within its rating within [five-] [three-] cycles of trip initiation.
 2. Contact-wear indicator shall be readily visible from the rear of the circuit breaker.
 3. Four minimum spare auxiliary contacts shall be provided. Additional contacts shall be provided on the cell wall as specified.
 4. Operating mechanism shall be electrically charged, mechanically and electrically trip-free and stored-energy operated.
 5. Closing velocity of moving contacts shall be independent of both control voltage level and operator.
 6. Design of mechanism shall permit manual charging of mechanism.
 7. Control power shall be 120 Vac for closing, 120 Vac with capacitor tripping.
 8. The operating mechanism shall be front accessible so that it is not necessary to work under the circuit breaker or tip it over in order to perform maintenance.



9. A single visual check, such as a contact erosion indicator, shall be sufficient to verify both spring pressure and contact wear. The contact erosion indicator shall be identical across all circuit breaker ratings. Confusing maintenance procedures, such as separate contact erosion and wipe measurements, shall not be permitted.
 10. Circuit breaker tripping provisions shall include shunt trip coil for tripping with protective relays, lockout relays, control switch, or manual command signal from the relay. The circuit breaker shall include mechanical push button for manual tripping.
 11. Circuit breaker closing provisions shall include close (spring release) coil for closing by electrical signal from control circuitry, control switch or manual command signal from the relay. The circuit breaker shall include mechanical push button for manual closing.
 12. Current transfer path from the interrupter moving stem to the circuit breaker pole-mounted finger cluster shall be flexible copper laminations with long mechanical life. Brush, roller, or wiping contacts shall not be permitted.
 13. Vacuum interrupters and circuit breaker shall be manufactured and warranted by the same manufacturer.
 14. Vacuum interrupter design shall limit the chopping currents to below 5 A to obviate the need for surge protection against switching transients during fault interruption for most loads. Surge limiters shall be provided for feeders to motors having locked rotor current of less than 600 A.
- B. The circuit breakers shall be floor rollout that permits convenient insertion and withdrawal of the vacuum circuit breakers in the lower cells (of switchgear not on a raised pad) without the use of lift truck, ramp or dolly.
 - C. Circuit breakers of equal ratings shall be interchangeable for the upper and lower cells.
 - D. [For 50 kA or lower ratings, the vacuum circuit breakers shall be designed to be used in switchgear cells of the same design and short-circuit rating but different voltage or continuous ratings, as long as the voltage and continuous current ratings of the circuit breaker shall be equal to or higher than required by the cell. 2000 A and 3000 A circuit breakers shall be designed to be used in 1200 A cells.]
 - E. [For 63 kA rating, the vacuum circuit breakers shall be designed to be used in switchgear cells of the same design and short-circuit rating but different voltage or continuous ratings, as long as the voltage and continuous current ratings of the circuit breaker shall be equal to or higher than required by the cell. 2000 A and 3000 A circuit breakers shall be designed to be used in 1200 A cells.]
 - F. It shall be possible to test the circuit breaker in the "Test" position inside the cell without the use of additional cables or couplers.
 - G. The switchgear manufacturer shall cycle each circuit breaker through at least 200 mechanical on-off operations as a part of routine production tests.

2.6 INFRARED VIEWING PANES (IR WINDOWS)

- A. The backside of the switchgear compartments contain cable or bus connections that can be thermographically inspected. One (1) Infrared window (3 inch round, transparent) shall be provided for each single high compartment section and two (2) windows (3 inches round, transparent) shall be provided for two high type sections. Refer to specification section 261414.
- B. Acceptable installers:
 1. IR viewing panes shall be factory installed by the switchgear manufacturer or field installed by a certified installer, as recommended by the IR viewing pane manufacturer.
 2. Installer shall be factory certified and trained by the IR viewing pane manufacturer.



2.7 ACCESSORIES

- A. Manual racking crank.
- B. Manual spring charging crank.
- C. [Circuit breaker test cabinet separately mounted and containing pushbuttons for circuit breaker closing and tripping, fuses and secondary coupler with cable approximately 9 feet long.]
- D. [Secondary test coupler to permit testing of circuit breaker outside the assembly.]
- E. [Circuit breaker lift truck for removing circuit breakers from the upper cells.]
- F. [Lift sling.]
- G. [Electric racking motor assembly and control station.]
- H. [Fifth wheel device for convenient handling of circuit breakers.]
- I. Six spare fuses of each type and rating of fuse used. Include spares for voltage transformer fuses and control power fuses.
- J. One spare indicating lamp of each type installed.
- K. ½ pint of touchup paint matching enclosure finish.
- L. Contact lubricant.
- M. [Ground and test device [for 50 kA or lower ratings], manually operated, suitable for phasing out, testing and grounding switchgear bus or feeder when the device is installed in place of circuit breaker shall include the following:
 - 1. Six primary disconnect studs.
 - 2. Padlock provisions on the doors of the test device in order to prevent access to a live circuit or a circuit that the user does not intend to ground or test.
 - 3. Six test terminals isolated phase-phase and phase-ground with insulating barriers and accessible by means of hinge insulating cover.
 - 4. Three single-pole three-position manually operable switches, suitable for connecting upper test terminals or lower test terminals to a common ground and including ground disconnect from connection to the switchgear ground bus system.]
- N. [Ground and test device [for 50 kA or lower ratings, or for 63 kA rating], electrically operated, suitable for phasing out, testing and grounding switchgear bus or feeder when the device shall be installed in place of circuit breaker and shall include the following:
 - 1. Interchangeable with drawout, medium voltage circuit breakers to provide interlocked electrical access to either bus or feeder; electrically operated.
 - 2. Remote-control station with [30] [40] [50] foot long coupler cable.
 - 3. Suitable interlocks to facilitate safe procedures.
 - 4. Test wells arranged to allow testing for presence of voltage on each of the 6 disconnects.
 - 5. Two devices shall be furnished, one for grounding the upper terminals and one for grounding the lower terminals through the power operated ground making switch.]
 - 6. [Optional - Ground and test device shall have interrupting capacity equal to that of the circuit breakers for which it is substituted.]



PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

- A. Conform to Section 014000 – Quality Requirements.

3.2 INSTALLATION

- A. Electrical contractor or switchgear installer shall install switchgear in accordance with manufacturer's written instructions and the following specifications.

3.3 ADJUSTMENTS AND CLEANING

- A. Remove debris from switchgear and wipe dust and dirt from all components.
- B. Repaint marred and scratched surfaces with touch up paint to match original finish.

3.4 FACTORY TESTING

- A. The following standard factory tests shall be performed on the circuit breaker element provided under this section. All tests shall be in accordance with the latest version of ANSI standards.
 - 1. Alignment test with master cell to verify all interfaces and interchangeability.
 - 2. Circuit breakers operated over the range of minimum to maximum control voltage.
 - 3. Factory setting of control gap.
 - 4. One-minute dielectric test per ANSI standards.
 - 5. Final inspections and quality checks.
- B. The following production test shall be performed on each breaker housing:
 - 1. Alignment test with master breaker to verify interfaces.
 - 2. One-minute dielectric test per ANSI standards on primary and secondary circuits.
 - 3. Operation of wiring, relays and other devices verified by an operational sequence test.
 - 4. Final inspection and quality check.
- C. The manufacturer shall provide certified copies of factory test reports for O & M Manuals.

3.5 MANUFACTURER'S CERTIFICATION

- A. A qualified factory-trained manufacturer's representative shall certify in writing that the equipment has been installed, adjusted and tested in accordance with the manufacturer's recommendations.
- B. The contractor shall provide copies of the manufacturer's representative's certification in O&M Manuals.

3.6 TRAINING

- A. The contractor shall provide a training session for up to five(5) USPS's representatives for 3 normal workdays at a jobsite location determined by the USPS.
- B. The training session shall be conducted by a manufacturer's qualified representative. Training program shall include instructions on the assembly, circuit breaker, protective devices and other major components.



3.7 FIELD ADJUSTMENTS

- A. The relays shall be set in the field by: A qualified representative of the manufacturer, retained by the Contractor, in accordance with settings designated in a coordinated study of the system as required elsewhere in the contract documents.

3.8 WARRANTY

- A. Equipment manufacturer shall warrant that all goods supplied are free of non-conformities in workmanship and materials for [12 months] [18 months] from date of initial operation.

3.9 START-UP SERVICE

- A. Switchgear manufacturer shall provide a factory-authorized service representative for a period of [2] [3] [4] [5] days to train USPS's maintenance personnel in the following:
 - 1. Procedures and schedules related to startup and shutdown, troubleshooting, servicing and preventive maintenance.
 - 2. Review data in the maintenance manuals. Refer to Division 1 Section.
 - 3. Schedule training with USPS with at least three week's advance notice.

3.10 COMMISSIONING

- A. Conform to Specification Sections:
 - 1. Section 260800 – Commissioning of Electrical Systems.
 - 2. Section 019113 – General Commissioning Requirements.

3.11 FIELD SERVICE

- A. Switchgear manufacturer's own field service office (same name as the manufacturer) shall be located not more than a three hour drive from the installation site.

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END OF SECTION 26 13 13 00



SECTION 26 13 17 00 - MPF MEDIUM-VOLTAGE INTERRUPTER SWITCHGEAR

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

This specification shall be utilized only upon written approval from USPS Headquarters, submitted through the Contracting Officer.

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes medium voltage metal-enclosed switchgear assemblies consisting of fusible or non-fusible load interrupter switches and associated auxiliary equipment.
- B. Related Documents: The Contract Documents, as defined in Section 011000 – Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Section include the following:
 - 1. Section 019113 - General Commissioning Requirements.
 - 2. Section 260500 - Common Work Results for Electrical.
 - 3. Section 260800 - Commissioning of Electrical Systems.
 - 4. Section 261116 - Secondary Unit Substations.
 - 5. Section 261216 - Dry-Type, Medium-Voltage Transformers.
 - 6. Section 261313 - Medium Voltage Circuit Breaker Switchgear.
 - 7. Section 261414 - Infrared Viewing Panes (IR Windows).
 - 8. Section 337173 - Electrical Utility Services.

1.2 SUBMITTALS

- A. Submit shop drawings and product data for approval and final documentation in the quantities listed according to the Conditions of the Contract. All transmittals shall be identified by customer name, customer location and customer order number.
- B. Documents for Approval: One-line diagrams, dimensioned plans, sections and elevations showing minimum clearances, installed devices, major features, nameplate legends and bills of material.
- C. Final Documents: Record documentation to include those in 1.3.B and wiring diagrams, single-line and three-line diagrams of switchgear bus and component connections, product data of accessories or parts not previously described in the drawings, list of recommended spare parts and instruction and installation manuals



- D. **Product Data:** Include features, characteristics and ratings of switches, fuses and other components. Also, time-current characteristic curves for power fuses and any overcurrent devices.
- E. **Shop Drawings:** Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components and location and size of each field connection. Include the following:
 - 1. Enclosure type and details.
 - 2. Nameplate legends.
 - 3. Bus configuration with size and number of conductors in each bus run, including phase, neutral and ground conductors of main and branch buses.
 - 4. Current ratings of buses.
 - 5. Short-time and short-circuit ratings of switchgear assembly.
 - 6. Mimic bus diagram.
 - 7. **Wiring Diagrams:** Detail wiring for power, signal and control systems and differentiate between manufacturer-installed and field-installed wiring.

1.3 RELATED STANDARDS

- A. Comply with requirements of latest revisions of applicable industry standards, specifically including the following:
 - 1. ANSI/IEEE C37.20.3 – Standard for Metal-Enclosed Interrupter Switchgear.
 - 2. ANSI/IEEE C37.20.4 – Standard for Indoor AC Medium Voltage Switches Used in Metal-Enclosed Switchgear.
 - 3. NEMA
 - 4. UL

1.4 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** Engage a firm with at least 5 years experience in manufacturing switchgear.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in factory labeled packages. Shipping groups shall not exceed 15 ft. in length.
- B. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from potential damage from weather and construction operations. Store so condensation will not form on or in switchgear and if necessary, apply temporary heat where required to obtain suitable service conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 - 1. Eaton Corporation, Cutler-Hammer Products, Pittsburg, PA (800) 525-2000.
 - 2. General Electric Company (800) 626-2000.
 - 3. Siemens Energy and Automation, Alpharetta, GA (800) 964-4114.
 - 4. Square D Company, Palatine, IL (800) 392-8781.
 - 5. No substitutions permitted.



2.2 RATINGS

- A. System Configuration: Switchgear suitable for application in three-phase, 60-Hz, grounded-neutral system.
- B. Electrical Ratings:
 - 1. Nominal System Voltage, kV: [4.16] [7.2] [13.8] [34.5]
 - 2. Maximum Design Voltage, kV: [5] [8.25] [15] [38]
 - 3. BIL Impulse Level: [60] [95] [150] [200]
 - 4. Main-Bus Continuous: [600] [1200] [2000] A.
 - 5. Switch Duty Cycle, Fault Closing, symmetrical A: [40] [61]

2.3 GENERAL REQUIREMENTS

- A. The switchgear shall be factory assembled and tested and comply with applicable industry standards. If multiple sections, it shall be a coordinated design so that shipping groups are easily connected together at the site into a continuous line-up. Necessary connecting materials shall be furnished.
- B. The switchgear assembly shall consist of one or more metal-enclosed ventilated sections in indoor NEMA 1 enclosure(s). Units shall be of individual frames of bolted steel construction with full-side sheets separating adjacent units. Each frame shall be adequately braced to function properly under normal operating and short-circuit conditions. Assembly shall have the following:
 - 1. Window on door to permit viewing switch-blade positions when door is closed.
 - 2. Rear removable panels with handles
 - 3. Danger-warning sign
 - 4. Interlock air-interrupter switch with transformer secondary main circuit breaker, preventing switch from being opened or closed unless secondary main circuit breaker is open.
- C. The switchgear shall be UL listed with separate door to the switch. Door shall be mechanically interlocked with the switch to prevent closing the switch with the door open and to prevent opening the door with the switch closed. Door shall have provision for pad lock.
- D. Surge Arresters: Comply with IEEE C62.11, station class; metal-oxide-varistor type, with ratings as indicated, connected in each phase of incoming circuit and ahead of any disconnecting device.
- E. Main bus shall connect vertical sections and between compartments and shall be uniform capacity the entire length of assembly. The main horizontal bus shall be run in a vertical, edge-to-edge arrangement for high short circuit strength. Access to the rear cable termination area shall be possible without reaching over the main and vertical bus.
 - 1. Bus shall be 98% minimum conductivity copper with silver-plated joints.
 - 2. Ground Bus shall be copper of 98 percent minimum conductivity, with pressure connector for feeder and branch-circuit ground conductors, minimum size 1/4 by 2 inches.
 - 3. Bus bracing shall be equal to the short circuit interrupting rating of the lowest rated non-fused circuit breaker applied in the assembly.
 - 4. Neutral Bus shall be [50] [100] percent of phase-bus ampacity. Equip bus with pressure-connector terminations for outgoing circuit neutral conductors.
 - 5. [Neutral bus equipped with pressure-connector terminations for outgoing circuit neutral conductors. Neutral-bus extensions for busway feeders are braced.]
 - 6. [Neutral Disconnect Link: Bolted, uninsulated, 1/4-by-2-inch copper bus, arranged to connect neutral bus to ground bus.]
 - 7. MV clearances shall be maintained in all horizontal and vertical buses such that insulation is not required.
- F. Fungus Proofing: Permanent fungicidal treatment for switchgear interior, including instruments and instrument transformers.



2.4 INFRARED VIEWING PANES (IR WINDOWS)

- A. The design of interrupter switches is such that all important electrical components and connections can be effectively viewed for thermographic inspection. A single, transparent, rectangular infrared window (9 inch W x 5 inch H) shall be provided in the front top section; centered on the Phase "B" inter-phase barrier. A single, transparent window (3 inch round) shall be provided in the bottom front section of the switch to view the fuses and another rectangular, window (9 inch W x 5 inch H, transparent) shall be provided in the top rear section, centered on phase "B", to view the cable connections at the top of the enclosure. Note that nonfusible, interrupter switches need not be equipped with a viewing pane in the bottom front section. Refer to specification section 261414 for specific details.
- B. Acceptable installers:
 - 1. IR viewing panes shall be factory installed by the switchgear manufacturer or field installed by a certified installer, as recommended by the IR viewing pane manufacturer.
 - 2. Installer shall be factory certified and trained by the IR viewing pane manufacturer.

2.5 COMPONENTS

- A. Instrument Transformers: Comply with IEEE C57.13.
 - 1. Potential Transformers: Secondary voltage rating of 120V and NEMA accuracy class of 0.3 with burdens of W, X and Y.
 - 2. Current Transformers: [Bar type for utilities] [Donut type for shielded cable], ratios as indicated; burden and accuracy class suitable for connected relays, meters and instruments.
- B. Multifunction Digital-Metering Monitors shall be UL-listed or -recognized, microprocessor-based unit suitable for three- or four-wire systems. Units shall be mounted in the instrument compartment door.
- C. The numerical protective relays shall have multi-phase inputs (current and voltage) and multifunction protection elements that are UL listed or recognized meeting ANSI Surge Withstand standards IEEE C37.90.1 and C37.90.2. Features include:
 - 1. Protection, breaker control and automation CFC (Continuous Function Logic)
 - 2. Four Function keys that can be user-programmed
 - 3. Four (4) Line Backlit front display for metering, relay settings and fault information
 - 4. Seven (7) user-programmable target LED's and two (2) diagnostic alarm LED's
 - 5. Front access to circuit boards packaged in a flush mounted case with removable front cover
 - 6. Microprocessor Based Protection that includes:
 - a. Three-phase and Ground Instantaneous (2 element) Overcurrent With Timer (50, 50-1, 50-2, 50N-1, 50N-2)
 - b. Time Overcurrent (Selectable Curves)(51, 51G, 51N)
 - c. Negative sequence time and Instantaneous Overcurrent (46TOC, 46-1, 46-2)
 - d. [Three-phase and Ground Directional (2 element) (67-1, 67-2, 67N-1, 67N-2)]
 - e. [Frequency protection with 4 independent setpoints that can be used for either under-frequency or over-frequency (81O/U)]
 - f. [Over-voltage protection (59)]
 - g. [Under-voltage protection (27-1, 27-2)]
 - h. Breaker failure (50BF)
 - i. Wide range of taps (0.5 - 20 amps, in 0.5 amp steps)
 - j. Trip coil monitoring, function 74TC, for dc control power applications
 - k. PLC programming capability to perform custom protection and control functions.
 - l. Windows based software for easy configuration and programming of the relay
 - 7. User Programmable Binary Inputs and Outputs
 - 8. Metering of phase and ground currents and amperes demand, min/max
 - 9. Metering of phase and ground voltages and min/max
 - 10. Metering of watts, vars, kilowatt-hours and kilovars-hours, including min/max and demand



11. Logging of system and protective events, last 50 events (accessible via front RS-232 communications port and rear system communications port)
12. Log of last 8 trips - containing time, date, interrupted amps, time in pickup, etc.
13. Logging of per-phase interrupted amperes for the last fault
14. 110-125VDC/110-250VAC power supply model selection options:
 - a. [7SJ6225-5EC02-3FG0 (no rear system port)]
 - b. [7SJ6225-5EC92-3FG0 +LOA (Profibus rear RS485 port)]
 - c. [7SJ6225-5EC92-3FG0 +LOB (Profibus rear Fiber port)]
 - d. [7SJ6225-5EC92-3FG0 +LOD (Modbus rear RS485 port)]
 - e. [7SJ6225-5EC92-3FG0 +LOE (Modbus rear Fiber port)]
 - f. [7SJ6225-5EC92-3FG0 +LOG (DNP3 rear RS485 port)]
 - g. [7SJ6225-5EC92-3FG0 +LOE (DNP3 rear Fiber port)]
- D. Control power transformer, single phase, with primary disconnect fuse 120/240 VAC secondary, internally mounted dry-type transformer with disconnect primary fuses, [5] [10] [15] kVA.
 1. [Automatic transfer of load with main-tie-main controls]
- E. Mimic Bus: Continuous mimic bus applied to front of switchgear, arranged in single-line diagram format, using symbols and lettered designations consistent with approved final mimic-bus diagram. Mimic-bus segments shall be coordinated with devices in switchgear sections to which applied, to produce a concise visual presentation of principal switchgear components and connections.]

2.6 INTERRUPTER SWITCH AND FUSE ASSEMBLY

- A. Load interrupter switches shall be three-pole, single throw, gang-operated stored energy type with quick-make, quick-break operation.
 1. Electrically operated
 2. Non removable switch handle
 3. Separate main and arcing contacts to provide maximum endurance for fault close and load interrupting duty
 4. Arcing contacts shall be spring loaded so that on opening they breaker after the main contacts, on closing they make after the main contacts. Arc interruption to take place in an interruption chute.

2.7 TESTING

- A. Perform production tests in compliance with ANSI C37 and NEMA SG 5 requirements. Provide certified test results.

2.8 UNITS REQUIRED

- A. Incoming Line: Qty []
 1. 3 - __ kV MCOV [station] [intermediate] class surge arrestors
 2. [Set of _ voltage transformers, rated _____V]
 3. [Set of _ current transformers, rated _____A]
 4. [1 Microprocessor-based 3-phase and ground overcurrent relay, ANSI Device 50/51, 50/51N.]
 5. [1 – Microprocessor-based meter]
 6. Connections shall be made via:
 - a. [A set cable lugs [] per phase, [Clamp-type] [compression-type] [Cable terminators] [Potheads] for [] type cable [] size, [] kV for [top] [bottom] entry.]
 - b. [Metal-enclosed bus rated [] A]
- B. Switches: Qty []
 1. Current rating: [600] [1200] A



2. [Outgoing set of cable lugs] [Close-couple connection to transformer with insulated cable] [Close-couple connection to transformer with rigid bus]

2.9 ACCESSORIES

- A. The following accessories shall be provided:
 1. Three spare control fuses for potential transformer and control power transformer.
 2. Spare Indicating Lights: One of each type installed.
 3. Touchup Paint: One-half pint of paint matching enclosure finish.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Electrical contractor to install metal-clad switchgear in accordance with manufacturer's written instructions and the following specifications.
- B. Install and anchor switchgear in accordance with manufacturer's instructions.
- C. Tighten bus joints, electrical connectors and terminals according to manufacturer's published torque-tightening values. Install equipment grounding conductors for switchgear with ground continuity to main electrical ground bus.

3.2 ADJUSTMENTS AND CLEANING

- A. Set field-adjustable, protective-relay trip characteristics.
- B. Clean exposed surfaces using manufacturer recommended materials and methods. Touch-up damaged coating and finishes using non-abrasive materials and methods recommended by manufacturer. Eliminate all visible evidence of repair.

3.3 TESTING

- A. After installing switchgear and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 1. Procedures: Perform inspections and tests specified below. Report values that do not meet manufacturer's written recommendations. Certify compliance with test parameters.
 2. Switchgear: Perform inspections and tests stated in NETA ATS, Section 7.1.
 3. Instrument Transformers: Perform inspections and tests stated in NETA ATS, Section 7.10.
 4. Metering and Instrumentation: Perform inspections and tests stated in NETA ATS, Section 7.11.
 5. Ground-Fault Systems: Perform inspections and tests stated in NETA ATS, Section 7.14.
 6. Battery Systems: Perform inspections and tests stated in NETA ATS, Section 7.18.
 7. Surge Arresters: Perform inspections and tests stated in NETA ATS, Section 7.19.

3.4 WARRANTY

- B. Equipment manufacturer warrants that all goods supplied are free of non-conformities in workmanship and materials for [12 months] [18 months] from date of initial operation.



3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Engage a factory-authorized service representative to inspect field-assembled components, installation and connection of switchgear; and to pretest and adjust switchgear components. Report results in writing.
- B. Remove and replace malfunctioning units with new units and retest.

3.6 STARTUP SERVICES

- A. Engage a factory-authorized service representative to perform startup service.
- B. Train USPS's maintenance personnel on procedures and schedules for energizing and de-energizing, troubleshooting, servicing and maintaining equipment and schedules.
- C. Verify that switchgear is installed and connected according to the Contract Documents.
- D. Verify that electrical control wiring installation complies with manufacturer's submittal by means of point-to-point continuity testing.
- E. Complete installation and startup checks according to manufacturer's written instructions.

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SECTION 26 14 14 00 - MPF INFRARED VIEWING PANES (IR WINDOWS)

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [] indicates information may be inserted at this location

PART 1 - GENERAL

1.1 SUMMARY

- A. This specification provides the technical requirements for the design, manufacture, testing and installation of Infrared viewing panes. The contractor shall provide and install all components as specified herein and shown on related electrical drawings
- B. Related Documents: The Contract Documents, as defined in Section 011000 – Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Section include the following:
 - 1. Section 260500 – Common Work Results for Electrical.
 - 2. Section 261116 – Secondary Unit Substations.
 - 3. Section 261216 – Dry-Type Medium-Voltage Transformers
 - 4. Section 261313 – Medium Voltage Circuit Breaker Switchgear.
 - 5. Section 261317 – Medium-Voltage Interrupter Switchgear.
 - 6. Section 262413 – Switchboards.

1.2 REFERENCES

- A. Infrared viewing panes shall be U.L. recognized, shall allow visual and infrared scanning and shall comply with the following standards:
 - 1. IEEE C.37.20.2, section a.3.6 and UL Standard 1558 for impact and load requirements.
 - 2. U.L. Standard 508C and 746C for impact and flammability requirements.
 - 3. U.L. 94 5VA Flammability Resistance.
 - 4. IP65/NEMA 4 rated; both open and closed.
 - 5. UL Standard 891 – Switchboards.
 - 6. UL Standards 508A, 50V and 50E recognized.

1.3 SUBMITTALS

- A. Submit shop drawings and product data for approval and final documentation in the quantities listed according to the Conditions of the Contract. All transmittals shall be identified by customer name, customer location and customer order number.
- B. Documents for Approval: Pane identification tags, recording inspection parameters, dimensioned drawings and sections, major features and installation instructions. Section 013300 - Submittal Procedures: Procedures for submittals.



1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Engage a firm with at least (10) years experience in manufacturing and installing infrared viewing panes (lens and/or optic type)

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in factory labeled packages.
- B. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from potential damage from weather and construction operations. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 1. IRISS, Bradenton, FL (877) 704-7477.
 2. Schneider Electric, Westchester, OH (888) 778-2733.
 3. FLIR, Nashua, NH (866) 477-3687.
 4. Substitutions permitted with approval from contracting officer.
- B. Infrared viewing panes shall be manufactured utilizing a crystal or IR optic polymer, shall be sized as indicated and shall be transparent or opaque as specified.
 1. Opaque 3 inch round IR windows:
 - a. Basis of Design: IRISS # VPFR-75.
 - b. Acceptable manufacturers: As listed in para. 2.1A.
 2. Transparent 3 inch round IR window:
 - a. Basis of Design: IRISS # VPT-75.
 - b. Acceptable manufacturers: As listed in para. 2.1A.
 3. Opaque 9 inch W x 5 inch H rectangular IR window:
 - a. Basis of Design: IRISS # CAP-C-12.
 - b. Acceptable manufacturers: As listed in para. 2.1A.
 4. Transparent 9 inch W x 5 inch H rectangular IR window:
 - a. Basis of Design: IRISS # CAP-CT-12.
 - b. Acceptable manufacturers: As listed in para. 2.1A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:

2.2 TESTING REQUIREMENTS

- A. The IR viewing panes (opaque or transparent and sized as specified) shall meet or exceed the following minimum requirements:



1. IR viewing panes shall be impact tested in accordance with U.L. 746c, section 56 with cover open and closed.
 - a. After conditioning at 0 degrees C for 3 hours, an impact of 5 foot-pounds shall be applied front and rear of the viewing panes. The test shall be deemed to have failed if the IR viewing pane cracks, shatters or dislodges.
2. IR viewing panels shall undergo a front and rear load test as per IEEE standard C37.20.2, specifically section A.3.6.
 - a. A force of 445 N (100 lbf) shall be exerted perpendicular to the surface in which the viewing pane is mounted. This force should be distributed evenly over an area of 0.010 M² (16 in²), as nearly square as possible, and as near the geometric center of the viewing pane as possible. If the viewing pane has an area less than 0.010 M² (16 in²), the force should be evenly distributed over the entire viewing area. The 445 N (100 lbf) should be sustained for a period of 1 min on the front and rear of the viewing panels. The test shall be deemed to have failed if the IR viewing panel cracks, shatters or dislodges.
3. IR viewing pane lens materials shall undergo a 5V flammability test in accordance with U.L. 746c, section 56.
 - a. After conditioning at 0 degrees C for 3 hours, the materials are subjected to a 5 inch flammability test. The test shall be deemed to have failed if the IR viewing panel cracks, shatters or dislodges.
4. IR viewing panes shall have fixed covers (i.e. the cover cannot be removed by removing a screw, etc.)
 - a. This requirement ensures that locking screws and protective covers are never lost and that the viewing panel will be secured at all times when not in use.
5. IR viewing panes shall be fail safe.
 - a. In the event of a premature failure of the lens, through accidental damage or misuse, the maximum opening within the panel should not exceed the requirement for IP2X.
6. IR viewing panes shall withstand a minimum of 25 psi.
7. IR viewing panes requiring PPE protection shall not be acceptable.

2.3 MECHANICAL PROPERTIES

- A. Infrared panes shall allow for safe visual and thermal imaging of fully energized electrical components through closed doors for voltages up to 72 KV. The IR windows as a minimum shall have the following mechanical properties:
 1. Environmental minimum standard: IP65 (Europe) or NEMA 4 (USA) both closed and when in use.
 2. Lens or optic shall be resistant to acids, alkalis and water (non-hydroscopic materials).
 3. Lens or optic must have vibration resistance.
 4. Gaskets and materials shall meet minimum flammability resistance per UL 94 5VA.
 5. IR window assembly shall be recognized by UL 508A and UL 50V.
 6. IR window assembly shall be supplied with all fitting instructions, cutting templates and fixing screws.
 7. Standard round viewing window lens or optic diameters shall be minimum 3 inch.
 8. Rectangular window viewing lens or optics shall be available in standard 9 inch W x 5 inch H or customized solutions.
 9. Visual inspection option shall be made available where specified and shall be in full compliance with UL 746C and IEEE C 37.20.2 section a.3.6.
 10. Optional training and support shall be made available to the Owner for additional cost.
 11. IR window assemblies shall be reusable and recyclable

2.4 INFRARED PERFORMANCE PROPERTIES

- A. The IR viewing panes shall be suitable for use with any thermal camera (i.e.: ultraviolet, shortwave, midwave and longwave IR ranges).
- B. Lens or optic material shall have stable transmission rates between 4 and 9 micron wavelengths. Transmission rates of the IR viewing panes shall therefore be quoted for the following wavelengths:



Shortwave IR wavelength = 4 microns (Basis of design @ 68 percent transmittance)
 Longwave IR wavelength = 9 microns (Basis of design @ 72 percent transmittance)

PART 3 - EXECUTION

3.1 INSTALLATION

NOTE TO SPECIFIER

IR viewing panes are to be factory installed by the switchgear manufacturer for new construction projects and are to be field installed for R&A projects. Select paragraphs 3.1A accordingly.

- A. [IR viewing panes shall be factory installed by the switchgear manufacturer as recommend by the IR viewing pane manufacturer.]
- A. [IR viewing panes are to be field installed. Installer shall be factory certified and trained by the IR viewing pane manufacturer.]
- B. Refer to applicable requirements contained within specification sections 261116, 261216, 261313 and 261317.

3.2 ADJUSTMENTS AND CLEANING

- A. Repaint marred and scratched switchgear surfaces to match original finish.

3.3 REQUIREMENTS FOR IR VIEWING PANES MANUFACTURERS.

- A. IR viewing panes manufacturers have a duty of care to their customers to provide all the relevant details regarding the IR viewing panes materials that are utilized and as such shall, as a minimum, provide the following information:
 1. IR viewing panes shall be provided with instructions for use labels.
 2. IR viewing panes shall be provided with label system that identifies the material in viewing panes and the IR wavelength to LW & SW IR.
 3. IR viewing panes manufacturers shall provide MSDS on all substances in the assembly as per current regulations.
 4. IR viewing panes shall not be manufactured utilizing barium fluoride due to its restricted and hazardous classification.

3.4 TESTING

- A. IR viewing panes shall be operationally tested after installation to ensure satisfactory performance as specified by the manufacturer.
 1. This test ensures the IR viewing panes are fit for the purpose and provide the thermographers using the IR viewing panels with all the relevant information required to view the pane correctly and to ensure accuracy of data gathered.
- B. The actual IR transmission rates of the lens materials shall be factory tested and documented by the manufacturer.



1. The manufacturer shall be responsible to complete regular functional testing to prove the IR transmission of the IR lens materials. These results shall then be made available to the inspecting bodies and clients utilizing the viewing panes.

3.5 LABELING

- A. All IR viewing panes shall be provided with labels to record the following:
 1. Instructions for use: Clearly defined instructions that ensure the operator can correctly utilize the IR viewing pane.
 2. Identification labels: A labeling system shall be provided to identify the type of lens, IR characteristics, targets, etc. to ensure that the IR data gathered is correct and repeatable.

3.6 GUARANTEE

- A. Manufacturer shall provide unconditional lifetime guarantee on the complete pane assembly (guarantee covering only manufacturing defects shall not be acceptable).

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Task	Specification	Specification Description
26 18 16 00	26 11 16 00	Switchgear
26 21 13 00	26 05 13 00	Undercarpet Cables



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SECTION 26 22 00 00 - MPF SECONDARY DRY TYPE TRANSFORMERS**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification.

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: The work specified in this Section includes, but shall not be limited to, the following:
 - 1. Premium 30 efficient transformers with internal losses at 30 percent loading reduced by 30 percent when using temperature and material correction factor to 75 degrees C per NEMA TP 1.
 - 2. Transformer shall be UL 1561 listed to feed a mix of equipment load profiles such as computers without derating or significant degradation of efficiency.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 260500 - Common Work Results for Electrical.
 - 2. Section 261414 - Infrared Viewing Panes (IR Windows).

1.2 REFERENCES

- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - 1. IEEE 1100, "IEEE Recommended Practice for Powering and Grounding Electronic Equipment."
 - 2. ANSI/IEEE C57.1110, "Recommended Practice for Establishing Transformer Capability When Feeding Nonsinusoidal Load Currents."
- C. International Code Council (ICC):
 - 1. ICC ES AC156, "Acceptance Criteria for Seismic Qualification by Shake Table Testing of Nonstructural Components and Systems."
 - 2. ICC IBC, "International Building Code."
- D. International Organization for Standardization (ISO):
 - 1. ISO 9001, "Quality Management Systems Requirements."
 - 2. ISO 14001, "Environmental Management Systems Requirements with Guidance for Use."
- E. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)."
 - 2. NEMA ST 20, "Dry Type Transformers for General Applications."
 - 3. NEMA TP 1, "Standard for the Labeling of Distribution Transformer Efficiency."



4. NEMA TP 2, "Standard Test Method for Measuring the Energy Consumption of Distribution Transformers."

F. National Fire Protection Association (NFPA):

1. NFPA 70, "National Electrical Code," hereinafter referred to as NEC.
2. NFPA 5000, "Building Construction and Safety Code."

G. Underwriters Laboratories, Inc. (UL):

1. UL 1561, "Standard for Dry Type General Purpose and Power Transformers."

1.3 SUBMITTALS

A. As specified in Section 260500 – Common Work Results for Electrical.

B. Section 013300 - Submittal Procedures: Procedures for submittals.

1. Product Data: Outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, and impedance ratings and characteristics, tap configurations, insulation system type, and rated temperature rise.
2. Manufacturer's Test Reports:
 - a. Copy of ISO 9001 Certification of manufacturing operation.
 - b. Copy of ISO 14001 Certification of manufacturing operation.
 - c. Confirmation that transformers are UL 1561 listed with a K9 rating. Those requiring a k factor rating will be either K9 or K13 rated.
 - d. Construction details, including, but not limited to, enclosure dimensions, kVA rating, primary and secondary nominal voltages, voltage taps, approximate center of gravity, and unit weight.
 - e. Basic performance characteristics, including, but not limited to, insulation class, temperature rise, core and coil materials, impedances and audible noise level, unit weight, and inrush value expressed in a multiplier of rated primary current RMS.
 - f. Efficiency data shall be reported as described in the following sections. Reference temperatures shall be included when reporting efficiency.
 - 1) No load and full load losses shall be calculated per NEMA ST 20 test methods.
 - 2) Efficiency curves as follows:
 - a.) Linear loads.
 - b.) Data per the non linear load test program.
 - g. Documentation describing non linear load test program.
 - h. Sound level ratings.
3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

C. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals:

1. Project Record Documents: Record actual locations of transformers.
2. Maintenance Data: Include recommended maintenance procedures and intervals.

1.4 QUALITY ASSURANCE

A. As specified in Section 260500 – Common Work Results for Electrical.



- B. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction. Obtain necessary approvals from such authorities.
 - 1. Seismic Requirements:
 - a. ICC IBC, NFPA 5000.
 - b. Tri axial shake table test results conducted in accordance with the ICC ES AC156 test protocol 3 (Acceptance Criteria for Seismic Qualification Testing of Nonstructural Components).
 - 2. Comply with NEMA Premium Efficiency Transformer Program Guidelines, Program Description and Specification Document
- C. Compliance: Comply with applicable requirements of the following standards.
 - 1. CSA 802.2.
 - 2. CSA C22.2.
 - 3. IEEE 1100.
 - 4. ANSI/IEEE C57.1110.
 - 5. NEMA 250.
 - 6. ASHRAE 90.1 – 2010.
- D. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Transformers shall be packaged for shipment using materials that shall have the least environmental impact..
 - 1. Transformer Wrapping: Transformers shall be protected by cardboard protective material, all plastic wraps shall not be accepted.
 - 2. Transformer Shipping Base: Transformers shall be shipped on a base that uses at least 50 percent less wood than traditional pallets. Comply with ISPM No. 15.
- C. Store in a warm, dry location with uniform temperature. Cover ventilation openings to keep out dust, water and other foreign material.
- D. Handle transformers using lifting eyes and/or brackets provided for that purpose. Protect against unfavorable external environment such as rain and snow, during handling.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Eaton Corporation, Cutler-Hammer Products, Pittsburgh, PA (800) 525-2000.
 - 2. General Electric Company (800) 626-2000.
 - 3. Siemens Energy & Automation, Inc., Alpharetta, GA (800) 964-4114.



4. Square D Company, Palatine, IL (800) 392-8781.

- B. Basis of Design: Product specified is "Premium Lighting and Distribution Transformers" as manufactured by Square D by Schneider Electric. Items specified are to establish a standard of quality for design, function, materials, and appearance. Equivalent products by other manufacturers are acceptable. The Architect/Engineer will be the sole judge of the basis of what is equivalent.
- C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- D. Transformers shall be designed to an efficiency standard higher than the lowest legal standard for the purpose of contributing to LEED Energy and Atmosphere (Optimize Energy Performance) and Utility Rebates.

2.2 TWO WINDING TRANSFORMERS

- A. The transformer shall be UL 1561 listed and labeled with a K9 or K13 rating (per UL 1561 35.2.1 and 34.2: K7 is not allowed).
- B. Windings shall be continuous wound copper with brazed or welded terminations.
- C. Insulation and varnish systems shall be Nomex-based UL recognized 220 degrees C class utilizing an epoxy polyester impregnation.
- D. Maximum winding temperature rise for non-k-rated units and K9-rated units shall be 80 degrees C.
- E. Terminals, including, but not limited to, those for changing taps, shall be readily accessible by removing a front cover plate.
- F. The transformers shall have a basic impulse level of 10 kV BIL.
- G. Voltage taps shall be as follows:
 - 1. Primary 600 volts to 380 volts.
 - a. For transformers 15 kVA to 300 kVA, provide two 2-1/2 percent full capacity taps above and four 2-1/2 percent below nominal primary voltage.
 - b. For transformers 500 kVA to 750 kVA, provide two 2-1/2 percent full capacity taps above and two 2-1/2 percent below nominal primary voltage.
- H. Impedance shall be the manufacturer's standard.
- I. No load losses shall not exceed the following values:
 - 1. 15 kVA: 55 W.
 - 2. 30 kVA: 90 W.
 - 3. 45 kVA: 125 W.
 - 4. 75 kVA: 165 W.
 - 5. 112.5 kVA: 230 W.
 - 6. 150 kVA: 290 W.
 - 7. 225 kVA: 435 W.
 - 8. 300 kVA: 560 W.
- J. Three phase transformer efficiency shall be as stated below (tested at 35 percent of the nameplate rating, per NEMA TP 1 and NEMA TP 2):
 - 1. 15 kVA: 97.88 percent.
 - 2. 30 kVA: 98.24 percent.
 - 3. 45 kVA: 98.38 percent.
 - 4. 75 kVA: 98.59 percent.
 - 5. 112.5 kVA: 98.73 percent.



6. 150 kVA: 98.80 percent.
7. 225 kVA: 98.95 percent.
8. 300 kVA: 99.02 percent.

K. Sound Levels shall be as follows:

1. 15 to 50 kVA: 42 dB.
2. 51 to 150 kVA: 47 dB.
3. 151 to 300 kVA: 52 dB.

L. Transformers shall be designed for continuous operation at rated kVA, for 24 hours a day, 365 days a year operation, with normal life expectancy as defined in ANSI C57.96.

M. Where required for K-Factor rating 4 or greater, the neutral bus shall be configured to accommodate 200% of the rated current.

N. Where required to suit manufacturer's performance requirements of equipment served, provide isolation transformers with electrostatic shielding.

O. Transformers sized above 112.5 KVA shall have U.L. Class 155 insulation ratings, minimum. Installation of transformers shall comply with NFPA 70, (NEC) Article 450.21(B).

P. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap in accordance with Article 250 of NFPA 70.

Q. Mounting: Suitable for wall, floor, or trapeze mounting, except transformers larger than 75 kVA, suitable for floor mounting.

2.3 ENCLOSURE

A. The enclosure construction shall be ventilated, NEMA 2 drip-proof, with lifting holes. All ventilation openings shall be protected against falling dirt. On outdoor units, provide weather shields over ventilated openings.

B. Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.

2.4 SOURCE QUALITY CONTROL

A. Production test each transformer according to NEMA ST20.

2.5 HARMONIC TEST PLAN

A. NEMA ST 20:

1. Open Circuit Test (No Load Losses):
 - a. Use for both linear and non linear.
 - b. Measure power.
2. Short Circuit Test (Load Losses):
 - a. Short Primary Winding:
 - 1) Linear test, complete with linear profile through secondary winding.
 - 2) Non linear test, complete with non linear profile through secondary windings.

Harmonic Profile (K-7 Load)				
Harmonic Number	Rated Percent Current	Phase Shift		
		A	B	C



1	100.0	0	120	240
3	81.0	0	0	0
5	60.6	0	240	120
7	37.0	0	120	240
9	15.7	0	0	0
11	2.4	0	240	120
13	6.3	0	120	240
15	7.9	0	0	0

b. Measure power.

- B. Take data and graph efficiency per NEMA ST 20.
- Graph 1: Linear loads 0 percent to 100 percent loads.
 - Graph 2: Non-linear profile at transformer's rated k factor (default shall be K7 for non-k factor rated units), 0 percent to 100 percent loads.
- C. Test plans measuring power in and power out will not be accepted since procedures are not covered by any standard.

NOTE TO SPECIFIER

Secondary, dry type transformers "rated above 125 KVA" shall be equipped with IR viewing panes. Include paragraph 2.6 below for transformers rated above 125 KVA.

2.6 INFRARED VIEWING PANES (IR WINDOWS)

- A. Typically, the high voltage and primary tap connections are located on the high voltage side of a dry type transformer. A single, opaque, rectangular window (9 inch W x 5 inch H) shall be provided to view the high voltage power and tap connections on this side of the transformer. The secondary (low voltage) connections are typically made by bolted connections at the low voltage end of the transformer. A single, opaque, rectangular window (9 inch W x 5 inch H) shall be provided at the secondary side of the transformer to view these bolted connections. Refer to specification section 261414.
- B. Acceptable installers:
- IR viewing panes shall be factory installed by the transformer manufacturer or field installed by a certified installer, as recommended by the IR viewing pane manufacturer.
 - Installer shall be factory certified and trained by the IR viewing pane manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. As specified in Section 260500 – Common Work Results for Electrical.

3.2 PREPARATION

- A. Provide minimum 4 inch high concrete pad for floor mounted transformers.



3.3 INSTALLATION

- A. Install transformers in accordance with NECA SI and manufacturer's published instructions, at locations and as indicated on Drawings.
 - 1. Use manufacturer approved mounting brackets for transformers supported from building structure.
 - 2. Securely anchor transformers to concrete pad for floor mounted transformers.
 - 3. Provide working clearances in conformance with NFPA 70 and manufacturer's recommendations.
 - 4. Provide both primary and secondary protection using fuses or circuit breakers as indicated on Drawings.
- B. Set transformers plumb and level.
- C. Use minimum 2 foot length flexible conduit for connections to transformer case. Make conduit connections to side panel of enclosure.
- D. Mount transformers on vibration isolating pads suitable for isolating transformer noise from building structure.
- E. Provide grounding and bonding as specified in Section 260500.
- F. Furnish and install engraved plastic nameplates as specified in Section 260500.
- G. Furnish and install seismic restraints designed for type of mounting used.

3.4 FIELD QUALITY CONTROL

- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. Section 014000 - Quality Control: Field testing and inspection.
- C. Check for damage and tight connections prior to energizing transformer.
- D. Measure primary and secondary voltages and make appropriate tap adjustments.

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END OF SECTION 26 22 00 00



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SECTION 26 22 00 00 - CSF SECONDARY DRY-TYPE TRANSFORMERS**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this Outline Specification Section for Customer Service Facilities only. This Specification defines "level of quality" for Customer Service Facility construction and is intended as a guide to the Architect/Engineer preparing the Construction Documents.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: The work specified in this Section includes, but shall not be limited to, the following:
 - 1. Premium 30 efficient transformers with internal losses at 30 percent loading reduced by 30 percent when using temperature and material correction factor to 75 degrees C per NEMA TP 1.
 - 2. Transformer shall be UL 1561 listed to feed a mix of equipment load profiles such as computers without derating or significant degradation of efficiency.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 260500 - Common Work Results for Electrical.
 - 2. Section 261414 - Infrared Viewing Panes (IR Windows).

1.2 REFERENCES

- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - 1. IEEE 1100, "IEEE Recommended Practice for Powering and Grounding Electronic Equipment".
 - 2. ANSI/IEEE C57.1110, "Recommended Practice for Establishing Transformer Capability When Feeding Nonsinusoidal Load Currents."
- C. International Code Council (ICC):



1. ICC ES AC156, "Acceptance Criteria for Seismic Qualification by Shake Table Testing of Nonstructural Components and Systems."
 2. ICC IBC, "International Building Code."
- D. International Organization for Standardization (ISO):
1. ISO 9001, "Quality Management Systems Requirements."
 2. ISO 14001, "Environmental Management Systems Requirements with Guidance for Use."
- E. National Electrical Manufacturers Association (NEMA):
1. NEMA 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)."
 2. NEMA ST 20, "Dry Type Transformers for General Applications."
 3. NEMA TP 1, "Standard for the Labeling of Distribution Transformer Efficiency."
 4. NEMA TP 2, "Standard Test Method for Measuring the Energy Consumption of Distribution Transformers."
- F. National Fire Protection Association (NFPA):
1. NFPA 70, "National Electrical Code," hereinafter referred to as NEC.
 2. NFPA 5000, "Building Construction and Safety Code."
- G. Underwriters Laboratories, Inc. (UL):
1. UL 1561, "Standard for Dry Type General Purpose and Power Transformers."

1.3 SUBMITTALS

- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. Section 013300 - Submittal Procedures: Procedures for submittals.
1. Product Data: Outline and support point dimensions of enclosures and accessories, unit weight, voltage, KVA, and impedance ratings and characteristics, tap configurations, insulation system type, and rated temperature rise.
 2. Manufacturer's Test Reports:
 - a. Copy of ISO 9001 Certification of manufacturing operation.
 - b. Copy of ISO 14001 Certification of manufacturing operation.
 - c. Confirmation that transformers are UL 1561 listed with a K9 rating. Those requiring a k factor rating will be either K9 or K13 rated.
 - d. Construction details, including, but not limited to, enclosure dimensions, kVA rating, primary and secondary nominal voltages, voltage taps, approximate center of gravity, and unit weight.
 - e. Basic performance characteristics, including, but not limited to, insulation class, temperature rise, core and coil materials, impedances and audible noise level, unit weight, and inrush value expressed in a multiplier of rated primary current RMS.
 - f. Efficiency data shall be reported as described in the following sections. Reference temperatures shall be included when reporting efficiency.
 - 1) No load and full load losses shall be calculated per NEMA ST 20 test methods.
 - 2) Efficiency curves as follows:
 - a.) Linear loads.
 - b.) Data per the non linear load test program.
 - g. Documentation describing non linear load test program.
 - h. Sound level ratings.
 3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.



- C. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals:
 - 1. Project Record Documents: Record actual locations of transformers.
 - 2. Maintenance Data: Include recommended maintenance procedures and intervals.

1.4 QUALITY ASSURANCE

- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction. Obtain necessary approvals from such authorities.
 - 1. Seismic Requirements:
 - a. ICC IBC, NFPA 5000.
 - b. Tri axial shake table test results conducted in accordance with the ICC ES AC156 test protocol 3 (Acceptance Criteria for Seismic Qualification Testing of Nonstructural Components).
 - 2. Comply with NEMA Premium Efficiency Transformer Program Guidelines, Program Description and Specification Document.
- C. Compliance: Comply with applicable requirements of the following standards.
 - 1. CSA 802.2.
 - 2. CSA C22.2.
 - 3. IEEE 1100.
 - 4. ANSI/IEEE C57.1110.
 - 5. NEMA 250.
 - 6. ASHRAE 90.1 – 2010.
- D. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Transformers shall be packaged for shipment using materials that shall have the least environmental impact.
 - 1. Transformer Wrapping: Transformers shall be protected by cardboard protective material, all plastic wraps shall not be accepted.
 - 2. Transformer Shipping Base: Transformers shall be shipped on a base that uses at least 50 percent less wood than traditional pallets. Comply with ISPM No. 15.
- C. Store in a warm, dry location with uniform temperature. Cover ventilation openings to keep out dust, water and other foreign material.
- D. Handle transformers using lifting eyes and/or brackets provided for that purpose. Protect against unfavorable external environment such as rain and snow, during handling.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.



2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Eaton Corporation, Cutler-Hammer Products, Pittsburgh, PA (800) 525-2000.
 - 2. General Electric Company (800) 626-2000.
 - 3. Siemens Energy & Automation, Inc., Alpharetta, GA (800) 964-4114.
 - 4. Square D Company, Palatine, IL (800) 392-8781.
- B. Basis of Design: Product specified is "Premium Lighting and Distribution Transformers" as manufactured by Square D by Schneider Electric. Items specified are to establish a standard of quality for design, function, materials, and appearance. Equivalent products by other manufacturers are acceptable. The Architect/Engineer will be the sole judge of the basis of what is equivalent.
- C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- D. Transformers shall be designed to an efficiency standard higher than the lowest legal standard for the purpose of contributing to LEED Energy and Atmosphere (Optimize Energy Performance) and Utility Rebates.

2.2 TWO WINDING TRANSFORMERS

- A. The transformer shall be UL 1561 listed and labeled with a K9 or K13 rating (per UL 1561 35.2.1 and 34.2: K7 is not allowed).
- B. Windings shall be continuous wound copper with brazed or welded terminations.
- C. Insulation and varnish systems shall be Nomex-based UL recognized 220 degrees C class utilizing an epoxy polyester impregnation.
- D. Maximum winding temperature rise for non-k-rated units and K9-rated units shall be 80 degrees.
- E. Terminals, including, but not limited to, those for changing taps, shall be readily accessible by removing a front cover plate.
- F. The transformers shall have a basic impulse level of 10 kV BIL.
- G. Voltage taps shall be as follows:
 - 1. Primary 600 volts to 380 volts.
 - a. For transformers 15 kVA to 300 kVA, provide two 2-1/2 percent full capacity taps above and four 2-1/2 percent below nominal primary voltage.
 - b. For transformers 500 kVA to 750 kVA, provide two 2-1/2 percent full capacity taps above and two 2-1/2 percent below nominal primary voltage.
- H. Impedance shall be the manufacturer's standard.
- I. No load losses shall not exceed the following values:
 - 1. 15 kVA: 55 W.
 - 2. 30 kVA: 90 W.
 - 3. 45 kVA: 125 W.
 - 4. 75 kVA: 165 W.
 - 5. 112.5 kVA: 230 W.



- 6. 150 kVA: 290 W.
- 7. 225 kVA: 435 W.
- 8. 300 kVA: 560 W.

- J. Three phase transformer efficiency shall be as stated below (tested at 35 percent of the nameplate rating, per NEMA TP 1 and NEMA TP 2):
 - 1. 15 kVA: 97.88 percent.
 - 2. 30 kVA: 98.24 percent.
 - 3. 45 kVA: 98.38 percent.
 - 4. 75 kVA: 98.59 percent.
 - 5. 112.5 kVA: 98.73 percent.
 - 6. 150 kVA: 98.80 percent.
 - 7. 225 kVA: 98.95 percent.
 - 8. 300 kVA: 99.02 percent.
- K. Sound Levels shall be as follows:
 - 1. 15 to 50 kVA: 42 dB.
 - 2. 51 to 150 kVA: 47 dB.
 - 3. 151 to 300 kVA: 52 dB.
- L. Transformers shall be designed for continuous operation at rated KVA, for 24 hours a day, 365 days a year operation, with normal life expectancy as defined in ANSI C57.96.
- M. Where required for K-Factor rating 4 or greater, the neutral bus shall be configured to accommodate 200 percent of the rated current.
- N. Where required to suit manufacturer's performance requirements of equipment served, provide isolation transformers with electrostatic shielding.
- O. Transformers sized above 112.5 KVA shall have U.L. Class 155 insulation ratings, minimum. Installation of transformers shall comply with NFPA 70, (NEC) Article 450.21(B).
- P. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap in accordance with Article 250 of NFPA 70.
- Q. Mounting: Suitable for wall, floor, or trapeze mounting, except transformers larger than 75 kVA, suitable for floor mounting.

2.3 ENCLOSURE

- A. The enclosure construction shall be ventilated, NEMA 2 drip-proof, with lifting holes. All ventilation openings shall be protected against falling dirt. On outdoor units, provide weather shields over ventilated openings.
- B. Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.

2.4 SOURCE QUALITY CONTROL

- A. Production test each unit according to NEMA ST20.

2.5 HARMONIC TEST PLAN

- A. NEMA ST 20:
1. Open Circuit Test (No Load Losses):
 - a. Use for both linear and non linear.
 - b. Measure power.
 2. Short Circuit Test (Load Losses):
 - a. Short Primary Winding:
 - 1) Linear test, complete with linear profile through secondary winding.
 - 2) Non linear test, complete with non linear profile through secondary windings.

Harmonic Profile (K-7 Load)				
Harmonic Number	Rated Percent Current	Phase Shift		
		A	B	C
1	100.0	0	120	240
3	81.0	0	0	0
5	60.6	0	240	120
7	37.0	0	120	240
9	15.7	0	0	0
11	2.4	0	240	120
13	6.3	0	120	240
15	7.9	0	0	0

- b. Measure power.
- B. Take data and graph efficiency per NEMA ST 20.
 1. Graph 1: Linear loads 0 percent to 100 percent loads.
 2. Graph 2: Non-linear profile at transformer's rated k factor (default shall be K7 for non-k factor rated units), 0 percent to 100 percent loads.
- C. Test plans measuring power in and power out will not be accepted since procedures are not covered by any standard.

NOTE TO SPECIFIER

Secondary, dry type transformers "rated above 125 KVA" shall be equipped with IR viewing panes. Include paragraph 2.6 below for transformers rated above 125 KVA.

2.6 INFRARED VIEWING PANES (IR WINDOWS)

- A. Typically, the high voltage and primary tap connections are located on the high voltage side of a dry type transformer. A single, opaque, rectangular window (9 inch W x 5 inch H) shall be provided to view the high voltage power and tap connections on this side of the transformer. The secondary (low voltage) connections are typically made by bolted connections at the low voltage end of the transformer. A single, opaque, rectangular window (9 inch W x 5 inch H) shall be provided at the secondary side of the transformer to view these bolted connections. Refer to specification section 261414.
- B. Acceptable installers:
1. IR viewing panes shall be factory installed by the transformer manufacturer or field installed by a certified installer, as recommended by the IR viewing pane manufacturer.
 2. Installer shall be factory certified and trained by the IR viewing pane manufacturer.



PART 3 - EXECUTION

3.1 EXAMINATION

- A. As specified in Section 260500 – Common Work Results for Electrical.

3.2 PREPARATION

- A. Provide minimum 4 inch high concrete pad for floor mounted transformers.

3.3 INSTALLATION

- A. Install transformers in accordance with NECA SI and manufacturer's published instructions, as indicated and located on the drawings.
 - 1. Use manufacturer approved mounting brackets for transformers supported from building structure.
 - 2. Securely anchor transformers to concrete pad for floor mounted transformers.
 - 3. Provide working clearances in conformance with NFPA 70 and manufacturer's recommendations.
 - 4. Provide both primary and secondary protection using fuses or circuit breakers as indicated on Drawings.
- B. Set transformers plumb and level.
- C. Use minimum 2 foot length flexible conduit for connections to transformer case. Make conduit connections to side panel of enclosure. Flexible conduit specified in Section 260533.
- D. Mount transformers on vibration isolating pads suitable for isolating transformer noise from building structure.
- E. Provide grounding and bonding as specified in Section 260500.
- F. Furnish and install engraved plastic nameplates as specified in Section 260500.
- G. Furnish and install seismic restraints designed for type of mounting used.

3.4 FIELD QUALITY CONTROL

- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. Section 014000 - Quality Requirements: Field testing and inspection.
- C. Check for damage and tight connections prior to energizing transformer.
- D. Measure primary and secondary voltages and make appropriate tap adjustments.

USPS CSF Specifications issued: 5/1/2014
Last revised: 3/19/2014

END OF SECTION 26 22 00 00



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Task	Specification	Specification Description
26 22 13 00	26 12 13 00	Low-Voltage Transformers



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SECTION 26 24 13 00 - ELECTRICITY METERING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for electricity metering. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes equipment for electricity metering by utility company and electricity metering by Owner.

C. Definitions

1. KY Pulse: Term used by the metering industry to describe a method of measuring consumption of electricity that is based on a relay opening and closing in response to the rotation of the disk in the meter.
2. PC: Personal computer.

D. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For electricity-metering equipment.
 - a. Wiring Diagrams: For power, signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features.
3. Field quality-control reports.
4. Operation and Maintenance Data. Include the following:
 - a. Application and operating software documentation.
 - b. Software licenses.
 - c. Software service agreement.
 - d. Hard copies of manufacturer's operating specifications, design user's guides for software and hardware, and PDF files on CD-ROM of the hard-copy Submittal.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Delivery, Storage, And Handling

1. Receive, store, and handle modular meter center according to NECA 400.

G. Project Conditions

1. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 - a. Notify Owner no fewer than two days in advance of proposed interruption of electrical service.
 - b. Do not proceed with interruption of electrical service without Owner's written permission.

H. Coordination

1. Electrical Service Connections: Coordinate with utility companies and components they furnish as follows:
 - a. Comply with requirements of utilities providing electrical power services.



- b. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.
- I. Software Service Agreement (May Not Be Allowed For Publicly Funded Projects)
 - 1. Technical Support: Beginning with Final Completion, provide software support for two years.
 - 2. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Final Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - a. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade its computer equipment if necessary.

1.2 PRODUCTS

- A. Equipment For Electricity Metering By Utility Company
 - 1. Meters will be furnished by utility company.
 - 2. Current-Transformer Cabinets: Comply with requirements of electrical-power utility company.
 - 3. Meter Sockets: Comply with requirements of electrical-power utility company.
 - OR**
 - 4. Modular Meter Center: Factory-coordinated assembly of a main service terminal box with lugs only **OR** disconnect device, **as directed**, wireways, tenant meter socket modules, and tenant feeder circuit breakers arranged in adjacent vertical sections. Assembly shall be complete with interconnecting buses and other features as specified below.
 - a. Comply with requirements of utility company for meter center.
 - b. Housing: NEMA 250, Type 1 **OR** Type 3R, **as directed**, enclosure.
 - c. Minimum Short-Circuit Rating: 22,000 **OR** 42,000 **OR** 65,000 **OR** 100,000, **as directed**, A symmetrical at rated voltage.
 - d. Main Disconnect Device: Circuit breaker, series-combination rated for use with downstream feeder and branch circuit breakers.
 - OR**
 - Main Disconnect Device: Fusible switch, series-combination rated by circuit-breaker manufacturer to protect downstream feeder and branch circuit breakers.
 - e. Tenant Feeder Circuit Breakers: Series-combination-rated molded-case units, rated to protect circuit breakers in downstream tenant and to house loadcenters and panelboards that have 10,000-A interrupting capacity.
 - 1) Identification: Complying with requirements in Division 26 Section "Identification For Electrical Systems" with legend identifying tenant's address.
 - 2) Physical Protection: Tamper resistant, with hasp for padlock.
 - f. Meter Socket: Rating coordinated with indicated tenant feeder circuit rating.
 - g. Surge Protection: For main disconnect device, comply with requirements in Division 26 Section "Transient-voltage Suppression For Low-voltage Electrical Power Circuits".
- B. Equipment For Electricity Metering By Owner
 - 1. General Requirements for Owner's Meters:
 - a. Comply with UL 1244.
 - b. Meters used for billing shall have an accuracy of 0.2 **OR** 0.5 **OR** 1.0, **as directed**, percent of reading, complying with requirements in ANSI C12.20.
 - c. Meters shall be certified by California Type Evaluation Program, **as directed**, as complying with Title 4, California Code of Regulations, Article 2.2, **as directed**.
 - d. Enclosure: NEMA 250, Type 1 **OR** Type 3R, **as directed**, minimum, with hasp for padlocking or sealing.
 - e. Identification: Comply with requirements in Division 26 Section "Identification For Electrical Systems".



- f. Memory Backup: Self-contained to maintain memory throughout power outages of 72 hours, minimum.
- g. Sensors: Current-sensing type, with current or voltage output, selected for optimum range and accuracy for meters indicated for this application.
 - 1) Type: Split **OR** Split and solid, **as directed**, core.
- h. Current-Transformer Cabinet: Listed or recommended by metering equipment manufacturer for use with sensors indicated.
- i. Building Automation System (BAS) Interface: One digital KY pulse to a user-definable increment of energy measurement. Match signal to BAS input and arrange to convey the instantaneous, integrated, demand level measured by meter to provide data for processing and possible programmed demand control action by destination system.
- 2. Kilowatt-hour Meter: Electronic single **OR** three **OR** single- and three, **as directed**, -phase meters, measuring electricity used.
 - a. Voltage and Phase Configuration: Meter shall be designed for use on circuits with voltage rating and phase configuration indicated for its application.
 - b. Display: LCD with characters not less than 0.25 inch (6 mm) high, indicating accumulative kilowatt-hours and current kilowatt load. Retain accumulated kilowatt-hour in a nonvolatile memory, until reset.

OR

Display: Digital electromechanical counter, indicating accumulative kilowatt-hours.
- 3. Kilowatt-hour/Demand Meter: Electronic single **OR** three **OR** single- and three, **as directed**, -phase meters, measuring electricity use and demand. Demand shall be integrated over a 15-minute interval.
 - a. Voltage and Phase Configuration: Meter shall be designed for use on circuits with voltage rating and phase configuration indicated for its application.
 - b. Display: LCD with characters not less than 0.25 inch (6 mm) high, indicating accumulative kilowatt-hours, current time and date, current demand, and historic peak demand, and time and date of historic peak demand. Retain accumulated kilowatt-hour and historic peak demand in a nonvolatile memory, until reset.
- 4. Data Transmission Cable: Transmit KY pulse data over Class 1 control-circuit conductors in raceway. Comply with Division 26 Section "Control-voltage Electrical Power Cables".
- 5. Software: PC based, a product of meter manufacturer, suitable for calculation of utility cost allocation and billing, **as directed**.
 - a. Utility Cost Allocation: Automatically import energy-usage records to allocate energy costs for the following:
 - 1) At least 15 departments.
 - 2) At least 30 tenants.
 - 3) At least five processes.
 - 4) At least five buildings.
 - b. Tenant or Activity Billing Software: Automatically import energy-usage records to automatically compute and prepare tenant bills **OR** activity demand and energy-use statements, **as directed**, based on metering of energy use and peak demand, **as directed**. Maintain separate directory for each tenant's historical billing information. Prepare summary reports in user-defined formats and time intervals.

1.3 EXECUTION

A. Installation

- 1. Comply with equipment installation requirements in NECA 1.
- 2. Install meters furnished by utility company. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.
- 3. Install modular meter center according to NECA 400 switchboard installation requirements.

B. Identification



1. Comply with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".
 - a. Series Combination Warning Label: Self-adhesive type, with text as required by NFPA 70.
 - b. Equipment Identification Labels: Adhesive film labels with clear protective overlay. For residential meters, provide an additional card holder suitable for printed, weather-resistant card **OR** typewritten card, **as directed**, with occupant's name.

C. Field Quality Control

1. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Tests and Inspections:
 - a. Connect a load of known kilowatt rating, 1.5 kW minimum, to a circuit supplied by metered feeder.
 - b. Turn off circuits supplied by metered feeder and secure them in off condition.
 - c. Run test load continuously for eight hours minimum, or longer, to obtain a measurable meter indication. Use test-load placement and setting that ensures continuous, safe operation.
 - d. Check and record meter reading at end of test period and compare with actual electricity used, based on test-load rating, duration of test, and sample measurements of supply voltage at test-load connection. Record test results.
3. Electricity metering will be considered defective if it does not pass tests and inspections.
4. Prepare test and inspection reports.

END OF SECTION 26 24 13 00



SECTION 26 24 13 00A - CSF SWITCHBOARDS

NOTE TO SPECIFIER

Use this Outline Specification Section for larger Customer Service Facilities requiring switchboards. This Specification defines "level of quality" for Customer Service Facility construction and is intended as a guide to the Architect/Engineer preparing the Construction Documents.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE. Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. The contractor shall provide and install [service entrance] [distribution] switchboards as herein specified and shown on related electrical drawings.
- B. Related Documents: The Contract Documents, as defined in Section 011000 – Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Section include the following:
 - 1. Section 250504 - Building Automation System (BAS) General
 - 2. Section 251104 - Meter and Submeter Devices
 - 3. Section 255104 - EEMS Integration
 - 4. Section 260500 - Common Work Results for Electrical.
 - 5. Section 264128 - Surge Protection Devices (SPDs).
 - 6. Section 337173 - Electrical Utility Service.
- D. Related standards: The switchboard shall be designed, manufactured and tested according to the latest applicable version of the following standards:
 - 1. ANSI/NFPA 70 – National Electrical Code (NEC)
 - 2. NEMA PB2 – Deadfront Distribution Switchboards
 - 3. UL 891 – Deadfront Switchboards

1.2 SUBMITTALS

- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. Product Data: Submit manufacturer's printed product data.
- C. Drawings: Submit shop drawings for approval. Include components, materials, finishes, detailed plan and elevation views, required conduit rough-in openings, anchors and accessories.

1.3 QUALITY ASSURANCE

- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. Manufacturer: For equipment required for the work of this section, provide product which is the responsibility of one manufacturer.



- C. Performance Requirements: Provide switchboards manufactured in accordance with Article 408 of the latest National Electrical Code and applicable portions of the NEMA PB2, UL 891 and NFPA 70, the National Electrical Code.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage from weather, excessive temperatures and construction operations.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 1. Eaton Corporation, Cutler-Hammer Products, Pittsburgh, PA (800) 525-2000.
 2. General Electric Company (800) 626-2000.
 3. Siemens Energy and Automation, Alpharetta, GA (800) 964-4114.
 4. Square D Company, Palatine, IL (800) 392-8781.
 5. No substitutions permitted.
- B. For the equipment specified herein, the manufacturer shall be ISO 9000, 9001 or 9002 certified.
- C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum of ten (10) years.

2.2 GENERAL REQUIREMENTS

- A. Construction
 1. Switchboard shall be of the modular type construction, constructed in accordance with the latest NEMA PB-2 and UL 891 standards, with the required number of vertical sections bolted together to form one metal enclosed rigid switchboard. The sides, top and rear shall be covered with removable screw-on code gauge steel plates. Switchboard shall include all protective devices and equipment as listed on drawings with necessary interconnections, instrumentation and control wiring. All groups of control wires leaving the switchboard shall be provided with terminal blocks with suitable numbering strips. Service entrance switchboards shall be suitable only for use as service equipment and be labeled in accordance with UL requirements. System voltage, amperage and interrupting capacity shall be as indicated on the drawings. Enclosure construction shall be NEMA 1 indoor.
- B. Bus Requirements
 1. The bus shall be of sufficient size to limit the temperature rise to 65 degree C, based on UL tests. The bus shall be braced and supported to withstand mechanical forces exerted during a short circuit from a power source having the available short circuit current as indicated on the drawings. Provide a full capacity neutral where a neutral is indicated on the drawings. The through bus on the end section shall be extended and pre-drilled to allow the addition of future sections. Ground



bus and grounding conductor lug shall be furnished. Ground bus shall extend the entire length of the switchboard and shall be firmly secured to each vertical section. Bus Material shall be silver-plated copper.

C. Incoming Service

1. [Underground Service: To isolate incoming underground service conductors, an underground cable pull or auxiliary section shall be used. This section shall be of the [non-bussed] [bussed] type and shall be sealable per local utility requirements, when required.]
2. [Overhead Service:
 - a. Cable entry: Where necessary, provide top cable pull box and provide construction that shall be sealable per local utility requirements, when required.
 - b. Busway Entry: Switchboard to be fed by copper busway, as detailed on drawings [and other sections of this specification]. The switchboard manufacturer shall be responsible for coordination, proper phasing and internal bussing to the incoming busway.]
3. Service Section: The service section shall be designed for the system parameters indicated and shall have user metering and main protective device as indicated.
4. Screw-type mechanical lugs to terminate copper cable shall be provided as detailed on the drawings.

D. [Fire Pump Tap

1. The fire pump tap section shall be on the line side of the main disconnect(s) and contain only through bus and tap lugs to feed the fire pump.]

E. Protective Devices

1. Service entrance style switchboard shall be equipped with low voltage, power circuit breaker for the "main" and molded case feeder circuit breakers for the branches. Low voltage power circuit breaker shall be provided with current rating as shown on the drawings. It shall be an electrically operated power circuit breaker with a solid-state trip device providing adjustments for long time pickup and delay, short time pickup and delay, instantaneous, ground fault pickup and delay, and zone selective interlocking for short time and ground fault.
 - a. Main circuit breaker shall comply with the requirements of UL489 and UL1066.
 - 1) Circuit breaker element shall have connected, test and disconnected position indicators, spring charged/discharged indicators and circuit breaker open or closed and ready to close indicators all of which shall be visible to the operator with the compartment door closed.
 - 2) Ratings: Interrupting up to 100 kA at 480V without fuses. Short time current ratings for each circuit breaker shall be as indicated on the drawings or data tables. Circuit breaker shall be 600-volt class.
 - 3) Operating Mechanism: Mechanically and electrically trip-free, stored-energy operating mechanism with the following features:
 - a) Normal Closing Speed: independent of both control and operator
 - b) Electrical operator, field installable with manual charging
 - c) Operations counter
 - 4) Low voltage circuit breaker shall be equipped with self-powered, microprocessor-based trip-device to sense overload and short circuit conditions. The device shall measure true RMS current. The tripping system shall consist of high accuracy (<1%) Rogowski coil sensors on each phase, a release mechanism and the following features:
 - a) Field Installable and interchangeable front mounted trip units. Trip units can be upgraded for future expansion in functionality, such as communication.
 - b) Functions: Long time, short time and extended instantaneous protection function shall be provided (EIP) to allow the breaker to be applied at the withstand rating of the breaker with minus 0% tolerance so that there is no instantaneous override whatsoever. This feature shall furthermore allow the circuit breaker to be applied up to the full instantaneous rating of the breaker on systems where the available fault current exceeds the breakers withstand rating. Each shall have an adjustable pick-up setting. In addition, long time



and short time bands shall each have adjustable time delay. Short time function shall include a switchable I2t ramp and optionally I4t to improve coordination with fuses or inverse relays.

- c) Individual LED's shall indicate an overcurrent, short circuit or ground fault trip condition.
 - d) Current Adjustability shall be accomplished by use of dial setting and rating plugs on trip units. The rating plug shall be front mounted and upgradeable. Upgrades to the rating plugs shall not require changes to the CT.
 - e) Pickup Points: 10 Long Time Settings.
 - f) Field Installable Ground-fault protection with at least three time-delay bands and an adjustable current pickup and an I2t ramp. Arrange to provide protection for three-wire service.
 - g) Field installable configurable analog and digital output relays shall be available to connect directly to the trip unit
 - h) A visible pin shall indicate wear. In addition to the visible pin indicator, estimated contact wear shall be calculated in the trip unit.
 - i) Terminal Block Connections, shall be front mounted and utilize screw type terminals
 - j) Padlocking Provisions shall be included to install at least three padlocks on each circuit breaker to prevent movement of the drawout mechanism.
 - k) Operating Handle shall be an integral part of the breaker. No external tools shall be required to rack the breaker
 - l) Under Voltage Trip: Adjustable time-delay.
 - m) Shunt-Trip – field installable
 - n) Accessories shall be front mounted.
 - o) Field interchangeable accessories shall include CT's, trip units and all internal and external accessories.
- b. Distribution section branch feeder, protective devices shall be molded case circuit breakers.
- 1) Molded Case Circuit Breakers (MCCB's) shall be of quick-make, quick-break, trip-free, thermal magnetic, solid-state – 150 amp frame, 30 amp trip and above type with frame, trip and voltage ratings, as indicated on the drawings. The switchboard shall have space or fully equipped provisions for future units as shown on the drawings.

F. Distribution Sections

- 1. Individual sections shall be front accessible, not less than 20 inches deep and the rear of all sections shall align. Incoming line termination, main device connection and all bolts used to join current-carrying parts shall be installed so as to permit servicing from the front only so that no rear access is required. The branch devices shall be front removable and panel mounted with line and load side connections front accessible. The interior shall be capable of accepting panel mounted molded case circuit breakers.

G. Ground Fault Protection

- 1. Furnish and install, in the service equipment switchboard, ground fault protection and indication equipment as shown on drawings in accordance with NEC 230-95. All parts of the systems specified shall be UL Listed. All ground fault protection and indication equipment shall be factory installed, wired and tested by the switchboard manufacturer.

NOTE TO SPECIFIER

Customer Service Facilities equal to or larger than 15,000 sq. ft. shall be provided with advanced metering. Include paragraph 2.2 H below for these larger facilities.



- H. Metering Equipment
 - 1. Advanced electric meters shall be provided as an integral part of the switchboard. Advanced electric meters shall be programmable and capable of measuring kWh and other power characteristics (kw, amperage, power factor, etc.) on 5 – 60 minute intervals with built-in data storage. A fifteen (15) minute interval measurement shall be programmed at installation. The data shall be accessible on a real-time basis and downloadable to the Building Automation System for management of data. Refer to section 337173 – Electrical Utility Services.
- I. Finish
 - 1. The complete switchboard shall be phosphatized and finished with ANSI 61 light gray polyester powder paint.
- J. Markings
 - 1. Each switchboard section shall have a label permanently affixed to it, listing the following information: Name of manufacturer, system voltage, ampacity, type, manufacturer's shop order number and date.
 - 2. Each section of switchboard shall bear a UL listing mark, where qualified and a short circuit rating label.
 - 3. Front, side, rear and top of each switchboard section will have a DANGER label in accordance with NEMA Standard PB-2.
- K. Surge Suppression
 - 1. Provide surge protective devices per specification Section 264128 – Surge Protective Devices (SPDs).
- L. ARC FLASH
 - 1. Apply in the field, the factory supplied arc flash warning labels to all switchboards to warn qualified persons of potential electrical arc flash hazards.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. As specified in Section 260500 – Common Work Results for Electrical.

3.2 INSTALLATION

- A. Examine substrates and conditions in which units will be installed. Check for clearance that will be required before, during and after equipment installation. Do not proceed with installation until unsatisfactory conditions are corrected.
- B. Strictly comply with manufacturer's instructions and recommendations and NEMA PB 2.1. Coordinate installation with adjacent work to ensure proper sequence of construction, clearances and support.
- C. Install units plumb, level and rigid without distortion to the switchboard cubicle(s).

3.3 ADJUSTMENTS AND CLEANING

- A. Clean exposed surfaces using manufacturer recommended materials and methods.
- B. Touch-up damaged coatings and finishes using non-abrasive materials and methods recommended by manufacturer. Eliminate all visible evidence of repair.



3.4 FIELD QUALITY CONTROL – ELECTRICAL TESTING AND INSPECTION

- A. As specified in Section 260500 – Common Work Results for Electrical
- B. Perform factory and installation tests in accordance with applicable NEC, NEMA and UL requirements.

3.5 WARRANTY

- A. Equipment manufacturer warrants that all goods supplied are free of non-conformities in workmanship and materials for [12 months] [18 months] from date of initial operation.

END OF SECTION

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Last revised: 6/17/2011 First Issue

END OF SECTION



SECTION 26 24 13 00A - MPF SWITCHBOARDS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. The contractor shall provide and install [service entrance] [distribution] switchboards as herein specified and shown on related electrical drawings.
- B. Related Documents: The Contract Documents, as defined in Section 011000 – Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Section include the following:
 - 1. Section 019113 - General Commissioning Requirements.
 - 2. Section 260500 - Common Work Results for Electrical.
 - 3. Section 260800 - Commissioning of Electrical Systems.
 - 4. Section 261116 - Secondary Unit Substations.
 - 5. Section 261216 - Dry-Type, Medium-Voltage Transformers.
 - 6. Section 261414 - Infrared Viewing Panes (IR Windows).
 - 7. Section 337173 - Electrical Utility Service.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's printed product data.
- B. Drawings: Submit shop drawings for approval. Include components, materials, finishes, detailed plan and elevation views, required conduit rough-in openings, anchors and accessories.

1.3 RELATED STANDARDS

- A. The switchboard shall be designed, manufactured and tested according to the latest applicable version of the following standards:
 - 1. ANSI/NFPA 70 – National Electrical Code (NEC)
 - 2. NEMA PB2 – Deadfront Distribution Switchboards
 - 3. UL 891 – Deadfront Switchboards

1.4 QUALITY ASSURANCE

- A. Manufacturer: For equipment required for the work of this section, provide product which is the responsibility of one manufacturer.



- B. Performance Requirements: Provide switchboards manufactured in accordance with Article 408 of the latest National Electrical Code and applicable portions of the NEMA PB2, UL 891 and NFPA 70, the National Electrical Code.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage from weather, excessive temperatures and construction operations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 - 1. Eaton Corporation, Cutler-Hammer Products, Pittsburgh, PA (800) 525-2000.
 - 2. General Electric Company (800) 626-2000.
 - 3. Siemens Energy and Automation, Alpharetta, GA (800) 964-4114.
 - 4. Square D Company, Palatine, IL (800) 392-8781.
 - 5. No substitutions permitted.
- B. For the equipment specified herein, the manufacturer shall be ISO 9000, 9001 or 9002 certified.
- C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum of ten (10) years.

2.2 GENERAL REQUIREMENTS

- A. Construction
 - 1. Switchboard shall be of the modular type construction, constructed in accordance with the latest NEMA PB-2 and UL 891 standards, with the required number of vertical sections bolted together to form one metal enclosed rigid switchboard. The sides, top and rear shall be covered with removable screw-on code gauge steel plates. Switchboard shall include all protective devices and equipment as listed on drawings with necessary interconnections, instrumentation and control wiring. All groups of control wires leaving the switchboard shall be provided with terminal blocks with suitable numbering strips. Service entrance switchboards shall be suitable only for use as service equipment and be labeled in accordance with UL requirements. System voltage, amperage and interrupting capacity shall be as indicated on the drawings. Enclosure construction shall be NEMA 1 indoor.
- B. Bus Requirements
 - 1. The bus shall be of sufficient size to limit the temperature rise to 65 degree C, based on UL tests. The bus shall be braced and supported to withstand mechanical forces exerted during a short circuit from a power source having the available short circuit current as indicated on the drawings. Provide a full capacity neutral where a neutral is indicated on the drawings. The through bus on the end section shall be extended and pre-drilled to allow the addition of future sections. Ground bus and grounding conductor lug shall be furnished. Ground bus shall extend the entire length of the switchboard and shall be firmly secured to each vertical section. Bus Material shall be silver-plated copper.
- C. Incoming Service



1. [Underground Service: To isolate incoming underground service conductors, an underground cable pull or auxiliary section shall be used. This section shall be of the [non-bussed] [bussed] type and shall be sealable per local utility requirements, when required.]
 2. [Overhead Service:
 - a. Cable entry: Where necessary, provide top cable pull box and provide construction that shall be sealable per local utility requirements, when required.
 - b. Busway Entry: Switchboard to be fed by copper busway, as detailed on drawings [and other sections of this specification]. The switchboard manufacturer shall be responsible for coordination, proper phasing and internal bussing to the incoming busway.]
 3. Service Section: The service section shall be designed for the system parameters indicated and shall have user metering and main protective device as indicated.
 4. Screw-type mechanical lugs to terminate copper cable shall be provided as detailed on the drawings.
- D. [Fire Pump Tap
1. The fire pump tap section shall be on the line side of the main disconnect(s) and contain only through bus and tap lugs to feed the fire pump.]
- E. Main Protective Device
1. Service entrance style switchboards shall be double-ended type equipped with draw-out, low voltage, power circuit breakers for the "mains and tie" breakers and molded case feeder circuit breakers. Low voltage power circuit breakers shall be provided with a drawout frame and current rating as shown on the drawings. It shall be electrically operated power circuit breaker with a solid-state trip device providing adjustments for long time pick up and delay, short time pickup and delay, instantaneous, ground fault pickup and delay, and zone selective interlocking for short time and ground fault.
 - a. Insulated case, draw-out circuit breakers shall comply with the requirements of UL489 and UL1066. Breakers shall be three-pole, 100% rated type:
 - 1) Circuit breaker element shall have connected, test and disconnected position indicators, spring charged/discharged indicators and circuit breaker open or closed and ready to close indicators all of which shall be visible to the operator with the compartment door closed. It shall be possible to rack the circuit breaker element from the connected to the disconnected position with the compartment door closed, otherwise known as "through the door drawout".
 - 2) Provide interlocks to prevent racking the circuit breaker unless the breaker is open
 - 3) Ratings: Interrupting up to 100 kA at 480V without fuses. Short time current ratings for each circuit breaker shall be as indicated on the drawings or data tables. Circuit breakers shall be 600-volt class.
 - 4) Operating Mechanism: Mechanically and electrically trip-free, stored-energy operating mechanism with the following features:
 - a) Normal Closing Speed: independent of both control and operator
 - b) Electrical operator, field installable with manual charging
 - c) Operations counter
 - 5) Each low voltage circuit breaker shall be equipped with self-powered, microprocessor-based trip-device to sense overload and short circuit conditions. The device shall measure true RMS current. The tripping system shall consist of high accuracy (<1%) Rogowski coil sensors on each phase, a release mechanism and the following features:
 - a) Field Installable and interchangeable front mounted trip units. Trip units can be upgraded for future expansion in functionality, such as communication.
 - b) Functions: Long time, short time and extended instantaneous protection function shall be provided (EIP) to allow the breaker to be applied at the withstand rating of the breaker with minus 0% tolerance so that there is no instantaneous override whatsoever. This feature shall furthermore allow the circuit breaker to be applied up to the full instantaneous rating of the breaker on systems where the available fault current exceeds the breakers withstand



- rating. Each shall have an adjustable pick-up setting. In addition, long time and short time bands shall each have adjustable time delay. Short time function shall include a switchable I2t ramp and optionally I4t to improve co-ordination with fuses or inverse relays.
- c) A software program shall be made available free of charge to support system co-ordination studies. The software will allow time current curves to be generated for the chosen settings.
 - d) Individual LED's shall indicate an overcurrent, short circuit or ground fault trip condition.
 - e) Time-current characteristics shall be field adjustable locally or optionally remotely via a bus system ModBus.
 - f) Current Adjustability shall be accomplished by use of dial setting and rating plugs on trip units. The rating plug shall be front mounted and upgradeable. Upgrades to the rating plugs shall not require changes to the CT.
 - g) Pickup Points: 10 Long Time Settings.
 - h) Field Installable Ground-fault protection with at least three time-delay bands and an adjustable current pickup and an I2t ramp. Arrange to provide protection for three-wire service.
 - i) Field installable zone selective interlocking: Connections will be made between main, tie and feeder circuit breakers to ensure that the circuit breaker closest to the fault trips for short time and ground fault conditions.
 - j) A LCD display shall be available to simplify settings & viewing data locally.
 - k) Field installable configurable analog and digital output relays shall be available to connect directly to the trip unit
 - l) Waveform capture and display shall be accomplished on the trip units LCD display.
 - m) A visible pin shall indicate wear. In addition to the visible pin indicator, estimated contact wear shall be calculated in the trip unit.
 - n) Terminal Block Connections, shall be front mounted and utilize screw type terminals
 - o) Padlocking Provisions shall be included to install at least three padlocks on each circuit breaker to prevent movement of the drawout mechanism.
 - p) Operating Handle shall be an integral part of the breaker. No external tools shall be required to rack the breaker
 - q) Control Switch: One for each electrically operated circuit breaker.
 - r) Key Interlocks: Main and tie-breakers.
 - s) Undervoltage Trip: Adjustable time-delay.
 - t) Shunt-Trip – field installable
 - u) Modular communication and relaying accessories are to be available for retrofitting by the clients chosen engineer. It shall not be necessary for the manufacturer's personnel to retrofit accessories.
 - v) Accessories shall be front mounted. Modular communications and relaying accessories are to be available for retrofitting by the clients chosen engineer. It shall not be necessary for the manufacturer's personnel to retrofit accessories.
 - w) Portable lifting yoke for drawout circuit breakers.
 - x) Field interchangeable accessories shall include CT's, trip units, racking mechanism and all internal & external accessories.
- b. Feeder circuit breakers shall be molded case, quick-make, quick-break, trip-free, thermal magnetic, solid state type. The continuous current rating shall be adjustable from 20 to 100% without the need for a rating plug. Solid state breaker trip functions shall include adjustments for continuous amperage, long time pickup and delay, instantaneous short time pickup and delay and ground fault pickup and delay, if required. Breaker ratings shall be as shown on the drawings.



2. Main circuit breakers within switchboards down stream of the incoming service shall be molded case quick-make, quick-break, trip-free, thermal magnetic, solid state type. The continuous current rating shall be adjustable from 20 to 100% without the need for a rating plug. Solid state breaker trip functions shall include adjustments for continuous amperage, long time pickup and delay, instantaneous short time pickup and delay, ground fault pickup and delay and zone selective interlocking for short time and ground fault. Breaker ratings shall be as shown on the drawings.
 - a. Distribution section branch protective devices shall be molded case circuit breakers.
 - 1) Molded Case Circuit Breakers (MCCB's) shall be of quick-make, quick-break, trip-free, thermal magnetic, solid-state – 150 amp frame, 30 amp trip and above type with frame, trip and voltage ratings, as indicated on the drawings. The switchboard shall have space or fully equipped provisions for future units as shown on the drawings.
- F. Distribution Sections
 1. Individual sections shall be front accessible, not less than 20" deep and the rear of all sections shall align. Incoming line termination, main device connection and all bolts used to join current-carrying parts shall be installed so as to permit servicing from the front only so that no rear access is required. The branch devices shall be front removable and panel mounted with line and load side connections front accessible. The interior shall be capable of accepting panel mounted molded case circuit breakers.
- G. Ground Fault Protection
 1. Furnish and install, in the service equipment switchboard, ground fault protection and indication equipment as shown on drawings in accordance with NEC 230-95. All parts of the systems specified shall be UL Listed. All ground fault protection and indication equipment shall be factory installed, wired and tested by the switchboard manufacturer.
- H. Metering Equipment
 1. Advanced electric meters shall be provided as an integral part of building switchgear for new construction. Advanced electric meters shall be programmable and capable of measuring kWh and other power characteristics (kw, amperage, power factor, etc.) on 5 – 60 minute intervals with built-in data storage. A fifteen (15) minute interval measurement shall be programmed at installation. The data shall be accessible on a real-time basis and downloadable to the Building Automation System for management of data. Refer to section 337173 – Electrical Utility Services.
- I. Finish
 1. The complete switchboard shall be phosphatized and finished with ANSI 61 light gray polyester powder paint.
- J. Markings
 1. Each switchboard section shall have a label permanently affixed to it, listing the following information: Name of manufacturer, system voltage, ampacity, type, manufacturer's shop order number and date.
 2. Each section of switchboard shall bear a UL listing mark, where qualified and a short circuit rating label.
 3. Front, side, rear and top of each switchboard section will have a DANGER label in accordance with NEMA Standard PB-2.
- K. Transient-Voltage Suppression
 1. Provide Transient-Voltage Suppression per specification Section 262200.
- L. ARC FLASH
 1. Apply in the field, the factory supplied arc flash warning labels to all switchboards to warn qualified persons of potential electrical arc flash hazards.

NOTE TO SPECIFIER



All switchboards calculated to be classified as an ARC Flash Hazard Risk Category of "Dangerous" shall be equipped with IR Viewing Panes. Include paragraph 2.3 below for switchboards classified as HRC=Dangerous.

2.3 *****
*****INFRARED VIEWING PANES (IR WINDOWS)

- A. Each breaker position of the switchboard shall be equipped with an opaque, 3" round infrared window. The IR window shall be located on the [front] [rear] of the switchboard, centered on the cable to lug connections of the breaker. Refer to specification section 261414 for specific details.
- B. Acceptable installers:
 - 1. IR viewing panes shall be factory installed by the switchboard manufacturer or field installed by a certified installer, as recommended by the IR viewing pane manufacturer.
 - 2. Installer shall be factory certified and trained by the IR viewing pane manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine substrates and conditions in which units will be installed. Check for clearance that will be required before, during and after equipment installation. Do not proceed with installation until unsatisfactory conditions are corrected.
- B. Strictly comply with manufacturer's instructions and recommendations and NEMA PB 2.1. Coordinate installation with adjacent work to ensure proper sequence of construction, clearances and support.
- C. Install units plumb, level and rigid without distortion to the switchboard cubicle(s).

3.2 ADJUSTMENTS AND CLEANING

- A. Clean exposed surfaces using manufacturer recommended materials and methods.
- B. Touch-up damaged coatings and finishes using non-abrasive materials and methods recommended by manufacturer. Eliminate all visible evidence of repair.

3.3 TESTING

- A. Perform factory and installation tests in accordance with applicable NEC, NEMA and UL requirements.

3.4 WARRANTY

- A. Equipment manufacturer warrants that all goods supplied are free of non-conformities in workmanship and materials for [12 months] [18 months] from date of initial operation.

END OF SECTION

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SECTION 26 24 16 00 - MPF PANELBOARDS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification.

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes:
 - 1. Panelboards.
- B. Related Documents: The contract documents as defined in Section 011000 – Summary of Work, apply to the work of this section. Additional requirements and information necessary to complete the work of this section may be found in other documents.
- C. Related Sections:
 - 1. Section 260500 – Common Work Results for Electrical.

1.2 SUBMITTALS

- A. Product Data: Required
- B. Shop Drawings: Required
- C. Directories: Required

1.3 QUALITY ASSURANCE

- A. Panelboard's shall be UL Listed and labeled and shall be designed in accordance with the applicable standards of ANSI and NEMA.

PART 2 - PRODUCTS

2.1 GENERAL CLASSIFICATION

- A. Manufacturers: General Electric Company(G.E.) Catalog numbers are used to identify type of equipment specified. Equivalent products by the following manufacturers are acceptable:
 - 1. Siemens
 - 2. Cutler Hammer
 - 3. Square-D
 - 4. Eaton/Cutler Hammer
 - a. Branch Circuit Panels:
 - 1) 120/208V: G.E. Type AQ
 - b. Distribution Panels:



- 1) Circuit breaker: G.E. Type CS or A

2.2 BRANCH CIRCUIT PANELS

- A. Cabinet: Construct cabinet with code gauge galvanized steel. Provide minimum 20 inch wide cabinets, and extra wiring space where incoming feed-through or parallel lines are required.
- B. Doors: Provide single door construction, made of cold-rolled steel. Door shall have concealed hinges, flush catch, and lock. (Tee bar handles not acceptable). Secure top and bottom of door to cabinet by slotted steel bolts. Release shall be by one-half turn with a screwdriver. All panels shall be keyed alike.
 1. Panelboards shall be equipped with "door within door" type trim.
- C. Panels located adjacent to each other shall have identically sized enclosures and trims.
- D. Finish: Finish exposed parts with one coat of primer and one coat of light gray enamel suitable for overpainting in field if desired.
- E. Phase, neutral and ground bus bars shall be tin plated copper.
- F. Provide all hardware for future breakers, identified on drawings as SPACES, or for the full length of usable bus, whichever is longer.
- G. Provide ground bus with full complement of terminals in addition to insulated neutral bus.
- H. Circuit Breakers:
 1. Provide multi-pole units with common trip elements. Handle ties are not acceptable.
 2. Provide key-operated circuit breakers in the panelboards used for the Fire Alarm. Security and CCTV Systems. Circuit breakers shall be similar to square D type QO_K.
 3. 120/208V branch circuit panelboards: Molded cast bolt-on type designed for 120/208V, three phase, four wire service with minimum 10,000 amperes rms short circuit rating.
 4. 277/480V branch circuit panelboards: Molded cast bolt-on type designed for 277/480V, three phase, four wire service with minimum 14,000 amperes rms short circuit rating.
- I. Provide all panelboards with lockout/tagout devices; Circuit-Safe type as manufactured by Stranco, Inc. or approved equal.
- J. Nameplates: Provide screwed-on (no adhesives) engraved bakelite nameplate identification on outside of each panel showing panel designation, voltage and phase in minimum 1/4 inch high letters.
- K. Circuit directories: Provide a metal-framed circuit directory on inside of inner door, with plastic protector.
- L. Provide 2-3/4 inch and 1-1 inch spare empty conduits routed above into accessible ceiling space from all flush mounted panelboards.
- M. Panels serving electronic equipment and/or other harmonic producing loads shall be equipped with double neutral bus bars.

PART 3 - EXECUTION

3.1 CLEARANCES

- A. Minimum code required clearances around panelboards must be maintained.



3.2 MOUNTING HEIGHT

- A. Typically mount panel boards top at 6 ft. - 0 in. above finished floor but no more than 6 ft. - 6 in. above finished floor to top of circuit breaker handle.

3.3 MOUNTING HARDWARE

- A. Provide all necessary blocking, channels and other hardware for securing panelboards to wall, column, or other parts of building structure.

3.4 FIELD CONTROL

- A. Section 014000 – Quality Requirements: Field Testing and Inspection.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.5.

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SECTION 26 24 16 00 - CSF PANELBOARDS

NOTE TO SPECIFIER

Use this Outline Specification Section for Customer Service Facilities only. This Specification defines "level of quality" for Customer Service Facility construction and is intended as a guide to the Architect/Engineer preparing the Construction Documents.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Panelboards.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. As specified in Section 260500 - Common Work Results for Electrical.

1.2 REFERENCES

- A. As specified in Section 260500 - Common Work Results for Electrical
- B. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA AB 1 - Molded Case Circuit Breakers.
 - 2. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
 - 3. NEMA KS 1 - Enclosed Switches.
 - 4. NEMA PB 1 - Panelboards.
 - 5. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
- C. Underwriters Laboratories (UL):
 - 1. UL 486 - Molded Case Circuit Breakers.
 - 2. UL 67 - Heat Rise Test for Panelboards.
 - 3. UL 50 - Steel Gauge Requirements for Cabinets and Enclosures.
 - 4. UL 1449 3rd Edition - Standard for Transient Voltage Surge Suppressors.

1.3 SUBMITTALS

- A. As specified in Section 260500 - Common Work Results for Electrical.
 - 1. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.



2. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.
 3. Shall include UL 1449 Listing documentation verifying the following:
 - a. Short Circuit Current Rating (SCCR)
 - b. Voltage Protection Ratings (VPRs) for all modes
 - c. Maximum Continuous Operating Voltage Rating (MCOV)
 - d. I-nominal rating (I-n)
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals:
1. Project Record Documents: Record actual locations of Products; indicate actual branch circuit arrangement.
 2. Operation and Maintenance Data: Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.
 3. Submit data showing compliance with UL 1449.

1.4 QUALITY ASSURANCE

- A. As specified in Section 260500 - Common Work Results for Electrical.
- B. Qualifications
1. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 GENERAL CLASSIFICATION

- A. Manufacturers: General Electric Company(G.E.) Catalog numbers are used to identify type of equipment specified. Equivalent products by the following manufacturers are acceptable: Alternate substitutions not permitted.
1. Siemens
 2. Square-D
 3. Eaton/Cutler Hammer
 - a. Branch Circuit Panels:
 - 1) 120/208V: G.E. Type AQ
 - b. Distribution Panels:
 - 1) Circuit breaker: G.E. Type CS or A

2.2 PANELBOARDS

- A. Cabinet: Construct cabinet with code gauge galvanized steel. Provide minimum 20 inch wide cabinets, and extra wiring space where incoming feed-through or parallel lines are required.



- B. Doors: Provide single door construction, made of cold-rolled steel. Door shall have concealed hinges, flush catch, and lock. (Tie bar handles not acceptable). Secure top and bottom of door to cabinet by slotted steel bolts. Release shall be by one-half turn with a screwdriver. All panels shall be keyed alike.
- C. Panels located adjacent to each other shall have identically sized enclosures and trims.
- D. Finish: Finish exposed parts with one coat of primer and one coat of light gray enamel suitable for overpainting in field if desired.
- E. Phase, neutral and ground bus bars shall be tin plated copper.
- F. Provide all hardware for future breakers, identified on drawings as SPACES, or for the full length of usable bus, whichever is longer.
- G. Provide ground bus with full complement of terminals in addition to insulated neutral bus.
- H. Circuit Breakers:
 - 1. Provide multi-pole units with common trip elements. Handle ties are not acceptable.
 - 2. Provide key-operated circuit breakers in the panelboards used for the Fire Alarm. Security and CCTV Systems. Circuit breakers shall be similar to square D type QO_K.
 - 3. 120/208V branch circuit panelboards: Molded cast bolt-on type designed for 120/208V, three phase, four wire service with minimum 10,000 amperes rms short circuit rating.
 - 4. 277/480V branch circuit panelboards: Molded cast bolt-on type designed for 277/480V, three phase, four wire service with minimum 14,000 amperes rms short circuit rating.
- I. Main circuit breakers shall be individually mounted. The panelboard interior assembly shall be dead front with panelboard front removed. Main lugs or main breakers shall have barriers on five sides. The barrier in front of the main lugs shall be hinged to a fixed part of the interior. The end of the bus structure opposite the main shall have barriers.
- J. Provide all panelboards with lockout/tagout devices; Circuit-Safe type as manufactured by Stranco, Inc. or approved equal.
- K. Nameplates: Provide screwed-on (no adhesives) engraved bakelite nameplate identification on outside of each panel showing panel designation, voltage and phase in minimum ¼ inch high letters.
- L. Circuit directories: Provide a metal-framed typewritten circuit directory on inside of inner door, with plastic protector.
- M. Provide 2-3/4 inches and 1-1 inch spare empty conduits routed above into accessible ceiling space from all flush mounted panelboards.
- N. Panels serving electronic equipment and/or other harmonic producing loads shall be equipped with double neutral bus bars.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. As specified in Section 260500 – Common Work Results for Electrical.

3.2 CLEARANCES



- A. Minimum code required clearances around panelboards must be maintained.

3.3 INSTALLATION

- A. Install panelboards in accordance with NEMA PB 1.1.
- B. Install panelboards plumb. Provide supports in accordance with Section 260500.
- C. Provide filler plates for unused spaces in panelboards.

3.4 MOUNTING HEIGHT

- A. Typically mount panel boards top at 6 ft. – 0 in. above finished floor but no more than 6 ft. – 6 in. above finished floor to top of circuit breaker handle.

3.5 MOUNTING HARDWARE

- A. Provide all necessary blocking, channels and other hardware for securing panelboards to wall, column, or other parts of building structure.

3.6 FIELD QUALITY CONTROL

- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. Inspect and test panelboard installation and torque connections.
- C. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.
- D. Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers.

USPS CSF Specifications issued: 10/1/2013
Last revised: 5/10/2011

END OF SECTION 26 24 16 00



SECTION 26 24 19 00 - POWER DISTRIBUTION UNITS

1.1 GENERAL

- A. Description Of Work
 - 1. This specification covers the furnishing and installation of materials for power distribution units. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.
- B. Summary
 - 1. This Section includes freestanding, prepackaged, power distribution units for transforming, conditioning, and distributing electrical power.
- C. Definitions
 - 1. TVSS: Transient voltage surge suppression.
 - 2. UPS: Uninterrupted power supply.
- D. Submittals
 - 1. Product Data: For power distribution units.
 - 2. Shop Drawings: Include dimensioned plans, sections, and elevations. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - a. Wiring Diagrams: Power, signal, and control wiring.
 - 3. Manufacturer Seismic Qualification Certification: Submit certification that power distribution units, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems". Include the following:
 - 4. Field quality-control test reports.
 - 5. Operation and Maintenance Data: For power distribution units to include in emergency, operation, and maintenance manuals.
- E. Quality Assurance
 - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 2. Comply with NFPA 70.
- F. Delivery, Storage, And Handling
 - 1. Deliver equipment in fully enclosed vehicles after specified environmental conditions have been permanently established in spaces where equipment is to be placed.
 - 2. Store equipment in spaces with environments controlled within manufacturer's ambient temperature and humidity tolerances for non-operating equipment.

1.2 PRODUCTS

- A. Manufactured Units
 - 1. Description: Integrated and coordinated assembly of power-line-conditioning and distribution components packaged in a single cabinet or modular assembly of cabinets each with full-swivel casters mounted to bottom frame, **as directed**. Include the following components:
 - a. Input-power, circuit-breaker section.
 - b. Isolation transformer.
 - c. TVSS system.
 - d. Output panelboard(s).



- e. Alarm, monitoring, and control system.
 2. Provide units that are constructed to withstand seismic forces specified in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
 3. Unit Capacity Rating: Unit shall carry indicated rms kilovolt-ampere load continuously without exceeding rated insulation temperature for the following input voltage and load current:
 - a. Input Voltage: Within rated input-voltage tolerance band of unit.
 - b. Load Current: Minimum of 3.0 crest factor and 85 percent total harmonic distortion.
- B. Input-Power, Circuit-Breaker Section
1. Description: 3-pole, shunt-tripped, thermal-magnetic-type circuit breaker, rated for indicated interrupting capacity and 125 percent of input current of unit at 100 percent rated load.
 - a. Dual-Input Units:
 - 1) Two input circuit breakers arranged to provide transfer between two input-voltage sources.
 - 2) Controls and interfaces to allow both open- and closed-transition transfer between two input-voltage sources.
 - 3) Use a 120-V permissive signal from both upstream voltage sources to indicate acceptable conditions for closed-transition transfer.
 - 4) Open second circuit breaker automatically after closed-transition transfer is completed.
- C. Isolation Transformer Section
1. Description: Dry-type, electrostatically shielded, three-phase, common-core, convection-air-cooled isolation transformer.
 - a. Comply with UL 1561 including requirements for nonsinusoidal load-current-handling capability defined by designated K-factor, **as directed**.
 - b. Cores: Grain-oriented, non-aging silicon steel, one leg per phase.
 - c. Coil Material and Insulation: Copper windings with a 220 deg C insulation class.
 - d. Temperature Rise: Designed for 80 **OR** 115 **OR** 150, **as directed**, deg C rise above 40 deg C ambient.
 - e. Output Impedance: 3.5 plus or minus 0.5 percent.
 - f. Regulation: 2 to 4 percent maximum, at full-resistive load; 5 percent maximum, at rated nonlinear load.
 - g. Taps: 6 full-capacity compensation taps at 2.5 percent increments; 2 above and 4 below nominal voltage.
 - h. Full-Load Efficiency: Minimum 96 percent at rated nonlinear, **as directed**, load.
 - i. Magnetic-Field Strength External to Transformer Enclosure: Less than 0.1 gauss at 450 mm.
 - j. Audible Noise: Comply with NEMA ST 20.
 - k. Electrostatic Shielding: Independently shield each winding with a double-copper, electrostatic shield arranged to minimize interwinding capacitance.
 - 1) Coil leads and terminal trips shall be arranged to minimize capacitive coupling between input and output connections.
 - 2) Shield Terminal: Separate, and marked "Shield" for grounding connection.
 - 3) Capacitance: Limit capacitance between primary and secondary windings to a maximum of 33 picofarads over a frequency range of 20 Hz to 1 MHz.
 - 4) Common-Mode Noise Attenuation: 120 dB minimum, 0.5 to 1.5 kHz; minus 65 dB minimum, 1.5 to 100 kHz.
 - 5) Normal-Mode Noise Attenuation: Minus 52 dB minimum, 1.5 to 10 kHz.
 - l. Neutral Rating: 1.732 times the system full-load ampere rating.
- D. TVSS System
1. Description: Integrated TVSS system complying with Division 26 Section "Transient-voltage Suppression For Low-voltage Electrical Power Circuits", to protect unit panelboard, and having the following features:



- a. Disconnect Device: Manual, three-pole, fused disconnect switch to de-energize TVSS system while permitting power distribution units to continue operation. Fuses are rated at 200-kA interrupting capacity.
 - b. Nonlinear Loading: System shall accommodate rated-load current with a minimum 3.0 crest factor and 85 percent total harmonic distortion.
- E. Output Panelboards
 - 1. Description: Panelboards complying with Division 26 Section "Panelboards", except for mounting provisions. Mount in front of power distribution units behind flush doors. Include the following features:
 - a. Construction: 42 pole, 240 V, 3 phase; capable of accepting branch circuit breakers rated to 100 A.
 - b. Panelboard Rating: 225 A, with main circuit breaker.
 - c. Panelboard Phase, Neutral and Ground Buses: Copper, with neutral bus at least 1.732 times the nominal phase bus rating.
 - d. Isolated Ground Bus: Copper, adequate for branch-circuit equipment ground conductors; insulated from supports.
 - e. Branch Circuit Breakers: Bolt **OR** Plug, **as directed**, on.
 - f. Cable Racks: Removable and arranged for supporting and routing cables for panelboard entrance.
 - g. Access Panels: Arranged so additional branch-circuit wiring can be installed and connected in the future.
- F. Power Distribution Unit Controls
 - 1. Include the following control features:
 - a. Emergency, power-off switch integral with power distribution unit.
 - b. Emergency, power-off input terminals for connection to remote power-off switch.
 - c. Over-under alarm shutdown with automatic unit disconnection for the following alarm conditions:
 - 1) High temperature.
 - 2) High and low input or output voltage.
 - 3) Phase loss.
 - 4) Ground fault.
 - 5) Reverse phase rotation.
 - d. Ground-fault protection with automatic system shutdown.
 - e. Alarm Contacts: Electrically isolated, Form C (one normally open and one normally closed), summary alarm; contact set shall change state if any monitored function goes into alarm mode.
 - f. Remote Power-Off Control: Control circuit with connection to shunt trip of power distribution unit main power circuit breaker and terminals for connection to one or more remote power-off, push-button stations.
- G. Monitoring, Status, And Alarm Annunciation
 - 1. Description: Microprocessor-based monitoring, status, and alarm annunciation panel mounted flush in front of power distribution unit to provide status display and failure-indicating interface for the following:
 - a. Power Monitoring:
 - 1) Input Voltage: Line to line, rms.
 - 2) Output Voltage: Line to line, rms.
 - 3) Output Voltage: Line to neutral, rms.
 - 4) Output current.
 - b. Status Indication: Unit on.
 - c. Alarm Annunciation:
 - 1) High temperature.
 - 2) High and low input voltage.
 - 3) High and low output voltage.



- 4) Phase loss.
- 5) Ground fault.
- 6) Frequency.
- 7) Phase rotation.
- 8) TVSS module failure.
- d. Audible Alarm and Silencing Switch: Alarm sounds when alarm indication occurs. Silencing switch shall silence audible alarm but leave visual indication active until failure or other alarm conditions are corrected.

H. Sound Level

- 1. General: Fully assembled products comply with minimum sound-level requirements in NEMA ST 20 for transformers of corresponding ratings when factory tested according to IEEE C57.12.91.
- 2. General: Fully assembled products have a minimum of 3 dB less than the maximum sound levels prescribed for transformers of corresponding ratings when factory tested according to IEEE C57.12.91.

I. Finishes

- 1. Manufacturer's standard finish over corrosion-resistant pretreatment and primer.

J. Source Quality Control

- 1. Factory Tests: Design and routine tests shall comply with referenced standards.
- 2. Factory Sound-Level Tests: Conduct sound-level tests on equipment. Comply with IEEE C57.12.91 and NEMA ST 20.

1.3 EXECUTION

A. Installation

- 1. Arrange power distribution units to provide adequate access to equipment and circulation of cooling air.
- 2. Anchor or restrain floor-mounting power distribution units according to manufacturer's written instructions, seismic codes applicable to Project, **as directed**, and requirements in Division 26 Section "Hangers And Supports For Electrical Systems".
- 3. Identify equipment and install warning signs according to Division 26 Section "Identification For Electrical Systems".

B. Connections

- 1. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 - a. Separately Derived Systems: Make grounding connections to grounding electrodes as indicated; comply with NFPA 70.
- 2. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

C. Field Quality Control

- 1. Perform tests and inspections and prepare test reports.
- 2. Tests and Inspections:
 - a. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification for circuit breakers, molded case; and for transformers, dry type, air cooled, low voltage, small. Certify compliance with test parameters.
 - b. Perform functional tests of power distribution units throughout their operating ranges. Test each monitoring, status, and alarm function.
 - c. Infrared Scanning: Two months after Final Completion, perform an infrared scan of conductor and bus connections.



- 1) Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
 - 2) Perform 2 follow-up infrared scans of transformers, one at 4 months and the other at 11 months after Final Completion.
 - 3) Prepare a certified report identifying connections checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.
 3. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.
- D. Adjusting
1. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
 2. Adjust power distribution units to provide optimum voltage to equipment served throughout normal operating cycle of loads served. Record input and output voltages and adjustment settings, and incorporate into test results.
- E. Cleaning
1. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 26 24 19 00



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Task	Specification	Specification Description
26 24 19 00	01 22 16 00	No Specification Required
26 24 19 00	26 09 23 00	Electrical Power Monitoring And Control
26 24 19 00	26 11 16 00	Switchgear
26 24 19 00	26 09 23 00a	Motor-Control Centers
26 25 00 00	26 05 19 13	Electrical Renovation
26 26 00 00	26 24 19 00	Power Distribution Units
26 27 16 00	01 22 16 00	No Specification Required
26 27 16 00	26 05 19 13	Electrical Renovation
26 27 16 00	26 09 23 00	Electrical Power Monitoring And Control
26 27 16 00	26 09 23 00a	Motor-Control Centers



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SECTION 26 27 26 00 - CSF WIRING DEVICES

NOTE TO SPECIFIER

Use this Outline Specification Section for Customer Service Facilities only. This Specification defines "level of quality" for Customer Service Facility construction and is intended as a guide to the Architect/Engineer preparing the Construction Documents.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wall switches.
 - 2. Receptacles.
 - 3. Device plates and box covers.
 - 4. Multi-outlet surface raceway.
 - 5. TelePower poles.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. As specified in Section 260500 - Common Work Results for Electrical.

1.2 REFERENCES

- A. As specified in Section 260500 - Common Work Results for Electrical.
- B. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA WD 1 - General Requirements for Wiring Devices.
 - 2. NEMA WD 6 - Wiring Device -- Dimensional Requirements.

1.3 SUBMITTALS

- A. As specified in Section 260500 - Common Work Results for Electrical.

1.4 QUALITY ASSURANCE

- A. As specified in Section 260500 - Common Work Results for Electrical.
- B. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum 5 years documented experience.



PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of preparation for Project.

2.1 WALL SWITCHES

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 - 1. Hubbell, Inc, Milford, CT (203) 882-4800.
 - 2. Leviton Manufacturing, Company, Inc., Little Neck, NY (800) 824-3005.
 - 3. Pass & Seymour, Syracuse, NY (800) 776-4035.
 - 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Provide 20 Amp, 120/277V, specification grade, flush, single pole toggle switches with side and back wired screw terminals. All switches shall be equipped with grounding screws.
- C. Single Pole Switch:
 - 1. Leviton Cat. No.1221-2.
 - 2. P&S Cat. No. PS20AC1.
 - 3. Hubbell Cat. No. HBL1221.
- D. Double Pole Switch:
 - 1. Leviton Cat. No. 1222-2.
 - 2. P&S Cat. No. PS20AC2.
 - 3. Hubbell, Cat. No. HBL1222.
- E. Three-way Switch:
 - 1. Leviton, Cat. No. 1223-2.
 - 2. P&S Cat. No. PS20AC-3.
 - 3. Hubbell Cat. No. HBL1223.
- F. Indicator Switch:
 - 1. Leviton Cat. No. 1221-PLR (Red).
 - 2. P&S Cat. No. PS20AC1-RPL (Red).
 - 3. Hubbell Cat. No. HBL1221PL (Red).
- G. Locator Switch:
 - 1. Leviton Cat. No. 1221-LHC (Clear).
 - 2. P&S Cat. No. PS20AC1-CSL (Clear).
 - 3. Hubbell Cat. No. HBL1221IL (Clear).
- H. Locking Switch:
 - 1. Leviton Cat. No. 1221-2LW.
 - 2. P&S Cat. No. PS20AC1-L.
 - 3. Hubbell Cat. No. HBL1221L.
- I. Color: White unless indicated otherwise.



2.2 RECEPTACLES

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 - 1. Leviton Manufacturing, Company, Inc., Little Neck, NY (800) 824-3005.
 - 2. Pass & Seymour, Syracuse, NY (800) 776-4035.
 - 3. Hubbell, Inc, Milford, CT (203) 882-4800.
 - 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Provide duplex, specification grade, 20 Amp, 120 Volt, 2 pole, 3 wire receptacles with grounding screw.
- C. Duplex Convenience Receptacle:
 - 1. Leviton Cat. No. 5362.
 - 2. P&S Cat. No. 5362.
 - 3. Hubbell Cat. No. HBL5352.
- D. GFCI Receptacle (Side Wired Feed-Thru):
 - 1. Leviton Cat. No. 6599.
 - 2. P&S Cat. No. 2091-SHG.
 - 3. Hubbell Cat. No. HBLGF5362.
- E. Color: White unless indicated otherwise.

2.3 WALL PLATES

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 - 1. P&S Sierra.
 - 2. Hubbell.
 - 3. Leviton.
 - 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Cover Plate: White smooth thermoplastic.
 - 1. Sierra TP8-W.
- C. Weatherproof Cover Plate: Gasketed cast metal with hinged gasketed device.
 - 1. Sierra 4510 cast aluminum.

2.4 MULTI-OUTLET SURFACE RACEWAY

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 - 1. Legrand/Wiremold, West Hartford, CT (800) 621-0049.
 - 2. Section 01600 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Raceway Material: Anodized aluminum with manufacturer's standard hardware and fittings. Length as indicated on drawings.
- C. Wire: Factory pre-wired with No. 12 AWG minimum. Provide equipment grounding conductor.
- D. Wiring Devices: NEMA5-20R duplex receptacles and/or telecommunication outlets. Quantity as indicated on drawings.



- E. Provide single channel raceway for applications requiring power receptacles only. Provide dual channel raceway for applications requiring power receptacles and telecommunications outlets.
- F. Single channel, single cover raceway.
 - 1. Wiremold #AL3000 Series.
- G. Dual channel, single cover raceway
 - 1. Wiremold #AL4000 Series.

2.5 TELE/POWER POLE

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 - 1. Legrand/Wiremold, West Hartford, CT (800) 621-0049.
 - 2. Section 01600 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Raceway Material: Anodized aluminum with manufacturer's standard hardware and fittings. Length as indicated on drawings.
- C. Wire: Factory pre-wired with No. 12 AWG minimum. Provide equipment grounding conductor.
- D. Wiring Devices: NEMA5-20R duplex receptacles and/or telecommunication outlets. Quantity as indicated on drawings.
- E. Basis of Design: Wiremold NP620 Series.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. As specified in Section 260500 - Common Work Results for Electrical.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify that outlet boxes are installed at proper height.
 - 2. Verify that wall openings are neatly cut and will be completely covered by wall plates.
 - 3. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean debris from outlet boxes.

3.3 INSTALLATION

- A. Install in accordance with NECA "Standard of Installation."



- B. Install devices plumb and level.
- C. Install switches with OFF position down.
- D. Install receptacles with grounding pole on bottom.
- E. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.
- F. Connect wiring devices by wrapping conductor 2/3 of screw diameter in clockwise direction around screw terminal. Tighten screw to 12 pound-inches. Do not use spring pressure devices for wire connections.
- G. Install coverplates on switch, receptacle, and blank outlets.

3.4 CONSTRUCTION

- A. Interface with other work:
 - 1. Coordinate locations of outlet boxes provided under Section 260533 to obtain mounting heights indicated on Drawings.

3.5 FIELD QUALITY CONTROL

- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. Inspect each wiring device for defects.
- C. Operate each wall switch with circuit energized and verify proper operation.
- D. Verify that each receptacle device is energized.
- E. Test each receptacle device for proper polarity.
- F. Test each GFCI receptacle device for proper operation.

3.6 ADJUSTING

- A. Adjust devices and wall plates to be flush, level and plumb with wall.

3.7 CLEANING

- A. Section 017300 Execution: Cleaning installed work.
- B. Clean exposed surfaces to remove splatters and restore finish.

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Last revised: 5/10/2011

END OF SECTION 26 27 26 00



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SECTION 26 27 26 00 - MPF WIRING DEVICES

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wall switches.
 - 2. Receptacles.
 - 3. Device plates and box covers.
 - 4. Receptacle raceway.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 260500 - Common Work Results for Electrical: Supporting devices, electrical identification, grounding and bonding.
 - 2. Section 260533 - Raceway and Boxes for Electrical Systems: Pull, junction, outlet and switch boxes.

1.2 REFERENCES

- A. National Electrical Contractors Association (NECA):
 - 1. NECA "Standard of Installation."
- B. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA WD 1 - General Requirements for Wiring Devices.
 - 2. NEMA WD 6 - Wiring Devices - Dimensional Requirements.
- C. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code.

1.3 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum 5 years documented experience.
- B. Regulatory Requirements:
 - 1. Conform to requirements of NFPA 70.
 - 2. Provide Products listed and classified by Underwriters Laboratories, Incorporated.



1.4 SUBMITTALS

- A. Product data required.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 WALL SWITCHES

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
1. Hubbell, Inc, Milford, CT (203) 882-4800.
 2. Leviton Manufacturing, Company, Inc., Little Neck, NY (800) 824-3005.
 3. Pass & Seymour, Syracuse, NY (800) 776-4035.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions:
- C. Provide 20Amp, 120/277Volt, specification grade, flush single pole toggle switches with side and back wired screw terminals.
- D. Single Pole Switch:
1. Leviton Cat. No.1221-2.
 2. P&S Cat. No. PS20AC1I.
 3. Hubbell Cat. No. HBL1221.
- E. Double Pole Switch:
1. Leviton Cat. No. 1222-2.
 2. P&S Cat. No. PS20AC2.
 3. Hubbell, Cat. No. HBL1222.
- F. Three-way Switch:
1. Leviton, Cat. No. 1223-2.
 2. P&S Cat. No. PS20AC-3.
 3. Hubbell Cat. No. HBL1223.
- G. Indicator Switch:
1. Leviton Cat. No. 1221-PLR (Red).
 2. P&S Cat. No. PS20AC1-RPL (Red).
 3. Hubbell Cat. No. HBL1221PL (Red).
- H. Locator Switch:
1. Leviton Cat. No. 1221-LHC (Clear).
 2. P&S Cat. No. PS20AC1-CSL (Clear).
 3. Hubbell Cat. No. HBL1221IL (Clear).
- I. Locking Switch:
1. Leviton Cat. No. 1221-2L.
 2. P&S Cat. No. PS20AC1-L.
 3. Hubbell Cat. No. HBL1221L.
- J. Color: Color as directed by USPS.



2.2 RECEPTACLES

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 - 1. Leviton Manufacturing, Company, Inc., Little Neck, NY (800) 824-3005.
 - 2. Pass & Seymour, Syracuse, NY (800) 776-4035.
 - 3. Hubbell, Inc, Milford, CT (203) 882-4800.
 - 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Provide duplex specification grade receptacles, 20Amp, 125Volt, 2 pole, 3 wire, grounding with green hexagonal equipment ground screw.
- C. Duplex Convenience Receptacle:
 - 1. Leviton Cat. No. 5362.
 - 2. P&S Cat. No. 5362.
 - 3. Hubbell Cat. No. HBL5352.
- D. Tamper and weather resistant GFCI Receptacle (Side Wired Feed-Thru):
 - 1. Hubbell Cat. No. GFR5362SG.
- E. Color: As directed by USPS.

2.3 WALL PLATES

- A. Provide stainless steel wall plates.
- B. Provide waterproof covers on all exterior receptacles.

2.4 RECEPTACLE RACEWAY

- A. Manufacturer: Wiremold
- B. Raceway Material: Metal with manufacturer's standard materials. Size as indicated on drawings.
- C. Wire: No. 12 AWG minimum
- D. Wiring Devices: Quantity, type as indicated on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify that outlet boxes are installed at proper height.
 - 2. Verify that wall openings are neatly cut and will be completely covered by wall plates.
 - 3. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.



- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean debris from outlet boxes.

3.3 INSTALLATION

- A. Install wiring devices as indicated, in accordance with manufacturer's written instruction, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.
- B. Install devices plumb and level.
- C. Install switches with OFF position down.
- D. Install receptacles with grounding pole on bottom.
- E. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.
- F. Connect wiring devices by wrapping conductor $\frac{2}{3}$ of screw diameter in clockwise direction around screw terminal. Tighten screw to 12 pound-inches. Do not use spring pressure devices for wire connections.
- G. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- H. Provide plates on switch, receptacle, and blank outlets.

3.4 CONSTRUCTION

- A. Interface with other work:
 - 1. Coordinate locations of outlet boxes provided under Section 260533 to obtain mounting heights indicated on Drawings.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection.
- B. Prior to energizing circuitry, test wiring for electrical continuity, and for short circuits. Ensure proper polarity of connections is maintained. Subsequent to energization, test wiring devices to demonstrate compliance with requirements.
- C. Operate each wall switch with circuit energized and verify proper operation.



3.6 ADJUSTING

- A. Adjust devices and wall plates to be flush, level and plumb with wall.

3.7 CLEANING

- A. Section 017300 - Execution: Cleaning installed work.
- B. Clean exposed surfaces to remove splatters and restore finish.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 3/31/2010

END OF SECTION 26 27 26 00



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Task	Specification	Specification Description
26 27 26 00	01 22 16 00	No Specification Required
26 27 26 00	26 05 19 13	Electrical Renovation
26 27 26 00	26 09 23 00	Electrical Power Monitoring And Control



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SECTION 26 28 13 00 - FUSES

1.1 GENERAL

- A. Description Of Work
 - 1. This specification covers the furnishing and installation of materials for fuses. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.
- B. Summary
 - 1. Section Includes:
 - a. Cartridge fuses rated 600-V ac and less for use in control circuits, enclosed switches, panelboards, switchboards, enclosed controllers, and motor-control centers.
 - b. Plug fuses rated 125-V ac and less for use in plug-fuse-type enclosed switches, fuseholders, and panelboards.
 - c. Plug-fuse adapters for use in Edison-base, plug-fuse sockets.
 - d. Spare-fuse cabinets.
- C. Submittals
 - 1. Product Data: For each type of product indicated.
 - 2. Operation and maintenance data.
- D. Quality Assurance
 - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Comply with NEMA FU 1 for cartridge fuses.
 - 3. Comply with NFPA 70.
 - 4. Comply with UL 248-11 for plug fuses.
- E. Project Conditions
 - 1. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.2 PRODUCTS

- A. Cartridge Fuses
 - 1. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
- B. Plug Fuses
 - 1. Characteristics: UL 248-11, nonrenewable plug fuses; 125-V ac.
- C. Plug-Fuse Adapters
 - 1. Characteristics: Adapters for using Type S, rejection-base plug fuses in Edison-base fuseholders or sockets; ampere ratings matching fuse ratings; irremovable once installed.
- D. Spare-Fuse Cabinet
 - 1. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
 - a. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.



- b. Finish: Gray, baked enamel.
- c. Identification: "SPARE FUSES" in 1-1/2-inch- (38-mm-) high letters on exterior of door.
- d. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

1.3 EXECUTION

A. Fuse Applications

1. Cartridge Fuses:
 - a. Service Entrance: Class L, fast acting **OR** Class L, time delay **OR** Class RK1, fast acting **OR** Class RK1, time delay **OR** Class J, fast acting **OR** Class J, time delay **OR** Class T, fast acting, **as directed**.
 - b. Feeders: Class L, fast acting **OR** Class L, time delay **OR** Class RK1, fast acting **OR** Class RK1, time delay **OR** Class RK5, fast acting **OR** Class RK5, time delay **OR** Class J, fast acting **OR** Class J, time delay, **as directed**.
 - c. Motor Branch Circuits: Class RK1 **OR** Class RK5, **as directed**, time delay.
 - d. Other Branch Circuits: Class RK1, time delay **OR** Class RK5, time delay **OR** Class J, fast acting **OR** Class J, time delay, **as directed**.
 - e. Control Circuits: Class CC, fast acting **OR** time delay, **as directed**.
2. Plug Fuses:
 - a. Motor Branch Circuits: Edison-base type, dual **OR** Edison-base type, single **OR** Type S, dual **OR** Type S, single, **as directed**, -element time delay.
 - b. Other Branch Circuits: Edison-base type, single-element fast acting **OR** Edison-base type, dual-element time delay **OR** Edison-base type, single-element time delay **OR** Type S, dual-element time delay **OR** Type S, single-element time delay, **as directed**.

B. Installation

1. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
2. Install plug-fuse adapters in Edison-base fuseholders and sockets. Ensure that adapters are irremovable once installed.
3. Install spare-fuse cabinet(s).

C. Identification

1. Install labels complying with requirements for identification specified in Division 26 Section "Identification For Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 26 28 13 00



Task	Specification	Specification Description
26 28 13 00	26 11 16 00	Switchgear



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SECTION 26 28 16 00 - MPF ENCLOSED SWITCHES AND CIRCUIT BREAKERS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Fuses.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 260500 - Common Work Results for Electrical: Basic electrical methods.

1.2 REFERENCES

- A. National Electrical Testing Association (NETA):
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- B. National Electrical Contractors Association (NECA):
 - 1. NECA SI - Standard of Installation.
- C. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA FU 1 - Low Voltage Cartridge Fuses.
 - 2. NEMA KS 1 - Enclosed Switches.
- D. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data:
 - a. Switch ratings and enclosure dimensions.
 - b. Fuse data sheets showing electrical characteristics including time-current curves.
 - 2. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.



- b. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.
 - B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Project Record Documents: Record actual locations of enclosed switches and actual fuse sizes.
 - 2. QUALITY ASSURANCE
 - C. Perform Work in accordance with NECA SI.
 - D. Manufacturer Qualifications: Company specializing in manufacturing Products specified in this Section with minimum five years documented experience.
 - E. Regulatory Requirements:
 - 1. Conform to requirements of NFPA 70.
 - 2. Products: Listed and classified by Underwriters Laboratories, Incorporated as suitable for purpose specified and indicated.
- 1.4 MAINTENANCE
- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - B. Extra Products: At completion of installation, deliver to Contracting Officer.
 - 1. Three of each size and type fuse installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Switches: Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 - 1. General Electric Company (800) 626-2000.
 - 2. Siemens Energy & Automation, Alpharetta, GA (800) 964-4114.
 - 3. Square D Company, Palatine, IL (800) 392-8781.
 - 4. Eaton Corporation, Cutler-Hammer Products, Pittsburg, PA (800) 525-2000.
- B. Fuses: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Cooper Industries Incorporated, Waukesha, WI (414) 524-3300.
 - 2. General Electric Company (800) 626-2000.
 - 3. Gould Shawmut, Newburyport, MA (508) 462-6662.
- C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 FUSIBLE ENCLOSED SWITCH ASSEMBLIES

- A. NEMA KS 1, Type HD heavy duty, 100,000 AIC load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Cover shall be equipped with a manual defeat to allow opening while energized by authorized personnel. Handle shall be lockable in ON or OFF position.
- B. Rating: 250 volts AC or 600 volts AC as indicated on Drawings.



- C. Fuse Clips: Designed to accommodate Class R fuses.
- D. Enclosures: NEMA KS 1.
 - 1. Interior Dry Locations: NEMA Type 1 or 12.
 - 2. Exterior Locations: NEMA Type 3R or 12.
- E. Provide factory ground lug and neutral block if required.

2.3 NONFUSIBLE SWITCH ASSEMBLIES

- A. NEMA KS 1, Type GD General Duty, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Cover shall be equipped with a manual defeat to allow opening while energized by authorized personnel. Handle shall be lockable in ON or OFF position.
- B. Rating: 250 volts AC or 600 volts AC as indicated on Drawings.
- C. Enclosures: NEMA KS 1.
 - 1. Interior Dry Locations: NEMA Type 1 or 12.
 - 2. Exterior Locations: NEMA Type 3R or 12.
- D. Provide factory ground lug and neutral block if required.

2.4 FUSES

- A. NEMA FU 1, Class RK1, dual element, current limiting, time delay, 250 volt AC or 600 volt AC as indicated on Drawings.
- B. Interrupting Rating: 100,000 rms amperes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Switches:
 - 1. Install in accordance with manufacturers published instructions and NECA SI.
 - 2. Install where indicated on Drawings, where required by equipment, and where required by NFPA 70.



3. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

B. Fuses:

1. Install fuses in fusible switches in accordance with manufacturer's published instructions, as indicated on Drawings, or as required by loading per NFPA 70.
2. Install fuse with label oriented with manufacturer, type, and size easily read.

3.3 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.5.

USPS Mail Processing Facility Specification issued: 10/1/2013

Last revised: 3/31/2010

END OF SECTION 26 28 16 00



SECTION 26 28 16 00 - CSF ENCLOSED SWITCHES

NOTE TO SPECIFIER

Use this Outline Specification Section for Customer Service Facilities only. This Specification defines "level of quality" for Customer Service Facility construction and is intended as a guide to the Architect/Engineer preparing the Construction Documents.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Fuses.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. As specified in Section 260500 - Common Work Results for Electrical.

1.2 REFERENCES

- A. As specified in Section 260500 - Common Work Results for Electrical.
- B. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA FU 1 - Low Voltage Cartridge Fuses.
 - 2. NEMA KS 1 - Enclosed Switches.

1.3 SUBMITTALS

- A. As specified in Section 260500 - Common Work Results for Electrical..
 - 1. Product Data:
 - a. Switch ratings and enclosure dimensions.
 - b. Fuse data sheets showing electrical characteristics including time-current curves.
 - 2. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.



1. Project Record Documents: Record actual locations of enclosed switches and actual fuse sizes.

1.4 QUALITY ASSURANCE

- A. As specified in Section 260500 - Common Work Results for Electrical.
- B. Perform Work in accordance with NECA SI.

1.5 MAINTENANCE

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Extra Products: At completion of installation, deliver to Contracting Officer.
 1. Three of each size and type fuse installed.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Switches: Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
 1. Eaton/Cutler Hammer Corp., Pittsburg, PA (800) 525-2000.
 2. General Electric Company (800) 626-2000.
 3. Siemens Energy & Automation, Alpharetta, GA (800) 964-4114.
 4. Square D Company, Palatine, IL (800) 392-8781.
- B. Fuses: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. Cooper Industries Incorporated, Waukesha, WI (414) 524-3300.
 2. General Electric Company (800) 626-2000.
 3. Gould Shawmut, Newburyport, MA (508) 462-6662.
- C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 FUSIBLE ENCLOSED SWITCH ASSEMBLIES

- A. NEMA KS 1, Type HD heavy duty, 100,000 AIC load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Cover shall be equipped with a manual defeat to allow opening by authorized personnel while energized. Handle shall be lockable in ON or OFF position.
- B. Rating: 250 volts AC or 600 volts AC as indicated on Drawings.
- C. Fuse Clips: Designed to accommodate Class R fuses.



- D. Enclosures: NEMA KS 1.
 - 1. Interior Dry Locations: NEMA Type 1 or 12.
 - 2. Exterior Locations: NEMA Type 3R or 12.
- E. Provide factory grounding lug and neutral block if required.

2.3 NONFUSIBLE SWITCH ASSEMBLIES

- A. NEMA KS 1, Type GD, general duty load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Cover shall be equipped with a manual defeat to allow opening by authorized personnel while energized. Handle shall be lockable in ON or OFF position.
- B. Rating: 250 volts AC or 600 volts AC as indicated on Drawings.
- C. Enclosures: NEMA KS 1.
 - 1. Interior Dry Locations: NEMA Type 1 or 12.
 - 2. Exterior Locations: NEMA Type 3R or 12.
- D. Provide factory grounding lug and neutral block if required.

2.4 FUSES

- A. NEMA FU 1, Class RK5, dual element, current limiting, time delay, 250 volt AC or 600 volt AC as indicated on Drawings.
- B. Interrupting Rating: 100,000 rms amperes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. As specified in Section 260500 – Common Work Results for Electrical.

3.2 INSTALLATION

- A. Switches:
 - 1. Install in accordance with manufacturers published instructions and NECA SI.
 - 2. Install where indicated on Drawings, where required by equipment, and where required by NFPA 70.
 - 3. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.
- B. Fuses:
 - 1. Install fuses in fusible switches in accordance with manufacturer's published instructions, as indicated on Drawings, or as required by loading per NFPA 70.
 - 2. Install fuse with label oriented with manufacturer, type, and size easily read.

3.3 FIELD QUALITY CONTROL



- A. As specified in Section 260500 – Common Work Results for Electrical.

USPS CSF Specifications issued: 10/1/2013

Last revised: 5/10/2011

END OF SECTION 26 28 16 00



Task	Specification	Specification Description
26 28 16 00	26 05 19 13	Electrical Renovation
26 29 13 13	01 22 16 00	No Specification Required
26 29 13 13	26 05 19 13	Electrical Renovation



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SECTION 26 29 23 00 - CSF VARIABLE FREQUENCY MOTOR CONTROLLERS

REMINDER TO USPS MASTER SPEC REVIEWERS

A macro is executed to automatically generate Program-specific specification sections. The macro uses the name of each Program within the brackets <>, below, and the highlighted areas within this section to produce the Program-specific version. If the text within the brackets <> is deleted or altered, the macro will no longer produce that Program's version. The macro will also delete this note.

*This section applies to:
Medium Standard Building Designs <MSBD>*

Where the text for each Program differs, it is identified by colored highlighting

Yellow highlighted text is for MSBD only.

Blue highlighted text is for SSBD and RSD only.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.26 29 23 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Variable Speed Drive System
 - 2. High efficiency electric motors
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 260500 - Common Work Results for Electrical: Basic electrical methods.

1.2 REFERENCES

- A. Institute of Electrical and Electronics Engineers (IEEE):
 - 1. IEEE 519-1992 - Harmonic Distortion Standard.
- B. National Electrical Contractors Association (NECA):
 - 1. NECA SI - Standard of Installation.
- C. National Electrical Manufacturers Association (NEMA):
- D. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code.



1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data:
 - a. Product Specifications.
 - b. Descriptive Bulletins
 - 2. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Project Record Documents: Record actual locations, ratings and sizes of variable speed drives.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with Manufacturer's recommendations and as specified herein.
- B. Manufacturer Qualifications: Company specializing in manufacturing Products specified in this Section with minimum five years documented experience.
- C. Regulatory Requirements:
 - 1. Conform to requirements of NFPA 70.
 - 2. Products: Listed and classified by Underwriters Laboratories, Incorporated as suitable for purpose specified and indicated.

1.5 MAINTENANCE

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Extra Products: At completion of installation, deliver to Contracting Officer.
 - 1. Three of each size and type fuse installed.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Variable Speed Drives and Motors: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. ABB, New Berlin WI, (414) 785-8605.
 - 2. Allen-Bradley, Milwaukee WI, (414) 382-2000.
 - 3. Cutler-Hammer Eaton Corp., Milwaukee WI, (800) 833-3927.
 - 4. Graham, Milwaukee WI, (414) 355-8800.
 - 5. MagneTek, La Vergne TN, (800) 624-6383.



6. Reliance Electric, Rockwell Automation, Cleveland OH, (800) 241-2886.

- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Not Permitted.

2.2 VARIABLE SPEED DRIVE EQUIPMENT (VSD):

- A. Drive System shall be compatible with electrical characteristics of motors furnished and rated for operation with equipment furnished.
- B. System shall feature the following minimum operating characteristics:
1. Input ac voltage tolerance of 480V, plus or minus 10 percent.
 2. Input frequency tolerance of 50/60 Hz, plus or minus 6 percent.
 3. Minimum Efficiency: 96 percent at 60 Hz, full load.
 4. Minimum Displacement Primary-Side Power Factor: 96 percent.
 5. Overload Capability: 1.1 times the base load current for 60 seconds; 2.0 times the base load current for 3 seconds.
 6. Starting Torque: 100 percent of rated torque or as indicated.
 7. Speed Regulation: Plus or minus 1 percent.
 8. Isolated control interface to allow controller to follow control signal over an 11:1 speed range.
 9. Electrical Signal: 4 to 20 mA at 24 V.
 10. Internal Adjustability Capabilities:
 11. Minimum Speed: 5 to 25 percent of maximum rpm.
 12. Maximum Speed: 80 to 100 percent of maximum rpm.
 13. Acceleration: 2 to a minimum of 22 seconds.
 14. Deceleration: 2 to a minimum of 22 seconds.
 15. Current Limit: 50 to a minimum of 110 percent of maximum rating.
 16. Self-Protection and Reliability Features:
 - a. Input transient protection by means of surge suppressors.
 - b. Under- and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.
 - c. Motor Overload Relay: Adjustable and capable of NEMA 250, Class 10 performance.
 - d. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
 - e. Instantaneous line-to-line and line-to-ground overcurrent trips.
 - f. Loss-of-phase protection.
 - g. Reverse-phase protection.
 - h. Short-circuit protection.
 17. Motor overtemperature fault.
 18. Automatic Reset/Restart: Attempts three restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Bidirectional autospeed search shall be capable of starting into rotating loads spinning in either direction and returning motor to set speed in proper direction, without damage to controller, motor, or load.
 19. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped.
 20. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.
 21. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
 22. Minimum 3% line reactor. Supplier to calculate harmonic study and provide appropriate line reactor.
 23. The VSD must meet the requirements for Radio Frequency Interference (RFI) above 7 MHz as specified by FCC regulations, part 15, subpart J, Class A devices.
 24. Status Lights: Door-mounted LED indicators shall indicate the following conditions:
 - a. Power on.
 - b. Run.
 - c. Overvoltage.



- d. Line fault.
 - e. Overcurrent.
 - f. External fault.
- C. Panel-Mounted Operator Station: Start-stop and auto-manual selector switches with manual speed control potentiometer and elapsed time meter.
- D. Indicating Devices: Digital display and selector switch, mounted flush in controller door and connected to indicate the following controller parameters:
- 1. Output frequency (Hz).
 - 2. Motor speed (rpm).
 - 3. Motor status (running, stop, fault).
 - 4. Motor current (amperes).
 - 5. Motor torque (percent).
 - 6. Fault or alarming status (code).
 - 7. PID feedback signal (percent).
 - 8. DC-link voltage (VDC).
 - 9. Set-point frequency (Hz).
 - 10. Motor output voltage (V).
- E. Control Signal Interface:
- 1. Electric Input Signal Interface: A minimum of 2 analog inputs (0 to 10 V or 0/4-20 mA) and 6 programmable digital inputs.
- F. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BMS or other control systems:
- 1. 0 to 10-V dc.
 - 2. 0-20 or 4-20 mA.
 - 3. Potentiometer using up/down digital inputs.
 - 4. Fixed frequencies using digital inputs.
 - 5. RS485.
- G. Keypad display for local hand operation
- H. Output Signal Interface:
- 1. A minimum of 1 analog output signal (0/4-20 mA), which can be programmed to any of the following:
 - a. Output frequency (Hz).
 - b. Output current (load).
 - c. DC-link voltage (VDC).
 - d. Motor torque (percent).
 - e. Motor speed (rpm).
 - f. Set-point frequency (Hz).
- I. Remote Indication Interface: A minimum of 2 dry circuit relay outputs (120-V ac, 1 A) for remote indication of the following:
- 1. Motor running.
 - 2. Set-point speed reached.
 - 3. Fault and warning indication (overtemperature or overcurrent).
 - 4. PID high- or low-speed limits reached.
- J. A. Communications Interface: Provide BACnet compliant MS/TCP interface to be used with an external system within a multidrop LAN configuration. Communication capabilities shall include, but not be limited to; run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, acceleration/deceleration time adjustments, and lock and unlock the keypad. The interface shall allow monitoring of process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature, VSD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the communications interface.
- K. Manual bypass shall be provided for each VSD. VSD and bypass components shall be mounted inside a common NEMA 1 enclosure, fully pre-wired and ready for installation as a single UL listed device. Bypass shall include the following:



1. Input, output, and bypass contactors, to disconnect power to the VSD, when the motor is running in the bypass mode.
 2. 115 V.A.C. control transformer, with fused primary.
 3. Thermal overload relay, to protect the motor while operating in the bypass mode.
 4. Circuit breaker/disconnect switch, with a "through-the-door" handle mechanism.
 5. Control and safety circuit terminal strip.
 6. "Drive-Off-Bypass" selector switch.
 7. Pilot lights for "Power On" and "Fault".
 8. "Normal/Test" selector switch, to allow testing and adjustment of the VSD while the motor is running in the bypass mode.
 9. Integral Disconnecting Means: NEMA KS 1, nonfusible switch.
 10. Isolating Switch: Non-load-break switch arranged to isolate VSD and permit safe troubleshooting and testing, both energized and de-energized, while motor is operating in bypass mode.
 11. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.
 12. Provide human machine interface (HMI) backlit LCD display with key pad mounted on door for control and indication.
- L. Programmable settings shall be held in non-volatile flash memory, not affected by power interruption or loss, or be backed up by a battery capable maintaining the program for a minimum of 72 hours.

2.3 ENCLOSURES

A. NEMA 1 enclosure

B. ACCESSORIES

1. Devices shall be factory installed in controller enclosure, unless otherwise indicated.
2. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.
3. Control Relays: Auxiliary and adjustable time-delay relays.
4. Standard Displays:
 - a. Output frequency (Hz).
 - b. Set-point frequency (Hz).
 - c. Motor current (amperes).
 - d. DC-link voltage (VDC).
 - e. Motor torque (percent).
 - f. Motor speed (rpm).
 - g. Motor output voltage (V).
5. Historical Logging Information and Displays:
 - a. Real-time clock with current time and date.
 - b. Running log of total power versus time.
 - c. Total run time.
 - d. Fault log, maintaining last four faults with time and date stamp for each.
6. 1.1 Current-Sensing, Phase-Failure Relays for Bypass Controller: Solid-state sensing circuit with isolated output contacts for hard-wired connection; arranged to operate on phase failure, phase reversal, current unbalance of from 30 to 40 percent, or loss of supply voltage; with adjustable response delay.

2.4 HIGH EFFICIENCY DRIVE EQUIPMENT:

- A. Motors shall conform to the latest applicable requirements of NEMA, IEEE, ANSI, NEC and be U.L. listed. Motors shall be designed for continuous duty. Motors shall feature an engraved, stainless steel nameplate listing horsepower, volts, phase, rated and full load amps, model and serial numbers.
- B. All new motors furnished on this project shall be premium efficiency type rated for [____] volt, [____] phase.



- C. All new motors furnished on this project shall be furnished with motor starters and fused disconnects with fuses sized as recommended by the motor manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Variable Speed Drives:
 - 1. Provide a digital, electronic variable speed drive system that is compatible with the equipment to be controlled and suitable for the application.
 - 2. Provide the services of a factory trained technician to assist in installation, startup and training of Postal Service personnel. Provide filters or other accessories as required to minimize harmonic noise in controlled motors.
 - 3. Connect new VSD's to operate equipment and be controlled by BAS or other method as specified. BAS Controller shall operate all VSD's according to the sequence of operations. VSD control systems requiring operator to make changes at drive unit are not acceptable.
 - 4. Connect VSD to BAS using either twisted pair or shielded cable as required for system furnished. Check that RPM/HERTZ and other readings at BAS are equal to readings at VSD panel. Insure that system is properly grounded and all connections are properly torqued to manufacturer's recommendations.
 - 5. Set minimum speed to allow proper motor cooling and lubrication (normally 20 percent).
 - 6. Mount VSD (normally on wall) to allow for less than 25 feet of lead length between the drive and motor to prevent voltage reflection. Allow for proper air flow around VSD for cooling and service access. Check for over-voltage by measuring the phase-phase voltage at the motor terminals.
 - 7. Provide line reactors with 3 to 5 percent impedance or use filter device between drive and motor where required to compensate for power fluctuations (surges and drops).
 - 8. Mount drive in location to provide adequate ventilation for heat dissipation. Provide dust free enclosures with exterior heat sink where required by environment.
 - 9. Coordinate startup and testing with controls contractor. All controls shall be installed and ready to function in accordance with the sequence of operations prior to final testing and training. Adjust controller to update minimum of twice per second.
 - 10. Where multiple pump or fan systems are designed to operate in parallel, adjust VSD to maintain speeds within 20 revolutions per minute of each other when multiple motors are operating.
- B. High Efficiency Motors:
 - 1. Provide premium efficiency drive motors that are compatible with digital electronic variable speed drive systems and suitable for the application.



2. Securely mount and connect new motors to new VSD in accordance with manufacturer's recommendations, the National Electrical Code and as noted above. Size wiring as specified and per the NEC. All wiring shall be run in conduit suitable for the application.
3. For three phase motors, verify direction of rotation. Verify proper grounding. Check phase to phase voltage and phase to ground voltage. Report results to the Contracting Officer.
4. Torque all connections per manufacturer's recommendations.
5. Provide thermal overloads in starter sized for the application.
6. Check operation of system complies with the sequence of operations.

3.3 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.

USPS Master Specifications issued: 10/1/2013
Last revised: 7/22/2010

END OF SECTION



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SECTION 26 29 34 00 - MPF VARIABLE SPEED DRIVES

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Variable Speed Drive System
 - 2. High efficiency electric motors
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 250504 – Building Automation System (BAS) General: BAS integration methods.
 - 2. Section 260500 – Common Work Results for Electrical: Basic electrical methods.

1.2 REFERENCES

- A. Institute of Electrical and Electronics Engineers (IEEE):
 - 1. IEEE 519-1992 - Harmonic Distortion Standard.
- B. National Electrical Contractors Association (NECA):
 - 1. NECA SI - Standard of Installation.
- C. National Electrical Manufacturers Association (NEMA):
- D. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data:
 - a. Product Specifications.
 - b. Descriptive Bulletins



2. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

- B. Section 017704 – Closeout Procedures and Training: Procedures for closeout submittals.
 1. Project Record Documents: Record actual locations, ratings and sizes of variable speed drives.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with Manufacturer's recommendations and as specified herein.
- B. Manufacturer Qualifications: Company specializing in manufacturing Products specified in this Section with minimum five years documented experience.
- C. Regulatory Requirements:
 1. Conform to requirements of NFPA 70.
 2. Products: Listed and classified by Underwriters Laboratories, Incorporated as suitable for purpose specified and indicated.

1.5 MAINTENANCE

- A. Section 017704 – Closeout Procedures and Training: Procedures for closeout submittals.
- B. Extra Products: At completion of installation, deliver to Contracting Officer.
 1. Three of each size and type fuse installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Variable Speed Drives and Motors: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. ABB, New Berlin WI, (414) 785-8605.
 2. Allen-Bradley, Milwaukee WI, (414) 382-2000.
 3. Cutler-Hammer Eaton Corp., Milwaukee WI, (800) 833-3927.
 4. Square D Company, Schneider Electric; (888) 778-2733.
 5. MagneTek, La Vergne TN, (800) 624-6383.
 6. Reliance Electric, Rockwell Automation, Cleveland OH, (800) 241-2886.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 VARIABLE SPEED DRIVE EQUIPMENT (VSD):

- A. Drive System shall be compatible with electrical characteristics of motors furnished and rated for operation with equipment furnished.
- B. System shall feature the following minimum operating characteristics:



1. Input ac voltage tolerance of 480V, plus or minus 10 percent.
2. Input frequency tolerance of 50/60 Hz, plus or minus 6 percent.
3. Minimum Efficiency: 96 percent at 60 Hz, full load.
4. Minimum Displacement Primary-Side Power Factor: 96 percent.
5. Overload Capability: 1.1 times the base load current for 60 seconds; 2.0 times the base load current for 3 seconds.
6. Starting Torque: 100 percent of rated torque or as indicated.
7. Speed Regulation: Plus or minus 1 percent.
- C. Isolated control interface to allow controller to follow control signal over an 11:1 speed range.
 1. Electrical Signal: 4 to 20 mA at 24 V.
- D. Internal Adjustability Capabilities:
 1. Minimum Speed: 5 to 25 percent of maximum rpm.
 2. Maximum Speed: 80 to 100 percent of maximum rpm.
 3. Acceleration: 2 to a minimum of 22 seconds.
 4. Deceleration: 2 to a minimum of 22 seconds.
 5. Current Limit: 50 to a minimum of 110 percent of maximum rating.
- E. Self-Protection and Reliability Features:
 1. Input transient protection by means of surge suppressors.
 2. Under- and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.
 3. Motor Overload Relay: Adjustable and capable of NEMA 250, Class 10 performance.
 4. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
 5. Instantaneous line-to-line and line-to-ground overcurrent trips.
 6. Loss-of-phase protection.
 7. Reverse-phase protection.
 8. Short-circuit protection.
 9. Motor overtemperature fault.
- F. Automatic Reset/Restart: Attempts three restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Bidirectional autospeed search shall be capable of starting into rotating loads spinning in either direction and returning motor to set speed in proper direction, without damage to controller, motor, or load.
- G. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped.
- H. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.
- I. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
- J. Minimum 5% line reactor.
- K. The VSD must meet the requirements for Radio Frequency Interference (RFI) above 7 MHz as specified by FCC regulations, part 15, subpart J, Class A devices.
- L. Status Lights: Door-mounted LED indicators shall indicate the following conditions:
 1. Power on.
 2. Run.
 3. Overvoltage.
 4. Line fault.
 5. Overcurrent.
 6. External fault.



- M. Panel-Mounted Operator Station: Start-stop and auto-manual selector switches with manual speed control potentiometer and elapsed time meter.
- N. Indicating Devices: Digital display and selector switch, mounted flush in controller door and connected to indicate the following controller parameters:
1. Output frequency (Hz).
 2. Motor speed (rpm).
 3. Motor status (running, stop, fault).
 4. Motor current (amperes).
 5. Motor torque (percent).
 6. Fault or alarming status (code).
 7. PID feedback signal (percent).
 8. DC-link voltage (VDC).
 9. Set-point frequency (Hz).
 10. Motor output voltage (V).
- O. Control Signal Interface:
1. Electric Input Signal Interface: A minimum of 2 analog inputs (0 to 10 V or 0/4-20 mA) and 6 programmable digital inputs.
 2. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BMS or other control systems:
 - a. 0 to 10-V dc.
 - b. 0-20 or 4-20 mA.
 - c. Potentiometer using up/down digital inputs.
 - d. Fixed frequencies using digital inputs.
 - e. RS485.
 - f. Keypad display for local hand operation.
 3. Output Signal Interface:
 - a. A minimum of 2 analog output signal (0/4-20 mA), which can be programmed to any of the following:
 - 1) Output frequency (Hz).
 - 2) Output current (load).
 - 3) DC-link voltage (VDC).
 - 4) Motor torque (percent).
 - 5) Motor speed (rpm).
 - 6) Set-point frequency (Hz).
 4. Remote Indication Interface: A minimum of 2 dry circuit relay outputs (120-V ac, 1 A) for remote indication of the following:
 - a. Motor running.
 - b. Set-point speed reached.
 - c. Fault and warning indication (overtemperature or overcurrent).
 - d. PID high- or low-speed limits reached.
- P. Communications Interface: Provide BACnet compliant MS/TCP interface to be used with an external system within a multidrop LAN configuration. Communication capabilities shall include, but not be limited to; run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, acceleration/deceleration time adjustments, and lock and unlock the keypad. The interface shall allow monitoring of process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature, VSD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the communications interface



- Q. Manual bypass shall be provided for each VFD. VFD and bypass components shall be mounted inside a common NEMA 1 enclosure, fully pre-wired and ready for installation as a single UL listed device. Bypass shall include the following:

1. Input, output, and bypass contactors, to disconnect power to the VFD, when the motor is running in the bypass mode.
2. 115 V.A.C. control transformer, with fused primary.
3. Thermal overload relay, to protect the motor while operating in the bypass mode.
4. Circuit breaker/disconnect switch, with a "through-the-door" handle mechanism.
5. Control and safety circuit terminal strip.
6. "Drive-Off-Bypass" selector switch.
7. Pilot lights for "Power On" and "Fault".
8. "Normal/Test" selector switch, to allow testing and adjustment of the VSD while the motor is running in the bypass mode.

2.3 ENCLOSURES

- A. NEMA 1 enclosure

2.4 ACCESSORIES

- A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.
- B. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.
- C. Control Relays: Auxiliary and adjustable time-delay relays.
- D. Historical Logging Information and Displays:
1. Real-time clock with current time and date.
 2. Running log of total power versus time.
 3. Total run time.
 4. Fault log, maintaining last four faults with time and date stamp for each.
- E. Current-Sensing, Phase-Failure Relays for Bypass Controller: Solid-state sensing circuit with isolated output contacts for hard-wired connection; arranged to operate on phase failure, phase reversal, current unbalance of from 30 to 40 percent, or loss of supply voltage; with adjustable response delay.

2.5 HIGH EFFICIENCY DRIVE EQUIPMENT:

- A. Motors shall conform to the latest applicable requirements of NEMA, IEEE, ANSI, NEC and be U.L. listed. Motors shall be designed for continuous duty. Motors shall feature an engraved, stainless steel nameplate listing horsepower, volts, phase, rated and full load amps, model and serial numbers.
- B. All new motors furnished on this project shall be premium efficiency type rated for [____] volt, [____] phase.



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Variable Speed Drives:
 - 1. Provide a digital, electronic variable speed drive system that is compatible with the equipment to be controlled and suitable for the application.
 - 2. Provide the services of a factory trained technician to assist in installation, startup and training of Postal Service personnel. Provide filters or other accessories as required to minimize harmonic noise in controlled motors.
 - 3. Connect new VSD's to operate equipment and be controlled by BAS or other method as specified. BAS Controller shall operate all VSD's according to the sequence of operations. VSD control systems requiring operator to make changes at drive unit are not acceptable.
 - 4. Connect VSD to BAS using either twisted pair or shielded cable as required for system furnished. Check that RPM/HERTZ and other readings at BAS are equal to readings at VSD panel. Insure that system is properly grounded and all connections are properly torqued to manufacturer's recommendations.
 - 5. Set minimum speed to allow proper motor cooling and lubrication (normally 20 percent).
 - 6. Mount VSD (normally on wall) to allow for less than 25 feet of lead length between the drive and motor to prevent voltage reflection. Allow for proper air flow around VSD for cooling and service access. Check for over-voltage by measuring the phase-phase voltage at the motor terminals.
 - 7. Provide line reactors with 3 to 5 percent impedance or use filter device between drive and motor where required to compensate for power fluctuations (surges and drops).
 - 8. Mount drive in location to provide adequate ventilation for heat dissipation. Mount drive in interior locations only and provide adequate ventilation.
 - 9. Coordinate startup and testing with controls contractor. All controls shall be installed and ready to function in accordance with the sequence of operations prior to final testing and training. Adjust controller to update minimum of twice per second.
 - 10. Where multiple pump or fan systems are designed to operate in parallel, adjust VSD to maintain speeds within 20 revolutions per minute of each other when multiple motors are operating.
- B. High Efficiency Motors:
 - 1. Provide premium efficiency drive motors that are compatible with digital electronic variable speed drive systems and suitable for the application.
 - 2. Securely mount and connect new motors to new VSD in accordance with manufacturer's recommendations, the National Electrical Code and as noted above. Size wiring as specified and per the NEC. All wiring shall be run in conduit suitable for the application.
 - 3. For three phase motors, verify direction of rotation. Verify proper grounding. Check phase to phase voltage and phase to ground voltage. Report results to the Contracting Officer.
 - 4. Torque all connections per manufacturer's recommendations.



5. Provide thermal overloads in starter sized for the application.
6. Check operation of system complies with the sequence of operations.

3.3 FIELD QUALITY CONTROL

- A. Section 014000 – Quality Requirements: Field testing and inspection.

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SECTION 26 31 00 00 - PHOTOVOLTAIC ENERGY EQUIPMENT

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for Photovoltaic Energy Equipment. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. PV laminates (cells laminated into rigid sheets, with connecting cables).
 - b. PV modules (laminates in mounting frames).
 - c. Charge controllers.
 - d. Inverters.
 - e. Mounting structures.

C. Definitions

1. CEC: California Energy Commission.
2. ETFE: Ethylene tetrafluoroethylene.
3. FEP: Fluorinated ethylene propylene.
4. IP Code: Required ingress protection to comply with IEC 60529.
5. MPPT: Maximum power point tracking.
6. PTC: USA standard conditions for PV.
7. PV: Photovoltaic.
8. STC: Standard Test Conditions defined in IEC 61215.

D. Action Submittals

1. Product Data: For each type of product.
 - a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for PV panels.
 - b. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Shop Drawings: For PV modules.
 - a. Include plans, elevations, sections, and mounting details.
 - b. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - c. Detail fabrication and assembly.
 - d. Include diagrams for power, signal, and control wiring.

E. Informational Submittals

1. Field quality-control reports.
2. Sample Warranty: For manufacturer's special materials and workmanship warranty and minimum power output warranty.

F. Closeout Submittals

1. Operation and Maintenance Data: For PV modules to include in operation and maintenance manuals.

G. Warranty



1. Manufacturer's Special Materials and Workmanship Warranty: Manufacturer agrees to repair or replace components of PV modules that fail in materials or workmanship within specified warranty period.
 - a. Manufacturer's materials and workmanship warranties include, but are not limited to, the following:
 - 1) Faulty operation of PV modules.
 - b. Warranty Period: Two **OR** Five years from date of Final Completion.
2. Manufacturer's Special Minimum Power Output Warranty: Manufacturer agrees to repair or replace components of PV modules that fail to exhibit the minimum power output within specified warranty period. Special warranty, applying to modules only, applies to materials only, on a prorated basis, for period specified.
 - a. Manufacturer's minimum power output warranties include, but are not limited to, the following warranty periods, from date of Final Completion:
 - 1) Specified minimum power output to 80 percent or more, for a period of 25 years.

1.2 PRODUCTS

A. Performance Requirements

1. NRTL (Nationally Recognized Testing Laboratory) Listing: Entire assembly shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for electrical and fire safety, Class A **OR** Class C, according to UL 1703.
2. FM approved for NFPA 70, Class 1, Division 2, Group C and Group D hazardous locations.

B. System Description

1. Grid-Tied PV System:
 - a. Connected via a utility meter to the electrical utility.
 - b. An array of six modules to generate a total nominal 1000 rated W.
 - c. System Components:
 - 1) Cell materials.
 - 2) PV modules.
 - 3) Array frame.
 - 4) Charge controller.
 - 5) Inverter.
 - 6) Overcurrent protection/combiner box.
 - 7) Mounting structure.
 - 8) Utility meter.
2. Battery-Storage PV System:
 - a. Connected to a battery bank to provide electricity to Project.
 - b. An array of six modules to generate a total nominal 1000 rated W.
 - c. System Components:
 - 1) Cell materials.
 - 2) PV modules.
 - 3) Array frame.
 - 4) Charge controller.
 - 5) Inverter.
 - 6) Overcurrent protection/combiner box.
 - 7) Mounting structure.
 - 8) Battery charge controller(s).
 - 9) Batteries.
 - 10) Battery-storage structure.

C. Manufactured Units

1. Cell Materials: Amorphous silicon (a-Si) **OR** Cell Materials: Copper indium (di)selenide (CIS) **OR** Cell Materials: Copper indium gallium (di)selenide (CIGS) **OR** Cadmium telluride (CdTe) **OR**



- Cadmium sulfide **OR** Polycrystalline (c-Si) **OR** Polycrystalline (Gallium arsenide (GaAs) **OR** Monocrystalline (c-Si) **OR** Monocrystalline (Gallium arsenide (GaAs)), **as directed**.
2. Module Construction:
 - a. Nominal Size: 32 inches (800 mm) wide by 64 inches (1600 mm) long.
 - b. Weight: 42.8 lb (19.4 kg).
 3. Insulating Substrate Film: Flexible **OR** Rigid, polyester **OR** polyimide, **as directed**.
 4. Conducting Substrate Film: Flexible **OR** Rigid **OR** fluoropolymer, ETFE **OR** FEP, **as directed**.
 5. Encapsulant: Ethyl vinyl acetate.
 6. Front Panel: Fully tempered glass.
 7. Front Panel: 0.125-inch- (3.2-mm-) thick glass.
 8. Front Panel: Low iron glass.
 9. Front Panel: Antireflective coating glass.
 10. Front Panel: Laminating film.
 11. Front Panel: Laminating material.
 12. Backing Material: Tempered glass.
 13. Backing Material: 0.125-inch- (3.2-mm-) thick glass; color **as directed**.
 14. Backing Material: Polyester film.
 - a. Layers: **as directed**.
 - b. Color: White **OR as directed**.
 15. Backing Material: PVC film.
 - a. Layers: **as directed**.
 - b. Color: White **OR as directed**.
 16. Bypass Diode Protection: Internal.
 17. Junction Box:
 - a. Size: 1.56 by 3.96 by 0.52 inch (39.6 by 100.6 by 13.2 mm).
 - b. Fully potted, vandal resistant.
 - c. IP Code: IP65 **OR** IP66 **OR** IP67, **as directed**.
 - d. Flammability Test: UL 1703.
 18. Output Cabling:
 - a. **0.158 inch (4 mm)**.
 - b. Quick, multiconnect, polarized connectors.
 - c. Two-Conductor Harness: No traditional return wire is needed from the end of a row back to the source combiner.
 19. Series Fuse Rating: **as directed**.

D. Capacities And Characteristics

1. Minimum Electrical Characteristics:
 - a. Rated Open Circuit Voltage (V_{oc}): **as directed**.
 - b. Maximum System Voltage: **as directed**.
 - c. Maximum Power at Voltage (V_{pm}): **as directed**.
 - d. Short-Circuit Temperature Coefficient: **as directed**.
 - e. Rated Short-Circuit Current (I_{sc}): **as directed**.
 - f. Maximum System: **as directed**.
 - g. Rated Operation Current (I_{mp}): **as directed**.
 - h. Maximum Power at STC (P_{max}): **as directed**.
2. Additional Electrical Characteristics:
 - a. PTC Rating: **as directed**.
 - b. Peak Power per Unit Area: **as directed**.
 - c. Tolerance of P_{max} : **as directed**.
 - d. Minimum Peak Power: **as directed**.
 - e. Series Fuse Rating: **as directed**.
 - f. Module Efficiency: **as directed**.
 - g. Temperature Cycling Range: **as directed**.
 - h. Humidity, Freeze, Damp Heat Condition: **as directed**.
 - i. Wind Loading or Surface Pressure: **as directed**.
 - j. Maximum Distortion Angle: **as directed**.



- k. Hailstone Impact Withstand: **as directed.**
 - l. Series Fuse Rating: **as directed.**
 - 3. Normal Operating Temperature Characteristics (NOTC):
 - a. Temperature at Nominal Operating Cell Temperature: **as directed.**
 - b. Temperature Coefficient (NOTC P_{max}): **as directed.**
 - c. Temperature Coefficient (NOTC V_{oc}): **as directed.**
 - d. Temperature Coefficient (NOTC I_{sc}): **as directed.**
 - e. Temperature Coefficient (NOTC V_{mp}): **as directed.**
 - f. Temperature Coefficient (NOTC I_{mp}): **as directed.**
- E. Module Framing
 - 1. PV laminates mounted in anodized extruded-aluminum frames.
 - a. Entire assembly UL listed for electrical and fire safety, Class A **OR** Class C, according to UL 1703, complying with IEC 61215.
 - b. Frame strength exceeding requirements of certifying agencies in subparagraph above.
 - c. Finish: Anodized aluminum.
 - 1) Alloy and temper recommended by framing manufacturer for strength, corrosion resistance, and application of required finish.
 - 2) Color: As indicated by manufacturer's designations.
 - d. Finish: High-performance organic finish.
 - 1) Fluoropolymer Two-Coat System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent PVC resin by weight.
 - 2) Color: As indicated by manufacturer's designations.
 - e. Finish: Baked-enamel finish.
 - 1) Color: As indicated by manufacturer's designations.
- F. Array Construction
 - 1. Framing:
 - a. Material: Extruded aluminum **OR** Galvanized steel **OR** Coated steel, **as directed.**
 - b. Maximum System Weight: Less than 4 lb/sq. ft. (19.53 kg/sq. m).
 - c. Minimum Distance to Connectors: **as directed.**
 - d. Raceway Cover Plates: Plastic **OR** Aluminum **OR** Galvanized steel, **as directed.**
 - 2. Flat-Roof Mounting:
 - a. No roof penetrations.
 - b. Self-ballasting.
 - c. Wind-tunnel tested to 110-mph (160-km/h) wind.
 - d. Service Life: **25** years.
 - e. Freestanding system.
- G. Charge Controller
 - 1. Charge Controller Electrical Characteristics:
 - a. Output Current Rating: **as directed.**
 - b. Nominal Battery Voltage: **as directed.**
 - c. PV Maximum Open Circuit Voltage: **as directed.**
 - d. Equalization Voltage: **as directed.**
 - e. Voltage Step-Down Capability: **as directed.**
 - f. Power Conversion Efficiency: **as directed.**
 - 2. Charge controllers shall have the following:
 - a. Digital display.
 - b. Data logging.
 - c. Remote interface.
 - d. External sensors.
 - e. Temperature compensation.



H. Inverter

1. Control Type: Pulse width modulation control.
2. Control Type: Maximum power point tracker control.
3. Inverter Electrical Characteristics:
 - a. Maximum Recommended PV Input Power: **as directed**.
 - b. Maximum Voc: **as directed**.
 - c. PV Start Voltage: **as directed**.
 - d. MPPT Voltage Range: **as directed**.
 - e. Maximum Input Current: **as directed**.
 - f. Number of String Inputs: **as directed**.
 - g. Number of Independent MPPT Circuits: **as directed**.
 - h. Nominal Output Voltage: **as directed**.
 - i. CEC Rated Power: **as directed**.
 - j. Nominal Output Voltage: **as directed**.
 - k. Maximum Output Current: **as directed**.
 - l. Peak Efficiency: **as directed**.
 - m. CEC Weighted Efficiency: **as directed**.
 - n. CEC Night Tare Loss: **as directed**.
 - o. DC/AC Terminal Range (AWG): **as directed**.
 - p. NEMA 250 Enclosure Rating: **as directed**.
4. Operating Conditions:
 - a. Operating Ambient Temperatures: Minus 4 to plus 122 deg F (20 to plus 50 deg C).
 - b. Storage Temperature: Minus 40 to plus 122 deg F (minus 40 to plus 50 deg C).
 - c. Relative Humidity: 0 to 95 percent, noncondensing.
5. Charge controllers shall have the following:
 - a. Overcurrent protection.
 - b. Generator input breaker box.
 - c. Automatic transfer relay.
 - d. Digital display.
 - e. Transformer.
 - f. Disconnect switch.
 - g. Shunt controller.
 - h. Shunt regulator.
 - i. Surge overload protection.
6. Enclosure:
 - a. NEMA 250, Type 3R.
 - b. Enclosure Material: Galvanized steel **OR** Steel, **as directed**.
 - c. Cooling Methods:
 - 1) Fan convection cooling.
 - 2) Passive cooling.
 - d. Protective Functions:
 - 1) AC over/under voltage.
 - 2) AC over/under frequency.
 - 3) Ground over current.
 - 4) Overtemperature.
 - 5) AC and dc overcurrent.
 - 6) DC over voltage.
 - e. Standard liquid crystal display, four lines, 20 characters, with user display and on/off toggle switch.
 - f. Weight: 260 lb (118 kg).
 - g. Dimensions: 54 by 36 by 19 inches (137 by 91 by 48 cm).
7. Disconnects:
 - a. Low-voltage disconnect.
 - b. Low-voltage reconnect.
 - c. High-temperature disconnect.
 - d. High-temperature reconnect.



8. Regulatory Approvals:
 - a. IEEE 1547.1.
 - b. IEEE 1547.3.
 - c. UL 1741.
9. Characteristics:
 - a. Inverter Dimensions: **as directed**.
 - b. Inverter Weight: **as directed**.

I. System Overcurrent Protection

1. Combiner Box:
 - a. Fuses: **as directed**.
 - b. Circuit Breakers: **as directed**.

J. Mounting Structures

1. Roof Mount: Extruded aluminum, two **OR** four rails, **as directed**, tilt legs, and roof standoffs.
2. Pole Mount: Top **OR** Panel tops **OR** Side, **as directed**.
3. Tracking Mounts: One **OR** Two axis, **as directed**.

1.3 EXECUTION

A. Examination

1. Examine substrate areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
2. Do not begin installation until mounting surfaces have been properly prepared.
3. If preparation of mounting surfaces is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
4. Examine modules and array frame before installation. Reject modules and arrays that are wet, moisture damaged, or mold damaged.
5. Examine roofs, supports, and supporting structures for suitable conditions where PV system will be installed.
6. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Field Quality Control

1. Perform tests and inspections **with the assistance of a factory-authorized service representative**.
2. PV module will be considered defective if it does not pass tests and inspections.
3. Prepare test and inspection reports.

END OF SECTION 26 31 00 00



Task	Specification	Specification Description
26 31 00 00	01 22 16 00	No Specification Required



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SECTION 26 32 13 13 - PACKAGED ENGINE GENERATORS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for packaged engine generators. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes packaged engine-generator sets for emergency **OR** standby, **as directed**, power supply with the following features:
 - a. Gas and Diesel engine.
 - b. Unit-mounted and Remote-mounting cooling system.
 - c. Unit-mounted and Remote-mounting control and monitoring.
 - d. Performance requirements for sensitive loads.
 - e. Load banks.
 - f. Outdoor enclosure.

C. Definitions

1. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.
2. LP: Liquid petroleum.

D. Submittals

1. Product Data: For each type of packaged engine generator and accessory indicated.
2. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Manufacturer Seismic Qualification Certification: Submit certification that day tank, engine-generator set, batteries, battery racks, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
4. Source quality-control test reports.
5. Field quality-control test reports.
6. Operation and maintenance data.
7. Warranty: Special warranty specified in this Section.

E. Quality Assurance

1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
2. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 200 miles (321 km) of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
4. Comply with ASME B15.1.
5. Comply with NFPA 37.
6. Comply with NFPA 70.
7. Comply with NFPA 99 for healthcare facilities.
8. Comply with NFPA 110 requirements for Level 1 **OR** 2, **as directed**, emergency power supply system.



9. Comply with UL 2200.
10. Engine Exhaust Emissions: Comply with applicable state and local government requirements.
11. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

F. Project Conditions

1. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
 - a. Ambient Temperature: 5 to 40 deg C **OR** Minus 15 to plus 40 deg C, **as directed**.
 - b. Relative Humidity: 0 to 95 percent for outdoor units.
 - c. Altitude: Sea level to 1000 feet (300 m).
2. Unusual Service Conditions: Engine-generator equipment and installation are required to operate under the following conditions:
 - a. High salt-dust content in the air due to sea-spray evaporation.

1.2 PRODUCTS

A. Engine-Generator Set

1. Factory-assembled and -tested, engine-generator set.
2. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.
 - a. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.
3. Capacities and Characteristics:
 - a. Power Output Ratings: Nominal ratings as indicated, with capacity as required to operate as a unit as evidenced by records of prototype testing.
 - b. Output Connections: Three-phase, three **OR** four, **as directed**, wire.
 - c. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.
4. Generator-Set Performance:
 - a. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
 - b. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
 - c. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
 - d. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
 - e. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
 - f. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
 - g. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
 - h. Start Time: Comply with NFPA 110, Type 10, system requirements.



5. Generator-Set Performance for Sensitive Loads:
 - a. Oversizing generator compared with the rated power output of the engine is permissible to meet specified performance.
 - 1) Nameplate Data for Oversized Generator: Show ratings required by the Contract Documents rather than ratings that would normally be applied to generator size installed.
 - b. Steady-State Voltage Operational Bandwidth: 1 percent of rated output voltage from no load to full load.
 - c. Transient Voltage Performance: Not more than 10 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 0.5 second.
 - d. Steady-State Frequency Operational Bandwidth: Plus or minus 0.25 percent of rated frequency from no load to full load.
 - e. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
 - f. Transient Frequency Performance: Less than 2-Hz variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within three seconds.
 - g. Output Waveform: At no load, harmonic content measured line to neutral shall not exceed 2 percent total with no slot ripple. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
 - h. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to winding insulation or other generator system components.
 - i. Excitation System: Performance shall be unaffected by voltage distortion caused by nonlinear load.
 - 1) Provide permanent magnet excitation for power source to voltage regulator.
 - j. Start Time: Comply with NFPA 110, Type 10, system requirements.

B. Engine

1. Fuel: Fuel oil, Grade DF-2 **OR** Natural gas with automatic LP-gas standby **OR** Natural gas, **as directed**.
2. Rated Engine Speed: 1800 rpm.
3. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm (11.4 m/s).
4. Lubrication System: The following items are mounted on engine or skid:
 - a. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
 - b. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
 - c. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
5. Engine Fuel System:
 - a. Main Fuel Pump For Diesel-Fueled Engine: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
 - b. Relief-Bypass Valve For Diesel-Fueled Engine: Automatically regulates pressure in fuel line and returns excess fuel to source.
 - c. Dual Natural Gas with LP-Gas Backup (Vapor-Withdrawal) System:
 - 1) Carburetor.
 - 2) Secondary Gas Regulators: One for each fuel type.
 - 3) Fuel-Shutoff Solenoid Valves: One for each fuel source.
 - 4) Flexible Fuel Connectors: One for each fuel source.
6. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.
7. Governor: Adjustable isochronous, with speed sensing.



8. Cooling System:
 - a. Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.
 - 1) Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
 - 2) Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
 - 3) Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
 - 4) Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
 - 5) Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
 - a) Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
 - b) End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.
 - b. Closed loop, liquid cooled, with remote radiator and integral engine-driven coolant pump.
 - 1) Configuration: Vertical **OR** Horizontal, **as directed**, air discharge.
 - 2) Radiator Core Tubes: Aluminum **OR** Nonferrous-metal construction other than aluminum, **as directed**.
 - 3) Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
 - 4) Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
 - 5) Fan: Driven by multiple belts from engine shaft **OR** totally enclosed electric motor with sealed bearings, **as directed**.
 - 6) Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
 - 7) Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
9. Muffler/Silencer:
 - a. Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
 - 1) Minimum sound attenuation of 25 dB at 500 Hz.
 - 2) Sound level measured at a distance of 10 feet (3 m) from exhaust discharge after installation is complete shall be 85 dBA or less.
 - b. Residential type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
 - 1) Minimum sound attenuation of 18 dB at 500 Hz.
 - 2) Sound level measured at a distance of 10 feet (3 m) from exhaust discharge after installation is complete shall be 95 dBA or less.
 - c. Industrial type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
 - 1) Minimum sound attenuation of 12 dB at 500 Hz.
 - 2) Sound level measured at a distance of 25 feet (8 m) from exhaust discharge after installation is complete shall be 87 dBA or less.
10. Air-Intake Filter: Standard **OR** Heavy, **as directed**, -duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.
11. Starting System: 12 **OR** 24, **as directed**, -V electric, with negative ground.



- a. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
 - b. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
 - c. Cranking Cycle: As required by NFPA 110 for system level specified **OR** 60 seconds, **as directed**.
 - d. Battery: Adequate capacity within ambient temperature range specified in Part 1.1 "Project Conditions" Article to provide specified cranking cycle at least twice **OR** three times, **as directed**, without recharging.
 - e. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
 - f. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in Part 1.1 "Project Conditions" Article. Include accessories required to support and fasten batteries in place.
 - g. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
 - h. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236.
 - 1) Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
 - 2) Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
 - 3) Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
 - 4) Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
 - 5) Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
 - 6) Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.
- C. Fuel Oil Storage
- 1. Comply with NFPA 30.
 - 2. Day Tank: Comply with UL 142, freestanding, factory-fabricated fuel tank assembly, with integral, float-controlled transfer pump and the following features:
 - a. Containment: Integral rupture basin with a capacity of 150 percent of nominal capacity of day tank.
 - 1) Leak Detector: Locate in rupture basin and connect to provide audible and visual alarm in the event of day-tank leak.
 - b. Tank Capacity: As recommended by engine manufacturer for an uninterrupted period of 4 hours' operation at 100 percent of rated power output of engine-generator system without being refilled.
 - c. Pump Capacity: Exceeds maximum flow of fuel drawn by engine-mounted fuel supply pump at 110 percent of rated capacity, including fuel returned from engine.
 - d. Low-Level Alarm Sensor: Liquid-level device operates alarm contacts at 25 percent of normal fuel level.
 - e. High-Level Alarm Sensor: Liquid-level device operates alarm and redundant fuel shutoff contacts at midpoint between overflow level and 100 percent of normal fuel level.



- f. Piping Connections: Factory-installed fuel supply and return lines from tank to engine; local fuel fill, vent line, overflow line; and tank drain line with shutoff valve.
- g. Redundant High-Level Fuel Shutoff: Actuated by high-level alarm sensor in day tank to operate a separate motor device that disconnects day-tank pump motor. Sensor shall signal solenoid valve, located in fuel suction line between fuel storage tank and day tank, to close. Both actions shall remain in shutoff state until manually reset. Shutoff action shall initiate an alarm signal to control panel but shall not shut down engine-generator set.
- 3. Base-Mounted Fuel Oil Tank: Factory installed and piped, complying with UL 142 fuel oil tank. Features include the following:
 - a. Tank level indicator.
 - b. Capacity: Fuel for eight hours' continuous operation at 100 percent rated power output.
 - c. Vandal-resistant fill cap.
 - d. Containment Provisions: Comply with requirements of authorities having jurisdiction.

D. Control And Monitoring

- 1. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms.
- 2. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms.
- 3. Configuration:
 - a. Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.
 - b. Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common wall-mounted control and monitoring panel.
 - c. Operating and safety indications, protective devices, basic system controls, engine gages, instrument transformers, generator disconnect switch or circuit breaker, and other indicated components shall be grouped in a combination control and power panel. Control and monitoring section of panel shall be isolated from power sections by steel barriers. Panel features shall include the following:
 - 1) Wall-Mounting Cabinet Construction: Rigid, self-supporting steel unit complying with NEMA ICS 6. Power bus shall be copper. Bus, bus supports, control wiring, and temperature rise shall comply with UL 891.
 - 2) Switchboard Construction: Freestanding unit complying with Division 26 Section "Switchboards".
 - 3) Switchgear Construction: Freestanding unit complying with Division 26 Section "Low-voltage Switchgear".
 - 4) Current and Potential Transformers: Instrument accuracy class.
- 4. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 **OR** 2, **as directed**, system, and the following:
 - a. AC voltmeter.
 - b. AC ammeter.
 - c. AC frequency meter.
 - d. DC voltmeter (alternator battery charging).
 - e. Engine-coolant temperature gage.
 - f. Engine lubricating-oil pressure gage.
 - g. Running-time meter.
 - h. Ammeter-voltmeter, phase-selector switch(es).



- i. Generator-voltage adjusting rheostat.
 - j. Fuel tank derangement alarm.
 - k. Fuel tank high-level shutdown of fuel supply alarm.
 - l. Generator overload.
5. Indicating and Protective Devices and Controls:
 - a. AC voltmeter.
 - b. AC ammeter.
 - c. AC frequency meter.
 - d. DC voltmeter (alternator battery charging).
 - e. Engine-coolant temperature gage.
 - f. Engine lubricating-oil pressure gage.
 - g. Running-time meter.
 - h. Ammeter-voltmeter, phase-selector switch(es).
 - i. Generator-voltage adjusting rheostat.
 - j. Start-stop switch.
 - k. Overspeed shutdown device.
 - l. Coolant high-temperature shutdown device.
 - m. Coolant low-level shutdown device.
 - n. Oil low-pressure shutdown device.
 - o. Fuel tank derangement alarm.
 - p. Fuel tank high-level shutdown of fuel supply alarm.
 - q. Generator overload.
6. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.
7. Connection to Data Link: A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication is reserved for connections for data-link transmission of indications to remote data terminals. Data system connections to terminals are covered in Division 26 Section "Electrical Power Monitoring And Control".
8. Common Remote Audible Alarm:
 - a. Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel.
 - 1) Overcrank shutdown.
 - 2) Coolant low-temperature alarm.
 - 3) Control switch not in auto position.
 - 4) Battery-charger malfunction alarm.
 - 5) Battery low-voltage alarm.
 - b. Common Remote Audible Alarm for manually starting systems or for automatically starting systems not specified to comply with NFPA 110, Level 1, but where some remote alarm functions are needed. Signal the occurrence of any events listed below without differentiating between event types. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset.
 - 1) Engine high-temperature shutdown.
 - 2) Lube-oil, low-pressure shutdown.
 - 3) Overspeed shutdown.
 - 4) Remote emergency-stop shutdown.
 - 5) Engine high-temperature prealarm.
 - 6) Lube-oil, low-pressure prealarm.
 - 7) Fuel tank, low-fuel level.
 - 8) Low coolant level.
9. Remote Alarm Annunciator: Comply with NFPA 99. An LED labeled with proper alarm conditions shall identify each alarm event and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.



10. Remote Emergency-Stop Switch: Flush; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

E. Generator Overcurrent And Fault Protection

1. Generator Circuit Breaker:

- a. Molded-case, thermal-magnetic type; 100 percent rated; complying with NEMA AB 1 and UL 489.
 - 1) Tripping Characteristic: Designed specifically for generator protection.
 - 2) Trip Rating: Matched to generator rating.
 - 3) Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
 - 4) Mounting: Adjacent to or integrated with control and monitoring panel.
- b. Molded-case, electronic-trip type; 100 percent rated; complying with UL 489.
 - 1) Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
 - 2) Trip Settings: Selected to coordinate with generator thermal damage curve.
 - 3) Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
 - 4) Mounting: Adjacent to or integrated with control and monitoring panel.
- c. Insulated-case, electronic-trip type; 100 percent rated; complying with UL 489.
- d. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
- e. Trip Settings: Selected to coordinate with generator thermal damage curve.
- f. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
- g. Mounting: Adjacent to or integrated with control and monitoring panel.

2. Generator Disconnect Switch: Molded-case type, 100 percent rated.

- a. Rating: Matched to generator output rating.
- b. Shunt Trip: Connected to trip switch when signaled by generator protector or by other protective devices.

3. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector shall perform the following functions:

- a. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms.
- b. Under single or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
- c. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the generator set.
- d. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.
- e. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground-fault. Integrate ground-fault alarm indication with other generator-set alarm indications.

F. Generator, Exciter, And Voltage Regulator

1. Comply with NEMA MG 1.
2. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
3. Electrical Insulation: Class H or Class F.
4. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.



5. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
6. Enclosure: Dripproof.
7. Instrument Transformers: Mounted within generator enclosure.
8. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
 - a. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.
9. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.
10. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
11. Subtransient Reactance: 12 percent, maximum.

G. Load Bank

1. Description: Permanent, outdoor, weatherproof, remote-controlled, forced-air-cooled, resistive **OR** resistive and reactive, **as directed**, unit capable of providing a balanced 3-phase, delta-connected load to generator set at 100 percent rated-system capacity, at 80 percent power factor, lagging. Unit may be composed of separate resistive and reactive load banks controlled by a common control panel. Unit shall be capable of selective control of load in 25 percent steps and with minimum step changes of approximately 5 and 10 percent available.
2. Resistive Load Elements: Corrosion-resistant chromium alloy with ceramic and steel supports. Elements shall be double insulated and designed for repetitive on-off cycling. Elements shall be mounted in removable aluminized-steel heater cases.
3. Reactive Load Elements: Epoxy-encapsulated reactor coils.
4. Load-Bank Heat Dissipation: Integral fan with totally enclosed motor shall provide uniform cooling airflow through load elements. Airflow and coil operating current shall be such that, at maximum load, with ambient temperature at the upper end of specified range, load-bank elements operate at not more than 50 percent of maximum continuous temperature rating of resistance elements.
5. Load Element Switching: Remote-controlled contactors switch groups of load elements. Contactor coils are rated 120 V. Contactors shall be located in a separate NEMA 250, Type 3R enclosure within load-bank enclosure, accessible from exterior through hinged doors with tumbler locks.
6. Contactor Enclosures: Heated by thermostatically controlled strip heaters to prevent condensation.
7. Load-Bank Enclosures: NEMA 250, Type 3R, complying with NEMA ICS 6. Louvers at cooling-air intake and discharge openings shall prevent entry of rain and snow. Openings for airflow shall be screened with 1/2-inch- (13-mm-) square, galvanized-steel mesh. Reactive load bank shall include automatic shutters at air intake and discharge.
8. Protective Devices: Power input circuits to load banks shall be fused, and fuses shall be selected to coordinate with generator circuit breaker. Fuse blocks shall be located in contactor enclosure. Cooling airflow and overtemperature sensors shall automatically shut down and lock out load bank until manually reset. Safety interlocks on access panels and doors shall disconnect load power, control, and heater circuits. Fan motor shall be separately protected by overload and short-circuit devices. Short-circuit devices shall be noninterchangeable fuses with 200,000-A interrupting capacity.
9. Remote-Control Panel: Separate from load bank in NEMA 250, Type 1 enclosure with a control power switch and pilot light, and switches controlling groups of load elements.
10. Control Sequence: Control panel may be preset for adjustable single-step loading of generator during automatic exercising.

H. Outdoor Generator-Set Enclosure

1. Description:
 - a. Vandal-resistant, weatherproof steel housing, wind resistant up to 100 mph (160 km/h). Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.



- b. Prefabricated or preengineered walk-in enclosure with the following features:
 - 1) Construction: Galvanized-steel, metal-clad, integral structural-steel-framed building erected on concrete foundation.
 - 2) Structural Design and Anchorage: Comply with ASCE 7 for wind loads.
 - 3) Space Heater: Thermostatically controlled and sized to prevent condensation.
 - 4) Louvers: Equipped with bird screen and filter arranged to permit air circulation when engine is not running while excluding exterior dust, birds, and rodents.
 - 5) Hinged Doors: With padlocking provisions.
 - 6) Ventilation: Louvers equipped with bird screen and filter arranged to permit air circulation while excluding exterior dust, birds, and rodents.
 - 7) Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits required by engine-generator-set components.
 - 8) Muffler Location: Within **OR** External to, **as directed**, enclosure.
 - 2. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.
 - a. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.
 - b. Automatic Dampers: At engine cooling-air inlet and discharge. Dampers shall be closed to reduce enclosure heat loss in cold weather when unit is not operating.
 - 3. Interior Lights with Switch: Factory-wired, vaporproof-type fixtures within housing; arranged to illuminate controls and accessible interior. Arrange for external electrical connection.
 - a. AC lighting system and connection point for operation when remote source is available.
 - b. DC lighting system for operation when remote source and generator are both unavailable.
 - 4. Convenience Outlets: Factory wired, GFCI. Arrange for external electrical connection.
- I. Motors
 - 1. General requirements for motors are specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 22.
- J. Vibration Isolation Devices
 - 1. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
 - a. Material: Standard neoprene **OR** Natural rubber **OR** Bridge-bearing neoprene, complying with AASHTO M 251, **as directed**.
 - b. Durometer Rating: 30 **OR** 40 **OR** 45 **OR** 50 **OR** 60 **OR** 65 **OR** 70, **as directed**.
 - c. Number of Layers: One **OR** Two **OR** Three **OR** Four, **as directed**.
 - 2. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.
 - a. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
 - b. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
 - c. Minimum Additional Travel: 50 percent of required deflection at rated load.
 - d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.



- K. Finishes
 - 1. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.
- L. Source Quality Control
 - 1. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
 - a. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.
 - b. Report factory test results within 10 days of completion of test.

1.3 EXECUTION

- A. Installation
 - 1. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.
 - 2. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.
 - 3. Install packaged engine generator with elastomeric isolator pads **OR** restrained spring isolators, **as directed**, having a minimum deflection of 1 inch (25 mm) on 4-inch- (100-mm-) high concrete base. Secure sets to anchor bolts installed in concrete bases. Concrete base construction is specified in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
 - 4. Install remote radiator with elastomeric isolator pads **OR** restrained spring isolators, **as directed**, having a minimum deflection of 1 inch (25 mm) on concrete base on grade **OR** roof equipment supports on roof, **as directed**.
 - 5. Install Schedule 40, black steel piping with welded joints for cooling water piping between engine-generator set and heat exchanger **OR** remote radiator, **as directed**. Piping materials and installation requirements are specified in Division 23 Section "Hydronic Piping".
 - 6. Install Schedule 40, black steel piping with welded joints and connect to engine muffler. Install thimble at wall. Piping shall be same diameter as muffler outlet. Flexible connectors and steel piping materials and installation requirements are specified in Division 23 Section "Hydronic Piping".
 - a. Install condensate drain piping to muffler drain outlet full size of drain connection with a shutoff valve, stainless-steel flexible connector, and Schedule 40, black steel pipe with welded joints. Flexible connectors and piping materials and installation requirements are specified in Division 23 Section "Hydronic Piping".
 - 7. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.
 - 8. Piping installation requirements are specified in Division 21. Drawings indicate general arrangement of piping and specialties.
 - 9. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow service and maintenance.
 - 10. Connect cooling-system water piping to engine-generator set and remote radiator **OR** heat exchanger, **as directed** with flexible connectors.
 - 11. Connect engine exhaust pipe to engine with flexible connector.
 - 12. Connect fuel piping to engines with a gate valve and union and flexible connector.
 - a. Natural-gas piping, valves, and specialties for gas distribution are specified in Division 23 Section "Facility Natural-gas Piping".
 - b. LP-gas piping, valves, and specialties for gas piping are specified in Division 23 Section "Facility Liquefied-petroleum Gas Piping".
 - 13. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 - 14. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
 - 15. Identify system components according to Division 23 Section "Identification For Hvac Piping And Equipment" and Division 26 Section "Identification For Electrical Systems".



B. Field Quality Control

1. Perform tests and inspections and prepare test reports.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Tests and Inspections:
 - a. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection (except those indicated to be optional) for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - b. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
 - c. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
 - 1) Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
 - 2) Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
 - 3) Verify acceptance of charge for each element of the battery after discharge.
 - 4) Verify that measurements are within manufacturer's specifications.
 - d. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
 - e. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
 - f. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg (120 kPa). Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
 - g. Exhaust Emissions Test: Comply with applicable government test criteria.
 - h. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
 - i. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.
 - j. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at four locations on the property line, and compare measured levels with required values.
3. Coordinate tests with tests for transfer switches and run them concurrently.
4. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
5. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
6. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
7. Remove and replace malfunctioning units and retest **OR** reinspect, **as directed**, as specified above.
8. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
9. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

C. Demonstration



1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

END OF SECTION 26 32 13 13



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Task	Specification	Specification Description
26 32 13 19	26 32 13 13	Packaged Engine Generators
26 32 13 26	26 32 13 13	Packaged Engine Generators
26 32 29 00	26 32 13 13	Packaged Engine Generators



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SECTION 26 33 43 00 - CENTRAL BATTERY INVERTERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for central battery inverters. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes slow-transfer, fast-transfer, and UPS central battery inverters with the following features:
 - a. Output distribution section.
 - b. Internal maintenance bypass/isolation switch.
 - c. External maintenance bypass/isolation switch.
 - d. Multiple output voltages.
 - e. Emergency-only circuits.
 - f. Remote monitoring provisions.

C. Definitions

1. LCD: Liquid-crystal display.
2. LED: Light-emitting diode.
3. THD: Total harmonic distortion.
4. UPS: Uninterruptible power supply.

D. Submittals

1. Product Data: For the following:
 - a. Electrical ratings, including the following:
 - 1) Capacity to provide power during failure of normal ac.
 - 2) Inverter voltage regulation and THD of output current.
 - 3) Rectifier data.
 - 4) Transfer time of transfer switch.
 - 5) Data for specified optional features.
 - b. Transfer switch.
 - c. Inverter.
 - d. Battery charger.
 - e. Batteries.
 - f. Battery monitoring.
 - g. Battery-cycle warranty monitor.
2. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, components, and location and identification of each field connection. Show access, workspace, and clearance requirements; details of control panels; and battery arrangement.
 - a. Wiring Diagrams: Detail internal and interconnecting wiring; and power, signal, and control wiring.
 - b. Elevation and details of control and indication displays.
 - c. Output distribution section.
3. Manufacturer Seismic Qualification Certification: Submit certification that central battery inverter equipment will withstand seismic forces defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
4. Operation and Maintenance Data.

E. Quality Assurance



1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Central Battery Inverter System: UL 924 and UL 1778, **as directed**, listed.
3. Comply with NFPA 70 and NFPA 101.

F. Delivery, Storage, And Handling

1. Deliver equipment in fully enclosed vehicles.
2. Store equipment in spaces having environments controlled within manufacturers' written instructions for ambient temperature and humidity conditions for non-operating equipment.

G. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace batteries that fail in materials or workmanship within specified warranty period. Special warranty, applying to batteries only, applies to materials only, on a prorated basis, for period specified.
 - a. Warranty Period: Include the following warranty periods, from date of Final Completion:
 - 1) Premium, Valve-Regulated, Recombinant, Lead-Calcium Batteries:
 - a) Full Warranty: One year.
 - b) Pro Rata: 19 years.
 - 2) Standard, Valve-Regulated, Recombinant, Lead-Calcium Batteries:
 - a) Full Warranty: One year.
 - b) Pro Rata: Nine years.
 - 3) Nickel-Cadmium, Wet-Cell Batteries:
 - a) Full Warranty: Five years.
 - b) Pro Rata: 15 years.
 - 4) Lead-Calcium, Wet-Cell Batteries:
 - a) Full Warranty: One year.
 - b) Pro Rata: Nine years.
 - 5) Lead-Antimony, Wet-Cell Batteries:
 - a) Full Warranty: One year.
 - b) Pro Rata: Nine years.

1.2 PRODUCTS

A. Inverter Performance Requirements

1. Slow-Transfer Central Battery Inverters: Automatically sense loss of normal ac supply and use an electromechanical switch to transfer loads. Transfer in one second or less from normal supply to battery-inverter supply.
 - a. Operation: Unit supplies power to output circuits from a single, external, normal supply source. Unit automatically transfers load from normal source to internal battery/inverter source. Retransfer to normal is automatic when normal power is restored.
2. Fast-Transfer Central Battery Inverters: Automatically sense loss of normal ac supply and use a solid-state switch to transfer loads. Transfer in 0.004 second or less from normal supply to battery-inverter supply.
 - a. Operation: Unit supplies power to output circuits from a single, external, normal supply source. Unit automatically transfers load from normal source to internal battery/inverter source. Retransfer to normal is automatic when normal power is restored.
3. UPS-Type Central Battery Inverters: Continuously provide ac power to connected electrical system.
 - a. Automatic Operation:
 - 1) Normal Conditions: Supply the load with ac power flowing from normal ac power input terminals, through rectifier-charger and inverter, with battery connected in parallel with rectifier-charger output.



- 2) Abnormal Supply Conditions: If normal ac supply deviates from specified and adjustable voltage, voltage waveform, or frequency limits, battery supplies constant, regulated, inverter ac power output to the load without switching or disturbance.
 - 3) If normal power fails, battery continues supply-regulated ac power through the inverter to the load without switching or disturbance.
 - 4) When power is restored at normal supply terminals of system, controls automatically synchronize inverter with the external source before transferring the load. Rectifier-charger then supplies power to the load through the inverter and simultaneously recharges battery.
 - 5) If battery becomes discharged and normal supply is available, rectifier-charger charges battery. When battery is fully charged, rectifier-charger automatically shifts to float-charge mode.
 - 6) If any element of central battery inverter system fails and power is available at normal supply terminals of system, static bypass transfer switch transfers the load to normal ac supply circuit without disturbance or interruption of supply.
 - 7) If a fault occurs in system supplied by central battery inverter and current flows in excess of the overload rating of central battery inverter system, static bypass transfer switch operates to bypass fault current to normal ac supply circuit for fault clearing.
 - 8) When fault has cleared, static bypass transfer switch returns the load to central battery inverter system.
 - 9) If battery is disconnected, central battery inverter continues to supply power to the load with no degradation of its regulation of voltage and frequency of output bus.
 - b. Manual Operation:
 - 1) Turning inverter off causes static bypass transfer switch to transfer the load directly to normal ac supply circuit without disturbance or interruption.
 - 2) Turning inverter on causes static bypass transfer switch to transfer the load to inverter.
 4. Maximum Acoustical Noise: **<Insert value>** dB, "A" weighting, emanating from any UPS component under any condition of normal operation, measured 39 inches (990 mm) from nearest surface of component enclosure.
- B. Service Conditions
1. Environmental Conditions: Inverter system shall be capable of operating continuously in the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 - a. Ambient Temperature for Electronic Components: 32 to 98 deg F (0 to 37 deg C).
 - b. Relative Humidity: 0 to 95 percent, noncondensing.
 - c. Altitude: Sea level to 4000 feet (1220 m).
- C. Inverters
1. Description: Solid-state type, with the following operational features:
 - a. Automatically regulate output voltage to within plus or minus 5 percent.
 - b. Automatically regulate output frequency to within plus or minus 1 Hz, from no load to full load at unit power factor over the operating range of battery voltage.
 - c. Output Voltage Waveform of Unit: Sine wave with maximum 10 percent THD throughout battery operating-voltage range, from no load to full load.
 - 1) THD may not exceed 5 percent when serving a resistive load of 100 percent of unit rating.
 - d. Output Protection: Current-limiting and short-circuit protection.
OR
Output Protection: Ferroresonant transformer to provide inherent overload and short-circuit protection.
 - e. Surge Protection: Panelboard **OR** Auxiliary panel, **as directed**, suppressors specified in Division 26 Section "Transient-voltage Suppression For Low-voltage Electrical Power Circuits".



- f. Overload Capability: 125 percent for 10 minutes; 150 percent surge.
- g. Brownout Protection: Produces rated power without draining batteries when input voltage is down to 75 percent of normal.

D. Battery Charger

- 1. Description: Solid-state, automatically maintaining batteries in fully charged condition when normal power is available. With LED indicators for "float" and "high-charge" modes.

E. Batteries

- 1. Description: Premium, valve-regulated, recombinant, lead-calcium **OR** Standard, valve-regulated, recombinant, lead-calcium **OR** Nickel-cadmium, wet-cell **OR** Lead-calcium, wet-cell **OR** Lead-antimony, wet-cell, **as directed**, batteries.
 - a. Capable of sustaining full-capacity output of inverter unit for minimum of 90 minutes.

F. Enclosures

- 1. NEMA 250, Type 1 steel cabinets with access to components through hinged doors with flush tumbler lock and latch.
- 2. Finish: Manufacturer's standard baked-enamel finish over corrosion-resistant prime treatment.

G. Seismic Requirements

- 1. Central battery inverter assemblies, subassemblies, components, fastenings, supports, and mounting and anchorage devices shall be designed and fabricated to withstand seismic forces, **as directed**. The term "withstand" is defined in the "Manufacturer Seismic Qualification Certification" Paragraph in Part 1.1 "Submittals" Article.

H. Control And Indication

- 1. Description: Group displays, indications, and basic system controls on common control panel on front of central battery inverter enclosure.
- 2. Minimum displays, indicating devices, and controls shall include those in lists below. Provide sensors, transducers, terminals, relays, and wiring required to support listed items. Alarms shall include an audible signal and a visual display.
- 3. Indications: Labeled LED **OR** Plain-language messages on a digital LCD or LED, **as directed**.
 - a. Quantitative Indications:
 - 1) Input voltage, each phase, line to line.
 - 2) Input current, each phase, line to line.
 - 3) System output voltage, each phase, line to line.
 - 4) System output current, each phase.
 - 5) System output frequency.
 - 6) DC bus voltage.
 - 7) Battery current and direction (charge/discharge).
 - 8) Elapsed time-discharging battery.
 - b. Basic Status Condition Indications:
 - 1) Normal operation.
 - 2) Load-on bypass.
 - 3) Load-on battery.
 - 4) Inverter off.
 - 5) Alarm condition exists.
 - c. Alarm Indications:
 - 1) Battery system alarm.
 - 2) Control power failure.
 - 3) Fan failure.
 - 4) Overload.
 - 5) Battery-charging control faulty.
 - 6) Input overvoltage or undervoltage.
 - 7) Approaching end of battery operation.



- 8) Battery undervoltage shutdown.
- 9) Inverter fuse blown.
- 10) Inverter transformer overtemperature.
- 11) Inverter overtemperature.
- 12) Static bypass transfer switch overtemperature.
- 13) Inverter power supply fault.
- 14) Inverter output overvoltage or undervoltage.
- 15) System overload shutdown.
- 16) Inverter output contactor open.
- 17) Inverter current limit.
- d. Controls:
 - 1) Inverter on-off.
 - 2) Start.
 - 3) Battery test.
 - 4) Alarm silence/reset.
 - 5) Output-voltage adjustment.
4. Dry-form "C" contacts shall be available for remote indication of the following conditions:
 - a. Inverter on battery.
 - b. Inverter on-line.
 - c. Inverter load-on bypass.
 - d. Inverter in alarm condition.
 - e. Inverter off (maintenance bypass closed).
5. Include the following minimum array:
 - a. Ready, normal-power on light.
 - b. Charge light.
 - c. Inverter supply load light.
 - d. Battery voltmeter.
 - e. AC output voltmeter with minimum accuracy of 2 percent of full scale.
 - f. Load ammeter.
 - g. Test switch to simulate ac failure.
6. Enclosure: Steel, with hinged lockable doors, suitable for wall **OR** floor, **as directed**, mounting. Manufacturer's standard corrosion-resistant finish.
- I. Optional Features
 1. Multiple Output Voltages: Supply unit branch circuits at different voltage levels if required. Transform voltages internally as required to produce indicated output voltages.
 2. Emergency-Only Circuits: Automatically energize only when normal supply has failed. Disconnect emergency-only circuits when normal power is restored.
 3. Maintenance Bypass/Isolation Switch: Load is supplied, bypassing central battery inverter system. Normal supply, electromechanical transfer switch, and system load terminals are completely disconnected from external circuits.
 4. Maintenance Bypass/Isolation Switch: Switch is interlocked so it cannot be operated unless static bypass transfer switch is in bypass mode. Switch provides manual selection among the following three conditions without interrupting supply to the load during switching:
 - a. Full Isolation: Load is supplied, bypassing central battery inverter system. Normal ac input circuit, static bypass transfer switch, and central battery inverter load terminals are completely disconnected from external circuits.
 - b. Maintenance Bypass: Load is supplied, bypassing central battery inverter system. Central battery inverter ac supply terminals are energized to permit operational checking, but system load terminals are isolated from the load.
 - c. Normal: Normal central battery inverter ac supply terminals are energized and the load is supplied either through static bypass transfer switch and central battery inverter rectifier-charger and inverter or through battery and inverter.
- J. Output Distribution Section



1. Panelboard: Comply with Division 26 Section "Panelboards" except provide assembly integral to equipment cabinet.

K. System Monitoring And Alarms

1. Remote Status and Alarm Panel: Labeled LEDs on panel faceplate shall indicate five basic status conditions. Audible signal indicates alarm conditions. Silencing switch in face of panel silences signal without altering visual indication.
 - a. Cabinet and Faceplate: Surface or flush mounted to suit mounting conditions indicated.
2. Provisions for Remote Computer Monitoring: Communication module in unit control panel provides capability for remote monitoring of status, parameters, and alarms specified in Part 1.2 "Control and Indication" Article. Remote computer and connecting signal wiring will be provided by Owner. Include the following features:
 - a. Connectors and network interface units or modems for data transmission via RS-232 link.
 - b. Software shall be designed to control and monitor inverter system functions and to provide on-screen explanations, interpretations, diagnosis, action guidance, and instructions for use of monitoring indications and development of reports. Include capability for storage and analysis of power-line transient records. Software shall be compatible with requirements in Division 26 Section "Electrical Power Monitoring And Control" and the operating system and configuration of Owner-furnished computers.
3. Battery Ground-Fault Detector: Initiates alarm when resistance to ground of positive or negative bus of battery is less than 5000 ohms.
 - a. Annunciation of Alarms: At inverter system control panel.
4. Battery-Cycle Warranty Monitoring: Electronic device, acceptable to battery manufacturer as a basis for warranty action, for monitoring charge-discharge cycle history of batteries covered by cycle-life warranty.
 - a. Basic Functional Performance: Automatically measures and records each discharge event, classifies it according to duration category, and totals discharges according to warranty criteria, displaying remaining warranted battery life on integral LCD.
 - b. Additional monitoring functions and features shall include the following:
 - 1) Measuring and recording of total voltage at battery terminals; providing alarm for excursions outside proper float voltage level.
 - 2) Monitoring of ambient temperature at battery and initiating an alarm if temperature deviates from normally acceptable range.
 - 3) Keypad on device front panel provides access to monitored data using front panel display.
 - 4) Alarm contacts arranged to provide local **OR** remote, **as directed**, alarm for battery discharge events **OR** abnormal temperature **OR** abnormal battery voltage or temperature, **as directed**.
 - 5) Memory device to store recorded data in nonvolatile electronic memory.
 - 6) RS-232 port to permit downloading of data to a portable personal computer.
 - 7) Modem to make measurements and recorded data accessible to remote personal computer via telephone line. Computer will be provided by Owner.

L. Source Quality Control

1. Factory test complete inverter system, including battery, before shipment. Include the following:
 - a. Functional test and demonstration of all functions, controls, indicators, sensors, and protective devices.
 - b. Full-load test.
 - c. Transient-load response test.
 - d. Overload test.
 - e. Power failure test.
2. Observation of Test: Give 14 days' advance notice of tests and provide access for Owner's representative to observe tests at Owner's option.
3. Report test results. Include the following data:



- a. Description of input source and output loads used. Describe actions required to simulate source load variation and various operating conditions and malfunctions.
- b. List of indications, parameter values, and system responses considered satisfactory for each test action. Include tabulation of actual observations during test.
- c. List of instruments and equipment used in factory tests.

1.3 EXECUTION

A. Installation

1. Install system components on floor **OR** concrete base, **as directed**, and attach by bolting.
 - a. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Division 26 Section "Vibration And Seismic Controls For Electrical Systems" for seismic-restraint requirements.
 - b. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 3 inches (75 mm) in all directions beyond the maximum dimensions of switchgear unless otherwise indicated or unless required for seismic anchor support. Construct concrete bases according to Division 26 Section "Hangers And Supports For Electrical Systems".
 - c. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - e. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-place Concrete".
2. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

B. Connections

1. Connections: Interconnect system components. Make connections to supply and load circuits according to manufacturer's wiring diagrams, unless otherwise indicated.
2. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 - a. Separately Derived Systems: Make grounding connections to grounding electrodes and bonding connections to metallic piping systems as indicated; comply with NFPA 70.
3. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

C. Identification

1. Identify equipment and components according to Division 26 Section "Identification For Electrical Systems".

D. Field Quality Control

1. Perform tests and inspections and prepare test reports.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Tests and Inspections:
 - a. Inspect interiors of enclosures for integrity of mechanical and electrical connections, component type and labeling verification, and ratings of installed components.
 - b. Test manual and automatic operational features and system protective and alarm functions.
 - c. Test communication of status and alarms to remote monitoring equipment.
 - d. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specifications. Certify compliance with test parameters.



- e. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Remove and replace malfunctioning units and retest as specified above.

E. Startup Service

1. Engage a factory-authorized service representative to perform startup service.
2. Verify that central battery inverter is installed and connected according to the Contract Documents.
3. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 22.
4. Complete installation and startup checks according to manufacturer's written instructions.

F. Adjusting And Cleaning

1. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
2. Install new filters in each equipment cabinet within 14 days from date of Final Completion.

END OF SECTION 26 33 43 00



SECTION 26 33 43 00a - PUBLIC ADDRESS AND MASS NOTIFICATION SYSTEMS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of public address and mass notification systems. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Preamplifiers.
 - b. Power amplifiers.
 - c. Transfer to standby amplifier.
 - d. Microphones.
 - e. Volume limiter/compressors.
 - f. Control console.
 - g. Equipment cabinet.
 - h. Equipment rack.
 - i. Telephone paging adapters.
 - j. Tone generator.
 - k. Monitor panel.
 - l. Loudspeakers.
 - m. Noise-operated gain controllers.
 - n. Microphone and headphone outlets.
 - o. Battery backup power unit.
 - p. Conductors and cables.
 - q. Raceways.

C. Definitions

1. Channels: Separate parallel signal paths, from sources to loudspeakers or loudspeaker zones, with separate amplification and switching that permit selection between paths for speaker alternative program signals.
2. VU: Volume unit.
3. Zone: Separate group of loudspeakers and associated supply wiring that may be arranged for selective switching between different channels.

D. Performance Requirements

1. Delegated Design: Design supports and seismic restraints for control consoles, equipment cabinets and racks, and components, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Seismic Performance: Supports and seismic restraints for control consoles, equipment cabinets and racks, and components shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

E. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For supports and seismic restraints for control consoles, equipment cabinets and racks, and components. Include plans, elevations, sections, details, and attachments to other work.



- a. Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Console layouts.
 - c. Control panels.
 - d. Rack arrangements.
 - e. Calculations: For sizing backup battery.
 - f. Wiring Diagrams: For power, signal, and control wiring.
 - 1) Identify terminals to facilitate installation, operation, and maintenance.
 - 2) Single-line diagram showing interconnection of components.
 - 3) Cabling diagram showing cable routing.
 3. Delegated-Design Submittal: For supports and seismic restraints for control consoles, equipment cabinets and racks, and components indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Detail fabrication and assembly of supports and seismic restraints for control consoles, equipment cabinets and racks, and components.
 4. Seismic Qualification Certificates: For control consoles, equipment cabinets and racks, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 5. Field quality-control reports.
 6. Operation and maintenance data.
- F. Quality Assurance
1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with NFPA 70.

1.2 PRODUCTS

A. Functional Description Of System

1. System Functions:
 - a. Selectively connect any zone to any available signal channel.
 - b. Selectively control sound from microphone outlets and other inputs.
 - c. "All-call" feature shall connect the all-call sound signal simultaneously to all zones regardless of zone or channel switch settings.
 - d. Telephone paging adapter shall allow paging by dialing an extension from any local telephone instrument and speaking into the telephone.
 - e. Produce a program-signal tone that is amplified and sounded over all speakers, overriding signals currently being distributed.
 - f. Reproduce high-quality sound that is free of noise and distortion at all loudspeakers at all times during equipment operation including standby mode with inputs off; output free of non-uniform coverage of amplified sound.

B. General Equipment And Material Requirements

1. Compatibility of Components: Coordinate component features to form an integrated system. Match components and interconnections for optimum performance of specified functions.
2. Equipment: Comply with UL 813. Equipment shall be modular, using solid-state components, and fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.



3. Equipment Mounting: Where rack, cabinet, or console mounting is indicated, equipment shall be designed to mount in a 19-inch (483-mm) housing complying with TIA/EIA-310-D.
 4. Weather-Resistant Equipment: Listed and labeled by a qualified testing agency for duty outdoors or in damp locations.
- C. Preamplifiers
1. Preamplifier: Separately mounted.
 2. Preamplifier: Integral to power amplifier.
 3. Output Power: Plus 4 dB above 1 mW at matched power-amplifier load.
 4. Total Harmonic Distortion: Less than 1 percent.
 5. Frequency Response: Within plus or minus 2 dB from 20 to 20,000 Hz.
 6. Input Jacks: Minimum of two. One matched for low-impedance microphone; the other matchable to cassette deck, CD player, or radio tuner signals without external adapters.
 7. Minimum Noise Level: Minus 55 dB below rated output.
 8. Controls: On-off, input levels, and master gain.
- D. Power Amplifiers
1. Mounting: Console **OR** Rack, **as directed**.
 2. Output Power: 70-V balanced line. 80 percent of the sum of wattage settings of connected for each station and speaker connected in all-call mode of operation, plus an allowance for future stations.
 3. Total Harmonic Distortion: Less than 3 percent at rated power output from 50 to 12,000 Hz.
 4. Minimum Signal-to-Noise Ratio: 60 dB, at rated output.
 5. Frequency Response: Within plus or minus 2 dB from 50 to 12,000 Hz.
 6. Output Regulation: Less than 2 dB from full to no load.
 7. Controls: On-off, input levels, and low-cut filter.
 8. Input Sensitivity: Matched to preamplifier and to provide full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphone or handset transmitter.
- E. Transfer To Standby Amplifier
1. Monitoring Circuit and Sensing Relay: Detect reduction in output of power amplifier of 40 percent or more and, in such event, transfer load and signal automatically to standby amplifier.
- F. Microphones
1. Paging Microphone:
 - a. Type: Dynamic, with cardioid **OR** omni, **as directed**, polar characteristic.
 - b. Impedance: 150 ohms.
 - c. Frequency Response: Uniform, 50 to 14,000 Hz.
 - d. Output Level: Minus 58 dB, minimum.
 - e. Finish: Satin chrome.
 - f. Cable: C25J.
 - g. Mounting: Desk stand with integral-locking, press-to-talk switch.
- G. Volume Limiter/Compressor
1. Minimum Performance Requirements:
 - a. Frequency Response: 45 to 15,000 Hz, plus or minus 1 dB minimum.
 - b. Signal Reduction Ratio: At least a 10:1 and 5:1 selectable capability.
 - c. Distortion: 1 percent, maximum.
 - d. Rated Output: Minimum of plus 14 dB.
 - e. Inputs: Minimum of two inputs with variable front-panel gain controls and VU or decibel meter for input adjustment.
 - f. Rack mounting.
- H. Control Console
1. Cabinet: Modular, desktop **OR** desk style, **as directed**; complying with TIA/EIA-310-D.



2. Housing: Steel, 0.0478 inch (1.2 mm) minimum, with removable front and rear panels. Side panels are removable for interconnecting side-by-side mounting.
 3. Panel for Equipment and Controls: Rack mounted.
 4. Controls:
 - a. Switching devices to select signal sources for distribution channels.
 - b. Program selector switch to select source for each program channel.
 - c. Switching devices to select zones for paging.
 - d. All-call selector switch.
 5. Indicators: A visual annunciation for each distribution channel to indicate source being used.
 6. Self-Contained Power and Control Unit: A single assembly of basic control, electronics, and power supply necessary to accomplish specified functions.
 7. Spare Positions: 20 percent spare zone control and annunciation positions on console.
 8. Microphone jack.
- I. Equipment Cabinet
1. Comply with TIA/EIA-310-D.
 2. House amplifiers and auxiliary equipment at each location.
 3. Cabinet Housing:
 - a. Constructed of 0.0478-inch (1.2-mm) steel, minimum, with front- and rear-locking doors and standard TIA/EIA-310-D-compliant, 19-inch (483-mm) racks.
 - b. Arranged for floor or wall mounting as indicated.
 - c. Sized to house all equipment indicated, plus spare capacity.
 - d. Include 20 percent minimum spare capacity for future equipment in addition to space required for future cassette deck and CD player.
 4. Power Provisions: A single switch in cabinet shall disconnect cabinet power distribution system and electrical outlets, which shall be uniformly spaced to accommodate ac-power cords for each item of equipment.
 5. Ventilation: A low-noise fan for forced-air cabinet ventilation. Fan shall be equipped with a filtered input vent and shall be connected to operate from 105- to 130-V ac, 60 Hz; separately fused and switched; arranged to be powered when main cabinet power switch is on.
- J. Equipment Rack
1. Racks: 19 inches (483 mm) standard, complying with TIA/EIA-310-D.
 2. Power-Supply Connections: Compatible plugs and receptacles.
 3. Enclosure Panels: Ventilated rear and sides and solid top. Use louvers in panels to ensure adequate ventilation.
 4. Finish: Uniform, baked-enamel factory finish over rust-inhibiting primer.
 5. Power-Control Panel: On front of equipment housing, with master power on-off switch and pilot light; and with socket for 5-A cartridge fuse for rack equipment power.
 6. Service Light: At top rear of rack with an adjacent control switch.
 7. Vertical Plug Strip: Grounded receptacles, 12 inches (300 mm) o.c.; the full height of rack.
 8. Maintenance Receptacles: Duplex convenience outlets supplied independent of vertical plug strip and located in front and bottom rear of rack.
 9. Spare Capacity: 20 percent in rack for future equipment.
- K. Telephone Paging Adapter
1. Adapters shall accept voice signals from telephone extension dialing access and automatically provide amplifier input and program override for preselected zones.
 - a. Minimum Frequency Response: Flat, 200 to 2500 Hz.
 - b. Impedance Matching: Adapter matches telephone line to public address equipment input.
 - c. Rack mounting.
- L. Tone Generator
1. Generator shall provide clock and program interface with public address and mass notification system.



2. Signals: Minimum of seven distinct, audible signal types including wail, warble, high/low, alarm, repeating and single-stroke chimes, and tone.
 3. Pitch Control: Chimes and tone.
 4. Volume Control: All outputs.
 5. Activation-Switch Network: Establishes priority and hierarchy of output signals produced by different activation setups.
 6. Mounting: Rack.
- M. Monitor Panel
1. Monitor power amplifiers.
 2. Components: VU or dB meter, speaker with volume control, and multiple-position rotary selector switch.
 3. Selector Switch and Volume Control: Selective monitoring of output of each separate power amplifier via VU or dB meter and speaker.
 4. Mounting: Rack.
- N. Loudspeakers
1. Cone-Type Loudspeakers:
 - a. Minimum Axial Sensitivity: 91 dB at one meter, with 1-W input.
 - b. Frequency Response: Within plus or minus 3 dB from 50 to 15,000 Hz.
 - c. Size: 8 inches (200 mm) with 1-inch (25-mm) voice coil and minimum 5-oz. (140-g) ceramic magnet.
 - d. Minimum Dispersion Angle: 100 degrees.
 - e. Rated Output Level: 10 W.
 - f. Matching Transformer: Full-power rated with four taps. Maximum insertion loss of 0.5 dB.
 - g. Surface-Mounting Units: Ceiling, wall, or pendant mounting, as indicated, in steel back boxes, acoustically dampened. Front face of at least 0.0478-inch (1.2-mm) steel and whole assembly rust proofed and shop primed for field painting.
 - h. Flush-Ceiling-Mounting Units: In steel back boxes, acoustically dampened. Metal ceiling grille with white baked enamel.
 2. Horn-Type Loudspeakers:
 - a. Type: Single-horn units, double-reentrant design, with minimum full-range power rating of 15 W.
 - b. Matching Transformer: Full-power rated with four standard taps. Maximum insertion loss of 0.5 dB.
 - c. Frequency Response: Within plus or minus 3 dB from 250 to 12,000 Hz.
 - d. Dispersion Angle: 130 by 110 degrees.
 - e. Mounting: Integral bracket.
 - f. Units in Hazardous (Classified) Locations: Listed and labeled for environment in which they are located.
- O. Noise-Operated Gain Controller
1. Gain controller shall be designed to continuously sense space noise level and automatically adjust signal level to local speakers.
 2. Frequency Response: 20 to 20,000 Hz, plus or minus 1 dB.
 3. Level Adjustment Range: 20 dB minimum.
 4. Maximum Distortion: 1 percent.
 5. Control: Permits adjustment of sensing level of device.
- P. Outlets
1. Volume Attenuator Station: Wall-plate-mounted autotransformer type with paging priority feature.
 - a. Wattage Rating: 10 W unless otherwise indicated.
 - b. Attenuation per Step: 3 dB, with positive off position.
 - c. Insertion Loss: 0.4 dB maximum.



- d. Attenuation Bypass Relay: Single pole, double throw. Connected to operate and bypass attenuation when all-call, paging, program signal, or prerecorded message features are used. Relay returns to normal position at end of priority transmission.
- e. Label: "PA Volume."
- 2. Microphone Outlet: Three-pole, polarized, locking-type, microphone receptacles in single-gang boxes. Equip wall outlets with brushed stainless-steel device plates. Equip floor outlets with gray tapered rubber or plastic cable nozzles and fixed outlet covers.
- 3. Headphone Outlet (for the Hearing Impaired): Microphone receptacles in single-gang boxes. Equip wall outlets with brushed stainless-steel device plates. Equip floor outlets with gray tapered rubber or plastic cable nozzles and fixed-outlet covers.

Q. Battery Backup Power Unit

- 1. Unit shall be rack mounted, consisting of time-delay relay, sealed lead-calcium battery, battery charger, on-off switch, "normal" and "emergency" indicating lights, and adequate capacity to supply maximum equipment power requirements for one hour of continuous full operation.
- 2. Unit shall supply public address equipment with 12- to 15-V dc power automatically during an outage of normal 120-V ac power.
- 3. Battery shall be on float charge when not supplying system and to transfer automatically to supply system after three to five seconds of continuous outage of normal power, as sensed by time-delay relay.
- 4. Unit shall automatically retransfer system to normal supply when normal power has been reestablished for three to five seconds continuously.

R. Conductors And Cables

- 1. Jacketed, twisted pair and twisted multipair, untinned solid copper.
 - a. Insulation for Wire in Conduit: Thermoplastic, not less than 1/32 inch (0.8 mm) thick.
 - b. Microphone Cables: Neoprene jacketed, not less than 2/64 inch (0.8 mm) thick, over shield with filled interstices. Shield No. 34 AWG, tinned, soft-copper strands formed into a braid or approved equivalent foil. Shielding coverage on conductors is not less than 60 percent.
 - c. Plenum Cable: Listed and labeled for plenum installation.

S. Raceways

- 1. Conduit and Boxes: Comply with Division 26 Section "Raceway And Boxes For Electrical Systems". Flexible metal conduit shall not be used, unless directed otherwise.
 - a. Outlet boxes shall be not less than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

1.3 EXECUTION

A. Wiring Methods

- 1. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters, and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used, **as directed**. Conceal raceway and cables except in unfinished spaces.
 - a. Install plenum cable in environmental air spaces, including plenum ceilings.
 - b. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway And Boxes For Electrical Systems".
- 2. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- 3. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.



- B. Installation Of Raceways
 1. Comply with requirements in Division 26 Section "Raceway And Boxes For Electrical Systems" for installation of conduits and wireways.
 2. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- C. Installation Of Cables
 1. Comply with NECA 1.
 2. General Cable Installation Requirements:
 - a. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
 - b. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
 - c. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - d. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
 - e. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 - f. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.
 3. Open-Cable Installation:
 - a. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 - b. Suspend speaker cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceiling by cable supports not more than 60 inches (1524 mm) apart.
 - c. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.
 4. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches (300 mm) apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.
- D. Installation
 1. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.
 2. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.
 3. Equipment Cabinets and Racks:
 - a. Group items of same function together, either vertically or side by side, and arrange controls symmetrically. Mount monitor panel above the amplifiers.
 - b. Arrange all inputs, outputs, interconnections, and test points so they are accessible at rear of rack for maintenance and testing, with each item removable from rack without disturbing other items or connections.
 - c. Blank Panels: Cover empty space in equipment racks so entire front of rack is occupied by panels.
 4. Volume Limiter/Compressor: Equip each zone with a volume limiter/compressor. Install in central equipment cabinet. Arrange to provide a constant input to power amplifiers.
 5. Wall-Mounted Outlets: Flush mounted.
 6. Floor-Mounted Outlets: Conceal in floor and install cable nozzles through outlet covers. Secure outlet covers in place. Trim with carpet in carpeted areas.



7. Conductor Sizing: Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker outlets not smaller than No. 18 AWG and conductors from microphone receptacles to amplifiers not smaller than No. 22 AWG.
8. Weatherproof Equipment: For units that are mounted outdoors, in damp locations, or where exposed to weather, install consistent with requirements of weatherproof rating.
9. Speaker-Line Matching Transformer Connections: Make initial connections using tap settings indicated on Drawings.
10. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

E. Grounding

1. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
2. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.
3. Install grounding electrodes as specified in Division 26 Section "Grounding And Bonding For Electrical Systems".

F. Field Quality Control

1. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Tests and Inspections:
 - a. Schedule tests with at least seven days' advance notice of test performance.
 - b. After installing public address and mass notification systems and after electrical circuitry has been energized, test for compliance with requirements.
 - c. Operational Test: Perform tests that include originating program and page messages at microphone outlets, preamplifier program inputs, and other inputs. Verify proper routing and volume levels and that system is free of noise and distortion.
 - d. Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:
 - 1) Disconnect microphone at connector or jack closest to it and replace it in the circuit with a signal generator using a 1000-Hz signal. Replace all other microphones at corresponding connectors with dummy loads, each equal in impedance to microphone it replaces. Measure signal-to-noise ratio.
 - 2) Repeat test for each separately controlled zone of loudspeakers.
 - 3) Minimum acceptance ratio is 50 dB.
 - e. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 50, 200, 400, 1000, 3000, 8000, and 12,000 Hz into each preamplifier channel. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 3 percent total harmonics.
 - f. Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in each zone. For spaces with seated audiences, maximum permissible variation in level is plus or minus 2 dB. In addition, the levels between locations in same zone and between locations in adjacent zones must not vary more than plus or minus 3 dB.
 - g. Power Output Test: Measure electrical power output of each power amplifier at normal gain settings of 50, 1000, and 12,000 Hz. Maximum variation in power output at these frequencies must not exceed plus or minus 1 dB.
 - h. Signal Ground Test: Measure and report ground resistance at public address equipment signal ground. Comply with testing requirements specified in Division 26 Section "Grounding And Bonding For Electrical Systems".



3. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.
4. Public address and mass notification systems will be considered defective if they do not pass tests and inspections.
5. Prepare test and inspection reports.
 - a. Include a record of final speaker-line matching transformer-tap settings, and signal ground-resistance measurement certified by Installer.

END OF SECTION 26 33 43 00a



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Task	Specification	Specification Description
26 33 53 00	26 33 43 00	Central Battery Inverters



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SECTION 26 35 33 00 - POWER FACTOR CORRECTION CAPACITORS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for power factor correction capacitors. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes power and automatic power factor correction equipment rated 600 V and less.

C. Performance Requirements

1. Seismic Performance: Power factor correction equipment shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

D. Submittals

1. Product Data: For each type of product indicated. Include dimensions, operating characteristics of multiple capacitor cells or elements, and data on features, ratings, and performance.
2. Shop Drawings: For automatic power factor correction units.
 - a. Detail equipment assemblies and indicate dimensions, weights, method of field assembly, components, and location and size of each field connection. Show access and workspace requirements and required clearances.
 - b. Wiring Diagrams: For power, signal, and control wiring.
3. Qualification Data: For qualified testing agency.
4. Seismic Qualification Certificates: For capacitors, accessories, and components, from manufacturer.
 - a. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
5. Field quality-control reports.
6. Operation and Maintenance Data: For equipment to include in emergency, operation, and maintenance manuals. Include the following:
 - a. Lists of spare parts and replacement components recommended for storage at Project site.
 - b. Detailed instructions covering operation under both normal and abnormal conditions.
7. Warranty: Sample of special warranty.

E. Quality Assurance

1. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - a. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Comply with IEEE 18 and NEMA CP 1.
4. Comply with NFPA 70.

F. Coordination



1. Coordinate sensor-communication module package with data network and with monitoring equipment specified in Division 26 Section "Electrical Power Monitoring And Control" for successful transmission and remote readout of remote monitoring data specified in this Section.

G. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace capacitor-bank components that fail in materials or workmanship within five years from date of Final Completion.

1.2 PRODUCTS

A. Capacitors, General

1. Comply with UL 810.
2. Service Conditions: Capacitor equipment suitable for the following conditions:
 - a. Operating Temperature: Minus 40 to plus 115 deg F (Minus 40 to plus 46 deg C).
 - b. Maximum Altitude: 6000 feet (1800 m).
 - c. Humidity: 0 to 95 percent, noncondensing.
3. Construction: Multiple capacitor cells or elements, factory wired in three-phase groups and mounted in metal enclosures.
4. Cells: Dry metallized-dielectric, self-healing type. Each cell shall be encapsulated in thermosetting resin inside plastic container.
5. Rupture Protection: Pressure-sensitive circuit interrupter for each cell.

B. Fixed Capacitors

1. Description: Factory wired, ready for field connection to external circuits at a single set of pressure terminals. Comply with UL 810.
2. Fuses: Current-limiting, noninterchangeable type; factory installed in each phase and located within the equipment enclosure. Features include the following:
 - a. Interrupting Capacity: 100,000 **OR** 200,000, **as directed**, A
 - b. Fuse Ratings and Characteristics: As recommended by capacitor manufacturer.
 - c. Neon Indicator Lamp for Each Fuse: Connect to illuminate when fuse has opened, but is still in place, and locate so it is visible from outside the enclosure.
3. Discharge Resistors: Factory installed and wired.
4. Enclosure: NEMA 250, steel **OR** aluminum, **as directed**, arranged to contain the fluid leakage from capacitor cells; factory equipped with mounting brackets suitable for type of mounting indicated.
 - a. Indoor Enclosures: NEMA 250, Type 12 or as indicated.
OR
Outdoor Enclosures: NEMA 250, Type 3R or as indicated.
OR
Outdoor Enclosures: NEMA 250, Type 4, equipped with watertight conduit connections.

C. Automatic Power Factor Correction Units

1. Description: Capacitors, contactors, controls, and accessories factory installed in independent enclosures **OR** motor-control center, with a connection to motor-control center bus, **as directed**, complying with NEMA ICS 2. Comply with UL 810.
2. Performance Requirements: Controls permit selection of a target power factor, adjustable to any value between unity and 0.80 lagging. Controls continuously sense the power factor on circuits being corrected and, when the power factor differs from the target setting for more than 10 seconds, operate a contractor to switch a capacitor bank into or out of the circuit. Contactors are opened or closed as required to bring the corrected circuit power factor closer to the target setting. Provide number of switching steps indicated on the Three-Phase Capacitor-Bank Schedule.
3. Current Transformer: Type, configuration, and ratio to suit sensing and mounting conditions.



4. Main Circuit Breaker: Thermal-magnetic, inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger. Operable from outside the enclosure to disconnect the unit.
5. Controls: Solid-state, microprocessor-based controls, including the following:
 - a. Undervoltage relay that interrupts capacitor switching and disconnects capacitors for power-supply interruptions longer than 15 minutes.
 - b. "Advance" and "Retard" push buttons on the control panel to permit manually controlled capacitor-bank switching.
6. Contactors: Three pole; rated for the repetitive high-inrush-switching duty in the capacitor application.
7. Fuses for Protection of Capacitor Banks: Rated to protect contactor, interconnecting wiring, and capacitors.
 - a. Spare-Fuse Cabinet: Identified and compartmented steel box **OR** cabinet with hinged lockable door, **as directed**.
8. Discharge Resistors: Factory installed and wired.
OR
Inductors: Air-core type, connected in capacitor circuits; rated to limit switching surges to within contactor ratings.
9. Precharge Capacitor Circuit: Resistive, precharge circuit to charge capacitors prior to switching and to limit switching surges to within contactor ratings.
10. Enclosure: NEMA 250, Type 1 **OR** Type 3R **OR** Type 12, **as directed**, steel or aluminum, with hinged door and hand-operated catch. Door shall be interlocked with controls or main circuit breaker to de-energize capacitors when door is opened.
 - a. Factory Finish: Manufacturer's standard enamel over corrosion-resistant treatment or primer coat.
11. Local Display: LED or liquid-crystal digital type, mounted in door of enclosure, indicating the following:
 - a. Target and actual power factors accurate to plus or minus 1 percent of reading.
 - b. Steps energized.
 - c. Step reconnection delay.
 - d. Real and reactive currents.
 - e. Voltage total harmonic distortion.
 - f. Alarm codes.
12. System Alarms: Alarm relay and local display indication of the following conditions:
 - a. Low power factor.
 - b. Leading power factor.
 - c. Frequency not detected.
 - d. Overcurrent.
 - e. Overvoltage.
 - f. Overtemperature.
 - g. Excessive voltage total harmonic distortion.
 - h. Capacitor overload.
 - i. Loss of capacitance.
13. Remote Monitoring Components: Sensors, associated communication modules, and network interface units, matched to and compatible with electrical power monitoring and control network. Communication module shall have capability to transmit the following data to remote monitoring devices:
 - a. System in alarm.
 - b. Power factor set point.
 - c. Corrected power factor.
 - d. Number of capacitor steps activated.

D. Source Quality Control

1. Factory test power factor correction equipment before shipment. Comply with NEMA CP 1. Include the following:



- a. Routine capacitor production tests, including short-time overvoltage, capacitance, leak, and dissipation-factor tests.
- b. Functional test of all operations, controls, indicators, sensors, and protective devices.

1.3 EXECUTION

A. Installation

- 1. Install freestanding equipment on concrete bases. Cast-in-place concrete is specified in Division 3.
- 2. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
- 3. Maintain minimum workspace according to manufacturer's written instructions.
- 4. Connect remote monitoring communication module to electrical power monitoring and control data network through appropriate network interface unit.
- 5. Identify components according to Division 26 Section "Identification For Electrical Systems".

B. Field Quality Control

- 1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- 2. Perform tests and inspections.
- 3. Tests and Inspections: Perform each visual and mechanical inspection and electrical test stated in the following Sections, except optional tests, in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - a. Current Transformers.
 - b. Capacitors and Reactors, Capacitors.

C. Startup Service

- 1. Perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.
 - b. Connect and run installed motors and equipment to verify the automatic switching of the capacitors. Verification shall include automatic switching of the total capacity of installed capacitors.
 - 1) Provide sufficient inductive/reactive load banks, in combination with resistive load banks, for the test.

D. Demonstration

- 1. Train Owner's maintenance personnel to adjust, operate, and maintain automatic power factor correction units.

END OF SECTION 26 35 33 00



Task	Specification	Specification Description
26 35 33 00	26 09 23 00	Electrical Power Monitoring And Control
26 35 53 00	26 32 13 13	Packaged Engine Generators



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SECTION 26 36 13 00 - TRANSFER SWITCHES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for transfer switches. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes transfer switches rated 600 V and less, including the following:
 - a. Automatic transfer switches.
 - b. Bypass/isolation switches.
 - c. Nonautomatic transfer switches.
 - d. Remote annunciation systems.
 - e. Remote annunciation and control systems.

C. Submittals

1. Product Data: Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.
2. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.
3. Manufacturer Seismic Qualification Certification: Submit certification that transfer switches accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems". Include the following:
4. Field quality-control test reports.
5. Operation and maintenance data.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Comply with NEMA ICS 1.
3. Comply with NFPA 70.
4. Comply with NFPA 99.
5. Comply with NFPA 110.
6. Comply with UL 1008 unless requirements of these Specifications are stricter.

1.2 PRODUCTS

A. General Transfer-Switch Product Requirements

1. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
2. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
 - a. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.
3. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.



4. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
5. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.
6. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - a. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
 - b. Switch Action: Double throw; mechanically held in both directions.
 - c. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.
7. Neutral Switching. Where four-pole switches are indicated, provide neutral pole switched simultaneously with phase poles **OR** overlapping neutral contacts, **as directed**.
8. Neutral Terminal: Solid and fully rated, unless otherwise indicated.
9. Oversize Neutral: Ampacity and switch rating of neutral path through units indicated for oversize neutral shall be double the nominal rating of circuit in which switch is installed.
10. Heater: Equip switches exposed to outdoor temperatures and humidity, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.
11. Battery Charger: For generator starting batteries.
 - a. Float type rated 2 **OR** 10, **as directed**, A.
 - b. Ammeter to display charging current.
 - c. Fused ac inputs and dc outputs.
12. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.
13. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Division 26 Section "Identification For Electrical Systems".
 - a. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
 - b. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
 - c. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
14. Enclosures: General-purpose NEMA 250, Type 1 **OR** 3R **OR** 12, **as directed**, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

B. Automatic Transfer Switches

1. Comply with Level 1 equipment according to NFPA 110.
2. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.
3. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.
4. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.
5. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.
6. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel.
7. Transfer Switches Based on Molded-Case-Switch Components: Comply with NEMA AB 1, UL 489, and UL 869A.
8. Automatic Closed-Transition Transfer Switches: Include the following functions and characteristics:



- a. Fully automatic make-before-break operation.
- b. Load transfer without interruption, through momentary interconnection of both power sources not exceeding 100 ms.
- c. Initiation of No-Interruption Transfer: Controlled by in-phase monitor and sensors confirming both sources are present and acceptable.
 - 1) Initiation occurs without active control of generator.
 - 2) Controls ensure that closed-transition load transfer closure occurs only when the 2 sources are within plus or minus 5 electrical degrees maximum, and plus or minus 5 percent maximum voltage difference.
- d. Failure of power source serving load initiates automatic break-before-make transfer.
9. In-Phase Monitor: Factory-wired, internal relay controls transfer so it occurs only when the two sources are synchronized in phase. Relay compares phase relationship and frequency difference between normal and emergency sources and initiates transfer when both sources are within 15 electrical degrees, and only if transfer can be completed within 60 electrical degrees. Transfer is initiated only if both sources are within 2 Hz of nominal frequency and 70 percent or more of nominal voltage.
10. Motor Disconnect and Timing Relay: Controls designate starters so they disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Control connection to motor starters is through wiring external to automatic transfer switch. Time delay for reconnecting individual motor loads is adjustable between 1 and 60 seconds, and settings are as indicated. Relay contacts handling motor-control circuit inrush and seal currents are rated for actual currents to be encountered.
11. Programmed Neutral Switch Position: Switch operator has a programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer. Pause is adjustable from 0.5 to 30 seconds minimum and factory set for 0.5 second, unless otherwise indicated. Time delay occurs for both transfer directions. Pause is disabled unless both sources are live.
12. Automatic Transfer-Switch Features:
 - a. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
 - b. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
 - c. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
 - d. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
 - e. Test Switch: Simulate normal-source failure.
 - f. Switch-Position Pilot Lights: Indicate source to which load is connected.
 - g. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
 - 1) Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - 2) Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
 - h. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
 - i. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.



- j. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
- k. Engine Shutdown Contacts: Instantaneous; shall initiate shutdown sequence at remote engine-generator controls after retransfer of load to normal source.
- l. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
- m. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
 - 1) Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
 - 2) Push-button programming control with digital display of settings.
 - 3) Integral battery operation of time switch when normal control power is not available.

C. Bypass/Isolation Switches

- 1. Comply with requirements for Level 1 equipment according to NFPA 110.
- 2. Description: Manual type, arranged to select and connect either source of power directly to load, isolating transfer switch from load and from both power sources. Include the following features for each combined automatic transfer switch and bypass/isolation switch:
 - a. Means to lock bypass/isolation switch in the position that isolates transfer switch with an arrangement that permits complete electrical testing of transfer switch while isolated. While isolated, interlocks prevent transfer-switch operation, except for testing or maintenance.
 - b. Drawout Arrangement for Transfer Switch: Provide physical separation from live parts and accessibility for testing and maintenance operations.
 - c. Bypass/Isolation Switch Current, Voltage, Closing, and Short-Circuit Withstand Ratings: Equal to or greater than those of associated automatic transfer switch, and with same phase arrangement and number of poles.
 - d. Contact temperatures of bypass/isolation switches shall not exceed those of automatic transfer-switch contacts when they are carrying rated load.
 - e. Operability: Constructed so load bypass and transfer-switch isolation can be performed by 1 person in no more than 2 operations in 15 seconds or less.
 - f. Legend: Manufacturer's standard legend for control labels and instruction signs shall describe operating instructions.
 - g. Maintainability: Fabricate to allow convenient removal of major components from front without removing other parts or main power conductors.
- 3. Interconnection of Bypass/Isolation Switches with Automatic Transfer Switches: Factory-installed copper bus bars; plated at connection points and braced for the indicated available short-circuit current.

D. Nonautomatic Transfer Switches

- 1. Operation: Electrically actuated by push buttons designated "Normal Source" and "Alternate Source." Switch shall be capable of transferring load in either direction with either or both sources energized.
- 2. Operation: Electrically actuated by push buttons designated "Normal Source" and "Alternate Source." In addition, removable manual handle provides quick-make, quick-break manual-switching action. Switch shall be capable of electrically or manually transferring load in either direction with either or both sources energized. Control circuit disconnects from electrical operator during manual operation.
- 3. Double-Throw Switching Arrangement: Incapable of pauses or intermediate position stops during switching sequence.



4. Nonautomatic Transfer-Switch Accessories:
 - a. Pilot Lights: Indicate source to which load is connected.
 - b. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and alternate-source sensing circuits.
 - 1) Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - 2) Emergency Power Supervision: Red light with nameplate engraved "Alternate Source Available."
 - c. Unassigned Auxiliary Contacts: One set of normally closed contacts for each switch position, rated 10 A at 240-V ac.
- E. Remote Annunciator System
 1. Functional Description: Remote annunciator panel shall annunciate conditions for indicated transfer switches. Annunciation shall include the following:
 - a. Sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
 - b. Switch position.
 - c. Switch in test mode.
 - d. Failure of communication link.
 2. Annunciator Panel: LED-lamp type with audible signal and silencing switch.
 - a. Indicating Lights: Grouped for each transfer switch monitored.
 - b. Label each group, indicating transfer switch it monitors, location of switch, and identity of load it serves.
 - c. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.
 - d. Lamp Test: Push-to-test or lamp-test switch on front panel.
- F. Remote Annunciator And Control System
 1. Functional Description: Include the following functions for indicated transfer switches:
 - a. Indication of sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
 - b. Indication of switch position.
 - c. Indication of switch in test mode.
 - d. Indication of failure of digital communication link.
 - e. Key-switch or user-code access to control functions of panel.
 - f. Control of switch-test initiation.
 - g. Control of switch operation in either direction.
 - h. Control of time-delay bypass for transfer to normal source.
 2. Malfunction of annunciator, annunciation and control panel, or communication link shall not affect functions of automatic transfer switch. In the event of failure of communication link, automatic transfer switch automatically reverts to stand-alone, self-contained operation. Automatic transfer-switch sensing, controlling, or operating function shall not depend on remote panel for proper operation.
 3. Remote Annunciation and Control Panel: Solid-state components. Include the following features:
 - a. Controls and indicating lights grouped together for each transfer switch.
 - b. Label each indicating light control group. Indicate transfer switch it controls, location of switch, and load it serves.
 - c. Digital Communication Capability: Matched to that of transfer switches supervised.
 - d. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.
- G. Source Quality Control
 1. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.



1.3 EXECUTION

A. Installation

1. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Division 26 Section "Hangers And Supports For Electrical Systems".
2. Floor-Mounting Switch: Anchor to floor by bolting.
 - a. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 4 inches (100 mm) in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to Division 26 Section "Hangers And Supports For Electrical Systems".
3. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.
4. Identify components according to Division 26 Section "Identification For Electrical Systems".
5. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

B. Connections

1. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.
2. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
3. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

C. Field Quality Control

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
2. Perform tests and inspections and prepare test reports.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installation, including connections, and to assist in testing.
 - b. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
 - c. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - d. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
 - 1) Check for electrical continuity of circuits and for short circuits.
 - 2) Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
 - 3) Verify that manual transfer warnings are properly placed.
 - 4) Perform manual transfer operation.
 - e. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
 - 1) Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
 - 2) Simulate loss of phase-to-ground voltage for each phase of normal source.
 - 3) Verify time-delay settings.
 - 4) Verify pickup and dropout voltages by data readout or inspection of control settings.
 - 5) Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.



- 6) Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
- f. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
 - 1) Verify grounding connections and locations and ratings of sensors.
3. Coordinate tests with tests of generator and run them concurrently.
4. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.
5. Remove and replace malfunctioning units and retest as specified above.
6. Infrared Scanning: After Final Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.
 - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Final Completion.
 - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - c. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- D. Demonstration
 1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below.
 2. Coordinate this training with that for generator equipment.

END OF SECTION 26 36 13 00



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Task	Specification	Specification Description
26 36 23 00	26 36 13 00	Transfer Switches



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SECTION 26 41 00 00 - MPF FACILITY LIGHTNING PROTECTION

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification.

NOTE TO SPECIFIER

A Lightning Protection System is not required on all Mail Processing Facilities. Utilize this Outline Specification for facilities where the lightning risk assessment calculation predicts expected lightning stroke frequency to exceed the tolerable lightning frequency.

PART 1 - GENERAL

1.1 SUMMARY

- A. The work covered by this section of the specifications consists of furnishing all labor, materials and items of service required for the completion of a functional and unobtrusive, UL 96A master labeled, lightning protection and grounding system as approved by the Engineer and in strict accordance with this section of the specifications
 - 1. If any departure from these specifications or submittal drawings covered below are deemed necessary by the contractor, details of such departures and reasons therefore shall be submitted as soon as practicable to the Engineer for approval. No such departures shall be made without the prior written approval of the Engineer.
- B. Section includes:
 - 1. Air Terminals and Bases.
 - 2. Grounding Electrodes.
 - 3. Lightning Protection Conductors.
 - 4. Grounding and Bonding for Lightning Protection.
- C. Substitutions:
 - 1. Section 016000 – Product Requirements: Product options and substitutions. Substitutions permitted.
- D. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- E. Related Sections:
 - 1. Section 260500 - Common Work Results for Electrical: Basic electrical methods

1.2 REFERENCES

- A. UL 96 – Lightning Protection Components
- B. UL96A – Installation Requirements for Lightning Protection Systems.
- C. ANSI/NFPA 780 – Lightning Protection Code.



- D. LPI-175 – Lightning Protection Institute.

1.3 SUBMITTALS

- A. Submit shop drawings showing layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects. Include terminal, electrode, and conductor sizes, and connection and termination details. Drawings shall include full layout of cabling and points, and connections.
- B. Submit product data showing dimensions and materials of each component, and include indication of listing in accordance with ANSI/UL 96.
- C. Submit manufacturer's installation instructions.
- D. Submittal shall include ground test wells.

1.4 PROJECT AS-BUILT DOCUMENTS

- A. Submit project as-built documents.
- B. Accurately record actual locations of air terminals, grounding electrodes, bonding connections and routing of system conductors.

1.5 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in lightning protection equipment with minimum five (5) years documented experience and member of the Lightning Protection Institute.
- B. Installer: Authorized installer of manufacturer with minimum five (5) years documented experience and member of the Lightning Protection Institute.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Harger Lightning Protection, Inc.
 - 2. Thompson Lightning Protection, Inc..
 - 3. Heary Brothers Lightning Protection, Inc..
 - 4. Independent Lightning Protection, Inc..

2.2 STANDARDS

- A. All equipment used in this installation shall be UL approved and labeled in accordance with UL procedures, with each air terminal bearing an "A" label and all main conductors bearing a "B" label at 10'-0" intervals.
- B. All equipment shall be new, the product of a single manufacturer as outlined above, and of a design and construction to suit the application where it is used in accordance with accepted industry standards and L.P.I. and UL code requirements.



2.3 EQUIPMENT

- A. All materials shall be copper, aluminum or bronze as indicated on the drawings. All materials shall be UL approved and labeled and of the size, weight, and construction for use on building in accordance with L.P.I. and UL Code requirements for Class I and II structures and as per manufacturer's recommendations.
- B. Air terminal bases shall be of cast construction with bolted pressure cable connections and shall be securely mounted with stainless steel screws or bolts. Crimp type connectors are not acceptable. Bases shall have a minimum surface contact area of 8.5 square inches.
- C. Cable fasteners shall be of cast construction with pressure cable connectors, electrolytically compatible with the conductor and mounting surface and shall be spaced according to UL, L.P.I. and NFPA Code requirements.
- D. Bonding devices, cable splicers and miscellaneous connectors shall be of cast bronze with bolt pressure connections to cable. Cast or stamped crimp fittings are not acceptable.
- E. Ground rods shall be 3/4" diameter, 10 feet long sectional copperweld steel. Obtain 5-OHMS maximum resistance as read with a ground reading megger using two reference rods. If 5-OHMS cannot be attained, drive additional sections until 5-OHMS has been obtained.
- F. All miscellaneous bolts, nuts and screws shall be brass, bronze or stainless steel. Crimp fittings are not acceptable. Stamped bronze materials are not acceptable.
- G. Equipment enclosures less than 3/16" thick shall be provided with individual air terminals bonded to the main coursing conductors.
- H. Equipment on ventilators, etc. shall be protected from corrosion in accordance with L.P.I. and UL requirements.
- I. All miscellaneous bolts, nuts and screws shall be stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with UL 96A, ANSI/NFPA 780 and LPI.
- C. Installation shall be made in an inconspicuous manner with conductors coursed to conceal equipment as much as possible. Down conductors shall be concealed with structure, and shall be run in 1" PVC conduit. Refer to NFPA 780 (78) 3-12.13.
- D. Where fasteners are to be mounted in masonry or structural work, they shall be furnished to the Masonry or Structural Contractor so they may be installed during construction of the project.
- E. Conductors concealed in steel reinforced concrete shall be installed, bonded, etc. per NFPA 780 (78) 3-18.3 and 3-12.13. Specific attention is brought to the requirements of 3-12.13 requiring down conductors to be connected to reinforced steel at its upper and lower extremities.
- F. Provide proper connections of lightning protection system to all grounded media in and around the protected structure per NFPA 780 (78) 3-23 "Potential Equalization".



- G. Provide proper grounding of all grounding media in, on and around structure to provide common ground potential per NFPA 780 (78) 3-17 including electric service, telephone and antenna system grounds as well as underground metallic piping systems, underground metal conduits, etc.
- H. Underground counterpoise: Bond to underground counterpoise system. Items required to be bonded/connected in "F" and "G" above shall be bonded/connected via ground ring system where available and applicable.
- I. All exposed conductors located 6 ft. or less above finished floor or finished grade is to be suitably protected/shielded as well as other exposed locations where conductor is subject to mechanical damage.
- J. Coordinate and receive approval of all penetrations of roofing system and mounting to roofing system with Designer and Roofing Contractor prior to submittal of shop drawings.
- K. Coordinate and receive approval of all connections to structural steel, rebar, etc. with Structural Engineer prior to submittal of shop drawings.
- L. Submittal of shop drawing by Contractor is evidence that the Contractor has received approval of penetrations, connections, etc., by all parties and that Contractor assumes responsibility for such penetrations, connections, etc.
- M. Locate air terminals as required. Take care to insure that all points are within 2'-0" of outside building edge, outside corners and ridge ends, and that maximum spacing does not exceed 20'-0", and that minimum projection above object protected is 10".
- N. Maintain horizontal or downward coursing of main conductor and insure that all bends have at least an 8" radius and do not exceed 90'.
- O. Support all roof coursing conductors, down leads and bonding cables at 3'-0" on center maximum.
- P. Ground electrodes shall be installed within concrete handholes, in unpaved, accessible areas, but in no instance shall they be less than 1'-0" below grade and 2'-0" from foundation wall. Driven rods shall penetrate earth at least 10'-0". All down conductors shall be bonded to the electrodes utilizing exothermic welds.
- Q. Bond to all metal bodies of conductance on roof with main size conductors as shown and as required by UL codes. These bonds include, but are not limited to, exhaust fans, vents, handrails, metal screens and panels, HVAC units, hatches, skylights, cooling towers, flag poles, antennas, etc., or any large metal body subject to direct stroke or exceeds the height of adjacent air terminals.
- R. Bond to metal bodies of conductance located within 6'-0" of main conductor or other bonded object with approved secondary bonding conductor as shown and as required by UL codes. Such objects include, but are not limited to, flashings, metal coping caps, gravel guards, fascias, roof drains, down-spouts, interior ducts, machinery or piping, etc., or, in general, any isolated body at or below the roof subject to inductance and within 6'-0" of system.

3.2 FIELD QUALITY CONTROL

- A. Obtain the service of Underwriters Laboratories, Inc. to provide inspection and certification of the lightning protection system under provisions of UL 96A. Submit certification and submit in O&M Manual.
- B. Obtain UL Master Label per UL 96A. Submit copy of paperwork to the Contracting Officer and submit in O&M Manual.



- C. Submit test results on each ground location including final length of each ground rod and final distance between each installed ground rod at each ground rod location.

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Last revised: 7/1/2010

END OF SECTION 26 41 00 00



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SECTION 26 41 13 00 - CSF LIGHTNING PROTECTION FOR STRUCTURES

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this Outline Specification Section for Customer Service Facilities only. This Specification defines "level of quality" for Customer Service Facility construction and is intended as a guide to the Architect/Engineer preparing the Construction Documents.

"EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

A Lightning Protection System is not required on all Customer Service Facilities. Utilize this Outline Specification for facilities where the lightning risk assessment calculation predicts expected lightning stroke frequency to exceed the tolerable lightning frequency.

PART 1 - GENERAL

1.1 SUMMARY

- A. The work covered by this section of the specifications consists of furnishing all labor, materials and items of service required for the completion of a functional and unobtrusive, UL 96A master labeled, lightning protection and grounding system as approved by the Engineer and in strict accordance with this section of the specifications
 - 1. If any departure from these specifications or submittal drawings covered below are deemed necessary by the contractor, details of such departures and reasons therefore shall be submitted as soon as practicable to the Engineer for approval. No such departures shall be made without the prior written approval of the Engineer.
- B. Section Includes:
 - 1. Air terminals and bases.
 - 2. Grounding electrodes.
 - 3. Lightning Protection Conductors.
 - 4. Grounding and bonding for lightning protection.
- C. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.



- D. Related Sections:
 - 1. Section 260500 - Common Work Results for Electrical.
 - 2. Section 264128 – Surge Protective Devices (SPDs).

1.2 REFERENCES

- A. Lightning Protection Institute (LPI):
 - 1. LPI-175 - Lightning Protection Installation Standard.
 - 2. LPI-176 - Lightning Protection System Material and Components Standard.
 - 3. LPI-177 - Inspection Guide for LPI Certified Systems.
- B. National Fire Protection Association (NFPA):
 - 1. NFPA 780 - Lightning Protection Code.
- C. Underwriters Laboratories, Inc. (UL):
 - 1. UL 96 - Lightning Protection Components.
 - 2. UL 96A - Installation Requirements for Lightning Protection Systems.

1.3 SUBMITTALS

- A. As specified in Section 260500 - Common Work Results for Electrical.
- B. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Provide dimensions and materials of each component, and include indication of listing in accordance with UL 96.
 - 2. Shop Drawings: Provide scaled drawings indicating the layout of air terminals, grounding electrodes, underground counterpoise and bonding connections to structure and other metal objects. Include terminal, electrode, and conductor sizes, and connection and termination details.
 - a. Submit manufacturer's installation instructions.
 - b. Submittal shall include ground test wells.
 - 3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
- C. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Project Record Documents: Accurately record the following:
 - a. Actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors in project record documents.

1.4 QUALITY ASSURANCE

- A. As specified in Section 260500 - Common Work Results for Electrical.
- B. Perform Work in accordance with NFPA 780.
- C. Perform Work in accordance with UL 96A and provide Master Label.
- D. Perform Work in accordance with LPI-175 and provide LPI Certification.
- E. Qualifications:



1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience and member of Lightning Protection Institute.
2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience, certified by manufacturer as an "Approved Installer," and certified by Lightning Protection Institute.

F. Regulatory Requirements

1. Product Listing: UL 96 and LPI-176.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. Harger Lightning Protection, Inc., Grays Lake, IL (800) 842-7437.
 2. Heary Brothers Lightning Protection Company, Springville, NY (716) 941-6141.
 3. Independent Protection Co., Inc., Goshen, IN (800) 860-8388.
 4. Thompson Lightning Protection Company, St. Paul, MN (800) 777-1230.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 STANDARDS

- A. All equipment used in this installation shall be UL approved and labeled in accordance with UL procedures, with each air terminal bearing an "A" label and all main conductors bearing a "B" label at 10 ft. – 0 in. intervals.
- B. All equipment shall be new, the product of a single manufacturer as outlined above, and of a design and construction to suit the application where it is used in accordance with accepted industry standards and L.P.I. and UL code requirements.

2.3 EQUIPMENT

- A. All materials shall be copper, aluminum or bronze as indicated on the drawings. All materials shall be UL approved and labeled and of the size, weight, and construction for use on building in accordance with L.P.I. and UL Code requirements for Class I structures and as per manufacturer's recommendations.
- B. Air terminal bases shall be of cast construction with bolted pressure cable connections and shall be securely mounted with stainless steel screws or bolts. Crimp type connectors are not acceptable. Bases shall have a minimum surface contact area of 8.5 square inches.
- C. Cable fasteners shall be of cast construction with pressure cable connectors, electrolytically compatible with the conductor and mounting surface and shall be spaced according to UL, L.P.I. and NFPA Code requirements.



- D. Bonding devices, cable splicers and miscellaneous connectors shall be of cast bronze with bolt pressure connections to cable. Cast or stamped crimp fittings are not acceptable.
- E. Ground rods shall be 3/4 inch diameter, 10 feet long sectional copperweld steel. Obtain 5-OHMS maximum resistance as read with a ground reading megger using two reference rods. If 5-OHMS cannot be attained, drive additional sections until 5-OHMS has been obtained.
- F. All miscellaneous bolts, nuts and screws shall be brass, bronze or stainless steel. Crimp fittings are not acceptable. Stamped bronze materials are not acceptable.
- G. Equipment enclosures less than 3/16 inch thick shall be provided with individual air terminals bonded to the main coursing conductors.
- H. Equipment on ventilators, etc. shall be protected from corrosion in accordance with L.P.I. and UL requirements.
- I. All miscellaneous bolts, nuts and screws shall be stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. As specified in Section 260500 – Common Work Results for Electrical.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with UL 96A, ANSI/NFPA 780 and LPI.
- C. Installation shall be made in an inconspicuous manner with conductors coursed to conceal equipment as much as possible. Down conductors shall be concealed with structure, and shall be run in 1 inch PVC conduit. Refer to NFPA 780 (78) 3-12.13.
- D. Where fasteners are to be mounted in masonry or structural work, they shall be furnished to the Masonry or Structural Contractor so they may be installed during construction of the project.
- E. Conductors concealed in steel reinforced concrete shall be installed, bonded, etc. per NFPA 780 (78) 3-18.3 and 3-12.13. Specific attention is brought to the requirements of 3-12.13 requiring down conductors to be connected to reinforced steel at its upper and lower extremities.
- F. Provide proper connections of lightning protection system to all grounded media in and around the protected structure per NFPA 780 (78) 3-23 "Potential Equalization".
- G. Provide proper grounding of all grounding media in, on and around structure to provide common ground potential per NFPA 780 (78) 3-17 including electric service, telephone and antenna system grounds as well as underground metallic piping systems, underground metal conduits, etc.
- H. Underground counterpoise: Bond to underground counterpoise system. Items required to be bonded/connected in "F" and "G" above shall be bonded/connected via ground ring system where available and applicable.



- I. All exposed conductors located 6 ft. or less above finished floor or finished grade are to be suitably protected/shielded as well as other exposed locations where conductor is subject to mechanical damage.
- J. Coordinate and receive approval of all penetrations of roofing system and mounting to roofing system with Designer and Roofing Contractor prior to submittal of shop drawings.
- K. Coordinate and receive approval of all connections to structural steel, rebar, etc. with Structural Engineer prior to submittal of shop drawings.
- L. Submittal of shop drawing by Contractor is evidence that the Contractor has received approval of penetrations, connections, etc., by all parties and that Contractor assumes responsibility for such penetrations, connections, etc.
- M. Locate air terminals as required. Take care to insure that all points are within 2 ft. - 0 in. of outside building edge, outside corners and ridge ends, and that maximum spacing does not exceed 20 ft. - 0 in, and that minimum projection above object protected is 10 inches.
- N. Maintain horizontal or downward coursing of main conductor and insure that all bends have at least an 8 inch radius and do not exceed 90 ft.
- O. Support all roof coursing conductors, down leads and bonding cables at 3 ft. - 0 in. on center maximum.
- P. Ground electrodes shall be installed within concrete handholes, in unpaved, accessible areas, but in no instance shall they be less than 1 ft. - 0 in. below grade and 2 ft. - 0 in. from foundation wall. Driven rods shall penetrate earth at least 10 ft. - 0 in.. All down conductors shall be bonded to the electrodes utilizing exothermic welds.
- Q. Bond to all metal bodies of conductance on roof with main size conductors as shown and as required by UL codes. These bonds include, but are not limited to, exhaust fans, vents, handrails, metal screens and panels, HVAC units, hatches, skylights, cooling towers, flag poles, antennas, etc., or any large metal body subject to direct stroke or exceeds the height of adjacent air terminals.
- R. Bond to metal bodies of conductance located within 6 ft. - 0 in. of main conductor or other bonded object with approved secondary bonding conductor as shown and as required by UL codes. Such objects include, but are not limited to, flashings, metal coping caps, gravel guards, fascias, roof drains, downspouts, interior ducts, machinery or piping, etc., or, in general, any isolated body at or below the roof subject to inductance and within 6 ft. - 0 in. of system.

3.3 FIELD QUALITY CONTROL

- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. Obtain the service of Underwriters Laboratories, Inc. to provide inspection and certification of the lightning protection system under provisions of UL 96A. Submit certification and submit in O&M Manual.
- C. Obtain UL Master Label per UL 96A. Submit copy of paperwork to the Contracting Officer and submit in O&M Manual.
- D. Submit test results on each ground location including final length of each ground rod and final distance between each installed ground rod at each ground rod location.

3.4 TESTING AND INSPECTION:



- A. Inspect and test in accordance with NETA ATS, where applicable.
- B. Perform inspections and tests listed in NETA ATS, Section 7.13.
- C. Test ground resistance of system with ground resistance tester. The resistance of the grounding system shall not exceed 5 ohms. Where tests show resistance-to-ground is over 5 ohms, take appropriate action to reduce resistance to 5 ohms, or less, but driving additional ground rods; then retest to demonstrate compliance . Install rods at least 8 feet apart.
- D. Method for testing individual ground rods and overall grounding system shall be accomplished by the three point method per military handbook 419. Test probes shall be placed minimum of 30 feet and 60 feet from rod being tested. Furnish written report of all test results for all ground rods.

3.5 CONSTRUCTION

- A. Interface with Other Work: Coordinate Work with roofing and interior finish installations.

3.6 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Perform inspection and testing in accordance with LPI-177.

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END OF SECTION 26 41 13 00



SECTION 26 41 28 00 - MPF SURGE PROTECTIVE DEVICES (SPDS)

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification.

PART 1 - GENERAL

1.1 SUMMARY

- A. This section describes the materials and installation requirements for surge protective devices (SPD) for the protection of all power and communications circuits. Provide and install materials, labor and auxiliaries required to furnish and install complete surge suppression for the protection of building electrical and electronics systems from the effects of induced transient voltage surge and lightning discharge as indicated on drawings.
 - 1. Provide surge suppression devices for the following equipment:
 - a. Each main electrical service switchboard as indicated for on drawings.
 - b. Distribution and branch panels as indicated for on drawings.
 - c. All electronic communications equipment installed including but not limited to: fire alarm, intrusion, security, CCTV, and paging systems.
 - 2. Provide surge suppression protection on all exterior communications systems wiring and equipment if the "expected lightning stroke frequency" exceeds the "tolerable lightning frequency" to the structure.
- B. Related documents: The contract documents, as defined in Section 011000-Summary of Work, apply to work of this section. Additional requirements and information necessary to complete the work of this section may be found in other documents.
- C. Related sections:
 - 1. Section 281304 – Physical Access Control System
 - 2. Section 282304 – Security, Burglary and Robbery Countermeasures Analog CCTV System.
 - 3. Section 282305 – Integrated Security and Investigative Platform (ISIP) CCTV System.
 - 4. Section 337173 – Electrical Utility Services.
 - 5. Section 262413 – Switchboards.
 - 6. Section 265600 – Exterior Lighting.
 - 7. Section 264100 – Facility Lightning Protection.
 - 8. Section 275116 – Public Address and Mass Notification Systems.
 - 9. Section 283100 – Fire Detection and Alarm.

1.2 REFERENCES

- A. IEEE C62.41.1, IEEE Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits,
- B. IEEE C62.41.2, IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits,



- C. IEEE C62.45, IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits.
- D. National Electrical Code: Article 285
- E. UL 1283 - Electromagnetic Interference Filters
- F. UL 1449, Third Edition, effective September 29, 2009 – Surge Protective Devices

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.
 - 2. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.
 - 3. Certification submitted SPDs are manufactured in the United States.
 - 4. Shall include UL 1449 Listing documentation verifying the following:
 - a. Short Circuit Current Rating (SCCR)
 - b. Voltage Protection Ratings (VPRs) for all modes
 - c. Maximum Continuous Operating Voltage rating (MCOV)
 - d. I-nominal rating (I-n)
 - e. Type 1 Device Listing
 - 1) VPR, MCOV, I-n, and Type 1 information is posted at www.UL.com, under Certifications, searching using UL Category Code: VZCA. SCCR's are posted in manufacturer's UL docs.
 - 2) UL data and visual inspection takes precedence over manufacturer's published documentation.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals:
 - 1. Project Record Documents: Record actual locations of Products; indicate actual branch circuit arrangement.
 - 2. Operation and Maintenance Data: Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.
 - 3. Submit data showing compliance with UL 1449 3rd edition.

1.4 QUALITY ASSURANCE

- A. SPDs must be manufactured in the United States.
- B. Manufacturer Qualifications: Engage a firm with at least ten (10) years experience in manufacturing transient voltage surge suppressors.
- C. Manufacturer shall be ISO 9001 or 9002 certified.
- D. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (10) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- E. The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.



1.5 DELIVERY, STORAGE AND HANDLING

- A. Handle and store equipment in accordance with manufacturer's Installation and Maintenance Manuals. One (1) copy of this document to be provided with the equipment at time of shipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following.
 1. Advanced Protection Technologies, Incorporated, Clearwater, FL (800) 237-4567.
 2. Emerson/Liebert Corporation, Columbus, OH, (800) 877-9222.
 3. Atlantic Scientific Corporation, Melbourne, FL, (800) 544-4737.
 4. Current Technology Inc., Irving, TX, (800) 238-5000.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 SERVICE ENTRANCE SURGE PROTECTIVE DEVICES (SPDS)

- A. Models:
 1. Basis of Design: Advanced Protection Technologies: "TEXAS" Series.
- B. Surge Protective Device Description: Replaceable module type complying with UL 1283 and UL 1449 3rd Edition Listed. Provide unit with the following features and accessories:
 1. LED indicator lights for power and protection status.
 2. Audible alarm, with silencing switch, to indicate when protection has failed.
 3. One set of dry contacts rated at 5.0 amperes, 240 volts ac, for remote monitoring of protection status.
- C. Short Circuit Current Rating: SPD shall be UL labeled with 200kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD, per NEC 285.6.
- D. SPD Type: SPD shall be UL labeled as Type 1 (verifiable at UL.com), intended for use without need for external or supplemental overcurrent controls. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal overtemperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.
- E. In Rating: SPD shall be UL labeled with 20kA Inominal (I-n) (verifiable at UL.com) for compliance to UL 96A Lightning Protection Master Label and NFPA 780.
- F. SPD shall provide surge current diversion paths for all modes of protection; L-N, L-G, N-G, and L-L in WYE systems, and L-L, L-G in DELTA Systems.
- G. Minimum Single Impulse Surge Current Capability (single pulse rated) per phase shall be.
 1. Single Impulse Surge Current Capacity is to be 300 kA.
- H. Connection Means: Permanently wired via internal disconnect. The device shall have a NEMA designed and certified safety interlocked integral disconnect switch. The switch shall be located within the unit with an externally mounted metal manual operator.
- I. Protection modes and UL 1449 3rd Edition Voltage Protection Rating for grounded WYE circuits with voltages of 480Y/277, 3-phase, 4-wire shall be as follows:



<u>VOLTAGE</u>	<u>L-N</u>	<u>L-G</u>	<u>N-G</u>
208Y/120V	700V	700V	700V
480Y/277V	1500V	1500V	1500V

- J. Install devices at service entrance at load side, with ground lead bonded to service entrance ground.
- K. Test unit in accordance with manufacturer's written instructions.

2.3 DISTRIBUTION SURGE PROTECTIVE DEVICES (SPDS)

- A. Models:
 - 1. Basis of Design: Advanced Protection Technologies: "TEXDS" Series.
- B. Surge Protective Device Description: Non-modular type complying with UL 1283 and UL 1449 3rd Edition Listed. Provide unit with the following features and accessories:
 - 1. LED indicator lights for power and protection status.
- C. Short Circuit Current Rating: SPD shall be UL labeled with 200kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD, per NEC 285.6.
- D. SPD Type: SPD shall be UL labeled as Type 1 (verifiable at UL.com), intended for use without need for external or supplemental overcurrent controls. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal overtemperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.
- E. In Rating: SPD shall be UL labeled with 20kA Inominal (I-n) (verifiable at UL.com).
- F. SPD shall provide surge current diversion paths for all modes of protection; L-N, L-G, N-G, and L-L in WYE systems, and L-L, L-G in DELTA Systems.
- G. Minimum Single Impulse Surge Current Capability (single pulse rated) per phase shall be.
 - 1. Single Impulse Surge Current Capacity is to be 150 kA.
- H. Connection Means: Permanently wired via internal disconnect. The device shall have a NEMA designed and certified safety interlocked integral disconnect switch. The switch shall be located within the unit with an externally mounted metal manual operator.
- I. Protection modes and UL 1449 3rd Edition Voltage Protection Rating for grounded WYE circuits with voltages of 480Y/277, 3-phase, 4-wire shall be as follows:

<u>VOLTAGE</u>	<u>L-N</u>	<u>L-G</u>	<u>N-G</u>
208Y/120V	700V	700V	700V
480Y/277V	1500V	1500V	1500V

- J. Install devices as close as possible to distribution or branch panelboards.
- K. Test unit in accordance with manufacturer's written instructions.

2.4 FIRE ALARM AND SECURITY SYSTEM SURGE PROTECTIVE DEVICES (SPDS)

- A. Power Surge Protection



1. SPD shall be listed or recognized in accordance with UL 1449 Third Edition verifiable by visiting UL.com.
 2. SPD shall provide surge current L-N or L-G mode of protection.
 3. SPD shall be chase
 4. Every mode of protection, shall be protected by internal overcurrent and thermal overtemperature controls.
 5. SPD shall meet or exceed the following criteria:
 - a. Minimum surge current capability (single pulse rated) per phase shall be:
 - 1) 120/240 Panel Application 50kA per phase
 - b. UL 1449 3rd Edition listed Voltage Protection Ratings for shall not exceed the following:

<u>VOLTAGE</u>	<u>L-N/L-G</u>	<u>MCOV</u>
120V or 240/120V	600V	150V
 6. SPD shall have a warranty for a period of two years, incorporating unlimited replacements of suppressor parts if they are destroyed by transients during the warranty period.
- B. Signal line protection
1. SPD shall be solid state, silicon avalanche diode circuitry for protection from overvoltages on 2 or 4 wire signal lines such as balanced pair telephone, metallic pair telephone, buried and overhead field cable, remote radio equipment, and control systems. Unit shall have an external ground lug or wire. Connect ground lug or wire to protected equipment grounding system with a No. 12 green insulated stranded ground wire as short as possible.
 - a. Pins Protected: Pins 4, 5 on the RJ- 45 Interface; Pins 3, 4 on the RJ- 11 Interface
 - b. Clamping Voltage: 310 Volts in 500 nsec
 - c. Surge Capacity: 1500 Watts for 1 msec;
 - d. Protection Mode:
 - 1) Common Mode Pins 4, 5 to shielding braid
 - 2) Differential Mode Pins 4,5
 - e. Shall be listed to UL497A Telco Specification
- C. Video 75 ohm coaxial cable
1. Solid state, silicon avalanche diode circuitry for non-interrupting overvoltage protection of RG-59/U coaxial cable. Unit shall be provided with one female input connector for "F" series male connector, one output RG-59/U coax cable terminated with an "F" series male cable end connector and A #16 stranded, 18 inch long grounding wire on output end of unit or similar arrangement. Securely mount adjacent to protection equipment and ground to equipment or local building ground if an equipment ground is not available.
 - a. Normal Operating Characteristics
 - 1) Voltage5.8V max
 - 2) Current.....500ma max
 - 3) Frequency.....DC to 10 Mhz
 - 4) Insertion Loss.....3.5db @ 4Mhz
 - b. Protection Requirements
 - 1) Transient suppression level.....7.5v Voltage Protection Level
 - 2) Transient response.....<5 nanoseconds
 - 3) Operating temp.....-20° C to +50° C
 - 4) Energy dissipation.....15,000 watts (10X1000 Test Wave)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.



- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. The installation shall meet the following criteria:
 - 1. Install per manufacturer's recommendations and contract documents.
 - 2. Install units plumb, level and rigid without distortion
 - 3. One primary suppressor shall be installed external to the service entrance in accordance with manufacturer instructions.
 - 4. Service Entrance SPD shall be installed on the load side of the main service disconnect.
 - 5. Service Entrance SPD ground shall be bonded to the service entrance ground.
 - 6. At Service Entrance, a UL approved disconnect switch shall be provided as a means of servicing if a 60A breaker is not available.
 - 7. One SPD shall be installed external to each designated distribution panelboard.
 - 8. At Distribution and Branch, SPD shall have an independent means of disconnect such that the protected panel remains energized. A 30A breaker (or larger) may serve this function.
 - 9. SPD shall be installed per manufacturer's installation instructions with lead lengths as short (less than 24") and straight as possible. Gently twist conductors together.
 - 10. Before energizing, installer shall verify service and separately derived system Neutral to Ground bonding jumpers per NEC.

3.3 ADJUSTMENTS AND CLEANING

- A. Remove debris from SPD and wipe dust and dirt from all components.
- B. Repaint marred and scratched surfaces with touch up paint to match original finish.

3.4 TESTING

- A. Check tightness of all accessible mechanical and electrical connections to assure they are torqued to the minimum acceptable manufacture's recommendations.
- B. Check all installed panels for proper grounding, fastening and alignment.

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END OF SECTION 26 41 28 00



SECTION 26 41 28 00 - CSF SURGE PROTECTIVE DEVICES (SPDS)

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this Outline Specification Section for Customer Service Facilities only. This Specification defines "level of quality" for Customer Service Facility construction and is intended as a guide to the Architect/Engineer preparing the Construction Documents.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

NOTE TO SPECIFIER

Provide surge suppression protection on all exterior lighting and communications systems wiring if the "expected lightning stroke frequency" exceeds the "tolerable lightning frequency" to the structure.

1.1 SUMMARY

- A. This section describes the materials and installation requirements for surge protective devices (SPD) for the protection of all power and communications circuits. Provide and install materials, labor and auxiliaries required to furnish and install complete surge suppression for the protection of building electrical and electronics systems from the effects of induced transient voltage surge and lightning discharge as indicated on drawings.
 - 1. Provide surge suppression devices for the following equipment:
 - a. Each main electrical service switchboard as indicated for on drawings.
 - b. Distribution and branch panels as indicated for on drawings.
 - c. All electronic communications equipment installed including but not limited to: fire alarm, intrusion, security, CCTV, and paging systems.
- B. Related documents: The contract documents, as defined in Section 011000-Summary of Work, apply to work of this section. Additional requirements and information necessary to complete the work of this section may be found in other documents.
- C. Related sections:
 - 1. Section 260500 – Common Work Results for Electrical.
 - 2. Section 262413 – Switchboards.
 - 3. Section 264113 – Lightning Protection for Structures.
 - 4. Section 265600 – Exterior Lighting.
 - 5. Section 275116 – Public Address Paging Systems.



6. [Section 282304 – Security, Burglary and Robbery Countermeasures Analog CCTV System.]
7. [Section 282305 – Integrated Security and Investigative Platform (ISIP) CCTV System.]
8. Section 283100 – Fire Detection and Alarm.

1.2 REFERENCES

- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. IEEE C62.41.1, IEEE Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits,
- C. IEEE C62.41.2, IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits,
- D. IEEE C62.45, IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits.
- E. NFPA 70; National Electrical Code: Article 285
- F. UL 1283 - Electromagnetic Interference Filters
- G. UL 1449, Third Edition, effective September 29, 2009 – Surge Protective Devices

1.3 SUBMITTALS

- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. Section 013300 - Submittal Procedures: Procedures for submittals.
 1. Shop Drawings: Indicate outline and support point dimensions, voltage, integrated short circuit ampere rating, and sizes.
 2. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.
 3. Certification submitted SPDs are manufactured in the United States.
 4. Shall include UL 1449, 3rd edition Listing documentation verifying the following:
 - a. Short Circuit Current Rating (SCCR)
 - b. Voltage Protection Ratings (VPRs) for all modes
 - c. Maximum Continuous Operating Voltage rating (MCOV)
 - d. I-nominal rating (I-n)
 - e. Type 1 Device Listing
 - 1) VPR, MCOV, I-n, and Type 1 information is posted at www.UL.com, under Certifications, searching using UL Category Code: VZCA. SCCR's are posted in manufacturer's UL docs.
 - 2) UL data and visual inspection takes precedence over manufacturer's published documentation.
- C. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals:
 1. Project Record Documents: Record actual locations of Products.
 2. Operation and Maintenance Data: Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.4 QUALITY ASSURANCE

- A. As specified in Section 260500 – Common Work Results for Electrical.



- B. SPDs must be manufactured in the United States.
- C. Manufacturer Qualifications: Engage a firm with at least ten (10) years experience in manufacturing transient voltage surge suppressors.
- D. Manufacturer shall be ISO 9001 or 9002 certified.
- E. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (10) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- F. The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Handle and store equipment in accordance with manufacturer's Installation and Maintenance Manuals. One (1) copy of this document to be provided with the equipment at time of shipment.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following.
 - 1. Advanced Protection Technologies, Incorporated, Clearwater, FL (800) 237-4567.
 - 2. Emerson/Liebert Corporation, Columbus, OH, (800) 877-9222.
 - 3. Atlantic Scientific Corporation, Melbourne, FL, (800) 544-4737.
 - 4. Current Technology Inc., Irving, TX, (800) 238-5000.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 SERVICE ENTRANCE SURGE PROTECTIVE DEVICES (SPDS)

- A. Models:
 - 1. Basis of Design: Advanced Protection Technologies: "TEXAS" Series.
- B. Surge Protective Device Description: Replaceable module type complying with UL 1283 and UL 1449 3rd Edition Listed. Provide unit with the following features and accessories:
 - 1. LED indicator lights for power and protection status.
 - 2. Audible alarm, with silencing switch, to indicate when protection has failed.
 - 3. One set of dry contacts rated at 5.0 amperes, 240 volts ac, for remote monitoring of protection status.
- C. Short Circuit Current Rating: SPD shall be UL labeled with 200kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD, per NEC 285.6.
- D. SPD Type: SPD shall be UL labeled as Type 1 (verifiable at UL.com), intended for use without need for external or supplemental overcurrent controls. Every suppression component of every mode, including



N-G, shall be protected by internal overcurrent and thermal overtemperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.

- E. In Rating: SPD shall be UL labeled with 20kA Inominal (I-n) (verifiable at UL.com) for compliance to UL 96A Lightning Protection Master Label and NFPA 780.
- F. SPD shall provide surge current diversion paths for all modes of protection; L-N, L-G, N-G, and L-L in WYE systems, and L-L, L-G in DELTA Systems.
- G. Minimum Single Impulse Surge Current Capability (single pulse rated) per phase shall be.
 - 1. Single Impulse Surge Current Capacity is to be 300 kA.
- H. Connection Means: Permanently wired via internal or external disconnecting means.
- I. Protection modes and UL 1449 3rd Edition Voltage Protection Rating for grounded WYE circuits with voltages of 480Y/277, 3-phase, 4-wire shall be as follows:

<u>VOLTAGE</u>	<u>L-N</u>	<u>L-G</u>	<u>N-G</u>
208Y/120V	700V	700V	700V
480Y/277V	1500V	1500V	1500V

- J. Install devices at service entrance at load side, with ground lead bonded to service entrance ground.
- K. Test unit in accordance with manufacturer's written instructions.

2.3 DISTRIBUTION SURGE PROTECTIVE DEVICES (SPDS)

- A. Models:
 - 1. Basis of Design: Advanced Protection Technologies: "TEXDS" Series.
- B. Surge Protective Device Description: Non-modular type complying with UL 1283 and UL 1449 3rd Edition Listed. Provide unit with the following features and accessories:
 - 1. LED indicator lights for power and protection status.
- C. Short Circuit Current Rating: SPD shall be UL labeled with 200kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD, per NEC 285.6.
- D. SPD Type: SPD shall be UL labeled as Type 1 (verifiable at UL.com), intended for use without need for external or supplemental overcurrent controls. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal overtemperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.
- E. In Rating: SPD shall be UL labeled with 20kA Inominal (I-n) (verifiable at UL.com).
- F. SPD shall provide surge current diversion paths for all modes of protection; L-N, L-G, N-G, and L-L in WYE systems, and L-L, L-G in DELTA Systems.
- G. Minimum Single Impulse Surge Current Capability (single pulse rated) per phase shall be.
 - 1. Single Impulse Surge Current Capacity is to be 150 kA.
- H. Connection Means: Permanently wired via internal or external disconnecting means.



- I. Protection modes and UL 1449 3rd Edition Voltage Protection Rating for grounded WYE circuits with voltages of 480Y/277, 3-phase, 4-wire shall be as follows:

<u>VOLTAGE</u>	<u>L-N</u>	<u>L-G</u>	<u>N-G</u>
208Y/120V	700V	700V	700V
480Y/277V	1500V	1500V	1500V

- J. Install devices as close as possible to distribution or branch panelboards.
- K. Test unit in accordance with manufacturer's written instructions.

2.4 FIRE ALARM AND SECURITY SYSTEM SURGE PROTECTIVE DEVICES (SPDS)

A. Power Surge Protection

1. SPD shall be listed or recognized in accordance with UL 1449 Third Edition verifiable by visiting UL.com.
2. SPD shall provide surge current L-N or L-G mode of protection.
3. SPD shall be chase
4. Every mode of protection, shall be protected by internal overcurrent and thermal overtemperature controls.
5. SPD shall meet or exceed the following criteria:
 - a. Minimum surge current capability (single pulse rated) per phase shall be:
 - 1) 120/240 Panel Application 50kA per phase
 - b. UL 1449 3rd Edition listed Voltage Protection Ratings for shall not exceed the following:

<u>VOLTAGE</u>	<u>L-N/L-G</u>	<u>MCOV</u>
120V or 240/120V	600V	150V
6. SPD shall have a warranty for a period of two years, incorporating unlimited replacements of suppressor parts if they are destroyed by transients during the warranty period.

B. [Signal line protection

1. SPD shall be solid state, silicon avalanche diode circuitry for protection from overvoltages on 2 or 4 wire signal lines such as balanced pair telephone, metallic pair telephone, buried and overhead field cable, remote radio equipment, and control systems. Unit shall have an external ground lug or wire. Connect ground lug or wire to protected equipment grounding system with a No. 12 green insulated stranded ground wire as short as possible.
 - a. Pins Protected: Pins 4, 5 on the RJ- 45 Interface; Pins 3, 4 on the RJ- 11 Interface
 - b. Clamping Voltage: 310 Volts in 500 nsec
 - c. Surge Capacity: 1500 Watts for 1 msec;
 - d. Protection Mode:
 - 1) Common Mode Pins 4, 5 to shielding braid
 - 2) Differential Mode Pins 4,5
 - e. Shall be listed to UL497A Telco Specification]

C. [Video 75 ohm coaxial cable

1. Solid state, silicon avalanche diode circuitry for non-interrupting overvoltage protection of RG-59/U coaxial cable. Unit shall be provided with one female input connector for "F" series male connector, one output RG-59/U coax cable terminated with an "F" series male cable end connector and A #16 stranded, 18 inch long grounding wire on output end of unit or similar arrangement. Securely mount adjacent to protection equipment and ground to equipment or local building ground if an equipment ground is not available.
 - a. Normal Operating Characteristics
 - 1) Voltage5.8V max
 - 2) Current.....500ma max
 - 3) Frequency.....DC to 10 Mhz
 - 4) Insertion Loss.....3.5db @ 4Mhz



- b. Protection Requirements
 - 1) Transient suppression level.....7.5v Voltage Protection Level
 - 2) Transient response.....<5 nanoseconds
 - 3) Operating temp.....-20° C to +50° C
 - 4) Energy dissipation.....15,000 watts (10X1000 Test Wave)]

PART 3 - EXECUTION

3.1 EXAMINATION

- A. As specified in Section 260500 – Common Work Results for Electrical.

3.2 INSTALLATION

- A. The installation shall meet the following criteria:
 - 1. Install per manufacturer's recommendations and contract documents.
 - 2. Install units plumb, level and rigid without distortion
 - 3. One primary lightning arrestor shall be installed external to the service entrance in accordance with manufacturer instructions.
 - 4. Service Entrance SPD shall be installed on the load side of the main service disconnect.
 - 5. Service Entrance SPD ground shall be bonded to the service entrance ground.
 - 6. At Service Entrance, a UL approved disconnecting means shall be provided as a means of servicing.
 - 7. One SPD shall be installed external to each designated distribution panelboard.
 - 8. At Distribution and Branch, SPD shall have an independent means of disconnect such that the protected panel remains energized. A 30A breaker (or larger) may serve this function.
 - 9. SPD shall be installed per manufacturer's installation instructions with lead lengths as short (less than 24") and straight as possible. Gently twist conductors together.
 - 10. Before energizing, installer shall verify service and separately derived system Neutral to Ground bonding jumpers per NEC.

3.3 ADJUSTMENTS AND CLEANING

- A. Remove debris from SPD and wipe dust and dirt from all components.
- B. Repaint marred and scratched surfaces with touch up paint to match original finish.

3.4 FIELD QUALITY CONTROL

- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. Check tightness of all accessible mechanical and electrical connections to assure they are torqued to the minimum acceptable manufacture's recommendations.
- C. Check all installed panels for proper grounding, fastening and alignment.

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END OF SECTION 26 41 28 00



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SECTION 26 42 13 00 - CATHODIC PROTECTION

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for cathodic protection. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes passive cathodic protection systems that use magnesium or zinc anodes to protect iron and steel piping and tanks.

C. Performance Requirements

1. Delegated Design: Design, supervise, test, and inspect the installation of cathodic protection systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
 - a. Design cathodic protection for pipelines according to NACE RP0169.
 - b. Design cathodic protection for metal underground storage tanks according to NACE RP0285.
2. Survey site and determine soil or water corrosivity (resistivity), current requirements, potential surveys, stray currents, and water chemistry/corrosivity (pH).
3. Select anodes and accessories relevant to level of protection. Design anodes for an estimated life of 15 **OR** 30, **as directed**, years before replacement.
4. Cathodic protection systems shall provide protective potential that complies with referenced NACE standards. Insulators are required if needed to insulate protected metals from other structures.

D. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For cathodic protection. Include plans, evaluations, sections, details, and attachments to other work.
 - a. Detail locations of cathodic protection equipment, devices, and outlets, with characteristics and cross-references to products.
 - b. Include calculations and details of anode designs.
 - c. Include labeling and identifying scheme for wires, cables, and test boxes.
3. Delegated-Design Submittal: For cathodic protection system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified corrosion engineer responsible for their preparation.
 - a. Conduct site tests necessary for design, including soil resistivity, close-interval potential surveys, testing during construction, interference testing, and training of Owner's personnel.
 - b. Provide system design calculations, stating the maximum recommended anode current output density, and the rate of gaseous production, if any, at that current density.
4. Coordination Drawings: Plans, drawn to scale, and coordinating connections to piping and tanks.
5. Qualification Data: For qualified professional engineer. Submit evidence of current license, corporate authorization (if applicable) of the engineering business, and NACE certifications.
6. Field quality-control reports.
7. Operation and Maintenance Data: Include the following:
 - a. Basic system operation, outlining the step-by-step procedures required for system startup, operation, adjustment of current flow, and shutdown.
 - b. Instructions for pipe-to-reference cell and tank-to-reference cell potential measurements and frequency of monitoring.



- c. Instructions for dielectric connections, interference and sacrificial-anode bonds; and precautions to ensure safe conditions during repair of pipe, tank or other metallic systems. Instructions shall be neatly bound.
 - d. Locations of all anodes, test stations, and insulating joints.
 - e. Structure-to-reference cell potentials as measured during the tests required by "Field Quality Control" Article.
 - f. Recommendations for maintenance testing, including instructions for pipe-to-reference cell potential measurements and frequency of testing.
 - g. Precautions to ensure safe conditions during repair of pipe system.
- 8. Warranty: Sample of special warranty.
- E. Quality Assurance
 - 1. Corrosion Engineer Qualifications: A qualified professional engineer who has education and experience in cathodic protection of buried and submerged metal structures and has NACE accreditation or certification as a Corrosion Specialist or Cathodic Protection Specialist.
- F. Delivery, Storage, And Handling
 - 1. Protect anodes from exposure to rain and direct sunlight.
- G. Warranty
 - 1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace permanent reference electrodes that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period: 15 **OR** 30, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

- A. Magnesium Anodes, Type II
 - 1. Comply with ASTM B 843.
 - 2. Chemical composition as percent of weight shall be as follows:
 - a. Aluminum: 0.010 maximum.
 - b. Manganese: 0.50 to 1.3.
 - c. Zinc: 0.05 maximum.
 - d. Silicon: 0.50 maximum.
 - e. Copper: 0.02 maximum.
 - f. Nickel: 0.001 maximum.
 - g. Iron: 0.03 maximum.
 - h. Other Impurities: 0.05 each; 0.3 maximum total.
 - i. Magnesium: Remainder.
 - 3. Anode Core: Galvanized steel with anode wire silver-soldered to the core. Connection shall be recessed and epoxy insulated for 600-V rating. Connection shall be covered with heat-shrinkable tubing, and insulation shall be extended over connection.
 - 4. Anode Wires: Factory-installed cables, with copper conductors, suitable for direct burial; not less than No. 10 AWG with Type THWN insulation according to ASTM D 1248 and NEMA WC 70/ICEA S-95-658; long enough to extend to accompanying junction box without splicing.
 - 5. Anode Backfill: Backfill materials packaged in water-permeable fabric sack or cardboard container. Anodes shall be factory installed in packaged backfill using methods that result in dense packing of fill with factory-installed anode spacers to ensure centering of anode in packaged anode backfill. Backfill material shall have the following chemical composition by weight:
 - a. Hydrated Gypsum: 75 percent.
 - b. Bentonite Clay: 20 percent.
 - c. Anhydrous Sodium Sulfate: 5 percent.



- B. Magnesium/Manganese Alloy Anodes
1. Chemical composition as percent of weight shall be as follows:
 - a. Aluminum: 0.01 maximum.
 - b. Manganese: 0.50 to 1.3.
 - c. Copper: 0.02 maximum.
 - d. Nickel: 0.001 maximum.
 - e. Iron: 0.03 maximum.
 - f. Other Impurities: 0.05 each; 0.3 maximum total.
 - g. Magnesium: Remainder.
 2. Bare Anode Weight: 40 lb (18 kg), not including core, and a nominal length of 60 inches (1520 mm).
 3. Anode Wires: Factory-installed cables, with copper conductors, suitable for direct burial; not less than No. 10 AWG with Type THWN insulation according to ASTM D 1248 and NEMA WC 70/ICEA S-95-658; long enough to extend to accompanying junction box without splicing.
 4. Anode Backfill: Backfill materials packaged in water-permeable fabric sack or cardboard container. Anodes shall be factory installed in packaged backfill using methods that result in dense packing of fill with factory-installed anode spacers to ensure centering of anode in packaged anode backfill. Backfill material shall have the following chemical composition by weight:
 - a. Hydrated Gypsum: 75 percent.
 - b. Bentonite Clay: 20 percent.
 - c. Anhydrous Sodium Sulfate: 5 percent.
- C. Zinc Anodes For Buried Service, Type Z-1
1. Comply with ASTM B 418, Type II.
 2. Chemical composition as percent of weight shall be as follows:
 - a. Aluminum: 0.005 maximum.
 - b. Cadmium: 0.003 maximum.
 - c. Iron: 0.0014 maximum.
 - d. Zinc: Remainder.
 3. Bare Anode Ingot Weight: 30 lb (13.6 kg), 2 inches (50 mm) square and 30 inches (760 mm) long. Packaged weight of anode bag shall be 70 lb (32 kg).
 4. Anode Wires: Factory-installed cables, with copper conductors, suitable for direct burial; not less than No. 10 AWG with Type THWN insulation according to ASTM D 1248 and NEMA WC 70/ICEA S-95-658; long enough to extend to accompanying junction box without splicing.
 5. Anode Backfill: Backfill materials packaged in water-permeable fabric sack or cardboard container. Anodes shall be factory installed in packaged backfill using methods that result in dense packing of fill with factory-installed anode spacers to ensure centering of anode in packaged anode backfill. Backfill material shall have the following chemical composition by weight:
 - a. Hydrated Gypsum: 75 percent.
 - b. Bentonite Clay: 20 percent.
 - c. Anhydrous Sodium Sulfate: 5 percent.
- D. Permanent Reference Electrodes
1. Copper/copper sulfate (Cu/CuSO₄), suitable for direct burial. Electrode shall be guaranteed by supplier for 15 **OR** 30, **as directed**, years' service in the installed environment.
- E. Wire And Cable
1. Anode Header Cable: Single-conductor, Type HMWPE, insulated cable specifically designed for direct-buried dc service in cathodic protection installations.
 - a. Conductor: Stranded, annealed, uncoated copper, not less than No. 8 AWG, complying with ASTM B 3 and ASTM B 8.



- b. Insulation: High-molecular-weight polyethylene, complying with NEMA WC 70/ICEA S-95-658.
 - c. Minimum Average Thickness of Insulation: 110 mils (2.8 mm) for Nos. 8 through 2 AWG, and 125 mils (3.2 mm) for Nos. 1 through 4/0 AWG; rated at 600 V.
 - d. Connectors: Copper-compression type or exothermic welds.
 - 2. Conductors and Cables: Comply with requirements in Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
 - a. Bonding Conductors for Joint and Continuity Bonds: Not less than No. 8 AWG, stranded, Type THWN copper conductors.
 - b. Flexible Pipe Coupling Bonds: Flexible copper straps with electrical resistance equal to No. 1/0 AWG stranded copper wire and with five holes for five exothermic welds to pipe.
 - c. Test Wires: No. 12 AWG, Type THWN copper conductors.
 - d. Resistance Wires: No. 16 or No. 22 AWG nickel-chromium wire.
 - e. Cables for Installation in Conduit: Type THWN copper conductors.
- F. Test Stations
- 1. Plastic Test Stations: Flush-mounted type, manufactured of high-impact-resistant PVC or polycarbonate with watertight conduit connections and cover and removable terminal board having at least five terminals.
 - 2. Test Station Mounting Enclosures:
 - a. Non-Traffic-Area Boxes: Comply with requirements in Division 26 Section "Raceway And Boxes For Electrical Systems".
 - b. Traffic-Area Boxes: Comply with requirements in Division 26 Section "Underground Ducts And Raceways For Electrical Systems". Boxes shall have cast-iron covers with a welded bead legend "CP TEST."
- G. Sealing, Potting, And Dielectric Compounds
- 1. Sealing and Dielectric Insulating Compound: Comply with NACE RP0188. Black, rubber based, soft, permanently pliable, tacky, moldable, and unbacked; 0.125 inch (3 mm) **OR** 0.5 inch (13 mm), **as directed**, thick.
 - 2. Potting Compound: Comply with NACE RP0188. Cast-epoxy, two-package type; fabricated for this purpose and covered with heat-shrinkable tape.
 - 3. Pressure-Sensitive, Vinyl-Plastic Electrical Tape: Comply with UL 510.
- H. Exothermic Welding Materials
- 1. Exothermic Weld Kits: Specifically designed by manufacturer for welding materials and shapes required.
 - 2. Exothermic Weld Caps: Dome of high-density polyethylene, 10-mil (0.254-mm) minimum thickness, filled with mastic and containing a tunnel portion to separate lead wire from exothermic weld.
- I. Coating Repair Materials
- 1. Touchup Coating Materials: Comply with requirements in Division 09 Section "High-performance Coatings" for coating systems for touchup of factory-applied coatings.
 - 2. Adhesive-Applied Coating Materials: Coating materials shall be compatible with factory-applied coating system.
 - a. Nominal thickness of coating materials shall be not less than 8 mils (0.2 mm) **OR** 16 mils (0.4 mm) **OR** 24 mils (0.6 mm) **OR** 40 mils (1.0 mm) **OR** 60 mils (1.5 mm), **as directed**, plus or minus 5 percent.
 - b. Coating materials shall be one of the following supplied by factory-applied coating system manufacturer:
 - 1) Polyvinyl-chloride, pressure-sensitive, adhesive tape.
 - 2) High-density polyethylene/bituminous rubber compound tape.
 - 3) Butyl rubber tape.
 - 4) Coal-tar epoxy.



1.3 EXECUTION

A. General Installation Requirements

1. Comply with ANSI/IEEE C2 and NFPA 70.
2. Make connections to ferrous pipe and metal tanks using exothermic welding.
3. Coat welds with the coating repair material and apply an exothermic weld cap.

B. Magnesium Anode Installation

1. Install magnesium anodes at locations that clear obstructions. Install at least 36 inches (900 mm) and no more than 10 feet (3 m) from pipe or tank to be protected. Install in augered holes with top of anode 24 inches (600 mm) below pipe invert elevation **OR** a minimum of 36 inches (900 mm) below finished grade. In soils that will collapse into augered holes, use casing of galvanized sheet steel.
2. Install anodes in a dry condition after plastic or waterproof protective covering has been completely removed from water-permeable permanent container that houses anode metal. Do not use anode-connecting wire for lowering anode into hole. Backfill annular space around anode with fine earth in 6-inch (150-mm) layers; compact each layer using hand tools. Do not strike anode or connecting wire during backfilling and compacting. After backfilling and compacting to within 6 inches (150 mm) of finished grade, pour approximately 5 gal. (20 L) of water into each filled hole. After water has been absorbed by earth, complete backfilling to finished level.
3. If rock strata are encountered before achieving specified augured hole depth, install anodes horizontally at depth at least as deep as bottom of pipe to be protected.
4. Install anodes spaced as indicated, directly connected **OR** connected through a test station, **as directed**, to the pipeline, allowing slack in connecting wire to compensate for movement during backfill operation.
5. For tank protection, connect groups of anodes to collector cable. Make contact, through a test station, with tank to be protected.
6. Do not use resistance wires to reduce current output of individual or group anodes.

C. Zinc Anode Installation

1. Install zinc anode horizontally in a hole at least 3 inches (76 mm) larger than anode. Install anode under new copper water tubing, including service lines, blowoffs, and air releases. Separate piping and anode by at least 24 inches (600 mm), but not more than 60 inches (1520 mm).
2. Install anode midway between both ends of piping. Install anode wire in piping trench and connect to piping at an accessible location. Install anode wire in PVC conduit where rising out of the ground to the aboveground connection.

D. Installation Of Reference Electrodes

1. Install directly beneath the buried metallic component being protected.

E. Cable And Wire Installation

1. Install conductors, except anode wires, in PVC conduit with waterproof PVC junction boxes. Comply with requirements in Division 26 Section "Raceway And Boxes For Electrical Systems" for conduit and its installation.
2. Anode Wire Installation: Cover trench bottom for the anode wire with 3-inch (76-mm) layer of sand or stone-free earth. Center wire on backfill layer and do not stretch or kink the conductor. Place backfill over wire in layers not exceeding 6 inches (150 mm) deep, and compact each layer. Use clean fill, free from roots, vegetable matter, and refuse. Place cable underground-line warning tape within 18 inches (460 mm) of finished grade, above cable and conduit.
3. Bonding Conductors: Install conductors on metallic pipe and tanks, to and across buried flexible couplings, mechanical joints, and flanged joints except at places where insulating joints are specified. Welded and threaded joints are considered electrically continuous and do not require bonding.
 - a. Install at least two bonds between parts requiring bonding.



- b. Bonding conductors must contain sufficient slack for anticipated movement between structures. Bonding conductors across pipe joints shall have not less than a 4-inch (100-mm) slack for pipe expansion, contraction, and soil stress.
- c. Connect bonding conductors to pipe, coupling follower rings and coupling middle ring or sleeve. Connect bonding conductors with exothermic welds.
4. For wire splicing, use compression connectors or exothermic welds.

F. Test Stations

1. Install test stations as follows:
 - a. At 1000-foot (300-m) intervals.
 - b. At insulating joints.
 - c. At both ends of casings when casing material is included in the cathodic protection system.
 - d. Where pipe crosses other metal pipes.
 - e. Where pipe connects to existing piping system.
 - f. Where pipe connects to dissimilar metal pipe.
 - g. At each tank component.
2. Install test stations on backfill complying with requirements for trench bottom fill for anode wires unless otherwise indicated.
3. Terminate test conductors on terminal boards and install a spare set of test leads at each testing location.

G. Pipe Joints

1. Insulating Flange Sets: Cover flanges with sealing and dielectric compound.
2. Insulating Unions: Install electrical isolation at each building entrance and at other locations indicated on approved Delegated-Design Drawings. Cover unions with sealing and dielectric compound.

H. Insulating Pipe Sleeves

1. Install insulating sleeves between metallic piping and metal buildings, hangers, supports, and other metal structures. Completely surround the metallic pipe for the full length of the steel contact and effectively prevent contact between the cathodically protected metallic pipe and other metallic structures. Support insulating sleeve to prevent damage to coating and to accommodate relative movement, vibrations, and temperature differentials.

I. Dissimilar Metals

1. Underground Dissimilar Piping: Coat insulating joint and pipe at joints of dissimilar piping material with sealing and dielectric compound for a minimum distance of 10 pipe diameters on both sides of joint.
2. Underground Dissimilar Valves: Coat dissimilar ferrous valves and pipe with sealing and dielectric compound for a minimum distance of 10 pipe diameters on both sides of valve.
3. Aboveground Dissimilar Pipe and Valves: If dissimilar metal pipe joints and valves are not buried and are exposed only to atmosphere, coat connection or valve, including pipe, with sealing and dielectric compound for a minimum distance of three pipe diameters on both sides of junction.

J. Coatings

1. Field Joints: Apply adhesive-applied coating system in a thickness to achieve corrosion protection equal to adjacent factory-applied coating.

K. Identification

1. Comply with requirements in Division 26 Section "Identification For Electrical Systems".
 - a. Identify anode wires and anode header cables with marker tape.
 - b. Identify underground wires and cables with underground-line warning tape.
 - c. Identify text boxes with engraved, laminated acrylic or melamine label, permanently attached to text box.



- L. Field Quality Control
1. Comply with NACE RP0169 and NACE RP0285.
 2. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 3. Tests and Inspections:
 - a. Static Pull Test: Choose, at random, one completed anode of each type for this destructive test. Demonstrate that anode wire connections have enough strength to withstand a minimum tensile load of 300 lb (136 kg). If test fails, replace all anodes and repeat test at another randomly selected anode.
 - b. Insulation Testing: Before anode system is connected to pipe and tank, test insulation at each insulating joint and fitting. Demonstrate that no metallic contact, or short circuit, exists between the two insulated sections of pipe and tank. Replace defective joints or fittings.
 - c. Bonding Tests: Test for electrical continuity across all bonded joints. Repair or add additional bonds until electrical continuity is achieved.
 - d. Baseline Potentials: After backfilling of pipe, tank, and anodes is completed, but before anodes are connected to pipe and tank, measure the static potential of pipe and tank to soil. Record initial measurements.
 - e. Anode Output: Measure electrical current as anodes or groups of anodes are connected to pipe and tank. Use a low-resistance ammeter. Record current, date, time, and location of each measurement.
 - f. Pipe- and- Tank-to-Reference Electrode Potential Measurements: On completion of installation of entire cathodic protection system, make electrode potential measurements according to NACE RP0169, using a copper/copper-sulfate reference electrode and a potentiometer-voltmeter, or a dc voltmeter with an internal resistance (sensitivity) of not less than 100,000 ohms per volt and a full scale of 1 or 2 V. Make measurements at same locations as those used for baseline potentials. Record voltage, date, time, and location of each measurement, using one of the following two methods:
 - 1) 0.85 V Negative Voltage: With cathodic system in operation, measure a negative voltage of at least minus 0.85 V between pipe or tank and a saturated copper/copper-sulfate reference electrode contacting the earth directly over pipe or tank.
 - 2) 100-mV Polarization Voltage: Determine polarization voltage shift by interrupting protective current and measuring polarization decay. An immediate voltage shift will occur if protective current is interrupted. Use voltage reading, after immediate shift, as base reading from which to measure polarization decay. Measure at least a minimum polarization voltage shift of 100 mV between pipe or tank and a saturated copper/copper-sulfate reference electrode contacting the earth directly over pipe or tank.
 4. Location of Measurements for Piping: For coated piping or conduit, measure from reference electrode in contact with the earth directly over pipe. Measure at intervals not exceeding 400 feet (120 m). Make additional measurements at each distribution service riser, with reference electrode placed directly over service line.
 5. Location of Measurements for Tanks: For underground tanks, measure from reference electrode located as follows:
 - a. Directly over center of tank.
 - b. At a point directly over tank and midway between each pair of anodes.
 - c. At each end of tank.
 6. Interference Testing: Test interference with cathodic protection from any foreign pipes and tanks in cooperation with Owner of foreign pipes and tanks. Report results and recommendations.
 7. Stray Current Measurements: Perform at each test station. Mitigate stray currents due to lightning or overhead ac power transmission lines as provided for in NACE standards.
 8. Inspect coatings; comply with NACE RP0188. Repair imperfections of factory-applied coatings as specified in "Coatings" Article.



- a. Use electronic holiday detectors to detect coating imperfections.
- b. All damage to the protective coating during transit and handling shall be repaired before installation.
- c. Repair factory-applied coatings to have equal or better corrosion resistance than the factory-applied coating system. Field-repair material shall be of the type approved by, and shall be applied as recommended by, manufacturer of the coating material.

M. Adjusting

- 1. Adjust cathodic current using resistors as recommended by corrosion engineer who prepared the Delegated-Design Submittal in Part 1.1.
- 2. During the first year after Final Completion, test, inspect, and adjust cathodic protection system every three months to ensure its continued compliance with specified requirements.

N. Demonstration

- 1. Train Owner's maintenance personnel to adjust, operate, and maintain cathodic protection system.

END OF SECTION 26 42 13 00



Task	Specification	Specification Description
26 42 13 00	01 22 16 00	No Specification Required



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SECTION 26 43 13 00 - TRANSIENT VOLTAGE SUPPRESSION

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for transient voltage suppression. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes field-mounted TVSS for low-voltage (120 to 600 V) power distribution and control equipment.

C. Definitions

1. ATS: Acceptance Testing Specifications.
2. SVR: Suppressed voltage rating.
3. TVSS: Transient voltage surge suppressor(s), both singular and plural; also, transient voltage surge suppression.

D. Submittals

1. Product Data: For each type of product indicated. Include rated capacities, operating weights, electrical characteristics, furnished specialties, and accessories.
2. Field quality-control reports.
3. Operation and maintenance data.
4. Warranties: Sample of special warranties.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.
2. Comply with IEEE C62.41.2 and test devices according to IEEE C62.45.
3. Comply with NEMA LS 1.
4. Comply with UL 1283, **as directed**, and UL 1449.
5. Comply with NFPA 70.

F. Project Conditions

1. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 - a. Notify Owner no fewer than two days in advance of proposed electrical service interruptions.
 - b. Do not proceed with interruption of electrical service without Owner's written permission.
2. Service Conditions: Rate TVSS devices for continuous operation under the following conditions unless otherwise indicated:
 - a. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
 - b. Operating Temperature: 30 to 120 deg F (0 to 50 deg C).
 - c. Humidity: 0 to 85 percent, noncondensing.
 - d. Altitude: Less than 20,000 feet (6090 m) above sea level.

G. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within Five years from date of Final Completion.



2. Special Warranty for Cord-Connected, Plug-in Surge Suppressors: Manufacturer's standard form in which manufacturer agrees to repair or replace electronic equipment connected to circuits protected by surge suppressors.

1.2 PRODUCTS

A. Service Entrance Suppressors

1. Surge Protection Devices:

- a. Non-modular.
- b. LED indicator lights for power and protection status.
- c. Audible alarm, with silencing switch, to indicate when protection has failed.
- d. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.

OR

Surge Protection Devices:

- e. Comply with UL 1449.
 - f. Modular design (with field-replaceable modules) **OR** Non-modular design, **as directed**.
 - g. Fuses, rated at 200-kA interrupting capacity.
 - h. Fabrication using bolted compression lugs for internal wiring.
 - i. Integral disconnect switch (if a fused switch or circuit breaker is not provided for the TVSS in the panelboard and the TVSS will not have a direct bus bar connection).
 - j. Redundant suppression circuits.
 - k. Redundant replaceable modules.
 - l. Arrangement with copper bus bars and for bolted connections to phase buses, neutral bus, and ground bus.
- #### OR
- m. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 - n. LED indicator lights for power and protection status.
 - o. Audible alarm, with silencing switch, to indicate when protection has failed.
 - p. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
 - q. Four **OR** Six, **as directed**,-digit transient-event counter set to totalize transient surges.
2. Peak Single-Impulse Surge Current Rating: 320 kA per mode/640 kA **OR** 240 kA per mode/480 kA **OR** 160 kA per mode/320 kA, **as directed**, per phase.
 3. Minimum single impulse current ratings, using 8-by-20-mic.sec waveform described in IEEE C62.41.2
 - a. Line to Neutral: 70,000 A.
 - b. Line to Ground: 70,000 A.
 - c. Neutral to Ground: 50,000 A.
 4. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 V **OR** 208Y/120 V **OR** 600Y/347 V, **as directed**, 3-phase, 4-wire circuits shall be as follows:
 - a. Line to Neutral: 800 V for 480Y/277 V **OR** 400 V for 208Y/120 V **OR** 1200 V for 600Y/347 V, **as directed**.
 - b. Line to Ground: 800 V for 480Y/277 V **OR** 400 V for 208Y/120 V **OR** 1200 V for 600Y/347 V, **as directed**.
 - c. Neutral to Ground: 800 V for 480Y/277 V **OR** 400 V for 208Y/120 V **OR** 1200 V for 600Y/347 V, **as directed**.

OR

Protection modes and UL 1449 SVR for 240/120 V, single-phase, 3-wire circuits shall be as follows:



- a. Line to Neutral: 400 V.
- b. Line to Ground: 400 V.
- c. Neutral to Ground: 400 V.

OR

Protection modes and UL 1449 SVR for 240/120-V, 3-phase, 4-wire circuits with high leg shall be as follows:

- a. Line to Neutral: 400 V, 800 V from high leg.
- b. Line to Ground: 400 V.
- c. Neutral to Ground: 400 V.

OR

Protection modes and UL 1449 SVR for 240 V, 480 V, or 600 V, 3-phase, 3-wire, delta circuits shall be as follows:

- a. Line to Line: 2000 V for 480 V **OR** 1000 V for 240 V **OR** 2500 V for 600 V, **as directed**.
- b. Line to Ground: 2000 V for 480 V **OR** 1000 V for 240 V **OR** 2500 V for 600 V, **as directed**.

B. Panelboard Suppressors**1. Surge Protection Devices:**

- a. Non-modular.
- b. LED indicator lights for power and protection status.
- c. Audible alarm, with silencing switch, to indicate when protection has failed.
- d. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.

OR

Surge Protection Devices:

- a. Comply with UL 1449.
 - b. Modular design (with field-replaceable modules) **OR** Non-modular design, **as directed**.
 - c. Short-circuit current rating complying with UL 1449, and matching or exceeding the panelboard short-circuit rating and redundant suppression circuits; with individually fused metal-oxide varistors.
 - d. Fuses, rated at 200-kA interrupting capacity.
 - e. Fabrication using bolted compression lugs for internal wiring.
 - f. Integral disconnect switch (if a fused switch or circuit breaker is not provided for the TVSS in the panelboard and the TVSS will not have a direct bus bar connection).
 - g. Redundant suppression circuits.
 - h. Redundant replaceable modules.
 - i. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 - j. LED indicator lights for power and protection status.
 - k. Audible alarm, with silencing switch, to indicate when protection has failed.
 - l. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
 - m. Four **OR** Six, **as directed**, -digit transient-event counter set to totalize transient surges.
- 2. Peak Single-Impulse Surge Current Rating:** 160 kA per mode/320 kA **OR** 120 kA per mode/240 kA **OR** 80 kA per mode/160 kA, **as directed**, per phase.
- 3. Minimum single impulse current ratings, using 8-by-20-mic.sec waveform described in IEEE C62.41.2:**
- a. Line to Neutral: 70,000 A.
 - b. Line to Ground: 70,000 A.
 - c. Neutral to Ground: 50,000 A.
- 4. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 V **OR** 208Y/120 V **OR** 600Y/347 V, **as directed**, 3-phase, 4-wire circuits shall be as follows:**
- a. Line to Neutral: 800 V for 480Y/277 V **OR** 400 V for 208Y/120 V **OR** 1200 V for 600Y/347 V, **as directed**.



- b. Line to Ground: 800 V for 480Y/277 V **OR** 400 V for 208Y/120 V **OR** 1200 V for 600Y/347 V, **as directed**.
- c. Neutral to Ground: 800 V for 480Y/277 V **OR** 400 V for 208Y/120 V **OR** 1200 V for 600Y/347 V, **as directed**.

OR

Protection modes and UL 1449 SVR for 240/120-V, single-phase, 3-wire circuits shall be as follows:

- a. Line to Neutral: 400 V.
- b. Line to Ground: 400 V.
- c. Neutral to Ground: 400 V.

OR

Protection modes and UL 1449 SVR for 240/120-V, 3-phase, 4-wire circuits with high leg shall be as follows:

- a. Line to Neutral: 400 V, 800 V from high leg.
- b. Line to Ground: 400 V.
- c. Neutral to Ground: 400 V.

OR

Protection modes and UL 1449 SVR for 240 V, 480 V, or 600 V, 3-phase, 3-wire, delta circuits shall be as follows:

- a. Line to Line: 2000 V for 480 V **OR** 1000 V for 240 V **OR** 2500 V for 600 V, **as directed**.
- b. Line to Ground: 1500 V for 480 V **OR** 800 V for 240 V **OR** 2500 V for 600 V, **as directed**.

C. Enclosures

- 1. Indoor Enclosures: NEMA 250 Type 1 **OR** Type 12, **as directed**.
- 2. Outdoor Enclosures: NEMA 250 Type 3R **OR** Type 4 **OR** Type 4X, **as directed**.

1.3 EXECUTION

A. Installation

- 1. Install TVSS devices at service entrance on load side, with ground lead bonded to service entrance ground.
- 2. Install TVSS devices for panelboards and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
 - a. Provide multiple, 30 **OR** 60 **OR** 100, **as directed**, -A circuit breaker as a dedicated disconnecting means for TVSS unless otherwise indicated.

B. Field Quality Control

- 1. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- 2. Tests and Inspections:
 - a. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, "Surge Arresters, Low-Voltage Surge Protection Devices" Section. Certify compliance with test parameters.
 - b. After installing TVSS devices but before electrical circuitry has been energized, test for compliance with requirements.
 - c. Complete startup checks according to manufacturer's written instructions.
- 3. TVSS device will be considered defective if it does not pass tests and inspections.
- 4. Prepare test and inspection reports.

C. Startup Service



- a. Do not energize or connect service entrance equipment **OR** panelboards **OR** control terminals **OR** data terminals, **as directed**, to their sources until TVSS devices are installed and connected.
 - b. Do not perform insulation resistance tests of the distribution wiring equipment with the TVSS installed. Disconnect before conducting insulation resistance tests, and reconnect immediately after the testing is over.
- D. Demonstration
- a. Train Owner's maintenance personnel to maintain TVSS devices.

END OF SECTION 26 43 13 00



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SECTION 26 51 00 00 - MPF INTERIOR LIGHTING**

NOTE TO SPECIFIER

Use this Specification Section for Mail Processing Facilities only. This Specification is intended as a guide to the Architect/Engineer preparing the Construction Documents.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS FACILITIES, THROUGH THE CONTRACTING OFFICER'S REPRESENTATIVE.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Interior luminaires and accessories.
 - 2. Emergency lighting units.
 - 3. Exit signs.
 - 4. Ballasts.
 - 5. Lamps.
 - 6. Luminaire accessories.
- B. Substitutions:
 - 1. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Not allowed.
- C. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- D. Related Sections:
 - 1. Section 260500 - Common Work Results for Electrical: Basic electrical methods.
 - 2. Section 260623 - Lighting Control Devices.

1.2 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI C78.379 - Electric Lamps - Incandescent and High-Intensity Discharge Reflector Lamps - Classification of Beam Patterns.
 - 2. ANSI C82.1 - Ballasts for Fluorescent Lamps - Specifications.
- B. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA WD 6 - Wiring Devices-Dimensional Requirements.
- C. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code.



2. NFPA 101 - Life Safety Code.

D. Building Codes:

1. International Building Codes
2. National Electrical Code
3. State and Local Codes (where applicable)

E. Federal Communications Commission Parts 18.305, 18.307 (EMI RFI).

F. American Society of Heating, Refrigerating and Air Conditioning, Inc.

1. ANSI/ ASHRAE/ IES Standard 90.1 – 2010.

1.3 SUBMITTALS

A. Section 013300 - Submittals Procedures: Procedures for submittals.

1. Product Data: Provide dimensions, ratings, and performance data for each luminaire specified.
2. Assurance/Control Submittals:
 - a. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals:

1. Operation and Maintenance Data: Submit manufacturer's operation and maintenance instructions for each type of luminaire.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

B. Regulatory Requirements:

1. Conform to requirements of NFPA 70.
2. Conform to requirements of NFPA 101.
3. Products: Listed and classified by Underwriters Laboratories Incorporated as suitable for the purpose specified and indicated.

1.5 MAINTENANCE

A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.

B. Extra Products: At completion of installation, deliver to Contracting Officer.

1. Two of each luminaire lens type.
2. Each component type: Provide quantity for each unique ballast, and lamp equal to 2 percent of luminaire total, but not less than two of each type.

NOTE TO SPECIFIER

****REQUIRED PART (PRODUCTS) FOLLOWS. DO NOT REVISE THIS PART, EXCEPT AS NOTED BELOW, WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS FACILITIES, THROUGH THE CONTRACTING OFFICER'S REPRESENTATIVE.**



PART 2 - PRODUCTS

2.1 LUMINAIRE MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Belfer Group, Farmingdale, NJ (732) 493-2666.
 2. Canlet/Canplas Industries Ltd., Denver, CO (303) 373-1918.
 3. Chloride Systems, Burgaw, NC (910) 259-1000.
 4. Cooper Lighting (Halo, Invue, Lumark, McGraw-Edison, Metalux, Portfolio, Sure-Lites), Peachtree City, GA (770)486-4800.
 5. Day-Brite, Tupelo, MS (662) 842-7212.
 6. Dual-Lite, Cheshire, CT (203) 699-2000.
 7. Edison-Price Lighting, Long Island City, NY (718) 685-0700.
 8. Elcast Lighting, Addison, IL (630) 543-5390.
 9. Fostoria Process Equipment, Chicago, IL (800) 495-4525.
 10. Gardco Lighting, San Leandro, CA (800) 227-0758.
 11. Gotham Lighting, Conyers, GA (800) 315-4982.
 12. Guth Lighting, St. Louis, MO (314) 533-3200.
 13. H.E.Williams, Carthage, MO (417) 358-4065.
 14. Holophane, Newark, OH (740) 345-9631.
 15. Hubbell Lighting, Inc., (Columbia, Spaulding, Sterner) Spartanburg, SC (864) 599-6000.
 16. Indy Lighting, Fishers, IN (317) 849-1233.
 17. Kenall Manufacturing, Gurnee, IL (847) 360-8200.
 18. Kirlin Lighting, Detroit, MI (313) 259-6400.
 19. Kramer Lighting, Sturtevant, WI (800) 236-6800.
 20. Kurt Versen Company, Westwood, NJ (201) 664-8200.
 21. LaMar Lighting, Farming Dale, NY (631) 777-7700.
 22. LightAlarms (Thomas & Betts) Montreal, ON (888) 552-6467.
 23. Lighting Alternatives, Cherry Hill, NJ (877)847-1102.
 24. Lightolier, Fall River, MA (508) 679-8131.
 25. Lithonia Lighting, Conyers, GA (770) 922-9000.
 26. LSI Industries, Cincinnati, OH (513) 793-3200.
 27. Lumux Lighting Inc., Sacramento, CA (877) 895-5552.
 28. Nulite, Denver, CO (303) 287-9646.
 29. Omega Lighting, Tupelo, MS (800) 234-1890.
 30. Optimum Lighting, Henderson, NC (800) 541-9082.
 31. Pheonix Products, Milwaukee, WI (414) 438-1200.
 32. Prescolite Lighting, Spartanburg, SC (864) 599-6000.
 33. Prudential Lighting, Los Angeles, CA (213) 746-0360.
 34. Vista Lighting, Tupelo, MS (662) 690-4105.
 35. Zumtobel Staff, Highland, NY (800) 448-4131.

NOTE TO SPECIFIER

Edit for location and Luminaire Schedule.

2.2 LUMINAIRES

NOTE TO SPECIFIER

The USPS Design Criteria requires integral battery backup for fluorescent luminaires where mounting heights do not exceed 10 ft. – 0 in. AFF. The following luminaire types do not contain the necessary part numbers for



integral battery packs. Contact the manufacturer to identify part numbers for the battery backup version of the same luminaire.

NOTE TO SPECIFIER

Interior, linear, fluorescent luminaires shall utilize 28W lamps for low ceiling applications (10 ft. or less). Utilize 32Watt, 3000 lumen lamps for high ceiling applications (above 10 ft.) and in areas where the temperature will fall below 65 degrees F.

- A. Type A1 Lithonia 2SP8G Series.
 - 1. Description: Recessed, 2 ft. W x 4 ft. L x 4 in. D fluorescent grid troffer with acrylic lens non-air handling.
 - 2. Lens: Prismatic acrylic, A-12 pattern, 0.125 inches thick, 100 percent UV stabilized.
 - 3. Housing: 22 gauge steel body, flush steel door with mitered corners. Frame and housing finished with baked white enamel or powder coated finish.
 - 4. Ballast: For requirements refer to Ballast section below and for quantities, and circuitry refer to drawings.
 - 5. Mounting: Recessed in Inverted T suspended ceiling.
 - 6. Lamps: Two, three or four T8 as specified in the Lamps section below.
 - 7. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
 - 8. Alternate Manufacturers:
 - a. Lightolier SPS2 Series.
 - b. Metalux 2GC8 Series.
 - c. As listed in paragraph 2.1A.
- B. Type A2 Lithonia 2SP8F Series.
 - 1. Description: Recessed, 2 ft. W x 4 ft. L x 4 in. D or 2 ft. W x 4 ft. L x 4 in. D fluorescent flanged troffer with acrylic lens, non-air handling.
 - 2. Lens: Prismatic acrylic, A-12 pattern, 0.125 inches thick, 100 percent UV stabilized.
 - 3. Housing: 22 gauge steel body, flush steel door with mitered corners. Frame and housing finished with baked white enamel or powder coated finish.
 - 4. Ballast: For requirements refer to Ballast section below and for quantities, and circuitry refer to drawings.
 - 5. Mounting: Recessed in a gypsum board ceiling. Provide frame-in kit or plaster frame.
 - 6. Lamps: Two, three or four T8 as specified in the Lamps section below.
 - 7. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
 - 8. Alternate Manufacturers:
 - a. Lightolier SPS2 Series.
 - b. Metalux 2FC8 Series.
 - c. As listed in paragraph 2.1A.
- C. Type A3 Lithonia SP8G Series.
 - 1. Description: Recessed, 1 ft. W x 4 ft. L x 4 in. D fluorescent grid troffer, non-air handling.
 - 2. Lens: Prismatic acrylic, A-12 pattern, 0.125 inches thick, 100 percent UV stabilized.
 - 3. Housing: 22 gauge steel body, flush steel door with mitered corners. Frame and housing finished with baked white enamel or powder coated finish.
 - 4. Ballast: For requirements refer to Ballast section below and for quantities, and circuitry refer to drawings.
 - 5. Mounting: Recessed in inverted T suspended ceiling.
 - 6. Lamps: One or two T8 as specified in the Lamps section below.
 - 7. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
 - 8. Alternate Manufacturers:
 - a. Lightolier SPS1 Series.
 - b. Metalux GC8 Series.
 - c. As listed in paragraph 2.1A.



- D. Type A4 Lithonia SP8F Series.
1. Description: Recessed 1 ft. W x 4 ft. L x 4 in. D fluorescent flanged troffer with acrylic lens, non-air handling.
 2. Lens: Prismatic acrylic, A-12 pattern, 0.125 inches thick, 100 percent UV stabilized.
 3. Housing: 22 gauge steel, flush steel door with mitered corners, white baked enamel or powder coated finish.
 4. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings.
 5. Mounting: Recessed in gypsum board ceiling. Provide frame-in kit or plaster frame.
 6. Lamps: One or Two T8 as specified in the Lamps section below.
 7. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
 8. Alternate Manufacturers:
 - a. Metalux FC8 Series.
 - b. Lightolier SPS1 Series.
 - c. As listed in paragraph 2.1A.
- E. Type A5 Lithonia VC Series.
1. Description: 12 in. W x 4 ft. L x 3.25 in. D fluorescent wraparound luminaire, non-air handling.
 2. Lens: Injection molded prismatic acrylic, A-12 pattern, 0.187 inches thick, 100 percent UV stabilized.
 3. Housing: 20 gauge steel body with mitered corners. Housing: White baked enamel or powder coated finish.
 4. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings.
 5. Mounting: Surface ceiling mounted.
 6. Lamps: Two T8 as specified in the Lamps section below.
 7. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
 8. Alternate Manufacturers:
 - a. Lightolier CBS232 Series.
 - b. Metalux WBI Series.
 - c. As listed in paragraph 2.1A.
- F. Type A6 Lightolier #LS4RX32 Series.
1. Description: 6 in. W x 4 ft. L x 3 7/8 in. D fluorescent wraparound luminaire, non-air handling.
 2. Lens: Prismatic acrylic, A-12 pattern, 0.125 inches thick, 100 percent UV stabilized.
 3. Housing: 20 gauge steel with mitered corners. Housing: White baked enamel or powder coated finish.
 4. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings.
 5. Mounting: Surface ceiling mounted.
 6. Lamps: One or Two T8 as specified in the Lamps section below.
 7. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
 8. Alternate Manufacturers:
 - a. Metalux BC Series.
 - b. LSI Industries #TSW5X32 Series.
 - c. Prudential #5100T804WA Series.
 - d. As listed in paragraph 2.1A.
- G. Type B1 Lithonia DMS-ARDP Series.
1. Description: 4 ft. long enclosed and gasketed industrial fluorescent luminaire. UL listed for damp location.
 2. Lens: Deep high impact acrylic diffuser.
 3. Housing: Steel housing
 4. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings.
 5. Mounting: Surface.



6. Lamps: One, two or three T8 as specified in the Lamps section below.
7. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
8. Alternate Manufacturers:
 - a. Lightolier SC4 Series
 - b. Nulite DM Series
 - c. As listed in paragraph 2.1A.

H. Type B2 Lithonia DMST-ARDP Series.

1. Description: 8 ft. long enclosed and gasketed industrial fluorescent luminaire. UL listed for damp location.
2. Lens: Deep high impact acrylic diffuser.
3. Housing: Steel housing
4. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings.
5. Mounting: Surface.
6. Lamps: Two or four T8 as specified in the Lamps section below.
7. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
8. Alternate Manufacturers:
 - a. Lightolier SC4 Series (2 required)
 - b. Nulite DM-8 Series
 - c. As listed in paragraph 2.1A.

NOTE TO SPECIFIER

Utilize luminaire "B3" within unattended stairways to comply with ASHRAE 90.1 – 2010, 9.4.1.6.g.

I. Type B3 Newstar #V1C4N-232-RC-UN-WH-PR-OC.

1. Description: 4 ft. long enclosed and gasketed industrial fluorescent luminaire. UL listed for damp location.
2. Lens: High impact, clear ribbed, polycarbonate diffuser.
3. Housing: Extruded aluminum housing with cast aluminum end caps: White finish.
4. Ballast: (2) Single lamp ballasts. For requirements refer to Ballast section below and for quantities and circuitry refer to drawings.
5. Mounting: Surface wall or ceiling.
6. Lamps: One or two T8 as specified in the Lamps section below.
7. Luminaire shall be equipped with integral occupancy sensor to control (1) lamp.
8. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
9. Alternate Manufacturers:
 - a. Eclipse #574-CPR-2EB-WH-MS12-PRS
 - b. Luminaire #TSL94-2F32T8-2B-UNV-CP-WHT-DAMP
 - c. As listed in paragraph 2.1A.

J. Type CL1 Lithonia C Series.

1. Description; 4 ft. - 0 in. long, fluorescent lamp strip luminaire with protective tube guards around lamps.
2. Lens: None
3. Housing: 20 gauge cold rolled steel housing with punched knockouts for mounting. End plates shall be die-formed heavy gauge rolled steel with punched knockouts for through wiring. White baked enamel with a minimum 90 percent reflectance.
4. Ballast: For requirements refer to Ballast section below and for quantities, and circuitry refer to drawings.
5. Mounting:
 - a. Surface mounted to the underside of the ceiling. Attach luminaire to ceiling grid by means of a gripper hanger which attaches to any standard ceiling grid system.



- b. For spaces without ceiling, suspend from structure with all-thread rods to required height.
 - c. Electrical Contractor to determine quantity of hangers required for either method.
 - 6. Lamps: One or two T8 as specified in the Lamps section below.
 - 7. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
 - 8. Alternate Manufacturers:
 - a. Lightolier SW Series.
 - b. Metalux SS Series.
 - c. As listed in paragraph 2.1A.
- K. Type CL2 Lithonia C Series.
 - 1. Description; 3 ft. long, fluorescent strip luminaire with protective tube guards around lamps.
 - 2. Lens: None
 - 3. Housing: 20 gauge cold rolled steel housing with punched knockouts for mounting. End plates shall be die-formed heavy gauge rolled steel with punched knockouts for through wiring. White baked enamel or powder coated with a minimum 90 percent reflectance.
 - 4. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings.
 - 5. Mounting:
 - a. Surface mounted to the underside of the ceiling. Attach luminaire to ceiling grid by means of a gripper hanger which attaches to any standard ceiling grid system.
 - b. For spaces without ceiling, suspend from structure with all-thread rods to required height.
 - c. Electrical Contractor to determine quantity of hangers required for either method.
 - 6. Lamps: Two or four T8 as specified in the Lamps section below.
 - 7. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
 - 8. Alternate Manufacturers:
 - a. Lightolier SW Series.
 - b. Metalux SS Series.
 - c. As listed in paragraph 2.1A.
- L. Type EM1 Lithonia ELSQN-ELASRK Series.
 - 1. Description: Ceiling mounted semi-recessed 10.5 inch square decorative halogen emergency light unit with nickel-cadmium battery. Provide with line latching, solid-state voltage limiting charger, solid-state switching, low voltage disconnect, brownout circuit, overload, short-circuit protection test switch and power indicator light.
 - 2. Lens: Lexan lens.
 - 3. Housing: Black thermoplastic body, UL924 listed, all components meet the UL 94-0.5VA flame retardant standard.
 - 4. Mounting: Provide with manufacturer rough-in kit for semi-recessed installation.
 - 5. Voltage: [277] [120]
 - 6. Lamps: 10W Tungsten Halogen (included)
 - 7. Alternate Manufacturers:
 - a. Lightolier SI Series.
 - b. Sure-Lites USF1 Series.
 - c. As listed in paragraph 2.1A.
- M. Type EM2 Lithonia ELM627 Series.
 - 1. Description: Compact contemporary design krypton emergency lighting unit with adjustable heads and nickel-cadmium battery. Provide with line latching, solid-state voltage limiting charger, solid-state switching, low voltage disconnect, brownout circuit, overload, short-circuit protection test switch and power indicator light.
 - 2. Battery: Sealed, maintenance free Nickel-Cadmium, 6 volt, with 27 Watt capacity.
 - 3. Housing: White thermoplastic body, UL924 listed, all components meet the UL 94-0.5VA flame retardant standard.
 - 4. Mounting: Wall mounted.
 - 5. Voltage: [277] [120]
 - 6. Lamps: 9W krypton. (included)
 - 7. Alternate Manufacturers:



- a. Lightolier E2 Series.
 - b. Emergi-Lite #EC-2HC-AD-N.
 - c. As listed in paragraph 2.1A.
- N. Type EM3 Lithonia ELT24 Series.
 - 1. Description: Industrial design halogen emergency lighting unit with adjustable heads and nickel-cadmium battery. Provide with line latching, solid-state voltage limiting charger, solid-state switching, low voltage disconnect, brownout circuit, overload, short-circuit protection test switch and power indicator light.
 - 2. Battery: Sealed, maintenance free Nickel-Cadmium, 6 volt, with 24 Watt capacity.
 - 3. Housing: 18-gauge steel housing finished in instrument tan color, with hinged faceplate for ease of maintenance. UL924 listed, all components meet the UL 94-0.5VA flame retardant standard.
 - 4. Mounting: Wall mounted.
 - 5. Voltage: [277] [120].
 - 6. Lamps: 8W Halogen (included)
 - 7. Alternate Manufacturers:
 - a. Lightolier E4 Series.
 - b. Sure-Lites XR16 Series.
 - c. As listed in paragraph 2.1A.
- O. Type EM4 (exterior egress doors) Lithonia AFN/EXT Series.
 - 1. Description: Wall Mounted UL wet location Xenon emergency lighting unit
 - 2. Lamping: Sealed Beam 6 Watt-Xenon.
 - 3. Housing: UL listed wet location (NEMA 4X) heavy-duty polycarbonate sealed, gasketed, and corrosion resistant. Finish by contracting officer.
 - 4. Battery: Nickel-Cadmium, with self-diagnostics. Listed for cold weather (-40 degrees to 122 degrees F), wet locations.
 - 5. Mounting: Surface wall.
 - 6. Voltage: [277] [120]
 - 7. Lamps: Two 6 Watt-Xenon.
 - 8. Alternate Manufacturers:
 - a. Lightolier LVL Series.
 - b. Sure-Lites: AELI Series
 - c. As listed in paragraph 2.1A.

NOTE TO SPECIFIER

Ceiling mounted dock lights should be selected for all platforms. Luminaire to be controlled by dock door operation. Coordinate connection of control switch with dock door manufacturer.

- P. Type P1 Phoenix DL-INC-IR-GG1
 - 1. Description: Ceiling Mounted Dock Light with spring suspension swivel mounting, compact fluorescent provide light head with glare guard and timer control switch.
 - 2. Housing: Luminaire head of 18 gauge steel.
 - 3. Mounting: Swivel hanger for direct mounting to standard 4 inch junction box. Pendant to be 1/2 inch conduit with flexible spring for impact resistance and sufficient length to suspend center of light at 8 ft.- 6 in. AFF.
 - 4. Voltage: 120.
 - 5. Lamps: CF23EL/PAR38/BL/2/12 Sylvania
 - 6. Alternate Manufacturers:
 - a. Fostoria DKL-25-FLX + INC + GS-1

NOTE TO SPECIFIER



Exterior open platforms, canopies, docks, etc. to be lighted within coastal states, with hot and humid climates, shall be illuminated using wet location luminaires, type PL1 and/or PL2. The intent is to utilize luminaires type PL1/PL2 for applications where damp location luminaires B1/B2 are not appropriate.

- Q. Type PL1 (exterior platforms) Mark EXWL
1. Description: 4 ft. long enclosed and gasketed fluorescent luminaire. UL listed for wet location.
 2. Lens: 0.156 in. high impact, ribbed clear, polycarbonate diffuser.
 3. Housing: Extruded aluminum housing with die cast aluminum end caps.
 4. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings.
 5. Mounting: Surface.
 6. Voltage: [277] [120].
 7. Lamps: One or two T8 as specified in the Lamps section below.
 8. Climate Temperature: Provide 0 degrees F or -20 degrees F rated electronic ballast(s) in colder climates.
 9. Alternate Manufacturers:
 - a. Nulite DM Series (painted stainless steel housing)
 - b. Kenall SH548 Series (painted stainless steel housing)
 - c. As listed in paragraph 2.1A.
- R. Type PL2 (exterior platforms) Mark EXWL
1. Description: 8 ft. long enclosed and gasketed fluorescent luminaire. UL listed for wet location.
 2. Lens: 0.156 in. high impact, ribbed clear, polycarbonate diffuser.
 3. Housing: Extruded aluminum housing with die cast aluminum end caps.
 4. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings.
 5. Mounting: Surface.
 6. Voltage: [277] [120].
 7. Lamps: Two or four T8 as specified in the Lamps section below.
 8. Climate Temperature: Provide 0 degrees F or -20 degrees F rated electronic ballast(s) in colder climates.
 9. Alternate Manufacturers:
 - a. Nulite DM Series (painted stainless steel housing)
 - b. Kenall SH596 Series (painted stainless steel housing)
 - c. As listed in paragraph 2.1A.
- S. Type R1 Lightolier C4L10DL40KWHPVA-C4L10NZ10V.
1. Description: Recessed 4.5 inch dia. aperture LED downlight.
 2. Reflector: Low brightness, white painted, flangeless reflector.
 3. Ballast/Driver: 20 Watt/1000 Lumen LED light engine with remote phosphor technology; 5-year factory warranty.
 4. Mounting Frame: Frame to be 18 gauge galvanized steel ring. Mounting ring shall be secured to grid ceiling bar hangers (supplied with luminaire). NOTE: Luminaire frame to be supported from the structure by at least two opposing corners.
 5. Junction Box: Junction box to be code approved for through wiring. Junction box to be secured to the mounting ring and accessible from two sides. Junction box to be pre-wired and accessible per code through the ceiling trim opening.
 6. Mounting: 24 inch grid ceiling bar hangers shall be supplied by manufacturer and securely fastened to grid or provide 28 inch 'C' channel mounting bars and flange kit for drywall ceilings.
 7. Voltage: [277] [120].
 8. Lamp: 1000 Lumen, 4000 degree K, remote phosphor enclosed LED array; 60,000 hours at LLD = 0.7.
 9. Alternate Manufacturers:
 - a. Gotham #EVO41/104ARMDWH Series.
 - b. Portfolio #LD409D010ERM4840 Series.



c. As listed in paragraph 2.1A.

T. Type R3 Lithonia Lighting 2AVG/MDC Series.

1. Description: Recessed, 2 feet x 4 feet x 5.5 inches, fluorescent grid troffer with indirect louver.
2. Louver: Indirect, white metal diffuser, round holes with large center slots constructed of aluminum. Louver shall be held by internal spring catches and center itself in the housing when it is snapped-in.
3. Housing: 22 gauge steel, with white baked enamel or powder coated finish.
4. Ballast: For requirements refer to Ballast section below and for quantities, and circuitry refer to drawings.
5. Mounting: Recessed in inverted T suspended ceiling.
6. Lamps: Two or three T8 as specified in the Lamps section below.
7. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
8. Alternate Manufacturers:
 - a. Lightolier QVS2 Series.
 - b. Metalux 2RDI-SL5 Series.
 - c. As listed in paragraph 2.1A.

U. Type R4 Lithonia AVG/MDC series.

1. Description: Recessed 1 foot x 4 feet x 5.5 inches, fluorescent grid troffer with indirect louver.
2. Louver: Indirect, white metal diffuser, round holes with large center slots constructed of aluminum. Louver shall be held by internal spring catches and center itself in the housing when it is snapped-in.
3. Housing: 22 gauge steel with white baked enamel finish or powder coated finish. Housing shall be prepared in a three step process of cleaning, degreasing and washing prior to painting.
4. Ballast: For requirements refer to Ballast section below and for quantities, ballast factor, and circuitry refer to drawings.
5. Mounting: Recessed in inverted T suspended ceiling.
6. Lamps: One or two T8 as specified in the Lamps section below.
7. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
8. Alternate Manufacturers:
 - a. Lightolier QVS1 Series.
 - b. Metalux 2RDI-SLS Series.
 - c. As listed in paragraph 2.1A.

V. Type R5 Lightolier C6L1520D40KMWHP-C6L15N

1. Description: Recessed 6 inch dia. aperture LED downlight.
2. Reflector: Low brightness white painted, flangeless reflector.
3. Ballast/Driver: 27 Watt/1500 Lumen LED light engine with remote phosphor technology; 5-year factory warranty.
4. Mounting Frame: Frame to be 18 gauge galvanized steel ring. Mounting ring shall be secured to grid ceiling bar hangers (supplied with luminaire). NOTE: Luminaire frame to be supported from the structure by at least two opposing corners.
5. Junction Box: Junction box to be code approved for through wiring. Junction box to be secured to the mounting ring and accessible from two sides. Junction box to be pre-wired and accessible per code through the ceiling trim opening.
6. Mounting: 24 inch grid ceiling bar hangers shall be supplied by manufacturer and securely fastened to grid or provide 28 inch 'C' channel mounting bars and flange kit for drywall ceilings.
7. Voltage: [277] [120].
8. Lamp: 1500 Lumen, 4000 degree K, remote phosphor enclosed LED array; 60,000 hours at LLD = 0.7.
9. Alternate Manufacturers:
 - a. Gotham #EVO41/146ARMDWH Series.
 - b. Portfolio #LD615D010ERM6 Series
 - c. As listed in paragraph 2.1A.



- W. Type UC 1 Lithonia N2S Series.
1. Description: Under cabinet mounted 2' long, single fluorescent lamp luminaire, with solid front. Tandem wired.
 2. Housing: 20 gauge cold rolled steel. White polyester powder coat finish with 92% overall reflectance.
 3. Lens: Clear acrylic prismatic serrated diffuser shall snap into place without tools.
 4. Ballast: For requirements refer to Ballast section below and for quantities, ballast factor, and circuitry refer to drawings. Electrical contractor shall wire the lamp sockets to an adjacent UC 2 luminaire.
 5. Lamp: One T8 as specified in the Lamps section below.
 6. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
 7. Alternate Manufacturers:
 - a. Lightolier TCF Series.
 - b. Metalux OFCL Series.
 - c. As listed in paragraph 2.1A.
- X. Type UC 2 Lithonia N2S Series.
1. Description: Under cabinet mounted 3' long, single fluorescent lamp luminaire, with solid front. Tandem wired.
 2. Housing: 20 gauge cold rolled steel. White polyester powder coat finish with 92% overall reflectance.
 3. Lens: Clear acrylic prismatic serrated diffuser shall snap into place without tools.
 4. Ballast: For requirements refer to Ballast section below and for quantities, ballast factor, and circuitry refer to drawings. Ballast to operate this luminaire and an adjacent UC 1 luminaire where applicable. Individual lead lengths shall not exceed 18 feet.
 5. Lamp: One T8 as specified in the Lamps section below.
 6. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
 7. Alternate Manufacturers:
 - a. Lightolier TCF Series.
 - b. Metalux OFCL Series.
 - c. As listed in paragraph 2.1A.

NOTE TO SPECIFIER

Standard preferred lamps are 3,100 lumens but lower lumen lamps may be used in combination with ballast factor to achieve optimum efficiency at the lowest installed/operating cost and still meet required light levels.

- Y. Type W1 Lithonia TAF Series
1. Description: Cable/chain hung, 8 ft. long tandem, industrial fluorescent luminaire, providing 20 percent uplighting with locking lamp holders and protective tube guards.
 2. Louvers: None.
 3. Housing: Channel and end plates of formed steel, 20 gauge material thickness. Finished with 90% minimum reflectance, white baked enamel or powder coated.
 4. Ballast: For requirements refer to Ballast section below and for quantities, and circuitry refer to drawings.
 5. Mounting: Wire rope/chain from ceiling structure.
 6. Lamps: Two, four, six or eight T8 as specified in the Lamps section below.
 7. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
 8. Switching: See electrical drawings.
 9. Alternate Manufacturers:
 - a. Lightolier TU8 Series.
 - b. Metalux 8TDIM Series.
 - c. H.E. Williams "828" Series.
 - d. Lighting Alternatives "TURT8" Series.
 - e. Holophane "ICS08" Series.

- Z. Type W2 Lithonia AF Series.



1. Description: Cable/chain hung, 4 ft. long single, industrial fluorescent luminaire, providing 20 percent uplighting with locking lamp holders and protective tube guards. Use wire guards if specified on drawings.
 2. Louver: None.
 3. Housing: Channel and end plates of formed 20 gauge steel. Finished with 90% minimum reflectance white baked enamel or powder coated finish.
 4. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings.
 5. Mounting: Wire rope/chain from ceiling structure.
 6. Lamps: One, two, three or four T8 as specified in the Lamps section below.
 7. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
 8. Switching: See electrical drawings.
 9. Alternate Manufacturers:
 - a. Lightolier TU4 Series.
 - b. Metalux DIM Series.
 - c. H.E.Williams "824" Series.
 - d. Lighting Alternatives "TURT8" Series.
 - e. Holophane "ICS04" Series.
- AA. Type W6 Nulite TH Series.
1. Description: Cable/chain hung 4 ft. long high bay industrial fluorescent luminaire with wide beam distribution and protective tube guards; no wire guards.
 2. Housing: Impact and corrosion resistant, die formed aluminum (0.40 inches), painted after fabrication with 90% reflectance white or specular aluminum reflector, baked enamel or powder coated finish.
 - a. Welded, riveted or screwed rigid housing, 20 gauge, cold rolled steel is an acceptable housing.
 3. Ballast: For requirements refer to Ballast section below and for quantities, and circuitry refer to drawings.
 4. Mounting: Ceiling, 20' and above, wire rope/chain from ceiling structure.
 5. Lamps: Four, six or eight T8 as specified in the Lamps section below.
 6. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
 7. Alternate Manufacturers:
 - a. Lighting Alternatives FWHB24 Series.
 - b. Optimum Lighting G16 Series.
 - c. Metalux HBE Series.
 - d. LaMar Lighting MO Series.
 - e. H.E. Williams "GL" Series.
 - f. Holophane "HFN" Series.
 - g. Lithonia "FGB" Series.
- BB. Type XF1 (hazardous location) Canlet GFCF42H-GHC
1. Description: Vapor tight fluorescent luminaire UL listed for Class I, Div. 2, Groups C,D, hazardous locations.
 2. Lens: Heat and impact resistant glass globe.
 3. Housing: Body and guard of Lexan polycarbonate.
 4. Mounting: Surface ceiling mounted.
 5. Voltage: [277] [120]
 6. Lamps: One CF42DT/E/IN/841/ECO
 7. Alternate Manufacturer:
 - a. Hubbell NV21G15AHG-NV2FG42
 - b. Guth EXP-CFL42 Series.
 - c. As listed in paragraph 2.1A.



NOTE TO SPECIFIER

The exit sign luminaires specified below include a battery. If the Facility is equipped with emergency power delete the battery and connect the luminaire to an emergency circuit as necessary. Modify manufacturer number as necessary.

CC. Type X1 Lithonia LQM-ELN Series.

1. Description: Ceiling mount, single face LED exit sign with canopy. Self powered and with self diagnostics.
2. Features: Red Letters, White Stencil, White Housing (verify colors with local jurisdiction). Injection molded UL94-5V rated polycarbonate frame and canopy.
3. Mounting: Ceiling or end-mount.
4. Battery: Maintenance free sealed Nickel Cadmium with long life, full recharge time of 24 hours max.
5. Voltage: [277] [120].
6. Lamps: LED lamp module.
7. Alternate Manufacturers:
 - a. Lightolier LL Series.
 - b. Sure-Lites LPX7 Series.
 - c. As listed in paragraph 2.1A.

DD. Type X2 Lithonia LQM-ELN Series.

1. Description: Ceiling mount, double face LED exit sign with canopy. Self powered and with self diagnostics.
2. Features: Red Letters, White Stencil, White Housing (verify colors with local jurisdiction). Injection molded UL94-5V rated polycarbonate frame and canopy. Two bottom apertures snap out to emit downlight as required.
3. Mounting: Ceiling or end-mount.
4. Battery: Maintenance free sealed nickel-cadmium with long life, full recharge time of 24 hours maximum.
5. Voltage: [277] [120].
6. Lamps: LED lamp module.
7. Alternate Manufacturers:
 - a. Lightolier LL Series.
 - b. Sure-Lites LPX7 Series.
 - c. As listed in paragraph 2.1A.

EE. Type CIO2 Vista AGVSP-LED-DC-HL-C-ZN-WT-UNV-MW

1. Description: Recessed 9.25" w x 3.3" h x 4.3" d step light with L.E.D. source
2. Features: Die cast aluminum step light with louver face.
3. Housing: Back box constructed of die-cast aluminum alloy.
4. Louvers: Die-cast aluminum alloy.
5. Mounting: Recessed wall mounting.
6. Voltage: Universal (both 120 & 277)
7. Lamp: White LED's included
8. Alternate Manufacturers:
 - a. Kenall MSLS)DBCPWLL (9.25 inch W x 3.75 inch H x 3.5 inch D).
 - b. Lumux SL630/LED/BRONZE (10.25 inch W x 4 inch H x 3.25 inch D).
 - c. Elcast Lighting 1216-LED-UNV (7 inch W x 3 inch H x 3.5 inch D).
 - d. As listed in paragraph 2.1A.

2.3 ELECTRONIC FLUORESCENT LAMP BALLASTS

A. Manufacturers:

1. Advance Transformer Company, Rosemont, IL (847) 390-5000.
2. General Electric Co., Nela Park, OH (800) 435-2677



3. Osram/Sylvania, Danvers, MA (800) 544-4828.
4. Universal Lighting Technologies, Nashville, TN (615) 316-5100.

B. Description:

1. Fluorescent lamp ballasts shall be parallel lamp, high frequency, energy efficient, electronic program start ballasts operating lamps at a frequency above 42 kHz with a minimum power factor of 0.98 for primary lamp. Ballast shall be compatible for operating the lamps indicated. Ballast shall have a minimum ballast factor for primary lamp of 1.15. The lamp crest factor shall measure 1.7 or less. Ballasts shall meet or exceed all EMI and RFI standards of the Federal Communications Commission (FCC) regulations Part 18 (including 15J). Ballasts shall be UL labeled and comply with all local, State and Federal efficiency standards. Lamp and ballast combinations shall be chosen to provide a minimum efficacy of 94 LMS/Watt.

NOTE TO SPECIFIER

R&A Projects may require several ballast factor and lamp types due to the existing construction. Therefore, substitute the paragraph below in place of paragraph 2.3 B.1. for R&A projects. Delete paragraph for new construction.

1. Fluorescent lamp ballasts shall be parallel lamp, high frequency, energy efficient, electronic program start ballasts operating lamps at a frequency above 42 kHz with a minimum power factor of 0.98 for primary lamp. Ballast shall be compatible for operating the lamps indicated. Ballast shall have a minimum ballast factor for primary lamp of 0.71. The lamp crest factor shall measure 1.7 or less. Ballasts shall meet or exceed all EMI and RFI standards of the Federal Communications Commission (FCC) regulations Part 18 (including 15J). Ballasts shall be UL labeled and comply with all local, State and Federal efficiency standards. Lamp and ballast combinations shall be chosen to provide a minimum efficacy of 84 LMS/Watt.
2. Compact fluorescent ballasts shall be parallel lamp, high frequency, energy efficient, electronic ballasts operating at a frequency above 50 kHz with a minimum power factor of 0.96. Ballast shall have a minimum ballast factor of 0.97. Total harmonic distortion shall range from 5 to 13 percent, depending upon lamp/ballast combination. Compact fluorescent ballasts shall operate 10 to 42 Watt lamps. Ballasts shall be factory tested and meet ANSI 15 C62.41, ANSI C82.1 Class P. Ballasts integrated into flood light or other special application lamps should meet the specifications if available.

C. Provide five-year lamp and five-year ballast factory warranties

- D. Universal Voltage shall be used when available and cost effective. Otherwise use Voltage 120 or 277 volts as required to match source voltage.**

NOTE TO SPECIFIER

Include paragraph 2.3E. below if the lightning risk assessment calculation deems a building lightning protection system is required.

- E. All ballasted fluorescent luminaires shall be equipped with individual factory fuse protection.**

2.4 LAMPS

A. Fluorescent and High Intensity Discharge (HID) Lamp Manufacturers:

1. General Electric Company, Nela Park, OH (800) 435-2677.
2. Osram/Sylvania, Danvers, MA (800) 544-4828.
3. Philips Lighting Company, Somerset, NJ (800) 555-0050.



- B. Lamp Types: As specified for luminaire. Refer to Section 016000 for substitutions and product options.
- C. Linear Fluorescent Lamps
 - 1. Color Temperature: 4100K.
 - 2. Life: Lamp to be rated for a minimum of 60,000 hours based on the lamp operating with a program start ballast on 12-hour cycles.
- D. Reflector Lamp Beam Patterns: ANSI C78.379.
- E. Mercury content: Fluorescent lamps shall contain low mercury and pass the federal Toxic Characteristic Leaching Procedure (TCLP) test and be classified as non-hazardous waste. Lamp must be marked as such (i.e., green tips, green etchings, etc.)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Conform to Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install suspended luminaires and exit luminaire signs using pendants supported from swivel hangers, as applicable, or wire rope from ceiling structure, as applicable, or in accordance with details shown on drawings. Provide pendant/wire rope length required to suspend luminaire at indicated height.
- B. Support grid mounted recessed fluorescent luminaires at each corner using a minimum of four wire hangers of same gauge as ceiling suspension system supported from building structure independent of ceiling framing.
- C. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.
- D. Install surface mounted luminaires and exit luminaire signs plumb and adjust to align with building lines and with each other. Secure to prevent movement. Mount exit signs to outlet box mounted flush in wall or ceilings. Outlet box for ceiling mounted exit signs: Connect to rigid conduit system.
- E. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure.
- F. Install recessed luminaires to permit removal from below.
- G. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating. In fire rated ceilings recessed luminaires must carry 1 hour UL fire rating classification.
- H. Install earthquake clips to secure recessed grid-supported luminaires in place.



- I. Install wall mounted luminaires, emergency lighting units and exit luminaire signs at height as scheduled.
- J. Install accessories furnished with each luminaire.
- K. Bond products and metal accessories to branch circuit equipment grounding conductor.
- L. Install specified lamps in each emergency lighting unit, exit luminaire sign, and luminaire.

3.3 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Operate each luminaire after installation and connection. Inspect for proper connection and operation.
- C. Final acceptance for areas larger than 10,000 sq. ft. will be based on measurement of initial lighting levels after required hours of burn in as specified in USPS Mail Processing Facility Design Criteria, not maintained lighting levels.

3.4 ADJUSTING

- A. Aim and adjust luminaires as directed by Contracting Officer.
- B. Position exit luminaire sign directional arrows as indicated.

3.5 CLEANING

- A. Section 017300 - Execution: Cleaning installed work.
- B. Clean electrical parts to remove conductive and deleterious materials.
- C. Remove dirt and debris from enclosures.
- D. Clean photometric control surfaces as recommended by manufacturer.
- E. Clean finishes and touch up damage.
- F. Relamp luminaires with defective or burned out lamps just prior to Final Acceptance.

USPS Mail Processing Facility Specification issued: 5/1/2014
Last revised: 4/16/2014

END OF SECTION 26 51 00 00



SECTION 26 51 00 00 - CSF INTERIOR LIGHTING**

NOTE TO SPECIFIER

Use this Specification Section for Customer Service Facilities only. This Specification is intended as a guide to the Architect/Engineer preparing the Construction Documents.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS FACILITIES, THROUGH THE CONTRACTING OFFICER'S REPRESENTATIVE.**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior luminaires and accessories.
2. Emergency lighting units.
3. Exit signs.
4. Ballasts.
5. Lamps.
6. Luminaire accessories.

B. Substitutions:

1. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Not allowed.

C. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the work of this section. Additional requirements and information necessary to complete the work of this section may be found in other documents.

D. Related Sections:

1. Section 260500 - Common Work Results for Electrical.
2. Section 260623 - Lighting Controls.

1.2 REFERENCES

A. As specified in Section 260500 - Common Work Results for Electrical.

B. American National Standards Institute (ANSI):

1. ANSI C78.379 - Electric Lamps - Incandescent and High-Intensity Discharge Reflector Lamps - Classification of Beam Patterns.
2. ANSI C82.1 - Ballasts for Fluorescent Lamps - Specifications.

C. National Electrical Manufacturers Association (NEMA):

1. NEMA WD 6 - Wiring Devices-Dimensional Requirements.



- D. Federal Communications Commission Parts 18.305, 18.307 (EMI RFI).
- E. American Society of Heating, Refrigerating and Air Conditioning, Inc.
 - 1. ANSI/ ASHRAE/ IES Standard 90.1 – 2010.

1.3 SUBMITTALS

- A. As specified in Section 260500 – Common Work Results for Electrical.
 - 1. Product Data: Provide dimensions, ratings, and performance data for each luminaire specified.
 - 2. Assurance/Control Submittals:
 - a. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals:
 - 1. Operation and Maintenance Data: Submit manufacturer's operation and maintenance instructions for each type of luminaire.

1.4 QUALITY ASSURANCE

- A. As specified in Section 260500 - Common Work Results for Electrical.

1.5 MAINTENANCE

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Extra Products: At completion of installation, deliver to Contracting Officer.
 - 1. Two of each luminaire lens type.
 - 2. Each component type: Provide quantity for each unique ballast, relay, I/O module and lamp equal to 2 percent of luminaire total, but not less than two of each type.

NOTE TO SPECIFIER

****REQUIRED PART (PRODUCTS) FOLLOWS. DO NOT REVISE THIS PART, EXCEPT AS NOTED BELOW, WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS FACILITIES, THROUGH THE CONTRACTING OFFICER'S REPRESENTATIVE.**

PART 2 - PRODUCTS

2.1 LUMINAIRE MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Belfer Group, Farmingdale, NJ (732) 493-2666
 - 2. Canlet/Canplas Industries, Ltd., Denver, CO (303) 373-1918
 - 3. Chloride Systems, Burgaw, NC (910) 259-1000.
 - 4. Cooper Lighting (Halo, Invue, Lumark, Metalux, Portfolio, Sure-Lites), Peachtree City, GA (770)486-4800.
 - 5. Day-Brite, Tupelo, MS (662) 842-7212.



6. Dual-Lite, Cheshire, CT (203) 699-2000.
7. Edison-Price Lighting, Long Island City, NY (718) 685-0700.
8. Elcast Lighting, Addison, IL (630) 543-5390.
9. Fostoria Process Equipment, Chicago, IL (800) 495-4525.
10. Gardco Lighting, San Leandro, CA (800) 227-0758.
11. GE Lighting Systems, Charlotte, NC (803) 462-2016.
12. Gotham Lighting, Conyers, GA (800) 315-4982.
13. Guth Lighting, St. Louis, MO (314) 533-3200.
14. H.E. Williams, Carthage, MO (417) 358-4065.
15. Holophane, Newark, OH (740) 345-9631.
16. Hubbell Lighting, Inc., (Columbia, Spaulding, Sterner) Spartanburg, SC (864) 599-6000.
17. Indy Lighting, Fishers, IN (817) 849-1233.
18. Kenall Manufacturing, Gurnee, IL (847) 360-8200.
19. Kirlin Lighting, Detroit, MI (313) 259-6400.
20. Kramer Lighting, Sturtevant, WI (800) 236-6800.
21. Kurt Versen Company, Westwood, NJ (201) 664-8200.
22. LaMar Lighting, Farming Dale, NY (631) 777-7700.
23. LightAlarms (Thomas & Betts) Montreal, ON (888) 552-6467.
24. Lighting Alternatives, Cherry Hill, NJ (877) 847-1102.
25. Lightolier, Fall River, MA (508) 679-8131.
26. Lithonia Lighting, Conyers, GA (770) 922-9000.
27. LSI Industries, Cincinnati, OH (513) 793-3200.
28. Lumux Lighting, Inc., Sacramento, CA (877) 895-5552.
29. Nulite, Denver, CO (303) 287-9646.
30. Omega Lighting, Tupelo, MS (800) 234-1890.
31. Optimum Lighting, Henderson, NC (800) 541-9082.
32. Phoenix Products, Milwaukee, WI (414) 438-1200.
33. Prescolite Lighting, Spartanburg, SC (864) 599-6000.
34. Prudential Lighting, Los Angeles, CA (213) 746-0360.
35. Vista Lighting, Tupelo, MS (662) 690-4105.
36. Zumtobel Staff, Highland, NY (800) 448-4131.

NOTE TO SPECIFIER

Edit for location and Luminaire Schedule.

2.2 LUMINARIES

NOTE TO SPECIFIER

The USPS Design Criteria requires integral battery backup for fluorescent luminaires where mounting heights do not exceed 10 ft. – 0 in. AFF. The following luminaire types do not contain the necessary part numbers for integral battery packs. Contact the manufacturer to identify part numbers for the battery backup version of the same luminaire.

NOTE TO SPECIFIER

Interior, linear, fluorescent luminaires shall utilize 28W lamps for low ceiling applications (10 ft. or less). Utilize 32Watt, 3000 lumen lamps for high ceiling applications (above 10 ft.) and in areas where the temperature will fall below 65 degrees F.

- A. Type A1 Lithonia 2SP8G Series.
 1. Description: Recessed, 2' W x 4' L x 4" D fluorescent grid troffer with acrylic lens, non-air handling.
 2. Lens: Prismatic acrylic, A-12 pattern, 0.125 inches thick, 100% UV stabilized.



3. Housing: 22 gauge steel body, flush steel door with mitered corners. Frame and housing white baked enamel or powder coated finish.
 4. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings.
 5. Mounting: Recessed in Inverted T suspended ceiling.
 6. Lamps: Two, three or four T8 as specified in the Lamps section below.
 7. Marking: luminaires are to be labeled on the reflector side with lamp and ballast type used.
 8. Alternate Manufacturers:
 - a. Lightolier SPS2 Series.
 - b. Metalux 2GC8 Series.
 - c. As listed in paragraph 2.1A.
- B. Type A2 Lithonia 2SP8F Series.
1. Description: Recessed, 2' W x 4' L x 4" D fluorescent flanged troffer with acrylic lens, non-air handling.
 2. Lens: Prismatic acrylic, A-12 pattern, 0.125 inches thick, 100% UV stabilized.
 3. Housing: 22 gauge steel body, flush steel door with mitered corners. Frame and housing white baked enamel or powder coated finish.
 4. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings.
 5. Mounting: Recessed in a gypsum board ceiling. Provide frame-in kit or plaster frame.
 6. Lamps: Two, three or four T8 as specified in the Lamps section below.
 7. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
 8. Alternate Manufacturers:
 - a. Lightolier SPS2 Series.
 - b. Metalux 2FC8 Series.
 - c. As listed in paragraph 2.1A.
- C. Type A3 Lithonia SP8G Series.
1. Description: Recessed, 1' W x 4' L x 4" D fluorescent grid troffer with acrylic lens, non-air handling.
 2. Lens: Prismatic acrylic, A-12 pattern, 0.125 inches thick, 100% UV stabilized.
 3. Housing: 22 gauge steel body, flush steel door with mitered corners. Frame and housing white baked enamel or powder coated finish.
 4. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings.
 5. Mounting: Recessed in Inverted T suspended ceiling.
 6. Lamps: One or Two T8 as specified in the Lamps section below.
 7. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
 8. Alternate Manufacturers:
 - a. Lightolier SPS1 Series.
 - b. Metalux GC8 Series.
 - c. As listed in paragraph 2.1A.
- D. Type A4 Lithonia SP8F Series.
1. Description: Recessed 1' W x 4' L x 4" D fluorescent flanged troffer with acrylic lens, non-air handling.
 2. Lens: Prismatic acrylic, A-12 pattern, 0.125 inches thick, 100% UV stabilized.
 3. Housing: 22 gauge steel, flush steel door with mitered corners, white baked enamel or powder coated finish.
 4. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings.
 5. Mounting: Recessed in gypsum board ceiling. Provide frame-in kit or plaster frame.
 6. Lamps: One or Two T8 as specified in the Lamps section below.
 7. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.



8. Alternate Manufacturers:
 - a. Metalux FC8 Series.
 - b. Lightolier SPS1 Series.
 - c. As listed in paragraph 2.1A.

- E. Type A5 Lithonia VC Series.
 1. Description: 12" W x 4' L x 3.25" D fluorescent wraparound luminaire, non-air handling.
 2. Lens: Injection molded prismatic acrylic, A-12 pattern, 0.187 inches thick, 100% UV stabilized.
 3. Housing: 20 gauge steel body with mitered corners. Housing: White baked enamel or powder coated finish.
 4. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings.
 5. Mounting: Surface ceiling mounted.
 6. Lamps: Two T8 as specified in the Lamps section below.
 7. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
 8. Alternate Manufacturers:
 - a. Lightolier CBS232 Series.
 - b. Metalux WBI Series.
 - c. As listed in paragraph 2.1A.

- F. Type A6 Lightolier #LS4RX32.
 1. Description: 6" W x 4' L x 3 7/8" D fluorescent wraparound luminaire, non-air handling.
 2. Lens: Prismatic acrylic, A-12 pattern, 0.125 inches thick, 100% UV stabilized.
 3. Housing: 20 gauge steel with mitered corners. Housing: White baked enamel or powder coated finish.
 4. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings.
 5. Mounting: Surface ceiling mounted.
 6. Lamps: One or Two T8 as specified in the Lamps section below.
 7. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
 8. Alternate Manufacturers:
 - a. Metalux BC Series.
 - b. LSI Industries #TSW5X32 Series.
 - c. Prudential #5100T804WA Series.
 - d. As listed in paragraph 2.1A.

- G. Type B1 Lithonia DMS-ARDP Series.
 1. Description: 4 ft. long enclosed and gasketed industrial fluorescent luminaire. UL listed for damp location.
 2. Lens: Deep high impact acrylic diffuser.
 3. Housing: Steel housing
 4. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings.
 5. Mounting: Surface.
 6. Lamps: One, two or three T8 as specified in the Lamps section below.
 7. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
 8. Alternate Manufacturers:
 - a. Lightolier SC4 Series
 - b. Nulite DM Series
 - c. As listed in paragraph 2.1A.

- H. Type B2 Lithonia DMST-ARDP Series.
 1. Description: 8 ft. long enclosed and gasketed industrial fluorescent luminaire. UL listed for damp location.
 2. Lens: Deep high impact acrylic diffuser.
 3. Housing: Steel housing



4. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings.
5. Mounting: Surface.
6. Lamps: Two or four T8 as specified in the Lamps section below.
7. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
8. Alternate Manufacturers:
 - a. Lightolier SC4 Series (2 required)
 - b. Nulite DM-8 Series
 - c. As listed in paragraph 2.1A.

NOTE TO SPECIFIER

Utilize luminaire "B3" within unattended stairways to comply with ASHRAE 90.1 – 2010, 9.4.1.6.g.

- I. Type B3 Newstar #V1C4N-232-RC-UN-WH-PR-OC.
 1. Description: 4 ft. long enclosed and gasketed industrial fluorescent luminaire. UL listed for damp location.
 2. Lens: High impact, clear ribbed, polycarbonate diffuser.
 3. Housing: Extruded aluminum housing with cast aluminum end caps: White finish.
 4. Ballast: (2) Single lamp ballasts. For requirements refer to Ballast section below and for quantities and circuitry refer to drawings.
 5. Mounting: Surface wall or ceiling.
 6. Lamps: One or two T8 as specified in the Lamps section below.
 7. Luminaire shall be equipped with integral occupancy sensor to control (1) lamp.
 8. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
 9. Alternate Manufacturers:
 - a. Eclipse #574-CPR-2EB-WH-MS12-PRS
 - b. Luminaire #TSL94-2F32T8-2B-UNV-CP-WHT-DAMP
 - c. As listed in paragraph 2.1A.
- J. Type CL1 Lithonia C Series.
 1. Description; 4 ft. long, fluorescent strip luminaire with protective tube guards around lamps.
 2. Lens: None
 3. Housing: 20 gauge cold rolled steel housing with punched knockouts for mounting. End plates shall be die-formed heavy gauge rolled steel with punched knockouts for through wiring. White baked enamel or powder coated with a minimum 90 percent reflectance.
 4. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings.
 5. Mounting:
 - a. Surface mounted to the underside of the ceiling. Attach luminaire to ceiling grid by means of a gripper hanger which attaches to any standard ceiling grid system.
 - b. For spaces without ceiling, suspend from structure with all-thread rods to required height.
 - c. Electrical Contractor to determine quantity of hangers required for either method.
 6. Lamps: One or two T8 as specified in the Lamps section below.
 7. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
 8. Alternate Manufacturers:
 - a. Lightolier SW Series.
 - b. Metalux SS Series.
 - c. As listed in paragraph 2.1A.
- K. Type CL2 Lithonia C Series.
 1. Description; 3 ft. long, fluorescent strip luminaire with protective tube guards around lamps.
 2. Lens: None



3. Housing: 20 gauge cold rolled steel housing with punched knockouts for mounting. End plates shall be die-formed heavy gauge rolled steel with punched knockouts for through wiring. White baked enamel or powder coated with a minimum 90 percent reflectance.
 4. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings.
 5. Mounting:
 - a. Surface mounted to the underside of the ceiling. Attach luminaire to ceiling grid by means of a gripper hanger which attaches to any standard ceiling grid system.
 - b. For spaces without ceiling, suspend from structure with all-thread rods to required height.
 - c. Electrical Contractor to determine quantity of hangers required for either method.
 6. Lamps: Two or four T8 as specified in the Lamps section below.
 7. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
 8. Alternate Manufacturers:
 - a. Lightolier SW Series.
 - b. Metalux SS Series.
 - c. As listed in paragraph 2.1A.
- L. Type CV1 Lithonia S Series.
1. Description: 4 ft. long cove mounted; one lamp fluorescent narrow strip luminaire.
 2. Louver: Lay-in chrome parabolic cube louver for illuminated cove, manufactured by American Louver Company, Skokie, Illinois (800) 323-4250, or approved substitution. Cell size- 1 1/2 inch x 1 1/2 inch x 1 inch. Width and Length - Refer to plans.
 3. Louver to be shipped to the site and installed with the protective film. Once the final inspection has been conducted the film is to be removed.
 4. Housing: 20 gauge cold rolled steel with a painted exterior surface. Interlocked housing corners with positive locking and rigid construction. White baked enamel or powder coated finish with a minimum reflectivity of 90 percent.
 5. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings. Ballast to operate this luminaire and an adjacent CV2 luminaire where applicable.
 6. Individual lead lengths shall not exceed 18 feet.
 7. Mounting: Surface mounted to the underside of the cove on a 2 inch spacer.
 8. Louver lays into constructed cove on wall angles (furnished and installed by general contractor). Louver shall be made into lengths and configurations shown on plans and fill the cove end to end.
 9. Lamp: One T8 as specified in the Lamps section below.
 10. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
 11. Alternate Manufacturers:
 - a. Metalux SN Series.
 - b. Lightolier SN Series.
 - c. As listed in paragraph 2.1A.
- M. Type CV2 Lithonia S Series.
1. Description: 2 ft. long cove mounted; one lamp fluorescent narrow strip luminaire.
 2. Louver: Lay-in chrome parabolic cube louver for illuminated cove, manufactured by American Louver Company, Skokie, Illinois (800) 323-4250, or approved substitution Paracube II. Cell size- 1 1/2 inch x 1 1/2 inch x 1 inch. Width and Length - Refer to plans.
 3. Louver to be shipped to the site and installed with the protective film. Once the final inspection has been conducted the film is to be removed.
 4. Housing: 20 gauge cold rolled steel with a painted exterior surface. Interlocked housing corners with positive locking and rigid construction. White baked enamel finish with a minimum reflectivity of 90 percent.
 5. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings. Electrical contractor shall wire the lamp sockets to an adjacent CV1 or CV3 luminaire.
 6. Mounting: Surface mounted to the underside of the cove on a 2 inch spacer.
 7. Louver lays into constructed cove on wall angles (furnished and installed by general contractor). Louver shall be made into lengths and configurations shown on plans and fill the cove end to end.
 8. Lamp: One T8 as specified in the Lamps section below.



9. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
 10. Alternate Manufacturers:
 - a. Lightolier SN Series.
 - b. Metalux SN Series.
 - c. As listed in paragraph 2.1A.
- N. Type CV3 Lithonia S Series.
1. Description: 3 ft. long cove mounted; one lamp fluorescent narrow strip luminaire.
 2. Louver: Lay-in chrome parabolic cube louver for illuminated cove, manufactured by American Louver Company, Skokie, Illinois (800) 323-4250, or approved substitution Paracube II. Cell size- 1 1/2 inch x 1 1/2 inch x 1 inch. Width and Length - Refer to plans.
 3. Louver to be shipped to the site and installed with the protective film. Once the final inspection has been conducted the film is to be removed.
 4. Housing: 20 gauge cold rolled steel with a painted exterior surface. Interlocked housing corners with positive locking and rigid construction. White baked enamel finish with a minimum reflectivity of 90 percent.
 5. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings. Ballast to operate this luminaire and an adjacent CV2 luminaire where applicable.
 6. Individual lead lengths shall not exceed 18 feet.
 7. Mounting: Surface mounted to the underside of the cove on a 2 inch spacer.
 8. Louver lays into constructed cove on wall angles (furnished and installed by general contractor). Louver shall be made into lengths and configurations shown on plans and fill the cove end to end.
 9. Lamp: One T8 as specified in the Lamps section below.
 10. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
 11. Alternate Manufacturers:
 - a. Lightolier SN Series.
 - b. Metalux SN Series.
 - c. As listed in paragraph 2.1A.
- O. Type EM1 Lithonia ELSQMN-ELASRK Series.
1. Description: Ceiling mounted semi-recessed 10.5 inch square decorative halogen emergency light unit with nickel-cadmium battery. Provide with line latching, solid-state voltage limiting charger, solid-state switching, low voltage disconnect, brownout circuit, overload, short-circuit protection test switch and power indicator light.
 2. Lens: Lexan lens.
 3. Housing: Black thermoplastic body, UL924 listed, all components meet the UL 94-0.5VA flame retardant standard.
 4. Mounting: Provide with manufacturer rough-in kit for semi-recessed installation.
 5. Voltage: [277] [120]
 6. Lamps: 10W Tungsten Halogen (included)
 7. Alternate Manufacturers:
 - a. Lightolier SI Series
 - b. Sure-Lites USF1 Series
 - c. As listed in paragraph 2.1A.
- P. Type EM2 Lithonia ELM627 Series.
1. Description: Compact contemporary design krypton emergency light unit with adjustable heads and nickel-cadmium battery. Provide with line latching, solid-state voltage limiting charger, solid-state switching, low voltage disconnect, brownout circuit, overload, short-circuit protection test switch and power indicator light.
 2. Battery: Sealed, maintenance free Nickel-Cadmium, 6 volt, with 24 Watt capacity.
 3. Housing: White thermoplastic body, UL924 listed, all components meet the UL 94-0.5VA flame retardant standard.
 4. Mounting: Wall mounted.
 5. Voltage: [277] [120]



6. Lamps: 9W krypton. (included)
 7. Alternate Manufacturers:
 - a. Lightolier E2 Series
 - b. Emergi-Lite #EC-2HC-AD-N
 - c. As listed in paragraph 2.1A.
- Q. Type EM3 Lithonia ELT24Series.
1. Description: Industrial design halogen emergency light unit with adjustable heads and nickel-cadmium battery. Provide with line latching, solid-state voltage limiting charger, solid-state switching, low voltage disconnect, brownout circuit, overload, short-circuit protection test switch and power indicator light.
 2. Battery: Sealed, maintenance free Nickel-Cadmium, 6 volt, with 24 Watt capacity.
 3. Housing: 18-gauge steel housing finished in instrument tan color, with hinged faceplate for ease of maintenance. UL924 listed, all components meet the UL 94-0.5VA flame retardant standard.
 4. Mounting: Wall mounted.
 5. Voltage: [277] [120].
 6. Lamps: 8W Halogen (included)
 7. Alternate Manufacturers:
 - a. Lightolier E4 Series
 - b. Sure-Lites XR16 Series
 - c. As listed in paragraph 2.1A.
- R. Type EM4 (exterior egress doors) Lithonia AFN/EXT Series.
1. Description: Wall mounted wet location xenon emergency light unit
 2. Lamping: Sealed Beam 6 Watt xenon.
 3. Housing: UL listed wet location (NEMA 4X) heavy-duty polycarbonate sealed, gasketed, and corrosion resistant. Finish by contracting officer.
 4. Battery: Nickel-Cadmium, with self-diagnostics. Listed for cold weather (-40 degrees to 122 degrees F), wet locations.
 5. Mounting: Surface wall.
 6. Voltage: [277] [120].
 7. Lamps: Two 6 Watt xenon.
 8. Alternate Manufacturers:
 - a. Lightolier LVL Series
 - b. Sure-Lites: AEL1 Series
 - c. As listed in paragraph 2.1A.

NOTE TO SPECIFIER

Ceiling mounted dock lights should be selected for all platforms.

- S. Type P1 Phoenix DL-INC-IR-GG1
1. Description: Ceiling Mounted Dock Light with spring suspension swivel mounting, compact fluorescent light head with glare guard.
 2. Housing: Luminaire head of 18 gauge steel.
 3. Mounting: Swivel hanger for direct mounting to standard 4 inch junction box. Pendant to be 1/2 inch conduit with flexible spring for impact resistance and sufficient length to suspend center of light at 8 ft – 6 inch AFF.
 4. Voltage: 120.
 5. Lamps: CF23EL/PAR38/BL/2/12 Sylvania
 6. Alternate Manufacturers:
 - a. Fostoria DKL-25-FLX + INC + GS-1

NOTE TO SPECIFIER



Exterior open platforms, canopies, docks, etc. to be lighted within coastal states, with hot and humid climates, shall be illuminated using wet location luminaires, type PL1 and/or PL2. The intent is to utilize luminaires type PL1/PL2 for applications where damp location luminaires B1/B2 are not appropriate.

- T. Type PL1 (exterior platforms) Mark EXWL
 - 1. Description: 4 ft. long enclosed and gasketed fluorescent luminaire. UL listed for wet location.
 - 2. Lens: 0.156 in. high impact, ribbed clear, polycarbonate diffuser.
 - 3. Housing: Extruded aluminum housing with die cast aluminum end caps.
 - 4. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings.
 - 5. Mounting: Surface.
 - 6. Voltage: [277] [120].
 - 7. Lamps: One or two T8 as specified in the Lamps section below.
 - 8. Climate Temperature: Provide 0 degrees F or -20 degrees F rated electronic ballast(s) in colder climates.
 - 9. Alternate Manufacturers:
 - a. Nulite DM Series (painted stainless steel housing)
 - b. Kenall SH548 Series (painted stainless steel housing)
 - c. As listed in paragraph 2.1A.

- U. Type PL2 (exterior platforms) Mark EXWL
 - 1. Description: 8 ft. long enclosed and gasketed fluorescent luminaire. UL listed for wet location.
 - 2. Lens: 0.156 in. high impact, ribbed clear, polycarbonate diffuser.
 - 3. Housing: Extruded aluminum housing with die cast aluminum end caps.
 - 4. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings.
 - 5. Mounting: Surface.
 - 6. Voltage: [277] [120].
 - 7. Lamps: Two or four T8 as specified in the Lamps section below.
 - 8. Climate Temperature: Provide 0 degrees F or -20 degrees F rated electronic ballast(s) in colder climates.
 - 9. Alternate Manufacturers:
 - a. Nulite DM Series (painted stainless steel housing)
 - b. Kenall SH596 Series (painted stainless steel housing)
 - c. As listed in paragraph 2.1A.

- V. Type R1 Lightolier C4L10DL40KWHPVA-C4L10NZ10V.
 - 1. Description: Recessed 4.5 inch dia. aperture LED downlight.
 - 2. Reflector: Low brightness, white painted, flangeless reflector.
 - 3. Ballast/Driver: 20 Watt/1000 Lumen LED light engine with remote phosphor technology; 5-year factory warranty.
 - 4. Mounting Frame: Frame to be 18 gauge galvanized steel ring. Mounting ring shall be secured to grid ceiling bar hangers (supplied with luminaire). NOTE: Luminaire frame to be supported from the structure by at least two opposing corners.
 - 5. Junction Box: Junction box to be code approved for through wiring. Junction box to be secured to the mounting ring and accessible from two sides. Junction box to be pre-wired and accessible per code through the ceiling trim opening.
 - 6. Mounting: 24 inch grid ceiling bar hangers shall be supplied by manufacturer and securely fastened to grid or provide 28 inch 'C' channel mounting bars and flange kit for drywall ceilings.
 - 7. Voltage: [277] [120].
 - 8. Lamp: 1000 Lumen, 4000 degree K, remote phosphor enclosed LED array; 60,000 hours at LLD = 0.7.
 - 9. Alternate Manufacturers:
 - a. Gotham #EVO41/104ARMDWH Series.
 - b. Portfolio #LD409D010ERM4840 Series.



c. As listed in paragraph 2.1A.

- W. Type R2 Lightolier C4L10WW40KWHP-C4L10NZ10V
1. Description: Recessed 4.5 inch dia. aperture LED wallwasher type downlight.
 2. Reflector: Low brightness, white painted, flangeless reflector.
 3. Ballast/Driver: 20 Watt/1000 Lumen LED light engine with remote phosphor technology; 5-year factory warranty.
 4. Mounting Frame: Frame to be 18 gauge galvanized steel ring. Mounting ring shall be secured to ceiling bar hangers (supplied with luminaire). NOTE: Luminaire frame to be supported from the structure by at least two opposing corners.
 5. Junction Box: Junction box to be code approved for through wiring. Junction box to be secured to the mounting ring and accessible from two sides. Junction box to be pre-wired and accessible per code through the ceiling trim opening.
 6. Mounting: 24 inch grid ceiling bar hangers shall be supplied by manufacturer and securely fastened to grid or provide 28 inch "C" channel mounting bars and flange kit for drywall ceiling.
 7. Voltage: [277] [120].
 8. Lamp: 1000 Lumen, 4000 degree K, remote phosphor enclosed LED array; 60,000 hours at LLD = 0.7.
 9. Alternate Manufacturers:
 - a. Gotham #EVO41/104ARMDWH Series
 - b. Portfolio #LD409D010ERM4840 Series
 - c. As listed in paragraph 2.1A.
- X. Type R3 Lithonia Lighting 2AVG/MDC Series.
1. Description: Recessed, 2' W x 4' L x 5 1/2' D fluorescent grid troffer with indirect louver.
 2. Louver: Indirect white metal diffuser, round holes with large center slots, constructed of aluminum.. Louver shall be held by internal spring catches and center itself in the housing when it is snapped-in.
 3. Housing: 22 gauge steel with white baked enamel or powder coated finish.
 4. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings.
 5. Mounting: Recessed in Inverted T suspended ceiling.
 6. Lamps: Two or three T8 as specified in the Lamps section below.
 7. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
 8. Alternate Manufacturers:
 - a. Lightolier QVS2 Series.
 - b. MetaLux 2RDI-SL5 Series.
 - c. As listed in paragraph 2.1A.
- Y. Type R4 Lithonia AVG/MDC Series.
1. Description: Recessed 1' W x 4' L x 5 1/2" D, fluorescent grid troffer with indirect louver.
 2. Louver: Indirect white metal diffuser, round holes with large center slots, constructed of aluminum. Louver shall have a smooth, crack free, brilliant surface without iridescence. Louver shall be held by internal spring catches and center itself in the housing when it is snapped-in.
 3. Housing: 22 gauge steel with white baked enamel or powder coated finish.
 4. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings.
 5. Mounting: Recessed in inverted T suspended ceiling.
 6. Lamps: One or two T8 as specified in the Lamps section below.
 7. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
 8. Alternate Manufacturers:
 - a. Metalux RDI-SLS Series.
 - b. Lightolier QVS1 Series.
 - c. As listed in paragraph 2.1A.
- Z. Type R5 Lightolier C6L1520DL40KMWHP-C6L15N



1. Description: Recessed 6 inch dia. aperture LED downlight.
 2. Reflector: Low brightness, white painted, flangeless reflector.
 3. Ballast/Driver: 27 Watt/1500 Lumen LED light engine with remote phosphor technology; 5-year factory warranty.
 4. Mounting Frame: Frame to be 18 gauge galvanized steel ring. Mounting ring shall be secured to grid ceiling bar hangers (supplied with luminaire). NOTE: Luminaire frame to be supported from the structure by at least two opposing corners.
 5. Junction Box: Junction box to be code approved for through wiring. Junction box to be secured to the mounting ring and accessible from two sides. Junction box to be pre-wired and accessible per code through the ceiling trim opening.
 6. Mounting: 24 inch grid ceiling bar hangers shall be supplied by manufacturer and securely fastened to grid or provide 28 inch 'C' channel mounting bars and flange kit for drywall ceilings.
 7. Voltage: [277] [120].
 8. Lamp: 1500 Lumen, 4000 degree K, remote phosphor enclosed LED array; 60,000 hours at LLD = 0.7.
 9. Alternate Manufacturers:
 - a. Gotham #EVO41/146ARMDWH Series.
 - b. Portfolio #LD615D010ERM6 Series.
 - c. As listed in paragraph 2.1A.
- AA. Type UC1 Lithonia N2S Series.
1. Description: Under cabinet mounted 2' long, single fluorescent lamp luminaire, with solid front.
 2. Lens: Clear acrylic prismatic serrated diffuser shall snap into place without tools.
 3. Housing: 20 gauge cold rolled steel. White polyester powder coat finish with 92% overall reflectance.
 4. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings. Electrical contractor shall wire the lamp sockets to an adjacent UC 2 luminaire.
 5. Lamp: One T8 as specified in the Lamps section below.
 6. Alternate Manufacturers:
 - a. Lightolier TCF Series.
 - b. Metalux OFCL Series.
 - c. As listed in paragraph 2.1A.
- BB. Type UC2 Lithonia N2S Series.
1. Description: Under cabinet mounted 3' long, single fluorescent lamp luminaire, with solid front. Tandem Wired.
 2. Lens: Clear acrylic prismatic serrated diffuser shall snap into place without tools.
 3. Housing: 20 gauge cold rolled steel. White polyester powder coat finish with 92% overall reflectance.
 4. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings. Ballast to operate this luminaire and an adjacent UC 1 luminaire where applicable. Individual lead lengths shall not exceed 18 feet.
 5. Lamp: One T8 as specified in the Lamps section below.
 6. Alternate Manufacturers:
 - a. Lightolier TCF Series.
 - b. Metalux OFCL Series.
 - c. As listed in paragraph 2.1A.
- CC. Type W1 Lithonia TAF Series.
1. Description: Cable/chain hung, 8 ft. long (tandem), industrial fluorescent luminaire providing 20% uplighting with locking lampholders and protective tube guards.
 2. Louver: None.
 3. Housing: Channel and end plates of formed steel, 20 gauge material thickness. Finished with 90 percent minimum reflectance white baked enamel or powder coated.



4. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings.
 5. Mounting: Wire rope/chain from ceiling structure.
 6. Lamps: Two, four, six or eight T8 as specified in the Lamps section below.
 7. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
 8. Alternate Manufacturers:
 - a. Lightolier TU8 Series.
 - b. H.E. Williams 828 Series.
 - c. Metalux 8TDMF Series.
 - d. Lighting Alternatives TURT8 Series.
 - e. Holophane ICS08 Series.
- DD. Type W2 Lithonia AF Series.
1. Description: Cable/chain hung, 4 ft. long, industrial fluorescent luminaire providing 20 percent uplighting, with locking lampholders and protective tube guards.
 2. Louver: None.
 3. Housing: Channel and end plates of formed steel, 20 gauge material thickness. Finished with 90 percent minimum reflectance white baked enamel or powder coated.
 4. Ballast: For requirements refer to Ballast section below and for quantities and circuitry refer to drawings.
 5. Mounting: Wire rope/chain from ceiling structure.
 6. Lamps: One, two, three or four T8 as specified in the Lamps section below.
 7. Marking: Luminaires are to be labeled on the reflector side with lamp and ballast type used.
 8. Switching: See electrical drawings for dual level workroom lighting requirements.
 9. Alternate Manufacturers:
 - a. Lightolier TU4 Series.
 - b. H.E. Williams 824 Series.
 - c. Metalux DMF Series.
 - d. Lighting Alternatives TURT8 Series.
 - e. Holophane ICS04 Series.
- EE. Type XF1 (hazardous location) Canlet GFCF42H-GHC
1. Description: Vapor tight fluorescent luminaire UL listed for Class I, Div. 2, Groups C,D, hazardous locations.
 2. Lens: Heat and impact resistant glass globe.
 3. Housing: Body and guard of Lexan polycarbonate.
 4. Mounting: Surface ceiling mounted.
 5. Voltage: [277] [120]
 6. Lamps: One CF42DT/E/IN/841/ECO
 7. Alternate Manufacturer:
 - a. Hubbell NV21G15AHG-NV2FG42
 - b. Guth EXP-CFL42 Series.
 - c. As listed in paragraph 2.1A.

NOTE TO SPECIFIER

The exit sign luminaires specified below include a battery. If the Facility is equipped with emergency power delete the battery and connect to an emergency circuit as appropriate. Modify manufacturer number as necessary.

- FF. Type X1 Lithonia LQM-ELN Series.
1. Description: Ceiling mount, single face LED exit sign with canopy. Self Powered and with self diagnostics.
 2. Features: Red Letters, White Stencil, White Housing (verify colors with local jurisdiction). Injection molded UL94-5V rated polycarbonate frame and canopy.
 3. Mounting: Ceiling or end-mount.



4. Battery: Maintenance free sealed Nickel Cadmium with long life, full recharge time of 24 hours max.
5. Voltage: [277] [120].
6. Lamps: LED lamp module.
7. Alternate Manufacturers:
 - a. Sure-Lites LPX7 Series.
 - b. Lightolier LL Series.
 - c. As listed in paragraph 2.1A.

GG. Type X2 Lithonia LQM-ELN Series.

1. Description: Ceiling mount, double face LED exit sign with canopy.
2. Features: Red Letters, White Stencil, White Housing (verify colors with local jurisdiction). Injection molded UL94-5V rated polycarbonate frame and canopy. Two bottom apertures snap out to emit downlight as required.
3. Mounting: Ceiling or end-mount.
4. Battery: Maintenance free sealed nickel-cadmium with long life, full recharge time of 24 hours maximum.
5. Voltage: [277] [120].
6. Lamps: LED lamp module.
7. Alternate Manufacturers:
 - a. Sure-Lites LPX7 Series.
 - b. Lightolier LL Series.
 - c. As listed in paragraph 2.1A.

HH. Type CIO2 Vista AGVSP-LED-DC-HL-C-ZN-WT-UNV-MW

1. Description: Recessed 9.25" w x 3.3" h x 4.3" d step light with L.E.D. source
2. Features: Die cast aluminum step light with louver face.
3. Housing: Back box constructed of die-cast aluminum alloy.
4. Louvers: Die-cast aluminum alloy.
5. Mounting: Recessed wall mounting.
6. Voltage: Universal (both 120 & 277)
7. Lamp: White LED's included
8. Alternate Manufacturers:
 - a. Kenall MSLS)DBCPWLL (9.25 inch W x 3.75 inch H x 3.5 inch D)
 - b. Lumux SL630/LED/BRONZE (10.25 inch W x 4 inch H x 3.25 inch D)
 - c. Elcast Lighting 1216 LED-UNV (7 inch W x 3 inch H x 3.5 inch D)
 - d. As listed in paragraph 2.1A.

2.3 ELECTRONIC FLUORESCENT LAMP BALLASTS

A. Manufacturers:

1. Advance Transformer Company, Rosemont, IL (847) 390-5000.
2. General Electric Co., Nela Park, OH (800) 435-2677.
3. Osram/Sylvania, Danvers, MA (800) 544-4828.
4. Universal Lighting Technologies, Nashville, TN (615) 316-5100.

B. Description:

1. Fluorescent lamp ballast shall be parallel lamp, high frequency, energy efficient, electronic program start ballasts operating lamps at a frequency above 42 kHz with a minimum Power Factor of 0.98 for primary lamp. Ballast shall be compatible for operating the lamps indicated. Ballast shall have a minimum Ballast Factor for primary lamp of 1.15. The lamp crest factor shall measure 1.7 or less. Ballasts shall meet or exceed all EMI and RFI standards of the Federal Communications Commission (FCC) regulations Part 18 (including 15J). Ballasts shall be UL labeled and comply with all local, State and Federal efficiency standards. Lamp and ballast combinations shall be chosen to provide a minimum efficacy of 94 LMS/Watt.



NOTE TO SPECIFIER

R&A Projects may require several ballast factor and lamp types due to the existing construction. Therefore, substitute the paragraph below in place of paragraph 2.3 B.1. for R&A projects. Delete paragraph for new construction.

1. Fluorescent lamp ballasts shall be parallel lamp, high frequency, energy efficient, electronic program start ballasts operating lamps at a frequency above 42 kHz with a minimum power factor of 0.98 for primary lamp. Ballast shall be compatible for operating the lamps indicated. Ballast shall have a minimum ballast factor for primary lamp of 0.71. The lamp crest factor shall measure 1.7 or less. Ballasts shall meet or exceed all EMI and RFI standards of the Federal Communications Commission (FCC) regulations Part 18 (including 15J). Ballasts shall be UL labeled and comply with all local, State and Federal efficiency standards. Lamp and ballast combinations shall be chosen to provide a minimum efficacy of 84 LMS/Watt.
 2. Compact fluorescent ballasts shall be parallel lamp, high frequency, energy efficient, electronic ballasts operating at a frequency above 50 kHz with a minimum Power Factor of 0.96. Ballast shall have a minimum ballast factor of 0.97. Total harmonic distortion shall range from 5 to 13%, depending upon lamp/ballast combination. Compact fluorescent ballasts shall operate 10 to 42 Watt lamps. Ballasts shall be factory tested and meet ANSI 15 C62.41, ANSI C82.1 Class P. Ballasts integrated into flood light or other special application lamps should meet the specifications if available.
- C. Provide five-year lamp and five-year ballast factory warranties.
- D. Universal Voltage shall be used when available and cost effective. Otherwise use 120 or 277 volts as required to match source voltage.

NOTE TO SPECIFIER

Include paragraph 2.3E. below, if the lightning risk assessment calculation deems a building lightning protection system is required.

- E. All ballasted fluorescent luminaires shall be equipped with individual factory fuse protection.

2.4 LAMPS

- A. Fluorescent and High Intensity Discharge (HID) Lamp Manufacturers:
 1. General Electric Company, Nela Park, OH (800) 435-2677.
 2. Osram/Sylvania, Danvers, MA (800) 544-4828.
 3. Philips Lighting Company, Somerset, NJ (800) 555-0050.
- B. Lamp Types: As specified for luminaire. Refer to Section 016000 for substitutions and product options.
- C. Linear Fluorescent Lamps
 1. Color Temperature: 4100K
 2. Life: Lamp to be rated for a minimum of 60,000 hours based on the lamp operating with a program start ballast on 12-hour cycles.
- D. Reflector Lamp Beam Patterns: ANSI C78.379.
- E. Mercury Content: Fluorescent lamps must contain low mercury and pass the federal Toxic Characteristic Leaching Procedure (TCLP) test and be classified as non-hazardous waste. Lamp must be marked as such (i.e., green tips, green etchings, etc.)



PART 3 - EXECUTION

3.1 EXAMINATION

- A. As specified in Section 260500 – Common Work Results for Electrical.

3.2 INSTALLATION

- A. Install suspended luminaires and exit luminaire signs using pendants supported from swivel hangers, as applicable, or wire rope from ceiling structure, as applicable, or in accordance with details shown on drawings. Provide pendant/wire rope length required to suspend luminaire at indicated height.
- B. Support grid mounted, recessed fluorescent luminaires at each corner using a minimum of four wire hangers of same gauge as ceiling suspension system supported from building structure independent of ceiling framing.
- C. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.
- D. Install surface mounted luminaires and exit luminaire signs plumb and adjust to align with building lines and with each other. Secure to prevent movement. Mount exit signs to outlet box mounted flush in wall or ceilings. Outlet box for ceiling mounted exit signs: Connect to rigid conduit system.
- E. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure.
- F. Install recessed luminaires to permit removal from below.
- G. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating. In fire rated ceilings recessed luminaires must carry 1 hour UL fire rating classification.
- H. Install earthquake clips to secure recessed grid-supported luminaires in place.
- I. Install wall mounted luminaires, emergency lighting units and exit luminaire signs at height as scheduled.
- J. Install accessories furnished with each luminaire.
- K. Bond products and metal accessories to branch circuit equipment grounding conductor.
- L. Install specified lamps in each emergency lighting unit, exit luminaire sign, and luminaire.

3.3 FIELD QUALITY CONTROL

- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. Operate each luminaire after installation and connection. Inspect for proper connection and operation.
- C. Final acceptance for areas larger than 10,000 sq. ft. will be based on measurement of initial lighting levels after required hours of burn in as specified in USPS Customer Service Facilities Design Criteria, not maintained lighting levels.



3.4 ADJUSTING

- A. Aim and adjust luminaires as directed by Contracting Officer.
- B. Position exit luminaire sign directional arrows as indicated.

3.5 CLEANING

- A. Conform to Section 017300 - Execution: Cleaning installed work.
- B. Clean electrical parts to remove conductive and deleterious materials.
- C. Remove dirt and debris from enclosures.
- D. Clean photometric control surfaces as recommended by manufacturer.
- E. Clean finishes and touch up damage.
- F. Relamp any luminaires with defective or burned out lamps, just prior to Final Acceptance.

USPS CSF Specifications issued: 5/1/2014
Last revised: 4/16/2014

END OF SECTION 26 51 00 00



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Task	Specification	Specification Description
26 51 13 00	01 22 16 00	No Specification Required
26 54 00 00	01 22 16 00	No Specification Required



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SECTION 26 56 00 00 - CSF EXTERIOR LIGHTING**

NOTE TO SPECIFIER

Use this Specification Section for Customer Service Facilities only. This Specification is intended as a guide to the Architect/Engineer preparing the Construction Documents.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT WRITTEN DEVIATION FROM USPS HEADQUARTERS FACILITIES THROUGH THE CONTRACTING OFFICER'S REPRESENTATIVE.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Exterior luminaires and accessories.
 - 2. Poles.
 - 3. Ballasts
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the work of this section. Additional requirements and information necessary to complete the work of this section may be found in other documents.
- C. Related Sections
 - 1. As specified in Section 260500 - Common Work Results for Electrical.
 - 2. Section 033000 - Cast-in-Place Concrete.
 - 3. Section 260623 - Lighting Controls.

1.2 REFERENCES

- A. As specified in Section 260500 - Common Work Results for Electrical.
- B. American National Standards Institute (ANSI):
 - 1. ANSI C78.379 - Electric Lamps - Incandescent and High-Intensity Discharge Reflector Lamps - Classification of Beam Patterns.
 - 2. ANSI C82.4 - Ballasts for High-Intensity-Discharge and Low Pressure Sodium Lamps (Multiple-Supply Type).
- C. Illuminating Engineering Society North America (IESNA):
 - 1. IESNA RP-8 - Recommended Practice for Roadway Lighting.
 - 2. IESNA RP-20 - Recommended Practice for Lighting for Parking Facilities.
 - 3. IESNA RP-33 - Recommended Practice for Lighting for Exterior Environments.
- D. Federal Communications Commission Parts 18.305, 18.307 (EMI RFI).



- E. American Society of Heating, Refrigerating and Air Conditioning, Inc.
 - 1. ANSI/ ASHRAE/ IES Standard 90.1 – 2010.

1.3 SUBMITTALS

- A. As specified in Section 260500 – Common Work Results for Electrical.
 - 1. Product Data:
 - a. Luminaire dimensions, ratings, and performance data.
 - b. Complete computer data printout of illumination levels based on a 5 ft. by 5 ft. grid pattern.
 - 2. Shop Drawings:
 - a. Indicate dimensions and components for each luminaire which is not a standard Product of the manufacturer.
 - b. Indicate illumination levels in accordance with layout and scheduled luminaires indicated on Drawings.

1.4 QUALITY ASSURANCE

- A. As specified in Section 260500 – Common Work Results for Electrical.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Material and Equipment: Transport, Handle, Store, and Protect Products.

1.6 MAINTENANCE

- A. Section 017704 – Closeout Procedures and Training. Procedures for closeout submittals.
- B. Extra Products: At completion of installation, deliver to Contracting Officer.
 - 1. Each component type: Provide quantity for each unique ballast, surge protector and lamp equal to two (2) percent of luminaire total, but not less than two of each type.

NOTE TO SPECIFIER

****REQUIRED PART (PRODUCTS) FOLLOWS. DO NOT REVISE THIS PART, EXCEPT AS NOTED BELOW, WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS FACILITIES, THROUGH THE CONTRACTING OFFICER'S REPRESENTATIVE.**

PART 2 - PRODUCTS

2.1 LUMINAIRE MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Architectural Landscape Lighting, Santa Ana, CA 92704 (714) 668-1107.
 - 2. Barron Lighting Group (Trace-Lite), Phoenix, AZ 85027 (888) 533-3948.
 - 3. Bronzelite Commercial Landscape Lighting, (800) 273-1569.
 - 4. Cooper Lighting (Halo, Invue, Lumark, Lumiere, McGraw-Edison, Portfolio), Peachtree City, GA (770) 486-4800.
 - 5. Gardco Lighting, San Leandro, CA (800) 227-0758.
 - 6. Gotham Lighting, Conyers, GA (800) 315-4982.
 - 7. H.E. Williams, Carthage, MO (417) 358-4065.



8. Holophane, Newark, OH (740) 345-9631.
9. Hubbell Lighting, Inc., (Kim, Spaulding, Sterner) Spartanburg, SC (864) 599-6000.
10. Hydrel Architectural and Landscape Products, Sylmar, CA 91342 (818) 362-9465.
11. Intense Lighting, Anaheim, CA (800) 961-5322.
12. Kenall Manufacturing, Gurnee, IL (847) 360-8200.
13. Kim Lighting, City of Industry, CA (626) 968-5666.
14. Kirlin Lighting, Detroit, MI (313) 259-6400.
15. Lightolier, Fall River, MA (508) 679-8131.
16. Lithonia Lighting, Conyers, GA (770) 922-9000.
17. McPhilben Lighting, San Leandro, CA (510) 357-6900.
18. Neptun Light Inc., Lake Bluff, IL (888) 735-8330.
19. Pathway Lighting, Old Saybrook, CT (800) 342-0592.
20. Quality Lighting, Franklin Park, IL (847) 451-0090.
21. Visionaire Lighting, Rancho Dominguez, CA (310) 512-6480.
22. Wide-Lite, San Marcos, TX (512) 392-5821

B. Substitutions:

1. Section 016000 – Product Requirements: Product options and substitutions, substitutions not permitted.

2.2 Luminaire Types

A. **Type MH3** (exterior) Trace-Lite TLED111A Series.

1. Description: 18 inch dia. half cylinder wall mounted full cut-off, solid state, LED luminaire. Lens door is fully gasketed with one-piece solid silicone and UL listed for wet locations.
2. Lens: 1/8 inch thick tempered glass.
3. Housing: Die-cast single piece aluminum housing. Finish by contracting officer.
4. Ballast: Solid state light engine and driver.
5. Mounting: Surface wall.
6. Voltage: [277] [120]
7. Lamp: 48Watt, 5,000 lumen, LED, 85cRI, 4100 degree K.
8. Published Life: 50,000 hours at 70 percent lumen depreciation.
9. Warranty: Full five (5) year factory replacement warranty (internal components).
10. Alternate Manufacturers:
 - a. Gardco: 104LED/55LA Series.
 - b. Hubbell: RDI-50L8.
 - c. Lithonia: WSRLED-2-700MA-X-MVOLT.
 - d. McGraw Edison: ISC-C02-LED-E1-BL3.
 - e. As listed in paragraph 2.1A.

B. **Type PL3** (exterior) Lightolier C6L1520DL-40KMWHP-C6L20N

1. Description: Recessed 6 inch diameter aperture LED downlight .
2. Reflector: Low brightness white painted, flangeless reflector.
3. Ballast/Driver: 39 Watt/2000 Lumen LED light engine with remote phosphor technology; 5-year factory warranty.
4. Mounting Frame: Frame to be 18 gauge galvanized steel ring. Mounting ring shall be secured to ceiling hangers (supplied with luminaire). NOTE: Luminaire frame to be supported from the structure by at least two opposing corners.
5. Junction Box: Junction box to be code approved for through wiring. Junction box to be secured to the mounting ring and accessible from two sides. Junction box to be pre-wired and accessible per code through the ceiling trim opening.
6. Mounting: 28 inch 'C' channel mounting bars and flange kit for drywall ceilings.
7. Voltage: [277] [120].
8. Lamp: 2000 Lumen, 4000 degree K, remote phosphor enclosed LED array; 60,000 hours at LLD = 0.7.
9. Label: U.L. listed for damp locations.



10. Alternate Manufacturers:
 - a. Gotham #EVO41/226WRMD Series
 - b. Portfolio #LD620D010ERM6-840H20 Series
 - c. Omega #OM6LED39U-R6LED40KMDWH
 - d. Intense Lighting #RP62000408-27 Series
 - e. As listed in paragraph 2.1A..

C. **Type PL4** (exterior) Kenall MR13EL-18L40K-DV-FS Series

1. Description: 13 inch dia., round with vertical eyelid, wall mounted, full cut-off LED luminaire. UL listed for wet locations.
2. Reflector: High efficiency, semi-specular aluminum.
3. Lens: Pearlescent, U.V. stabilized, high impact resistant, virgin injection molded polycarbonate.
4. Finish: Finish by contracting officer.
5. Recessed Housing: 18 gauge, cold rolled steel.
6. Ballast/Driver: 20 Watt/1000 Lumen, LED light engine; 5-year factory warranty.
7. Mounting: Semi-recessed, wall mounted; A.D.A. compliant.
8. Voltage: [277] [120].
9. Lamp: 1000 Lumen, 4000 degree K, enclosed LED array; 60,000 hours at LLD = 0.7.
10. Label: U.L. listed for wet locations.
11. Alternate manufacturers:
 - a. Cooper/Fail-Safe TR15LED Series.
 - b. KIM WF31CSLED Series.
 - c. As listed in paragraph 2.1A.

D. **Type PL5** Omega OM6LED39PC-40KMDCS-WL

1. Description: Pendant 8 inch dia., aperture LED downlight.
2. Reflector: Low brightness clear specular alzak finish.
3. Housing: Heavy gauge aluminum cylinder, finished white. Pendant hung on a 24 inch stem with a swivel canopy.
4. Ballast/Driver: 39 Watt/2450 Lumen, LED light engine with remote phosphor technology; 5-year factory warranty.
5. Mounting: Pendant mounted, height as indicated by architectural elevations.
6. Voltage: [277] [120].
7. Lamp: 2450 Lumen, 4000 degree K, enclosed LED array; 60,000 hours at LLD = 0.7.
8. Label: U.L. listed for wet locations.
9. Alternate manufacturers:
 - a. H.E. Williams.
 - b. Gotham: EVOCYL-41/22-6AR-MVOLT.
 - c. Pathway: C66PLB30-4K-M
 - d. Kirlin: LSR-09350-41K.
 - e. Portfolio: LCR8A-40-D010-ER8A-40/840-8LMO-H.
 - f. As listed in paragraph 2.1A.

E. **Type SB1** Kim #VRB1-20LED5KUV

1. Description: 6 inch dia. x 42 inch high aluminum domed top round LED bollard with flared cone.
2. Reflector: Anodized aluminum upper reflector with spun anodized aluminum flared cone
3. Housing: extruded, one piece aluminum, 0.156 inch wall thickness. Top cover is a weldment of 0.125 inch wall extrusion and 0.25 inch top plate. Top cover seals to housing with closed cell EPDM gasketing. Finish by contracting officer.
4. Ballast/Driver: 24 Watt/1300 Lumen, LED light engine; 5-year factory warranty.
5. Mounting: Four ½ inch x 11 inch anchor bolts with double nuts and washers included.
6. Voltage: [277] [120]
7. Lamp: 1300 Lumen, 5000 degree K, enclosed LED array; 60,000 hours at LLD = .07.
8. Label: U.L. listed for wet locations.
9. Alternate Manufacturers:



- a. Visionaire: OWK-2/42-COG-20-7-4K-UNV-AB.
- b. Gardco: BRM832-42-CWL-NW-360-UNIV.
- c. McGraw-Edison
- d. Spaulding
- e. As listed in paragraph 2.1A.

F. Type SF1 Bronzelite DB2100H/D/S/N/R/N/SL

- 1. Description: Round, direct burial spotlight to illuminate flagpole (3 required).
- 2. Reflector: 15 degree beam pattern, specular aluminum spun reflector.
- 3. Housing: Single piece, compression-molded, composite housing with integral junction box
- 4. External Lens: ¼ inch thick, walk-over, clear high-impact tempered glass lens.
- 5. Internal Lens and Gasket: Clear, high-impact, tempered glass lens with silicone gasket.
- 6. Ballast: Encapsulated, pulse start electronic ballast. Osram/Sylvania QTP1x100MH/UNV.
- 7. Mounting: Direct burial mounting. Provide 6 inch deep gravel bed.
- 8. Voltage: [480] [277] [208] [120].
- 9. Lamp: Osram Sylvania MC100/U/MED/940.
- 10. Alternate Manufacturers: As listed in paragraph 2.1A.

G. Type SP1 Gardco EH14L-XX-X-110LA

- 1. Description: Rectilinear architectural arm-mounted sharp cut-off, solid state, LED luminaire.
- 2. Reflector: Anodized segmented reflectors. Beam distribution as required.
- 3. Housing: Rugged aluminum rectilinear housing with all seams continuously welded for integrity. Corrosion-resistant polyester powder coat. Finish by contracting officer.
- 4. Ballast: Solid state light engine and driver.
- 5. Mounting: 20 – 25 ft. high straight square aluminum pole.
- 6. Voltage: [480] [277] [208] [120].
- 7. Lamp: 110Watt, 9,800 lumen, LED, 85cRI, 4000 degree K.
- 8. Quantity of luminaires per pole as shown on the design drawings.
- 9. Published Life: 60,000 hours at 70 percent lumen depreciation.
- 10. Warranty: Full five (5) year factory replacement warranty (internal components).
- 11. Alternate Manufacturers: As listed in paragraph 2.1A.

H. Type SP2 Gardco EH14L-XX-X-160LA

- 1. Description: Rectilinear architectural arm-mounted full cut-off, solid state, LED luminaire.
- 2. Reflector: Anodized segmented reflectors. Beam distribution as required.
- 3. Housing: Rugged aluminum rectilinear housing with all seams continuously welded for integrity. Corrosion-resistant polyester powder coat
- 4. Ballast: Solid state light engine and driver.
- 5. Mounting: 20 – 25 ft. aluminum pole.
- 6. Voltage: [480] [277] [208] [120].
- 7. Lamp: 160Watt, 13,170 lumen, LED, 85cRI, 4000 degree K.
- 8. Quantity of luminaires per pole as shown on the design drawings.
- 9. Published Life: 60,000 hours at 70 percent lumen depreciation.
- 10. Warranty: Full five (5) year factory replacement warranty (internal components).
- 11. Alternate Manufacturers: As listed in paragraph 2.1A.

I. Type SP5 Gardco EH14L-XX-X-85LA

- 1. Description: Rectilinear architectural arm-mounted full cut-off, solid state, LED luminaire.
- 2. Reflector: Anodized segmented reflectors. Beam distribution as required.
- 3. Housing: Rugged aluminum rectilinear housing with all seams continuously welded for integrity. Corrosion-resistant polyester powder coat
- 4. Ballast: Solid state light engine and driver.
- 5. Mounting: 12 – 15 ft. aluminum pole.
- 6. Voltage: [480] [277] [208] [120].
- 7. Lamp: 85Watt, 7,400 lumen, LED, 85cRI, 4000 degree K.
- 8. Quantity of luminaires per pole as shown on the design drawings.



9. Published Life: 60,000 hours at 70 percent lumen depreciation.
10. Warranty: Full five (5) year factory replacement warranty (internal components).
11. Alternate Manufacturers: As listed in paragraph 2.1A.

2.3 HIGH INTENSITY DISCHARGE (HID) BALLAST

A. Manufacturers:

1. Advance Transformer Company, Rosemont, IL (847) 390-5000.
2. General Electric Company, Nela Park, OH (800) 435-2677.
3. Universal Lighting Technologies, Nashville, TN (615) 316-5100.
4. Osram/Sylvania, Danvers, MA (800) 544-4828.

B. Description:

1. ANSI C82.4, high intensity discharge and low pressure sodium lamp ballast.
2. Metal Halide Electronic Ballast for lamps shall be high efficiency, energy efficient, pulse start, electronic ballasts with a minimum power factor of .98, ballast factor of 1.0, capable of powering pulse start lamps. Multi-voltage capable and shall operate from a nominal voltage range of 277/120 Volts. System efficiency of greater than 93% under full lamp operation. Ballasts shall meet or exceed all EMI and RFI standards of the Federal Communications Commission (FCC) regulations parts 18.305 and 18.307. Total harmonic distortion of less than 5 percent. Lamp wattage shall not vary more than 0.5 percent for a 10 percent change in input line voltage. The lamp crest factor shall measure 1.7 or less. Ballast assembly shall be UL listed for damp locations, 40 degrees C, and comply with all local, state and federal efficiency standards.

C. All luminaires shall be fused. Locate fuses within handhole of pole for pole mounted luminaires.

D. Voltage: [480] [277] [208] [120].

NOTE TO SPECIFIER

Include paragraph 2.3E below, if the lightning risk assessment calculation deems a building lightning protection system is required.

E. Provide individual surge protectors within handhole of each pole mounted luminaire. Branch circuit breakers feeding pole mounted luminaires shall also be equipped with surge protection.

2.4 LAMPS

A. High Intensity Discharge (HID) Lamp Manufacturers:

1. General Electric Company, Nela Park, OH (800) 435-2677.
2. Osram/Sylvania, Danvers, MA (800) 544-4828.
3. Philips Lighting Company, Somerset, NJ (800) 555-0050.
4. Section 016000 – Product Requirements: Product Options and Substitutions: Substitutions not permitted.

B. NEMA CFT designated lamps must pass the federal Toxic Characteristic Leaching Procedure (TCLP) test and be classified non-hazardous waste.

C. Lamp Types: As specified for luminaire.

NOTE TO SPECIFIER



Pole height listed as basis of design. Edit to suit site conditions or comply with jurisdictional requirements. Pole manufacturer to match pole mounted luminaires selected.

2.5 POLES

- A. Manufacturers:
 - 1. As listed in paragraph 2.1A.
 - 2. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Material and Finish: Aluminum. Finish by contracting officer.
- C. Section Shape and Dimensions: [Straight or Tapered] [Round or Square].
- D. Height: 25 feet, (7.62 m).
- E. Base: Nonbreakaway.
- F. Accessories:
 - 1. Handhole.
 - 2. Anchor bolts.
 - 3. Base Cover.
 - 4. Bolt covers.
 - 5. Ground rod and conductor.

NOTE TO SPECIFIER

Edit for Wind Loading.

- G. Approximate Loading Capacity Ratings:
 - 1. Luminaire Weight: 35 pounds.
 - 2. Luminaire and Bracket Effective Projected Area: 1.5 square feet.
 - 3. Steady Wind: [90] [____] miles per hour minimum, with gust factor of [1.3] [____].

PART 3 - EXECUTION

3.1 EXAMINATION

- A. As specified in Section 260500 – Common Work Results for Electrical.

3.2 INSTALLATION

- A. Provide 3000 PSI minimum concrete for lighting pole bases at locations indicated, in accordance with Section 033000 and details shown on drawings.
- B. Install poles plumb and provide double nuts to adjust plumb. Grout around each base and provide bolt covers.
- C. Install lamps in each luminaire.



- D. Bond luminaires, metal accessories and metal poles to branch circuit equipment grounding conductor. Provide supplementary 3/4 inch x 10 foot copper clad rod with #2/AWG copper grounding electrode at each pole.

3.3 FIELD QUALITY CONTROL

- A. As specified Section 260500 - Common Work Results for Electrical.
- B. Operate each luminaire after installation and connection. Inspect for improper connections and operation.
- C. Measure illumination levels to verify conformance with layout and performance requirements.
- D. Take measurements during night sky, without moon or with heavy overcast clouds effectively obscuring moon.

3.4 ADJUSTING

- A. Aim and adjust luminaires to provide illumination levels and distribution as directed.

3.5 CLEANING

- A. Conform to Section 017300 - Execution: Cleaning installed work.
- B. Clean electrical parts to remove conductive and deleterious materials.
- C. Remove dirt and debris from enclosure, pole and base.
- D. Clean photometric control surfaces as recommended by manufacturer.
- E. Clean finishes and touch up damage.

3.6 PROTECTION OF FINISHED WORK

- A. Conform to Section 017300 - Execution: Protecting installed work.
- B. Relamp or re-ballast luminaires with defective or burned out lamps, just prior to final acceptance.

USPS CSF Specifications issued: 5/1/2014

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END OF SECTION 26 56 00 00



SECTION 26 56 00 00 - MPF EXTERIOR LIGHTING**

NOTE TO SPECIFIER

Use this Specification Section for Mail Processing Facilities only. This Specification is intended as a guide to the Architect/Engineer preparing the Construction Documents.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS FACILITIES, THROUGH THE CONTRACTING OFFICER'S REPRESENTATIVE.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Exterior luminaires and accessories.
 - 2. Poles.
 - 3. Ballasts.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the work of this section. Additional requirements and information necessary to complete the work of this section may be found in other documents.
- C. Related Sections
 - 1. Section 033000 - Cast-in-Place Concrete: Concrete for pole foundation.
 - 2. Section 260500 - Common Work Results for Electrical: Basic electrical methods.
 - 3. Section 260623 - Lighting Control Devices.

1.2 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI C78.379 - Electric Lamps - Incandescent and High-Intensity Discharge Reflector Lamps - Classification of Beam Patterns.
 - 2. ANSI C82.4 - Ballasts for High-Intensity-Discharge and Low Pressure Sodium Lamps (Multiple-Supply Type).
- B. Illuminating Engineering Society North America (IESNA):
 - 1. IESNA RP-8 - Recommended Practice for Roadway Lighting.
 - 2. IESNA RP-20 - Recommended Practice for Lighting for Parking Facilities.
 - 3. IESNA RP-33 - Recommended Practice for Lighting for Exterior Environments.
- C. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code.
 - 2. NFPA 101 - Life Safety Code
 - 3. State and Local Building Codes (where applicable)



- D. Federal Communications Commission Parts 18.305, 18.307 (EMI RFI).
- E. American Society of Heating, Refrigerating and Air Conditioning, Inc.
 - 1. ANSI/ ASHRAE/ IES Standard 90.1 – 2010.

1.3 SUBMITTALS

- A. Conform to Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data:
 - a. Luminaire dimensions, ratings, and performance data.
 - b. Complete computer data printout of illumination levels based on a 5 ft. by 5 ft. grid pattern.
 - 2. Shop Drawings:
 - a. Indicate dimensions and components for each luminaire which is not a standard Product of the manufacturer.
 - b. Indicate illumination levels in accordance with layout and scheduled luminaires indicated on Drawings.

1.4 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.
- B. Regulatory requirements
 - 1. Conform to requirements of NFPA 70 and 101.
 - 2. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, Handle, Store, and Protect Products.

1.6 MAINTENANCE

- A. Section 017704 – Closeout Procedures and Training: Procedures for closeout submittals.
- B. Extra Products: At completion of installation, deliver to Contracting Officer.
 - 1. Each component type: Provide quantity for each unique ballast, surge protector and lamp equal to two (2) per cent of luminaire total, but not less than two of each type.

NOTE TO SPECIFIER

****REQUIRED PART (PRODUCTS) FOLLOWS. DO NOT REVISE THIS PART, EXCEPT AS NOTED BELOW, WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS FACILITIES, THROUGH THE CONTRACTING OFFICER'S REPRESENTATIVE.**



PART 2 - PRODUCTS

2.1 LUMINAIRE MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Architectural Landscape Lighting, Santa Ana, CA 92704 (714) 668-1107.
 2. Barron Lighting Group (Trace-Lite), Phoenix, AZ 85027 (888) 533-3948.
 3. Bronzelite Commercial Landscape Lighting, (800) 273-1569.
 4. Cooper Lighting (Invue, Lumark, Lumiere, Portfolio, McGraw-Edison, Portfolio), Peachtree City, GA (770)486-4800.
 5. Gardco Lighting, San Leandro, CA (800) 227-0758.
 6. Gotham Lighting, Conyers, GA (800) 315-4982.
 7. Hadco Lighting, Littlestown, PA (717) 359-7131.
 8. H.E. Williams, Carthage, MO (417) 358-4065.
 9. Holophane, Newark, OH (740) 345-9631.
 10. Hydrel Architectural and Landscape Products, Sylmar, CA 91342 (818) 362-9465.
 11. Hubbell Lighting, Inc., (KIM, Spaulding,) Spartanburg, SC (864) 599-6000.
 12. Intense Lighting, Anaheim, CA (800) 961-5322.
 13. Kenall Manufacturing, Gurnee, IL (847) 360-8200.
 14. Kim Lighting, City of Industry, CA (626) 968-5666.
 15. Kirlin Lighting, Detroit, MI (313) 259-6400.
 16. Lightolier, Fall River, MA (508) 679-8131.
 17. Lithonia Lighting, Conyers, GA (770) 922-9000.
 18. McPhilben Lighting, San Leandro, CA (510) 357-6900.
 19. Pathway Lighting, Old Saybrook, CT (800) 342-0592.
 20. Neptun Light Inc., Lake Bluff, IL (888) 735-8330.
 21. Quality Lighting, Franklin Park, IL (847) 451-0090.
 22. Visionaire Lighting, Rancho Dominguez, CA (310) 512-6480.
 23. Wide-Lite, San Marcos, TX (512) 392-5821.
- B. Substitutions:
1. Section 016000 – Product Requirements: Product options and substitutions, substitutions not permitted.

2.2 LUMINAIRE TYPES

- A. **Type MH3** (exterior) Trace-Lite TLED111A Series.
1. Description: 18 inch dia. half cylinder wall mounted full cut-off, solid state, LED luminaire. Lens door is fully gasketed with one-piece solid silicone and UL listed for wet locations.
 2. Lens: 1/8 inch thick tempered glass.
 3. Housing: Die-cast single piece aluminum housing. Finish by contracting officer.
 4. Ballast: Solid state light engine and driver.
 5. Mounting: Surface wall.
 6. Voltage: [277] [120]
 7. Lamp: 48Watt, 5,000 lumen, LED, 85cRI, 4100 degree K.
 8. Published Life: 50,000 hours at 70 percent lumen depreciation.
 9. Warranty: Full five (5) year factory replacement warranty (internal components).
 10. Alternate Manufacturers:
 - a. Gardco: 104LED/55LA Series.
 - b. Hubbell: RDI-50L8 Series.
 - c. Lithonia: WSRLED-2-700MA-X-MVOLT.
 - d. McGraw Edison: ISC-C02-LED-E1-BL3.
 - e. As listed in paragraph 2.1A.



- B. Type PL3 (exterior) Lightolier C6L1520DL40KMWHP-C6L20N**
1. Description: Recessed 6 inch diameter aperture LED downlight.
 2. Reflector: Low brightness white painted, flangeless reflector.
 3. Ballast/Driver: 39 Watt/2000 Lumen LED light engine with remote phosphor technology; 5-year factory warranty.
 4. Mounting Frame: Frame to be 18 gauge galvanized steel ring. Mounting ring shall be secured to ceiling hangers (supplied with luminaire). NOTE: Luminaire frame to be supported from the structure by at least two opposing corners.
 5. Junction Box: Junction box to be code approved for through wiring. Junction box to be secured to the mounting ring and accessible from two sides. Junction box to be pre-wired and accessible per code through the ceiling trim opening.
 6. Mounting: 28 inch 'C' channel mounting bars and flange kit for drywall ceilings.
 7. Voltage: [277] [120].
 8. Lamp: 2000 Lumen, 4000 degree K, remote phosphor enclosed LED array; 60,000 hours at LLD = 0.7.
 9. Label: U.L. listed for damp locations.
 10. Alternate Manufacturers:
 - a. Gotham #EVO41/226WRMD Series.
 - b. Portfolio #LD620D010ERM6-840H20 Series.
 - c. Omega #OM6LED39U-R6LED40KMDWH.
 - d. Intense Lighting #RP62000408-27 Series.
 - e. As listed in paragraph 2.1A.
 - f. .
- C. Type PL4 (exterior) Kenall MR13EL-18L40K-DV-FS Series**
1. Description: 13 inch dia., round with vertical eyelid, wall mounted, full cut-off LED luminaire. UL listed for wet locations.
 2. Reflector: High efficiency, semi-specular aluminum.
 3. Lens: Pearlescent, U.V. stabilized, high impact resistant, virgin injection molded polycarbonate.
 4. Finish: Finish by contracting officer.
 5. Recessed Housing: 18 gauge, cold rolled steel.
 6. Ballast/Driver: 20 Watt/1000 Lumen, LED light engine; 5-year factory warranty.
 7. Mounting: Semi-recessed, wall mounted; A.D.A. compliant.
 8. Voltage: [277] [120].
 9. Lamp: 1000 Lumen, 4000 degree K, enclosed LED array; 60,000 hours at LLD = 0.7.
 10. Label: U.L. listed for damp locations.
 11. Alternate manufacturers:
 - a. Cooper/Fail-Safe TR15LED Series.
 - b. KIM WF31CSLED Series.
 - c. As listed in paragraph 2.1A.
- D. TYPE PL5 Omega OM6LED39PC-40KMDCS-WL**
1. Description: Pendant 8 inch dia., aperture LED downlight.
 2. Reflector: Low brightness clear specular alzak finish.
 3. Housing: Heavy gauge aluminum cylinder, finished white. Pendant hung on a 24 inch stem with a swivel canopy.
 4. Ballast/Driver: 39 Watt/2450 Lumen, LED light engine with remote phosphor technology; 5-year factory warranty.
 5. Mounting: Pendant mounted, height as indicated by architectural elevations.
 6. Voltage: [277] [120].
 7. Lamp: 2450 Lumen, 4000 degree K, enclosed LED array; 60,000 hours at LLD = 0.7.
 8. Label: U.L. listed for wet locations.
 9. Alternate manufacturers:
 - a. H.E. Williams.
 - b. Gotham #EVOCYL-41/22-6AR-MVOLT.
 - c. Pathway #C66PLB30-4K-M



- d. Kirlin #LSR-09350-41K.
- e. Portfolio #LCR8A-40-D010-ER8A-40/840-8LM0-H.
- f. As listed in paragraph 2.1A.

E. Type SB1 Kim #VRB1-20LED5KUV

- 1. Description: 6 in. x 42 in. high aluminum domed top round LED bollard with flared cone.
- 2. Reflector: Anodized aluminum upper reflector with spun anodized aluminum flared cone
- 3. Housing: extruded, one piece aluminum, 0.156 inch wall thickness. Top cover is a weldment of 0.125 inch wall extrusion and 0.25 inch top plate. Top cover seals to housing with closed cell EPDM gasketing. Finish by contracting officer.
- 4. Ballast/Driver: 24 Watt/1300 Lumen, LED light engine; 5-year factory warranty.
- 5. Mounting: Four ½ in. x 11 in. anchor bolts with double nuts and washers, included.
- 6. Voltage: [277]
- 7. Lamp: 1300 Lumen, 5000 degree K, enclosed LED array; 60,000 hours at LLD = 0.7.
- 8. Label: U.L. listed for wet locations.
- 9. Alternate Manufacturers:
 - a. Visionaire #OWK-2/42-COG-20-7-4K-UNV-AB
 - b. Gardco #BRM832-42-CWL-NW-360-UNIV
 - c. McGraw-Edison
 - d. Spaulding
 - e. As listed in paragraph 2.1A.

F. Type SF1 Bronzelite DB2100H/D/S/N/R/N/SL

- 1. Description: Round, direct burial spotlight to illuminate flagpole (3 required).
- 2. Reflector: 15 degree beam pattern, specular aluminum spun reflector.
- 3. Housing: Single piece, compression-molded, composite housing with integral junction box.
- 4. External Lens: ¼ inch thick, walk-over, clear high-impact tempered glass lens.
- 5. Internal Lens and Gasket: Clear, high-impact, tempered glass lens with silicone gasket.
- 6. Ballast: Encapsulated, pulse start electronic. Osram/Sylvania QTP1x100MH/UNV
- 7. Mounting: Direct burial mounting. Provide 6 inch deep gravel bed.
- 8. Voltage: [480] [277] .
- 9. Lamp: Osram/Sylvania MC100/U/MED/940.
- 10. Alternate Manufacturers: As listed in paragraph 2.1 A.

G. Type SP1 Gardco EH14L-XX-X-110LA

- 1. Description: Rectilinear architectural arm-mounted sharp cut-off, solid state, LED luminaire.
- 2. Reflector: Anodized segmented reflectors, beam distribution as required.
- 3. Housing: Rugged aluminum rectilinear housing with all seams continuously welded for integrity. Corrosion-resistant polyester powder coat. Finish by contracting officer.
- 4. Ballast: Solid state light engine and driver.
- 5. Mounting: 20 – 25 ft. high straight square aluminum pole.
- 6. Voltage: [480] [277].
- 7. Lamp: 110Watt, 9,800 lumen, LED, 85cRI, 4000 degree K.
- 8. Quantity of luminaires per pole as shown on the design drawings.
- 9. Published Life: 60,000 hours at 70 percent lumen depreciation.
- 10. Warranty: Full five (5) year factory replacement warranty (internal components).
- 11. Alternate Manufacturers: As listed in paragraph 2.1 A.

H. Type SP2 Gardco EH14L-XX-X-160LA

- 1. Description: Rectilinear architectural arm-mounted full cut-off, solid state, LED luminaire.
- 2. Reflector: Anodized segmented reflectors. Beam distribution as required.
- 3. Housing: Rugged aluminum rectilinear housing with all seams continuously welded for integrity. Corrosion-resistant polyester powder coat. Finish by contracting officer.
- 4. Ballast: Solid state light engine and driver.
- 5. Mounting: 20 – 25 ft. high aluminum pole.
- 6. Voltage: [480] [277].



7. Lamp: 160Watt, 13,170 lumen, LED, 85cRI, 4000 degree K..
8. Quantity of luminaires per pole as shown on the design drawings.
9. Published Life: 60,000 hours at 70 percent lumen depreciation.
10. Warranty: Full five (5) year factory replacement warranty (internal components).
11. Alternate Manufacturers: As listed in paragraph 2.1 A.

I. **Type SP5** Gardo EH14L-XX-X-85LA

1. Description: Rectilinear architectural arm-mounted full cut-off, solid state, LED luminaire.
2. Reflector: Anodized segmented reflectors. Beam distribution as required.
3. Housing: Rugged aluminum rectilinear housing with all seams continuously welded for integrity. Corrosion-resistant polyester powder coat. Finish by contracting officer.
4. Ballast: Solid state light engine and driver.
5. Mounting: 12 – 15 ft. high aluminum pole.
6. Voltage: [480] [277].
7. Lamp: 85Watt, 7,400 lumen, LED, 85cRI, 4000 degree K.
8. Quantity of luminaires per pole as shown on the design drawings.
9. Published Life: 60,000 hours at 70 percent lumen depreciation.
10. Warranty: Full five (5) year factory replacement warranty (internal components).
11. Alternate Manufacturers: As listed in paragraph 2.1 A.

2.3 HIGH INTENSITY DISCHARGE (HID) BALLAST

A. Manufacturers:

1. Advance Transformer Company, Rosemont, IL (847) 390-5000.
2. General Electric Company, Nela Park, OH (800) 435-2677.
3. Universal Lighting Technologies, Nashville, TN (615) 316-5100.
4. Osram/Sylvania, Danvers, MA (800) 544-4828.

B. Description:

1. ANSI C82.4, high intensity discharge and low pressure sodium lamp ballast.
2. Metal halide electronic ballast for lamps shall be high efficiency, energy efficient, pulse start, electronic ballasts with a minimum power factor of .98, ballast factor of 1.0, capable of powering pulse start lamps. Multi-voltage capable and shall operate from a nominal voltage range of 277/120 Volts. System efficiency of greater than 93 percent under full lamp operation. Ballasts shall meet or exceed all EMI and RFI standards of the Federal Communications Commission (FCC) regulations parts 18.305 and 18.307. Total harmonic distortion of less than 5 percent. Lamp wattage shall not vary more than 0.5 percent for a 10 percent change in input line voltage. The lamp crest factor shall measure 1.7 or less. Ballast assembly shall be UL listed for damp locations, 40 degrees C, and comply with all local, state and federal efficiency standards

C. All luminaires shall be fused. Locate fuses within handhole of pole for pole mounted luminaires.

D. Voltage: [480] [277] [208] [120].

NOTE TO SPECIFIER

Include paragraph 2.3E below, if the lightning risk assessment calculation deems a building lightning protection system is required.

E. Provide individual surge protectors within handhole of each pole mounted luminaire. Branch circuit breakers feeding pole mounted luminaires shall also be equipped with surge protection.



2.4 LAMPS

- A. High Intensity Discharge (HID) Lamp Manufacturers:
 - 1. General Electric Company, Nela Park, OH (800) 435-2677.
 - 2. Osram/Sylvania, Danvers, MA (800) 544-4828.
 - 3. Philips Lighting Company, Somerset, NJ (800) 555-0050.
 - 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Not Permitted.
- B. NEMA CFT designated lamps must pass the federal Toxic Characteristic Leaching Procedure (TCLP) test and be classified non-hazardous waste.
- C. Lamp Types: As specified for luminaire.

NOTE TO SPECIFIER

Pole height listed as basis of design. Edit to suit site conditions or comply with jurisdictional requirements. Pole manufacturer to match pole mounted luminaires selected.

2.5 POLES

- A. Manufacturers:
 - 1. As listed in paragraph 2.1A.
 - 2. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Not permitted.
- B. Material and Finish: Aluminum. Finish by contracting officer.
- C. Section Shape [straight or tapered] [round or square].
- D. Height: [25 feet].
- E. Base: Nonbreakaway.
- F. Accessories:
 - 1. Handhole.
 - 2. Anchor bolts.
 - 3. Base cover.
 - 4. Bolt covers.
 - 5. Ground rod and conductor.

NOTE TO SPECIFIER

Edit for Wind Loading.

- G. Approximate Loading Capacity Ratings:
 - 1. Luminaire Weight: 35 pounds.
 - 2. Luminaire and Bracket Effective Projected Area: 1.5 square feet.
 - 3. Steady Wind: [90] [____] miles per hour minimum, with gust factor of [1.3] [____].

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide 3000 PSI minimum concrete for lighting poles bases at locations indicated, in accordance with Section 033000 and details shown on drawings.



- B. Install poles plumb. Provide double nuts to adjust plumb. Grout around each base and provide bolt covers.
- C. Install lamps in each luminaire.
- D. Bond luminaires, metal accessories and metal poles to branch circuit equipment grounding conductor. Provide supplementary 3/4 inch x 10 foot copper clad rod with #2/AWG/copper grounding electrode conductor at each pole.

3.2 FIELD QUALITY CONTROL

- A. Conform to Section 014000: Quality Requirements.
- B. Operate each luminaire after installation and connection. Inspect for improper connections and operation.
- C. Measure illumination levels to verify conformance with layout and performance requirements.
- D. Take measurements during night sky, without moon or with heavy overcast clouds effectively obscuring moon.

3.3 ADJUSTING

- A. Aim and adjust luminaires to provide illumination levels and distribution as directed.

3.4 CLEANING

- A. Conform to Section 017300 -Execution: Cleaning and protecting installed work.
- B. Clean electrical parts to remove conductive and deleterious materials.
- C. Remove dirt and debris from enclosure, pole and base.
- D. Clean photometric control surfaces as recommended by manufacturer.
- E. Clean finishes and touch up damage.

3.5 PROTECTION OF FINISHED WORK

- A. Conform to Section 017300 – Execution: Protecting installed work.
- B. Relamp or re-ballast luminaires with defective or burned out lamps, just prior to final acceptance..

USPS Mail Processing Facility Specification issued: 5/1/2014
Last revised: 4/16/2014

END OF SECTION 26 56 00 00



Task	Specification	Specification Description
26 56 13 00	01 22 16 00	No Specification Required
26 56 23 00	01 22 16 00	No Specification Required
26 56 26 00	01 22 16 00	No Specification Required



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SECTION 27 05 00 00 - CSF COMMON WORK RESULTS FOR COMMUNICATIONS**

NOTE TO SPECIFIER

Use this Specification Section for Customer Service Facilities only.

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes the Common Work Results for the following structured wiring system components:
 - 1. Communication cable.
 - 2. Termination equipment.
 - 3. Patching equipment.
 - 4. Telecommunications Equipment Room (ER) Equipment Rack(s).
 - 5. Telecommunications Room (TR) Equipment Rack(s).
 - 6. Telephone service entrance.
- B. Related Documents:
 - 1. The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section.
 - 2. USPS Lan Infrastructure Best Practices, May 2011.
 - 3. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 078400 - Fire stopping: Fire stopping sealant at penetrations of fire-rated assemblies.
 - 2. Section 260500 - Common Work Results for Electrical: Basic electrical methods.
 - 3. Section 260533 - Raceway and Boxes for Electrical Systems: Conduit and boxes for installation of cable.
 - 4. Section 271100 - Communications Equipment Room Fittings
 - 5. Section 271300 - Communications Backbone Cabling
 - 6. Section 271500 - Communications Horizontal Cabling
 - 7. Section 281600 - Intrusion Detection

NOTES TO SPECIFIER

Use following Specification listings for larger CSF projects only.

- 8. Section 250504 - Building Automation System (BAS) General
- 9. Section 251304 - EMS Communication to Remote Enterprise Server
- 10. Section 275116 - Public Address Paging Systems
- 11. Section 282304 - Security, Burglary and Robbery Countermeasures Analog CCTV System
- 12. Section 282305 - Integrated Security and Investigative Platform (ISIP) CCTV System

1.2 REFERENCES

- A. Telecommunication Industry Association (TIA), Electronic Industries Association (EIA):
 - 1. ANSI/TIA/EIA-568-C Commercial Building Telecommunications Cabling Standard (2009 - including all addendums).



2. ANSI/TIA/EIA-569-B Commercial Building Standard for Telecommunications Pathways (2004 or Current edition).
3. ANSI/TIA/EIA J-STD-606B Administration Standard for Commercial Telecommunications Infrastructure (2002 or Current Edition).
4. ANSI/TIA/EIA-607A Commercial Building Grounding and Bonding Requirements for Telecommunications (2002 or Current Edition).
5. BICSI Telecommunications Distribution Methods Manual (Version-12 including all addendums.)

- B. National Electrical Manufacturer's Association (NEMA):
 1. NEMA WC 26 - Wire and Cable Packaging.
- C. National Fire Protection Association (NFPA):
 1. NFPA 70 - National Electrical Code. (Current Version)

1.3 SYSTEM DESCRIPTION

- A. Telecommunication system for entire building consisting of cables, connectors, faceplates, termination patch panels, patch cords, wire management panels, and cable supports. System serves the following:
 1. Telephone.
 2. Data.
 3. Modem.
 4. Printer.
 5. Facsimile.
 6. Point-of-service (POS)

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 1. Product Data: Provide for each material or equipment item specified.
 2. Shop Drawings:
 - a. Point-to-point wiring diagrams for cables installed under this Section.
 - b. Detailed plan views and elevations of telecommunications spaces showing racks, termination blocks, and cable paths.
 - c. Minimum Scale for Details: 1/4 inch.
 3. Termination Schedule: Indicate the following.
 - a. T/O (telecommunications outlet) identification.
 - b. Cable identification number.
 - c. Room location.
 - d. Patch panel identification number.
 - e. Patch panel port identification number.
 4. Assurance/Control Submittals:
 - a. Sample Forms: Submit proposed format for cable test reports.
 - b. Test Reports: Submit the following reports directly to Contracting Officer from Testing Laboratory, with copy to General Contractor. Prepare reports in conformance with section 014000 – Quality Requirements.
 - 1) End-to-end tests.
 - c. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - d. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.



- B. Section 017704 -Closeout Procedures and Training: Procedures for closeout submittals. Deliver prior to Final Acceptance.
1. Certification: Comprehensive test results for Category 6 and fiber optic certification of cable plant per specifications of ANSI/TIA/EIA-568-C, and all addendums. Immediately following new Category 6 copper and laser optimized multi-mode fiber installation, submit raw test results via e-mail to the Raleigh IT Service Center representative who will be performing copper and fiber site acceptance. All testing must be performed using an industry standard compliant test device. Test results must be furnished in format used by test device. Vender generated spreadsheets or pdfs will not be accepted. If special software is required for viewing test results, said software shall be supplied by installing vendor at no cost to USPS.
 2. Project Record Documents: Accurately record the following:
 - a. Cable pulling schedules, in printed form on CD-ROM.
 - b. Cable routings (as-built drawings) shall be provided with cable plant depicted on floor plans prior to acceptance. The drawings must identify location of all T/Os (Telecommunications Outlets), TRs (Telecommunications Rooms), the ER (Telecommunications Equipment Room) and any other installed component of the cabling solution. The actual routing of the cable bundles (pathways) and backbone cables on the floor plans shall also be shown. Provide master overall set plus one set for the ER and each TR which will detail TOs served. As-built drawings will be provided to the USPS IT by the installing Contractor electronically in a USPS compatible version of AutoCad on a CDROM.
 - c. Labeling shall conform with the ANSI/TIA/EIA-606A and USPS labeling guidelines.
 - d. A detailed cable termination record shall be provided, in sufficient detail, so that:
 - 1) Telephone Utility Company or telephone interconnect company can install cross connects.
 - 2) Postal Service users can install and maintain patch cords at patch panel fields.
 - 3) Location and size of service entrance conduit can be determined.
 3. Operations and Maintenance Data: Data including wiring diagrams, parts lists, shop drawings, product data, manufacturer's instructions for cables and equipment, and Certification(s) identified above shall be provided.

1.5 QUALITY ASSURANCE

- A. Single Source Responsibility: Furnish and install Products of one manufacturer for each Product type. Multiple manufacturers not permitted.
- B. Qualifications:
1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 2. Installer: Company specializing in the installation of Category 6 and fiber optic Structured Cabling Systems with minimum 5 years documented experience. Contractor shall have a minimum of one BICSI Certified Technician on job site at all times with documented formal training in the installation of Category 6 and fiber optic cabling systems. Installers shall possess a certification for a total systems solution issued by the manufacturers of the cabling and terminating hardware. The contractor must present this certification to the contracting officer before beginning work. Contractor must have a full time BICSI RCDD with current credentialing on staff.
 3. Warranty: Total Systems Solution required providing minimum 15 year warranty from both manufacturer of cabling as well as connecting hardware when installed together according to predetermined manufacturers' specifications. Installer shall possess certifications from manufacturers of the components installed as a total systems solution and must present said certifications to the contracting officer in advance of beginning the Work.
- C. Regulatory Requirements:
1. Conform to requirements of NFPA 70.
 2. Products: Listed and classified by Underwriter's Laboratories Incorporated as suitable for the purpose specified and indicated.



3. Perform Work that interfaces with Telephone Utility Company in accordance with Telephone Utility Company rules and regulations.
4. Conform to current ANSI/TIA/EIA and BICSI TDMM standards for telecommunications installation.

D. Pre-Installation Meetings:

1. Convene a pre-installation meeting two weeks prior to commencing Work of this Section.
2. Require attendance of parties directly affecting Work of this Section. The United States Postal Service telecommunications system representatives for CSF projects will be the District Telecommunications Specialist.
3. Review conditions of operations, procedures and coordination with related Work.
4. Agenda:
 - a. Tour, inspect, and discuss building conditions relating to communications cabling and equipment
 - b. Coordination with Telephone Utility Company and United States Postal Service telecommunications system representative will be through the Contracting Officer.
 - c. Review exact location of each item within building construction, casework, and fixtures and their requirements.
 - d. Review required submittals, both completed and yet to be completed.
 - e. Review Drawings and Specifications.
 - f. Approve proposed equipment.
 - g. Review and finalize construction schedule related to voice and data installation and verify availability of materials, personnel, equipment, and facilities needed to complete project and avoid delays.
 - h. Review required labeling process, inspections and testing.
 - i. Review cable routing and support.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver in accordance with NEMA WC 26.

PART 2 - PRODUCTS

2.1 CONDUITS AND BOXES

- A. Specified in Section 260533 - Raceway and Boxes for Electrical Systems.

2.2 TELEPHONE HANDSETS: Provided by US Postal Service under separate contract.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.



3.2 INSTALLATION

- A. Special Requirements For Cable Routing And Installation
 1. The majority of the structured cabling system wiring in this building will be installed above ceilings without conduit. All cabling used throughout this project shall comply with the requirements as outlined in the National Electric Code (NEC) article 725. All cabling shall bare CMP and/or appropriate markings for the environment in which they are installed.
 2. Sealing of openings between floors, through rated fire and smoke walls, existing or created by the contractor for cable pass through shall be the responsibility of the contractor. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of the contractor's work. Any openings created by or for this contractor and left unused shall also be sealed as part of this work.
- B. Support cables installed in ceiling spaces with Category 6 compliant wide-base canvas loop suspension devices such as the Erico Caddy #425 Loop anchored to building structural steel (red iron). The use of wide-based, J-hooks ("Erico" Caddy Cable CAT series) shall be permitted for no more than (3) Category 6 cables.
 1. Minimum and Maximum Spacing Between Supports: 4 feet.
 2. Maximum Number of 4 Pair Cables per Support: 25.
 3. Furnish and install additional supports as required.
 4. Install complete cable support device system before starting installation of cable.
 - a. Installation of cable before completion of support system not permitted.
 - b. Unsupported cable shall not be permitted.
 5. Organize and group cables. Install cable group as single run through ceiling spaces following column and building lines. Do not install cable group runs diagonally across center of building.
 6. Install armored fiber optic cabling in cable tray or approved support solution.
 7. Cabling shall not be suspended from any electrical conduits, sprinkler systems, gas, or water pipes, etc.
 8. Cabling shall not be attached to suspended ceiling grid system.
 9. Cabling system shall be installed in approved suspension devices for telecommunications cabling.
 10. No element of the building structure (i.e. webbing of trusses) shall be used to support any telecommunications cabling.
 11. Vertical runs of backbone and horizontal cables (e.g.: cables exiting thru-wall penetrations) shall be equipped with factory manufactured cable drop out fittings or kellums cord grips to properly support the cables at the vertical bends.
- C. Cable trays shall be required for areas of heavy cable concentration including but not limited to the "ER" and TRs.
 1. Maximum spacing between each cable tray support: Specified by manufacturer of cable tray.
 2. Maximum number of cables supported by cable tray: Specified by manufacturer of cable tray not-to-exceed 40% fill ratio.
 3. Furnish and install additional supports as required.
 4. Install complete cable tray system before starting installation of cable.
 - a. Installation of cable before completion of tray system not permitted.
 - b. Cabling shall not be bundled within cable tray.
 - c. Provide factory manufactured cable drop-out fittings for transportation of cabling entering or exiting the cable tray.
- D. Cabling routed underground, exterior of the building, through inaccessible ceilings or less than 10'-0" A.F.F. in the workroom shall be contained in conduit. Provide flush boxes within finished areas and surface mounted, cast aluminum, "FS" factory boxes in unfinished areas. Provide 1" conduit risers with 90 degree bend and bushing for all T/O's.
 1. All conduit stubs must have a plastic bushing installed at each end.
 2. No conduit is to be buried in the slab.
 3. There shall be no more than 180 degrees of bend in a conduit longer than 30 feet. All conduits that are comprised of more than two (2) ninety degree bends or a reverse bend shall have a



- properly installed pull box. Pull boxes shall be 12"x 12" x 6" for up to 1" EMT, 18"x18"x8" for up to 1 ½" EMT. Ninety degree bends in fiber runs shall be installed using dual forty-five degree bends.
4. Under no circumstances shall a pull box be used to change direction of a conduit. All conduits shall be installed in a manner so that cabling passes directly through the pull box without changing direction.
 5. The minimum size conduit shall be 1" diameter. Larger conduits shall be sized for 40% fill.
- E. Route cable for T/O (telecommunications outlets) as follows:
1. Wall Mounted: Through ceiling spaces to conduit stub-ups or junction boxes. Include drag lines.
 2. Furniture System Cable Raceway: Point of entry to outlet.
 3. Floor Outlet Box: Through under floor conduit to box. (This method is highly discouraged.)
 4. Column Mounted-Workroom Floor: Through surface mount conduit stubs to junction box or cable tray.
 5. Ladder Rack mounted: Along ladder rack from rack to conduit stubs or cable tray.
- F. Separate communications cables from other cables and fixtures minimum distance as follows:
1. Non-Shielded Electrical Cables: 12 inches.
 2. Fluorescent Light Fixtures: 12 inches.
- G. Cross electrical cables with communications cables at 90 degrees only.
- H. Comply with cable manufacturers minimum bend radius requirements. For Category 6, minimum bend radius shall be no less than 4 times diameter of outer sheath of cable. For Fiber Optic cabling, minimum bend radius shall be no less than 10 times diameter of outer sheath of cable.
1. Do not stretch, stress, tightly coil, bend or crimp cables.
 2. Replace cables that are severely stressed during installation at no additional cost to United States Postal Service.
- I. Cabling installed in plenum or non-plenum air returns.
1. **Plenum Environments:** If the majority of the area for the cabling installation is deemed to be a return air plenum, all components of the installation in those areas shall be rated for the plenum environment in which they are installed. There shall be no installation of any non-plenum component of this cabling system in the plenum environment unless those components are enclosed in such a manner as to maintain the integrity of the plenum environment. If the area beneath a raised floor is considered a plenum environment, there shall be no installation of any components of the cabling system that are not rated for a plenum environment unless they are completely enclosed in such a manner as to maintain the integrity of the plenum environment. This includes, outlets, jacks, patch cords, copper or fiber, cabling or any other component that are not rated for installation in a plenum environment.
 2. **Non-Plenum Environments:** The work room floor is considered a non-plenum environment and all components of the Structured Cabling System shall be rated for installation in non-plenum area. If, at any point, the non-plenum cabling enters or passes through a plenum area, the cabling shall be encased in a continuous EMT conduit pathway throughout the entire plenum area.
 3. A determination as to which areas at a USPS facility are plenum or non plenum shall be obtained by the installing contractor prior to ordering any materials for the installation. It is the responsibility of the installing contractor to verify the cable installation meets the EIA/TIA standards for installation in the environment in which it is installed.
- J. Identification: Section 260500 - Common Work Results for Electrical; furnish and install machine generated labels.
1. Patch Panels and Outlet Faceplates: Display outlet or cable identification number in uppercase lettering on permanent adhesive label stock.



- a. Label the Telecommunications Equipment Room as ER and Telecommunications rooms 01, 02, 03, etc.
- b. Label all copper patch panel ports in a horizontal fashion (left to right in numerical sequence).
- c. Label telecommunications outlet faceplate in the same manner as the patch panel.
- d. Exception: in case of expansion projects, follow existing labeling scheme.
- 2. Communications Cables:
 - a. Display cable identification number in black uppercase lettering on permanent adhesive self laminating label of contrasting color from cable sheath.
 - b. Place labels on each end of cable, maximum 6 inches from cable termination.
 - c. Follow ANSI/TIA/EIA-606A – Administration Standard for Commercial Telecommunications Infrastructure (Current Edition).
- 3. Fiber Optic Interconnect Centers: Display ER/TR, and cable strand identification numbers in uppercase lettering, or numbers on machine generated permanent adhesive label stock.
 - a. Follow ANSI/TIA/EIA-606A – Administration Standard for Commercial Telecommunications Infrastructure (Current Edition)
- K. Cable Run Lengths: Route cables so that cable run length does not exceed recommended maximum.
 - 1. UTP cable limited to a total run of 90m (295 feet) between the back of the patch panel to the Telecommunications Outlet per ANSI/TIA/EIA-568-C.
 - 2. Cable conductors shall be continuous (“Homerun”) from originating termination equipment to destination termination equipment.

3.3 INSTALLATION - COMPONENTS

- A. Cables: Furnish and install communications cables as specified, in accordance with Cable Pulling Schedules, manufacturer's published instructions, ANSI/TIA/EIA-568-C including all addendums and as indicated on Drawings.
 - 1. Dress cable to final location, remove sheath to point allowing splaying of conductor, and terminate. Make each termination uniform and precise. Hook and Loop “velcro” cable ties shall be used for bundling and dressing all cabling. No nylon zip ties shall be used for cable bundling or attachment.
 - 2. Maintain sheath integrity. Remove minimum amount of sheath required for termination up to a maximum of 1 inch.
 - 3. Maintain manufacturer's twisting of wire pairs to termination point. Do not attempt to restore, modify, or add to manufacturer's twisting of cable. Do not untwist more than ½ inch of the stripped cable.
 - 4. Label each end with a machine generated, self laminating label.
 - 5. Mechanical couplers or splices not permitted in copper cabling.

NOTE TO SPECIFIER

The majority of Customer Service Facilities (CSF) are less than 60,000 s.f. and will not require fiber optic backbone cabling. Add paragraphs 3.3A.6. & 7. below if fiber cabling is deemed necessary.

- 6. A fiber optic service loop of sheathed fiber no less than 10 feet at each end of a fiber optic cable shall be installed at each termination point. All service loops shall be installed so that the minimum bend radius (10 times the outside diameter of the fiber) shall not be exceeded. All service loops shall be installed outside of the fiber optic termination housing. Once the fiber reaches the entrance point of the fiber optic enclosure, there shall be no less than 3 feet of unsheathed fiber installed neatly in the fiber optic storage tray prior to terminations being installed. Unsheathed fiber shall be installed in the storage tray per the fiber optic enclosures manufacturer's instructions.
- 7. When installing Armored Fiber Optic cabling, proper grounding techniques to ground the metallic member of the Armored Fiber Optic Cable must be maintained.



- B. Fire Stopping:
 - 1. Fire stop penetrations of fire-resistive rated assemblies as specified in Section 078400 – Fire Stopping.
 - a. No through wall penetrations or conduit sleeves used for communications cabling will be Firestop sealed with a Silicone foam or other non-removable type sealant. The penetrations shall be firestopped to allow for ease of future access using intumescent putty.

3.4 CONSTRUCTION

- A. Interface with Other Work:
 - 1. Provide information to affected trades regarding requirements and responsibilities for preparation of Work of a particular trade for installation of Work installed under this Section.
 - 2. Coordinate with Telephone Utility Company for interface of systems and required interconnections.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Testing and Certification Overview
 - 1. The Contractor shall provide equipment and materials for the testing of all installed copper and fiber transmission media. The supplier shall employ Level III compliant test equipment that stores the test results in internal memory and produces test result reports. The supplier shall provide the USPS, test results in test equipment format (raw electronic). Supplier prepared spread sheets and PDF files are not acceptable. If the USPS does not have the software to read the test result files the supplier shall provide the necessary software to view the files at no charge to the USPS. The test reports shall provide complete listings of all tested parameters and provide optional plots and graphs of all parameters in the cable tests.
 - a. The USPS technical representative may conduct random tests of copper and fiber cable with USPS test equipment as part of the final inspection. The Contractor shall re-terminate and retest any cable found to be defective.
 - b. The Contractor shall provide all equipment and services necessary to secure and provide the USPS a system warranty. Inspect installation of cables and equipment during and at completion of installation.
- C. Copper Cable Testing
 - 1. The Contractor shall perform tests on all installed Category 6 data wiring. Contractor test equipment used shall be Level III compliant. The Category 6 copper cable tester must test for the copper cable being installed. A generic Category 6 cable setting is not acceptable. Example: If “Superior Essex” Cat.6 CMR, the tester shall be setup to test for “Superior Essex” Cat.6 CMR and not a generic CAT.6 cable. Test parameters include, but are not limited to:
 - NEXT, NEXT @ Remote
 - Wire Map
 - Characteristic Impedance
 - Length
 - DC Loop Resistance
 - Propagation Delay
 - Return Loss (RL), RL @ Remote
 - Delay Skew
 - Attenuation
 - Attenuation-to-Crosstalk Ratio (ACR), ACR @ Remote



Power Sum ACR, PSACR @ Remote
 ELFEXT, ELFEXT @ Remote
 Power Sum ELFEXT, PSELFEXT @ Remote
 Power Sum NEXT, PSNEXT @ Remote

2. Cable test parameters shall be set to correct values for NVP and Test Limit (ANSI/TIA/EIA 568-C Category 6, Permanent Link).
3. The copper wiring to be tested includes, but is not limited to:
 - a. Telecommunications outlet wiring
4. Perform end-to-end tests of each 4-pair cable as follows:
 - a. Pair/conductor for proper pinouts and continuity.
 - b. Ground fault.
 - c. Proper termination, shorts, and crossed pairs.
 - d. Channel attenuation per ANSI/TIA/EIA-568-C, including all addendums.
 - e. Channel bi-directional worst case near end cross talk (NEXT) at frequencies up to 250 MHz, per ANSI/TIA/EIA-568-C including all addendums.
 - f. Measured effective cable run length.

NOTE TO SPECIFIER

The majority of Customer Service Facilities (CSF) are less than 60,000 s.f. and will not require fiber optic backbone cabling. Add Section 3.5D. below if fiber cabling is deemed necessary.

D. Fiber Optic Cable Testing

1. The supplier shall perform Bi-directional testing on all installed fiber optic cabling. Supplier test equipment shall perform testing of fiber in accordance with the fiber type being tested, 50 micron laser optimized using the procedures outlined in ANSI/TIA/EIA-568C and ANSI/TIA/EIA-526-14-A, Method B for multimode fiber, ANSI/TIA/EIA-526-7 for singlemode fiber.
 - a. The fiber testers and test heads shall have passed calibration within one year of test date. Any calibration in excess of one year is not acceptable.
2. Multimode fiber optic cable shall be tested bi-directionally at wavelengths of 850nm and 1300nm. Singlemode fiber optic cable shall be tested bi-directionally at 1310nm and 1550 nm.
3. Cable tester test parameter shall be set to correct values for:
 - Actual manufacturer of 10Gb LOMF. Tester cannot be a generic 10Gb fiber type and must be specific to the manufacturer's model of fiber cable being tested.
 - Index of Refraction based on manufacturer specifications for cable type being tested..
 - Quantity of adapters (typically 2).
 - Fiber Type.
 - Test Limit (ANSI TIA/EIA/568-C).
4. The Supplier shall review test settings with the USPS technical representative. Supplier shall have cable specifications on site for USPS technical review to verify settings are correct on test equipment.
5. Fiber optic cables shall pass all attenuation tests referenced to formulas presented in the listed standards.
6. Perform end-to-end tests of each fiber optic backbone cable as follows (applies to TR applications only):
 - a. Power meter, and light source tests per ANSI/TIA/EIA-568-C specification.
 - b. Optical Time Domain Reflectometer (OTDR) tests per ANSI/TIA/EIA-568-C specification including all addendums.
 - c. Measured effective cable run length.



USPS CSF Specifications issued: 10/1/2013
Last revised: 8/29/2013

END OF SECTION 27 05 00 00



SECTION 27 05 00 00 - MPF COMMON WORK RESULTS FOR COMMUNICATIONS**

NOTE TO SPECIFIER

Use this section for Mail Processing Facilities.

****THIS ENTIRE SECTION CONSISTS OF REQUIRED PARTS OR ARTICLES. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes the following structured cabling system components:
 - 1. Communication cable.
 - 2. Termination equipment.
 - 3. Patching equipment.
 - 4. Consolidated Computer Room (CCR).
 - 5. Telecommunications Room (TR) / Telecommunications Enclosure (TE)
 - 6. Telephone service entrance.
- B. Related Documents:
 - 1. The Contract Documents, as defined in Section 011000 – Summary of Work, apply to the Work of this Section.
 - 2. USPS Lan Infrastructure Best Practices, May 2011.
 - 3. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 078400 – Fire stopping: Fire stopping sealant at penetrations of fire-rated assemblies.
 - 2. Section 250504 – Building Automation System (BAS) General.
 - 3. Section 255104 – EEMS Integration.
 - 4. Section 260500 – Common Work Results for Electrical: Basic electrical methods.
 - 5. Section 260533 – Raceway and Boxes for electrical Systems: Conduit and boxes for installation of communications cabling
 - 6. Section 271100 – Communications Equipment Room Fittings
 - 7. Section 271300 – Communications Backbone Cabling
 - 8. Section 271500 – Communications Horizontal Cabling
 - 9. Section 275116 – Public Address Paging Systems.
 - 10. Section 281304 – Enterprise Physical Access Control System.
 - 11. Section 281600 – Intrusion Detection System.
 - 12. Section 282304 – Security, Burglary and Robbery Countermeasures Analog CCTV System.
 - 13. Section 282305 – Integrated Security and Investigative Platform (ISIP) CCTV System.

1.2 REFERENCES

- A. Telecommunication Industry Association (TIA), Electronic Industries Association (EIA):
 - 1. ANSI/TIA/EIA-568-C Commercial Building Telecommunications Cabling Standard (2009) including all addendums.
 - 2. ANSI/TIA/EIA-569-B - Commercial Building Standard for Telecommunications Pathways (Current edition).



3. ANSI/TIA/EIA-J-STD-606B - Administration Standard for Commercial Telecommunications Infrastructure (2002 or Current Edition).
4. ANSI/TIA/EIA J-STD-607-A - Commercial Building Grounding and Bonding Requirements for Telecommunications (2002 or Current Edition).
5. BICSI Telecommunications Distribution Methods Manual (Version-12 including all addendums)

B. National Electrical Manufacturer's Association (NEMA):

1. NEMA WC 26 - Wire and Cable Packaging.

C. National Fire Protection Association (NFPA):

1. NFPA 70 - National Electrical Code. (Current Version)

1.3 SYSTEM DESCRIPTION

A. Telecommunications system for entire building consisting of cabling, connectors, faceplates, termination patch panels, patch cords, wire management panels, and cabling supports. System will serve the following:

1. Telephone.
2. Data.
3. Modem.
4. Printer.
5. Facsimile.
6. Point-of-service (POS).

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

1. Product Data: Provide for each material or equipment item specified.
2. Shop Drawings:
 - a. Point-to-point wiring diagrams for cables installed under this Section.
 - b. Detailed plan views and elevations of telecommunications spaces showing racks, termination blocks, and cable paths.
 - c. Minimum Scale for Details: 1/4 inch.
3. Termination Schedule: Indicate the following.
 - a. T/O (telecommunications outlet) identification.
 - b. Cable identification number.
 - c. Room location.
 - d. Patch panel identification number.
 - e. Patch panel port identification number.
4. Assurance/Control Submittals:
 - a. Sample Forms: Submit proposed format for cable test reports.
 - b. Test Reports: Submit the following reports directly to Contracting Officer from Testing Laboratory, with copy to General Contractor. Prepare reports in conformance with Section 014000 – Quality Requirements.
 - 1) End-to-end tests.
 - c. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - d. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals. Deliver prior to Final Acceptance.



1. Certification: Comprehensive test results for Category 6 and fiber optic certification of cable plant per specifications of TIA/EIA-568-C, and all addendums. Immediately following new Category 6 copper and laser optimized multi-mode fiber installation, submit raw test results via e-mail to the Raleigh IT Service Center representative who will be performing copper and fiber site acceptance. All testing must be performed using an industry standard compliant test device. Test results must be furnished in format used by testing device. Vendor generated spreadsheets or PDF's will not be accepted. If special software is required for viewing test results, said software shall be supplied by installing vendor at no cost to USPS.
2. Project Record Documents: Accurately record the following:
 - a. Cable pulling schedules, in printed form on CD-ROM.
 - b. Cable routings (as-built drawings) shall be provided with cable plant depicted on floor plans prior to acceptance. The drawings must identify location of all T/Os (Telecommunications Outlets), TR/TE's (Telecommunications Rooms / Enclosures), Consolidated Computer Rooms (CCR) and any other installed component of the cabling solution. The actual routing of the cable bundles (pathways) and backbone cables on the floor plans shall also be shown. Provide master overall set plus one set for each TR/TE which will detail T/O's and CP's served by that TR/TE. As-built drawings will be provided to USPS IT by the installing Contractor electronically in a USPS compatible version of AutoCAD on a CD-ROM..
 - c. Labeling shall conform to the ANSI/TIA/EIA-606-A and USPS labeling guidelines.
 - d. A detailed cable termination record will be provided in sufficient detail, so that:
 - 1) Telephone Utility Company or telephone interconnect company can install cross connects.
 - 2) Postal Service users can install and maintain patch cords at patch panel fields.
 - 3) The location and size of the service entrance conduits are known.
3. Operations and Maintenance Data: Data including wiring diagrams, parts lists, shop drawings, product data, manufacturer's instructions for cables and equipment and certifications identified above shall be provided.

1.5 QUALITY ASSURANCE

- A. Single Source Responsibility: Furnish and install products of one manufacturer for each product type. Multiple manufacturers not permitted.
- B. Qualifications:
 1. Manufacturer: Company specializing in manufacturing the products specified with a minimum of 5 years documented experience.
 2. Installer: Company specializing in the installation of Category 6 and fiber optic Structured Cabling Systems with a minimum of 5 years documented experience. Contractor must have a full time BICSI RCDD with current credentialing on staff. Contractor shall have a minimum of one BICSI certified Technician on the job site at all times with documented formal training in the installation of Category 6 and fiber optic cabling systems. Installers shall possess a certification for a total systems solution from the manufacturer of the cabling and terminating hardware. The contractor must present these certifications to the contracting officer before beginning work.
 3. Warranty: Total Systems Solution required providing a minimum 15 year warranty from both manufacturer of cabling as well as connecting hardware when installed together according to predetermined manufacturers' specifications. Installer shall possess certifications from manufacturers of the components installed as a total systems solution and must present said certifications to the contracting officer in advance of beginning the Work.
- C. Regulatory Requirements:
 1. Conform to requirements of NFPA 70.
 2. Products: Listed and classified by Underwriter's Laboratories Incorporated as suitable for the purpose specified and indicated.
 3. Perform Work that interfaces with Telephone Utility Company in accordance with Telephone Utility Company rules and regulations.



4. Conform to current ANSI/TIA/EIA standards and BICSI TDMM for telecommunications installation.

D. Pre-Installation Meetings:

1. Convene a pre-installation meeting two weeks prior to commencing Work of this Section.
2. Require attendance of parties directly affecting Work of this Section. The USPS telecommunications system representative for Mail Processing Facilities projects will be the Raleigh Information Telecommunications Support Center (RITSC) and the District Telecommunication Specialist.
3. Review conditions of operations, procedures and coordination with related Work.
4. Agenda:
 - a. Tour, inspect, and discuss building conditions relating to communications cabling and equipment.
 - b. Coordination with Telephone Utility Company and the USPS telecommunications system representative will be through the Contracting Officer.
 - c. Review exact location of each item within building construction, casework, and fixtures and their requirements.
 - d. Review required submittals, both completed and yet to be completed.
 - e. Review Drawings and Specifications.
 - f. Approve proposed equipment.
 - g. Review and finalize construction schedule related to voice and data installation, verify availability of materials, personnel, equipment and facilities needed to complete project and avoid delays.
 - h. Review required labeling process, inspections and testing.
 - i. Review cable routing and support.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 – Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver in accordance with NEMA WC 26.

PART 2 - PRODUCTS

2.1 CONDUITS AND BOXES

- A. Specified in Section 260533 – Raceway and Boxes for Electrical Systems.

2.2 TELEPHONE HANDSETS: PROVIDED BY US POSTAL SERVICE UNDER SEPARATE CONTRACT.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.



3.2 INSTALLATION

- A. Special Requirements For Cable Routing And Installation
 - 1. The majority of the structured cabling system wiring in this building will be installed above ceilings without conduit. All cabling used throughout this project shall comply with the requirements as outlined in the National Electric Code (NEC) article 725. All cabling shall bare CMP and/or appropriate markings for the environment in which they are installed.
 - 2. Sealing of openings between floors, through rated fire and smoke walls, existing or created by the contractor for cable pass through shall be the responsibility of the contractor. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of the contractor's work. Any openings created by or for this contractor and left unused shall also be sealed as part of this work.
- B. Support cables installed in ceiling spaces with cable tray and/or wide-base canvas loop Category 6 compliant suspension devices such as the Erico Caddy #425 loop, anchored to building ceiling structural steel (red iron). The use of wide-based J-hooks "Erico" Caddy Cable CAT series shall be permitted for no more than (3) category 6 cables.
 - 1. Minimum and maximum spacing between supports: 4 feet.
 - 2. Maximum Number of 4 Pair Cables per support: 25.
 - 3. Furnish and install additional supports as required.
 - 4. Install complete cable support device system before starting installation of cable.
 - a. Installation of cable before completion of support system not permitted.
 - b. Unsupported cable not permitted.
 - 5. Organize and group cables. Install cable group as single run through ceiling spaces following column and building lines. Do not install cable group runs diagonally across center of building.
 - 6. Install armored fiber optic cabling in cable tray or approved support solution.
 - 7. Cabling will not be suspended from any electrical conduits, sprinkler systems, gas, or water pipes, etc.
 - 8. Cabling will not be attached to suspended ceiling grid system.
 - 9. Cabling system shall be installed in approved suspension devices for telecommunications cabling.
 - 10. No element of the building structure (i.e. truss webbing) will be used to support any telecommunications cabling.
 - 11. Vertical runs of backbone and horizontal cabling (e.g.: cabling exiting thru-wall penetrations) shall be equipped with factory manufactured cable drop out fittings or kellums cord grips to properly support the cabling at the vertical bends.
- C. Cable trays shall be required for areas of heavy cable concentration including but not limited to CCRs, TR/TE's, and large administrative hallways.
 - 1. Maximum spacing between each cable tray support: Specified by manufacturer of cable tray.
 - 2. Maximum number of cables supported by cable tray: Specified by manufacturer of cable tray not-to-exceed 40% fill ratio.
 - 3. Furnish and install additional supports as required.
 - 4. Install complete cable tray system before starting installation of cable.
 - a. Installation of cable before completion of tray system not permitted.
 - b. Cabling shall not be bundled within cable tray.
 - c. Provide factory manufactured cable drop-out fittings for transportation of cabling entering or exiting the cable tray.
- D. Cabling routed underground, exterior of the building or through inaccessible ceilings shall be contained in conduit. Provide flush boxes within finished areas and surface mounted, cast aluminum, "FS" factory boxes in unfinished areas. Provide 1" conduit risers with 90 degree bend and bushing for all T/O's.
 - 1. Conduit/EMT and cable tray shall be used in the ceiling of the work room floor or wherever a suspended ceiling system is not present.
 - 2. All conduit stubs must have a plastic bushing installed at each end.
 - 3. The size of the conduit shall be a minimum of 1 inch in diameter. Larger conduits shall be sized for 40 per cent fill.
 - 4. No conduit is to be buried in the slab.



5. There shall be no more than 180 degrees of bend in a conduit longer than 30 feet. All conduits that are comprised of more than two (2) ninety degree bends or a reverse bend shall have a properly installed pull box. Pull boxes shall be 12"x 12" x 6" for up to 1" EMT, 18"x18"x8" for up to 1 ½" EMT. Ninety degree bends in fiber runs shall be installed using dual forty-five degree bends.
 6. Under no circumstances shall a pull box be used to change direction of a conduit. All conduits shall be installed in a manner so that cabling passes directly through the pull box without changing direction.
- E. Route cable for T/O (telecommunications outlets) as follows:
1. Wall Mounted: Through ceiling spaces to conduit stub-ups or junction boxes. Include drag lines.
 2. Furniture System Cable Raceway: Point of entry to outlet.
 3. Floor Outlet Box: Through under floor conduit to box. (This method is highly discouraged).
 4. Column Mounted-Workroom Floor: Through surface mount conduit stubs to junction box or cable tray.
 5. Consolidated Computer Room: Along ladder rack from rack to locations to be run in ladder tray / basket tray.
- F. Communications cabling and fixtures shall have minimum separation from the following devices:
1. Non-Shielded Electrical Cables: 12 inches.
 2. Fluorescent Light Fixtures: 12 inches.
- G. Cross electrical cables with communications cables at 90 degrees only.
- H. Comply with cable manufacturers minimum bend radius requirements. For Category 6, minimum bend radius shall be no less than 4 times diameter of outer sheath of cable. For Fiber Optic cabling, minimum bend radius shall be no less than 10 times diameter of outer sheath of cable.
1. Do not stretch, stress, tightly coil, bend or crimp cables.
 2. Replace cables that are severely stressed during installation at no additional cost to USPS.
- I. Cabling installed in plenum or non-plenum air returns.
1. Plenum Environments: If the majority of the area for the cabling installation is deemed to be a return air plenum, all components of the installation in those areas shall be rated for the plenum environment in which they are installed. There shall be no installation of any non-plenum component of this cabling system in the plenum environment unless those components are enclosed in such a manner as to maintain the integrity of the plenum environment. If the area beneath a raised floor is considered a plenum environment, there shall be no installation of any components of the cabling system that are not rated for a plenum environment unless they are completely enclosed in such a manner as to maintain the integrity of the plenum environment. This includes, outlets, jacks, patch cords, innerduct, copper and fiber optic cabling or any other components that are not rated for installation in a plenum environment.
 2. Non-Plenum Environments: The work room floor is considered a non-plenum environment and all components of the Structured Cabling System shall be rated for installation in non-plenum area. If, at any point, the non-plenum cabling or innerduct enters or passes through a plenum area, the cabling or innerduct shall be encased in a continuous EMT conduit pathway throughout the entire plenum area.
 3. A determination as to which areas at a USPS facility are plenum or non plenum shall be obtained by the installing Contractor prior to ordering any materials for the installation. It is the responsibility of the installing Contractor to verify the cable installation meets the EIA/TIA standards for installation in the environment in which it is installed.
- J. Identification: Section 260500 – Common Work Results for Electrical; furnish and install machine generated labels.
1. Patch Panels, CP1 Enclosures, and Outlet Faceplates: Display outlet or cable identification number in uppercase lettering on permanent machine generated adhesive label stock.



- a. Label the Consolidated Computer Room as CCR and Telecommunications Rooms/Enclosures as 01, 02, 03, etc.
- b. Label all copper patch panel ports in a horizontal fashion left to right in numerical sequence.
- c. Label all (TR/TE) Workroom Floor locations with 12 inch high, contrasting color, block letters mounted on all visible sides. Example: IDF1-02 on all visible sides in contrasting color to cabinet.
- d. Label all (WRF) Workroom Floor CP-1 Nema-12 housing units with a minimum of (3") three inch, black, block letters.
- e. All CP-1 type terminations will be labeled alphabetically per each TR/TE. Example: TR/TE-01 first CP-1 would be labeled 01-A, the second CP-1 would be labeled 01-B, the third 01-C, etc. TR/TE-02's first CP-1 would be labeled 02-A, the second 02-B, etc.
- f. CP-1s will have the following Patch Panel Port assignments. Example: (01-A Ports 1-12), (01-B Ports 13-24) (01-C Ports 25-36), (01-D Ports 37-48), (01-E Ports 49-60) * Note CP-1 01-E begins on the second patch panel numerically numbered ports 49 – 96.
- g. Label Copper Patch Panel ports in the order the cables were terminated beginning with all CP type terminations, then T/O terminations.
 - 1) CP-1 (TR/TE # - Zone A, B, C – Port#'s) i.e. 01A-1-12, 01B-13-24, 01C-25-36, 01D-37-48, 01E-49-60 etc.
 - 2) T/O (TR/TE # - T/O # - Port #) i.e. 1-T1-37, 38, 39, 1-T2-40, 41, 42, 1-T3-43, 44, 45, etc.
- h. Label telecommunications outlet faceplate and CP location in the same manner as the patch panel.
2. Communications Cables:
 - a. Display cable identification number in black uppercase lettering on machine generated permanent adhesive self laminating label of contrasting color from cable sheath.
 - b. Place labels on each end of cable, maximum 6 inches from cable termination.
 - c. Follow ANSI/TIA/EIA-606A – Administration Standard for Commercial Telecommunications Infrastructure (Current Edition).
3. Fiber Optic Interconnect Centers: Display TR/TE, and cable strand identification numbers in uppercase lettering, or numbers on machine generated permanent adhesive label stock. Applies to TR/TE applications only.
 - a. Follow ANSI/TIA/EIA-606A – Administration Standard for Commercial Telecommunications Infrastructure (Current Edition)
- K. Cable Run Lengths: Route cables so that cable run length does not exceed recommended maximum distance.
 1. UTP cabling from the back of the patch panel to the Telecommunications Outlet (T/O) is limited to a maximum total run of 90m (295 feet) in Admin. areas and 70m (230 feet) on the work room floor. Any work room floor T/O locations that will need to exceed 230 feet will require prior USPS approval.
 2. UTP cable between back of patch panel and Types 1, 2 and 3 Consolidation Points or Multi-User Telecommunications Outlet Assembly are limited to a maximum total run of 70m (230 feet) per ANSI/TIA/EIA-568-C. Minimum cable run length between back of patch panel and Types 1, 2 and 3 Consolidation Points or Multi-User Telecommunications Outlet Assembly shall be 15m (49 feet) per ANSI/TIA/EIA-568-C.
 3. Cable conductors shall be continuous ("Homerun") from originating termination equipment to destination termination equipment.

3.3 INSTALLATION - COMPONENTS

- A. Cables: Furnish and install communications cables as specified, in accordance with Cable Pulling Schedules, manufacturer's published instructions, ANSI/TIA/EIA-568-C including all addendums and as indicated on Drawings.
 1. Dress cable to final location, remove sheath to point allowing splaying of conductor, and terminate. Make each termination uniform and precise. Hook and Loop "velcro" cable ties shall



be used for bundling and dressing all cabling. No nylon zip ties shall be used for cable bundling or attachment.

2. Maintain sheath integrity. Remove minimum amount of sheath required for termination up to a maximum of 1 inch.
3. Maintain manufacturer's twisting of wire pairs to termination point. Do not attempt to restore, modify, or add to manufacturer's twisting of cable. Do not untwist more than ½ inch of the stripped cable.
4. Label each end with a machine generated, self laminating label.
5. Mechanical couplers or splices not permitted in copper cabling.
6. A fiber optic service loop of sheathed fiber no less than 10 feet at each end of a fiber optic cable shall be installed at each termination point. All service loops shall be installed so that the minimum bend radius (10 times the outside diameter of the fiber) shall not be exceeded. All service loops shall be installed outside of the fiber optic termination housing. Once the fiber reaches the entrance point of the fiber optic enclosure, there shall be no less than 3 feet of unsheathed fiber installed neatly in the fiber optic storage tray prior to terminations being installed. Unsheathed fiber shall be installed in the storage tray per the fiber optic enclosures manufacturer's instructions.
7. When installing Armored Fiber Optic cabling, proper grounding techniques to ground the metallic member of the Armored Fiber Optic Cable must be maintained.

B. Fire Stopping

1. Fire stop penetrations of fire-resistive rated assemblies as specified in Section 078400 – Fire Stopping.
 - a. No through wall penetrations or conduit sleeves used for communications cabling will be Firestop sealed with a Silicone foam or other non-removable type sealant. The penetrations shall be firestopped to allow for ease of future access using intumescent putty.

3.4 CONSTRUCTION

A. Interface with Other Work:

1. Provide information to affected trades regarding requirements and responsibilities for preparation of Work of a particular trade for installation of Work installed under this Section.
2. Coordinate with Telephone Utility Company for interface of systems and required interconnections.

3.5 FIELD QUALITY CONTROL

A. Section 014000 – Quality Requirements: Field testing and inspection.

B. Testing and Certification Overview

1. The Contractor shall provide equipment and materials for the testing of all installed copper and fiber transmission media. The supplier shall employ Level III compliant test equipment that stores the test results in internal memory and produces test result reports. The supplier shall provide the USPS, test results in test equipment format (raw electronic). Supplier prepared spread sheets and PDF files are NOT ACCEPTABLE. If the USPS does not have the software to view the test result files the supplier shall provide the necessary software to view the files at no charge to the USPS. The test reports shall provide complete listings of all tested parameters and provide optional plots and graphs of all parameters in the cable tests.
 - a. The USPS technical representative may conduct random tests of copper and fiber cable with USPS test equipment as part of the final inspection. The Contractor shall re-terminate and retest any cable found to be defective.



- b. The Contractor shall provide all equipment and services necessary to secure and provide the USPS a system warranty. Inspect installation of cables and equipment during and at completion of installation.
- C. Copper Cable Testing
1. The Contractor shall perform tests on all installed Category 6 data wiring. Contractor test equipment used shall be Level III compliant. The Category 6 copper cable tester must test for the copper cable being installed. A generic Category 6 cable setting is not acceptable. Example: If "Superior Essex" Cat.6 CMR cable is utilized, the tester shall be setup to test for "Superior Essex" Cat.6 CMR cable and not a generic CAT.6 cable. Test parameters include, but are not limited to:
 - NEXT, NEXT @ Remote
 - Wire Map
 - Characteristic Impedance
 - Length
 - DC Loop Resistance
 - Propagation Delay
 - Return Loss (RL), RL @ Remote
 - Delay Skew
 - Attenuation
 - Attenuation-to-Crosstalk Ratio (ACR), ACR @ Remote
 - Power Sum ACR, PSACR @ Remote
 - ELFEXT, ELFEXT @ Remote
 - Power Sum ELFEXT, PSELFEXT @ Remote
 - Power Sum NEXT, PSNEXT @ Remote
 2. Cable test parameters shall be set to correct values for NVP and Test Limit (ANSI/TIA/EIA 568-C Category 6, Permanent Link).
 3. The copper wiring to be tested includes, but is not limited to:
 - CP wiring from to the TR/TE patch panel
 - Communications Box wiring from the MPE to the TR/TE patch panel
 - Telecommunications wiring
 4. Perform end-to-end tests of each 4-pair cable as follows:
 - a. Pair/conductor for proper pinouts and continuity.
 - b. Ground fault.
 - c. Proper termination, shorts, and crossed pairs.
 - d. Channel attenuation per ANSI/TIA/EIA-568-C, including all addendums.
 - e. Channel bi-directional worst case near end cross talk (NEXT) at frequencies up to 250 MHz, per ANSI/TIA/EIA-568-C, including all addendums.
 - f. Measured effective cable run length.
- D. Fiber Optic Cable Testing
1. The supplier shall perform Bi-directional testing on all installed fiber optic cabling. Supplier test equipment shall perform testing of fiber in accordance with the fiber type being tested, 50 micron laser optimized using the procedures outlined in ANSI/TIA/EIA-568-C.1 and ANSI/TIA/EIA-526-14-A, Method B for Multimode fiber, ANSI/TIA/EIA-526-7 for Singlemode fiber.
 - a. The fiber testers and test heads shall have passed calibration within one year of test date. Any calibration in excess of one year is not acceptable.
 2. Multimode fiber optic cable shall be tested bi-directionally at wavelengths of 850nm and 1300nm. Singlemode fiber optic cable shall be tested bi-directionally at 1310nm and 1550 nm.
 3. Cable tester test parameter shall be set to correct values for:
 - Actual manufacturer of 10Gb LOMF. Tester cannot be a generic 10Gb fiber type and must be specific to the manufacturer's model of fiber cable being tested.
 - Index of Refraction based on manufacturer specifications for cable type being tested..



- Quantity of adapters (typically 2).
 - Fiber Type.
 - Test Limit (ANSI/TIA/EIA/568-C).
4. The Supplier shall review test settings with the USPS technical representative. Supplier shall have cable specifications on site for USPS technical review to verify settings are correct on test equipment.
 5. Fiber optic cables shall pass all attenuation tests referenced to formulas presented in the listed standards.
 6. Perform end-to-end tests of each fiber optic backbone cable as follows (applies to TR/TE applications only):
 - a. Power meter, and light source tests per ANSI/TIA/EIA-568-C specification.
 - b. Optical Time Domain Reflectometer (OTDR) tests per ANSI TIA/EIA-568-C specification including all addendums.
 - c. Measured effective cable run length.

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END OF SECTION 27 05 00 00



SECTION 27 11 00 00 - MPF COMMUNICATIONS EQUIPMENT ROOM FITTINGS

NOTE TO SPECIFIER

Use this section for Mail Processing Facilities.

****THIS ENTIRE SECTION CONSISTS OF REQUIRED PARTS OR ARTICLES. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes the following structured cabling system components:
 - 1. Consolidated Computer Room (CCR).
 - 2. Telecommunications Room (TR) / Telecommunications Enclosure (TE)
 - 3. Telephone service entrance.
- B. Related Documents:
 - 1. Specified in Section 270500 – Common Work Results for Communications.
- C. Related Sections:
 - 1. Specified in Section 270500 – Common Work Results for Communications

1.2 REFERENCES

- A. Specified in Section 270500 – Common Work Results for Communications.

1.3 SUBMITTALS

- 1. Specified in Section 270500 – Common Work Results for Communications.

1.4 QUALITY ASSURANCE

- A. Specified in Section 270500 – Common Work Results for Communications.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 – Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver in accordance with NEMA WC 26.



PART 2 - PRODUCTS**2.1 CATEGORY 6, PATCH CORDS AND STATION CABLES**

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. CommScope Uniprise, Claremont, NC (800) 544-1948
 2. Hubbell, Inc., Milford, CT (203) 882-4800.
 3. Molex Premise Networks, Harvard, MA (987) 772-5630.
 4. Belden, Richmond, IN (800) 235-3361.
 5. Ortronics, New London, CT (800) 934-5432.
 6. Siemon Company, Watertown, CT (860) 274-2523.
 7. Tyco Electronics AMP NETCONNECT, Berwyn, PA (800) 522-6752.
 8. Leviton, Bothell, WA (800) 977-0190.
 9. Panduit, Tinley Park, IL (800) 777-3300.
 10. Product options and substitutions. Substitutions: Not permitted.
- B. Conductors: Straight through type 4 twisted pair minimum 24 AWG, stranded copper.
1. Terminated with male 8-pin modular plugs.
 2. Complies with individual characteristics established in ANSI/TIA/EIA-568-C, and all addendums for Category 6 cable performance specification.
 3. Nominal Impedance: 100 ohms plus or minus 15 percent.
 4. Match performance and impedance characteristics of the installed horizontal unshielded twisted pair cable.
 5. Contractor shall provide one electronic switch patch panel cable for every T/O or one for every three 8-pin modular connector. Provide 50% of cables 7-foot long and 50% of cables 10-foot long. Contractor shall provide manufacturer terminated patch cables. All copper patch cord colors shall be determined by Raleigh ITSC personnel. Patch cords within the "CCR" shall be lengthened as necessary to compensate for the distance separation of neighboring racks and yet eliminate unwanted slack.
 6. In addition to patch cords at the racks, provide Category 6 station cables from the telecommunications outlets to USPS furnished telephone handsets and personal computers. Provide 75 percent of cables 9 ft. – 0 in. long and 25 percent of cables 15 ft. – 0 in. long. Contractor shall provide one manufacturer terminal station cable for every T/O. Station cable colors shall be determined by Raleigh ITSC personnel.

2.2 CATEGORY 6 8-PIN MODULAR INSULATION DISPLACEMENT CONNECTORS (IDC)

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. CommScope Uniprise, Claremont, NC (800) 544-1948
 2. Hubbell, Inc., Milford, CT (203) 882-4800.
 3. Molex Premise Networks, Harvard, MA (987) 772-5630.
 4. Belden, Richmond, IN (800) 235-3361.
 5. Ortronics, New London, CT (800) 934-5432.
 6. Siemon Company, Watertown, CT (860) 274-2523.
 7. Tyco Electronics AMP NETCONNECT, Berwyn, PA (800) 522-6752.
 8. Leviton, Bothell, WA (800) 977-0190.
 9. Panduit, Tinley Park, IL (800) 777-3300.
 10. Product options and substitutions. Substitutions: Not permitted.
- B. Connector:
1. 8-pin modular, Category 6, non-keyed.
 2. Complies with ANSI/TIA/EIA-568-C "T568A" pinning configuration.



3. Color: Selected by Contracting Officer.

2.3 CATEGORY 6 8-PIN MODULAR IDC "110" STYLE PATCH PANELS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. CommScope Uniprise, Claremont, NC (800) 544-1948
 2. Hubbell, Inc., Milford, CT (203) 882-4800.
 3. Molex Premise Networks, Harvard, MA (987) 772-5630.
 4. Belden, Richmond, IN (800) 235-3361.
 5. Ortronics, New London, CT (800) 934-5432.
 6. Siemon Company, Watertown, CT (860) 274-2523.
 7. Tyco Electronics AMP NETCONNECT, Berwyn, PA (800) 522-6752.
 8. Leviton, Bothell, WA (800) 977-0190.
 9. Panduit, Tinley Park, IL (800) 777-3300.
 10. Product options and substitutions. Substitutions: Not permitted.
- B. Panels:
 1. Rack mounted 48 port 8-pin modular, Category 6, non-keyed.
 2. Complies with ANSI/TIA/EIA-568-C "T568A" pinning configuration.
 3. Provide strain relief bar assemblies for rear copper terminations. Secure Cat. 6 cable with velcro straps. Plastic tie wraps are not acceptable.

2.4 WIRE MANAGEMENT PANELS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. Chatsworth Products, Chatsworth, CA (818) 882-8595.
 2. CommScope Uniprise, Claremont, NC (800) 544-1948
 3. Homaco, Chicago, IL (888) 445-6226.
 4. Hubbell, Inc., Milford, CT (203) 882-4800.
 5. Molex Premise Networks, Harvard, MA (987) 772-5630.
 6. Belden, Richmond, IN (800) 235-3361.
 7. Ortronics, New London, CT (800) 934-5432.
 8. Siemon Company, Watertown, CT (860) 274-2523.
 9. Tyco Electronics AMP NETCONNECT, Berwyn, PA (800) 522-6752.
 10. Leviton, Bothell, WA (800) 977-0190.
 11. Panduit, Tinley Park, IL (800) 777-3300.
 12. Product options and substitutions. Substitutions: Permitted.
- B. Management Panels: Rack mounted with horizontally and vertically mounted split D-rings.
 1. Each horizontal wire management panel will be 3 1/2 inch high (2 Rack unit) x 19 inch wide for use between 48-port Category 6 patch panels.
 2. Management panels for use at top of equipment rack will be 3.5 inches high x 19 inches wide.
 3. Management panels for use between fiber optic rack mount interconnect center and PFE components shall be 1 3/4 inches high x 19 inches wide.

2.5 EQUIPMENT (RELAY) AND SERVER RACKS WITH CABLE CHANNELS.

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. Chatsworth Products, Inc., Chatsworth, CA (818) 882-8595.
 2. CommScope Uniprise, Claremont, NC (800) 544-1948.
 3. Homaco, Inc., Chicago, IL (888) 446-6226.



4. Hubbell, Inc., Milford, CT (203) 882-4800.
5. Molex Premise Networks, Harvard, MA (987) 772-5630.
6. Ortronics Corporation, New London, CT (800) 934-5432.
7. Siemon Company, Watertown, CT (860) 274-2523.
8. Tyco Electronics AMP NETCONNECT, Berwyn, PA (800) 522-6752.
9. Leviton, Bothell, WA (800) 977-0190.
10. Panduit, Tinley Park, IL (800) 777-3300.
11. Product options and substitutions. Substitutions: Requires Approval.

- B. Constructed of aluminum extrusion framework. Dimensions: 84 inch high x 3 inch deep x 19 inch wide. Double sided, 12/24 tapped holes with universal EIA rack unit spacing. Black or Aluminum finish.
- C. Vertical Cable Channels: Dimensions: 6 inch x 5 1/2 inch x 78 11/16 inch. Black or Aluminum finish. Attach to sides of relay racks. Must be able to cover and conceal patch cabling.

2.6 FIBER OPTIC PATCH CORDS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. CommScope Uniprise, Claremont, NC (800) 544-1948.
 2. Corning Cable Systems, Hickory, NC (800) 743-2671.
 3. Hubbell, Inc., Milford, CT (203) 882-4800.
 4. Molex Premise Networks, Harvard, MA (987) 772-5630.
 5. Belden, Richmond, IN (800) 235-3361.
 6. Ortronics, New London, CT (800) 934-5432.
 7. Siemon Company, Watertown, CT (860) 274-2523.
 8. 3M Telecommunications, Austin, TX (800) 695-0447.
 9. Tyco Electronics AMP NETCONNECT, Berwyn, PA (800) 522-6752.
 10. Leviton, Bothell, WA (800) 977-0190.
 11. Panduit, Tinley Park, IL (800) 777-3300.
 12. Product options and substitutions. Substitutions: Not permitted.
- B. Fiber optic duplex SC/LC to LC/LC patch cords: Two strand tight buffered 50/125 laser optimized, 10-Gigabit Ethernet Compliant, "1500/500" multi-mode fiber optic cord.
 1. USPS to specify connector type for patch cords.
 2. Complies with individual characteristics established in ANSI/TIA/EIA-568-C including all addendums for fiber optic patch cable performance specification.
 3. Patch cords will be factory made and tested
 4. Fiber optic patch cord terminations and quantities shall be specified by USPS prior to procurement.
 5. Match performance characteristics of installed fiber optic backbone.

2.7 CONDUITS AND BOXES

- A. Specified in Section 260533 – Raceway and Boxes for Electrical Systems.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Specified in Section 270500 – Common Work Results for Communications.



3.2 INSTALLATION - COMPONENTS

- A. Patch Panels: Install 48-port, 8-pin module Category 6) patch panels at main cross-connect and horizontal cross-connect for termination of cables installed as part of Work of this Section.
 1. Install patch panels inside wall mounted data enclosure for retrofit column mounted TE applications. Install patch panels on floor mounted 19 inch wide by 84 inch high open relay racks at CCR and TR room locations.
 2. Furnish and install patch panels with cable designation strips.
 3. Furnish and install wire management panel on rack or cabinet mounting rails above and below each patch panel for all locations.
 4. Furnish and install termination and cable support bars sufficient to maintain UTP bend radius at rear of panels.
 5. Terminate all 4 pairs of each horizontal 4 pair cable to each 8 pin ("T568A") patch panel port.
 6. Consolidation Points (CP-1s) on the (WRF) workroom floor designated to provide LAN connectivity for Mail Processing Equipment (MPE) shall not be used in the calculation for the voice backbone cabling. Column T/Os and administrative area T/Os being serviced from WRF TR/TE's shall be used to determine if additional voice backbone requirements are needed.
 7. Consolidation Point cabling will terminate starting on the first Category 6 copper patch panel followed by a minimum of 24 spare ports for future CP locations. T/O cabling will terminate after the last spare port in consecutive order (1, 2, 3...)
 8. Consolidation Points (CP-1s, CP-2s, & CP-3s) used within the administrative (ADMIN) areas shall be counted to determine the number of voice backbone pairs required.
- B. CCR (Consolidated Computer Room):
 1. Furnish and install three each 4-pair Category 6 UTP cables from each office area and workroom column mounted T/O (telecommunications outlet) to Consolidated Computer Room as indicated on drawings. Terminate 12 each 4-pair Category 6 UTP cables from each Type 1 Consolidation Point as indicated on drawings. Terminate 48 each 4-pair Category 6 UTP cables from each Type 2 or Type 3 Consolidation Points as indicated on drawings. Terminate 12 each 4-pair Category 6 UTP cables from each Admin. area CP-1.
 2. Terminate each cable to 8-pin modular connector (568-A) at workstation and to rack mounted patch panels at Consolidated Computer Room. Provide a minimum of a 8 to 10 foot service loop, in figure eight coil, for all copper cables.
 3. Furnish, install, and ground, floor mounted, 84 inch high x 3 inch deep x 19 inch wide relay racks shoulder-to-shoulder separated by 6 inch vertical wire managers perpendicular to wall housing plywood backboards.
 - a. Mount relay racks in a "side by side" fashion with one vertical wire management channel between each rack, and one wire management channel on outside side rail of both end racks.
 - b. Allow minimum 2 empty racks for PFE (Postal Furnished Equipment) data components. If TR/TEs are present, place these racks on each side of the rack containing fiber optic patch panels. (Consult USPS for room exact rack placements.)
 - c. Sections of 12 inch wide ladder tray/basket tray shall be mounted to top of relay racks and extend to plywood backboard or other ladder rack/basket tray for each relay rack installed. This ladder rack serves as additional support for relay racks as well as cable routing from relay rack to backboard.
 - d. Each rack will receive a separate #6 AWG ground wire home run to the telecommunications main grounding busbar (TMGB).
 - e. Each rack shall be equipped with a factory manufactured power strip equipped with (10) NEMA5-15R receptacles.
 4. Furnish and install a maximum of two (2) 4 ft. x 8 ft. plywood backboards along walls behind and perpendicular to CCR racks.
 - a. Plywood: 48 inch x 96 inch x 3/4-inch, fire rated, void-free, smooth side out.
 - b. Install plywood with long dimension in vertical orientation.
 - c. Field paint with white or gray enamel fire resistant paint prior to installation of telephone equipment.



- d. Furnish and install an industry approved main grounding buss bar and attach #6 AWG ground using 2 hole compression type fittings. All metallic components of CCR shall be grounded to the installed Telecommunication Main Grounding Busbar (TMGB).
 5. Install 12 inch wide ladder rack/basket tray with 2 inch side bars the entire width of plywood back boards at 7'-6" to 8 feet AFF (Racks are 84 inches high).
 - a. Furnish and install 12 inch wide ladder rack/basket tray with 2 inch side bars at 7'-6" to 8 feet AFF between plywood backboards and relay racks (racks are 84 inches high). All sections of ladder rack and or basket tray shall be joined with manufacturer approved devices. No sections of ladder rack or basket tray shall be zip tied together. All sections of ladder rack and/or basket tray will be grounded or bonded.
 - b. Provide (2) factory manufactured cable drop out fittings at each rack within the "CCR".
 6. Install number of Category 6 48-port patch panels in relay rack(s) that the 4-pair cables serving only the CCR are to be terminated. It is recommended that Telecommunications Outlets within the CCR be installed using the ladder rack/basket tray system and terminated in work-boxes attached to the ladder rack/basket tray. USPS IT will specify final termination points.
 7. Patch Cords: Furnish 4-pair Category 6 UTP patch cords. Provide one patch cord for every triplex T/O or one cord for every three 8-pin modular connectors.
 8. Fiber Optic Patch Cords: Furnish duplex fiber optic patch cords for each TR/TE, terminations, quantities, and lengths are to be determined by USPS. Provide duplex cords for 2/3 of the fiber optic termination. Example: 24 strands of fiber terminated at each rack-mount fiber-optic interconnect center requires 8 duplex patch cords.
 9. A fiber optic service loop of sheathed fiber no less than 20 feet at each end of a fiber optic cable shall be installed at each termination point. All service loops shall be installed so that the minimum bend radius (10 times the outside diameter of the fiber) shall not be exceeded. All service loops shall be installed outside of the fiber optic termination housing. Once the fiber reaches the entrance point of the fiber optic enclosure, there shall be no less than 10 feet of unsheathed fiber installed neatly in the fiber optic storage tray prior to terminations being installed. Unsheathed fiber shall be installed in the storage tray per the fiber optic enclosures manufacturers' instructions.
 10. Fiber Optic Patch Cords: Furnish 50 percent two-meter and 50 percent five-meter duplex SC/LC and LC/LC fiber optic patch cords (Quantities and additional lengths are to be coordinated with USPS prior to procurement.) Provide duplex 50/125 micron Laser Optimized 10-Gigabit Ethernet compliant 1500/500 fiber optic patch cords for 2/3 of the fiber optic terminations. Example: 24 strands of fiber terminated at each rack-mount fiber-optic interconnect center requires 8 duplex patch cords.
 11. Provide central uninterruptible power supply correctly sized for the networking equipment utilized. All UPS outlets shall be red/orange in color.
 12. All metallic ladder tray, basket tray, equipment racks or enclosures shall be bonded and grounded using a #6 AWG stranded ground wire with green insulation using 2 hole compression type fittings or ground fitting approved for basket tray installation. All painted surfaces shall be burnished for paint removal to achieve maximum ground connection.
 13. All grounding in CCR shall be made at the telecommunications main grounding busbar (TMGB) installed by Contractor.
 14. Provide a minimum of (300) 12/24 mounting screws per CCR, TR, TE rack for the installation of USPS PFE active electronic components.
- C. Telecommunications Room (TR):
1. Furnish and install three each 4-pair Category 6 UTP cables from each office area and workroom column mounted T/O (telecommunications outlets) to Telecommunications Room as indicated on drawings. Terminate 12 each 4-pair Category 6 UTP cables from each Type 1 Consolidation Point to Telecommunications Room as indicated on drawings. Terminate 48 each 4-pair Category 6 UTP cables from each Type 2 or Type 3 Consolidation Points to Telecommunications Room as indicated on drawings. Terminate 12 each 4-pair Category 6 UTP cables from each Admin. area CP-1.
 2. Terminate each cable to 8-pin modular connector at workstation and to patch panels in Telecommunications Room.



3. Provide a minimum 8 to 10 foot service loop in a figure eight coil for all copper cables.
 4. Furnish, install, and ground, floor mounted, 84 inch high x 3 inch deep x 19 inch wide relay racks shoulder-to-shoulder, separated by 6 inch vertical wire managers, perpendicular to wall housing plywood backboards.
 - a. Racks will be used to house wiring, Contractor-provided rack mountable fiber interconnect center and U.S. Postal Service provided data interface equipment.
 - b. Allow a minimum (16) empty rack units for PFE data equipment.
 - c. Provide (1) factory manufactured cable drop out fitting at each rack within the "TR".
 - d. Each rack shall be equipped with a factory manufactured power strip equipped with (10) NEMA5-15R receptacles. Mount power strip above the UPS unit.
 5. Furnish and install one rack mounted, 24 strand fiber optic interconnect center at top of rack.
 6. Furnish and install one (1) plywood backboard on wall of Telecommunications Room.
 - a. Plywood: 48 inch x 96 inch x 3/4 inch, fire rated, void-free, smooth side out.
 - b. Field paint with white or gray enamel fire resistant paint prior to installation of telephone equipment.
 - c. Install plywood with long dimension in vertical orientation.
 - d. Each rack shall be equipped with separate #6 AWG ground conductor homerun to the Telecommunications Ground Bar (TGB).
 - e. Furnish and install an industry approved copper grounding busbar and attach #6 AWG ground conductor from approved electrical ground using 2 hole compression type fittings. All metallic components of the "TR" shall be grounded to the installed TGB.
 7. Patch Cords: Furnish 4-pair Category 6 UTP patch cords. 50 percent of cords will be 3 foot, 50 percent will be 5 foot in length, based on number of T/O (Telecommunications Outlets) in Project unless other lengths are determined necessary by the designer. Provide one patch cord for every triplex T/O or one cord for every three 8-pin modular connectors.
 8. Fiber Optic Patch Cords: Furnish 50 percent two-meter and 50 percent three-meter duplex SC/LC fiber optic patch cords. (Quantities and additional lengths are to be coordinated with USPS prior to procurement.) Provide duplex 50/125 micron Laser Optimized 10-Gigabit Ethernet compliant 1500/500 fiber optic patch cords for 2/3 of the fiber optic terminations. Example: 24 strands of fiber terminated at each rack-mount fiber-optic interconnect center requires 8 duplex patch cords. USPS will specify connector type.
 9. A fiber optic service loop of sheathed fiber no less than 20 feet at each end of a fiber optic cable shall be installed at each termination point. All service loops shall be installed so that the minimum bend radius (10 times the outside diameter of the fiber) shall not be exceeded. All service loops shall be installed outside of the fiber optic termination housing. Once the fiber reaches the entrance point of the fiber optic enclosure, there shall be no less than 10 feet of unsheathed fiber installed neatly in the fiber optic storage tray prior to terminations being installed. Unsheathed fiber shall be installed in the storage tray per the fiber optic enclosures manufacturers' instructions.
 10. Provide a minimum 1.5kVA uninterruptible rack mountable power supply with 30 minute battery reserve in each TR.
 11. Provide a minimum of (300) 12/24 screws per TR for the installation of USPS PFE active electronic components.
- D. Telecommunications Enclosure for Column Mounted Applications
1. Constructed of steel or aluminum with Plexiglas front doors. Cabinet must be rated NEMA-12, designed for front or rear access, have forced fan with filtration for intake and exhaust ventilation, and adjustable vertical mounting rails. The intake fan with filter will be mounted 5 inches from the top center of the rear metal door and a filtered louvered exhaust vent will be mounted 4 inches from the bottom center of the rear door. The fan must be oriented to blow filtered air into the cabinet to create a positive pressure within the cabinet and will be plugged into the power strip (min. 10 outlet NEMA 5-15R with power switch guard) mounted inside of the cabinet. Dimensions: 86 inches high x 24 inches deep x 24 inches wide with 19 inch EIA rack width. Include a rack mountable 1.5kVA uninterruptible power supply with 30 minute backup and a 6-foot power cord mounted on the back rail of the cabinet. The Telecommunications Enclosure and the installation of the enclosure must comply with area seismic zone rating.



2. Furnish and install three each 4-pair Category 6 UTP cables from each office area and workroom column mounted T/O (telecommunications outlet) to Telecommunications Enclosure as indicated on drawings. Terminate 12 each 4-pair Category 6 UTP cables from each Type 1 Consolidation Point to Telecommunications Enclosure as indicated on drawings. Terminate 48 each 4-pair Category 6 UTP cables from each Type 2 or Type 3 Consolidation Points to Telecommunications Enclosure as indicated on drawings. Terminate 12 each 4-pair Category 6 UTP cables from each Admin. area CP-1
3. Terminate each cable to 8-pin modular connector at workstation and to cabinet/rack mounted patch panels at TE.
4. Provide a minimum 8 to 10 foot service loop in a figure eight coil for all copper cables.
5. Furnish and install a NEMA 12 Cabinet: 86 inches high x 24 inches deep x 24 inches wide with 19 inch EIA rack width by bolting through of the cabinet to a platform which is attached to the building column at 9' AFF. Platform shall be designed to support a minimum of 1000 lbs., be firmly connected to the column and or the overhead building support structure and shall meet all codes and seismic requirements. A structural engineer approved platform solution shall be provided to the USPS by the vendor.
 - a. Cabinet will be used to house wiring, Contractor-provided rack mountable fiber interconnect center and U.S. Postal Service provided data interface equipment.
 - b. Allocate 16 RU's within the rack for PFE and provide a second rack if required. Two units can be "ganged" together (inner side panels removed and doors adjusted to open from center) to form one TE for workroom floor applications. The doors shall be adjusted to open in opposite directions from the center. Cabinets shall be bolted together in such a manner to maintain the NEMA-12 compliance, and the inner side panels will be removed from each unit creating an open pathway between cabinets. All copper connections will be placed in the left-most cabinet and the fiber along with the 1.5 kVA UPS will be installed in the right-most cabinet.
 - c. Provide appropriate number of conduit risers equipped with 90 degree bends and bushings for incoming backbone and outgoing horizontal cables. Conduit risers shall be minimum 2 inch diameter and sized for 40 percent fill.
6. Furnish and install one rack/cabinet mounted, 24 strand fiber optic interconnect center at top of cabinet.
7. Furnish and install a minimum #6 ground to TGB.
8. All metallic ladder tray, basket tray, equipment racks or enclosures shall be bonded and grounded using a #6 AWG stranded ground wire with green insulation using 2-hole compression type fittings or ground fitting approved for basket tray installation. All painted surfaces shall be burnished for paint removal to achieve maximum ground connection.
9. Grounding and bonding of all contractor-provided hardware and cabling must be completed in accordance with the TIA/EIA-607A specifications as well as the NFPA 70 NEC and any applicable codes. A #6 AWG THHN ground wire shall be installed from approved electrical ground to contractor supplied TGB. Attachment to busbar to be performed by Contractor.
10. A fiber optic service loop of sheathed fiber no less than 20 feet at each end of a fiber optic cable shall be installed at each termination point. All service loops shall be installed so that the minimum bend radius (10 times the outside diameter of the fiber) shall not be exceeded. All service loops shall be installed outside of the fiber optic termination housing. Once the fiber reaches the entrance point of the fiber optic enclosure, there shall be no less than 10 feet of unsheathed fiber installed neatly in the fiber optic storage tray prior to terminations being installed. Unsheathed fiber shall be installed in the storage tray per the fiber optic enclosures manufacturers' instructions.
11. Provide a minimum 1.5kVA uninterruptible power supply with 30 minute battery reserve rack mounted within each TE.
12. Install conduit/EMT through roof of cabinet to allow cable entry as needed. Seal openings with an intumescent fire-stop putty when all cables have been installed.
13. Patch Cords: Furnish 4-pair Category 6 UTP patch cords. 50 percent of cords will be 3 foot, 50 percent will be 5 foot in length, based on number of T/O (Telecommunications Outlets) in Project unless other lengths are determined necessary by the designer. Provide one patch cord for every triplex T/O or one cord for every three 8-pin modular connectors.



14. Fiber Optic Patch Cords: Furnish 50 percent two-meter and 50 percent three-meter duplex SC/LC fiber optic patch cords (Quantities and additional lengths are to be coordinated with USPS prior to procurement.) Provide duplex 50/125 micron Laser Optimized 10-Gigabit Ethernet compliant 1500/500 fiber optic patch cords for 2/3 of the fiber optic terminations. Example: 24 strands of fiber terminated at each rack-mount fiber-optic interconnect center requires 8 duplex patch cords. USPS will specify connector type.
15. Provide a minimum of (300) 12/24 screws for the installation of USPS PFE active electronic components.
16. Maximum horizontal cabling distances shall not exceed 230 feet for both standard Telecommunications Outlets and Consolidation Points. This horizontal distance is to include all vertical distances plus required service loops. Total workroom floor coverage is required when designing the TE placements throughout the workroom floor environment.

3.3 CONSTRUCTION

- A. Specified in Section 270500 – Common Work Results for Communications.

3.4 FIELD QUALITY CONTROL

- A. Specified in Section 270500 – Common Work Results for Communications.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 8/29/2013

END OF SECTION 27 11 00 00



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SECTION 27 11 00 00 - CSF COMMUNICATIONS EQUIPMENT ROOM FITTINGS

NOTE TO SPECIFIER

Use this Outline Specification Section for Customer Service Facilities only.

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes the following structured wiring system components:
 - 1. Telecommunications Equipment Room (ER) Equipment Rack(s).
 - 2. Telecommunications Room (TR) Equipment Rack(s).
 - 3. Telephone service entrance.
- B. Related Documents:
 - 1. Specified in Section 270500 – Common Work Results for Communications.
- C. Related Sections:
 - 1. Specified in Section 270500 - Common Work Results For Communications.

1.2 REFERENCES

- A. Specified in Section 270500 – Common Work Results for Communications.

1.3 SUBMITTALS

- A. Specified in Section 270500 – Common Work Results for Communications.

1.4 QUALITY ASSURANCE

- A. Specified in Section 270500 – Common Work Results for Communications.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver in accordance with NEMA WC 26.

PART 2 - PRODUCTS

2.1 CATEGORY 6, PATCH CORDS AND STATION CABLES

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:



1. CommScope Uniprise, Claremont, NC (800) 544-1948
2. Hubbell, Inc., Milford, CT (203) 882-4800.
3. Molex Premise Networks, Harvard, MA (987) 772-5630.
4. Belden, Richmond, IN (800) 235-3361.
5. Ortronics, New London, CT (800) 934-5432.
6. Siemon Company, Watertown, CT (860) 274-2523.
7. Tyco Electronics AMP NETCONNECT, Berwyn, PA (800) 522-6752.
8. Leviton, Bothwell, WA (800) 977-0190.
9. Panduit, Tinley Park, IL (800) 777-3300.
10. Product options and substitutions. Substitutions: Not permitted.

B. Conductors: Straight through type 4 twisted pair -minimum 24 AWG, stranded copper.

1. Terminated with male 8-pin modular plugs.
2. Complies with individual characteristics established in ANSI/TIA/EIA-568-C, and all addendums for Category 6 cable performance specification.
3. Nominal Impedance: 100 ohms plus or minus 15 percent.
4. Match performance and impedance characteristics of the installed horizontal unshielded twisted pair cable.
5. Contractor shall provide one electronic switch patch cable for every "T/O" or one for every three 8-pin modular connector. Provide 50% of cables 3'-0" long and 50% of cables 5'-0" long. Contractor shall provide manufacturer terminated patch cables. All copper patch cord colors shall be determined by Raleigh ITSC personnel.
6. In addition to patch cords at the racks, provide Category 6 station cables from the telecommunications outlets to USPS furnished telephone handsets and personal computers. Provide 75 percent of cables 9 ft. – 0 in. long and 25 percent of cables 15 ft. – 0 in. long. Contractor shall provide one manufacturer terminal station cable for every T/O. Station cable colors shall be determined by Raleigh ITSC personnel.

2.2 CATEGORY 6, 8-PIN MODULAR INSULATION DISPLACEMENT CONNECTORS (IDC)

A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:

1. CommScope Uniprise, Claremont, NC (800) 544-1948
2. Hubbell, Inc., Milford, CT (203) 882-4800.
3. Molex Premise Networks, Harvard, MA (987) 772-5630.
4. Belden, Richmond, IN (800) 235-3361.
5. Ortronics, New London, CT (800) 934-5432.
6. Siemon Company, Watertown, CT (860) 274-2523.
7. Tyco Electronics AMP NETCONNECT, Berwyn, PA (800) 522-6752.
8. Leviton, Bothwell, WA (800) 977-0190.
9. Panduit, Tinley Park, IL (800) 777-3300.
10. Product options and substitutions. Substitutions: Not permitted.

B. Connector:

1. 8-pin modular, Category 6, non-keyed.
2. Complies with ANSI/TIA/EIA-568-C "T568A" pinning configuration.
3. Color: Selected by Contracting Officer.

2.3 CATEGORY 6, 8-PIN MODULAR IDC "110" STYLE PATCH PANELS

A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:

1. CommScope Uniprise, Claremont, NC (800) 544-1948
2. Hubbell, Inc., Milford, CT (203) 882-4800.



3. Molex Premise Networks, Harvard, MA (987) 772-5630.
4. Belden, Richmond, IN (800) 235-3361.
5. Ortronics, New London, CT (800) 934-5432.
6. Siemon Company, Watertown, CT (860) 274-2523.
7. Tyco Electronics AMP NETCONNECT, Berwyn, PA (800) 522-6752.
8. Leviton, Bothell, WA (800) 977-0190.
9. Panduit, Tinley Park, IL (800) 777-3300.
10. Product options and substitutions. Substitutions: Not permitted.

B. Panels:

1. Rack mounted 48 port 8-pin modular, Category 6, non-keyed.
2. Complies with ANSI/TIA/EIA-568-C "T568A" pinning configuration.
3. Provide strain relief bar assemblies for rear copper terminations. Secure Cat. 6 cable with velcro straps. Plastic tie wraps are not acceptable.

2.4 WIRE MANAGEMENT PANELS

A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following

1. Chatsworth Products, Inc., Chatsworth, CA (800) 834-4969.
2. CommScope Uniprise, Claremont, NC (800) 544-1948
3. Homaco, Chicago, IL (888) 445-6226.
4. Hubbell, Inc., Milford, CT (203) 882-4800.
5. Molex Premise Networks, Harvard, MA (987) 772-5630.
6. Belden, Richmond, IN (800) 235-3361.
7. Ortronics, New London, CT (800) 934-5432.
8. Siemon Company, Watertown, CT (860) 274-2523.
9. Tyco Electronics AMP NETCONNECT, Berwyn, PA (800) 522-6752.
10. Leviton, Bothell, WA (800) 977-0190.
11. Panduit, Tinley Park, IL (800) 777-3300.
12. Product options and substitutions. Substitutions: Permitted.

B. Management Panels: Rack mounted with horizontally and vertically mounted split D-rings.

1. Each horizontal wire management panel will be 3.5 inch high (2 Rack unit) x 19 inch wide for use between 48-port Category 6 patch panels.
2. Management panels for use at top of equipment rack will be 3.5 inches high x 19 inches wide.
3. Management panels for use between fiber optic rack mount interconnect center and PFE components shall be 1 3/4 inches high x 19 inches wide.

2.5 EQUIPMENT (RELAY) AND SERVER RACKS WITH CABLE CHANNELS

A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:

1. Chatsworth Products, Inc., Chatsworth, CA (800) 834-4969.
2. CommScope Uniprise, Claremont, NC (800) 544-1948.
3. Homaco, Inc., Chicago, IL (888) 446-6226.
4. Hubbell, Inc., Milford, CT (203) 882-4800.
5. Molex Premise Networks, Harvard, MA (987) 772-5630.
6. Ortronics Corporation, New London, CT (800) 934-5432.
7. Siemon Company, Watertown, CT (860) 274-2523.
8. Tyco Electronics AMP NETCONNECT, Berwyn, PA (800) 522-6752.
9. Leviton, Bothell, WA (800) 977-0190.
10. Panduit, Tinley Park, IL (800) 777-3300.
11. Product options and substitutions. Substitutions: Permitted upon USPS approval.



- B. Constructed of aluminum extrusion framework. Dimensions: 84 inch high x 3 inch deep x 19 inch wide. Double sided, 12/24 tapped holes with universal EIA rack unit spacing. Black or Aluminum finish.
- C. Vertical Cable Channels: Dimensions: 6 inch x 5 1/2 inch x 78-11/16 inch. Black or Aluminum finish. Attach to sides of relay racks. Must be able to cover and conceal patch cabling.

2.6 CONDUITS AND BOXES

- A. Specified in Section 260533 – Raceway and Boxes for Electrical Systems.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Specified in 270500 – Common Work Results for Communications.

3.2 INSTALLATION - COMPONENTS

- A. Patch Panels: Install 48-port, 8-pin module, category 6 patch panels at main cross-connect and horizontal cross-connect for termination of cables installed as part of Work of this Section.
 1. Install patch panels on floor mounted 19 inch wide by 84 inch high racks.
 2. Furnish and install patch panels with cable designation strips.
 3. Furnish and install wire management panel on rack mounting rails above and below each patch panel for all locations.
 4. Furnish and install termination and cable support bars sufficient to maintain UTP bend radius at rear of panels.
 5. Terminate all 4 pairs of each horizontal 4 pair cable to each 8 pin "T568A" patch panel port.
- B. Telecommunications Equipment Room (ER):
 1. Furnish and install three each 4-pair Category 6 UTP cables from each office area and workroom column mounted T/O (telecommunications outlet) to Telecommunications Equipment Room as indicated on drawings.
 2. Terminate each cable to 8-pin modular connector (568-A) at workstation and to rack mounted patch panels at Telecommunications Equipment Room (ER). Provide a minimum 10 foot service loop, in figure eight coil, for all copper cables.
 3. Furnish, install, and ground, floor mounted, 84 inch high x 3 inch deep x 19 inch wide relay racks shoulder-to-shoulder separated by vertical patch cord managers perpendicular to wall housing plywood backboards.
 - a. Mount relay racks in a "side by side" fashion with one vertical wire management channel between each rack, and one wire management channel on outside side rail of both end racks.
 - b. Allow minimum of (24) empty rack units for PFE (Postal Furnished Equipment) data components. (Consult USPS for room exact rack placements.)
 - c. Sections of 12 inch wide ladder or basket tray shall be mounted to top of relay rack(s) and extend to plywood backboard. This tray serves as additional support for relay racks as well as cable routing from relay rack to backboard. All sections of ladder rack and or basket tray shall be joined with manufacturer approved devices.
 - d. Provide (2) factory manufactured cable drop out fittings at each rack within the "ER".
 - e. Each rack shall be equipped with separate #6 AWG ground conductor homerun to the TMGB.



- f. Each rack shall be equipped with a factory manufactured power strip equipped with (10) NEMA5-15R receptacles. Mount power strip above the UPS unit.
4. Furnish and install a maximum of two (2) 4 ft. x 8 ft. plywood backboard(s) along wall perpendicular to ER rack(s).
 - a. Plywood: 48-inch x 96-inch x 3/4-inch void-free, smooth side out.
 - b. Install plywood with long dimension in vertical orientation.
 - c. Field paint with white or gray enamel fire resistant paint prior to installation of telephone equipment.
 - d. Furnish and install an industry approved main grounding copper busbar and #6 AWG ground conductors using 2 hole compression type fittings. All metallic components of ER shall be grounded to installed (TMGB) Telecommunication Main Grounding Busbar..
5. Provide a minimum 3kVA uninterruptible power supply with 30 minute battery reserve rack mounted in the Telecommunications Equipment Room (ER).
6. All metallic ladder tray, basket tray, equipment racks and enclosures shall be bonded and grounded using a #6 AWG stranded ground wire with green insulation using 2 hole compression type fittings or ground fitting approved for the installation. All painted surfaces shall be burnished for paint removal to achieve maximum ground connection.
7. All grounding in ER shall be made at TMGB installed by the contractor.
8. Provide a minimum of (300) 12/24 screws per ER rack for the installation of USPS PFE active electronic components.

NOTE TO SPECIFIER

The majority of Customer Service Facilities (CSF) are less than 60,000 sq. ft. and will not require fiber-optic backbone cabling. Add paragraphs 3.2B.10., 11 & 12 below if Fiber-Optic Backbone Cabling is deemed necessary.

9. A fiber optic service loop of sheathed fiber no less than 20 feet at each end of a fiber optic cable shall be installed at each termination point. All service loops shall be installed so that the minimum bend radius (10 times the outside diameter of the fiber) shall not be exceeded. All service loops shall be installed outside of the fiber optic termination housing. Once the fiber reaches the entrance point of the fiber optic enclosure, there shall be no less than 10 feet of unsheathed fiber installed neatly in the fiber optic storage tray prior to terminations being installed. Unsheathed fiber shall be installed in the storage tray per the fiber optic enclosures manufacturers' instructions.
10. When installing Armored Fiber Optic cabling, proper grounding techniques to ground the metallic member of the Armored Fiber Optic Cable must be maintained.
11. Fiber Optic Patch Cords: Furnish 50 percent two-meter and 50 percent three-meter duplex SC/LC and LC/LC fiber optic patch cords (Quantities and additional lengths are to be coordinated with USPS prior to procurement.) Provide duplex 50/125 micron Laser Optimized 10-Gigabit Ethernet compliant 1500/500 fiber optic patch cords for 2/3 of the fiber optic terminations. Example: 24 strands of fiber terminated at each rack-mount fiber-optic interconnect center requires 8 duplex patch cords.

NOTE TO SPECIFIER

The majority of Customer Service Facilities (CSF) are less than 60,000 sq. ft. and will not require Satellite Telecommunication Rooms. Add Section 3.2C. below if Telecommunications Room(s) are deemed necessary.

C. Telecommunications Room (TR):

1. Furnish and install three each 4-pair Category 6 UTP cables from each office area and workroom column mounted T/O (telecommunications outlets) to Telecommunications Room (TR) as indicated on drawings.
2. Terminate each cable to 8-pin modular connector at workstation and to patch panels in Telecommunications Room. Provide a minimum 10 foot service loop for all copper cables.



3. Furnish, install, and ground, floor mounted, 84 inch high x 3 inch deep x 19 inch wide relay racks shoulder-to-shoulder, separated by 6 inch vertical wire managers, perpendicular to wall housing plywood backboards.
 - a. Rack used to house wiring Contractor-provided rack mounted 24 strand fiber interconnect center, and U.S. Postal Service provided data interface equipment.
 - b. Allow minimum 16 rack units empty space for PFE data equipment.
 - c. Provide (1) factory manufactured cable drop out fitting at each rack within the "TR".
 - d. Each rack shall be equipped with a factory manufactured power strip equipped with (10) NEMA5-15R receptacles. Mount power strip above the UPS unit.
4. Furnish and install one rack mounted, 24 strand, fiber optic interconnect center at top of rack.
- 5.
6. Furnish and install one (1) plywood backboard on one wall of Telecommunications Closet.
 - a. Plywood: 48-inch x 96-inch x 3/4-inch void-free, smooth side out.
 - b. Install plywood with long dimension in vertical orientation.
 - c. Field paint with white or gray enamel fire resistant paint prior to installation of telephone equipment.
 - d. Each rack shall be equipped with separate #6 AWG ground conductor homerun to the TGB.
 - e. Furnish and install an industry approved copper grounding busbar and attach #6 AWG ground conductor from approved electrical ground using 2 hole compression type fittings. All metallic components of the "TR" shall be grounded to the installed Telecommunications Ground Bar (TGB).
7. Patch Cords: Furnish 4-pair Category 6 UTP patch cords. 50 percent of cords will be three foot, 50 percent will be five foot in length, based on number of T/O (Telecommunications Outlets) in Project unless other lengths are determined necessary by the designer. Provide one patch cord for every triplex T/O or one cord for every three 8-pin modular connectors.
8. Fiber Optic Patch Cords: Furnish 50 percent two-meter and 50 percent three-meter duplex SC/LC fiber optic patch cords. (Quantities and additional lengths are to be coordinated with USPS prior to procurement.) Provide duplex 50/125 micron Laser Optimized 10-Gigabit Ethernet compliant 1500/500 fiber optic patch cords for 2/3 of the fiber optic terminations. Example: 24 strands of fiber terminated at rack-mount fiber-optic interconnect center requires 8 duplex patch cords.
9. A fiber optic service loop of sheathed fiber no less than 20 feet at each end of a fiber optic cable shall be installed at each termination point. All service loops shall be installed so that the minimum bend radius (10 times the outside diameter of the fiber) shall not be exceeded. All service loops shall be installed outside of the fiber optic termination housing. Once the fiber reaches the entrance point of the fiber optic enclosure, there shall be no less than 10 feet of unsheathed fiber installed neatly in the fiber optic storage tray prior to terminations being installed. Unsheathed fiber shall be installed in the storage tray per the fiber optic enclosures manufacturers' instructions.
10. Provide a minimum 1.5kVA uninterruptible power supply with 30 minute battery reserve rack mounted in each TR.
11. Provide a minimum of (300) 12/24 screws per TR for the installation of USPS PFE active electronic components.

3.3 CONSTRUCTION

- A. Specified in 270500 – Common Work Results for Communications.

3.4 FIELD QUALITY CONTROL

- A. Specified in 270500 – Common Work Results for Communications.



USPS CSF Specifications issued: 10/1/2013
Last revised: 8/29/2013

END OF SECTION 27 11 00 00



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SECTION 27 13 00 00 - MPF COMMUNICATIONS BACKBONE CABLING**

NOTE TO SPECIFIER

Use this section for Mail Processing Facilities.

****THIS ENTIRE SECTION CONSISTS OF REQUIRED PARTS OR ARTICLES. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes the following structured cabling system components:
 - 1. Communication cable.
 - 2. Termination equipment.
 - 3. Patching equipment.
- B. Related Documents:
 - 1. Specified in Section 270500 – Common Work Results for Communications.
- C. Related Sections:
 - 1. Specified in Section 270500 – Common Work Results for Communications

1.2 REFERENCES

- A. Specified in Section 270500 – Common Work Results for Communications.

1.3 SYSTEM DESCRIPTION

- A. Specified in Section 270500 – Common Work Results for Communications.

1.4 SUBMITTALS

- A. Specified in Section 270500 – Common Work Results for Communications.

1.5 QUALITY ASSURANCE

- A. Specified in Section 270500 – Common Work Results for Communications.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 – Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver in accordance with NEMA WC 26.



PART 2 - PRODUCTS

2.1 CONDUITS AND BOXES

- A. Specified in Section 260533 – Raceway and Boxes for Electrical Systems.

2.2 NEMA-12 ENCLOSED DATA CABINETS FOR COLUMN MOUNTED TE APPLICATIONS ON WORKROOM FLOOR

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Rittal, Springfield, OH (800) 477-4000.
 2. Hoffman, 2100 Hoffman Way, Anoka, MN (763) 421-2240.
 3. Bud Industries, PO Box 998, Willoughby, OH (440) 946-3200.
 4. Damac Products, Inc., 1-888-949-2289.
 5. Product options and substitutions. Substitutions: Requires Approval.
- B. Constructed of steel or aluminum with Plexiglas front doors. Cabinet must be rated NEMA-12, designed for front or rear access, have forced fan with filtration for intake and exhaust ventilation, and adjustable vertical mounting rails. The intake fan with filter will be mounted 5 inches from the top center of the rear metal door and a filtered louvered exhaust vent will be mounted 4 inches from the bottom center of the rear door. The fan must be oriented to blow filtered air into the cabinet to create a positive pressure within the cabinet and will be plugged into the power strip (min. 6 outlet NEMA 5-15R with power switch guard) mounted inside of the cabinet. Dimensions: 86 inches high x 24 inches deep x 24 inches wide with 19 inch EIA rack width. Include a rack mountable 1.5kVA uninterruptible power supply with 30 minute backup and a 6-foot power cord mounted on the back rail of the cabinet. The installation of the Telecommunications Enclosure must comply with area seismic zone rating.
- C. If required, two units shall be "ganged" together to form one TE for work room floor applications. Cabinets shall be bolted through the bottom and mounted directly to the platform, which is attached to the building support column at minimum 9' AFF. The doors to be adjusted to open in opposite directions from the center. Cabinets shall be bolted together in such a manner to maintain NEMA 12 compliance, and the inner side panels will be removed from each unit creating an open pathway between cabinets. All copper connections will be placed in the left-most cabinet and the fiber along with the 1.5 KVA UPS will be installed in the right-most cabinet.

2.3 6, 12, 24, 48 AND 96 STRAND ARMORED TIGHT BUFFERED 50/125 MICRON, LASER-OPTIMIZED, 10-GIGABIT-ETHERNET-COMPLIANT, "1500/500", MULTI-MODE FIBER OPTIC BACKBONE CABLING.

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Berk-Tek, Inc., New Holland, PA (800) 237-5835.
 2. CommScope Uniprise, Claremont, NC (800) 544-1948.
 3. Corning Cable Systems, Hickory, NC (800) 743-2671.
 4. Draka Comteq, Franklin, MA (888) 541-7100.
 5. General Cable, Highland Heights, KY (800) 424-5666.
 6. Mohawk/CDT, Leominster, MA (978) 537-9961.
 7. Belden, Richmond, IN (800) 235-3361.
 8. Superior Essex, Atlanta, GA (800) 685-4887.
 9. Product options and substitutions. Substitutions: Substitutions require approval.



- B. Fiber Type: 6, 12, 24, 48 and 96 strand armored tight buffered 50/125 micron, laser-optimized, 10-Gigabit-Ethernet-Compliant, "1500/500" multi-mode fiber optic cable.
 - 1. Individually insulated plenum rated strands under common plenum rated sheath unless entire cable is contained within conduit/EMT or if area where cable is installed is not considered a return air plenum according to any applicable codes.
 - 2. Complies with individual characteristics established in ANSI/TIA/EIA-568-C including all addendums for fiber optic cable performance specification.

2.4 FIBER OPTIC RACK MOUNT INTERCONNECT CENTER

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. CommScope Uniprise, Claremont, NC (800) 544-1948.
 - 2. Corning Cable Systems, Hickory, NC (800) 743-2671.
 - 3. Hubbell, Inc., Milford, CT (203) 882-4800.
 - 4. Molex Premise Networks, Harvard, MA (987) 772-5630.
 - 5. Belden, Richmond, IN (800) 235-3361.
 - 6. Ortronics, New London, CT (800) 934-5432.
 - 7. Siemon Company, Watertown, CT (860) 274-2523.
 - 8. 3M Telecommunications, Austin, TX (800) 695-0447.
 - 9. Tyco Electronics AMP NETCONNECT, Berwyn, PA (800) 522-6752.
 - 10. Product options and substitutions. Substitutions: Not permitted.
- B. Enclosure connector and adapter panels:
 - 1. SC type Laser Optimized connectors
 - 2. 12 port coupler panels with laser optimized SC adapters.
 - 3. Each rack mount enclosure used in CCR will be 1.75 inches (1 RU) with (2) 12-Port SC/SC style laser optimized coupler panels and house the backbone fiber. Each individual TR/TE will receive a dedicated rack mount enclosure. Each enclosure will be separated by a 1RU wire manager.
 - 4. Rack mount enclosure used in TR/TE locations will be 1.75 inches (1 RU) with (2) 12-Port SC/SC style laser optimized coupler panels. Supply one (1) 1RU wire manager directly below the enclosure.
 - 5. Complies with ANSI/TIA/EIA-568-C specification.

2.5 FIBER OPTIC PATCH CORDS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. CommScope Uniprise, Claremont, NC (800) 544-1948.
 - 2. Corning Cable Systems, Hickory, NC (800) 743-2671.
 - 3. Hubbell, Inc., Milford, CT (203) 882-4800.
 - 4. Molex Premise Networks, Harvard, MA (987) 772-5630.
 - 5. Belden, Richmond, IN (800) 235-3361.
 - 6. Ortronics, New London, CT (800) 934-5432.
 - 7. Siemon Company, Watertown, CT (860) 274-2523.
 - 8. 3M Telecommunications, Austin, TX (800) 695-0447.
 - 9. Tyco Electronics AMP NETCONNECT, Berwyn, PA (800) 522-6752.
 - 10. Product options and substitutions. Substitutions: Not permitted.
- B. Fiber optic duplex tight buffered 50/125 micron Laser Optimized 10-Gigabit Ethernet compliant 1500/500 fiber optic patch cords.
 - 1. Terminated with SC/LC connectors
 - 2. Complies with individual characteristics established in ANSI/TIA/EIA-568-C including all addendums for fiber optic patch cable performance specification.



3. Fiber optic patch cord terminations and quantities shall be coordinated with U.S. Postal Service personnel prior to procurement.
4. Match performance characteristics of installed fiber optic backbone.

2.6 CATEGORY-6 12 PORT MODULAR SURFACE-MOUNTED "110"-STYLE PATCH PANELS TYPE 1 CONSOLIDATION POINTS (CP-1).

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. CommScope Uniprise, Claremont, NC (800) 544-1948.
 2. Hubbell, Inc., Milford, CT (203) 882-4800.
 3. Molex Premise Networks, Harvard, MA (987) 772-5630.
 4. Belden, Richmond, IN (800) 235-3361.
 5. Ortronics, New London, CT (800) 934-5432.
 6. Siemon Company, Watertown, CT (860) 274-2523.
 7. Tyco Electronics AMP NETCONNECT, Berwyn, PA (800) 522-6752.
 8. Leviton, Bothell, WA (800) 977-0190.
 9. Panduit, Tinley Park, IL (800) 777-3300.
 10. Product options and substitutions. Substitutions: Not permitted.
- B. Panels:
1. Capable of terminating (12) Category 6 cables.
 2. Equipped with an 89D surface mounting bracket.
 3. Complies with ANSI/TIA/EIA-568-C "T568A" pinning configuration.

2.7 TYPE 1 CONSOLIDATION POINT (CP-1) AND TYPE 1 FIBER OPTIC POINT (FP_1) FOR WORKROOM FLOOR ENCLOSURES

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Hoffman Enclosures, Inc., Anoka, MN (612) 421-2240.
 2. Rittal Corporation: (AE, or EB Series enclosures), Springfield, OH (800) 477-4000.
 3. Product options and substitutions. Substitutions: Permitted with approval.
- B. Enclosures:
1. 12 inches high x 12 inches wide x 8 inches deep sheet steel NEMA 12 enclosure with hinged, lockable door with rubber gasket, mounted at 20-23' AFF. Alternate size: 14 inches high x 16 inches wide x 6 inches deep.
 2. Door must be oriented so that it opens in a horizontal manner. Enclosure may not be mounted in a manner so that the door opens downward.

2.8 CATEGORY-6 12 PORT TYPE 1 CONSOLIDATION POINTS (CP-1). (THIS OPTION ONLY USED IN SPECIAL APPLICATIONS FOR LARGE OFFICE AND ADMINISTRATIVE AREAS).

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. CommScope Uniprise, Claremont, NC (800) 544-1948.
 2. Hubbell, Inc., Milford, CT (203) 882-4800.
 3. Molex Premise Networks, Harvard, MA (987) 772-5630.
 4. Belden, Richmond, IN (800) 235-3361.
 5. Ortronics, New London, CT (800) 934-5432.
 6. Siemon Company, Watertown, CT (860) 274-2523.
 7. Tyco Electronics AMP NETCONNECT, Berwyn, PA (800) 522-6752.



8. Leviton, Bothwell, WA (800) 977-0190.
9. Panduit, Tinley Park, IL (800) 777-3300.
10. Product options and substitutions. Substitutions: Not permitted.

B. Connector:

1. 8-pin modular, Category 6, non-keyed.
2. Complies with ANSI/TIA/EIA-568-C "T568A" pinning configuration.
3. Color: Selected by Contracting Officer.
4. Attached to backboard of CP 1 with 89-D type bracket.

C. Housing

1. Wall or raceway mounted outlet enclosure, CP1.
2. Able to contain 12 modular 8-pin connectors
3. Installation over single gang junction box, double gang junction box, or raceway knockout as indicated on Drawings.
4. Color: Selected by Contracting Officer.

NOTE TO SPECIFIER

Delete the following two sections if CP-2 is not used.

2.9 48 PORT, CATEGORY 6, 8-PIN MODULAR RACK MOUNTED "110 STYLE" PATCH PANELS FOR TYPE 2 CONSOLIDATION POINT (CP-2)

A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:

1. CommScope Uniprise, Claremont, NC (800) 544-1948.
2. Hubbell, Inc., Milford, CT (203) 882-4800.
3. Molex Premise Networks, Harvard, MA (987) 772-5630.
4. Belden, Richmond, IN (800) 235-3361.
5. Ortronics, New London, CT (800) 934-5432.
6. Siemon Company, Watertown, CT (860) 274-2523.
7. Tyco Electronics AMP NETCONNECT, Berwyn, PA (800) 522-6752.
8. Leviton, Bothell, WA (800) 977-0190.
9. Panduit, Tinley Park, IL (800) 777-3300.
10. Product options and substitutions. Substitutions: Not permitted.

B. Panels:

1. Rack mounted 48 port 8-pin modular, Category 6, non-keyed or insulation-displacement "110"-type.
2. Complies with ANSI/TIA/EIA-568-C "T568A" pinning configuration.

2.10 TYPE 2 CONSOLIDATION POINT ENCLOSURES

A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:

1. American Access Technologies, Inc., Altamonte Spring, FL (800) 285-2070.
2. American Cable Systems, New Bedford, MA (800) 426-3170.
3. Chatsworth Products, Chatsworth, CA (818) 882-8595.
4. Holocom Networks, Inc., Carlsbad, CA (888) 465-6266.
5. Siemon Company, Watertown, CT (860) 274-2523.
6. Product options and substitutions. Substitutions: Substitutions require approval.

B. Enclosures:



1. Metal, surface mountable to wall, or flush mountable into wall.
2. Gasketed lockable access door.
3. Room for 48-port patch panel or IDC panel, standoff brackets, and horizontal and vertical patch cord management.
4. Access knockouts in top/bottom and/or sides to allow egress of station cables to TR/TE and UTP Cable Assemblies to cubicle furniture.

NOTE TO SPECIFIER

Delete the following two sections if CP-3 is not used.

2.11 48 PORT, CATEGORY 6, 8-PIN MODULAR RACK MOUNTED "110 STYLE" PATCH PANELS FOR TYPE 3 CONSOLIDATION POINT CP-3

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. CommScope Uniprise, Claremont, NC (800) 544-1948.
 2. Hubbell, Incorporated, Milford, CT (203) 882-4800.
 3. Molex Premise Networks, Harvard, MA (987) 772-5630.
 4. Belden, Richmond, IN (800) 235-3361.
 5. Ortronics, New London, CT (800) 934-5432.
 6. Siemon Company, Watertown, CT (860) 274-2523.
 7. Tyco Electronics AMP NETCONNECT, Berwyn, PA (800) 522-6752.
 8. Leviton, Bothell, WA (800) 977-0190.
 9. Panduit, Tinley Park, IL (800) 777-3300.
 10. Product options and substitutions. Substitutions: Not permitted.
- B. Panels:
 1. Rack mounted 48-port, 8-pin modular, Category 6, non-keyed or insulation-displacement "110"-type.
 2. Complies with ANSI/TIA/EIA-568-C "T568A" pinning configuration.

2.12 TYPE 3 CONSOLIDATION POINT ENCLOSURE

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. American Access Technologies, Inc., Altamonte Spring, FL (800) 285-2070.
 2. America Cable Systems, New Bedford, MA (800) 426-3170.
 3. Chatsworth Products, Chatsworth, CA (818) 882-8595.
 4. Holocom Networks, Inc., Carlsbad, CA (888) 465-6266.
 5. Product options and substitutions. Substitutions: Substitutions require approval.
- B. Enclosures:
 1. Plenum rated metal enclosure.
 2. Securable access panel.
 3. Room for 48-port patch panel, standoff brackets and horizontal and vertical patch cord management.
 4. Sufficient egress for station cables back to TR/TE and UTP Cable Assemblies out to cubicle furniture.
 5. Secure mounting hardware to attach to building steel while aligning into office suspended ceiling system.
 6. Fire stopping medium to seal cable egress passages to ensure compliance with all fire safety codes regarding return air plenums.



NOTE TO SPECIFIER

Delete the following section if FP-1 is not used.

2.13 LASER OPTIMIZED 50/125 MICRON FIBER TYPE 1 CONSOLIDATION POINT (FP-1)

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. Berk-Tek, Inc., New Holland, PA (800) 237-5835.
 2. CommScope Uniprise, Claremont, NC (800) 544-1948.
 3. Corning Cable Systems, Hickory, NC (800) 743-2671.
 4. Draka Comteq, Franklin, MA (888) 541-7100.
 5. General Cable, Highland Heights, KY (800) 424-5666.
 6. Mohawk/CDT, Leominster, MA (978) 537-9961.
 7. Belden, Richmond, IN (800) 235-3361.
 8. Superior Essex, Atlanta, GA (800) 685-4887.
 9. Product options and substitutions. Substitutions: Substitutions require approval.
- B. Enclosure, connectors and adapter plates:
 1. SC type Laser Optimized connectors.
 2. 6 port coupler panel with laser optimized SC adapters for each FP.
 3. 6 Strands x Number of FPs = size of enclosure needed, and amount of SC adapters for CCR.
 4. Rack mount enclosure is 1.75 inches high. (1 Rack Unit)
 5. Complies with ANSI/TIA/EIA-568-C specification.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Specified in Section 270500 – Common Work Results for Communications.

3.2 INSTALLATION - COMPONENTS

- A. Type 1 Consolidation Point and Type 1 Fiber Optic Point: Furnish and install 12 port consolidation point (CP-1) or fiber optic enclosures (FP-1) at each location identified on Electrical Drawings using NEMA 12 rated enclosures. Mount consolidation points and fiber optic points with uni-strut or equivalent fastening devices to steel ceiling structure (red iron) so that box is vertical and installed between 20 to 23 feet above the finished floor. Door must be oriented so that it opens in a horizontal manner. Enclosure may not be mounted in a manner so that the door opens downward. Contractor must ensure all minimum bend radius specifications for cables can be achieved inside the enclosures. Install all cables between the Type 1 Consolidation Point and the telecommunications closet in conduit/EMT or enclose cables in conduit/EMT from multiple Consolidation Points to a common cable tray leading to the TR/TE. All terminating components shall match the requirements/performance specifications of the cable specified. Install cables from Fiber Optic Points to CCR in conduit/EMT or wire basket tray.
- B. Modular Patch Panel for Type 1 Consolidation Point: Install 12-port, "110 Style" punch-down block in each consolidation point enclosure, terminate 12 four pair Category 6 cables at each CP location.
 1. Furnish, and install blocks inside consolidation point enclosure for all consolidation point applications. Install patch panel blocks on "89D" bracket on box adapter plate, or plywood inside each consolidation point.
 2. Furnish and install patch panel blocks with cable designation strips.



3. Terminate all 4 pairs of each horizontal 4 pair cable, one 4 pair cable per port.
- C. Labeling for Type 1 Consolidation Point: Label each consolidation point with TR/TE #, CP zone letter (A, B, C, etc.), and port #'s (1-12). TR/TE and zone patch panel ports are labeled as follows: CP zone A equals ports 1-12, CP zone B equals ports 13-24, CP zone C equals ports 25-36, CP zone D equals ports 37-48 CP zone E equals ports 49-60, etc., or as identified on the Electrical Drawings. * Note CP-1 01-E begins on the second patch panel numerically numbered ports 49 – 96.
 1. Example: CP-1 (TR/TE # - Zone A, B, C...- Port #'s) i.e. 01A-1-12, 01B-13-24, 01C-25-36, 01D-37-48, 01E-49-60 etc .
 - D. Type 2 Consolidation Point: Furnish a 48-port consolidation point enclosures at each location identified on site drawings. Mount Type 2 Consolidation Points either recessed into or flush mounted onto a wall 54 inches AFF in accordance with particular manufacturer specifications. Contractor must ensure all minimum bend radius specifications for cables can be achieved inside consolidation point enclosures. NOTE: Usually, the UTP Cable Assemblies between the Type 2 Consolidation Point and the cubicle furniture will be provided by the USPS and will be installed at a later time. However, if the installation of cubicle furniture is included in the general contract for the facility, it will be the responsibility of the contractor to obtain and install the UTP Cable Assemblies to connect the Type 2 Consolidation Point and the cubicle furniture.
 - E. Panels for Type 2 Consolidation Point: Install 48-port, 8-pin modular “110 style” patch panel in each consolidation point enclosure and terminate 48 four-pair Category 6 cables, one 4 pair cable per port, to each 48 port patch panel. Once connected via UTP cable assemblies, each cubicle workstation will receive one standard triplex telecommunications outlet.
 - F. Labeling for Type 2 Consolidation Point: Label each consolidation point with TR/TE # (01, 02, 03, 04), CP zone letter (A, B, C, etc.), and port count. TR/TE and zone patch panel ports are labeled as follows: CP zone A equals ports 1-48, CP zone B equals ports 49-96, CP zone C equals ports 97-144, etc., or as identified on the Electrical Drawings.
 1. Example: CP-2 (TR/TE # - Zone A, B, C...- Port #'s) i.e. 01A-1-48, 01B-49-96, 01C-97-144, 01D-145-192, etc.
 - G. Type 3 Consolidation Point: Furnish 48-port consolidation point enclosure at each location identified on site drawings. Mount Type 3 Consolidation Points in suspended ceiling using threaded rod and appropriate fasteners to building steel ceiling structure (red iron). Fasten ceiling tile to face of enclosure according to manufacturer's specifications and align the enclosure with the suspended ceiling grid system to ensure that the access panel opens freely. Contractor must ensure all minimum bend radius specifications for cables can be achieved inside consolidation point enclosures. NOTE: Usually, the UTP Cable Assemblies between the Type 3 Consolidation Point and the cubicle furniture will be provided by the USPS and will be installed at a later time. However, if the installation of the cubicle furniture is included in the general contract for the facility, it will be the responsibility of the contractor to obtain and install the UTP Cable Assemblies between the Type 3 Consolidation Point and the cubicle furniture.
 - H. Panels for Type 3 Consolidation Point: Install 48-port, 8-pin modular “110 Style” patch panel in each consolidation point enclosure and terminate up to 48 four-pair Category 6 cables, one 4 pair cable per port. When connected via UTP cable assemblies, each cubicle workstation will receive one standard triplex telecommunications outlet.
 - I. Labeling for Type 3 Consolidation Point: Label each consolidation point box with TR/TE # (01, 02, 03, 04), CP zone letter (A, B, C, etc.), and port count. TR/TE and consolidation point patch panel ports are labeled as follows: CP zone A equals ports 1-48, CP zone B equals port 49-96, CP zone C equals ports 97-144, etc., or as identified on the Electrical Drawings.
 1. Example: CP-3 (TR/TE # - Zone A, B, C...- Port #'s) i.e. 01A-1-48, 01B-49-96, 01C-97-144, 01D-145-192, etc.



3.3 CONSTRUCTION

- A. Specified in Section 270500 – Common Work Results for Communications.

3.4 FIELD QUALITY CONTROL

- A. Specified in 270500 – Common Work Results for Communications.

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END OF SECTION 27 13 00 00



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SECTION 27 13 00 00 - CSF COMMUNICATIONS BACKBONE CABLING**

NOTE TO SPECIFIER

Use this Outline Specification Section for Customer Service Facilities only.

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes the following structured wiring system components:
 - 1. Communication cable.
 - 2. Termination equipment.
 - 3. Patching equipment.
- B. Related Documents:
 - 1. Specified in Section 270500 - Common Work Results For Communications.
- C. Related Sections:
 - 1. Specified in Section 270500 - Common Work Results For Communications

1.2 REFERENCES

- A. Specified in Section 270500 - Common Work Results For Communications.

1.3 SUBMITTALS

- A. Specified in Section 270500 - Common Work Results For Communications.

1.4 QUALITY ASSURANCE

- A. Specified in Section 270500 - Common Work Results For Communications.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver in accordance with NEMA WC 26.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

The majority of Customer Service Facilities (CSF) are less than 60,000 s.f. and will not require fiber optic backbone cabling. Add section 2.2, 2.3 and 2.4 below if fiber cabling is deemed necessary.



- 2.1 6, 12, and 24 STRAND ARMORED TIGHT BUFFERED 50/125 micron, laser-optimized, 10-Gigabit-Ethernet-Compliant, "1500/500", MULTI-MODE FIBER OPTIC BACKBONE CABLING.
- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Berk-Tek, Inc., New Holland, PA (800) 237-5835.
 2. CommScope Uniprise, Claremont, NC (800) 544-1948.
 3. Corning Cable Systems, Hickory, NC (800) 743-2671.
 4. Draka Comteq, Franklin, MA (888) 541-7100.
 5. General Cable, Highland Heights, KY (800) 424-5666.
 6. Mohawk/CDT, Leominster, MA (978) 537-9961.
 7. Belden, Richmond, IN (800) 235-3361.
 8. Superior Essex, Atlanta, GA (800) 685-4887.
 9. Product options and substitutions. Substitutions: Substitutions require approval.
- B. Fiber Type: 6, 12, and 24 strand armored tight buffered 50/125 micron, laser-optimized, 10-Gigabit-Ethernet-Compliant, "1500/500" multi-mode fiber optic cable.
1. Individually insulated plenum rated strands under common plenum rated sheath unless entire cable is contained within conduit/EMT or if area where cable is installed is not considered a return air plenum according to any applicable codes.
 2. Complies with individual characteristics established in ANSI/TIA/EIA-568-C including all addendums for fiber optic cable performance specification.
- 2.2 FIBER OPTIC RACK MOUNT INTERCONNECT CENTER
- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. CommScope Uniprise, Claremont, NC (800) 544-1948.
 2. Corning Cable Systems, Hickory, NC (800) 743-2671.
 3. Hubbell, Inc., Milford, CT (203) 882-4800.
 4. Molex Premise Networks, Harvard, MA (987) 772-5630.
 5. Belden, Richmond, IN (800) 235-3361.
 6. Ortronics, New London, CT (800) 934-5432.
 7. Siemon Company, Watertown, CT (860) 274-2523.
 8. 3M Telecommunications, Austin, TX (800) 695-0447.
 9. Tyco Electronics AMP NETCONNECT, Berwyn, PA (800) 522-6752.
 10. Product options and substitutions. Substitutions: Not permitted.
- B. Enclosure connector and adapter panels:
1. SC type laser optimized connectors
 2. 24 port coupler panels with laser optimized SC adapters.
 3. Each rack mount enclosure used in ER/TR will be 1.75 inches (1 Rack Unit) with (2) 12-port SC/SC style laser optimized coupler panels to house the backbone fiber. The "ER" and each individual TR will receive a dedicated rack mount enclosure. Each enclosure will be separated by a 1 RU wire manager.
 4. Complies with ANSI/TIA/EIA-568-C specification.
- 2.3 FIBER OPTIC PATCH CORDS
- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. CommScope Uniprise, Claremont, NC (800) 544-1948.
 2. Corning Cable Systems, Hickory, NC (800) 743-2671.
 3. Hubbell, Inc., Milford, CT (203) 882-4800.



4. Molex Premise Networks, Harvard, MA (987) 772-5630.
 5. Belden, Richmond, IN (800) 235-3361.
 6. Ortronics, New London, CT (800) 934-5432.
 7. Siemon Company, Watertown, CT (860) 274-2523.
 8. 3M Telecommunications, Austin, TX (800) 695-0447.
 9. Tyco Electronics AMP NETCONNECT, Berwyn, PA (800) 522-6752.
 10. Product options and substitutions. Substitutions: Not permitted.
- B. Fiber optic duplex tight buffered 50/125 micron Laser Optimized 10-Gigabit Ethernet compliant 1500/500 fiber optic patch cords.
1. Terminated with SC/LC connectors
 2. Complies with individual characteristics established in ANSI/TIA/EIA-568-C including all addendums for fiber optic patch cable performance specification.
 3. Fiber optic patch cord terminations and quantities shall be coordinated with U.S. Postal Service personnel prior to procurement.
 4. Match performance characteristics of installed fiber optic backbone.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Specified in Section 270500 – Common Work Results for Communications.

3.2 INSTALLATION

- A. Specified in Section 270500 – Common Work Results for Communications.
- B. Identification:
1. See Section 270500 – Common Work Results for Communications for additional requirements.

NOTE TO SPECIFIER

The majority of Customer Service Facilities (CSF) are less than 60,000 s.f. and will not require fiber optic backbone cabling. Add section 3.2,B. 2. below if fiber cabling is deemed necessary.

2. Fiber Optic Interconnect Centers: Display ER/TR and cable strand identification numbers in uppercase lettering, or numbers on permanent adhesive label stock.

3.3 INSTALLATION - COMPONENTS

1. Specified in Section 270500 – Common Work Results for Communications.

3.4 CONSTRUCTION

- A. Specified in Section 270500 – Common Work Results for Communications.

3.5 FIELD QUALITY CONTROL

- A. Specified in Section 270500 – Common Work Results for Communications.



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END OF SECTION 27 13 00 00



SECTION 27 15 00 00 - MPF COMMUNICATIONS HORIZONTAL CABLING**

NOTE TO SPECIFIER

Use this Specification section for Mail Processing Facilities.

****THIS ENTIRE SECTION CONSISTS OF REQUIRED PARTS OR ARTICLES. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes the following structured cabling system components:
 - 1. Communication cable.
 - 2. Termination equipment.
 - 3. Patching equipment.
- B. Related Documents:
 - 1. Specified in Section 270500 – Common Work Results for Communications.
- C. Related Sections:
 - 1. Specified in Section 270500 – Common Work Results for Communications.

1.2 REFERENCES

- A. Specified in Section 270500 – Common Work Results for Communications.

1.3 SYSTEM DESCRIPTION

- A. Specified in Section 270500 – Common Work Results for Communications.

1.4 SUBMITTALS

- A. Specified in Section 270500 – Common Work Results for Communications.

1.5 QUALITY ASSURANCE

- A. Specified in Section 270500 – Common Work Results for Communications.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 – Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver in accordance with NEMA WC 26.



PART 2 - PRODUCTS

2.1 4-PAIR CATEGORY 6 UNSHIELDED TWISTED PAIR CABLE

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Berk-Tek, Inc., New Holland, PA (800) 237-5835.
 - 2. CommScope Uniprise, Claremont, NC (800) 544-1948.
 - 3. Draka Comteq, Franklin, MA (888) 541-7100.
 - 4. Mohawk/CDT Leominster, MA (978) 537 9961.
 - 5. Belden, Richmond, IN (800) 235-3361.
 - 6. General Cable, Highland Heights, KY (800) 424-5666.
 - 7. Superior Essex, Atlanta, GA (800) 685-4887.
 - 8. Leviton, Bothell, WA (800) 977-0190.
 - 9. Panduit, Tinley Park, IL (800) 777-3300.
 - 10. Product options and substitutions. Substitutions: Not permitted.
- B. Conductors: 4 twisted pair minimum 24 AWG, solid copper.
 - 1. Individually insulated plenum rated conductors under common plenum rated sheath unless entire cable is installed within conduit/EMT or if area where cable is installed is not considered a return air plenum according to any applicable codes.
 - 2. Complies with individual characteristics established in ANSI/TIA/EIA-568-C, and all addendums for Category 6 cable performance specification.
 - 3. Nominal Impedance: 100 ohms plus or minus 15 percent.
 - 4. Certified and capable of performing to a minimum of 250 MHz.

2.2 OUTLET FACEPLATES/MOUNTING FRAMES

- A. Wall mounted, or raceway mounted outlet faceplates or mounting frames, suitable for the following:
 - 1. Mounting required number of 8-pin modular connectors.
 - 2. Use with approved 8-pin modular connectors.
 - 3. Installation over single gang junction box, double gang junction box, or raceway knockout as indicated on Drawings.
 - 4. All empty faceplate ports shall have blanks of matching color installed.
- B. Color: Selected by Contracting Officer.

2.3 CONDUITS AND BOXES

- A. Specified in Section 260533 – Raceway and Boxes for Electrical Systems.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Specified in Section 270500 – Common Work Results for Communications.



3.2 INSTALLATION

- A. Cables: Furnish and install communications cables as specified, in accordance with Cable Pulling Schedules, manufacturer's published instructions, ANSI/TIA/EIA-568-C including all addendums and as indicated on Drawings.
 - 1. Dress cable to final location, remove sheath to point allowing splaying of conductors, and terminate. Make each termination uniform and precise. Hook and Loop "Velcro" cable ties shall be used for bundling and dressing all cabling. No nylon zip ties shall be used for cable bundling or attachment.
 - 2. Maintain sheath integrity. Remove minimum amount of sheath required for termination up to a maximum of 1 inch.
 - 3. Maintain manufacturer's twisting of wire pairs to termination point. Do not attempt to restore, modify, or add to manufacturer's twisting of cable. Do not untwist more than 1/2 inch of the stripped cable.
 - 4. Label each end with a machine generated, self laminating label.
 - 5. Mechanical couplers or splices not permitted in copper cabling.
 - 6. Cable conductors shall be continuous from originating termination equipment to destination termination equipment.
- B. Telecommunications Outlet: Furnish and install three female 8-pin modular jack connectors on one face plate at each T/O (telecommunications outlet) as indicated on Drawings.
 - 1. Install faceplate over duplex outlet box, double duplex outlet box, or raceway knockout, level and in alignment with adjacent faceplates.
 - 2. Except where entire cable run is in conduit/EMT, provide a minimum 10-foot service loop in the ceiling at the end of the conduit/EMT riser before the cable enters the outlet box.
 - 3. Coordinate color with Raleigh IT Service Center POC.

3.3 INSTALLATION COMPONENTS

- A. Specified in Section 270500 – Common Work Results for Communications.

3.4 CONSTRUCTION

- A. Specified in Section 270500 – Common Work Results for Communications.

3.5 FIELD QUALITY CONTROL

- A. Specified in Section 270500 – Common Work Results for Communications.

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END OF SECTION 27 15 00 00



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SECTION 27 15 00 00 - CSF COMMUNICATIONS HORIZONTAL CABLING**

NOTE TO SPECIFIER

Use this Outline Specification Section for Customer Service Facilities only.

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes the following structured wiring system components:
 - 1. Communication cable.
 - 2. Termination equipment.
 - 3. Patching equipment.
- B. Related Documents:
 - 1. Specified in Section 270500 – Common Work Results for Communications.
- C. Related Sections:
 - 1. Specified in Section 270500 - Common Work Results For Communications

1.2 REFERENCES

- A. Specified in Section 270500 – Common Work Results for Communications.

1.3 SUBMITTALS

- A. Specified in Section 270500 – Common Work Results for Communications.

1.4 QUALITY ASSURANCE

- A. Specified in Section 270500 – Common Work Results for Communications.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver in accordance with NEMA WC 26.

PART 2 - PRODUCTS

2.1 4-PAIR Category 6 UNSHIELDED TWISTED PAIR CABLE



- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Belden/CDT, St. Louis, MO (800) 235-3361.
 - 2. Berk-Tek, Inc., New Holland, PA (800) 237-5835.
 - 3. CommScope Uniprise, Claremont, NC (800) 544-1948.
 - 4. Draka Comteq, Franklin, MA (888) 541-7100.
 - 5. Mohawk/CDT Leominster, MA (978) 537 9961.
 - 6. Belden, Richmond, IN (800) 235-3361.
 - 7. Tyco Electronics AMP NETCONNECT, Berwyn, PA (800) 522-6752.
 - 8. General Cable, Highland Heights, KY (800) 424-5666.
 - 9. Superior Essex, Atlanta, GA (800) 685-4887.
 - 10. Leviton, Bothell, WA (800) 977-0190.
 - 11. Panduit, Tinley Park, IL (800) 777-3300.
 - 12. Product options and substitutions. Substitutions: Not permitted.
- B. Conductors: 4 twisted pair -minimum 24 AWG, solid copper.
 - 1. Individually insulated plenum rated conductors under common plenum rated sheath unless entire cable is installed within conduit/EMT or if area where cable is installed is not considered a return air plenum according to any applicable codes.
 - 2. Complies with individual characteristics established in ANSI/TIA/EIA-568-C and all addendums for Category 6 cable performance specification.
 - 3. Nominal Impedance: 100 ohms plus or minus 15 percent.
 - 4. Certified and capable of performing to a minimum of 250 MHz.

2.2 OUTLET FACEPLATES/MOUNTING FRAMES

- A. Wall mounted, or raceway mounted outlet faceplates or mounting frames, suitable for the following:
 - 1. Mounting required number of 8-pin modular connectors.
 - 2. Use with approved 8-pin modular connectors.
 - 3. Installation over single gang junction box, double gang junction box, or raceway knockout as indicated on Drawings.
 - 4. All empty faceplate ports shall have blanks of matching color installed.
- B. Color: Selected by Contracting Officer.

2.3 CONDUITS AND BOXES

- A. Specified in Section 260533 – Raceway and Boxes for Electrical Systems.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Specified in 270500– Common Work Results for Communications.

3.2 INSTALLATION

- A. Cables: Furnish and install communications cables as specified, in accordance with Cable Pulling Schedules, manufacturer's published instructions, ANSI/TIA/EIA-568-C including all addendums and as indicated on Drawings.



1. Dress cable to final location, remove sheath to point allowing splaying of conductors, and terminate. Make each termination uniform and precise. Hook and Loop "Velcro" cable ties shall be used for bundling and dressing all cabling. No nylon zip ties shall be used for cable bundling or attachment.
 2. Maintain sheath integrity. Remove minimum amount of sheath required for termination up to a maximum of 1 inch.
 3. Maintain manufacturer's twisting of wire pairs to termination point. Do not attempt to restore, modify, or add to manufacturer's twisting of cable. Do not untwist more than ½ inch of the stripped cable.
 4. Label each end with a machine generated, self laminating label.
 5. Mechanical couplers or splices not permitted.
 6. Cable conductors shall be continuous from originating termination equipment to destination termination equipment.
- B. Telecommunications Outlet: Furnish and install three female 8-pin modular jack connectors on one face plate at each T/O (telecommunications outlet) as indicated on Drawings.
1. Install faceplate over single duplex outlet box, double duplex outlet box, or raceway knockout, level and in alignment with adjacent faceplates.
 2. Provide a minimum of a 10-foot service loop in the ceiling at the end of the conduit/EMT riser before the cable enters the outlet box.
 3. Coordinate color with Raleigh IT Service Center POC.

3.3 INSTALLATION - COMPONENTS

- A. Specified in Section 270500 – Common Work Results for Communications.

3.4 CONSTRUCTION

- A. Specified in Section 270500 – Common Work Results for Communications.

3.5 FIELD QUALITY CONTROL

- A. Specified in Section 270500 – Common Work Results for Communications.

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END OF SECTION 27 15 00 00



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Task	Specification	Specification Description
27 15 13 00	26 05 13 00	Undercarpet Cables
27 15 13 00	26 05 19 16	Control-Voltage Electrical Power Cables
27 15 33 00	26 05 13 00	Undercarpet Cables
27 15 33 00	26 05 19 16	Control-Voltage Electrical Power Cables
27 41 23 00	26 33 43 00a	Public Address and Mass Notification Systems



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SECTION 27 51 16 00 - MPF PUBLIC ADDRESS AND PAGING SYSTEMS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Paging system.
- B. Related Sections:
 - 1. Section 260500 - Common Work Results for Electrical:
 - 2. Section 260533 - Raceway and Boxes for Electrical Systems:
 - 3. Section 270500 - Common Work Results for Communications: Telecommunications cables, termination, and patching equipment.

1.2 REFERENCES

- A. Electronic Industries Association (EIA):
 - 1. ANSI/TIA/EIA-568-A - Commercial Building Wiring Standard.
- B. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

- A. Procedures for submittals.
 - 1. Product data: For each type of equipment.
 - 2. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location of each field connection.
 - 3. Control equipment.
 - 4. Rack arrangements.
 - 5. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring. Identify terminals to facilitate installation, operation, and maintenance. Include a single-line diagram showing cabling interconnection of components.
- B. Calculations: For sizing backup battery.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements. Include record of final speaker-line matching transformer-tap settings, and signal ground-resistance measurement certified by Installer.
- D. Maintenance Data: For equipment to include in maintenance manuals specified in Division 1.



- E. Assurance/Control Submittals:
 1. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 2. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
- F. Procedures for closeout submittals.
 1. Operating and Maintenance Data: Operating and maintenance instructions, parts lists and wiring diagrams.
 2. Submit written special warranty with forms completed in United States Postal Service name and registered with manufacturer as specified in this Section.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience and an authorized representative of equipment manufacturer for both installation and maintenance of equipment.
- B. Regulatory Requirements:
 1. Conform to requirements of NFPA 70 and UL 50.
 2. Products: Listed and classified by Underwriter's Laboratories Incorporated as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. Alpha Communications.
 2. Altec Lansing/University Sound.
 3. Atlas-Soundolier; Atapco Security & Communications Group.
 4. Bogen Communications, Incorporated.
 5. Dukane Corp.; Communications Systems Division.
 6. Electro-Voice, Incorporated.
 7. Executone Information Systems Incorporated.
 8. Federal Signal Corporation; Signal Div./Electrical Products.
 9. Lucent Technologies, Silver Spring, MD (301) 608-4765.
 10. Peavey Electronics Corporation.
 11. Rauland-Borg Corporation.
 12. Valcom, Incorporated, Roanoke, VA (540) 427-3900.
 13. Whelen Engineering Company, Incorporated.



2.2 SYSTEM FUNCTIONS

- A. Include the following:
1. Selectively connecting separate zones to different signal channels.
 2. Selectively amplifying sound among various microphone outlets and other inputs.
 3. Communicating simultaneously to all zones regardless of zone or channel switch settings.
 4. Paging, by dialing an extension from any local telephone instrument and speaking into the telephone.
 5. Producing a program-signal tone that is amplified and sounded over all speakers, overriding signals currently being distributed.
 6. Reproducing high-quality sound that is free from noise and distortion at all loudspeakers at all times during equipment operation, including standby mode with inputs off; and output free from non-uniform coverage of amplified sound.

NOTE TO SPECIFIER

Delete paragraph below if Postal Service will contract separately for this service.

7. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions. Provide up to three on-site assistance visits within one year of Substantial Completion.

2.3 EQUIPMENT

- A. Coordinate features to form an integrated system. Match components and interconnections for optimum performance of specified functions.
- B. Equipment: Modular type, using solid-state components, fully rated for continuous duty, unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.
- C. Waterproof Equipment: Listed and labeled for duty outdoors or in damp locations.

2.4 PREAMPLIFIERS

- A. Comply with EIA #SE-101-A; either separately mounted or as an integral part of power amplifier.
- B. Output Power: Plus 4 dB above 1 mW at matched power-amplifier load.
- C. Total Harmonic Distortion: Less than 1 percent.
- D. Frequency Response: Within plus or minus 2 dB from 20 to 20,000 Hz.
- E. Input Jacks: Minimum of two. One matched for low-impedance microphone; the other matchable to cassette deck, CD player, or radio tuner signals without external adapters.
- F. Minimum Noise Level: Minus 55 dB below rated output.
- G. Controls: On/off, input levels, and master gain.

2.5 POWER AMPLIFIERS

- A. Comply with EIA #SE-101-A.



- B. Mounting: Rack mounted.
- C. Output Power: 70-W balanced line.
- D. Frequency Response: Within plus or minus 2 dB from 50 to 12,000 Hz.
- E. Minimum Signal-to-Noise Ratio: 60 dB, at rated output.
- F. Total Harmonic Distortion: Less than 3 percent at rated power output from 50 to 12,000 Hz.
- G. Output Regulation: Less than 2 dB from full to no load.
- H. Controls: On/off, input levels, and low-cut filter.
- I. Input Sensitivity: Matched to preamplifier and providing full-rated output with a sound-pressure level of less than 10 dynes/sq. cm impinging on a speaker microphone or handset transmitter.

2.6 COMPONENTS

NOTE TO SPECIFIER

Edit paragraph below to suit Project. Console can vary from a small switch and pilot-light panel to a large, complex unit. Coordinate with Drawings for identification of items to be mounted and for console mounting provision: desk, counter, wall, etc.

- A. Control Equipment: Complying with EIA-310.
 - 1. Panel for Equipment and Controls: Each module is nominal 19 inches (48 cm) wide by 8-3/4 inches (22 cm) high for installation in equipment rack.
 - 2. Controls: Include the following:
 - a. Switching devices to select signal sources for distribution channels.
 - b. Program selector switch to select source for each program channel.
 - c. Switching devices to select zones for paging.
 - d. All-call selector switch.
 - 3. Indicators: A visual annunciation for each distribution channel to indicate source being used.
 - 4. Spare Positions: 20 percent spare zone control and annunciation positions on console.
 - 5. Microphone jack.
- B. Telephone Paging Adapter: Arranged to accept voice signals from telephone extension dialing access and to automatically provide amplifier input and program override for preselected zones.
 - 1. Minimum Frequency Response: Flat, 200 to 2500 Hz.
 - 2. Impedance Matching: Adapter matches telephone line to public address equipment input.
- C. Equipment Rack: Comply with EIA-310-D. House amplifiers, control equipment and auxiliary equipment in standard EIA 19-inch (483-mm) racks.
 - 1. Group items of same function together, either vertically or side by side, and arrange controls symmetrically.
 - 2. Power-Supply Connections: Approved plugs and receptacles.
 - 3. Arrange all inputs, outputs, interconnections, and test points so they are accessible at rear of rack for maintenance and testing, with each item removable from rack without disturbing other items or connections.
 - 4. Blank Panels: Cover empty space in equipment racks so entire front of rack is occupied by panels.
 - 5. Enclosure Panels: Ventilated rear and sides and solid top. Use louvers in panels to ensure adequate ventilation.
 - 6. Finish: Uniform, baked-enamel factory finish over rust-inhibiting primer.



7. Power-Control Panel: On front of equipment housing, with a master power on/off switch and pilot light, and socket for a 5-A, indicating, cartridge fuse for rack equipment power.
 8. Vertical Plug Strip: Metal wireway with integral grounded receptacles, 12 inches (30 cm) o.c. the full height of rack, to supply rack-mounted equipment.
 9. Spare Capacity: [20] [____] percent spare space capacity in rack for future equipment.
- D. Cone-Type Loudspeakers: Comply with EIA SE-103.
1. Minimum Axial Sensitivity: EIA pressure rating of 45 dB.
 2. Frequency Response: Within plus or minus 3 dB from 50 to 15,000 Hz.
 3. Size: 8 inches (200 mm) with 1-inch (25-mm) voice coil and minimum 5-oz. (140-g) ceramic magnet.
 4. Minimum Dispersion Angle: 100 degrees.
 5. Rated Output Level: 10 W.
 6. Matching Transformer: Comply with EIA-160. Full-power rated with four EIA standard taps. Maximum insertion loss of 0.5 dB.
 7. Surface-Mounting Units: Ceiling, wall, or pendant mounting, as indicated on drawings, in steel back boxes, acoustically dampened. Front face of at least 0.0478-inch (1.2-mm) steel and whole assembly rust proofed and shop primed for field painting.
 8. Flush-Ceiling Mounting Units: In steel back boxes, acoustically dampened. Metal ceiling grille with baked, white-enamel finish.
- E. Horn-Type Loudspeakers: Comply with EIA SE-103.
1. Type: Single-horn units, double-reentrant design, with minimum full-range power rating of 15 W.
 2. Matching Transformer: Comply with EIA-160. Full-power rated with four EIA standard taps. Maximum insertion loss of 0.5 dB.
 3. Frequency Response: Within plus or minus 3 dB from 250 to 12,000 Hz.
 4. Dispersion Angle: 130 by 110 degrees.
 5. Mounting: Integral bracket.
 6. Units in Hazardous (Classified) Locations: Listed and labeled for the environment in which they are located.
- F. Noise-Operated Gain Controller: Units continuously sense space noise level and automatically adjust signal level to local speakers.
1. Frequency Response: 20 to 20,000 Hz, plus or minus 1 dB.
 2. Level Adjustment Range: 20 dB minimum.
 3. Maximum Distortion: 1 percent.
 4. Control: Permits adjustment of sensing level of device.
- G. Volume Attenuator Stations: Wall-plate-mounted autotransformer type with paging priority feature.
1. Wattage Rating: 10 W, unless otherwise indicated.
 2. Attenuation per Step: 3 dB, with positive off position.
 3. Insertion Loss: 0.4 dB maximum.
 4. Attenuation Bypass Relay: Single pole, double throw. Connected to operate and bypass attenuation when all-call, paging, program signal, or prerecorded message features are used. Relay returns to normal position at end of priority transmission.
 5. Label: "PA Volume."
- H. Cable and Conductors: Jacketed, twisted-pair and twisted-multipair, untinned, solid-copper conductors.
1. Insulation for Wire without Conduit: Thermoplastic, not less than 1/32 inch (0.8 mm) thick.
 2. Microphone Cables: Neoprene jacketed, not less than 2/64 inch (0.8 mm) thick over shield with filled interstices. Shield No. 34 AWG tinned, soft-copper strands formed into a braid or approved equivalent foil. Shielding coverage on conductors is not less than 60 percent.
 3. Plenum Cable: Listed and labeled for plenum installation.
- I. Special Requirements For Cable Routing And Installation
1. The majority of paging system wiring in this building will be installed above ceilings without conduit. All communications cabling used throughout this project shall comply with the



- requirements as outlined in the National Electric Code (NEC) article 725. All cabling shall bare CMP and/or appropriate markings for the environment in which they are installed.
2. Sealing of openings between floors, through rated fire and smoke walls, existing or created by the contractor for cable pass through shall be the responsibility of the contractor. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of the contractor's work. Any openings created by or for this contractor and left unused shall also be sealed as part of this work.
 3. Cabling routed underground, exterior of the building, through inaccessible ceilings or less than 10'-0" A.F.F. in the workroom shall be contained in conduit. Provide flush boxes within finished areas and factory boxes in unfinished areas. Provide 3/4" conduit risers with 90 degree bend and bushing for all wall mounted devices.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- B. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- C. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Verify that electrical connections are made correctly.
- C. Install exposed cables parallel and perpendicular to surfaces or exposed structural members, and follow surface contours. Secure and support cables by straps, staples, or similar fittings so designed and installed to avoid damage to cables. Secure cable at intervals not exceeding 30 inches (76 cm) and not more than 6 inches (15 cm) from cabinets, boxes, or fittings.
- D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess. Use lacing bars in cabinets.
- E. Control-Circuit Wiring: Install number and size of conductors as recommended by system manufacturer for control functions indicated.
- F. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Where exposed or in same enclosure, separate conductors at least 12 inches (30 cm) for speaker microphones and adjacent parallel power and voice wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.
- G. Splices, Taps, and Terminations: Make splices, taps, and terminations on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- H. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.



- I. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables to identify media in coordination with system wiring diagrams.
- J. Conductor Sizing: Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker outlets not smaller than number 14 AWG and conductors from microphone receptacles to amplifiers not smaller than number 20 AWG.
- K. Weatherproof Equipment: Install units that are mounted outdoors, in damp locations, or where exposed to weather consistent with requirements of weatherproof rating. Provide surge protection where required.
- L. Line Matching Transformer Connections: Make initial connections using tap settings indicated on Drawings.
- M. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- N. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installations, including connections. Report results in writing.
- B. Operational Test: Perform tests that include originating program and page material at microphone outlets, preamplifier program inputs, and other inputs. Verify proper routing and volume levels and freedom from noise and distortion.
- C. Signal-to-Noise Ratio Test: Measure the ratio of signal to noise of complete system at normal gain settings, using the following procedure:
 - 1. Disconnect a microphone at the connector or jack closest to it and replace it in the circuit with a signal generator using a 1000-Hz signal. Replace all other microphones at corresponding connectors with dummy loads, each equal in impedance to microphone it replaces. Measure the ratio of signal to noise.
 - 2. Repeat test for each separately controlled zone of loudspeakers.
 - 3. Minimum acceptance ratio is 50 dB.
- D. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 50, 200, 400, 1000, 3000, 8000, and 12,000 Hz into each preamplifier channel. For each frequency, measure the distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 3 percent total harmonics.
- E. Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use a sound-level meter with octave-band filters to measure level at five locations in each zone. For spaces with seated audiences, maximum permissible variation in level is plus or minus 2 dB. In addition, the levels between locations in the same zone and between locations in adjacent zones must not vary more than plus or minus 3 dB.
- F. Power Output Test: Measure electrical power output of each power amplifier at normal gain setting at 50, 1000, and 12,000 Hz. Maximum variation in power output at these frequencies must not exceed plus or minus 1 dB.
- G. Signal Ground Test: Measure and report ground resistance at public address equipment signal ground. Comply with testing requirements specified in Division 26.
- H. Retesting: Correct deficiencies, revising tap settings of speaker-line matching transformers where necessary to optimize volume and uniformity of sound levels, and retest. Prepare written record tests.



- I. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.
- J. Schedule tests with at least seven days advance notice of test performance.

3.4 ADJUST AND CLEAN

- A. Adjust equipment for proper operation.

3.5 PROTECTION

- A. Protect finishes until substantial completion.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train maintenance personnel to adjust, operate, and maintain equipment as specified below:
 - 1. Train maintenance personnel on programming equipment for starting up and shutting down, troubleshooting, servicing, and maintaining equipment.
 - 2. Review data in maintenance manuals.
 - 3. Schedule training with Postal Service at least seven days in advance.

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END OF SECTION 27 51 16 00



SECTION 27 51 16 00 - CSF PUBLIC ADDRESS PAGING SYSTEMS

NOTE TO SPECIFIER

Use this Outline Specification Section for larger Customer Service Facilities requiring a paging system. This Specification defines "level of quality" for Customer Service Facility construction and is intended as a guide to the Architect/Engineer preparing the Construction Documents.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.27 51 16 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Public address paging system.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 260500 - Common Work Results for Electrical.
 - 2. Section 270500 - Common Work Results for Communications.

1.2 REFERENCES

- A. As specified in section 260500 – Common Work Results for Electrical.
- B. Electronic Industries Association (EIA):
 - 1. ANSI/TIA/EIA-568-A - Commercial Building Wiring Standard.

1.3 SUBMITTALS

- A. As specified in section 260500 – Common Work Results for Electrical.
- B. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product data: For each type of equipment.
 - 2. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location of each field connection.
 - 3. Control equipment.
 - 4. Rack arrangements.
 - 5. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring. Identify terminals to facilitate installation, operation, and maintenance. Include a single-line diagram showing cabling interconnection of components.



- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements. Include record of final speaker-line matching transformer-tap settings, and signal ground-resistance measurement certified by Installer.
- D. Maintenance Data: For equipment to include in maintenance manuals specified in Division 1.
- E. Assurance/Control Submittals:
 - 1. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - 2. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
- F. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Operating and Maintenance Data: Operating and maintenance instructions, parts lists and wiring diagrams.
 - 2. Submit written special warranty with forms completed in United States Postal Service name and registered with manufacturer as specified in this Section.

1.4 QUALITY ASSURANCE

- A. As specified in section 260500 – Common Work Results for Electrical.
- B. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 - 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience and an authorized representative of equipment manufacturer for both installation and maintenance of equipment.
- C. Regulatory Requirements:
 - 1. Conform to requirements of NFPA 70 and UL 50.
 - 2. Products: Listed and classified by Underwriter's Laboratories Incorporated as suitable for the purpose specified and indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

1.6 WARRANTY

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.

1.7 MAINTENANCE

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.



2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Alpha Communications, Hauppauge, NY (800) 666-4800.
 2. Altec Lansing/University Sound, Oklahoma City, OK (800) 685-6386.
 3. Atlas Sound, Ennis, TX (800) 876-3333.
 4. Bogen Communications, Incorporated, Ramsey, NJ (800) 685-6386.
 5. Dukane Corp.; Communications Systems Division, St. Charles, IL (630) 584-2300.
 6. EVI Audio, Buchanan, MI (800) 234-6831.
 7. Federal Signal Corp., University Park, IL (800) 548-7229.
 8. Lowell Manufacturing Co., Pacific, MO (800) 325-9660.
 9. Peavey Electronics Corp., Meridian, MS (601) 483-5376.
 10. Rauland-Borg Corporation, Skokie, IL (847) 679-0900.
 11. Valcom, Incorporated, Roanoke, VA (540) 427-2400.

2.2 SYSTEM FUNCTIONS

- A. Include the following:
1. Selectively connecting separate zones to different signal channels.
 2. Selectively amplifying sound among various inputs.
 3. Communicating simultaneously to all zones regardless of zone or channel switch settings.
 4. Paging, by dialing an extension from any local telephone instrument and speaking into the telephone.
 5. Producing a program-signal tone that is amplified and sounded over all speakers, overriding signals currently being distributed.
 6. Reproducing high-quality sound that is free from noise and distortion at all loudspeakers at all times during equipment operation, including standby mode with inputs off; and output free from non-uniform coverage of amplified sound.
 7. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions. Provide up to three on-site assistance visits within one year of Substantial Completion.

2.3 EQUIPMENT

- A. Coordinate features to form an integrated system. Match components and interconnections for optimum performance of specified functions.
- B. Equipment: Modular type, using solid-state components, fully rated for continuous duty, unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.
- C. Waterproof Equipment: Listed and labeled for duty outdoors or in damp locations.

2.4 PREAMPLIFIERS

- A. Comply with EIA #SE-101-A; either separately mounted or as an integral part of power amplifier.
- B. Output Power: Plus 4 dB above 1 mW at matched power-amplifier load.



- C. Total Harmonic Distortion: Less than 1 percent.
- D. Frequency Response: Within plus or minus 2 dB from 20 to 20,000 Hz.
- E. Input Jacks: Minimum of four. One matched for low-impedance microphone; (2) matchable for CD player and radio tuner signals, and (1) spare. All shall be matchable without utilizing external adapters.
- F. Minimum Noise Level: Minus 55 dB below rated output.
- G. Controls: On/off, input levels, and master gain.

2.5 POWER AMPLIFIERS

- A. Comply with EIA #SE-101-A.
- B. Mounting: Rack mounted.
- C. Output Power: 70-W balanced line.
- D. Frequency Response: Within plus or minus 2 dB from 50 to 12,000 Hz.
- E. Minimum Signal-to-Noise Ratio: 60 dB, at rated output.
- F. Total Harmonic Distortion: Less than 3 percent at rated power output from 50 to 12,000 Hz.
- G. Output Regulation: Less than 2 dB from full to no load.
- H. Controls: On/off, input levels, and low-cut filter.
- I. Input Sensitivity: Matched to preamplifier and providing full-rated output with a sound-pressure level of less than 10 dynes/sq. cm impinging on a speaker microphone or handset transmitter.

2.6 COMPONENTS

NOTE TO SPECIFIER

Edit paragraph below to suit Project. Console can vary from a small switch and pilot-light wall mounted panel to a large, floor mounted unit. Coordinate with Drawings for identification of items to be mounted and for console mounting provision: desk, counter, wall, etc.

- A. Control Equipment: Complying with EIA-310.
 - 1. Panel for Equipment and Controls: Each module is nominal 19 inches (48 cm) wide by 8-3/4 inches (22 cm) high for installation in equipment rack.
 - 2. Controls: Include the following:
 - a. Switching devices to select signal sources for distribution channels.
 - b. Program selector switch to select source for each program channel.
 - c. Switching devices to select zones for paging.
 - d. All-call selector switch.
 - 3. Indicators: A visual annunciation for each distribution channel to indicate source being used.
 - 4. Spare Positions: 20 percent spare zone control and annunciation positions on console.



- B. Telephone Paging Adapter: Arranged to accept voice signals from telephone extension dialing access and to automatically provide amplifier input and program override for preselected zones.
1. Minimum Frequency Response: Flat, 200 to 2500 Hz.
 2. Impedance Matching: Adapter matches telephone line to public address equipment input.
- C. Equipment Rack: Comply with EIA-310-D. House amplifiers, control equipment and auxiliary equipment in standard EIA 19-inch (483-mm) racks.
1. Group items of same function together, either vertically or side by side, and arrange controls symmetrically.
 2. Power-Supply Connections: Approved plugs and receptacles.
 3. Arrange all inputs, outputs, interconnections, and test points so they are accessible at rear of rack for maintenance and testing, with each item removable from rack without disturbing other items or connections.
 4. Blank Panels: Cover empty space in equipment racks so entire front of rack is occupied by panels.
 5. Enclosure Panels: Ventilated rear and sides and solid top. Use louvers in panels to ensure adequate ventilation.
 6. Finish: Uniform, baked-enamel factory finish over rust-inhibiting primer.
 7. Power-Control Panel: On front of equipment housing, with a master power on/off switch and pilot light, and socket for a 5-A, indicating, cartridge fuse for rack equipment power.
 8. Vertical Plug Strip: Metal wireway with integral grounded receptacles, 12 inches (30 cm) o.c. the full height of rack, to supply rack-mounted equipment.
 9. Spare Capacity: [20] [____] percent spare space capacity in rack for future equipment.
- D. Cone-Type Loudspeakers: Comply with EIA SE-103.
1. Minimum Axial Sensitivity: EIA pressure rating of 45 dB.
 2. Frequency Response: Within plus or minus 3 dB from 50 to 15,000 Hz.
 3. Size: 8 inches (200 mm) with 1-inch (25-mm) voice coil and minimum 5-oz. (140-g) ceramic magnet.
 4. Minimum Dispersion Angle: 100 degrees.
 5. Rated Output Level: 10 W.
 6. Matching Transformer: Comply with EIA-160. Full-power rated with four EIA standard taps. Maximum insertion loss of 0.5 dB.
 7. Surface-Mounting Units: Ceiling, wall, or pendant mounting, as indicated on drawings, in steel back boxes, acoustically dampened. Front face of at least 0.0478-inch (1.2-mm) steel and whole assembly rust proofed and shop primed for field painting.
 8. Flush-Ceiling Mounting Units: In steel back boxes, acoustically dampened. Aluminum ceiling grille with baked, white-enamel finish.
- E. Horn-Type Loudspeakers: Comply with EIA SE-103.
1. Type: Single-horn units, double-reentrant design, with minimum full-range power rating of 15 W.
 2. Matching Transformer: Comply with EIA-160. Full-power rated with four EIA standard taps. Maximum insertion loss of 0.5 dB.
 3. Frequency Response: Within plus or minus 3 dB from 250 to 12,000 Hz.
 4. Dispersion Angle: 130 by 110 degrees.
 5. Mounting: Integral bracket.
 6. Units in Hazardous (Classified) Locations: Listed and labeled for the environment in which they are located.

NOTE TO SPECIFIER

Include paragraph below for CSF workrooms where ambient noise level varies greatly under different use conditions and manual level adjustment is impractical.

- F. Noise-Operated Gain Controller: Units continuously sense space noise level and automatically adjust signal level to local speakers.
1. Frequency Response: 20 to 20,000 Hz, plus or minus 1 dB.



2. Level Adjustment Range: 20 dB minimum.
 3. Maximum Distortion: 1 percent.
 4. Control: Permits adjustment of sensing level of device.
- G. Volume Attenuator Stations: Wall-plate-mounted autotransformer type with paging priority feature.
1. Wattage Rating: 10 W, unless otherwise indicated.
 2. Attenuation per Step: 3 dB, with positive off position.
 3. Insertion Loss: 0.4 dB maximum.
 4. Attenuation Bypass Relay: Single pole, double throw. Connected to operate and bypass attenuation when all-call, paging, program signal, or prerecorded message features are used. Relay returns to normal position at end of priority transmission.
 5. Label: "PA Volume."
- H. Cable and Conductors: Jacketed, twisted-pair and twisted-multipair, untinned, solid-copper conductors.
1. Insulation for Wire without Conduit: Thermoplastic, not less than 1/32 inch (0.8 mm) thick.
 2. Microphone Cables: Neoprene jacketed, not less than 2/64 inch (0.8 mm) thick over shield with filled interstices. Shield No. 34 AWG tinned, soft-copper strands formed into a braid or approved equivalent foil. Shielding coverage on conductors is not less than 60 percent.
 3. Plenum Cable: Listed and labeled for plenum installation.
- I. Special Requirements For Cable Routing And Installation
1. The majority of paging system wiring in this building will be installed above ceilings without conduit. All communications cabling used throughout this project shall comply with the requirements as outlined in the National Electric Code (NEC) article 725. All cabling shall bare CMP and/or appropriate markings for the environment in which they are installed.
 2. Sealing of openings between floors, through rated fire and smoke walls, existing or created by the contractor for cable pass through shall be the responsibility of the contractor. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of the contractor's work. Any openings created by or for this contractor and left unused shall also be sealed as part of this work.
 3. Cabling routed underground, exterior of the building, through inaccessible ceilings or less than 10'-0" A.F.F. in the workroom shall be contained in conduit. Provide flush boxes within finished areas and factory boxes in unfinished areas. Provide 3/4" conduit risers with 90 degree bend and bushing for all wall mounted devices.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. As specified in Section 260500 - Common Work Results for Electrical.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Verify that electrical connections are made correctly.
- C. Install exposed cables parallel and perpendicular to surfaces or exposed structural members, and follow surface contours. Secure and support cables by straps, staples, or similar fittings so designed and installed to avoid damage to cables. Secure cable at intervals not exceeding 30 inches (76 cm) and not more than 6 inches (15 cm) from cabinets, boxes, or fittings.



- D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess. Use lacing bars in cabinets.
- E. Control-Circuit Wiring: Install number and size of conductors as recommended by system manufacturer for control functions indicated.
- F. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Where exposed or in same enclosure, separate conductors at least 12 inches (30 cm) for speaker microphones and adjacent parallel power and voice wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.
- G. Splices, Taps, and Terminations: Make splices, taps, and terminations on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- H. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.
- I. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables to identify media in coordination with system wiring diagrams.
- J. Conductor Sizing: Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker outlets not smaller than number 14 AWG and conductors from microphone to amplifiers not smaller than number 20 AWG.
- K. Weatherproof Equipment: Install units that are mounted outdoors, in damp locations, or where exposed to weather consistent with requirements of weatherproof rating. Provide surge protection where required.
- L. Line Matching Transformer Connections: Make initial connections using tap settings indicated on Drawings.
- M. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- N. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.

3.3 FIELD QUALITY CONTROL

- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. Section 014000 - Quality Requirements: Field testing and inspection.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installations, including connections. Report results in writing.
- D. Operational Test: Perform tests that include originating program and page material at microphone outlets, preamplifier program inputs, and other inputs. Verify proper routing and volume levels and freedom from noise and distortion.
- E. Signal-to-Noise Ratio Test: Measure the ratio of signal to noise of complete system at normal gain settings, using the following procedure:
 - 1. Disconnect a microphone at the connector or jack closest to it and replace it in the circuit with a signal generator using a 1000-Hz signal. Replace all other microphones at corresponding connectors with dummy loads, each equal in impedance to microphone it replaces. Measure the ratio of signal to noise.
 - 2. Repeat test for each separately controlled zone of loudspeakers.



3. Minimum acceptance ratio is 50 dB.

- F. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 50, 200, 400, 1000, 3000, 8000, and 12,000 Hz into each preamplifier channel. For each frequency, measure the distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 3 percent total harmonics.
- G. Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use a sound-level meter with octave-band filters to measure level at five locations in each zone. For spaces with seated audiences, maximum permissible variation in level is plus or minus 2 dB. In addition, the levels between locations in the same zone and between locations in adjacent zones must not vary more than plus or minus 3 dB.
- H. Power Output Test: Measure electrical power output of each power amplifier at normal gain setting at 50, 1000, and 12,000 Hz. Maximum variation in power output at these frequencies must not exceed plus or minus 1 dB.
- I. Signal Ground Test: Measure and report ground resistance at public address equipment signal ground. Comply with testing requirements specified in Division 26.
- J. Retesting: Correct deficiencies, revising tap settings of speaker-line matching transformers where necessary to optimize volume and uniformity of sound levels, and retest. Prepare written record tests.
- K. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.
- L. Schedule tests with at least seven days advance notice of test performance.

3.4 ADJUST AND CLEAN

- A. Adjust equipment for proper operation.

3.5 PROTECTION

- A. Protect finishes until substantial completion.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train maintenance personnel to adjust, operate, and maintain equipment as specified below:
 - 1. Train maintenance personnel on programming equipment for starting up and shutting down, troubleshooting, servicing, and maintaining equipment.
 - 2. Review data in maintenance manuals. Refer to Section 017704 - Closeout Procedures and Training.
 - 3. Schedule training with Postal Service at least seven days in advance.

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END OF SECTION



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SECTION 27 51 17 00 - MPF VIDEO INTERCOM AND EXTERIOR GATE CONTROL SYSTEM

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SCOPE

- A. Provide an integrated audio and video intercom system complete with door and gate controls for the exterior motorized gates and employee entrances. Provide multiple master control units and video door stations as shown on the drawings.

1.2 SUMMARY

- A. Section Includes:
 1. Audio and video master control station.
 2. Central exchange unit.
 3. Video door stations.
- B. Related Sections:
 1. Section 260500 - Common Work Results for Electrical.
 2. Section 270500 - Common Work Results for Communications.
 3. Section 281304 - Enterprise Physical Access Control System.

1.3 REFERENCES

- A. Electronic Industries Association (EIA):
 1. ANSI/TIA/EIA-568-A - Commercial Building Wiring Standard.
- B. National Fire Protection Association (NFPA):
 1. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

- A. Procedures for submittals.
 1. Product data: For each type of equipment.
 2. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location of each field connection.
 3. Control equipment.
 4. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring. Identify terminals to facilitate installation,

MPF VIDEO INTERCOM AND EXTERIOR GATE CONTROL



operation, and maintenance. Include a single-line diagram showing cabling interconnection of components.

- B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- C. Maintenance Data: For equipment to include in maintenance manuals specified in Division 1.
- D. Assurance/Control Submittals:
 - 1. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - 2. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
- E. Procedures for closeout submittals.
 - 1. Operating and Maintenance Data: Operating and maintenance instructions, parts lists and wiring diagrams.
 - 2. Submit written special warranty with forms completed in United States Postal Service name and registered with manufacturer as specified in this Section.

1.5 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 - 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience and an authorized representative of equipment manufacturer for both installation and maintenance of equipment.
- B. Regulatory Requirements:
 - 1. Conform to requirements of NFPA 70 and UL 50.
 - 2. Products: Listed and classified by Underwriter's Laboratories Incorporated as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Aiphone Corp., Bellevue, WA (800) 692-0200.
 - 2. Atlas-Soundolier; Atapco Security & Communications Group.
 - 3. Bogen Communications, Incorporated.
 - 4. Dukane Corp.; Communications Systems Division.
 - 5. Executone Information Systems Incorporated.
 - 6. Rauland-Borg Corporation.
 - 7. Valcom, Incorporated, Roanoke, VA (540) 427-3900.
 - 8.



NOTE TO SPECIFIER

Delete paragraph below if Postal Service will contract separately for this service.

- B. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, video images and controls to meet occupancy conditions. Provide up to three on-site assistance visits within one year of Substantial Completion.

2.2 EQUIPMENT

- A. Coordinate features to form an integrated system. Match components and interconnections for optimum performance of specified functions.
- B. Equipment: Modular type, using solid-state components, fully rated for continuous duty, unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.
- C. Waterproof Equipment: Listed and labeled for duty outdoors or in damp locations.

2.3 AUDIO VIDEO MASTER CONTROL STATION(S)

- A. Master station(s) shall initiate and answer calls from up to (7) additional master units and up to (8) door substations. Master station(s) shall be expandable in increments of (16) channels, shall be wall or desk mounted and shall have the following features:
 1. 3.5 inch TFT color video monitor
 2. 8 master station channels
 3. 8 door / sub station channels
 4. LED and call tone annunciation for programmable length or infinite call-in
 5. Hands-free VOX communication or Push-to-Talk
 6. All call to other master stations
 7. Selective calling to any station in the system
 8. Add-on selectors in increments of 16 channels for max. capacity of 120 door / sub stations (CEU capacity also required)
 9. Privacy prevents other masters from listening in
 10. CO transfer allows calls to transfer to a telephone number (Viking K-1900-5 dialer required).
 11. Scan Monitor allows listening to door / sub stations in programmed time increments
 12. Door release button activates door strike or magnetic lock (selectable N/O or N/C contacts from CEU)
 13. 3.5mm speaker and mic jacks for computer-style headset or handset connection
 14. Tone and volume adjustments for open voice and headset communication
 15. Brightness and contrast adjustments for video
 16. Option connector for video output, call extension, or footswitch operation of TALK function
- B. Operation: When a video door station calls, a tremolo tone rings and the 3.5 inch color monitor comes on, displaying the image from the door station location. To answer the call, simply press the TALK button once and speak hands-free, or Press and Hold the TALK button to use as push-to-talk, release-to-listen. If access control is included, simply press the "key" button and the associated electric strike or magnetic lock will be activated.
- C. Wiring: Each master station shall be connected via CAT-5e cable homerun to the Central Exchange Unit. Feature and operation variables are set with the system set-up software and uploaded to the CEU.
- D. Basis of Design: Aiphone #AX-8MV.



2.4 CENTRAL EXCHANGE UNIT (CEU)

- A. The central exchange unit shall support a minimum of (8) master stations and up to (24) door / sub stations. Unit shall be expandable and shall have the following features:
 - 1. Wiring hub for system using CAT-5e cable
 - 2. Controls all functionality of AX system
 - 3. 8 Master station ports (RJ45)
 - 4. 24 Door / sub station ports (RJ45)
 - 5. 2 24V DC power supply input terminals
 - 6. 24 Door release dry contacts (24V AC/DC 500mA)
 - 7. 2 BNC composite video outputs and video switching triggers
 - 8. Outputs for add-on exchanges to support the maximum capacity of 120 doors
 - 9. CO line transfer output to Viking K-1900-5 programmable auto-dialer
 - 10. Programmable functionality via supplied software
 - 11. USB to serial adaptor and gender changer, software program and Installation and Operation Manual on CD, and QuikStart Guide
- B. Operation: The CEU handles the calling and communication signals for the system, as well as providing selective door release outputs, video outputs, DVR trigger outputs and CO line transfer output. System set-up and a variety of functions are programmed in the CEU with the use of the supplied software. Power is applied directly to the CEU via two PS-2420UL power supplies. The serial connection is for uploading the system programming, for raw RS232 data output, or for system monitoring via supplied program.
- C. Mounting: The unit shall be surface mounted to a wall, desk mounted, or mounted in a standard 19 inch EIA rack.
- D. Wiring: The audio/video master units and door stations shall be connected to the CEU via homerun CAT-5e wiring and RJ45 jacks.
- E. Basis of Design: Aiphone #AX-048C with Viking K-1900-5 dialer.
- F. Battery Backup: The CEU shall be provided with 30 minute, UPS battery reserve power. Provide 1500 Watt at 120Volt stand alone UPS unit.

2.5 AUDIO/VIDEO DOOR STATIONS

- A. The remote audio/video door stations shall include a color camera, microphone, speaker and call button with the following features:
 - 1. Color video camera with audio intercom
 - 2. 2-way hands-free voice communication with master station
 - 3. Call button to initiate call to master(s)
 - 4. White LED illuminator for low light conditions
 - 5. RJ45 jack for CAT-5e connection
 - 6. 980 ft. wiring distance from CEU using CAT-5e cable
- B. Operation: When the call button on the door station is pushed, the master station(s) ring and the video monitor comes on with the image from the door station's camera. The master station user then pushes the "TALK" button to initiate communication. The person at the door station speaks hands-free.
- C. Wiring: Each door station shall be connected to the CEU via CAT-5e cable. Door stations located more than 980 ft. from CEU shall be connected using fiber cabling.
- D. Basis of Design: Aiphone #AX-DV (surface mounted); Aiphone #AX-DVF (flush mounted).



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- B. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- C. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Verify that electrical connections are made correctly.
- C. Install exposed conduits and cables parallel and perpendicular to surfaces or exposed structural members, and follow surface contours. Secure and support cables by straps, staples, or similar fittings so designed and installed to avoid damage to cables. Secure cable at intervals not exceeding 30 inches (76 cm) and not more than 6 inches (15 cm) from cabinets, boxes, or fittings.
- D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess. Use lacing bars in cabinets.
- E. Control-Circuit Wiring: Install number and size of conductors as recommended by system manufacturer for control functions indicated.
- F. Identification of Conductors and Cables: Apply wire and cable marking tape to designate wires and cables to identify media in coordination with system wiring diagrams.
- G. Weatherproof Equipment: Install units that are mounted outdoors, in damp locations, or where exposed to weather consistent with requirements of weatherproof rating. Provide surge protection where required.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installations, including connections. Report results in writing.
- B. Operational Test: Verify proper routing and volume levels and freedom from noise and distortion.
- C. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
- D. Schedule tests with at least seven days advance notice of test performance.



3.4 ADJUST AND CLEAN

- A. Adjust equipment for proper operation.

3.5 PROTECTION

- A. Protect finishes until substantial completion.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train maintenance personnel to adjust, operate, and maintain equipment as specified below:
 - 1. Train maintenance personnel on programming equipment for starting up and shutting down, troubleshooting, servicing, and maintaining equipment.
 - 2. Review data in maintenance manuals.
 - 3. Schedule training with Postal Service at least seven days in advance.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 6/17/2013

END OF SECTION 27 51 17 00



Task	Specification	Specification Description
27 51 17 00	27 51 16 00	MPF PUBLIC ADDRESS AND PAGING SYSTEMS
27 51 17 00	27 51 16 00	CSF PUBLIC ADDRESS PAGING SYSTEMS



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SECTION 27 51 23 00 - CSF INTERCOMMUNICATION AND PROGRAM SYSTEMS

NOTE TO SPECIFIER

Use this Outline Specification Section for larger Customer Service Facilities requiring a paging system. This Specification defines "level of quality" for Customer Service Facility construction and is intended as a guide to the Architect/Engineer preparing the Construction Documents.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.27 51 23 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Doorbell call system.
 - 2. Assistance Buzzer.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 260500 - Common Work Results for Electrical.

1.2 REFERENCES

- A. As specified in Section 260500 – Common Work Results for Electrical.

1.3 SUBMITTALS

- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Project Record Documents: Accurately record the following:
 - a. Location and size of actual service entrance conduit.
 - b. Actual locations and sizes of pathways and outlets.

1.4 QUALITY ASSURANCE

- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.



2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

C. Regulatory Requirements:

1. Conform to requirements of NFPA 70.
2. Products: Listed and classified by Underwriter's Laboratories Incorporated as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with Project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. Broan – Nutone, LLC. Hartford WI (800) 558-1711
 2. Carlon/Thomas & Betts, Cleveland OH (216) 464-3400
 3. Edwards Signaling and Security Systems, Plainville, CT (800) 336-4206.
 4. EZ Tone, Hermitage TN (800) 366-7235
 5. Federal Signal Corp., University Park, IL (800) 548-7229.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 DOORBELL CALL SYSTEM

- A. Description: Residential two tone chime type doorbell, pushbuttons, power transformer, conduits, chimes, and wiring as required for complete system.
- B. Materials:
 1. System with pushbutton, power transformer, conduits, and wiring as required for complete system.
 2. Provide chimes with audibly different and distinct sound from sound made by assistance buzzer.
 3. Color/finishes of pushbutton and faceplate to match other electrical devices.
- C. Transformer: 12 volts AC rated.
- D. Location:
 1. Wicket Door (set to two tone chime).
 2. Personnel Door (set to single chime).
 3. BMEU.

2.3 ASSISTANCE BUZZER

- A. Description: Commercial buzzer type doorbell, pushbuttons, power transformer, conduits, buzzer, and wiring as required for complete system.
- B. Materials:



1. System with pushbutton , power transformer, conduits, and wiring.
 2. Provide buzzer with audibly different and distinct sound from sound made by doorbell chimes.
 3. Color/finishes of pushbutton and faceplate to match other electrical devices.
- C. Transformer: 12 volts AC rated.
- D. Location:
1. IRT (one button) with buzzer near lunchroom.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. As specified in Section 260500 - Common Work Results for Electrical.

3.2 INSTALLATION

- A. Install system transformer at outlet box at accessible location.
- B. Install low voltage wiring in conduit.
- C. Flush mount wall outlets at 48 inches above finish floor unless otherwise noted on Drawings.

USPS CSF Specifications issued: 10/1/2013
Last revised: 5/23/2011

END OF SECTION



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Task	Specification	Specification Description
27 51 33 00	26 33 43 00a	Public Address and Mass Notification Systems



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SECTION 27 53 13 00 - MPF WIRELESS, SYNCHRONIZED, GPS CLOCK SYSTEM

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification.

PART 1 - GENERAL

1.1 SUMMARY

- A. General Requirements and Scope: Furnish and install a complete new wireless, synchronized, GPS clock system, including equipment, accessories and materials in accordance with these specifications and drawings.
- B. This section addresses the needs and requirements of the wireless clock system, It includes requirements for the wireless clock system components including, but not limited to, the following:
 - 1. Master Clock with Wireless Transceiver
 - 2. Wireless Repeater
 - 3. Secondary Wireless Analog Clock
- C. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- D. Related Sections:
 - 1. Section 260500 - Common Work Results for Electrical.

1.2 REFERENCES

- A. As specified in Section 260500 - Common Work Results for Electrical.

1.3 SUBMITTALS

- A. As specified in Section 260500 - Common Work Results for Electrical.
- B. General: Submit the following in accordance with Conditions of Contract Sections:
 - 1. Submit equipment prints, full electronic wiring diagrams and specifications sheets for each item specified herein. Provide a tabulation of the specification clearly comparing the submitted item with the specified item, being able to refer to all written expressed functions and capabilities. Specification sheets shall be submitted on all items.
 - a. Shop drawings detailing wireless clock
 - 2. Wiring diagrams, detailing wiring for power, signal, and control.
 - 3. Submit wiring diagrams showing typical connections for all equipment.
 - 4. Submit a certificate of completion of installation and service training.



1.4 QUALITY ASSURANCE

- A. As specified in Section 260500 - Common Work Results for Electrical.
- B. All items of equipment shall be designed by the manufacturer to function as a complete system and shall be accompanied by the manufacturer's complete service notes and drawings detailing all interconnections.
- C. The contractor shall be an established communications and electronics contractor that has had and currently maintains a locally run and operated business for at least five (5) years. The contractor shall utilize a duly authorized distributor of the equipment supplied for this project location with full manufacturer's warranty privileges.
- D. The contractor shall show satisfactory evidence, upon request, that the supplier maintains a fully equipped service organization capable of furnishing adequate inspection and service to the system. The supplier shall maintain at his facility the necessary spare parts in the proper proportion as recommended by the manufacturer to maintain and service the equipment being supplied.
- E. Electrical Component Standard: Provide work complying with applicable requirements of NFPA 70 "National Electrical Code" including, but not limited to:
 - 1. Article 250, Grounding.
 - 2. Article 300, Part A. Wiring Method.
 - 3. Article 310, Conductors for General Wiring.
 - 4. Article 725, Remote Control, Signaling Circuits.
 - 5. Article 800, Communication Systems.
- F. Installation and start up of all systems shall be under the direct supervision of a local agency regularly engaged in installation, repair, and maintenance of such systems. The supplier shall be accredited by the proposed equipment manufacturers.
- G. The agency providing equipment shall be responsible for providing all specified equipment and mentioned services for all equipment as specified herein. The agency must be a local authorized distributor of all specified equipment for single source of responsibility and shall provide documents proving such. The agency must provide written proof that the agency is adequately staffed with factory-trained technicians for all of the specified equipment. The agency must have established business for and currently be providing all services for the equipment.
- H. The contractor shall guarantee availability of local service by factory-trained personnel of all specified equipment from an authorized distributor of all equipment specified under this section. Maintenance shall be provided at no cost to the purchaser for a period of one (1) year (parts and labor) from date of acceptance unless damage or failure is caused by misuse, abuse, neglect, or accident. Additionally, all manufacturer supplied products must be covered by three (3) year (parts only) limited warranty from the date of acceptance. The warranty period shall begin on the date of purchase by the Owner/engineer.
- I. The contractor shall, at the Owner's request, make available a service contract offering continuing factory authorized service of the system after the initial warranty period.
- J. The contractor is responsible for all cost associated with proper installation, termination, configuration, programming, impedance and load matching of all system components.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in factory boxes. Store in clean, dry space in original boxes. Protect products from fumes and construction traffic. Handle carefully to avoid damage.



1.6 IN-SERVICE TRAINING

- A. The contractor shall provide training with this system. These sessions shall be broken into segments that will facilitate the training of individuals in the operation of this system. Operators Manuals and Users Guides shall be provided at the time of this training.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Sapling, Inc., Huntingdon, PA (215) 322-6063.
 2. Primex Wireless, Inc., Lake Geneva, WI (800) 537-0464.
 3. Substitutions permitted with approval from Contracting Officer.

- B. The "Basis of Design" manufacturer shall be:

Sapling, Inc.
 1633 Republic Road
 Huntingdon Valley, PA 19006
 Phone: 215.322.6063
 Fax: 215.322.8498
 Web: www.Sapling-Inc.com

- C. The intent of this specification is to establish a standard of quality, function and features. It is the responsibility of the contractor to insure that the proposed product meets or exceeds every standard set forth in these specifications.
- D. The functions and features specified are vital to the operation of this facility, therefore, the acceptance of alternate manufacturers does not release the contractor from strict compliance with the requirements of this specification.
- E. The contractor shall be responsible for providing a complete functional system including all necessary components whether included in this specification or not.
- F. Any approval of an alternate system does not automatically exempt the supplier from the intent of these specifications. Failure to comply with the operational and functional intent of these specifications may result in the total removal of the alternate system at the expense of the contractor.

2.2 SYSTEM REQUIREMENTS

- A. Wireless analog and/or digital clock system with interface capability to GPS, network, internet and existing systems such as: 58 minute, 59 minute, National Time & Rauland sync-wire, once a day reset, 2-wire digital communication and RS485 communication.



2.3 SYSTEM

- A. The system shall function as a stand alone system or in conjunction with an existing wired system and the system shall have interface capability to GPS, network, Internet and existing systems such as: 58 minute, 59 minute, National Time & Rauland sync-wire, once a day reset, 2-wire digital communication and RS485 communication.
- B. The system shall be capable of working in 915-928 MHz frequency-hopping technology. The system shall be capable of automatic transmission of data along 51 alternating frequencies that allows for an enhanced signal, even if there is interference in one of the frequencies.
 - 1. Contractor shall obtain a federal assignment for the transmit frequency that is to be utilized by the clock system. Frequency clearance shall be requested through Raleigh IT Service Center.
- C. Each secondary clock in the system shall be capable of receiving and transmitting the wireless signal which allows it to be used as a repeater while boosting the data stream and sending along the system. With this dual capability there shall be no limit on the number of clocks that can be used in the installation. The clocks shall be designed to automatically work together without interference with each other. The system shall be capable of increasing the quality of the signal while increasing the quantity of the clocks.
- D. The secondary analog clocks shall have the following option:
 - 1. Two (2) D cell batteries; the clock receives and transmits time every two (2) or four (4) hours, as selected by the user.
- E. The analog secondary clocks shall include automatic digital calibration for time base to minimize deviation from each other.
- F. The analog secondary clocks shall have a built-in close-loop system that will allow the clock to detect the position of the hands and bring the clock to the correct time even if the clock were manually or forcefully altered.
- G. The analog secondary clocks shall have the capability for diagnostic function that will allow the user to view the quality of the signal, how long since the last time the clock received a signal, as well as functional tests of the electronics and the gears.
- H. The system shall operate in a license-free frequency range where no license is required.

2.4 FCC APPROVAL

- A. This equipment shall be tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a commercial installation. This equipment shall not cause harmful interference to radio or television communications.

2.5 PRODUCTS

- A. SMA 2000 Master Clock/Transceiver/Transmitter: The Master Clock / Transmitter shall be the Sapling SMA 2000 Series. The master clock shall have a LED display and two push switches. The transmitter shall be capable of transmitting data to the SAL wireless analog clock. The master clock shall be capable of receiving a signal from any SNTP time server via the Internet. The master clock shall have up to ten pre-programmed SNTP servers to use in case the clock does not receive time from one of the servers via a web interface. The transmitter will be capable of receiving signals from all Sapling Master Clocks via RS485, as well as 59 minute correction, 58 minute correction, National Time and Rauland, and Dukane. The transmitter shall have the capability of transferring a wired system into a wireless



system. The transmitter shall contain two clock circuits that have the capability to run synchronous wire systems such as 59 minute correction, 58 minute correction, National Time/Rauland or a once a day pulse for intercom systems. The transmitter shall be capable of acting as a repeater while receiving a signal wired or wirelessly from the main transmitter. The master clock shall be programmed via the two push switches on the front panel. The transmitter shall be capable of interfacing with the wired analog clocks via the Converter Box. The transmitter shall utilize 915–928 MHz frequency–hopping technology. The master clock shall be powered by 110VAC/60 Hz or 220VAC/50 Hz.

1. SMA 2000 options
 - a. GPS – The master clock shall have the option of having a GPS receiver built into the unit for synchronization from the satellites via UTC.
 - b. Web Interface – The master clock shall be able to be programmed completely from a web interface that can be accessed through any typical web browser such as Microsoft Internet Explorer or Mozilla FireFox. The interface shall allow the user to program all display features, IP settings of the master clock and any system setting that the master clock has.
 - c. SNTP Server – The master clock shall have the capability to act as a SNTP server that other devices can point to in order to receive the time through SNTP protocol.
- B. SMA 1000 Wireless Repeater: The repeater shall be a Sapling Wireless Repeater. The repeater shall wirelessly transmit and receive data. The repeater shall be capable of transmitting to the wireless analog clocks. The repeater shall work on 915–928 MHz frequency–hopping technology. The repeater shall wirelessly transmit and receive data. The repeater is to have a maximum antenna size of seven (7) inches. The repeater shall have an RF input sensitivity of –103 dbm. The repeater is to have a RF power output of 27 dbm. The voltage input for the repeater shall be 110 volts/60 Hz or 220 volts/50 Hz.
- C. Analog Secondary Clock: The secondary clock shall be Sapling SAL-2 Series, 12 or 15 inch diameter, wireless type. The clock will be capable of receiving a signal from multiple clocks. The clock shall receive and transmit with 915–928 MHz frequency–hopping technology. The clock is to be capable of transmitting the time simultaneously without interfering with each other. The clocks shall include automatic calibration, as well as a diagnostic function that allows the user to view the quality of the signal, the last time the clock received a correction signal, a gearbox test and a comprehensive analysis of the entire clock. The clock shall have a maximum correction time of five (5) minutes. The clock shall be capable of receiving a signal every 2 or 4 hours. It shall be designed to be used with the Sapling SMA Series Master Clock (with transmitter option) or the Sapling Repeater, which can be regulated via Sapling wireless communication protocol. Upon receipt of the wireless signal, the clock will immediately self–correct. The clock shall have a semi–flush smooth surface ABS case. The dial is to be made of durable polystyrene material. The crystal is to be shatterproof, side molded polycarbonate. Glass and visible molding marks are unacceptable. The clock shall have black hour and minute hands as well as a red second hand. The clock shall be FCC compliant, part 15 Section 15, 247.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. As specified in Section 260500 - Common Work Results for Electrical.
- B. Examine conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the wireless clock system.
- C. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General:



1. Install system in accordance with applicable codes. Install equipment in accordance with manufacturer's written instructions.
2. Upon installation completion, a room-by-room test shall be conducted for every device in the system. A technician shall perform the test after school hours, and repairs shall be performed as needed at no cost to the Owner to any devices, which do not function correctly, including cable. A written room-by-room report following testing and repairs shall be prepared and submitted to the Engineer.

3.3 FIELD QUALITY CONTROL

- A. As specified in Section 260500 - Common Work Results for Electrical.
- B. Provide services of a service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.
- C. Make observations to verify that units and controls are properly labeled.
- D. Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at the Contractor's expense. Verify by the system test that the total system meets the specifications and complies with applicable standards.

3.4 TRAINING

- A. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventative maintenance of the system. Operators Manuals and Users Guides shall be provided at the time of this training.
- B. Schedule training with Owner through the Architect, with at least seven (7) days advance notice.

3.5 CLEANING AND PROTECTION

- A. Prior to final acceptance, clean system components and protect from damage and deterioration.

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END OF SECTION 27 53 13 00



Task	Specification	Specification Description
28 05 13 16	26 05 13 00	Undercarpet Cables
28 05 13 16	26 05 19 16	Control-Voltage Electrical Power Cables
28 05 13 19	26 05 13 00	Undercarpet Cables
28 05 13 19	26 05 19 16	Control-Voltage Electrical Power Cables
28 05 13 23	26 05 13 00	Undercarpet Cables
28 05 13 23	26 05 19 16	Control-Voltage Electrical Power Cables



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SECTION 28 13 04 00 - MPF ENTERPRISE PHYSICAL ACCESS CONTROL SYSTEM**

NOTE TO SPECIFIER

Use this Specification section where a Enterprise Physical Access Control System (ePACS) is part of the Work. Verify ePACS requirements with USPS Contracting Officer and Inspection Services.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes specifications for an integrated security management system which shall perform the following general service
 - 1. Access control.
 - 2. Alarm monitoring.
 - 3. Reporting functions.
 - 4. Security management functions.
 - 5. Photo-ID badge issuing.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 081100 – Metal Doors and Frames.
 - 2. Section 087100 – Door Hardware.
 - 3. Section 111415 – Turnstiles.
 - 4. Section 260500 – Common Work Results for Electrical.
 - 5. Section 270500 – Common Work Results for Communications.
 - 6. Section 275117 – Video Intercom and Exterior Gate Control System.
 - 7. Section 282305 – Integrated Security and Investigative Platform (ISIP) CCTV System.
 - 8. Section 283100 – Fire Detection and Alarm.

1.2 SYSTEM DESCRIPTION

- A. Enterprise Physical Access Control System:
 - 1. Access management system (System) shall monitor and control access to areas defined herein.
 - 2. The system will utilize proximity cards as its primary access device, but will support ISO 14443 Contactless smartcard technology, such as Mifare, and (keypad) technology at each door. It shall also support alarm inputs and control out puts.
 - 3. System shall consist of computers (servers/workstations), stand-alone microprocessor based controllers, card readers and/or Keypads and host software.



4. The microprocessor based controllers (FP) will be capable of controlling 16 card reader inputs and 16 door outputs. It will also be able to monitor a minimum of 92 alarm points, storing a minimum of 5000 events before down loading to the central computer. It will be able to store a minimum of 10,000 cardholders
5. System shall be capable of operating in a distributed processing environment with or without host connectivity.
6. Specific types of devices and their functions shall be addressed in relevant sections.
7. The system shall support an integrated electronic photo identification (photo-ID) system.
8. System will utilize an ODBC compliant database, such that it can share or retrieve information from a local database.
9. System shall be able to compare its list with the information from the USPS database and flag discrepancies of listed individuals in either database and have the ability to generate a report listing the discrepancies and records.
10. System will share its database with the electronic photo-ID system to eliminate redundant input of data to the databases for common data fields.
11. The operating system shall be USPS Windows applicable version (ACE standard operating system).
12. The system shall support true multi-user, multi-tasking with a minimum of 3 workstations.
13. The system shall include capability for remote access for off-site support and/or management workstations. Systems that connect to the network must provide remote access via the Postal Service business partner VPN connectivity. Dial-up phone connectivity is not permitted when systems are connected to the network.
14. The system shall utilize standard GUI interface allowing day-to-day operations to be performed using a standard mouse. All graphics shall be dynamic color alarm graphic maps (user definable) created with graphic drawing programs, not vector files. All device names shall be user programmable (minimum of 32 characters, full English).
15. The complete operator instruction manual shall be imbedded in the on-line help and shall be readily accessible using standard "Index," "Help Topics," "Keyword" and "Search" requests.
16. The client shall have the ability to define events for viewing in any one of multiple event viewer screens or any combination of screens. Events shall also be designated for printing to selectable printers.
17. Provide multiple levels of password protected system access with encryption. All passwords will use one-way encryption.
18. Provide operator with configurable reporting of event history and cardholder activity by authorized request only.
19. Provide reports for: Inputs (all or in groups), outputs (all or in groups), alarm messages, instructions, event action, card transaction history, field devices and panel reports, alarm history, alarm suppression.
20. Report generation shall allow for reports to be filtered by time and date as well as by device name, event category and definition and by card holder categories or individual record(s).
21. It will monitor all emergency egress doors and interface the alarms from these doors with the CCTV system.

B. Description of work:

1. The Systems Integrator shall include all necessary labor, tools, equipment, and ancillary materials required to furnish and install a complete and operational access control and alarm monitoring system.

NOTE TO SPECIFIER

Review the following lists with the Contracting Officer and Inspection Services. Note that coded keypads shall only be utilized upon approved exception by USPS. Modify Accordingly.



2. Enterprise Physical Access Control System will manage access to the following [building] [and] [selected areas] using [encoded cards.] [and/or] [coded Keypads.]
 - a. employee entrances/exits
 - b. access to administrative space
 - c. Registry Cage
 - d. Stamp Depository
 - e. Vehicular access (employee and USPS maneuvering area).
3. The extent of Enterprise Physical Access Control System work is defined to include, but not by way of limitation:
 - a. ePACS Controller.
 - b. Reader Interface Modules.
 - c. Card reading sensors.
 - d. Cards: Not In Contract, provided by local USPS facility. Contact USPS via email at PACS-SUPPORT@usps.gov for assistance in procuring cards.
 - e. ACE Standard Server/Workstations & software: Not In Contract, provided by USPS.
 - f. Photo-ID badge issuing software. Not In Contract, provided by local USPS facility. Contact USPS via email at PACS-SUPPORT@usps.gov for installation of software.
 - g. Photo-ID badge printer. Not In Contract, provided by local USPS facility. Contact USPS via email at PACS-SUPPORT@usps.gov for assistance in procuring printer.
 - h. Digital badge camera, backdrop, consumables and peripherals. Not In Contract, provided by local USPS facility. Contact USPS via email at PACS-SUPPORT@usps.gov for assistance in purchase.
 - i. Input monitoring modules.
 - j. Output relay modules.
 - k. Wiring, power supplies, switches and ancillary equipment.
4. Requirements are indicated elsewhere in these specifications for work including, but not limited to, raceways and electrical boxes and fittings required for installation of control equipment and wiring, not the work of this section.

1.3 REFERENCES

- A. NEC: All electrical wiring work shall comply with the latest edition of the NEC.
- B. NEMA: Electrical equipment shall comply with applicable portions of NEMA.
- C. FCC: All assemblies shall be in compliance with FCC emission standards.
 1. Proximity/Contactless Smartcard Card Reading Sensors: Part 15, Subpart F (field disturbance sensors).
 2. Dial-up modems: Part 68.
- D. UL-1012 and CSA: All power supplies shall be in compliance with Underwriters Laboratories standard 1012 and CSA standards for power supplies.
 1. UL-294: The system shall comply with Underwriters Laboratories standard 294 for Enterprise Physical Access Control Systems.

1.4 SUBMITTALS

- A. Product Data: Submit for prior approval, six (6) copies of manufacturer's data on Enterprise Physical Access Control System and components, including manufacturer's model numbers, catalog data sheets, power requirements, dimensions, layouts, installation details, single line riser diagram.
- B. Shop Drawings: Submit dimensioned drawings of Enterprise Physical Access Control System and accessories including: FP, proximity card reading sensors, keypads, power supplies, switches and ancillary equipment, photo-ID equipment including but not limited to card printer, digital camera,

MPF ENTERPRISE PHYSICAL ACCESS CONTROL
SYSTEM**



backdrop and light. Submit separate layout drawings of each equipment rack, control panel, interpanel and intrapanel wiring, power supplies, terminal strips, including labeling of all components, point-to-point wiring, and calculations for UPS power. Provide 1/8 inch scale floor plans showing locations of all devices.

- C. Security Riser Diagram: Shall detail the number and location of controllers, reader interface modules, power supplies, indicate all cabling and wiring, host equipment. Riser diagrams shall be submitted to the Contracting Officer for review and concurrence prior to execution.
- D. Operator's Manual: Submit for prior approval, six (6) copies of manufacturer's manual for programming and operating the system and its related components.
- E. Submit evidence of training from the manufacturer of the system proposed for installation. Evidence shall include written certificates of training or similar documentation on manufacturer's letterhead demonstrating the installer's qualifications.

1.5 QUALITY ASSURANCE

- A. Manufacturer: Manufacturer of products defined in this section must have:
 - 1. Industry experience: Company must have at least five (5) years experience in manufacturing and servicing integrated access control and alarm monitoring systems.
- B. Systems Integrator:
 - 1. Company with a minimum of five (5) years system design, engineering supervision, and installation experience in the alarm, building automation, or Access Control industry.
 - 2. The Integrator shall obtain a Sensitive Clearance from the USPS. This clearance will be coordinated by the Contracting Officer representative. Use the following email for assistance in obtaining this clearance: PACS-SUPPORT@usps.gov
 - a. An interim clearance will be issued to allow the Integrator to request an ACE logon from the Contracting Officer.
 - b. It will take a minimum of two weeks to obtain an interim clearance.
 - 3. Company that is trained and authorized to install manufacturer products.
 - 4. Company that has been successfully installing systems of equal size and complexity for a minimum of five (5) years. Submit a minimum of three (3) references. System references shall include projects where software and hardware installed is similar to the software and hardware proposed for this project.
 - 5. The systems integrator shall include all necessary labor, tools, equipment, and ancillary materials required to furnish and install a complete and operational access control and alarm monitoring system.
 - 6. The extent of Enterprise Physical Access Control System work is defined to include, but not be limited to:
 - a. Installation of and testing of system including: controllers, reader interface modules, proximity/contactless smartcard card readers, keypads, input modules and output modules, software and photo-ID badge issuing system equipment.
 - b. Wiring, power supplies, switches and ancillary equipment.
 - c. Programming of system, including creation/translation of database with USPS input, and access levels.
 - d. Operator Training for using and programming the system for up to six (6) operators and two (2) shift supervisors, provide in two (2) sessions of eight (8) hours each. Provide two (2) additional eight (8) hour training sessions three (3) months after acceptance. Provide separate training for photo-ID badge production operators.
 - e. Submitting procedures for installing system on USPS networks and performing cut-over and acceptance testing on the system. Coordinate procedures with USPS Information Technology to ensure no interference with USPS network or systems.



- f. Provide two (2) eight (8) hour maintenance training sessions.

C. System Checkout:

1. Burn-in: 1,000 hours at normal operating conditions or equivalency.
2. On-site testing: Manufacturer trained and authorized Systems Integrator shall functionally test each component in the system after installation to verify proper operation and confirm that the panel wiring and addressing conform to the wiring documentation.
3. Service facility: Systems Integrator shall have service facilities within 4 hours travel time of the installation. Any increase in this time shall be approved by the Contracting Officer.

1.6 WARRANTY

A. System Components: twelve (12) months from date of acceptance.

1. Systems Integrator shall provide twenty-four (24) hour emergency service for all reported system operational failures during such twelve (12) month warranty period. The system must be fully operational within forty-eight (48) hours. Include all necessary maintenance for the entire integrated system for the twelve (12) month warranty period. On-site service response shall be within four (4) hours of the initial request for service and shall be provided twenty-four (24) hours a day, seven (7) days a week inclusive of all holidays.
2. Service requests shall be reported via phone call to a designated service toll free phone number provided by the Systems Integrator.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project. Review and confirm system requirements with USPS Inspection Services. Modify following paragraphs accordingly. Vanderbilt Industries has been selected by the USPS as the sole source provider for the system controller. Revisions to or substitutions for the controller are not permitted. All other ePACS peripheral components can be provided by any of the manufacturers listed below.

2.1 MANUFACTURERS

A. Enterprise Physical Access Control System Controller:

1. Contract transfer to Vanderbilt Industries (sole source provider for controller).
 - a. Contact the following;
 - 1) G. Patrick Shadood, USPS Account Manager, 2 Cranberry Road, Parsippany NJ 07054, office 973-316-3910 ; mobile 908-432-8806; fax 973-334-4850; PatrickShadood@vanderbiltindustries.com
 - 2) THE CONTRACTOR IS REQUIRED TO INFORM THE MANUFACTURER THAT THE CONTROLLER IS FOR A U.S. POSTAL SERVICE PROJECT.
2. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Not Permitted.

B. All other Enterprise Physical Access Control System peripheral components:

1. Subject to compliance with project requirements, manufacturer offering Products which may be incorporated in the Work, including the following:
 - a. GE Security (800)428-2733.
 - b. HID Corporation (800) 721-7336
 - c. Hirsch Electronics Corporation, Irvine, CA (714) 250-8888.
 - d. Honeywell Security (800)323-4576.



- e. Vanderbilt Industries: contact G. Patrick Shadood; Office - (973) 316-3910; Mobile – (908) 432-8806.
- f. Lenel Systems International (716) 248-9720.
- g. Software House (800)550-6660.
- h. XceedID Corporation (877) 671-7011.
- 2. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS AND COMPONENTS

- A. Enterprise Physical Access Control System Controller:
 - 1. The Enterprise Physical Access Control System shall include a microprocessor based controller by Vanderbilt Industries.
 - 2. The contractor is required to inform the manufacturer that the controller is for a U.S. Postal Service project.
 - 3. The controller shall be ordered in a metal enclosure for wall mounting and include integrated battery back up.
- B. Field Panel: provide complete hardware to operate with the following features:
 - 1. The field panel shall support a minimum of sixteen (16) card reading sensors and shall be capable of supporting additional input and output modules
 - 2. Database: Database shall store all user operating data and handle event reporting for all possible attached devices, and shall contain memory capacity for the following:
 - a. Minimum of 10,000 card holder records.
 - 3. Event activity: System shall designate activity as an alarm or non-alarm condition, dependent upon modules installed, and shall report activity for:
 - a. Supervised monitor points: ninety-two (92) minimum.
 - b. Outputs: forty-six (46) minimum.
 - 4. Relay outputs: System shall initiate relay output commands based on:
 - a. Card Access Activity.
 - b. Operator Keyboard Inputs.
 - c. Pre-programmed Time Periods.
 - d. Input activation.
 - 5. System diagnostics:
 - a. Automatic system diagnostics and automatic alarming based on detected faults in the field panel, card readers, wiring, and expansion modules. At a minimum, diagnostics shall include faults, card reader errors, input change of state, expansion module faults, host communications, power monitoring and reader communications errors. If a problem is detected, it shall be reported to the host (when communications is restored).
 - b. Each time the field panel is powered, the panel shall go through an automatic diagnostic cycle. If a problem is detected, it shall be reported to the host. Diagnostics cycle shall include indications for fault, reader error, card swipe, monitor point change of state, host communication, card reader communication, program watchdog and power.
 - 6. Transaction buffer: 5,000 transactions, minimum.
 - 7. Flash memory for real time program updates from the host and/or locally connected computer.
 - 8. Communication: Primary communications shall support TCP/IP protocols for Ethernet using the USPS structured wiring system via an on-board Ethernet port. In addition, the field panel shall have an on-board RS-232 port for local connection and emergency dial-up communications.
 - 9. Tamper Switch: enclosure shall include a SPDT tamper switch wired at the factory.
 - 10. UL-294 rated.
 - 11. Power:



- a. The field panel shall operate on 12 - 24VDC, powered from an external, regulated power supply with battery backup. The field panel shall provide necessary power to all card readers and expansion modules.
 - b. Memory Retention: The field panel shall maintain configuration and card holder information for up to seventy-two (72) hours when operating power is disconnected from the field panel.
- C. Card Reading Sensor:
 - 1. General:
 - a. Reader (CR) shall read both proximity card and contactless smartcard and send signal to Controller for processing. The CR shall be compatible with:
 - 1) 125 KHz proximity, such as HID Corp 1000, capable of direct image printing (PVC overlay for direct image printing is acceptable).
 - 2) Contactless smartcard (ISO 14443 Standard, such as Mifare, and FIPS 201 compliant) capable of direct image printing (PVC overlay for direct image printing is acceptable).
 - b. Reader shall be dual technology and be listed in the FIPS 201 Evaluation Program Approved Product list <http://fips201ep.cio.gov/apl.php>
 - c. CR shall comply with the Standards for Facility Accessibility by the Physically Handicapped (USPS Handbook RE-4).
 - d. CR shall have the means to be electrically isolated to prevent short circuits from disrupting other communications in the data line network.
 - 2. Capacities:
 - a. CR shall read digital proximity cards signals to a minimum distance of 2 inches and contactless smartcard to a minimum distance of 1.5 inches (5.08mm) and does not require contact with the sensor.
 - 3. Long Range Proximity Card Readers (CR) to be provided at:
 - a. High-speed rollup doors.
 - b. Automatic impact doors.
 - c. Inbound Truck Maneuvering Area Gates (a long range reader on top due to mirror on high vehicles and multi-format mounted low for cars).
 - d. These readers are exempt from the requirements of FIPS201.
 - 4. Specifications: Material shall be Polycarbonate UL94, and shall be UV resistant, sealed, water and weather resistant, and tamperproof.
 - 5. Environmental:
 - a. Humidity: 0 percent to 100 percent condensing.
 - b. Temperature: -50 degrees to +180 degrees F (-46 degrees to +82 degrees C).
 - 6. Regulatory: Controller shall be designed to meet the following regulatory requirements:
 - a. UL294 Listing Standard for Safety.
 - b. FCC EMI and EMC Class A.
 - c. EN55022 EMI and EMC Class A.
 - 7. Mounting:
 - a. CR shall have the capacity to be mounted and operated behind any non-metallic, non-conductive surface, including glass.
 - b. CR shall have the capability to be mounted on any metal door frame.
 - c. Long range proximity card readers (CR):
 - 1) At high-speed rollup and automatic impact doors mount per manufacturer's recommendations for industrial powered trucks and protect CR from vehicle impacts.
 - 2) At Inbound Truck Maneuvering Area Gate mount per Standard Details.
 - 8. Power:
 - a. Source: Via the wiegand interface cable to the field panel.
 - b. The sensor shall emit a low power (less than one microwatt) RF field in up to six (6) inches from surface.
 - 9. Wiring: Multiple conductor overall shielded cable (22 AWG minimum). Size cable gauge to meet distance requirements from the field panel.



10. Feedback:
 - a. Single tri-color LED (green/amber/red) shall provide capability for diagnostic feedback.
 - b. Green LED indicates valid card and red LED indicates invalid card.
 - c. An audio tone shall indicate successful digital proximity/contactless smartcard card read and access granted.
11. Diagnostics: CR and data-line integrity shall be monitored continuously and shall alarm if failure is detected and indicate device and location of fault.
12. Self-protection:
 - a. Physical damage, including breaking open sensor housing, shall not allow access to any circuitry which would allow the system to be compromised.
 - b. Transmission of any frequency (or set of frequencies) into the sensor at any power level shall not compromise the system.

NOTE TO SPECIFIER

Note that coded keypads shall only be utilized upon approved exception by USPS.

- D. Keypad:
 1. General:
 - a. The Keypad shall operate In conjunction with CR for an increased level of user authentication.
 - b. Where required, the keypad shall be integral to the CR and provided as a single card reader/keypad combination unit.
 - c. The system shall have the means to utilize a numeric keypad for entry of a Personal Identification Number (PIN).
 2. Capacities:
 - a. Keypad only reader shall provide a standard 10 digit numeric entry organized in the standard telephone pad layout.
 - b. The user shall be able to enter a 4-digit Personal Identification Number (PIN).
- E. Power Supplies with battery backup: Provide separate power supplies for controllers, associated electric locks and reader interface modules not powered by controllers.
 1. General:
 - a. Un-interruptable Power Supply shall provide continuous power to the field panel, card reader, expansion modules, annunciator devices, and electric locks and operate from a 120VAC/60Hz source.
 - b. Provide external rechargeable battery(s) to maintain all field panel, card reader, expansion module, and electric lock operation for at least four (4) hours in event of power failure.
 2. Capacities: The Power supply shall provide:
 - a. 12 volt DC output to the field panel; or 24 volt DC output to the electric locks.
 - b. Ampere output current at 12 VDC, 24 VDC – 6 amps continuous.
 - c. Power failure output and battery charger output.
 3. Environmental:
 - a. Humidity: 85 percent at 86 degrees F (30 degrees C).
 - b. Temperature: 32 degrees to +122 degrees F (-0 degrees to +50 degrees C).
 4. Regulatory: UL 294 and CSA.
 5. Power: 120VAC/60Hz source.
 6. Wiring:
 - a. The power supply shall be connected to the field panel via wiring of at least 16 AWG.
 - b. The power supply shall utilize phoenix type connectors to allow for ease of field wiring and unit replacement or as recommended by the manufacturer.
 7. Feedback: A single LED indicates power ON condition.
 8. Self-protection: The power supply shall provide the following signals to the Controller:



- a. Power fail.
 - b. Battery recharge signal.
- 9. The electric lock power supplies shall provide a fire alarm interface for emergency lock release.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION AND DOCUMENTATION

A. Installation:

1. The Enterprise Physical Access Control System shall be installed and wired completely on the USPS structured wiring system as shown on the plans by factory trained and authorized employees of the Systems Integrator.
2. Systems Integrator shall make all necessary wiring connections to external devices and equipment. Systems integrator shall program anti-pass back modes into the system in accordance with USPS requirements. Use the following e-mail for assistance in obtaining information regarding current USPS requirements: PACS-SUPPORT@usps.gov
3. Systems Integrator employees shall carry proof of manufacturer's certification at all times.
4. Install systems to conform with the approved submittal data. Where coordination requirements conflict with the system requirements, refer conflicts to the Contracting Officer.
5. Install materials and equipment level and plumb, parallel and perpendicular to other building systems and components.
6. Install equipment to facilitate servicing, maintenance, and repair or replacement of equipment components.
7. Where mounting heights are not detailed, consult with and coordinate with the Architect.
8. Coordinate all cutting, patching and site work with the [Design Build Entity] [or] [General Contractor].
9. All Enterprise Physical Access Control System devices shall be securely mounted to the building structure and fastened with tamper resistant screws. Provide USPS with three sets of tamper screw removal tools to be stored locally for service and maintenance.
10. All wiring connections shall enter enclosures at one location and be neatly dressed.
11. Device Mounting:
 - a. The field panel shall be wall mounted in a secure area.
 - b. The power supplies shall be installed in a secure area adjacent to the field panel.
12. All DC operated locking hardware, relays, and all other inductive loads shall have a diode connected to them to prevent noise and/or any induced currents. All AC operated relays or electric strikes shall have a MOV connected to them to suppress any current induced noise. Diodes and MOVs shall be connected at the strike or relay and shall be of the type recommended by the device manufacturer.
13. Install PIR request-to-exit sensors such that "corridor pedestrian traffic" will not activate the sensor. Ceiling or wall mount shall be acceptable. Adjust the pattern and sensitivity such that detection is ensured for all egress attempts and such that detection cannot be achieved from the exterior side of the door.
14. Touch-up scratched and marred surfaces to match original finishes; remove all dirt and construction debris.
15. All work areas shall be left in a broom swept condition at the end of each day.

B. Network Communications:

1. Installer shall coordinate all network communications wiring requirements with the structured cabling system provider to insure transmission pathway through the structured wiring system.
2. Telecommunications outlets for equipment as shown on the plans will be provided under Section 270500.

C. Documentation:



1. Accurate "as built" drawings shall be furnished before final acceptance is requested, by the Systems Integrator to aid the USPS in programming. These shall indicate the door(s) controlled by each lock output, the monitoring points for the door controlled area, host server, workstation and badge issuing station location, all field panel locations, all electrical circuit and telecommunications outlet designations and any annunciator outputs or special inputs into the system in hard copy and electronic format (AutoCAD-coordinate version requirements with the USPS Contracting Officer).
2. The Systems Integrator shall supply six (6) copies of operating and maintenance manuals to aid the USPS in the programming of the system.

D. Special Requirements For Cable Routing And Installation

1. The majority of the ePACS wiring in this building will be installed above ceilings without conduit. All communications cabling used throughout this project shall comply with the requirements as outlined in the National Electric Code (NEC) article 725. All cabling shall bare CMP and/or appropriate markings for the environment in which they are installed.
2. Sealing of openings between floors, through rated fire and smoke walls, existing or created by the contractor for cable pass through shall be the responsibility of the contractor. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of the contractor's work. Any openings created by or for this contractor and left unused shall also be sealed as part of this work.
3. Cabling routed underground, on the exterior, through inaccessible ceilings or less than 10 ft. – 0 in. A.F.F. in the workroom shall be contained in conduit. Provide flush boxes within finished areas and factory boxes in unfinished areas. Provide 3/4 inch conduit risers with 90 degree bend and bushing for all wall mounted devices.

3.2 SERVICE AND SUPPORT

A. Startup:

1. The Systems Integrator shall coordinate all system database requirements with the USPS and build the system database for the host server and workstations. At a minimum the Systems Integrator shall:
 - a. Provide worksheets to the USPS with requested database information a minimum of four (4) weeks prior to anticipated system startup.
 - b. Load all system device names and system addresses.
 - c. Load basic access levels.
 - d. Load and test all applications and interfaces.
 - e. Load and test sample proximity cards compatible with USPS Standard Card.
2. After the system has been installed, the documentation delivered to the USPS and network communications is established in compliance with Sections 3.1 & 3.2, A above, the Systems Integrator shall verify correct operation of all system components and demonstrate and test the system for the USPS.
3. Final system acceptance testing shall be conducted by the USPS Contracting Officer or, at the option of USPS, their authorized representative. Acceptance testing shall demonstrate all aspects of the Enterprise Physical Access Control System as described in the contract documents. The Systems Integrator shall make provisions for testing (any simulations required for testing) and provide a final acceptance test plan a minimum of one week prior to the anticipated testing date.
4. Final acceptance testing shall be conducted on the completed system as described in this specification and configured to the satisfaction of the USPS Contracting Officer.
5. The Systems Integrator shall guarantee all material and workmanship involving the system for twelve (12) months after startup.

B. Training (in addition to the requirements of Section 1.5, B, 5):



1. After system startup, the Systems Integrator shall instruct USPS personnel in how to program the system and demonstrate a typical operating program for each type of access controlled area.
 2. Enterprise Physical Access Control System training sessions shall be arranged with the USPS at least one week prior to the training date. Training manuals shall be delivered for each trainee with one additional copy delivered for archiving on the project site.
 3. Training manuals shall consist of an agenda, defined objectives for each lesson, a detailed description of the subject matter of each lesson, and the manufacturer's written operation and system manuals. At a minimum, training agenda shall consist of the following.
 - a. An overview of the system components and features.
 - b. A detailed description of how the equipment will operate to meet the performance requirements of the Enterprise Physical Access Control System.
 - c. A description of the operating system and application software.
 - d. Start up and orderly shut down procedures for the system.
 - e. Hands on training on all Enterprise Physical Access Control System software and hardware features.
 - f. Basic troubleshooting guide intended to identify the source of system problems.
 - g. System configuration and data back-up and restoration procedures.
- C. Warranty Support:
1. The Authorized Systems Integrator shall be available during the warranty period to answer programming and application questions to support USPS personnel during this period.
 2. The Authorized Systems Integrator shall have the training and capability to provide additional support services including:
 - a. Regular testing and inspection of all system components and to submit reports on the results.
 - b. Emergency Service for repairs and adjustments to the system and part replacement if necessary

USPS Mail Processing Facility Specification issued: 10/1/2013
 Last revised: 8/28/2013

END OF SECTION 28 13 04 00



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Task	Specification	Specification Description
28 13 33 16	26 33 43 00a	Public Address and Mass Notification Systems



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SECTION 28 16 00 00 - CSF INTRUSION DETECTION SYSTEM**

NOTE TO SPECIFIER

Use this Specification Section for Customer Service Facilities only. This Specification is intended as a guide to the Architect/Engineer preparing the Construction Documents.

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Intrusion detection devices.
 - 2. Alarm control panel.
 - 3. Signaling devices.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 260500 - Common Work Results for Electrical.
 - 2. Section 264128 - Surge Protective Devices (SPDs).
 - 3. Section 270500 - Common Work Results for Communications.
 - 4. [Section 282304 - Security, Burglary and Robbery Countermeasures Analog CCTV System.]
 - 5. [Section 282305 - Integrated Security and Investigative Platform (ISIP)CCTV System.]

1.2 REFERENCES

- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. Underwriters Laboratories Incorporated (UL):
 - 1. UL 609 - Local Burglar Alarm Units.
 - 2. UL 634 - Connectors and Switches for Use with Burglar-Alarm Systems.
 - 3. UL 639 - Intrusion Detection Devices.
 - 4. UL 681 - Installation and Classification of Mercantile and Bank Burglar-Alarm Systems.
 - 5. UL 1023 - Household Burglar-Alarm Systems.
 - 6. UL 1076 - Proprietary Burglar Alarm Units and Systems.
 - 7. UL 1449; 3rd Edition - Transient Voltage Surge Suppressors.

1.3 DEFINITIONS

- A. Hard-Wired System: Alarm, supervisory, and detection devices directly connected, through individual dedicated conductors, to central control panel.



- B. Multiplex System: Communications link using signaling method characterized by simultaneous or sequential transmission, or both, and reception of multiple signals in a communication channel, including means for positively identifying each signal.
- C. Zone: A single initiating device or combination of devices connected to a single point/zone on the Intrusion Detection Device panel. Circuit showing the display of alarms point/zone.
- D. Dial-Up System: Communication link utilizing voice line which connects alarm to central station through dial-up circuit.

1.4 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. System: Central microprocessor, remote intrusion sensors and detection devices, and a communications link to perform monitoring and alarm functions. System physically and electronically modular with provision for field expansion. System self-monitoring and self-diagnostic.
 - 2. Communication Link: Voice grade dial-up line and dedicated to intrusion detection, alarm service, and control of security related functions.
 - 3. Environmental: Design to withstand the following environmental conditions without mechanical or electrical damage or degradation of operating capability.
 - a. Altitude: Sea level to 4000 feet.
 - b. Ambient Temperature for Interior Elements: 0 degrees C to plus 40 degrees C.
 - c. Relative Humidity for Interior Elements: 5 to 95 percent, noncondensing.
 - d. Ambient Temperature for Exterior Elements: Minus 25 degrees C to plus 50 degrees C.
 - e. Relative Humidity for Exterior Elements: 0 to 100 percent.
- B. Performance Requirements:
 - 1. Intrusion Detection: Performed by indicated intrusion detection devices. Devices are assigned to detection of points/zones as indicated.
 - 2. Alarm Indication: Audible signal sounds and alphanumeric display at the alarm keypad identifying the zone originating an alarm. An alarm displayed at the keypad will annunciate with an audible tone. Alarm keypad provides alpha text as to the location of the alarm zone.
 - 3. When alarm signal is unable to be sent by telephone; a local 110 decibel horn is to sound for 5 minutes after the last sensor activation. The horn is to be located in the workroom.

1.5 SUBMITTALS

- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Data for system components, including UL listing data and list of materials, dimensioned plans, sections, and elevations showing minimum clearances, mounting arrangements, and installed features and devices.
 - 2. Shop Drawings: Wiring diagrams for system, including devices, components, and auxiliary equipment. System diagram is unique to the Project system; manufacturer's generic system diagram not permitted. Diagrams differentiate between manufacturer-installed and field-installed wiring. Include diagrams for equipment and for system with all terminals and interconnections identified.
 - 3. Assurance/Control Submittals:
 - a. Design Data: System operation description indicating method of operation and supervision of each component and each type of circuit, and sequence of operations for all manually and automatically initiated system inputs for this specific Project. Manufacturer's standard descriptions for generic systems not permitted.



- b. Test Reports: Submit the following reports directly to Contracting Officer from Manufacturer's Quality Control Inspector with, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
 - 1) Pre-test.
 - 2) Acceptance test.
 - c. Certificates: Manufacturer's certificate certifying that components and Products meet or exceed specified requirements.
 - d. Qualification Documentation: Submit documentation of manufacturer and installer experience indicating compliance with specified qualification requirements. Include lists of completed projects with project names and addresses, names of Engineers and Owners.
 - e. Manufacturer's Field Reports: Submit the following reports directly to Contracting Officer from Manufacturer's Quality Control Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
 - 1) Preparatory inspection.
 - 2) Initial inspection.
 - 3) Follow-up inspection.
 - 4) Final inspection.
- C. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Operation and Maintenance Data: Include data for each type product, including features and operating sequences, both automatic and manual. Include user's software data and recommendations for spare parts to be stocked at the site. Provide names, addresses, and telephone numbers of service organizations that stock repair parts for the system.
 - 2. Project Record Documents: Record actual locations of equipment and devices, and routing of alarm wiring.

1.6 QUALITY ASSURANCE

- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. Manufacturer Qualifications: Firms experienced in manufacturing equipment of the types and capacities indicated that have record of successful in-service performance with minimum 5 years documented experience. Prime system manufacturer and manufacturers of major system components required to qualify separately.
 - 1. Service Center: Prime system manufacturer maintains a service center capable of providing training, parts, and emergency maintenance and repairs for overall system at Project site within 8 hour maximum response time.
- C. Installer Qualifications: Experience with systems of the type and scope indicated and certified as authorized service representative of the prime system manufacturer with minimum 5 years documented experience.
 - 1. System shall be installed by a single contractor that assumes responsibility for system components and their compatibility.
 - 2. Only manufacturer's certified installer shall be utilized.
 - 3. Installer shall be NFBA/SIA technical level #1 certified.
 - 4. Installer shall be licensed where required by state or county.
 - 5. Installer shall require a security clearance if the installation is accomplished after the facility starts processing the mail.
- D. Regulatory Requirements:
 - 1. Coordination and verification of standards and requirements with Postal Inspection Service through Contracting Officer is required throughout planning, design, construction phases, and final approval of alarm security system.
 - 2. Postal Inspection Service has sole responsibility for evaluating the need for any security related equipment.



- E. Comply with UL Standard 609, 1023, and 1076.
- F. FM Compliance: Provide FM-approved intrusion detection systems and components.

1.7 OWNER'S INSTRUCTION

- A. Postal Inspection Service will provide training to end user.
- B. Postal Inspection Service will provide final programming.

1.8 MAINTENANCE

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Extra Materials: Furnish extra materials described below that match products installed, packaged with protective covering for storage and identified with labels clearly describing contents.
 - 2. Intrusion Detection Devices: Furnish quantity equal to 5 percent of the number of units of each type installed, but not less than 1 of each type.

NOTE TO SPECIFIER

****REQUIRED PART (PRODUCTS) FOLLOWS. DO NOT REVISE THIS PART, EXCEPT AS NOTED BELOW, WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering specified Products which may be incorporated in the Work include the following:
 - 1. Bosch Security, Fairport, NY (800) 289-0096(alarm & keypad).
 - 2. Visonic, Inc., Bloomfield, CT (800) 223 0020.
- B. Section 016000 - Product Requirements: Product options and substitutions.
 - 1. Conflicts, deviations, or change requests shall be submitted in writing to Postal Inspection Service through Contracting Officer with supporting documentation. Include written justification, designs, manufacturer's specifications, cost benefits, and any special circumstances dictated by local conditions. Documentation package shall be submitted in sufficient time to minimize any adverse effects of the proposed changes to the project construction schedule. Postal Inspection Service through Contracting Officer reserves the right to reject substitute and other systems.
 - 2. Substitutions are not permitted for control panel, expansion boards and control stations.
- C. Specified Products:
 - 1. Door Switches: Sentrol: Magnetic Contacts, #1078CW with 1K ohm resistor.
 - 2. Dual-Technology Devices, Passive Infrared and Ultrasonic:
 - a. Wall Mounted
 - 1) Bosch DS860.
 - 2) Visonic DUO 220AM
 - b. Ceiling Mounted



- 1) Bosch DS9360.
- 2) Visonic DUO 240
3. Control Panel: Bosch: #G7412GV4-USA Control/Communicator.
4. Expansion Boards: Bosch: #D8128D OctoPOPIT.
5. Control Stations (Keypad): Bosch: #D1255 Command Center.

2.2 INTRUSION DETECTION EQUIPMENT

- A. Surge Protection: Comply with minimum requirements of UL Standard 1449, 3rd Edition, for each component using solid-state devices and having line voltage power source connection or exterior underground signal connection.
- B. Interference Resistance: Systems and equipment and their operation not affected by radiated radio frequency interference and electrical induction of 15 V/m over frequency range of 10 to 10,000 MHz and conducted interference signals up to 0.25 V rms injected into power supply lines at 10 to 10,000 MHz.

2.3 INTRUSION DETECTION DEVICES

- A. Types, features, accessories, and mounting conditions of individual devices are as indicated.
- B. Alarm Contact Arrangement: Contact-making intrusion detection devices are single-pole, double-throw type.

2.4 DOOR SWITCHES

- A. Comply with UL Standard 634.
- B. All door contacts will have 1 K resistors added or 1 K resistor built in
- C. Balanced magnetic type. Magnet part designed for installation in door; magnetically operated switch installed in door frame. Unit uses bias magnet and sensitive read switch to resist compromise by introduction of foreign magnetic fields.
 1. Flush-Mounted Units: Flush with surface of door frame and door.

2.5 SPACE INTRUSION DETECTION DEVICES

- A. Comply with UL Standard 639 and the following general requirements:
 1. Configuration: Devices consist of single component or two or more separately mounted components as indicated or as required to perform functions. Single-component devices may not be used where multiple-component devices are indicated.
 2. Power Source Characteristics: Devices are supplied by one or more dedicated 120 V 60 Hz supply circuits from alarm control panel.
 3. Detection Indicator: LED in unit housing, latching-type where indicated.
 4. Sensitivity: Units detect presence of an intruder within their specified detection patterns and are insensitive to influences outside the pattern.
 5. Self-Testing Capability: Devices indicated to have this feature automatically test themselves periodically, but not less than once per hour, to verify normal device functioning and alarm initiation capability. Test failure is signaled to control panel by a trouble signal.
 6. Anti-Masking Capability: Devices indicated to have this feature automatically check operation continuously or at intervals of a minute or less and use signal-processing logic to detect blocking, masking, jamming, tampering, or other operational dysfunction. Such detection is signaled to the control panel as an alarm signal.



7. Addressability: Indicated devices include communication transmitter and receiver with unique identification and status-reporting capability to system control panel.
8. Remote Controllability: Indicated devices are individually monitored at system control panel for calibration, sensitivity, and alarm condition and are individually adjustable for sensitivity from panel.

- B. Dual-Technology Devices, Passive Infrared and Ultrasonic: Combine the two detection modes described above into a single housing.
 1. Detection by both methods results in an alarm signal.

2.6 CONTROL PANEL

- A. Comply with UL Standard 1076.
- B. Cabinet: Lockable steel enclosure. Arrange panel so operations required for testing or for normal operation and maintenance are performed from front of enclosure. If more than single unit is required to form complete control panel, provide exact matching, keyed alike panels. Accommodate components and allow ample gutter space for interconnection of panels and field wiring. Identify each enclosure by engraved, laminated, phenolic resin nameplate. Lettering on enclosure nameplate shall not be less than 1 inch (25 mm) high. Identify individual components and modules within cabinets with permanent labels.
- C. Systems: Alarm and supervisory systems are separate and independent in control panel. Alarm-initiating zone boards in panel consist of plug-in cards. Arrangement requiring removal of field wiring for module replacement not permitted. Use Bosch D7412GV4-USA (complete) package containing the G7412GV4-USA control panel. The manufacturer has verified that the control panel will be produced for U.S. Postal Service Projects. **THE CONTRACTOR IS REQUIRED TO INFORM THE MANUFACTURER THAT THE CONTROL PANEL IS FOR A U.S. POSTAL SERVICE PROJECT**
- D. Control Modules: Types and capacities as required to perform functions of system. Visible and audible signals in control panel indicate alarm, supervisory, and trouble conditions for each zone. Each type of audible alarm has distinct sound.
- E. Expansion Boards: Provide and install as many expansion boards (D8128D OCTOPOPITS) as necessary to connect all door contacts and motion sensors. All expansion boards shall be installed in the control panel cabinet OR in a like cabinet immediately adjacent to the control panel cabinet. All unused points shall have EOL resistors installed. Popits are not allowed.
- F. Zones: Quantity of alarm and supervisory zones and zone assignment numbers as indicated. Provide expansion boards with capacity for expanding number of zones by minimum of 25 percent.
- G. Power Supply Circuits: Panel provides power for remote power-consuming detection devices. Provide adequate circuit capacity for at least a 25 percent increase in load. Transformer near the panel, minimum 18AWG copper wire. Earth ground, use #10AWG solid copper wire.
- H. Command center (keypad): Individual annunciation for each zone. Blue fluorescent vacuum. Alphanumeric display for each control panel section/area display devices on the keypad. Manual toggle test-switches or push test-buttons do not require key to operate. Alarm and supervisory signals displays for the associated zone.

NOTE TO SPECIFIER

Include the following paragraph if a Criminal Investigative Office is to be included.

1. The alarm keypad panel shall not display or annunciate the status of any IDS components (i.e., motion sensor, entry delay tone, etc.) associated with the Criminal Investigative Office.



- I. Resetting: Controls permit silencing audible signals for individual zones but prevent the resetting of alarm, supervisory, or trouble signals while condition still exists.
- J. Alphanumeric Display and System Controls: Arrange for basic interface between human operator at control panel and system components, including annunciation and supervision. A display with minimum of 18 characters displays alarm, supervisory, and component status messages. Arrange keypad to enter and execute control commands.

2.7 SECURE-ACCESS CONTROL STATIONS

- A. Keypad and display module is arranged for entering and executing commands for system-status changes and for displaying system status and command-related data.

2.8 HORN

- A. 110 decibel horn powered by control panel with battery backup.

2.9 WIRE AND CABLE

- A. Stranded copper. Size conductors as indicated but not less than recommended by system manufacturer.
- B. Comply with Section 260519, except as indicated.
- C. Cable for Low-Voltage Control and Signal Circuits: All sensors and keypads will have wiring concealed inside walls. Provide flush outlet boxes with ¾ inch conduit risers. All sensors and keypad shall have dedicated homerun wires to the D7412GV4-USA panel. Wire will be category 2, unshielded, four-pair twisted 22 AWG stranded wire (conductors), except where manufacturer recommends shielded cable. Use wire colors red, green, black, orange, yellow, blue, brown, and white.

2.10 SPECIAL REQUIREMENTS FOR CABLE ROUTING AND INSTALLATION

- A. The majority of IDS wiring in this building will be installed above ceilings without conduit. All communications cabling used throughout this project shall comply with the requirements as outlined in the National Electric Code (NEC) article 725. All cabling shall bare CMP and/or appropriate markings for the environment in which they are installed.
- B. Sealing of openings between floors, through fire rated and smoke walls, existing or created by the contractor for cable pass through shall be the responsibility of the contractor. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of the contractor's work. Any openings created by or for this contractor and left unused shall also be sealed as part of this work.
- C. Support cables installed in ceiling spaces with wide-base canvas loop suspension devices such as the Erico Caddy #425 Loop anchored to building structural steel (red iron).
 - 1. Minimum and Maximum Spacing Between Supports: 4 - 5 feet.
 - 2. Furnish and install additional supports as required.
 - 3. Install complete cable support device system before starting installation of cable.
 - a. Installation of cable before completion of support system not permitted.
 - b. Unsupported cable shall not be permitted.



4. Organize and group cables. Install cable group as single run through ceiling spaces following column and building lines. Do not install cable group runs diagonally across center of building.
5. Cabling shall not be suspended from any electrical conduits, sprinkler systems, gas, or water pipes, etc.
6. Cabling shall not be attached to suspended ceiling grid system.
7. No element of the building structure (i.e. webbing of trusses) shall be used to support any telecommunications cabling.

- D. Cabling routed underground, exterior of the building, through inaccessible ceilings or less than 10'-0" A.F.F. in the workroom shall be contained in conduit. Provide flush boxes within finished areas and surface mounted factory boxes in unfinished areas. Provide ¾ inch conduit risers with 90 degree bend and bushing for all wall mounted devices.

2.11 POWER REQUIREMENTS

- A. Normal System Power Supply: 120 V 60 Hz from locked disconnect device. System components are supplied with power through system control panel.
- B. Power Source Transfer: When normal power is interrupted, system is automatically switched to backup supply without degradation of critical system function or loss of signals or status data.
 1. Backup Source: Batteries in power supplies of individual system components. Such batteries are an integral part of power supplies of components. When system is in "Alarm" mode, power source shall provide a minimum of 4 hours of battery backup, with 8 to 12 hours in "Normal" mode.
 2. Annunciation: Switching of system or any system component to backup power is indicated on system control panel as a change in system condition.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. As specified in Section 260500 – Common Work Results for Electrical.

3.2 INSTALLATION

- A. Install system according to NFPA 70, applicable codes, and manufacturer's published instructions.
- B. Comply with UL Standard 681.
- C. Installer to be Bosch Security Certified. Installer will meter test the system to insure proper wiring and function. Do not leave installer lock code in panel. Lock code should be the Bosch Security default code. Alarm monitoring is done by the National Law Enforcement Control Center (NLECC), Tel: 1-877-MYNLECC or 1-877-696-5322, Fax: 1-651-306-6700. Postal Management must complete Burglary Alarm Information Form (BAIF) and send to NLECC. This needs to be done at least one week prior to the installer requesting programming. Leave all installation and operating instruction books inside cabinet.
 1. Questions regarding alarm monitoring at USPS sites should be directed to the following specialist:
 - a. Leonardo V. Martinez, Sr. Physical Security Specialist, Technical Services Division – NLECC, Dulles, Virginia, LVMartinez@uspis.gov



D. Connection and Programming Protocol:

1. The Contractor shall connect the panel to a voice line using a RJ31x wired for line seizure.
2. The Contractor shall call 877-696-5322 Mon – Fri between 8am and 8pm (Eastern Time) and request to speak with a USPIS Alarm Technician.
3. The Contractor shall provide descriptive text for each point (zone) covered, and the point it was landed to on the Alarm Panel.
4. The Contractor shall advise USPIS which points need a delay for Entry/Exit.
5. The Contractor shall have all keypads addressed individually. (USPIS can provide support for this).
6. The Contractor shall advise USPIS if any special code is needed to dial out on the Alarm Panel's phone line (9, 8, etc).
7. The Contractor shall provide USPIS with all system information necessary for the completion of the programming template by USPIS. Upon completion of the template, USPIS will transmit program to the panel for final testing.
8. Contractor will adjust the sensitivity of all sensors, adjust and mask if necessary to prevent false activations.
9. Sensors will not be mounted in close proximity to air handling vents, as this will cause false activations.
10. No panic, smoke, sprinkler flow control or fire alarm monitoring will be supervised at the intrusion panel. Panic system interface will not be permitted without advance special approval by HQ Security Group.

E. Wiring Within Enclosures: Bundle, lace, and train conductors to terminal points with no excess. Provide and use lacing bars and distribution spools.

F. Number of Conductors: As recommended by system manufacturer for functions indicated.

G. Tighten connections to comply with tightening torques specified in UL Standard 486A.

H. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so media are identified and coordinated with system wiring diagrams as specified in Section 260500

I. Install power supplies and other auxiliary components for detection devices at alarm control panel or at a data-gathering panel except as otherwise indicated. Do not install such items in vicinity of devices they serve.

J. Install panel and keypad at locations indicated on Drawings and verified by Postal Inspection Service through Contracting Officer.

K. Grounding: Ground system components and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common mode returns, noise pickup, cross talk, and other impairments.

L. All IDS system wiring shall be homerun from each individual device back to IDS control panel.

M. At IDS control panel consolidate individual cable runs at a junction box located above ceiling near the IDS control panel with a single conduit down to the IDS control panel. Splicing within any cable run is not acceptable.

3.3 CONSTRUCTION

A. Interface with Other Work: Interface installation of intrusion detection system with closed circuit television system.



3.4 FIELD QUALITY CONTROL

- A. As specified in Section 260500 - Common Work Results for Electrical.
- B. Inspection:
 - 1. Inspect equipment installation, interconnection with system devices, mounting locations, and mounting methods.
 - 2. Verify that units and controls are properly installed, connected, and labeled and that interconnecting wires and terminals are identified.
- C. Pretesting: Align and adjust system and perform pretesting of components, wiring, and functions to verify conformance with specified requirements. Correct deficiencies by replacing malfunctioning or damaged items with new items. Retest until satisfactory performance and conditions are achieved.
- D. Acceptance Operational Tests:
 - 1. Perform operational system tests to verify conformance with specifications. Test modes of system operation and intrusion detection. Methodically test for false alarms in each zone of space intrusion detection devices by simulating activities outside indicated detection patterns.
 - 2. Provide minimum 10 days notice of acceptance test performance schedule to Contracting Officer who will coordinate with Postal Inspection Service.
- E. Retesting: Correct deficiencies and retest until total system meets the requirements of Specifications and complies with applicable standards.

3.5 ADJUSTING

- A. Occupancy Adjustments: When requested within 1 year of date of Final Acceptance, provide on-site assistance in adjusting and reprogramming to suit actual occupied conditions. Provide up to 2 visits to site for this purpose at no additional cost to United States Postal Service.

USPS CSF Specifications issued: 10/1/2013
Last revised: 9/16/2013

END OF SECTION 28 16 00 00



SECTION 28 16 00 00 - MPF INTRUSION DETECTION**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Intrusion detection devices.
 - 2. Alarm control panel.
 - 3. Signaling devices.
- B. Related Sections:
 - 1. Section 282304 – Integrated Security and Investigative Platform (ISIP) CCTV System
 - 2. Section 260500 - Common Work Results for Electrical: Supporting devices and electrical identification.
 - 3. Section 260533 – Raceway and Boxes for Electrical Systems. Conduit for system wiring.

1.2 REFERENCES

- A. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code.
- B. Underwriters Laboratories Incorporated (UL):
 - 1. UL 609 - Local Burglar Alarm Units.
 - 2. UL 634 - Connectors and Switches for Use with Burglar-Alarm Systems.
 - 3. UL 639 - Intrusion Detection Devices.
 - 4. UL 681 - Installation and Classification of Mercantile and Bank Burglar-Alarm Systems.
 - 5. UL 1023 - Household Burglar-Alarm Systems.
 - 6. UL 1076 - Proprietary Burglar Alarm Units and Systems.
 - 7. UL 1449 - Transient Voltage Surge Suppressors.

1.3 DEFINITIONS

- A. Hard-Wired System: Alarm, supervisory, and detection devices directly connected, through individual dedicated conductors, to central control panel.



- B. Multiplex System: Communications link using signaling method characterized by simultaneous or sequential transmission, or both, and reception of multiple signals in a communication channel, including means for positively identifying each signal.
- C. Zone: A single initiating device or combination of devices connected to a single point/zone on the Intrusion Detection Device panel. Circuit showing the display of alarms point/zone.
- D. Dial-Up System: Communication link utilizing PSTN line which connects alarm to central station through dial-up circuit.

1.4 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. System: Central microprocessor, remote intrusion sensors and detection devices, and a communications link to perform monitoring and alarm functions. System physically and electronically modular with provision for field expansion. System self-monitoring and self-diagnostic.
 - 2. Communication Link: Voice grade dial-up line and dedicated to intrusion detection, alarm service, and control of security related functions.
 - 3. Environmental: Design to withstand the following environmental conditions without mechanical or electrical damage or degradation of operating capability.
 - a. Altitude: Sea level to 4000 feet.
 - b. Ambient Temperature for Interior Elements: 0 degrees C to plus 40 degrees C.
 - c. Relative Humidity for Interior Elements: 5 to 95 percent, noncondensing.
 - d. Ambient Temperature for Exterior Elements: Minus 25 degrees C to plus 50 degrees C.
 - e. Relative Humidity for Exterior Elements: 0 to 100 percent.
- B. Performance Requirements:
 - 1. Intrusion Detection: Performed by indicated intrusion detection devices. Devices are assigned to detection points/zones as indicated.
 - 2. Alarm Indication: Audible signal sounds and alphanumeric display at the alarm keypad identifying the zone originating an alarm. An alarm displayed at the keypad will annunciate with an audible tone. Alarm keypad provides alpha text as to the location of the alarm zone.
 - 3. When alarm signal is unable to be sent by telephone; a local 110 decibel horn is to sound for 5 minutes after the last sensor activation. The horn is to be located in the workroom.

1.5 SUBMITTALS

- A. Submittal Procedures:
 - 1. Product Data: Data for system components, including UL listing data and list of materials, dimensioned plans, sections, and elevations showing minimum clearances, mounting arrangements, and installed features and devices.
 - 2. Shop Drawings: Wiring diagrams for system, including devices, components, and auxiliary equipment. System diagram is unique to the Project system; manufacturer's generic system diagram not permitted. Diagrams differentiate between manufacturer-installed and field-installed wiring. Include diagrams for equipment and for system with all terminals and interconnections identified.
 - 3. Assurance/Control Submittals:
 - a. Design Data: System operation description indicating method of operation and supervision of each component and each type of circuit, and sequence of operations for all manually and automatically initiated system inputs for this specific Project. Manufacturer's standard descriptions for generic systems not permitted.
 - b. Test Reports: Submit pre-test and acceptance test reports directly to Contracting Officer from Manufacturer's Quality Control Inspector with, with copy to Contractor.



- c. Certificates: Manufacturer's certificate certifying that components and Products meet or exceed specified requirements.
 - d. Qualification Documentation: Submit documentation of manufacturer and installer experience indicating compliance with specified qualification requirements. Include lists of completed projects with project names and addresses, names of Engineers and Owners.
 - e. Manufacturer's Field Reports: Submit preparatory inspection, initial inspection, follow-up inspection, and final inspection reports directly to Contracting Officer from Manufacturer's Quality Control Inspector, with copy to Contractor.
- B. Procedures for closeout submittals.
- 1. Operation and Maintenance Data: Include data for each type product, including features and operating sequences, both automatic and manual. Include user's software data and recommendations for spare parts to be stocked at the site. Provide names, addresses, and telephone numbers of service organizations that stock repair parts for the system.
 - 2. Project Record Documents: Record actual locations of equipment and devices, and routing of alarm wiring.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firms experienced in manufacturing equipment of the types and capacities indicated that have record of successful in-service performance with minimum 5 years documented experience. Prime system manufacturer and manufacturers of major system components required to qualify separately.
- 1. Service Center: Prime system manufacturer maintains a service center capable of providing training, parts, and emergency maintenance and repairs for overall system at Project site within 8 hour maximum response time.
- B. Installer Qualifications: Experience with systems of the type and scope indicated and certified as authorized service representative of the prime system manufacturer with minimum 5 years documented experience.
- 1. System shall be installed by a single contractor that assumes responsibility for system components and their compatibility.
 - 2. Only manufacturer's certified installer shall be utilized.
 - 3. Installer shall be NFBA/SIA technical level #1 certified.
 - 4. Installer shall be licensed where required by state or county.
 - 5. Installer shall require a security clearance if the installation is accomplished after the facility starts processing the mail.
- C. Regulatory Requirements:
- 1. Coordination and verification of standards and requirements with Postal Inspection Service through Contracting Officer is required throughout planning, design, construction phases, and final approval of alarm security system.
 - 2. Postal Inspection Service has sole responsibility for evaluating the need for any security related equipment.
- D. Comply with requirements of NFPA 70.
- E. Comply with UL Standard 609, 1023, and 1076.
- F. FM Compliance: Provide FM-approved intrusion detection systems and components.

1.7 OWNER'S INSTRUCTION

- A. Installer will provide training to end user.



- B. Postal Inspection Service will provide final programming.

1.8 MAINTENANCE

- A. Extra Materials: Furnish extra materials described below that match products installed, packaged with protective covering for storage and identified with labels clearly describing contents.
 - 1. Intrusion Detection Devices: Furnish quantity equal to 5 percent of the number of units of each type installed, but not less than 1 of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering specified Products which may be incorporated in the Work include the following:
 - 1. Bosch Security, Fairport, NY (800) 289-0096 (alarm & keypad).
 - 2. Visonic, Inc., Bloomfield, CT (888) 223-0020.
- B. Section 016000 - Product Requirements: Product options and substitutions.
 - 1. Conflicts, deviations, or change requests shall be submitted in writing to Postal Inspection Service through Contracting Officer with supporting documentation. Include written justification, designs, manufacturer's specifications, cost benefits, and any special circumstances dictated by local conditions. Documentation package shall be submitted in sufficient time to minimize any adverse effects of the proposed changes to the project construction schedule. Postal Inspection Service through Contracting Officer reserves the right to reject substitute and other systems.
 - 2. Substitutions are not permitted for control panel, expansion boards, and control stations.
- C. Specified Products:
 - 1. Door Switches: Sentrol Magnetic Contacts, #1078CW with 1K ohm resistor.
 - 2. Dual-Technology Devices, Passive Infrared and Microwave:
 - a. Wall Mounted
 - 1) Bosch DS860
 - 2) Visonic DUO 220AM
 - b. Ceiling Mounted
 - 1) Bosch DS9360
 - 2) Visonic DUO 240
 - 3. Control Panel: Bosch: # G7412GV4-USA Control/Communicator.
 - 4. Expansion Boards: Bosch: #D8128D OctoPOPIT.
 - 5. Control Stations (Keypad): Bosch: #D1255 Command Center.

2.2 INTRUSION DETECTION EQUIPMENT

- A. Surge Protection: Comply with minimum requirements of UL Standard 1449 for each component using solid-state devices and having line voltage power source connection or exterior underground signal connection.
- B. Interference Resistance: Systems and equipment and their operation not affected by radiated radio frequency interference and electrical induction of 15 V/m over frequency range of 10 to 10,000 MHz and conducted interference signals up to 0.25 V rms injected into power supply lines at 10 to 10,000 MHz.



2.3 INTRUSION DETECTION DEVICES

- A. Types, features, accessories, and mounting conditions of individual devices are as indicated.
- B. Alarm Contact Arrangement: Contact-making intrusion detection devices are single-pole, double-throw type.

2.4 DOOR SWITCHES

- A. Comply with UL Standard 634.
- B. All door contacts will have 1 K resistors added or 1 K resistor built in
- C. Balanced magnetic type. Magnet part designed for installation in door; magnetically operated switch installed in door frame. Unit uses bias magnet and sensitive read switch to resist compromise by introduction of foreign magnetic fields.
 - 1. Flush-Mounted Units: Flush with surface of door frame and door.

2.5 SPACE INTRUSION DETECTION DEVICES

- A. Comply with UL Standard 639 and the following general requirements:
 - 1. Configuration: Devices consist of single component or two or more separately mounted components as indicated or as required to perform functions. Single-component devices may not be used where multiple-component devices are indicated.
 - 2. Power Source Characteristics: Devices are supplied by one or more dedicated 120 V 60 Hz supply circuits from alarm control panel.
 - 3. Detection Indicator: LED in unit housing, latching-type where indicated.
 - 4. Sensitivity: Units detect presence of an intruder within their specified detection patterns and are insensitive to influences outside the pattern.
 - 5. Self-Testing Capability: Devices indicated to have this feature automatically test themselves periodically, but not less than once per hour, to verify normal device functioning and alarm initiation capability. Test failure is signaled to control panel by a trouble signal.
 - 6. Anti-Masking Capability: Devices indicated to have this feature automatically check operation continuously or at intervals of a minute or less and use signal-processing logic to detect blocking, masking, jamming, tampering, or other operational dysfunction. Such detection is signaled to the control panel as an alarm signal.
 - 7. Addressability: Indicated devices include communication transmitter and receiver with unique identification and status-reporting capability to system control panel.
 - 8. Remote Controllability: Indicated devices are individually monitored at system control panel for calibration, sensitivity, and alarm condition and are individually adjustable for sensitivity from panel.
- B. Passive Infrared (PIR) Devices: Detects intrusion by monitoring infrared energy emitted within protected zone. Units are sensitive to infrared wavelengths emitted by human body and are insensitive to general area thermal variations.
 - 1. Wall-Mounted Units: Maximum detection range for individual units exceeds scheduled distance by 25 percent, but is not less than 50 feet (15m).
 - 2. Ceiling-Mounted Units: Full 360 degree conical spot-detection pattern. With device mounted at 8 feet (2500mm) above floor the pattern at floor level is minimum diameter of 7 feet (2000mm). With device mounted at 25 feet (7600mm) above floor the pattern at floor level is minimum diameter of 18 feet (5500mm).
- C. Dual-Technology Devices, Passive Infrared and Microwave: Combine the two detection methods described above in a single housing.



1. Detection by either or both methods results in an alarm signal. A control in device selects operating mode.

2.6 CONTROL PANEL

- A. Comply with UL Standard 1076.
- B. Cabinet: Lockable steel enclosure. Arrange panel so operations required for testing or for normal operation and maintenance are performed from front of enclosure. If more than single unit is required to form complete control panel, provide exact matching, keyed alike panels. Accommodate components and allow ample gutter space for interconnection of panels and field wiring. Identify each enclosure by engraved, laminated, phenolic resin nameplate. Lettering on enclosure nameplate shall not be less than 1 inch (25 mm) high. Identify individual components and modules within cabinets with permanent labels.
- C. Systems: Alarm and supervisory systems are separate and independent in control panel. Alarm-initiating zone boards in panel consist of plug-in cards. Arrangement requiring removal of field wiring for module replacement not permitted. Use Bosch D7412GV4-C-USA (complete) package containing the G7412GV4-USA control panel. The manufacturer has verified that the control panel will be produced for U.S. Postal Service Projects. **THE CONTRACTOR IS REQUIRED TO INFORM THE MANUFACTURER THAT THE CONTROL PANEL IS FOR A U.S. POSTAL SERVICE PROJECT.**
- D. Control Modules: Types and capacities as required to perform functions of system. Visible and audible signals in control panel indicate alarm, supervisory, and trouble conditions for each zone. Each type of audible alarm has distinct sound.
- E. Expansion Boards: Provide and install as many expansion boards (D8128D OCTOPOPITS) as necessary to connect all door contacts and motion sensors. All expansion boards shall be installed in the control panel cabinet or in a like cabinet immediately adjacent to the control panel cabinet. All unused points shall have EOL resistors installed. Popits are not allowed.
- F. Zones: Quantity of alarm and supervisory zones as indicated with capacity for expanding number of zones by minimum of 25 percent.
- G. Power Supply Circuits: Panel provides power for remote power-consuming detection devices. Provide adequate circuit capacity for at least a 25 percent increase in load. Transformer near the panel, minimum 18AWG copper wire. Earth ground, use 14-16AWG solid copper wire.
- H. Command center (keypad): Individual annunciation for each zone. Blue fluorescent vacuum alphanumeric display for each control panel section/area display devices on the keypad. Manual toggle test-switches or push test-buttons do not require key to operate. Alarm and supervisory signals display the associated zone.
 1. The alarm keypad shall not display or annunciate the status of any IDS components (i.e., motion sensor, entry delay tone, etc.) associated with the Criminal Investigative Office.
- I. Resetting: Controls permit silencing audible signals for individual zones but prevent the resetting of alarm, supervisory, or trouble signals while condition still exists.
- J. Alphanumeric Display and System Controls: Arrange for basic interface between human operator at control panel and system components, including annunciation and supervision. A display with minimum of 18 characters displays alarm, supervisory, and component status messages. Arrange keypad to enter and execute control commands.



2.7 SECURE-ACCESS CONTROL STATIONS

- A. Keypad and display module is arranged for entering and executing commands for system-status changes and for displaying system status and command-related data.

2.8 HORN

- A. 110 decibel horn powered by control panel with battery backup.

2.9 WIRE AND CABLE

- A. Stranded copper. Size conductors as indicated but not less than recommended by system manufacturer.
- B. Cable for Low-Voltage Control and Signal Circuits: All sensors and keypads will have wiring concealed inside walls or above ceiling in conduit. All sensors and keypad will be dedicated homerun wires to the D7412GV4-USA panel. Wire will be category2, unshielded, four-pair twisted 22 AWG stranded wire (conductors), except where manufacturer recommends shielded cable. Use wire colors red, green, black, orange, yellow, blue, brown, and white.

2.10 SPECIAL REQUIREMENTS FOR CABLE ROUTING AND INSTALLATION

- A. The majority of IDS wiring in this building will be installed above ceilings without conduit. All communications cabling used throughout this project shall comply with the requirements as outlined in the National Electric Code (NEC) article 725. All cabling shall bare CMP and/or appropriate markings for the environment in which they are installed.
- B. Sealing of openings between floors, through fire rated and smoke walls, existing or created by the contractor for cable pass through shall be the responsibility of the contractor. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of the contractor's work. Any openings created by or for this contractor and left unused shall also be sealed as part of this work.
- C. Cabling routed exterior of the building, underground, through inaccessible ceilings or less than 10'-0" A.F.F. in the workroom shall be contained in conduit. Provide flush boxes within finished areas and factory boxes in unfinished areas. Provide 3/4" conduit risers with 90 degree bend and bushing for all wall mounted devices.

2.11 POWER REQUIREMENTS

- A. Normal System Power Supply: 120 V 60 Hz from locked disconnect device. System components are supplied with power through system control panel.
- B. Power Source Transfer: When normal power is interrupted, system is automatically switched to backup supply without degradation of critical system function or loss of signals or status data.
 - 1. Backup Source: Batteries in power supplies of individual system components. Such batteries are an integral part of power supplies of components. When system is in "Alarm" mode, power source shall provide a minimum of 4 hours of battery backup, with 8 to 12 hours in "Normal" mode.
 - 2. Annunciation: Switching of system or any system component to backup power is indicated on system control panel as a change in system condition.



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Execution Requirements: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install system according to NFPA 70, applicable codes, and manufacturer's published instructions.
- B. Comply with UL Standard 681.
- C. Installer to be Bosch Security Certified. Installer will meter test the system to insure proper wiring and function. Do not leave installer lock code in panel. Lock code should be the Bosch Security default code. Alarm monitoring is done by the National Law Enforcement Control Center (NLECC), Tel: 1-877-MYNLECC or 1-877-696-5322, Fax: 1-651-306-6700. Postal Management must complete Burglary Alarm Information Form (BAIF) and send to NLECC. This needs to be done at least one week prior to the installer requesting programming. Leave all installation and operating instruction books inside cabinet.
 - 1. Questions regarding alarm monitoring at USPS sites should be directed to the following specialist:
 - a. Leonardo V. Martinez, Sr. Physical Security Specialist, Technical Services Division – NLECC, Dulles, Virginia, LVMartinez@uspis.gov
- D. Connection and Programming Protocol:
 - 1. The Contractor shall connect the panel to a telephone line using a RJ31x wired for line seizure.
 - 2. The Contractor shall call 877-696-5322 Mon – Fri between 8am and 8pm (Eastern Time) and request to speak with a USPIS Alarm Technician.
 - 3. The Contractor shall provide descriptive text for each point (zone) covered, and the point it was landed to on the Alarm Panel.
 - 4. The Contractor shall advise USPIS which points need a delay for Entry/Exit.
 - 5. The Contractor shall have all keypads addressed individually. (USPIS can provide support for this).
 - 6. The Contractor shall advise USPIS if any special code is needed to dial out on the Alarm Panel's phone line (9, 8, etc).
 - 7. The Contractor shall provide USPIS with all system information necessary for the completion of the programming template by USPIS. Upon completion of the template, USPIS will transmit program to the panel for final testing.
 - 8. Contractor will adjust the sensitivity of all sensors, adjust and mask if necessary to prevent false activations.
 - 9. Sensors will not be mounted in close proximity to air handling vents, as this will cause false activations.



10. No panic, smoke, sprinkler flow control or fire alarm monitoring will be supervised at the intrusion panel. Panic system device interface will not be permitted without advance special approval by HQ Security Group.
- E. Wiring Within Enclosures: Bundle, lace, and train conductors to terminal points with no excess. Provide and use lacing bars and distribution spools.
- F. Number of Conductors: As recommended by system manufacturer for functions indicated.
- G. Tighten connections to comply with tightening torques specified in UL Standard 486A.
- H. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so media are identified and coordinated with system wiring diagrams as specified in Section 260500.
- I. Install power supplies and other auxiliary components for detection devices at alarm control panel or at a data-gathering panel except as otherwise indicated. Do not install such items in vicinity of devices they serve.
- J. Install panel and keypad at locations indicated on Drawings and verified by Postal Inspection Service through Contracting Officer.
- K. Grounding: Ground system components and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common mode returns, noise pickup, cross talk, and other impairments.
- L. All IDS system wiring shall be homerun from each individual device back to IDS control panel.
- M. At IDS control panel consolidate individual cable runs at a junction box located above ceiling near the IDS control panel with a single conduit down to the IDS control panel. Splicing within any cable run is not acceptable.

3.3 CONSTRUCTION

- A. Interface with Other Work: Interface installation of intrusion detection system with closed circuit television system.

3.4 FIELD QUALITY CONTROL

- A. Inspection:
 1. Inspect equipment installation, interconnection with system devices, mounting locations, and mounting methods.
 2. Verify that units and controls are properly installed, connected, and labeled and that interconnecting wires and terminals are identified.
- B. Pretesting: Align and adjust system and perform pretesting of components, wiring, and functions to verify conformance with specified requirements. Correct deficiencies by replacing malfunctioning or damaged items with new items. Retest until satisfactory performance and conditions are achieved.
- C. Acceptance Operational Tests:
 1. Perform operational system tests to verify conformance with specifications. Test modes of system operation and intrusion detection. Methodically test for false alarms in each zone of space intrusion detection devices by simulating activities outside indicated detection patterns.
 2. Provide minimum 10 days notice of acceptance test performance schedule to Contracting Officer who will coordinate with Postal Inspection Service.



- D. Retesting: Correct deficiencies and retest until total system meets the requirements of Specifications and complies with applicable standards.

3.5 ADJUSTING

- A. Occupancy Adjustments: When requested within 1 year of date of Final Acceptance, provide on-site assistance in adjusting and reprogramming to suit actual occupied conditions. Provide up to 2 visits to site for this purpose at no additional cost to United States Postal Service.

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END OF SECTION 28 16 00 00



SECTION 28 23 00 00 - VIDEO SURVEILLANCE

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for video surveillance. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes a video surveillance system consisting of cameras, digital video recorder, data transmission wiring, and a control station with its associated equipment.
2. Video surveillance system shall be integrated with monitoring and control system specified in Division 13 Section "Perimeter Security", "Intrusion Detection", "Security Access", and PLC Electronic Detention Monitoring and Control Systems", which specifies systems integration.

C. Definitions

1. AGC: Automatic gain control.
2. BNC: Bayonet Neill-Concelman - type of connector.
3. B/W: Black and white.
4. CCD: Charge-coupled device.
5. FTP: File transfer protocol.
6. IP: Internet protocol.
7. LAN: Local area network.
8. MPEG: Moving picture experts group.
9. NTSC: National Television System Committee.
10. PC: Personal computer.
11. PTZ: Pan-tilt-zoom.
12. RAID: Redundant array of independent disks.
13. TCP: Transmission control protocol - connects hosts on the Internet.
14. UPS: Uninterruptible power supply.
15. WAN: Wide area network.

D. Performance Requirements

1. Seismic Performance: Video surveillance system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

E. Submittals

1. Product Data: For each type of product indicated. Include dimensions and data on features, performance, electrical characteristics, ratings, and finishes.
2. Shop Drawings: For video surveillance. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Functional Block Diagram: Show single-line interconnections between components for signal transmission and control. Show cable types and sizes.
 - c. Dimensioned plan and elevations of equipment racks, control panels, and consoles. Show access and workspace requirements.
 - d. UPS: Sizing calculations.
 - e. Wiring Diagrams: For power, signal, and control wiring.



3. Equipment List: Include every piece of equipment by model number, manufacturer, serial number, location, and date of original installation. Add pretesting record of each piece of equipment, listing name of person testing, date of test, set points of adjustments, name and description of the view of preset positions, description of alarms, and description of unit output responses to an alarm.
4. Seismic Qualification Certificates: For video surveillance, cameras, camera-supporting equipment, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 - d. Field quality-control reports.
 - e. Operation and Maintenance Data: For cameras, power supplies, infrared illuminators, monitors, videotape recorders, digital video recorders, video switches, and control-station components to include in emergency, operation, and maintenance manuals. Include the following:
 - 1) Lists of spare parts and replacement components recommended to be stored at the site for ready access.
5. Warranty: Sample of special warranty.

F. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NECA 1.
3. Comply with NFPA 70.
4. Electronic data exchange between video surveillance system with an access-control system shall comply with SIA TVAC.

G. Project Conditions

1. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 - a. Control Station: Rated for continuous operation in ambient temperatures of 60 to 85 deg F (16 to 29 deg C) and a relative humidity of 20 to 80 percent, noncondensing.
 - b. Interior, Controlled Environment: System components, except central-station control unit, installed in air-conditioned **OR** temperature-controlled, **as directed**, interior environments shall be rated for continuous operation in ambient temperatures of 36 to 122 deg F (2 to 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250, Type 1 enclosures.
 - c. Interior, Uncontrolled Environment: System components installed in non-air-conditioned **OR** non-temperature-controlled, **as directed**, interior environments shall be rated for continuous operation in ambient temperatures of 0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250, Type 3R **OR** Type 4 **OR** Type 12 **OR** Type 12K, **as directed**, enclosures.
 - d. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient temperatures of minus 30 to plus 122 deg F (minus 34 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph (137 km/h) and snow cover up to 24 inches (610 mm) thick, **as directed**. Use NEMA 250, Type 3 **OR** Type 3R **OR** Type 3S **OR** Type 4 **OR** Type 4X, **as directed**, enclosures.
 - e. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers shall be rated, listed, and installed according to NFPA 70.



- f. Corrosive Environment: System components subject to corrosive fumes, vapors, and wind-driven salt spray in coastal zones. Use NEMA 250, Type 4X **OR** Type 6P, **as directed**, enclosures.
- g. Security Environment: Camera housing for use in high-risk areas where surveillance equipment may be subject to physical violence.

H. Warranty

- 1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of cameras, equipment related to camera operation, and control-station equipment that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period: Three years from date of Final Completion.

1.2 PRODUCTS

A. System Requirements

- 1. Video-signal format shall comply with NTSC standard, composite interlaced video. Composite video-signal termination shall be 75 ohms.
- 2. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor's entry connection to components.
 - a. Minimum Protection for Power Connections 120 V and More: Auxiliary panel suppressors complying with requirements in Division 16 Section "Transient Voltage Suppression."
 - b. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Connections: Comply with requirements in Division 16 Section "Transient Voltage Suppression" as recommended by manufacturer for type of line being protected.
- 3. Tamper Protection: Tamper switches on enclosures, control units, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled. Control-station, control-unit alarm display shall identify tamper alarms and indicate locations.

B. Standard Cameras

- 1. B/W Camera:
 - a. Comply with UL 639.
 - b. Pickup Device: CCD interline transfer, 252,000 512(H) by 492(V) pixels, **unless directed otherwise**.
 - c. Horizontal Resolution: 380 lines.
 - d. Signal-to-Noise Ratio: Not less than 46 dB.
 - e. With AGC, manually selectable on or off.
 - f. Sensitivity: Camera shall provide usable images in low-light conditions, delivering an image at a scene illumination, as directed by the Owner, with camera AGC off, **as directed**.
 - OR**
 - Sensitivity: Camera shall deliver 1-V peak-to-peak video signal at the minimum specified light level. Illumination for the test shall be with lamps rated at approximately 2200-K color temperature, and with camera AGC off.
 - g. Manually selectable modes for backlight compensation or normal lighting.
 - h. Scanning Synchronization: Determined by external synch over the coaxial cable. Camera shall revert to internally generated synchronization on loss of external synch signal.
 - i. Motion Detector: Built-in digital.
- 2. Color Camera:
 - a. Comply with UL 639.
 - b. Pickup Device: CCD interline transfer, 380,000 771(H) by 492(V) pixels, **unless directed otherwise**.
 - c. Horizontal Resolution: 480 lines.
 - d. Signal-to-Noise Ratio: Not less than 50 dB, with camera AGC off.



- e. With AGC, manually selectable on or off.
- f. Sensitivity: Camera shall provide usable images in low-light conditions, delivering an image at a scene illumination, as directed by the Owner, with camera AGC off, **as directed.**
OR
Sensitivity: Camera shall deliver 1-V peak-to-peak video signal at the minimum specified light level. Illumination for the test shall be with lamps rated at approximately 2200-K color temperature, and with camera AGC off.
- g. Manually selectable modes for backlight compensation or normal lighting.
- h. Scanning Synchronization: Determined by external synch over the coaxial cable. Camera shall revert to internally generated synchronization on loss of external synch signal.
- i. White Balance: Auto-tracing white balance, with manually settable fixed balance option.
- j. Motion Detector: Built-in digital.
- 3. Automatic Color Dome Camera: Assembled and tested as a manufactured unit, containing dome assembly, color camera, motorized pan and tilt, zoom lens, and receiver/driver.
 - a. Comply with UL 639.
 - b. Pickup Device: CCD interline transfer, 380,000 768(H) by 494(V) pixels, **unless directed otherwise.**
 - c. Horizontal Resolution: 480 lines.
 - d. Signal-to-Noise Ratio: Not less than 50 dB, with camera AGC off.
 - e. With AGC, manually selectable on or off.
 - f. Sensitivity: Camera shall provide usable images in low-light conditions, delivering an image at a scene illumination, as directed by the Owner, with camera AGC off, **as directed.**
OR
Sensitivity: Camera shall deliver 1-V peak-to-peak video signal at the minimum specified light level. Illumination for the test shall be with lamps rated at approximately 2200-K color temperature, and with camera AGC off.
 - g. Manually selectable modes for backlight compensation or normal lighting.
 - h. Pan and Tilt: Direct-drive motor, 360-degree rotation angle, and 180-degree tilt angle. Pan-and-tilt speed shall be controlled by operator. Movement from preset positions shall be not less than 300 degrees per second.
 - i. Preset Positioning: Eight user-definable scenes, each allowing 16-character titles. Controls shall include the following:
 - 1) In "sequence mode," camera shall continuously sequence through preset positions, with dwell time and sequencing under operator control.
 - 2) Motion detection shall be available at each camera position.
 - 3) Up to four preset positions may be selected to be activated by an alarm. Each of the alarm positions may be programmed to output a response signal.
 - j. Scanning Synchronization: Determined by external synch over the coaxial cable. Camera shall revert to internally generated synchronization on loss of external synch signal.
 - k. White Balance: Auto-tracing white balance, with manually settable fixed balance option.
 - l. Motion Detector: Built-in digital.
 - m. Dome shall support multiplexed control communications using coaxial cable recommended by manufacturer.

C. Submersible Cameras

- 1. Camera: Color, designed for underwater monitoring and for inspecting pipes and storm drains. Attributes as follows:
 - a. Infrared LEDs to provide illumination in zero-light conditions.
 - b. 60-foot (18.3-m) factory-installed cable with BNC connector for video and a 2.1-mm jack for 12-V dc power supply.
 - c. An adjustable swivel mount and attachment base.
 - d. Pickup Device: CCD interline transfer, 290,000 500(H) by 580(V) pixels, **unless directed otherwise.**



- e. Horizontal Resolution: 380 lines.
 - f. Signal-to-Noise Ratio: Not less than 50 dB.
 - g. With AGC, from 4 to 39 dB.
 - h. Sensitivity: Camera shall provide usable images in low-light conditions, delivering an image at a scene illumination of 0.1 lux at f/2.0.
 - i. Scanning Synchronization: Internal.
 - j. White Balance: Auto-tracing white balance, for colors ranging from 2800 to 8200 deg K.
- D. Reinforced Dome Cameras
- 1. Camera: Designed for high-abuse locations, with a weathertight semirecessed **OR** surface, **as directed**, mounting, impact-resistance polycarbonate dome, and heavy-gage, 6061 T6 aluminum body.
 - a. Suitable for exterior environment, rated for continuous operation in ambient temperatures of minus 40 to plus 122 deg F (minus 40 to plus 50 deg C) dry bulb and up to 85 percent relative humidity.
 - b. Pickup Device: CCD interline transfer, 290,000 510(H) by 492(V) pixels, **unless directed otherwise**.
 - c. Horizontal Resolution: 350 lines.
 - d. Signal-to-Noise Ratio: Not less than 46 dB.
 - e. With AGC and automatic backlight compensation.
 - f. Sensitivity: Camera shall provide usable images in low-light conditions, delivering an image at a scene illumination of 6 lux at f/2.0.
 - g. Scanning Synchronization: Determined by external synch over the coaxial cable. Camera shall revert to internally generated synchronization on loss of external synch signal.
 - h. White Balance: Auto-tracing white balance.
- E. Lenses
- 1. Description: Optical-quality coated lens, designed specifically for video-surveillance applications and matched to specified camera. Provide color-corrected lenses with color cameras.
 - a. Auto-Iris Lens: Electrically controlled iris with circuit set to maintain a constant video level in varying lighting conditions.
 - b. Fixed Lens: With calibrated focus ring.
 - c. Zoom Lens: Motorized, remote-controlled unit, rated as "quiet operating." Features include the following:
 - 1) Electrical Leads: Filtered to minimize video signal interference.
 - 2) Motor Speed: Variable.
 - 3) Lens shall be available with preset positioning capability to recall the position of specific scenes.
- F. Power Supplies
- 1. Low-voltage power supplies matched for voltage and current requirements of cameras and accessories, and of type as recommended by manufacturer of camera, infrared illuminator, **as directed**, and lens.
 - a. Enclosure: NEMA 250, Type 1 **OR** Type 3 **OR** Type 4X, **as directed**.
- G. Infrared Illuminators
- 1. Description: Lighting fixtures that emit light only in the infrared spectrum, suitable for use with cameras indicated, for nighttime surveillance, without emitting visible light.
 - a. Field-Selectable Beam Patterns: Narrow, medium, and wide.
 - b. Rated Lamp Life: More than 8000 hours.
 - c. Power Supply: 12-V ac/dc **OR** 120-V ac, **as directed**.
 - 2. Area Coverage: Illumination to 150 feet (50 m) in a narrow beam pattern.
 - 3. Exterior housings shall be suitable for same environmental conditions as the associated camera.
- H. Camera-Supporting Equipment



1. Minimum Load Rating: Rated for load in excess of the total weight supported times a minimum safety factor of two.
2. Pan Units: Motorized automatic-scanning units arranged to provide remote-controlled manual and automatic camera panning action, and equipped with matching mounting brackets.
 - a. Scanning Operation: Silent, smooth, and positive.
 - b. Stops: Adjustable without disassembly, to limit the scanning arc.
3. Pan-and-Tilt Units: Motorized units arranged to provide remote-controlled aiming of cameras with smooth and silent operation, and equipped with matching mounting brackets.
 - a. Panning Rotation: 0 to 355 degrees, with adjustable stops.
 - b. Tilt Movement: 90 degrees, plus or minus 5 degrees, with adjustable stops.
 - c. Speed: 12 degrees per second in both horizontal and vertical planes.
 - d. Wiring: Factory prewired for camera and zoom lens functions and pan-and-tilt power and control.
 - e. Built-in encoders or potentiometers for position feedback, and thermostat-controlled heater, **as directed**.
 - f. Pan-and-tilt unit shall be available with preset positioning capability to recall the position of a specific scene.
4. Mounting Brackets for Fixed Cameras: Type matched to items supported and mounting conditions. Include manual pan-and-tilt adjustment.
5. Protective Housings for Fixed and Movable Cameras: Steel or 6061 T6 aluminum, **as directed**, enclosures with internal camera mounting and connecting provisions that are matched to camera/lens combination and mounting and installing arrangement of camera to be housed.
 - a. Tamper switch on access cover sounds an alarm signal when unit is opened or partially disassembled. Central-control unit shall identify tamper alarms and indicate location in alarm display. Tamper switches and central-control unit are specified in Division 13 Section "Intrusion Detection."
 - b. Camera Viewing Window: Polycarbonate **OR** Lexan, **as directed**, window, aligned with camera lens.
 - c. Duplex Receptacle: Internally mounted.
 - d. Alignment Provisions: Camera mounting shall provide for field aiming of camera and permit removal and reinstallation of camera lens without disturbing camera alignment.
 - e. Built-in, thermostat-activated heater and blower units. Units shall be automatically controlled so the environmental limits of the camera equipment are not exceeded.
 - f. Sun shield shall not interfere with normal airflow around the housing.
 - g. Mounting bracket and hardware for wall or ceiling mounting of the housing. Bracket shall be of same material as the housing; mounting hardware shall be stainless steel.
 - h. Finish: Housing and mounting bracket shall be factory finished using manufacturer's standard finishing process suitable for the environment.
 - i. Enclosure Rating: as directed by the Owner.

I. Monitors

1. Monochrome:
 - a. Metal cabinet units designed for continuous operation.
 - b. Screen Size (Diagonal Dimension): as directed by the Owner.
 - c. Horizontal Resolution: 600 lines, minimum, at center.
 - d. Minimum Front Panel Devices and Controls: Power switch; power-on indicator; and brightness, horizontal-hold, vertical-hold, and contrast controls.
 - e. Mounting: Adjustable tilting and training.
 - f. Mounting: Single, 14-inch (356-mm) **OR** Dual, 9-inch (229-mm), **as directed**, vertical, EIA 19-inch (483-mm) electronic equipment rack or cabinet complying with CEA 310-E.
 - g. Electrical: 120-V ac, 60 Hz.
2. Color:
 - a. Metal cabinet units designed for continuous operation.
 - b. Screen Size (Diagonal Dimension): as directed by the Owner.
 - c. Horizontal Resolution: 300 lines.



- d. Minimum Front Panel Devices and Controls: Power switch; power-on indicator; and brightness, contrast, color, and tint controls.
- e. Degaussing: Automatic.
- f. Mounting: Single, 14-inch (356-mm) **OR** Dual, 9-inch (229-mm), **as directed**, vertical, EIA 19-inch (483-mm) electronic equipment rack or cabinet complying with CEA 310-E.
- g. Electrical: 120-V ac, 60 Hz.

J. Videotape Recorders

- 1. Description: Industrial, time-lapse type recorder, designed for continuous operation. Tape format is 1/2 inch (13 mm) using industrial-grade, T-120 cassettes.
 - a. Horizontal Resolution: 400 lines, minimum.
 - b. Recording Heads: Rotary-scan type.
 - c. Integral Timer: Permits programming of recording operation for adjustable daily and weekly periods.
 - d. Time-Lapse Operating Modes: Multiple, covering 24 to 240 hours, minimum.
 - e. Other Operating Modes:
 - 1) Manual play and recording at two- and six-hour speeds.
 - 2) Forward and reverse high-speed search.
 - 3) Reverse, slow, and single-frame play.
 - f. Alarm Recording: Operating mode is automatically switched from time-lapse to two- or six-hour recording mode when an externally generated alarm signal is received.
 - g. Audio Recording: 70 to 7000 Hz. Phono and microphone input; phono output.
 - h. Time and Date Generator: Records time and date legend in corner of recorded scenes.
 - i. Tape Counter: Displays tape position.
 - j. Manual Recording Lock: Key or keypad operated. Prevents unauthorized tampering or control changes during preset operation.
 - k. Signal-to-Noise Ratio: 45 dB for video output in standard play mode.
 - l. Mounting: Standard 19-inch (483-mm) rack complying with CEA 310-E, or freestanding desktop.

K. Digital Video Recorders

- 1. Description: Digital, time-lapse type, full-frame and motion recorder, with removable hard drive.
 - a. Recording Time: 400 hours minimum.
 - b. Resolution: 720 by 480 lines, minimum.
 - c. Programming shall be from trackball and push buttons on face of the recorder, settings shall be displayed on any video monitor connected to the recorder. Programming shall include the following:
 - 1) Motion analysis graph.
 - 2) Password protection.
 - 3) Alarm and timer controls.
 - 4) Continuous recording option.
 - 5) Time-lapse operating modes.
 - 6) Search video by time, event, or motion.
 - d. Programming: SmartMedia card for software updating, image archiving, and image transfer to a PC.
 - e. Storage: 80-GB, **unless directed otherwise**, removable hard drive. Software shall permit hot-swapping drives.
 - f. Compression: MPEG-2.
 - g. Time and Date Generator: Records time (hr:min:sec) and date legend of each frame.
 - h. Audio Recording: 70 to 7000 Hz. Phono and microphone input; phono output.
 - i. Mounting: Standard 19-inch (483-mm) rack complying with CEA 310-E, or freestanding desktop.

L. Network Video Recorders

- 1. External storage or internal 250-1, 500-GB hard disk drive.
 - a. Video and audio recording over TCP/IP network.



- b. Video recording of MPEG-2 and MPEG-4 streams.
- c. Video recording up to 48 Mbps for internal storage and up to 100 Mbps for external storage.
- d. Duplex Operation: Simultaneous recording and playback.
- e. Continuous and alarm-based recording.
- f. Full-Featured Search Capabilities: Search based on camera, time, or date.
- g. Automatic data replenishment to ensure recording even if network is down.
- h. Digital certification by watermarking.
- i. Internal RAID storage or non-RAID storage of up to 1500 GB.
- j. Capable of adding external RAID storage up to 7000 GB for models with no internal storage.
- k. Full integration with LAN, Intranet, or Internet through standard Web browser or video management software.
- l. Integrated Web server FTP server functionality.
- m. Supports up to 16, 32, or 64 devices.

M. Digital Switchers

1. Quad Switch: For displaying images from four cameras on a single monitor. Provide color switcher if one or more cameras or monitors are in color.
 - a. Controls: Unit-mounted front panel.
 - b. Resolution: 720 by 480 lines, **unless directed otherwise**.
 - c. Modes: Auto, manual, and alarm. In manual mode, each channel can also be viewed in single display mode. In the event of an alarm, alarming channel shall automatically switch to full screen. If several alarms are activated, channels in alarm shall be in auto-switching mode.
 - d. Channel Loss Alarm: Audible buzzer; occurrence details shall be recorded.
 - e. Time: Indicate date and time.
 - f. Timing of Auto-Switcher: 1 to 30 seconds, selectable.
 - g. Mounting: Standard 19-inch (483-mm) rack complying with CEA 310-E, or freestanding desktop.
2. Manual Switch Bank: Low-loss, high-isolation, multiple-video switch to allow manual switching of multiple quad switches and cameras to a single output. Switches shall be illuminated.
3. Sequential Switchers: Automatically sequence outputs of multiple cameras to single monitor and videotape recorder.
 - a. Switching Time Interval: Continuously adjustable, 5 to 20 seconds minimum, with manual override.
 - b. Skip-Sequential-Hold Switch: One for each camera, with LED to indicate active camera.
 - c. Camera Identification Legend: Either on-screen message or label at skip-sequential switch.
 - d. Alarm Switching: In the event of an alarm, alarming channel shall automatically switch the monitor to full screen.
 - e. Mounting: Standard 19-inch (483-mm) rack complying with CEA 310-E.
4. PTZ Controls: Arranged for multiple-camera control, with switches to select camera to be controlled.
 - a. Pan-and-Tilt Control: Joystick type.
 - b. Zoom Control: Momentary-contact, "in-out" push button.
 - c. Automatic-Scan Control: A push button for each camera with pan capability that places camera in automatic-scanning mode.

N. IP Video Systems

1. Description:
 - a. System shall provide high-quality delivery and processing of IP-based video, audio, and control data using standard Ethernet-based networks.
 - b. System shall have seamless integration of all video surveillance and control functions.



- c. Graphical user interface software shall manage all IP-based video matrix switching and camera control functions, two-way audio communication, alarm monitoring and control, and recording and archive/retrieval management. IP system shall also be capable of integrating into larger system environments.
 - d. System design shall include all necessary compression software for high-performance, dual-stream, MPEG-2/MPEG-4 video. Unit shall provide connections for all video cameras, camera PTZ control data, bidirectional audio, discreet sensor inputs, and control system outputs.
 - e. All camera signals shall be compressed, encoded, and delivered onto the network for processing and control by the IP video-management software.
 - f. Camera system units shall be ruggedly built and designed for extreme adverse environments, complying with NEMA Type environmental standards.
 - g. Encoder/decoder combinations shall place video, audio, and data network stream that can be managed from multiple workstations on the user's LAN or WAN.
 - h. All system interconnect cables, workstation PCs, PTZ joysticks, and network intermediate devices shall be provided for full performance of specified system.
- O. Video Motion Sensors (Interior)
- 1. Device Performance: Detect changes in video signal within a user-defined protected zone. Video inputs shall be composite video as defined in SMPTE 170M. Provide an alarm output for each video input.
 - a. Detect movement within protected zone of intruders wearing clothing with a reflectivity that differs from that of background scene by a factor of two. Reject all other changes in video signal.
 - b. Modular design that allows for expansion or modification of number of inputs.
 - c. Controls:
 - 1) Size of detection zones.
 - 2) Sensitivity of detection of each protected zone.
 - d. Mounting: Standard 19-inch (483-mm) rack complying with CEA 310-E.
- P. Control Stations
- 1. Description: Heavy-duty, freestanding, modular, metal furniture units arranged to house electronic equipment. Coordinate component arrangement and wiring with components and wiring of other systems.
 - 2. Equipment Mounting: Standard 19-inch (483-mm) rack complying with CEA 310-E.
 - 3. Normal System Power Supply: 120 V, 60 Hz, through a locked disconnect device and an isolation transformer in central-station control unit. Central-station control unit shall supply power to all components connected to it unless otherwise indicated.
 - 4. Power Continuity for Control Station: Batteries in power supplies of central-station control units and individual system components shall maintain continuous system operation during outages of both normal and backup ac system supply.
 - a. Batteries: Rechargeable, valve-regulated, recombinant, sealed, lead-acid type with nominal 10-year life expectancy. Capacity adequate to operate portions of system served including audible trouble signal devices for up to four hours and audible and visual alarm devices under alarm conditions for an additional 10 minutes.
 - b. Battery Charger: Solid-state, fully automatic, variable-charging-rate type. Charger shall recharge fully discharged battery within 24 hours.
 - 5. Annunciation: Indicate change in system condition and switching of system or component to backup power.
- Q. Signal Transmission Components
- 1. Cable: Coaxial cable elements have 75-ohm nominal impedance. Comply with requirements in Division 16 Section "Conductors and Cables for Electronic Safety and Security."
 - 2. Video Surveillance Coaxial Cable Connectors: BNC type, 75 ohms. Comply with requirements in Division 16 Section "Conductors and Cables for Electronic Safety and Security."



1.3 EXECUTION

A. Examination

1. Examine pathway elements intended for cables. Check raceways and other elements for compliance with space allocations, installation tolerance, hazards to camera installation, and other conditions affecting installation.
2. Examine roughing-in for LAN, WAN, and IP network before device installation.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Wiring

1. Comply with requirements in Division 16 Section "Raceways and Boxes."
OR
Wiring Method: Install cables in raceways unless otherwise indicated.
 - a. Except raceways are not required in accessible indoor ceiling spaces and attics.
OR
Except raceways are not required in hollow gypsum board partitions.
 - b. Conceal raceways and wiring except in unfinished spaces.
2. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.
3. Splices, Taps, and Terminations: For power and control wiring, use numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
4. For LAN connection and fiber-optic and copper communication wiring, comply with Division 16 Sections "Communications Backbone Cabling" and "Communications Horizontal Cabling."
5. Grounding: Provide independent-signal circuit grounding recommended in writing by manufacturer.

C. Video Surveillance System Installation

1. Install cameras and infrared illuminators level and plumb.
2. Install cameras with 84-inch- (2134-mm-) minimum clear space below cameras and their mountings. Change type of mounting to achieve required clearance.
3. Set pan unit and pan-and-tilt unit stops to suit final camera position and to obtain the field of view required for camera. Connect all controls and alarms, and adjust.
4. Install power supplies and other auxiliary components at control stations unless otherwise indicated.
5. Install tamper switches on components indicated to receive tamper switches, arranged to detect unauthorized entry into system-component enclosures and mounted in self-protected, inconspicuous positions.
6. Avoid ground loops by making ground connections only at the control station.
 - a. For 12- and 24-V dc cameras, connect the coaxial cable shields only at the monitor end.
7. Identify system components, wiring, cabling, and terminals according to Division 16 Section "Electrical Identification."

D. Field Quality Control

1. Perform tests and inspections.
2. Tests and Inspections:
 - a. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.
 - b. Pretesting: Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements. Conduct tests at varying lighting levels, including day and night scenes as applicable. Prepare video-surveillance equipment for acceptance and operational testing as follows:
 - 1) Prepare equipment list described in "Submittals" Article.



- 2) Verify operation of auto-iris lenses.
 - 3) Set back-focus of fixed focal length lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Adjust until image is in focus with and without the filter.
 - 4) Set back-focus of zoom lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Additionally, set zoom to full wide angle and aim camera at an object 50 to 75 feet (17 to 23 m) away. Adjust until image is in focus from full wide angle to full telephoto, with the filter in place.
 - 5) Set and name all preset positions; consult Owner's personnel.
 - 6) Set sensitivity of motion detection.
 - 7) Connect and verify responses to alarms.
 - 8) Verify operation of control-station equipment.
 - c. Test Schedule: Schedule tests after pretesting has been successfully completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.
 - d. Operational Tests: Perform operational system tests to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.
 3. Video surveillance system will be considered defective if it does not pass tests and inspections.
 4. Prepare test and inspection reports.
- E. Adjusting
1. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Tasks shall include, but are not limited to, the following:
 - a. Check cable connections.
 - b. Check proper operation of cameras and lenses. Verify operation of auto-iris lenses and adjust back-focus as needed.
 - c. Adjust all preset positions; consult Owner's personnel.
 - d. Recommend changes to cameras, lenses, and associated equipment to improve Owner's use of video surveillance system.
 - e. Provide a written report of adjustments and recommendations.
- F. Cleaning
1. Clean installed items using methods and materials recommended in writing by manufacturer.
 2. Clean video-surveillance-system components, including camera-housing windows, lenses, and monitor screens.
- G. Demonstration
1. Train Owner's maintenance personnel to adjust, operate, and maintain video-surveillance equipment.

END OF SECTION 28 23 00 00



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SECTION 28 23 04 00 - CSF SECURITY, BURGLARY AND ROBBERY COUNTERMEASURES ANALOG CCTV

NOTE TO SPECIFIER

Use this Specification Section for Customer Service Facilities only. This specification may be used for small CCTV projects that are independent from an existing, or planned, IP CCTV system when 16 or fewer cameras are required. Typical use would be for small access control projects, retail, security, burglary and robbery countermeasures projects and replacement of failed components in existing analog CCTV systems.

**** THIS ENTIRE SECTION CONSISTS OF REQUIRED PARTS OR ARTICLES. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Provide and install a complete analog CCTV System including, but not limited to;
 - a. Video Surveillance Cameras, housings, power supplies, cabling, and related equipment.
 - b. Video control equipment.
 - c. Video monitoring and recording equipment.
 - d. Equipment enclosures.

B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents including:

1. System Installation Manuals

C. Related Sections:

1. Section 260500 - Common Work Results for Electrical.
2. Section 260533 - Raceway and Boxes for Electrical Systems.
3. Section 270500 - Common Work Results for Communications.
4. Section 281304 - Enterprise Physical Access Control System.
5. Section 281600 - Intrusion Detection.

D. Prompt Payments. In accordance with the Contractor Certification on Postal Service Form 4211B, "Project Contract Payment Authorization", the contractor certifies that prompt payment, (within 30 days) to the subcontractor (CCTV Provider) will be made.

1.2 REFERENCES

A. National Fire Protection Association (NFPA):

1. NFPA 70 - National Electrical Code.

1.3 SYSTEM DESCRIPTION

- ##### A. Design Requirements: Closed circuit television (CCTV) analog video communication system for no more than 16 analog cameras between points of surveillance indicated on Drawings and central monitoring station consisting of video cameras, camera outlets, camera controls, monitors, video switcher, signal-processing equipment, control stations, distribution components, video recorders, and accessories.



1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures:

1. Product Data: Manufacturer's specification sheets for each component shall not be required.
2. Due to USPS security requirements, submittals will be limited to one electronic copy of the block diagram and one copy of the shop drawings to be provided to the General Contractor.
3. Final As-Built Drawings, Operation and Installations Manual, will be supplied directly to USPS and stored within the rack per USPS COTR.

B. Shop Drawings:

1. The CCTV Provider will provide a Standard Drawing Package (Red Book) that shall be utilized for the installation of the CCTV system. This package shall include:
 - a. Block Diagram: System block diagrams noting major system components and interrelationships of each component.
 - b. Console and Equipment Racks: Rack elevation drawings showing console/equipment arrangement.

C. Sequence and Scheduling Plan: Installer shall provide installation scheduling plan for review and approval. Coordinate scheduling of software and revisions with the USPS.

D. Qualifications:

1. Installer: Factory Certified Dealer specializing in CCTV systems installation. Installer shall be capable of performing the Work specified in this Section with minimum 3 years documented experience in the field and authorized and approved by the CCTV Provider to install Postal Service systems.

E. Section 017704 - Closeout Procedures and Training:

1. Operation and Maintenance Data: Include data for each type of product, including features and operating sequences, both automatic and manual. This information shall be supplied directly to the USPS by the Direct Vendor.
2. Product Quick Reference cards for the operation of all key system components.
3. Project Record Documents: Installer shall provide field-accurate drawings that reflect actual locations of cameras and routing of signal cable, indicating cable identifiers, layout, location and numbering of system devices to reflect as-built conditions.
4. Provide a final materials list of equipment installed and spare parts on hand. Materials list shall include model number, serial number, and date installed.
5. Project Completion Certification: Document signed by the installing integrator and a Postal Service representative indicating that the project is fully complete with all punch-listed items resolved.
6. OPERATING INSTRUCTION
 - a. Provide on-site instruction to review the operation of the system and detail any common troubleshooting or maintenance that is required to ensure normal operation.
 - b. Provide one complete set of equipment operating, installation, and programming manuals that will remain at the installed location.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Keep devices and equipment in manufacturer's packaging in a secured location until system is ready for installation.
- C. Comply with manufacturer's requirements. Coordinate storage location with the Postal Service.
- D. The equipment delivered must be insured at the contractor's expense through acceptance.



1.6 CCTV PROVIDER WARRANTY/SERVICE/TECHNICAL SUPPORT PLAN

A. Warranty:

1. Provide manufacturer warranty for three (3) years after facility acceptance and project completion certification for materials and labor.
 - a. Warranty shall include all parts and labor, and shall include return shipping. Failed equipment shall be repaired or replaced at no charge to the Postal Service during the warranty period.
 - b. USPS shall not be required to process any paperwork in order to be entitled to service plan coverage. It is the CCTV Provider's sole responsibility to monitor and comply with warranty eligibility.
 - c. Where operational performance is substantially affected, all software and firmware shall be upgraded to the latest version supported by the purchased hardware platform throughout the service plan period and be provided at no cost to USPS. Such upgrades shall be covered under the warranty/service plan and are at the discretion of the Postal Inspector or Station Manager.
 - (i) Any software bugs identified by the USPS and mutually agreed upon as 'level one' bugs (impacting operation with no work-around) shall be rectified within two (2) weeks of their being reported.
 - (ii) Any software bugs identified by the USPS and mutually agreed upon as 'level two' bugs (impacting operation but with a work-around) shall be rectified within 90 days of their being reported.
 - d. Turnaround time for all repairs (warranty and out-of-warranty) shall not exceed 72 hours.
 - (i) CCTV Provider shall make advance replacement units available in cases where USPS operational issues require immediate replacement of a unit while minimizing down time.
 - (ii) In situations where a complete facility system is not being supplied but only replacements for certain aged equipment, the warranty will only apply to the equipment being replaced

B. Technical Support

1. CCTV Provider shall provide toll-free 24/7 technical support at no charge throughout the warranty period.
2. Data Recovery — CCTV Provider shall provide a service to assist the USPS in recovering data from digital recording system hard drives and removable storage media in the event of a failure.
 - a. Turnaround time for data recovery shall be less than seven (7) days from receipt of hard drives at CCTV Provider's data recovery center.

PART 2 PRODUCTS

2.1 PROVIDERS

A. DIEBOLD, INC.

Michael Tracey, USPS Account Manager
 44845 Falcon Place Suite 106
 Sterling, VA 20166
 Cell: 571-451-7629
 email: michael.tracey@diebold.com

1. Contract to Diebold should be addressed to:
 Diebold Inc.
 3 Westchester Plaza
 Elmsford, NY 10523

B. VICON INDUSTRIES, INC.

Christine Stone, USPS Program Manager
 89 Arkay Drive
 Hauppauge, NY 11788
 (800) 645-9116 or (631) 952-2288



Fax (631) 951-2288

Email: USPS@vicon-cctv.com

C. Section 016000 - Product Requirements:

1. Product options and substitutions are not permitted without a written and USPS approved deviation.
2. All equipment to be supplied under this specification shall be new and the current model of the Provider.
3. Systems and components shall have been thoroughly tested and proven in actual use.

2.2 VIDEO MONITORS

A. Provide 17-inch LCD flat-panel color monitors with the following minimum capabilities.

1. Product Requirements:
 - a. Video Input Connections: VGA (DB15), and Composite (BNC).
 - (i) Switching between inputs shall be performed using a front panel control.
 - (ii) VGA resolution shall be equal to the native resolution of the installed Digital Video Recorder, if applicable.
 - b. Input Power: 120VAC, 60Hz (a power adaptor may be used to provide this voltage).
 - c. Mounting: Each monitor shall be desktop mounted. VESA mounting holes shall be provided and a series of optional VESA compliant mounts shall be made available at extra cost.
 - d. Operating Temperature: Range shall be equal to or greater than 10 to 40 degrees Celsius.
 - e. Humidity: Withstand a minimum of 10% to 80% humidity.
 - f. Resolution: At least 420 TV lines of composite video.
 - g. Adjustments: Must support on-screen display for setup and adjustment of monitor parameters.
 - h. Colors: Must support a minimum of 16 million colors.

2.3 VIDEO CAMERAS

A. Provide solid-state color cameras for video surveillance and monitoring of specific areas as shown on the drawings and confirmed with Postal Inspection Service through Contracting Officer with the following minimum capacities:

1. FIXED POSITION INDOOR/OUTDOOR IMPACT/VANDAL RESISTANT DOME TYPE VIDEO CAMERAS: Shall meet or exceed the following minimum requirements:
 - a. CCD Image Sensor: High resolution color with digital image processing.
 - b. Horizontal Resolution: 480 or greater TVL.
 - c. Auto Iris Control.
 - d. White Balance: Automatic.
 - e. Input Power: 24VAC, 60Hz with line locking.
 - f. Automatic Gain Control.
 - g. Backlight Compensation.
 - h. BNC or UTP (screw terminal) video connector, as required.
 - (i) If UTP connection is used, unit must be in full compliance with UTP specifications outlined in Section 2.8.
 - i. Lens: 3.3-12mm manual varifocal lens, application permitting.
 - (i) Lens substitution may be required to provide an acceptable image based on camera position, field of view, and distance to subject..(ii).Three axis adjustment (pan, tilt & roll)
2. REMOTELY POSITIONABLE (PTZ) VIDEO CAMERAS: Integrated camera/lens packages in a dome type housing, shall be remotely positionable (pan/tilt/zoom/focus/iris) shall meet or exceed the following minimum requirements:
 - a. Horizontal Resolution: 470 TVL or greater.
 - b. Optical Zoom: Minimum 22X.
 - c. Automatic Focus / Iris Control with manual override.



- d. Rotation Speed: Shall range from 0.1 degrees/second to 120 degrees/second with a minimum of 32 speeds in any direction.
 - e. Tilt Speed: 0.2 degrees per second to 90 degrees per second.
 - f. Proportional Pan-Tilt: Yes.
 - g. Presets: At least 32 Individual presets.
 - h. Alarm Inputs: At least one programmable high or low input.
 - i. Alarm Outputs: At least one auxiliary relay output or one open collector driver.
 - j. Operating Voltage: 24VAC nominal, with an operating range of 18 to 32VAC.
 - k. Programming Backup: Dome shall retain all programmed parameters for a minimum of thirty (30) days.
 - l. Lower Dome:
 - (i) Interior Domes – Gradient tint required to obscure the movement of camera.
 - (ii) Exterior Domes – Gradient tint required to obscure the movement of camera.
- B. Products shall utilize internal or external surge protection such that a normally occurring power surge shall not void any manufacturer's warranty.

2.4 CAMERA POWER SUPPLIES:

- A. Interior Cameras: Camera power supplies shall be located within 500' of the camera, either in the CIO (distance permitting) or in another suitable protected area. Provide multiple outlet (4, 8, or 16) fused power supplies as required for interior fixed and PTZ cameras. See drawings G5-7-1a or G5-8-3b. Power supplies shall be rated to support 200% of the actual (nominal) power loading.
 - 1. A minimum of two (2) power supplies shall be used on each project, regardless of camera count.
 - 2. Cameras must be on separate power supplies, such that the failure of a single power supply shall not impact two adjacent cameras.
- B. Exterior Cameras: Provide individual power supplies located at the camera.
 - 1. Enclosures shall be weatherproof and sealed to prevent water and/or insect infiltration.
- C. Provide a means for disconnecting camera power supplies from mains power at the power supply enclosure, either through a detachable power cord, master fuse or circuit breaker, or other UL approved switching device.

2.5 VIDEO CAMERA HOUSINGS AND MOUNTS

- A. Provide indoor housings as required for all camera types with the following minimum capabilities:
 - 1. Interior Cameras:
 - a. All cameras shall be in a housing that is coordinated with adjacent finishes with the appropriate mounting hardware. Selection of housings and mounts, including incremental changes to paint colors, dome materials, and cosmetic finishes shall be approved by the USPS or their authorized agent.
 - b. All housings shall be sufficiently dust and moisture resistant to withstand normal environmental conditions in their chosen installation location.
 - c. Hardware shall be provided to ensure tamper-resistant mounting in a variety of locations without modification to the integrity of the housing.
 - d. Where used, pendant mounts shall be suitable for use as wall, ceiling and column mounts. Pendant mounts shall attach to the appropriate camera housing using installer provided standard threaded schedule 40 rigid iron pipes. Pipe lengths of 10 feet or less are to be a minimum of 1-inch diameter. Pipe lengths exceeding 10 feet are to be a minimum of 1-1/2 inch in diameter. Exterior pipe shall be galvanized.
 - e. All mounts shall incorporate installer provided safety chain or cable of sufficient endurance to support 2 times the weight of the equipment.
 - 2. Exterior Cameras:
 - a. Environmental: Thermostatically controlled heaters and blowers with defrosting capabilities.
 - b. Moisture: Rainproof seals and gaskets.



- c. Wind Resistance: Rated for 80mph sustained winds.
- d. Ambient Temperature Rating: -10 to 60 degrees Celsius.
 - (i) Areas with more demanding environmental conditions will be granted a deviation from this specification.

2.6 DIGITAL VIDEO RECORDERS

A. ROBBERY, BURGLARY AND COUNTERMEASURES, SECURITY (SITE AND ACCESS CONTROL) ANALOG CCTV SYSTEMS

1. Recording must be continuous in nature, with a series of "key frames" which periodically refresh the entire video image. The frequency of these key frames must be sufficient to allow the full range of motion to be visible.
2. Video images shall be recorded with sufficient resolution, color depth, and quality of image compression as to make the recorded image indistinguishable from a DVD sourced original.
3. The DVR shall support event driven recording. Events may be internally generated (motion analysis, video loss or presence), or externally triggered (contact closure).
4. Image Exporting — The system shall have the ability to export video images as follows:
 - a. Video Printing — The system shall allow for easy printing of still images.
 - (i) Images may be printed to standard, Windows™ based printer that does not require proprietary drivers.
 - (ii) Printer may be directly connected to the DVR or may be connected to a workstation to view the image via USP or Parallel port.
 - b. Still Images — Still images may be saved using the JPEG file format, for printing at a later time or electronic distribution.
 - c. CD-R and DVD recordable formats — Image shall be archived to DVD and CD in each of the following formats.
 - (i) *Proprietary* — Image may be saved in a format that provides authentication to ensure that the image has not been altered in any way. Such authentication must not alter the quality of the video image. Software to allow viewing of this proprietary format that may be freely copied and distributed at no further cost to the USPS must be provided.
 - (ii) *Standard* — Image may be saved in an open source format which may be distributed and played using a commonly available media player, such as Apple™ QuickTime™ or Microsoft™ Media Player™.
 - (iii) *Analog Out* — An analog output shall be provided that may be connected to a video monitor, VCR, or other analog recording or display device. The use of an external device to perform this function is acceptable.
5. The DVR shall auto restart on power failure.
 - a. The unit will automatically begin recording upon restoration of power.
 - b. The system must maintain all camera name and scheduling information and must return in the state it was programmed to be in at the time of the power failure.
 - c. The system must retain correct time and date information.
6. Input Connections
 - a. The system must support a minimum of 4 cameras.
 - b. All video inputs shall use a BNC connection.
 - c. Capability shall be provided to loop each video input signal to an additional device, through the use of an adaptor cable.
7. Output Connections
 - a. Composite video outputs (internal to the DVR or via an external device) shall be NTSC utilizing BNC connectors.
 - b. The system must utilize a VGA computer monitor for main screen user navigation and video viewing.
8. Record Duration – The DVR shall include online storage of 72 hours with less than 30 seconds required to retrieve a video clip.



- a. In order to calculate storage capacity, the following assumption may be used: All cameras are in high activity areas. These cameras will experience a large number of frequent image changes such as busy areas with many people walking or movement of heavy equipment.
 - b. Manufacturer shall make units available with greater recording duration which may be substituted through the USPS deviation process.
- 9. Frame Rate
 - a. ROBBERY, BURGLARY, AND COUNTERMEASURES, SECURITY (SITE AND ACCESS CONTROL) –
 - (i) 4 to 16 total cameras shall utilize an embedded 16 channel digital video recorder each channel capable of 15fps @ 4CIF with one terabyte of storage.
- 10. Duplex Operation — The system shall be capable of simultaneously performing a minimum of any two of the following functions:
 - a. recording video
 - b. displaying live video
 - c. playing back recorded video
 - d. exporting stored video
- 11. Video Monitoring
 - a. Images being played back may be synchronized or stopped (frozen) individually.
 - b. Provide multiple views on the same screen during playback or live video view.
 - c. Display software shall provide for multi-camera viewing using a variety of multi-screen display modes.
 - (i) These multiple images may be exported in such a manner as to allow later synchronized playback of the same series of images.
 - d. Provide the ability to digitally enhance video images, to increase or decrease contrast and brightness, correct image color characteristics, and digitally zoom in on the image.
 - e. Provide a full suite of search tools to allow the search and retrieval of images based on time, date, motion (within pre-defined screen areas), alarm, video loss, and video presence.
 - f. Provide the ability to sequence a number of individual video segments such that a composite video clip can be made of a series of individual clips or incidents.
 - g. Frame rate shall be adjustable on an individual camera basis in a range that extends from ~3 images per second (ips) to real-time which shall be indistinguishable from NTSC 30 ips video.

2.7 UNSHIELDED TWISTED PAIR (UTP) MODULES

- A. Unshielded twisted pair (UTP) modules will be used for cable runs where a signal must be transmitted further than 50 feet unless Fiber Optic transmission is a requirement (see Section 2.9).
 - 1. Passive Transceivers:
 - a. Signal Transmission: Units shall be used at the signal transmission end for all distances under 1,200 linear feet or less, unless the specific conditions outlined in Section 2.9 exist. Signal transmission end is defined as the end of the cable run where a signal is generated (camera or video output).
 - b. Signal Reception: Units shall be used at the signal reception end for all distances less than or equal to 500 feet. Signal reception end is defined as the end of the cable where a signal is received (monitor or video input).
 - c. Specifications:
 - (i) Passive UTP Transceivers shall be capable of transmitting and receiving baseband type monochrome or color video signals over unshielded twisted pair Category 5e or better (UTP) cable, up to a maximum cable distance of 500 feet with a transceiver device connected at each end of the cable.
 - (ii) The transceiver device shall be capable of driving a color video signal of NTSC standard 525 lines with an operating frequency range of DC to 10 MHz and common mode rejection to be greater than 60 dB.
 - (iii) The transceiver devices shall not require power to operate as specified.
 - (iv) The transceiver used as a transmitting device shall be designed to accept a baseband video signal from a 75 ohm impedance source and the transceiver used as a receiving

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- device shall deliver a baseband video signal capable of driving a 75 ohm impedance load.
- (v) The transceiver device shall support bi-directional signal transmission, i.e.; video from the video source to the receiving equipment and control from the receiving end to the video source equipment over a single unshielded twisted pair (UTP) using equipment that provides such bi-directional operation during the vertical interval.
 - (vi) Video connection to the transceiver device shall be by means of a BNC type female connector and connection to UTP cable shall be by means of two Phillips type head screw terminals. The screw terminals shall be plated with a rust preventive material to prevent corrosion.
 - (vii) The transceiver device shall be capable of driving an active (powered) companion UTP receiver, operating at a distance of up to 1,200 feet over cables specified for that unit.
 - (viii) The combination of the transceiver device and the active receiver shall provide a minimum of 500 lines of video resolution.
 - (ix) The transceiver devices shall operate within specifications without causing interference or interfering with any other base band video, communication, data and/or other low-voltage signals operating in multi-twisted pair UTP cables.
- d. Receivers (transceivers used at the receiving end) shall be four-channel units and shall be secured to a rack panel or other permanent surface. Individual, loose receivers are not acceptable.
2. Active Receivers:
- a. Signal Reception: Units shall be used at the signal reception end for all distances greater than 500 feet, or where environmental conditions dictate the use of signal equalization. Signal reception end is defined as the end of the cable where a signal is received (monitor or video input).
 - b. Specifications:
 - (i) Active UTP receivers shall be capable of receiving baseband type monochrome or color video signals over Category 5e or better (UTP) cable, up to a maximum cable length of 1,200 feet, when connected to a passive video transceiver.
 - 1. With a symmetrical and balanced composite input from the transmitter unit and using cables as specified at a cable length of 1,200 feet, the output shall be a 1 Vpp composite video signal into 75 ohms.
 - (ii) The active receiver shall be capable of equalizing and delivering a baseband color video signal of NTSC standard 525 lines at the maximum specified distance with an operating frequency range of DC to 10 MHz and common mode rejection to be greater than 60 dB.
 - (iii) The active receiver shall be provided with a companion power supply, which shall have provisions to plug directly into an AC wall outlet and connect to the receiver power terminals.
 - (iv) The active receiver shall provide frequency equalization by means of eight dual in-line (DIP) switches which shall provide compensation for varying cable lengths. The effect of the frequency compensation shall be to both equalize and to amplify the video signal thereby providing loss compensation for video as cable length is increased.
 - (v) The active receiver shall have built-in transient protection, with a screw connection for earth ground.
 - (vi) Video connection to the active receiver shall be by means of a BNC type female connector. A five screw terminal block shall provide connection to the UTP cable (2), 12 VDC power supply (2) and earth ground (1).
 - (vii) The active receiver shall operate within specifications without causing interference or interfering with any other base band video, communication, data and/or other low-voltage signals operating in multi-twisted pair UTP cables.
 - c. If four (4) or more active receivers are used in close proximity to each other, rack-mounted receivers with identical performance characteristics shall be substituted in their place.



2.8 FIBER OPTIC MODULES

- A. Fiber Optic transmission equipment shall be used when one or more of the following conditions are met:
 - 1. Camera cable runs exceed 1,200 linear feet.
 - 2. The camera is located outdoors and is exposed to the elements.
 - a. Cameras protected by canopies or other architectural elements that shield them from direct view of the overhead sky are excluded from this requirement.
 - 3. The cable path is within 20 feet of a TIME or MIMS aerial.
- B. Modules located at field devices shall be low profile "miniaturized" type, and shall be mounted in the camera housing for both fixed and PTZ cameras.
 - 1. Fiber optic transmit modules shall derive power from the camera power supply, eliminating the need for an additional power supply.
- C. Modules located at head-end locations shall be standalone modular units unless four (4) or more modules are required, in which case they shall be enclosed in a fiber-optic sub rack.
 - 1. If more than one fiber optic sub rack is used, modules shall be distributed as evenly as possible among the sub racks to reduce the load on the sub rack power supply and minimize the impact of a failed sub rack.
- D. Fiber optic modules shall conform to the following minimum specifications:
 - 1. Fixed Position Camera Location:
 - a. Transmission Type: single channel video.
 - b. Video Format: Color, NTSC RS-170A.
 - c. Bandwidth: 10MHz.
 - d. Signal to Noise Ratio: 60dB.
 - e. Maximum Optical Attenuation (with 62.5-um cable): 12dB.
 - f. Mounting: BNC "balun" type.
 - 2. PTZ Camera Location:
 - a. Transmission Type: single channel video & bi-directional "up the coax" data.
 - b. Video Format: Color, NTSC RS-170A.
 - c. Bandwidth: 8MHz.
 - d. Maximum Optical Attenuation (with 62.5-um cable): 12dB.
 - e. Mounting: Surface mount module or in-line connection as described in 2.9 B (above).

2.9 CABLING

- A. Video:
 - 1. Where UTP video modules are used, all video shall be run utilizing the brown/brown-white pair of a CAT-5e unshielded twisted pair (UTP) cable. The remaining conductors shall be left open as spares.
 - 2. Each cable shall be individually home run from the device to the control room.
- B. Power:

Power cable shall be appropriately sized to ensure that any signal loss as a function of cable length does not prohibit the delivery of sufficient voltage and current from the power supply to the powered device.
- C. Control Data
 - a. For cable runs of 500 feet or less, control data for remotely positionable cameras shall be combined with the video signal and shall not require the use of an additional cable or conductors. Such data signals must be fully compatible with the UTP modules specified in Section 2.8.



- b. For cable runs greater than 500 feet but less than 1200 feet, control data shall utilize the orange/orange-white pair of the CAT-5e unshielded twisted pair (UTP) cable that is used for the video signal. The remaining conductors shall be left open as spares.
- D. Fiber Optic - When fiber optic modules are required, provide fiber optic cable appropriate for the application. Cable shall conform to the following specifications:
1. 62.5 micron glass multimode fiber.
 2. "ST" type connectors shall be used on all cable terminations, including junction boxes and breakout trays.
 3. Performance characteristics (including optical attenuation) shall be such that the Fiber Optic modules specified in Section 2.9 function to deliver signals end-to-end with sufficient bandwidth and quality to meet the specified application.
 4. Physical characteristics such that the cable has sufficient strength and endurance to withstand installation and environmental conditions without adversely affecting optical performance.

Cable Type	Signal	Use
RG-59/U (Belden # 8241B or Approved Equal)	Video	Video cable runs up to 50 feet
Micro-Coax (Belden # 9221 or Approved Equal)	Video	Internal console and rack connections
Fiber Optic (Multi-Mode)	Video / Data	See Section 2.9
CAT5e (Belden# 1583A or Approved Equal)	UTP Video	UTP video signals (see Section 2.8)
22AWG 2-Pair individually shielded stranded copper (Belden # 872306 or Approved Equal)	Matrix Keypad/Controller	Connection of Keypad/Controller to Matrix Switch or PTZ Camera Data Distribution Unit
16AWG 2-conductor stranded, twisted pair, tinned copper with overall jacket (Belden #8471 or Approved Equal). Plenum version may require shielding to meet specification. (Belden #83702)	Camera Power	Low voltage power to cameras, 500' or less (see drawing G5-7-1a or G5-8-3b).

2.10 ACCESSORIES

- A. Lightning/Surge Protection: Products shall utilize internal or external surge protection such that a normally occurring power surge shall not void any manufacturer's warranty.
- B. All DVR's shall utilize a standalone UPS sized for a minimum of 15 minutes of battery run-time. The UPS shall be provided by the CCTV Provider.
1. the use of a single UPS to support multiple devices is acceptable provided that this run-time requirement is met.
- C. Upright Racks: Furnish and install upright equipment racks to provide sufficient mounting space for the required equipment. Upright racks and associated hardware shall be provided by the CCTV Provider.
1. Racks shall be all metal construction conforming to EIA standards with 19" equipment mounting opening and 1-3/4" vertical spacing of equipment. Rack rails shall be punched with captive nuts, 10-32 screws and nylon washers.
- D. DVR Cabinet:



1. Station Managers Office or Mechanical Room Application (Wall Rack): In applications where equipment is located in the station manager's office or the mechanical room and a DVR is used (16 cameras or less), a lockable, appropriately vented, DVR cabinet shall be used.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting Work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates, and conditions are as required, and ready to receive Work.
 1. Verify that power and video outlets are in correct locations.
 2. Verify that building structure for attachment of equipment mounting devices is in place.
- C. Report in writing to Contracting Officer any prevailing conditions that will adversely affect satisfactory execution of Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Postal Service.
- E. Provide required power outlets, low voltage power supplies, interconnecting cables, hardware and equipment for a complete and operable system.
- F. Camera locations are to be reviewed and approved by a Postal Inspector, through the Contracting Officer, prior to installation.

3.2 INSTALLATION

- A. Install all equipment in accordance with CCTV Provider's published instructions. Installation must be done by a CCTV Provider's certified dealer to assure proper installation and accountability. This includes, but is not limited to the following:
 1. All hardware used to secure equipment to racking shall include a nylon or other non-metallic washer or grommet between the screw head and equipment panel to prevent any damage to the equipment.
 - a. Rack mount screws shall be self-centering Philips-head configuration unless specialized tamper-resistant hardware has been specified.
 - b. Screws shall be tightened in such a manner as to allow their removal with common hand tools.
 2. Any equipment placed on shelving mounted on an incline of greater than 2 degrees shall be secured to the rack or shelving in such a manner as to prevent movement of the equipment in the direction of the incline. Such fastening shall be done in a manner as to preserve the integrity of the equipment case and chassis, and shall in no way jeopardize warranty coverage of the device.
 3. All equipment cabling shall be dressed in such a manner as to ensure a neat and clean appearance.
 4. Cable break-outs shall be at 90-degree angles from the harness or chase, and all chases shall be parallel to or at 90-degree angles from the rack frame.
 5. Cables are to be secured to the rack frames at sufficient intervals to ensure that the weight of the cable will not contribute to fatigue or early failure of that cable or the device and connector to which it is attached.
 6. Sufficient excess cable shall be provided in "service loop locations" to ensure that the cable may be re-connected without requiring the addition of extension pieces.
 7. All permanent cabling shall be mechanically numbered in a manner consistent with written system documentation.



8. Wiring for all equipment shall be tie-wrapped (except as indicated below) or secured with Velcro straps so that all connectors in a bundle can be removed and re-installed without the possibility of cross connecting.
 9. CAT-5e and Fiber Optic cables shall utilize Velcro fasteners in place of tie wraps to eliminate the risk of over-tightening cable bundles and affecting the strength or rated performance of the cable.
 10. Where wiring is routed through sheet metal or over frame members, the metal edges shall be covered with flexible grommeting or edge dressing (such as automobile door edge trim).
 11. Double-sided foam tape shall not be used to secure any equipment, terminal blocks, or accessory devices. All device mounting shall be of a permanent nature.
 12. All excess length AC cords are to be tie-wrapped out of the way. Where possible, they shall be routed in a separate bundle a minimum of 6 inches away from any signal or control cable.
 13. Exposed wires run to wall mounted cameras shall be fed through tubing or the body of the mount to present a professional appearance.
 - a. Any accessible cables that can be reached by an individual standing on the floor, a stool, or a small stepladder shall be encased in protective tubing or armored sheathing to prevent tampering or cutting with common hand tools.
 14. Care shall be exercised at all times to protect Postal Service property. For example, ladders shall not be placed against wallpapered or finished surfaces, equipment or furnishings; desks or countertops shall not be used in lieu of ladders.
 15. On pendant mounted cameras, label each camera on all four sides with three-inch numbers supplied by the Certified Dealer. Numbers shall be stenciled or laminated vinyl in a contrasting color to the camera housing. Camera number shall match and correspond to the camera input number, any on screen numeric identifier and/or printed map provided by the switches and/or multiplexer or DVR. Numbers shall not be placed on lower dome or any area that would obstruct camera viewing.
 16. Ensure that pendant mounted cameras are hung from stable, vibration free mounting platforms, using guy-wires or other support mechanisms to ensure stability where required. Mount cameras below any suspended lighting to avoid glare or reflection on camera dome and/or lens.
 17. Perform complete programming of the system, in coordination with the Contracting Officer and Postal Inspector, or designated representative. Programming shall include, but not be limited to, elimination of duplicate or redundant titling information, synchronization of system clocks, camera sequences, dome presets, salvos and tours. Programming of any system passwords or limiting of accessibility prior to commissioning and training is prohibited.
- B. Power requirements shall be determined by actual equipment used.
- C. Ensure that:
1. All applicable statutes, ordinances, regulations, license requirements and codes are fully complied with.
 2. All required permits are obtained.
 3. All required inspections are conducted.
 4. All necessary certificates are issued, obtained, and delivered to the Postal Service.
 5. All equipment installations and mounting are in strict accordance with requirements for applicable seismic classification.
- D. Arrange all components to be mounted in the console(s)/rack(s) in accordance with CCTV Provider and/or Postal Service provided System Elevation drawings. Design shall provide a neat appearance and accessibility for servicing equipment.
- E. Provide required power outlets, interconnecting cables, hardware and equipment for a complete and operable system.
1. Power, 120VAC: As required by codes and standards for the facility.



2. Where conduit is used, a minimum of 40% excess capacity shall be provided for future use.
- F. Install cameras in the general vicinity of locations indicated on Drawings at final locations defined by camera location test.
 1. Provide 84-inch minimum headroom below cameras and their mountings. Where necessary modify mounting type to maintain clearance, except as noted on drawings (behind counter) and along slat wall.
- G. All coaxial video connections must be made with crimp-type BNC connectors. Twist-on connectors are not acceptable.
- H. When not installed in cable trays, cable (CAT-5e, fiber optic, and low voltage power) shall be supported with wide base cable hangers rated for proper support of CAT-5e, fiber optic, and innerduct cables (compliant with UL and NEC requirements for structured cabling).
 1. Cable hangers shall be installed every 3 to 6 feet and shall be rated to support the weight of the cable multiplied by a factor of three (3).
 2. All Fiber Optic cables shall be installed in appropriately sized innerduct cabling.

3.3 CONSTRUCTION

- A. Interface with Other Work: Interface installation of CCTV System with Intrusion Detection System specified in Section 281600 and Enterprise Physical Access Control specified in Section 281304.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Inspection and testing procedures.
- B. Inspection:
 1. Inspect equipment installation, interconnection with system devices, mounting locations, and mounting methods.
 2. Verify that units and controls are properly installed, connected, and labeled and that interconnecting wires and terminals are identified.
- C. Testing:
 1. Perform tests and provide test equipment, tools, and personnel required to conduct system tests and inspections. These tests shall include video quality and PTZ operation (where applicable) for all cameras.
 2. Provide an actual demonstration of each system function.
 3. Conduct system acceptance test upon completion of installation using pre-approved procedures. Test shall consist of system, subsystem, and device level acceptance tests, including software.
 4. Prepare all test procedures and submit the procedures for review by the Postal Service facility manager. Obtain test procedure approval prior to actual system tests.
 5. Ensure that test procedures confirm each specification statement and manufacturer requirement has been met or exceeded. An actual demonstration of each system function and a simulation of each system failure shall be provided.
 6. An acceptance test period of thirty days shall begin at the start of the acceptance test. Any system failure during the acceptance test period will suspend the acceptance test. The thirty-day test period will restart when the required repairs have been made and certified.
 7. Perform all tests in the presence of the Postal Service facility manager or authorized agent. The Postal Service reserves the right to accept any portion or activate any phase prior to acceptance of entire system.



3.5 OPERATING INSTRUCTION

- A. Provide on-site instruction to review the operation of the system and detail any common troubleshooting or maintenance steps that are required to ensure normal operation.
- B. Provide one complete set of equipment operating, installation, and programming manuals that will remain in the installed location.

3.6 CLEANING AND ADJUSTING

- A. Clean installed items using methods and materials recommended by equipment manufacturers just before conducting acceptance test.
- B. Adjust manual lens irises to meet lighting conditions.
- C. Adjust field of view for each camera per Inspection Service direction.

USPS CSF Specifications issued: 10/1/2013
Last revised: 8/29/13

END OF SECTION 28 23 04 00



SECTION 28 23 04 00 - MPF SECURITY, BURGLARY AND ROBBERY COUNTERMEASURES ANALOG CCTV

NOTE TO SPECIFIER

Use this Specification section for Mail Processing Facilities only. This specification may be used for small CCTV projects that are independent from an existing, or planned, IP CCTV system when 16 or fewer cameras are required. Typical use would be for small access control projects, retail, security, burglary and robbery countermeasures projects and replacement of failed components in existing analog CCTV systems.

****THIS ENTIRE SECTION CONSISTS OF REQUIRED PARTS OR ARTICLES. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Provide and install a complete analog CCTV System including, but not limited to;
 - a. Video Surveillance Cameras, housings, power supplies, cabling, and related equipment.
 - b. Video control equipment.
 - c. Video monitoring and recording equipment.
 - d. Equipment enclosures.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents including:
 - 1. System Installation Manuals
- C. Related Sections:
 - 1. Section 260500 - Common Work Results for Electrical.
 - 2. Section 260533 - Raceway and Boxes for Electrical Systems.
 - 3. Section 270500 - Common Work Results for Communications.
 - 4. Section 281304 - Enterprise Physical Access Control System.
 - 5. Section 281600 - Intrusion Detection.
- D. Prompt Payments. In accordance with the Contractor Certification on Postal Service Form 4211B, "Project Contract Payment Authorization", the contractor certifies that prompt payment, (within 30 days) to the subcontractor (CCTV Provider) will be made.

1.2 REFERENCES

- A. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements: Closed circuit television (CCTV) analog video communication system for no more than 16 analog cameras between points of surveillance indicated on Drawings and central monitoring station consisting of video cameras, camera outlets, camera controls, monitors, video switcher,



signal-processing equipment, control stations, distribution components, video recorders, and accessories.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures:

1. Product Data: Manufacturer's specification sheets for each component shall not be required.
2. Due to USPS security requirements, submittals will be limited to one electronic copy of the block diagram and one copy of the shop drawings to be provided to the General Contractor.
3. Final As-Built Drawings, Operation and Installations Manual, will be supplied directly to USPS and stored within the rack per USPS COTR.

B. Shop Drawings:

1. The CCTV Provider will provide a Standard Drawing Package (Red Book) that shall be utilized for the installation of the CCTV system. This package shall include:
 - a. Block Diagram: System block diagrams noting major system components and interrelationships of each component.
 - b. Console and Equipment Racks: Rack elevation drawings showing console/equipment arrangement.

C. Sequence and Scheduling Plan: Installer shall provide installation scheduling plan for review and approval. Coordinate scheduling of software and revisions with the USPS.

D. Qualifications:

1. Installer: Factory Certified Dealer specializing in CCTV systems installation. Installer shall be capable of performing the Work specified in this Section with minimum 3 years documented experience in the field and authorized and approved by the CCTV Provider to install Postal Service systems.

E. Section 017704 - Closeout Procedures and Training:

1. Operation and Maintenance Data: Include data for each type of product, including features and operating sequences, both automatic and manual. This information shall be supplied directly to the USPS by the Direct Vendor.
2. Product Quick Reference cards for the operation of all key system components.
3. Project Record Documents: Installer shall provide field-accurate drawings that reflect actual locations of cameras and routing of signal cable, indicating cable identifiers, layout, location and numbering of system devices to reflect as-built conditions.
4. Provide a final materials list of equipment installed and spare parts on hand. Materials list shall include model number, serial number, and date installed.
5. Project Completion Certification: Document signed by the installing integrator and a Postal Service representative indicating that the project is fully complete with all punch-listed items resolved.
6. OPERATING INSTRUCTION
 - a. Provide on-site instruction to review the operation of the system and detail any common troubleshooting or maintenance that is required to ensure normal operation.
 - b. Provide one complete set of equipment operating, installation, and programming manuals that will remain at the installed location.

1.5 DELIVERY, STORAGE AND HANDLING

A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.

B. Keep devices and equipment in manufacturer's packaging in a secured location until system is ready for installation.

C. Comply with manufacturer's requirements. Coordinate storage location with the Postal Service.



- D. The equipment delivered must be insured at the contractor's expense through acceptance.

1.6 CCTV PROVIDER WARRANTY/SERVICE/TECHNICAL SUPPORT PLAN

A. Warranty:

1. Provide manufacturer warranty for three (3) years after facility acceptance and project completion certification for materials and labor.
 - a. Warranty shall include all parts and labor, and shall include return shipping. Failed equipment shall be repaired or replaced at no charge to the Postal Service during the warranty period.
 - b. USPS shall not be required to process any paperwork in order to be entitled to service plan coverage. It is the CCTV Provider's sole responsibility to monitor and comply with warranty eligibility.
 - c. Where operational performance is substantially affected, all software and firmware shall be upgraded to the latest version supported by the purchased hardware platform throughout the service plan period and be provided at no cost to USPS. Such upgrades shall be covered under the warranty/service plan and are at the discretion of the Postal Inspector or Station Manager.
 - (i) Any software bugs identified by the USPS and mutually agreed upon as 'level one' bugs (impacting operation with no work-around) shall be rectified within two (2) weeks of their being reported.
 - (ii) Any software bugs identified by the USPS and mutually agreed upon as 'level two' bugs (impacting operation but with a work-around) shall be rectified within 90 days of their being reported.
 - d. Turnaround time for all repairs (warranty and out-of-warranty) shall not exceed 72 hours.
 - (i) CCTV Provider shall make advance replacement units available in cases where USPS operational issues require immediate replacement of a unit while minimizing down time.
 - (ii) In situations where a complete facility system is not being supplied but only replacements for certain aged equipment, the warranty will only apply to the equipment being replaced

B. Technical Support

1. CCTV Provider shall provide toll-free 24/7 technical support at no charge throughout the warranty period.
2. Data Recovery — CCTV Provider shall provide a service to assist the USPS in recovering data from digital recording system hard drives and removable storage media in the event of a failure.
 - a. Turnaround time for data recovery shall be less than seven (7) days from receipt of hard drives at CCTV Provider's data recovery center.

PART 2 PRODUCTS

2.1 PROVIDERS

A. DIEBOLD, INC.

1. Michael Tracey, USPS Account Manager
44845 Falcon Place Suite 106 Sterling, VA 20166
Cell: 571-451-7629 Fax 703-467-8650 email: michael.tracey@diebold.com
Contract to Diebold should be addressed to:
Diebold Enterprise Security Solutions
3 Westchester Plaza
Elmsford, NY 10523

B. VICON INDUSTRIES, INC. Christine Stone, USPS Program Manager 89 Arkay Drive



Hauppauge, NY 11788
 (800) 645-9116 or (631) 952-2288
 Fax (631) 951-2288
 Email: USPS@vicon-cctv.com

C. Section 016000 - Product Requirements:

1. Product options and substitutions are not permitted without a written and USPS approved deviation.
2. All equipment to be supplied under this specification shall be new and the current model of the Provider.
3. Systems and components shall have been thoroughly tested and proven in actual use.

2.2 VIDEO MONITORS

A. Provide 17-inch LCD flat-panel color monitors with the following minimum capabilities.

1. Product Requirements:
 - a. Video Input Connections: VGA (DB15), and Composite (BNC).
 - (i) Switching between inputs shall be performed using a front panel control.
 - (ii) VGA resolution shall be equal to the native resolution of the installed Digital Video Recorder, if applicable.
 - b. Input Power: 120VAC, 60Hz (a power adaptor may be used to provide this voltage).
 - c. Mounting: Each monitor shall be desktop mounted. VESA mounting holes shall be provided and a series of optional VESA compliant mounts shall be made available at extra cost.
 - d. Operating Temperature: Range shall be equal to or greater than 10 to 40 degrees Celsius.
 - e. Humidity: Withstand a minimum of 10% to 80% humidity.
 - f. Resolution: At least 420 TV lines of composite video.
 - g. Adjustments: Must support on-screen display for setup and adjustment of monitor parameters.
 - h. Colors: Must support a minimum of 16 million colors.

2.3 VIDEO CAMERAS

A. Provide solid-state color cameras for video surveillance and monitoring of specific areas as shown on the drawings and confirmed with Postal Inspection Service through Contracting Officer with the following minimum capacities:

1. FIXED POSITION INDOOR/OUTDOOR IMPACT/VANDAL RESISTANT DOME TYPE VIDEO CAMERAS: Shall meet or exceed the following minimum requirements:
 - a. CCD Image Sensor: High resolution color with digital image processing.
 - b. Horizontal Resolution: 480 or greater TVL.
 - c. Auto Iris Control.
 - d. White Balance: Automatic.
 - e. Input Power: 24VAC, 60Hz with line locking.
 - f. Automatic Gain Control.
 - g. Backlight Compensation.
 - h. BNC or UTP (screw terminal) video connector, as required.
 - (i) If UTP connection is used, unit must be in full compliance with UTP specifications outlined in Section 2.8.
 - i. Lens: 3.3-12mm manual varifocal lens, application permitting.
 - (i) Lens substitution may be required to provide an acceptable image based on camera position, field of view, and distance to subject..(ii).Three axis adjustment (pan, tilt & roll)
2. REMOTELY POSITIONABLE (PTZ) VIDEO CAMERAS: Integrated camera/lens packages in a dome type housing, shall be remotely positionable (pan/tilt/zoom/focus/iris) shall meet or exceed the following minimum requirements:
 - a. Horizontal Resolution: 470 TVL or greater.



- b. Optical Zoom: Minimum 22X.
- c. Automatic Focus / Iris Control with manual override.
- d. Rotation Speed: Shall range from 0.1 degrees/second to 120 degrees/second with a minimum of 32 speeds in any direction.
- e. Tilt Speed: 0.2 degrees per second to 90 degrees per second.
- f. Proportional Pan-Tilt: Yes.
- g. Presets: At least 32 Individual presets.
- h. Alarm Inputs: At least one programmable high or low input.
- i. Alarm Outputs: At least one auxiliary relay output or one open collector driver.
- j. Operating Voltage: 24VAC nominal, with an operating range of 18 to 32VAC.
- k. Programming Backup: Dome shall retain all programmed parameters for a minimum of thirty (30) days.
- l. Lower Dome:
 - (i) Interior Domes – Gradient tint required to obscure the movement of camera.
 - (ii) Exterior Domes – Gradient tint required to obscure the movement of camera.
- B. Products shall utilize internal or external surge protection such that a normally occurring power surge shall not void any manufacturer's warranty.

2.4 CAMERA POWER SUPPLIES:

- A. Interior Cameras: Camera power supplies shall be located within 500' of the camera, either in the CIO (distance permitting) or in another suitable protected area. Provide multiple outlet (4, 8, or 16) fused power supplies as required for interior fixed and PTZ cameras. See drawings G5-7-1a or G5-8-3b. Power supplies shall be rated to support 200% of the actual (nominal) power loading.
 - 1. A minimum of two (2) power supplies shall be used on each project, regardless of camera count.
 - 2. Cameras must be on separate power supplies, such that the failure of a single power supply shall not impact two adjacent cameras.
- B. Exterior Cameras: Provide individual power supplies located at the camera.
 - 1. Enclosures shall be weatherproof and sealed to prevent water and/or insect infiltration.
- C. Provide a means for disconnecting camera power supplies from mains power at the power supply enclosure, either through a detachable power cord, master fuse or circuit breaker, or other UL approved switching device.

2.5 VIDEO CAMERA HOUSINGS AND MOUNTS

- A. Provide indoor housings as required for all camera types with the following minimum capabilities:
 - 1. Interior Cameras:
 - a. All cameras shall be in a housing that is coordinated with adjacent finishes with the appropriate mounting hardware. Selection of housings and mounts, including incremental changes to paint colors, dome materials, and cosmetic finishes shall be approved by the USPS or their authorized agent.
 - b. All housings shall be sufficiently dust and moisture resistant to withstand normal environmental conditions in their chosen installation location.
 - c. Hardware shall be provided to ensure tamper-resistant mounting in a variety of locations without modification to the integrity of the housing.
 - d. Where used, pendant mounts shall be suitable for use as wall, ceiling and column mounts. Pendant mounts shall attach to the appropriate camera housing using installer provided standard threaded schedule 40 rigid iron pipes. Pipe lengths of 10 feet or less are to be a minimum of 1-inch diameter. Pipe lengths exceeding 10 feet are to be a minimum of 1-1/2 inch in diameter. Exterior pipe shall be galvanized.
 - e. All mounts shall incorporate installer provided safety chain or cable of sufficient endurance to support 2 times the weight of the equipment.
 - 2. Exterior Cameras:



- a. Environmental: Thermostatically controlled heaters and blowers with defrosting capabilities.
- b. Moisture: Rainproof seals and gaskets.
- c. Wind Resistance: Rated for 80mph sustained winds.
- d. Ambient Temperature Rating: -10 to 60 degrees Celsius.
 - (i) Areas with more demanding environmental conditions will be granted a deviation from this specification.

2.6 DIGITAL VIDEO RECORDERS

A. ROBBERY, BURGLARY AND COUNTERMEASURES, SECURITY (SITE AND ACCESS CONTROL) ANALOG CCTV SYSTEMS

1. Recording must be continuous in nature, with a series of "key frames" which periodically refresh the entire video image. The frequency of these key frames must be sufficient to allow the full range of motion to be visible.
2. Video images shall be recorded with sufficient resolution, color depth, and quality of image compression as to make the recorded image indistinguishable from a DVD sourced original.
3. The DVR shall support event driven recording. Events may be internally generated (motion analysis, video loss or presence), or externally triggered (contact closure).
4. Image Exporting — The system shall have the ability to export video images as follows:
 - a. Video Printing — The system shall allow for easy printing of still images.
 - (i) Images may be printed to standard, Windows™ based printer that does not require proprietary drivers.
 - (ii) Printer may be directly connected to the DVR or may be connected to a workstation to view the image via USP or Parallel port.
 - b. Still Images — Still images may be saved using the JPEG file format, for printing at a later time or electronic distribution.
 - c. CD-R and DVD recordable formats — Image shall be archived to DVD and CD in each of the following formats.
 - (i) *Proprietary* — Image may be saved in a format that provides authentication to ensure that the image has not been altered in any way. Such authentication must not alter the quality of the video image. Software to allow viewing of this proprietary format that may be freely copied and distributed at no further cost to the USPS must be provided.
 - (ii) *Standard* — Image may be saved in an open source format which may be distributed and played using a commonly available media player, such as Apple™ QuickTime™ or Microsoft™ Media Player™.
 - (iii) *Analog Out* — An analog output shall be provided that may be connected to a video monitor, VCR, or other analog recording or display device. The use of an external device to perform this function is acceptable.
5. The DVR shall auto restart on power failure.
 - a. The unit will automatically begin recording upon restoration of power.
 - b. The system must maintain all camera name and scheduling information and must return in the state it was programmed to be in at the time of the power failure.
 - c. The system must retain correct time and date information.
6. Input Connections
 - a. The system must support a minimum of 4 cameras.
 - b. All video inputs shall use a BNC connection.
 - c. Capability shall be provided to loop each video input signal to an additional device, through the use of an adaptor cable.
7. Output Connections
 - a. Composite video outputs (internal to the DVR or via an external device) shall be NTSC utilizing BNC connectors.
 - b. The system must utilize a VGA computer monitor for main screen user navigation and video viewing.



8. Record Duration – The DVR shall include online storage of 72 hours with less than 30 seconds required to retrieve a video clip.
 - a. In order to calculate storage capacity, the following assumption may be used: All cameras are in high activity areas. These cameras will experience a large number of frequent image changes such as busy areas with many people walking or movement of heavy equipment.
 - b. Manufacturer shall make units available with greater recording duration which may be substituted through the USPS deviation process.
9. Frame Rate
 - a. ROBBERY, BURGLARY, AND COUNTERMEASURES, SECURITY (SITE AND ACCESS CONTROL) –
 - (i) 4 to 16 total cameras shall utilize an embedded 16 channel digital video recorder each channel capable of 15fps @ 4CIF with one terabyte of storage.
10. Duplex Operation — The system shall be capable of simultaneously performing a minimum of any two of the following functions:
 - a. recording video
 - b. displaying live video
 - c. playing back recorded video
 - d. exporting stored video
11. Video Monitoring
 - a. Images being played back may be synchronized or stopped (frozen) individually.
 - b. Provide multiple views on the same screen during playback or live video view.
 - c. Display software shall provide for multi-camera viewing using a variety of multi-screen display modes.
 - (i) These multiple images may be exported in such a manner as to allow later synchronized playback of the same series of images.
 - d. Provide the ability to digitally enhance video images, to increase or decrease contrast and brightness, correct image color characteristics, and digitally zoom in on the image.
 - e. Provide a full suite of search tools to allow the search and retrieval of images based on time, date, motion (within pre-defined screen areas), alarm, video loss, and video presence.
 - f. Provide the ability to sequence a number of individual video segments such that a composite video clip can be made of a series of individual clips or incidents.
 - g. Frame rate shall be adjustable on an individual camera basis in a range that extends from ~3 images per second (ips) to real-time which shall be indistinguishable from NTSC 30 ips video.

2.7 UNSHIELDED TWISTED PAIR (UTP) MODULES

- A. Unshielded twisted pair (UTP) modules will be used for cable runs where a signal must be transmitted further than 50 feet unless Fiber Optic transmission is a requirement (see Section 2.9).
 1. Passive Transceivers:
 - a. Signal Transmission: Units shall be used at the signal transmission end for all distances under 1,200 linear feet or less, unless the specific conditions outlined in Section 2.9 exist. Signal transmission end is defined as the end of the cable run where a signal is generated (camera or video output).
 - b. Signal Reception: Units shall be used at the signal reception end for all distances less than or equal to 500 feet. Signal reception end is defined as the end of the cable where a signal is received (monitor or video input).
 - c. Specifications:
 - (i) Passive UTP Transceivers shall be capable of transmitting and receiving baseband type monochrome or color video signals over unshielded twisted pair Category 5e or better (UTP) cable, up to a maximum cable distance of 500 feet with a transceiver device connected at each end of the cable.
 - (ii) The transceiver device shall be capable of driving a color video signal of NTSC standard 525 lines with an operating frequency range of DC to 10 MHz and common mode rejection to be greater than 60 dB.
 - (iii) The transceiver devices shall not require power to operate as specified.



- (iv) The transceiver used as a transmitting device shall be designed to accept a baseband video signal from a 75 ohm impedance source and the transceiver used as a receiving device shall deliver a baseband video signal capable of driving a 75 ohm impedance load.
- (v) The transceiver device shall support bi-directional signal transmission, i.e.; video from the video source to the receiving equipment and control from the receiving end to the video source equipment over a single unshielded twisted pair (UTP) using equipment that provides such bi-directional operation during the vertical interval.
- (vi) Video connection to the transceiver device shall be by means of a BNC type female connector and connection to UTP cable shall be by means of two Phillips type head screw terminals. The screw terminals shall be plated with a rust preventive material to prevent corrosion.
- (vii) The transceiver device shall be capable of driving an active (powered) companion UTP receiver, operating at a distance of up to 1,200 feet over cables specified for that unit.
- (viii) The combination of the transceiver device and the active receiver shall provide a minimum of 500 lines of video resolution.
- (ix) The transceiver devices shall operate within specifications without causing interference or interfering with any other base band video, communication, data and/or other low-voltage signals operating in multi-twisted pair UTP cables.
- d. Receivers (transceivers used at the receiving end) shall be four-channel units and shall be secured to a rack panel or other permanent surface. Individual, loose receivers are not acceptable.
- 2. Active Receivers:
 - a. Signal Reception: Units shall be used at the signal reception end for all distances greater than 500 feet, or where environmental conditions dictate the use of signal equalization. Signal reception end is defined as the end of the cable where a signal is received (monitor or video input).
 - b. Specifications:
 - (i) Active UTP receivers shall be capable of receiving baseband type monochrome or color video signals over Category 5e or better (UTP) cable, up to a maximum cable length of 1,200 feet, when connected to a passive video transceiver.
 - 1. With a symmetrical and balanced composite input from the transmitter unit and using cables as specified at a cable length of 1,200 feet, the output shall be a 1 Vpp composite video signal into 75 ohms.
 - (ii) The active receiver shall be capable of equalizing and delivering a baseband color video signal of NTSC standard 525 lines at the maximum specified distance with an operating frequency range of DC to 10 MHz and common mode rejection to be greater than 60 dB.
 - (iii) The active receiver shall be provided with a companion power supply, which shall have provisions to plug directly into an AC wall outlet and connect to the receiver power terminals.
 - (iv) The active receiver shall provide frequency equalization by means of eight dual in-line (DIP) switches which shall provide compensation for varying cable lengths. The effect of the frequency compensation shall be to both equalize and to amplify the video signal thereby providing loss compensation for video as cable length is increased.
 - (v) The active receiver shall have built-in transient protection, with a screw connection for earth ground.
 - (vi) Video connection to the active receiver shall be by means of a BNC type female connector. A five screw terminal block shall provide connection to the UTP cable (2), 12 VDC power supply (2) and earth ground (1).
 - (vii) The active receiver shall operate within specifications without causing interference or interfering with any other base band video, communication, data and/or other low-voltage signals operating in multi-twisted pair UTP cables.



- c. If four (4) or more active receivers are used in close proximity to each other, rack-mounted receivers with identical performance characteristics shall be substituted in their place.

2.8 FIBER OPTIC MODULES

- A. Fiber Optic transmission equipment shall be used when one or more of the following conditions are met:
 - 1. Camera cable runs exceed 1,200 linear feet.
 - 2. The camera is located outdoors and is exposed to the elements.
 - a. Cameras protected by canopies or other architectural elements that shield them from direct view of the overhead sky are excluded from this requirement.
 - 3. The cable path is within 20 feet of a TIME or MIMS aerial.
- B. Modules located at field devices shall be low profile "miniaturized" type, and shall be mounted in the camera housing for both fixed and PTZ cameras.
 - 1. Fiber optic transmit modules shall derive power from the camera power supply, eliminating the need for an additional power supply.
- C. Modules located at head-end locations shall be standalone modular units unless four (4) or more modules are required, in which case they shall be enclosed in a fiber-optic sub rack.
 - 1. If more than one fiber optic sub rack is used, modules shall be distributed as evenly as possible among the sub racks to reduce the load on the sub rack power supply and minimize the impact of a failed sub rack.
- D. Fiber optic modules shall conform to the following minimum specifications:
 - 1. Fixed Position Camera Location:
 - a. Transmission Type: single channel video.
 - b. Video Format: Color, NTSC RS-170A.
 - c. Bandwidth: 10MHz.
 - d. Signal to Noise Ratio: 60dB.
 - e. Maximum Optical Attenuation (with 62.5-um cable): 12dB.
 - f. Mounting: BNC "balun" type.
 - 2. PTZ Camera Location:
 - a. Transmission Type: single channel video & bi-directional "up the coax" data.
 - b. Video Format: Color, NTSC RS-170A.
 - c. Bandwidth: 8MHz.
 - d. Maximum Optical Attenuation (with 62.5-um cable): 12dB.
 - e. Mounting: Surface mount module or in-line connection as described in 2.9 B (above).

2.9 CABLING

- A. Video:
 - 1. Where UTP video modules are used, all video shall be run utilizing the brown/brown-white pair of a CAT-5e unshielded twisted pair (UTP) cable. The remaining conductors shall be left open as spares.
 - 2. Each cable shall be individually home run from the device to the control room.
- B. Power:

Power cable shall be appropriately sized to ensure that any signal loss as a function of cable length does not prohibit the delivery of sufficient voltage and current from the power supply to the powered device.
- C. Control Data
 - a. For cable runs of 500 feet or less, control data for remotely positionable cameras shall be combined with the video signal and shall not require the use of an additional cable or conduc-



- tors. Such data signals must be fully compatible with the UTP modules specified in Section 2.8.
- b. For cable runs greater than 500 feet but less than 1200 feet, control data shall utilize the orange/orange-white pair of the CAT-5e unshielded twisted pair (UTP) cable that is used for the video signal. The remaining conductors shall be left open as spares.
- D. Fiber Optic - When fiber optic modules are required, provide fiber optic cable appropriate for the application. Cable shall conform to the following specifications:
1. 62.5 micron glass multimode fiber.
 2. "ST" type connectors shall be used on all cable terminations, including junction boxes and breakout trays.
 3. Performance characteristics (including optical attenuation) shall be such that the Fiber Optic modules specified in Section 2.9 function to deliver signals end-to-end with sufficient bandwidth and quality to meet the specified application.
 4. Physical characteristics such that the cable has sufficient strength and endurance to withstand installation and environmental conditions without adversely affecting optical performance.

Cable Type	Signal	Use
RG-59/U (Belden # 8241B or Approved Equal)	Video	Video cable runs up to 50 feet
Micro-Coax (Belden # 9221 or Approved Equal)	Video	Internal console and rack connections
Fiber Optic (Multi-Mode)	Video / Data	See Section 2.9
CAT5e (Belden# 1583A or Approved Equal)	UTP Video	UTP video signals (see Section 2.8)
22AWG 2-Pair individually shielded stranded copper (Belden # 872306 or Approved Equal)	Matrix Keypad/Controller	Connection of Keypad/Controller to Matrix Switch or PTZ Camera Data Distribution Unit
16AWG 2-conductor stranded, twisted pair, tinned copper with overall jacket (Belden #8471 or Approved Equal). Plenum version may require shielding to meet specification. (Belden #83702)	Camera Power	Low voltage power to cameras, 500' or less (see drawing G5-7-1a or G5-8-3b).

2.10 ACCESSORIES

- A. Lightning/Surge Protection: Products shall utilize internal or external surge protection such that a normally occurring power surge shall not void any manufacturer's warranty.
- B. All DVR's shall utilize a standalone UPS sized for a minimum of 15 minutes of battery run-time. The UPS shall be provided by the CCTV Provider.
 1. the use of a single UPS to support multiple devices is acceptable provided that this run-time requirement is met.
- C. Upright Racks: Furnish and install upright equipment racks to provide sufficient mounting space for the required equipment. Upright racks and associated hardware shall be provided by the CCTV Provider.



1. Racks shall be all metal construction conforming to EIA standards with 19" equipment mounting opening and 1-3/4" vertical spacing of equipment. Rack rails shall be punched with captive nuts, 10-32 screws and nylon washers.
- D. DVR Cabinet:
 1. Station Managers Office or Mechanical Room Application (Wall Rack): In applications where equipment is located in the station manager's office or the mechanical room and a DVR is used (16 cameras or less), a lockable, appropriately vented, DVR cabinet shall be used.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting Work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates, and conditions are as required, and ready to receive Work.
 1. Verify that power and video outlets are in correct locations.
 2. Verify that building structure for attachment of equipment mounting devices is in place.
- C. Report in writing to Contracting Officer any prevailing conditions that will adversely affect satisfactory execution of Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Postal Service.
- E. Provide required power outlets, low voltage power supplies, interconnecting cables, hardware and equipment for a complete and operable system.
- F. Camera locations are to be reviewed and approved by a Postal Inspector, through the Contracting Officer, prior to installation.

3.2 INSTALLATION

- A. Install all equipment in accordance with CCTV Provider's published instructions. Installation must be done by a CCTV Provider's certified dealer to assure proper installation and accountability. This includes, but is not limited to the following:
 1. All hardware used to secure equipment to racking shall include a nylon or other non-metallic washer or grommet between the screw head and equipment panel to prevent any damage to the equipment.
 - a. Rack mount screws shall be self-centering Philips-head configuration unless specialized tamper-resistant hardware has been specified.
 - b. Screws shall be tightened in such a manner as to allow their removal with common hand tools.
 2. Any equipment placed on shelving mounted on an incline of greater than 2 degrees shall be secured to the rack or shelving in such a manner as to prevent movement of the equipment in the direction of the incline. Such fastening shall be done in a manner as to preserve the integrity of the equipment case and chassis, and shall in no way jeopardize warranty coverage of the device.
 3. All equipment cabling shall be dressed in such a manner as to ensure a neat and clean appearance.
 4. Cable break-outs shall be at 90-degree angles from the harness or chase, and all chases shall be parallel to or at 90-degree angles from the rack frame.



5. Cables are to be secured to the rack frames at sufficient intervals to ensure that the weight of the cable will not contribute to fatigue or early failure of that cable or the device and connector to which it is attached.
 6. Sufficient excess cable shall be provided in "service loop locations" to ensure that the cable may be re-connected without requiring the addition of extension pieces.
 7. All permanent cabling shall be mechanically numbered in a manner consistent with written system documentation.
 8. Wiring for all equipment shall be tie-wrapped (except as indicated below) or secured with Velcro straps so that all connectors in a bundle can be removed and re-installed without the possibility of cross connecting.
 9. CAT-5e and Fiber Optic cables shall utilize Velcro fasteners in place of tie wraps to eliminate the risk of over-tightening cable bundles and affecting the strength or rated performance of the cable.
 10. Where wiring is routed through sheet metal or over frame members, the metal edges shall be covered with flexible grommeting or edge dressing (such as automobile door edge trim).
 11. Double-sided foam tape shall not be used to secure any equipment, terminal blocks, or accessory devices. All device mounting shall be of a permanent nature.
 12. All excess length AC cords are to be tie-wrapped out of the way. Where possible, they shall be routed in a separate bundle a minimum of 6 inches away from any signal or control cable.
 13. Exposed wires run to wall mounted cameras shall be fed through tubing or the body of the mount to present a professional appearance.
 - a. Any accessible cables that can be reached by an individual standing on the floor, a stool, or a small stepladder shall be encased in protective tubing or armored sheathing to prevent tampering or cutting with common hand tools.
 14. Care shall be exercised at all times to protect Postal Service property. For example, ladders shall not be placed against wallpapered or finished surfaces, equipment or furnishings; desks or countertops shall not be used in lieu of ladders.
 15. On pendant mounted cameras, label each camera on all four sides with three-inch numbers supplied by the Certified Dealer. Numbers shall be stenciled or laminated vinyl in a contrasting color to the camera housing. Camera number shall match and correspond to the camera input number, any on screen numeric identifier and/or printed map provided by the switches and/or multiplexer or DVR. Numbers shall not be placed on lower dome or any area that would obstruct camera viewing.
 16. Ensure that pendant mounted cameras are hung from stable, vibration free mounting platforms, using guy-wires or other support mechanisms to ensure stability where required. Mount cameras below any suspended lighting to avoid glare or reflection on camera dome and/or lens.
 17. Perform complete programming of the system, in coordination with the Contracting Officer and Postal Inspector, or designated representative. Programming shall include, but not be limited to, elimination of duplicate or redundant titling information, synchronization of system clocks, camera sequences, dome presets, salvos and tours. Programming of any system passwords or limiting of accessibility prior to commissioning and training is prohibited.
- B. Power requirements shall be determined by actual equipment used.
- C. Ensure that:
1. All applicable statutes, ordinances, regulations, license requirements and codes are fully complied with.
 2. All required permits are obtained.
 3. All required inspections are conducted.
 4. All necessary certificates are issued, obtained, and delivered to the Postal Service.
 5. All equipment installations and mounting are in strict accordance with requirements for applicable seismic classification.



- D. Arrange all components to be mounted in the console(s)/rack(s) in accordance with CCTV Provider and/or Postal Service provided System Elevation drawings. Design shall provide a neat appearance and accessibility for servicing equipment.
- E. Provide required power outlets, interconnecting cables, hardware and equipment for a complete and operable system.
 - 1. Power, 120VAC: As required by codes and standards for the facility.
 - 2. Where conduit is used, a minimum of 40% excess capacity shall be provided for future use.
- F. Install cameras in the general vicinity of locations indicated on Drawings at final locations defined by camera location test.
 - 1. Provide 84-inch minimum headroom below cameras and their mountings. Where necessary modify mounting type to maintain clearance, except as noted on drawings (behind counter) and along slat wall.
- G. All coaxial video connections must be made with crimp-type BNC connectors. Twist-on connectors are not acceptable.
- H. When not installed in cable trays, cable (CAT-5e, fiber optic, and low voltage power) shall be supported with wide base cable hangers rated for proper support of CAT-5e, fiber optic, and innerduct cables (compliant with UL and NEC requirements for structured cabling).
 - 1. Cable hangers shall be installed every 3 to 6 feet and shall be rated to support the weight of the cable multiplied by a factor of three (3).
 - 2. All Fiber Optic cables shall be installed in appropriately sized innerduct cabling.

3.3 CONSTRUCTION

- A. Interface with Other Work: Interface installation of CCTV System with Intrusion Detection System specified in Section 281600 and Enterprise Physical Access Control System specified in Section 281304.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Inspection and testing procedures.
- B. Inspection:
 - 1. Inspect equipment installation, interconnection with system devices, mounting locations, and mounting methods.
 - 2. Verify that units and controls are properly installed, connected, and labeled and that interconnecting wires and terminals are identified.
- C. Testing:
 - 1. Perform tests and provide test equipment, tools, and personnel required to conduct system tests and inspections. These tests shall include video quality and PTZ operation (where applicable) for all cameras.
 - 2. Provide an actual demonstration of each system function.
 - 3. Conduct system acceptance test upon completion of installation using pre-approved procedures. Test shall consist of system, subsystem, and device level acceptance tests, including software.
 - 4. Prepare all test procedures and submit the procedures for review by the Postal Service facility manager. Obtain test procedure approval prior to actual system tests.
 - 5. Ensure that test procedures confirm each specification statement and manufacturer requirement has been met or exceeded. An actual demonstration of each system function and a simulation of each system failure shall be provided.



6. An acceptance test period of thirty days shall begin at the start of the acceptance test. Any system failure during the acceptance test period will suspend the acceptance test. The thirty-day test period will restart when the required repairs have been made and certified.
7. Perform all tests in the presence of the Postal Service facility manager or authorized agent. The Postal Service reserves the right to accept any portion or activate any phase prior to acceptance of entire system.

3.5 OPERATING INSTRUCTION

- A. Provide on-site instruction to review the operation of the system and detail any common troubleshooting or maintenance steps that are required to ensure normal operation.
- B. Provide one complete set of equipment operating, installation, and programming manuals that will remain in the installed location.

3.6 CLEANING AND ADJUSTING

- A. Clean installed items using methods and materials recommended by equipment manufacturers just before conducting acceptance test.
- B. Adjust manual lens irises to meet lighting conditions.
- C. Adjust field of view for each camera per Inspection Service direction.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 8/29/2013

END OF SECTION 28 23 04 00



SECTION 28 23 05 00 - MPF INTEGRATED SECURITY AND INVESTIGATIVE PLATFORM (ISIP) CCTV SYSTEM**

NOTE TO SPECIFIER

Use this Specification Section for Mail Processing Facilities only.

****THIS ENTIRE SECTION CONSISTS OF REQUIRED PARTS OR ARTICLES. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

This is a Direct Vendor supplied system used by the Postal Inspection Service for Security, Criminal Investigative, Burglary, and Robbery Countermeasure purposes in Postal facilities.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Provide and install a complete IP Video System including, but not limited to;
 - a. IP Video Surveillance Cameras, housings, power supplies, cabling, and related equipment.
 - b. Video management software.
 - c. Video monitoring and recording equipment.
 - d. Equipment enclosures.
 - e. Network equipment including routers and switches

B. Direct Vendor

1. All equipment including the servers, monitors, network switch, etc. are to be procured directly from the Direct Vendor (Diebold) utilizing the pass through pricing process.
2. The cameras, servers, monitors and associated equipment shall be supplied and installed by DIEBOLD, INC the sole approved USPS CCTV Direct Vendor. The Direct Vendor is to provide a Bill of Materials, pricing, and installation costs. The General Contractor is responsible for power, conduit, cable tray, cable and cable pulling. For assistance contact the Direct Vendor at:

DIEBOLD, INC.
 Michael Tracey, USPS Account Manager
 44845 Falcon Place Suite 106
 Sterling, VA 20166
 Cell: 571-451-7629
 email: michael.tracey@diebold.com

3. Contract to Diebold should be addressed to:

Diebold Inc.
 3 Westchester Plaza
 Elmsford, NY 10523

C. General Contractor

1. Responsible for providing power, conduit, cable tray, cable, and cable pulling and NEMA Enclosures to be used as part of the installation.



2. Provide camera placement drawings with field of view requirements to the Direct Vendor and any request documentation. This will include head end and remote node locations and any monitors requested.
 3. Verify customer location has 56 network available for installation of system via USPS site project manager or USPS IT.
- D. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents including:
1. System Installation Manuals (provided by the Direct Vendor) shall be left on-site during the final acceptance. Manuals will not be provided prior to installation completion.
- E. Prompt Payments. In accordance with the Contractor Certification on Postal Service Form 4211B, "Project Contract Payment Authorization", the contractor certifies that prompt payment, (within 30 days) to the subcontractor (Direct Vendor) will be made.
- F. Related Sections:
1. Section 260500 – Common Work Results for Electrical
 2. Section 260533 – Raceway and Boxes for Electrical Systems
 3. Section 281600 – Intrusion Detection.
 4. Section 281304 – Physical Access Control System.
 5. Section 270500 – Common Work Results for Communications.

1.2 REFERENCES

- A. National Fire Protection Association (NFPA):
1. NFPA 70 - National Electrical Code.
 2. ANSI / TIA / EIA 568-C Commercial Building Telecommunications Cabling Standard (2009)
 3. ANSI / TIA / EIA 569-B Commercial Building Standard for Telecommunications Pathways

1.3 SYSTEM DESCRIPTION

- A. Design Requirements: IP video system between points of surveillance indicated on Drawings and the central monitoring station consists of video IP cameras, camera outlets, camera controls, monitors, control stations, distribution components, video servers, Network Connections and accessories.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures:
1. Product Data: Manufacturer's specification sheets for each component shall not be required for all products provided as part of this Direct Vendor agreement.
 2. Due to USPS security requirements, submittals will be limited to one electronic copy of the block diagram and one copy of the shop drawings to be provided to the General Contractor.
 3. Final As-Built Drawings, Operation and Installations Manual, will be supplied directly to USPS and stored within the rack per USPS COTR.
- B. Shop Drawings:
1. The Direct Vendor will provide a Standard Drawing Package that shall be utilized for the installation of the CCTV system. This package shall include:
 - a. Block Diagram: System block diagrams noting major system components and interrelationships of each component.



- b. Console and Equipment Racks: Rack elevation drawings showing console/equipment arrangement.
 - c. The shop drawings shall include camera placement (camera placements shall be provided by the project specific design entity).
- C. Sequence and Scheduling Plan: Direct Vendor shall provide installation scheduling plan for review and approval. Coordinate scheduling of software and revisions with the USPS.
- D. Section 017704 - Closeout Procedures and Training:
 - 1. Operation and Maintenance Data: Include data for each type of product, including features and operating sequences, both automatic and manual. This information shall be supplied directly to the USPS by the Direct Vendor.
 - 2. Product Quick Reference cards for the operation of all key system components.
 - 3. Project Record Documents: Direct vendor shall provide field-accurate drawings that reflect actual locations of cameras and, indicating cable identifiers, layout, location and numbering of system devices to reflect as-built conditions. The General Contractor shall provide routing of cabling information.
 - 4. Provide a final materials list of equipment installed and spare parts on hand. Materials list shall include model number, serial number, and date installed.
 - 5. Project Completion Certification: Document signed by the direct vender and a Postal Service representative indicating that the project is fully complete with all punch-listed items resolved. IN NEW CONSTRUCTION, THE GENERAL CONTRACTOR WILL SIGN THE PROJECT COMPLETION CERTIFICATION.
 - 6. OPERATING INSTRUCTION
 - a. Provide on-site instruction to review the operation of the system and detail any common troubleshooting or maintenance that is required to ensure normal operation. Authorized USPS (USPSIS & USPS OIG) Representatives will receive this training.
 - b. Provide one complete set of equipment operating, installation.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Keep devices and equipment in manufacturer's packaging in a secured location until system is ready for installation.
- C. Comply with Direct Vendor requirements. Coordinate storage location with the Postal Service.
- D. The equipment delivered must be insured at the contractor's expense through acceptance.

1.6 DIRECT VENDOR WARRANTY/SERVICE/TECHNICAL SUPPORT PLAN

- A. Warranty:
 - 1. Direct Vendor to include manufacturer warranty for three (3) years after facility acceptance and project completion certification for materials and labor.
 - a. Service plan shall include all parts and labor, and shall include return shipping. Failed equipment shall be repaired or replaced at no charge to the Postal Service during the Direct Vendor warranty period.
 - b. USPS shall not be required to process any paperwork in order to be entitled to service plan coverage. It is the Direct Vendor's sole responsibility to monitor and comply with warranty eligibility.
 - c. Where operational performance is substantially affected, all software and firmware shall be upgraded to the latest version supported by the purchased hardware platform throughout the service plan period and be provided at no cost to USPS. Such upgrades shall be



covered under the warranty/service plan and are at the discretion of the Contracting Officers Technical Representative.

- d. Any software bugs identified by the USPS and mutually agreed upon as 'level one' bugs (impacting operation with no work-around) shall be rectified within two (2) weeks of their being reported.
- e. Any software bugs identified by the USPS and mutually agreed upon as 'level two' bugs (impacting operation but with a work-around) shall be rectified within 90 days of their being reported.
- f. Turnaround time for all repairs (warranty and out-of-warranty) shall not exceed 72 hours.
- g. Direct Vendor shall make advance replacement units available in cases where USPS operational issues require immediate replacement of a unit while minimizing down time.

B. Technical Support

- 1. Direct Vendor shall provide toll-free 24/7 technical support at no charge throughout the warranty period.
- 2. Direct Vendor shall provide on-site installation support for systems with more than 40 total cameras. These visits shall include pre-construction site survey and project review, punch-list generation, and final inspection and system certification.
- 3. Data Recovery — Direct Vendor shall provide a service to assist the USPS in recovering data from digital recording system hard drives and removable storage media in the event of a failure.
 - a. Turnaround time for data recovery shall be less than seven (7) days from receipt of hard drives at Direct Vendor's data recovery center.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Selected Direct Vendor

DIEBOLD, INC.
 Michael Tracey, USPS Account Manager
 44845 Falcon Place Suite 106
 Sterling, VA 20166
 Cell: 571-451-7629
 email: michael.tracey@diebold.com

B. Section 016000 - Product Requirements:

- 1. Product options and substitutions are not permitted without a written and USPS approved deviation.
- 2. All equipment to be supplied under this specification shall be new and the current model of the Direct Vendor listed above.
- 3. Systems and components shall have been thoroughly tested and proven in actual use.

2.2 VIDEO SERVER AND STORAGE

A. Based on the Construction Documents, the General Contractor shall purchase all equipment from the Direct Vendor.

B. Server :

- 1. Server/Storage Requirements: Server storage, processor, and RAM requirements will be based off a mathematical formula from the information obtained during the site survey process. Once the number, type and classification of cameras are approved by all parties, it will calculate the



required server(s) fit for the site. These servers are all HP Servers that contain USPS IT ACE images. These are approved CLINS and Assets by USPS.

- a. Storage for 30 Days of Video with 30 % Expansion Capability. Depending on size of system storage may be either internal to the sever or external iSCSI attached NAS device.
- b. Dual Network Interface Cards on board and 4 additional GB NIC ports via PCIe card per USPS requirements. The system also contains HP's integrated Lights Out management cards. This requires 1 connection on the USPS network per server. Thus each server will have (at minimum) 2 USPS 56 Network connections.
- c. UPS Power Supplies for Server and Storage
- d. Input Power: 120VAC, 60Hz (a power adaptor may be used to provide this voltage).
- e. Operating Temperature: Range shall be equal to or greater than 10 to 40 degrees Celsius.
- f. Humidity: Withstand a minimum of 10% to 80% humidity.
- g. Current Build of Ip Configure Network Video recording Software
- h. 17" Monitor
- i. Mouse
- j. Keyboard
- k. All items rack mounted

2.3 IP VIDEO SWITCH

A. CISCO NETWORK SWITCH (IP Video)

1. Based on the Construction Documents, the CISCO Switch is to be procured by the General Contractor from the Direct Vendor.

2.4 VIDEO ENCODER

A. Direct Vendor shall provide video encoders

- B. The video encoder blade shall be equipped with six (6) analog video inputs and shall be able to provide simultaneous Motion JPEG and MPEG-4 video streams. Furthermore the blade shall, for each video channel, support resolutions up to 704x576 (PAL) / 704x480 (NTSC) pixels in full frame rate (25/30fps). The Encoder Shall meet or Exceed the following requirements:

1. Be equipped with 6 analog composite video inputs with PAL/NTSC auto sensing
2. Provide resolutions up to 704x576 (PAL) / 704x480 (NTSC) pixels at 25/30 frames per second for each video channel
3. Support simultaneous Motion JPEG, MPEG-4 and H264 individually configurable for each video channel
4. Support both unicast and multicast MPEG-4, individually configurable for each video channel
5. Provide the ability to control PTZ devices from third party manufacturer
6. Support both IPv4 and IPv6
7. Provide multiple user passwords, support for HTTPS and SSL/TLS and incorporate IEEE802.1X authentication
8. Be equipped with 4 alarm inputs and 4 alarm outputs
9. Include embedded event functionality, which may be triggered by alarm input, video loss or by video motion detection
10. Be supported by an open and published API
11. Be equipped with a 1000BaseT Gigabit Ethernet interface

- C. The desktop Video Encoder shall be equipped with one analog video input and one channel of audio, provide simultaneous Motion JPEG and MPEG-4 video streams and shall support resolutions up to 704x576 (PAL) / 704x480 (NTSC) pixels in full frame rate (25/30fps). The Encoder Shall meet or Exceed the following requirements:



1. Be equipped with a 10BaseT/100BaseTX Ethernet interface
2. Be equipped with 1 analog video input, supporting composite and Y/C signals
3. Provide resolutions up to 704x576 (PAL) / 704x480 (NTSC) pixels at 25/30 frames per second
4. Support simultaneous Motion JPEG, MPEG-4 and H264
5. Support both unicast and multicast MPEG-4
6. Provide full duplex audio and be equipped with Line In and Line Out
7. Provide the ability to control PTZ devices from third party manufacturer
8. Support both IPv4 and IPv6
9. Provide multiple user passwords, support for HTTPS and SSL/TLS and incorporate IEEE802.1X authentication
10. Be equipped with 4 alarm inputs and 4 alarm outputs
11. Include embedded event functionality, which may be triggered by alarm input, video loss or by video motion or audio detection
12. Be supported by an open and published API

- D. The Video Encoder Blade and Video Encoder Shall be available as Rack Mountable or Desk-top versions.

2.5 VIDEO DECODERS

- A. Video Decoders will support single monitor with full screen camera view or a Quad Decoder with multiple single screen display with sequence of full screen or Quad cameras.
- B. Camera displays approved only by OIG and IS
1. Video output- Analog PAL or NTSC or HDMI
 2. Video decoding- motion JPEG and MPEG-4 Unicast and Multicast
 3. Security – Password protected user access HTTPS encryption

2.6 VIDEO CAMERAS

- A. Direct Vendor Shall provide Cameras
- B. IP Color cameras for video surveillance and monitoring of specific areas as shown on the drawings and confirmed with Postal Inspection Service through Contracting Officer Technical Representative with the following minimum capacities
- C. Fixed H.264, indoor, dome type camera shall be a network camera with WDR, light finder, remote focus and zoom and shall incorporate Power over Ethernet. The camera shall meet or exceed the following requirements:
1. Be equipped with a 10BaseT/100BaseTX Ethernet interface
 2. Include a vandal proof resistant casing with smoked transparent cover where required.
 3. Equipped with pixel counter.
 4. Image sensor: Progressive scan RGB CMOS 1/3 inch (effective).
 5. Lens: 6MM; 2.5 – 12MM, 105 degree – 49 degree view, F1.2 DC-IRIS.
 6. Minimum illumination:
 - a. Color: 0.1 LUX, F1.2.
 - b. B/W: 0.2 LUX, F1.2.
 7. Shutter time: 1/29500 to 2 seconds; 60 Hz.
 8. Pan/Tilt/Zoom: Digital PTZ, preset positions, guard tour.
 9. Angle Adjustment: Pan 360 degrees, tilt 170 degrees, rotation 340 degrees.
 10. Resolution: 1280x960 (1 MP) 160x90.
 11. Support simultaneous Motion JPEG, MPEG-4 and H264.
 12. Frame Rate:



- a. H.264; 30 fps in all resolutions; 60 Hz.
 - b. Motion JPEG; 30 fps in all resolutions; 60 Hz.
 13. Support both unicast and multicast MPEG-4.
 14. Support Power over Ethernet according to IEEE802.3af.
 15. Support both IPv4 and IPv6.
 16. Provide multiple user passwords, support for HTTPS and SSL/TLS and incorporate IEEE802.1X authentication.
 17. Be equipped with 1 alarm input and 1 alarm output.
 18. Include embedded event functionality, which may be triggered by alarm input or by video motion or audio detection.
 19. Be supported by an open and published API.
 20. Casing: Indoor; aluminum inner camera module with encapsulated electronics (1.4 lbs).
 21. Processor and Memory: ARTPEC-3, 256 MB RAM, 128 MB Flash.
 22. Connectors: RJ45 10 BASE – T/100BASE-TX PoE terminal block for (1) alarm input and (1) alarm output.
 23. Operating Conditions: Indoor; 32 – 122 degrees F; 10 – 85 percent RH.
 24. Accessories: Indoor; mounting bracket, smoked transparent cover. Provide ceiling or pendant mounting kits.
 25. Basis of Design: Indoor, Axis #P3364.
- D. Standard Resolution camera shall be a network camera, providing simultaneous Motion JPEG, MPEG-4 and H264 video streams, support resolutions up to 640x480 pixels in full frame rate (30fps), be equipped with full duplex audio and incorporate Power over Ethernet. The camera shall meet or exceed the following requirements:
1. Be equipped with a 10BaseT/100BaseTX Ethernet interface
 2. Include a tamper resistant casing
 3. Feature a progressive scan sensor
 4. Provide images down to 1 LUX at F1.3
 5. Provide resolutions up to 640x480 pixels at 30 frames per second
 6. Support simultaneous Motion JPEG, MPEG-4 and H264
 7. Support both unicast and multicast MPEG-4
 8. Support Power over Ethernet according to IEEE802.3af
 9. Support both IPv4 and IPv6
 10. Provide multiple user passwords, support for HTTPS and SSL/TLS and incorporate IEEE802.1X authentication
 11. Be equipped with 1 alarm input and 1 alarm output
 12. Include embedded event functionality, which may be triggered by alarm input or by video motion or audio detection
 13. Be supported by an open and published API
- E. PTZ camera shall be a network dome camera and shall incorporate 29x optical zoom, day/night functionality, and simultaneous Motion JPEG and MPEG-4 video streams. Camera Shall meet or exceed the following requirements:
1. Be equipped with a 10BaseT/100BaseTX Ethernet interface
 2. Include a vandal proof resistant casing with smoked transparent cover.
 3. Feature a progressive scan CCD sensor with Wide Dynamic Range (WDR), electronic image stabilizer and day/night functionality.
 4. Be equipped with 29x optical zoom.
 5. Image Sensor: 1/4 Progressive scan CCD.
 6. Lens: F1.43, 3.67 – 104 mm angle of view – horizontal – 53.1 to 2.0 degrees.
 7. Minimum Illumination: 0.5 LUX @ 30IRE F1.4.
 8. Shutter Time: 1/30,000s to 1s.
 9. PTZ
 - a. E-Flip, 100 preset positions
 - b. 29x optical zoom and 12x digital zoom, total 348x zoom.



- c. Pan: 360 degrees, 0.2 – 300 degrees/s.
 - d. Tilt: 180 degrees, 0.2 – 300 degrees/s
 - 10. Video Compression: H264 (MPEG – 4 part 10/AVC), motion J-PEG and H264.
 - 11. Resolution: D1 720x480 to 176x120.
 - 12. Frame Rate: H.264 – Up to 30 fps in VGA at max zoom.
 - 13. Frame Rate Motion: J-PEG – Up to 30 fps at max zoom.
 - 14. Support simultaneous Motion JPEG, MPEG-4 and H264.
 - 15. Support both unicast and multicast MPEG-4.
 - 16. Support Power over Ethernet according to IEEE802.3af.
 - 17. Support both IPv4 and IPv6.
 - 18. Provide multiple user passwords, support for HTTPS and SSL/TLS and incorporate IEEE802.1X authentication.
 - 19. Be equipped with full memory card for alarm triggers.
 - 20. Include embedded event functionality, which may be triggered by alarm input or by video motion or audio detection.
 - 21. Be supported by an open and published API.
 - 22. Casing:
 - a. Indoor; IK10 impact – resistant aluminum.
 - 23. Processor and Memory: 256 MB RAM, 128 MB Flash.
 - 24. Connectors: RJ45 10 BASE – T/100BASE-TX PoE terminal block for (2) alarm input and (2) alarm output.
 - 25. Operating Conditions:
 - a. Indoor; 32 – 122 degrees F; 20 – 80 percent RH.
 - 26. Security: Password protection, IP address filtering, HTTPS encryption, IEEE 8021x network access control.
 - 27. Power: 24 to 34 VDC max 15W indoor; power over Ethernet IEEE 802.3at.
 - 28. Accessories:
 - a. Indoor; ceiling or pendant mounting and connector kits. Provide pendant wall or pole attachment.
 - 29. Basis of Design: Indoor, Axis #P5532.
- F. Registry cage, Network Virtual PTZ camera shall be indoor dome type with remote focus and instant zoom, shall be equipped with full duplex audio and shall incorporate Power over Ethernet. The camera shall meet or exceed the following requirements:
- 1. Be equipped with a 10BaseT/100BaseTX Ethernet interface.
 - 2. Include a vandal proof resistant casing with smoked transparent cover.
 - 3. Equipped with pixel counter.
 - 4. Image Sensor -1/2 "Progressive scan C-MOS 3.1 mega-pixel
 - 5. Lens – F1.8 fixed iris, 2.7 mm, angle of view – horizontal -44 to 140 degrees, vertical 35 to 105 degrees.
 - 6. Minimum illumination – 10 LUX wide mode, 20 LUX tele-mode
 - 7. Shutter time 1/1000 s to 1/5 s
 - 8. PTZ – 3x zoom, .1 s wide to tele, 20 preset positions, + 70 degrees pan, +52 degrees tilt, max speed 400 degrees /s, Guard tour, designed for continuous movement
 - 9. Video Compression, MPEG-4 part 2, (ISO/ IEC 14496-2) motion J-PEG and H264
 - 10. Resolutions- 160x 90 to 640x 480
 - 11. Frame Rate MPEG-4 – Up to 30 fps in VGA at max zoom
 - 12. Frame Rate Motion J-PEG – Up to 30 fps at max zoom
 - 13. Video Streaming – Simultaneous M-PEG 4 and motion J-PEG controllable frame rate and band width, VBR/ CBR MPEG-4.
 - 14. Support both unicast and multicast MPEG-4.
 - 15. Support Power over Ethernet according to IEEE802.3af.
 - 16. Support both IPv4 and IPv6.
 - 17. Be equipped with 1 alarm input and 1 alarm output.



18. Include embedded event functionality, which may be triggered by alarm input or by video motion or audio detection.
19. Be supported by an open and published API.
20. Casing: Indoor; aluminum inner camera module with encapsulated electronics.
21. Processor and Memory: ARTPEC-A, 32 MB RAM, 8 MB Flash.
22. Connectors: RJ45 10 BASE – T/100BASE-TX PoE terminal block for (1) alarm input and (1) alarm output.
23. Security – Password protection, IP address filtering, HTTPS encryption, IEEE 802.1x network access control
24. Power – 4.9 to 5.1 VDC max 3.1 W power over Ethernet IEEE 802.3 af class 1
25. Operating Conditions – 5 to 40 degrees C.
26. Accessories: Indoor; pendant mounting bracket with smoked transparent cover.
27. Basis of Design: Indoor, Axis #212PTZ

NOTE TO SPECIFIER

The choice of exterior gate cameras shall be based on the viewing distance and the size of the area to be monitored. In general, utilize the AXIS #3364-VE dome type camera for non-blue sky, wall mounted applications and for blue sky applications requiring shorter viewing distances. Specifier to select the appropriate paragraph 2.6 G.

- G. Gate camera shall be fixed (1) mega pixel, outdoor, non-blue sky dome type camera shall be a network camera with WDR, light finder, remote focus and zoom, shall be equipped with full duplex audio and shall incorporate Power over Ethernet. The camera shall meet or exceed the following requirements:
 1. Be equipped with a 10BaseT/100BaseTX Ethernet interface.
 2. Include a vandal proof resistant casing smoked transparent cover.
 3. Equipped with pixel counter.
 4. Image sensor: Progressive scan RGB CMOS 1/3 inch (effective).
 5. Lens: 2.5 – 12MM, 105 degree – 49 degree view, F1.2 P-IRIS.
 6. Day and Night: Automatically removable infrared-cut filter.
 7. Minimum illumination:
 - a. Color: 0.15 LUX, F1.4.
 - b. B/W: 0.03 LUX, F1.4.
 8. Shutter time: 1/29500 to 2 seconds; 60 Hz.
 9. Pan/Tilt/Zoom: Digital PTZ, preset positions, guard tour.
 10. Angle Adjustment: Pan 360 degrees, tilt 170 degrees, rotation 340 degrees.
 11. Resolution: 1280x960 (1 MP) 160x90.
 12. Support simultaneous Motion JPEG, MPEG-4 and H264.
 13. Frame Rate: H264; 30 fps in all resolutions; 60 Hz.
 14. Support both unicast and multicast MPEG-4.
 15. Support Power over Ethernet according to IEEE802.3af.
 16. Support both IPv4 and IPv6.
 17. Provide multiple user passwords, support for HTTPS and SSL/TLS and incorporate IEEE802.1X authentication.
 18. Be equipped with 1 alarm input and 1 alarm output.
 19. Include embedded event functionality, which may be triggered by alarm input or by video motion or audio detection.
 20. Be supported by an open and published API.
 21. Casing: Outdoor; IP66 and NEMA 4X, IK10 impact resistant aluminum with integrated dehumidifying membrane.
 22. Processor and Memory: 256 MB RAM, 128 MB Flash.
 23. Connectors: RJ45 10 BASE – T/100BASE-TX PoE terminal block for (1) alarm input and (1) alarm output.
 24. Operating Conditions: Outdoor; -40 – 131 degrees F; 10 – 100 percent RH.



25. Accessories: Outdoor; Weather shield, cable shield, 16 ft. network cable with pre-mounted gasket. Provide pendant wall or pole attachment.
26. Basis of Design: Outdoor, Axis #P3364-VE.

G. Gate camera shall be fixed (1) mega pixel, outdoor, network type with WDR, light finder, remote focus and zoom and shall incorporate Power over Ethernet. The camera shall meet or exceed the following requirements:

1. Be equipped with a 10BaseT/100BaseTX Ethernet interface.
2. Include a vandal proof resistant casing with fan and heater.
3. Equipped with pixel counter.
4. Image Sensor- 1/4" Sony Wfine progressive scan RGB CCD.
5. Lens – F1.2 varifocal, 3 to 8 mm, DC iris.
6. Day and Night - automatic IR filter removal in low light conditions.
7. Angle of view – 66 to 27 degrees horizontal.
8. Camera angle adjustment – Pan 360, tilt 170 rotation 430 degrees.
9. Minimum Illumination – Color mode 0.3 lux at F1.2, black and white mode 0.5 lux at F1.2
10. Video compression – H264 (MPEG-4 part 10/AVC), Motion J-PEG.
11. Resolutions –1280x800 to 160x90.
12. Frame rate – Up to 30 fps in all resolutions.
13. Video Streaming – Simultaneous motion J-PEG, MPEG-4 and H264 controllable frame rate and band width, constant and variable bit rate (MPEG-4).
14. Support both unicast and multicast MPEG-4.
15. Support Power over Ethernet according to IEEE802.3af.
16. Support both IPv4 and IPv6.
17. Provide multiple user passwords, support for HTTPS and SSL/TLS and incorporate IEEE802.1X authentication.
18. Be equipped with 1 alarm input and 1 alarm output.
19. Include embedded event functionality, which may be triggered by alarm input or by video motion or audio detection.
20. Be supported by an open and published API.
21. Casing: Outdoor; IP66 and NEMA 4X, IK10 impact resistant aluminum with integrated humidifying membrane.
22. Processor and Memory: 256 MB RAM, 128 MB Flash.
23. Connectors: RJ45 10 BASE – T/100BASE-TX PoE terminal block for (1) alarm input and (1) alarm output. Shutter time – 1/24500s to 1/6s.
24. Power – Camera and built in fan, 9-24VDC, max 5.5 watts, 10-24 VAC, max 8VA, PoE (IEEE802.3af) class 2, When using built in heater, 12 VDC max 20 watts, 24 VAC max 25VA.
25. Operating Conditions – 5 to -50 C, with heater -20 to -50 C, Humidity 20-80 percent RH (non-condensating).
26. Accessories: Outdoor, weather shield, cable shield, 16 ft. network cable with pre-mounted gasket. Provide pole attachment.
27. Basis of Design: Outdoor Axis #P1344 with Pelco #EH3515/BK3512-1 blower, Pelco #HD3515-1 heater, Pelco #SS3515 sun shroud

H. Fixed (1) Mega pixel, outdoor, non-blue sky dome type camera shall be a network camera with WDR, light finder, remote focus and zoom, shall be equipped with full duplex audio and shall incorporate Power over Ethernet. The camera shall meet or exceed the following requirements:

1. Be equipped with a 10BaseT/100BaseTX Ethernet interface.
2. Include a vandal proof resistant casing smoked transparent cover.
3. Equipped with pixel counter.
4. Image sensor: Progressive scan RGB CMOS 1/3 inch (effective).
5. Lens: 2.5 –12MM, 105 degree – 49 degree view, F1.2 P-IRIS.
6. Day and Night: Automatically removable infrared-cut filter.



7. Minimum illumination:
 - a. Color: 0.15 LUX, F1.4.
 - b. B/W: 0.03 LUX, F1.4.
 8. Shutter time: 1/29500 to 2 seconds; 60 Hz.
 9. Pan/Tilt/Zoom: Digital PTZ, preset positions, guard tour.
 10. Angle Adjustment: Pan 360 degrees, tilt 170 degrees, rotation 340 degrees.
 11. Resolution: 1280x960 (1 MP) 160x90.
 12. Support simultaneous Motion JPEG, MPEG-4 and H264.
 13. Frame Rate: H264; 30 fps in all resolutions; 60 Hz.
 14. Support both unicast and multicast MPEG-4.
 15. Support Power over Ethernet according to IEEE802.3af.
 16. Support both IPv4 and IPv6.
 17. Provide multiple user passwords, support for HTTPS and SSL/TLS and incorporate IEEE802.1X authentication.
 18. Be equipped with 1 alarm input and 1 alarm output.
 19. Include embedded event functionality, which may be triggered by alarm input or by video motion or audio detection.
 20. Be supported by an open and published API.
 21. Casing: Outdoor; IP66 and NEMA 4X, IK10 impact resistant aluminum with integrated dehumidifying membrane.
 22. Processor and Memory: 256 MB RAM, 128 MB Flash.
 23. Connectors: RJ45 10 BASE – T/100BASE-TX PoE terminal block for (1) alarm input and (1) alarm output.
 24. Operating Conditions: Outdoor; -40 – 131 degrees F; 10 – 100 percent RH.
 25. Accessories: Outdoor; Weather shield, cable shield, 16 ft. network cable with pre-mounted gasket. Provide pendant wall or pole attachment.
 26. Basis of Design: Outdoor, Axis #P3364-VE.
- I. Exterior PTZ camera shall be a network dome camera and shall incorporate 36x optical zoom, day/night functionality, and simultaneous Motion JPEG and MPEG-4 video streams. Camera shall meet or exceed the following requirements:
1. Be equipped with a 10BASE-T/100BASE-TX Ethernet interface
 2. Include a vandal proof resistant casing with smoked transparent cover.
 3. Feature a progressive scan CCD sensor with Wide Dynamic Range, Electronic Image Stabilizer and day/night functionality
 4. Be equipped with 36x optical zoom
 5. Image Sensor – 1/4 ExView HAD Progressive scan CCD.
 6. Lens – f=3.3 - 119mm, F1.4 – 4.2, autofocus, automatic day/night, horizontal – 57.2 to 1.7 degrees.
 7. Minimum Illumination:
 - a. Color: 0.5 LUX at 30 IRE F1.4.
 - b. B/W: 0.008 LUX at 30 IRE F1.4.
 8. Shutter Time – 1/30,000s to 0.5s
 9. PTZ
 - a. E-Flip, 100 preset positions
 - b. 36x optical zoom and 12x digital zoom, total 240x zoom.
 - c. Pan; 360 degrees endless, 0.05 – 450 degrees/s
 - d. Tilt; 220 degrees, 0.05 – 450 degrees/s.
 10. Video Compression, H.264 (MPEG-4 part 10/AVC) motion J-PEG.
 11. Resolutions – Extended D1 752x480 to 176x120.
 12. Frame Rate – H.264 – Up to 30 fps in all resolutions.
 13. Frame Rate Motion J-PEG – Up to 30 fps at all resolutions.
 14. Support simultaneous motion JPEG, MPEG-4 and H264.
 15. Support both unicast and multicast MPEG-4.
 16. Support Power over Ethernet according to IEEE802.3af



17. Support both IPv4 and IPv6
18. Provide multiple user passwords, support for HTTPS and SSL/TLS and incorporate IEEE802.1X authentication
19. Be equipped with full memory card for alarm triggers.
20. Include embedded event functionality, which may be triggered by alarm input or by video motion or audio detection
21. Be supported by an open and published API.
22. Casing:
 - a. Outdoor; IP66 and NEMA 4X, IK10 impact-resistant aluminum with integrated dehumidifying membrane and sun shield.
23. Processor and Memory: 256 MB RAM, 128 MB Flash.
24. Connectors: RJ45 10 BASE – T/100BASE-TX PoE terminal block for (2) alarm input and (2) alarm output.
25. Operating Conditions:
 - a. Outdoor; -40 – 131 degrees F; 20 – 80 percent RH.
26. Security – Password protection, IP address filtering, HTTPS encryption, IEEE 802.1x network access control.
27. Power – 24 to 34 VDC max; 60W outdoor: power over Ethernet IEEE 802.3 af class 1.
28. Accessories:
 - a. Outdoor; required mounting bracket, weather shield, cable shield, 16 ft. network cable with pre-mounted gasket. Provide pendant mounting kits and pole attachment.
29. Basis of Design:
 - a. Outdoor; Axis #Q6032-E.

- J. Products shall utilize internal or external surge protection such that a normally occurring power surge shall not void any manufacturer's warranty

2.7 CAMERA POWER SUPPLIES:

- A. Based on the Construction Documents, the Direct Vendor will identify Camera power source. When required the Direct Vendor will provide Power Supplies for Camera
- B. Interior Fixed Cameras: Camera shall be powered by PoE from network switch. Maximum cable distance from switch to camera is 300 ft. Provide ethernet cable extenders for cable runs exceeding 300 ft., but less than 800 ft.
 1. Network switch shall be equipped with UPS power supply
- C. Interior PTZ Cameras: Camera shall be powered by PoE from network switch. Maximum cable distance from switch to camera is 300 ft. Provide ethernet cable extenders for cable runs exceeding 300 ft., but less than 800 ft. A mid-span device is required.
 1. Network switch shall be equipped with UPS power supply.
- D. Exterior Fixed Cameras (non "Blue Sky"):
 1. Camera and enclosure shall be powered by PoE from network switch. Maximum cable distance from switch to camera is 300 ft. Provide ethernet cable extenders for cable runs exceeding 300 ft., but less than 800 ft.
 2. Wall mounted Environmental Enclosure power supplies (where necessary) shall be located in a suitably protected area near the camera. Provide individually fused power supplies.
 3. Pole mounted Environmental Enclosure power supplies shall be located within a NEMA 4 enclosure at the pole. Provide individually fused power supplies.
- E. Exterior PTZ Cameras:



1. PTZ Exterior Cameras shall be powered from individually fused power supplies located within a NEMA 4 enclosure at the pole. Other options for powering these cameras are available based on site design.
- F. Fixed and PTZ cameras requiring cable runs in excess of 800 ft. and all exterior cameras exposed to the elements ("Blue Sky" type) shall utilize fiber optic transmission equipment and shall be powered by individually fused power supplies.
- G. Provide a means for disconnecting camera power supplies from main power at the power supply enclosure, either through a detachable power cord, master fuse or circuit breaker located in the power supply cabinet, or other UL approved switching device.
 1. Power supplies shall be rated to support 200 percent of the actual (nominal) power loading.
 2. Each power supply shall be fed from a dedicated 120Volt circuit.
 3. Adjacent cameras shall be fed from different power supplies.
 4. Multiple camera power supplies are available in the correct application.

2.8 VIDEO CAMERA HOUSINGS AND MOUNTS

- A. Direct Vendor shall Provide indoor housings as required for all camera types with the following minimum capabilities:
 1. Interior Cameras:
 - a. All cameras shall be in a housing that is coordinated with adjacent finishes with the appropriate mounting hardware. Selection of housings and mounts, including incremental changes to paint colors, dome materials, and cosmetic finishes shall be approved by the USPS or their authorized agent.
 - b. All housings shall be sufficiently dust and moisture resistant to withstand normal environmental conditions in their chosen installation location.
 - c. Hardware shall be provided to ensure tamper-resistant mounting in public access areas after normal business hours without modification to the integrity of the housing.
 - d. Where used, pendant mounts shall be suitable for use as wall, ceiling and column mounts. Pendant mounts shall attach to the appropriate camera housing using Direct Dealer provided standard threaded schedule 40 rigid iron pipes. Pipe lengths of 10 feet or less are to be a minimum of 1-1/2 inch diameter. Pipe lengths exceeding 10 feet are to be a minimum of 1-1/2 inch in diameter. Exterior pipe shall be galvanized.
 - e. All mounts shall incorporate installer provided safety chain or cable of sufficient endurance to support 2 times the weight of the equipment
 - f. The General Contractor shall terminate the Ethernet, camera power and fiber optic cabling to the patch panels provided by the Direct Vendor and located in the upright racks.
 2. Exterior Cameras:
 - a. Environmental: Thermostatically controlled heaters and blowers with defrosting capabilities.
 - b. Moisture: Rainproof seals and gaskets.
 - c. Wind Resistance: Rated for 80mph sustained winds, minimum.
 - d. Ambient Temperature Rating: -10 to 60 degrees Celsius.
 - e. Areas with more demanding environmental conditions will be granted a deviation from this specification.

2.9 FIBER OPTIC MEDIA CONVERTER MODULES

- A. Direct Vendor Shall Provide fiber optic media converters
- B. Fiber Optic transmission equipment shall be used when one or more of the following conditions are met:
 1. Camera cable runs exceed 800 linear feet.
 2. The camera is located outdoors and is exposed to the elements ("Blue Sky" type).

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3. Cameras protected by canopies or other architectural elements that shield them from direct view of the overhead sky are excluded from this requirement.
 4. The cable path is within 20 feet of a TIME or MIMS aerial.
- C. Modules located at field devices shall be low profile “miniaturized” type, and shall be mounted in the Power Supply/PoE Injector housing for both fixed and PTZ cameras.
1. Fiber optic transmit modules shall derive power from the camera power supply, eliminating the need for an additional power supply. AC power is required for PoE injector and media converter.
- D. Modules located at head-end locations shall be standalone modular units unless four (4) or more modules are required, in which case they shall be enclosed in a fiber-optic rack mount.
1. If more than one fiber optic rack is used, modules shall be distributed as evenly as possible among the racks to reduce the load on the rack power supply and minimize the impact of a failed rack.
- E. Fiber optic modules shall conform to the following minimum specifications:
1. 10/100 Mbps RJ-45 Ethernet port, ST Fiber Port
 2. 62.5/125 Multi-mode fiber
 3. PoE (PD) device or locally powered
 4. Protocol independent
 5. -31 to 158 deg operating Temperature
 6. IEEE 802.3, IEEE 803.2u and IEEE 803.2af Compliant
- F. Remote Node Cabinet
1. Remote Node Cabinet will house an IP video system network switch, patch panel, UPS and camera power supply.
 - a. The GC shall provide dedicated 110volt power, hang remote node cabinet, terminate fiber optic and CAT-6 cables.
- G. Patch Cables
1. Direct Vendor will provide CAT-6 and fiber optic patch cables for connections, CAT-6, fiber optic patch pushed to devices.
- 2.10 ETHERNET CABLE EXTENDERS
- A. Direct Vender shall provide Ethernet Cable Extenders as required
- B. Cable Extenders, or fiber optics, shall be used at the discretion of the design engineer or when one or more of the following conditions are met:
1. Camera Cable run exceeds 300 ‘ but is not more than 800’. It is not practical to use a remote switch and bridge to the head-end switch
- C. Modules located at the field devices shall be located in the camera enclosure or junction box close to the device Field device module derives power from the head end module and does require local power.
- D. Modules located at the head-end are standalone modules mounted in the equipment rack
- 2.11 CABLING
- A. Camera Ethernet Data Cabling:
1. 4-Pair Category 6 Unshielded Twisted Pair Cable shall be provided and installed by the General Contractor.



2. The General Contractor shall provide and install the RJ-45 jack as shown on the drawings. The General Contractor shall terminate and test the Cat 6 cable and RJ 45 jacks.
 3. Complies with individual characteristics established in ANSI/TIA/EIA-568-B terminated to T568A and all addendums for Category 6 cable performance specification.
 4. Cabling and wire ways shall be installed in accordance to sections 260533 and 270500
 - a. Power:
- B. Power cable shall be appropriately sized to ensure that any signal loss as a function of cable length does not prohibit the delivery of sufficient voltage and current from the power supply to the powered device. A separate power cable may be required by the design engineer as shown on the drawings.
- C. Cable shall have footage markings to Identify CCTV system Cable lengths.
- D. Fiber Optic - When fiber optic modules are required, the General Contractor shall provide fiber optic cable appropriate for the application. Cable shall conform to the following specifications:
1. 62.5 micron glass multimode fiber.
 2. "ST" type connectors shall be used on all cable terminations, including junction boxes and break-out trays.
 3. Performance characteristics (including optical attenuation) shall be such that the Fiber Optic modules specified in Section 2.9 function to deliver signals end-to-end with sufficient bandwidth and quality to meet the specified application.
 4. Physical characteristics such that the cable has sufficient strength and endurance to withstand installation and environmental conditions without adversely affecting optical performance.

Cable Type	Signal	Use
Fiber Optic (Multi-Mode) General Cable CG0021ANU.BK or Approved Equal	Data	See Section 2.9
CAT6 Plenum with footage markings (General Cable 7131769 or Approved Equal)	Camera Data	Camera Data (see Section 2.8)

2.12 ACCESSORIES

- A. Lightning/Surge Protection: Products shall utilize internal or external (power and low voltage) surge protection such that a normally occurring power surge shall not void any manufacturer's warranty.
- B. All Servers and workstations shall utilize a standalone UPS sized for a minimum of 20 minutes of battery run-time. The UPS shall be provided by the Direct Vendor. GC contractor will provide dedicated 120VAC or 220 VAC power determined by the Direct Vendor based on the construction documents
- C. Upright Racks: The Direct Vender shall provide and install upright equipment racks to provide sufficient mounting space for the required equipment.
 1. Racks shall be all metal construction conforming to EIA standards with 19" equipment mounting opening and 1-3/4" vertical spacing of equipment. Rack rails shall be punched with captive nuts, 10-32 screws and nylon washers.
- D. The General Contractor shall terminate the Ethernet, camera power and Fiber Optic cabling to the patch panels provided by the Direct Vender and located in the Upright Racks.



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting Work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates, and conditions are as required, and ready to receive Work.
 - 1. Verify that power and video outlets are in correct locations.
 - 2. Verify that building structure for attachment of equipment mounting devices is in place.
- C. Report in writing to Contracting Officer any prevailing conditions that will adversely affect satisfactory execution of Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Postal Service.
- E. Provide required power outlets, low voltage power supplies, interconnecting cables, hardware and equipment for a complete and operable system.
- F. Camera locations are to be reviewed and approved by a Postal Inspector, through the Contracting Officer, prior to installation.

3.2 INSTALLATION

- A. Install all equipment in accordance with Direct Vendor's published instructions. Installation must be done by the Direct Vendor to assure proper installation and accountability. This includes, but is not limited to the following:
 - 1. All hardware used to secure equipment to racking shall include nylon or other non-metallic washer or grommet between the screw head and equipment panel to prevent any damage to the equipment.
 - a. Rack mount screws shall be self-centering Philips-head configuration unless specialized tam-per-resistant hardware has been specified.
 - b. Screws shall be tightened in such a manner as to allow their removal with common hand tools.
 - 2. Any equipment placed on shelving mounted on an incline of greater than 2 degrees shall be secured to the rack or shelving in such a manner as to prevent movement of the equipment in the direction of the incline. Such fastening shall be done in a manner as to preserve the integrity of the equipment case and chassis, and shall in no way jeopardize warranty coverage of the device.
 - 3. All equipment cabling shall be dressed in such a manner as to ensure a neat and clean appearance.
 - 4. Cable break-outs shall be at 90-degree angles from the harness or chase, and all chases shall be parallel to or at 90-degree angles from the rack frame.
 - 5. Cables are to be secured to the rack frames at sufficient intervals to ensure that the weight of the cable will not contribute to fatigue or early failure of that cable or the device and connector to which it is attached.
 - 6. Sufficient excess cable shall be provided in "service loop locations" to ensure that the cable may be re-connected without requiring the addition of extension pieces.
 - 7. All permanent cabling shall be mechanically numbered in a manner consistent with Direct Vendors written system documentation.
 - 8. Wiring for all equipment shall be tie-wrapped (except as indicated below) so that all connectors in a bundle can be removed and re-installed without the possibility of cross connecting.



9. CAT-6 and Fiber Optic cables shall utilize Velcro fasteners in place of tie wraps to eliminate the risk of over-tightening cable bundles and affecting the strength or rated performance of the cable.
 10. Where wiring is routed through sheet metal or over frame members, the metal edges shall be covered with flexible grommeting or edge dressing (such as automobile door edge trim).
 11. Double-sided foam tape shall not be used to secure any equipment, terminal blocks, or accessory devices. All device mounting shall be of a permanent nature.
 12. All excess length AC cords are to be tie-wrapped out of the way. Where possible, they shall be routed in a separate bundle a minimum of 6 inches away from any signal or control cable.
 13. Exposed wires run to wall mounted cameras shall be fed through tubing or the body of the mount to present a professional appearance.
 - a. Any accessible cables that can be reached by an individual standing on the floor, a stool, or a small stepladder shall be encased in protective tubing or armored sheathing to prevent tampering or cutting with common hand tools.
 14. Care shall be exercised at all times to protect Postal Service property. For example, ladders shall not be placed against wallpapered or finished surfaces, equipment or furnishings; desks or countertops shall not be used in lieu of ladders.
 15. On pendant mounted cameras, label each camera on all four sides with three-inch numbers supplied by the Direct Vendor. Numbers shall be stenciled or laminated vinyl in a contrasting color to the camera housing. Camera number shall match and correspond to the Last Octet of camera IP Address and/or printed map provided by the Direct Vendor. Numbers shall not be placed on lower dome or any area that would obstruct camera viewing.
 16. Ensure that pendant mounted cameras are hung from stable, vibration free mounting platforms, using guy-wires or other support mechanisms to ensure stability where required. Mount cameras below any suspended lighting to avoid glare or reflection on camera dome and/or lens.
 17. Perform complete programming of the system, in coordination with the Contracting Officer and Postal Inspector, or designated representative. Programming shall include, but not be limited to, elimination of duplicate or redundant titling information, synchronization of system clocks, camera sequences, dome presets, salvos and tours. Programming of any system passwords or limiting of accessibility prior to commissioning and training is prohibited.
 18. Provide the Direct Vendor Red Line drawings with job condition changes required to provide accurate close-out documentation
- B. Power requirements shall be determined by actual equipment used.
- C. Ensure that:
1. All applicable statutes, ordinances, regulations, license requirements and codes are fully complied with.
 2. All required permits are obtained.
 3. All required inspections are conducted.
 4. All necessary certificates are issued, obtained, and delivered to the Postal Service.
 5. All equipment installations and mounting are in strict accordance with requirements for applicable seismic classification.
- D. Arrange all components to be mounted in the console(s)/rack(s) in accordance with Direct Vendor and/or Postal Service provided System Elevation drawings. Design shall provide a neat appearance and accessibility for servicing equipment.
- E. Provide required power outlets, interconnecting cables, hardware and equipment for a complete and operable system.
1. Power, 120VAC: As required by codes and standards for the facility.
 2. Where conduit is used, a minimum of 40% excess capacity shall be provided for future use.
- F. Install cameras as shown on the drawings and in accordance with the USPS specifications.
1. Provide 84-inch minimum headroom below cameras and their mountings. Where necessary modify mounting type to maintain clearance, except as noted on drawings (behind counter) and along slat wall.



- G. All Cat6 cable connections must be made to 8 pin modular jacks or plugs at the device and to 8 pin modular patch panel at the head end to the T568A standard. Patch panel shall be terminated per direct vendors documentation/drawings by the General Contractor.
- H. When not installed in cable trays, cable (CAT-6, fiber optic, and low voltage power) shall be supported with wide base cable hangers rated for proper support of CAT-6, fiber optic, and inner-duct cables (compliant with UL and NEC requirements for structured cabling).
 - 1. Cable hangers shall be installed every 3 to 6 feet and shall be rated to support the weight of the cable multiplied by a factor of three (3).
 - 2. Cable tray for camera wiring shall not include any low voltage AC wiring.

3.3 CONSTRUCTION COORDINATION

- A. The Direct Vender shall interface with Other Work: Interface installation of CCTV System with the Physical Access Control System specified in Section 281304.
 - 1. Interface shall be a contact closure provided by the Physical Access Control System vendor.
 - 2. The interface shall be done at a central location.
 - 3. The quantity of inputs shall be provided by the Physical Access Control System vendor.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Inspection and testing procedures.
- B. Inspection:
 - 1. The Direct Vender shall inspect equipment installation, interconnection with system devices, mounting locations, and mounting methods.
 - 2. The Direct Vender shall verify that units and controls are properly installed, connected, and labeled and that interconnecting wires and terminals are identified.
- C. Testing:
 - 1. The Direct Vender shall Perform tests and provide test equipment, tools, and personnel required to conduct system tests and inspections. These tests shall include video quality and PTZ operation (where applicable) for all cameras.
 - 2. The Direct Vender shall provide an actual demonstration of each system function.
 - 3. The Direct Vender shall conduct system acceptance test upon completion of installation using pre-approved procedures. Test shall consist of system, subsystem, and device level acceptance tests, including software.
 - 4. The Direct Vender shall use accepted Checklist for system testing.
 - 5. The Direct Vender shall ensure that test procedures confirm each specification statement and manufacturer requirement has been met or exceeded. An actual demonstration of each system function and a simulation of each system failure shall be provided.
 - 6. An acceptance test period of thirty days shall begin at the start of the acceptance test. Any system failure during the acceptance test period will suspend the acceptance test. The thirty-day test period will restart when the required repairs have been made and certified.
 - 7. Perform all tests in the presence of the Postal Service COTR. The Postal Service reserves the right to accept any portion or activate any phase prior to acceptance of entire system.

3.5 OPERATING INSTRUCTION

- A. The Direct Vender shall provide on-site instruction to review the operation of the system and detail any common troubleshooting or maintenance steps that are required to ensure normal operation to the USPS COTR.



- B. The Direct Vender shall provide two complete sets of equipment operating, installation, and programming manuals that will remain in the installed location.

3.6 CLEANING AND ADJUSTING

- A. Adjust manual lens irises to meet lighting conditions.
- B. Adjust field of view for each camera per USPS COTR direction.

USPS Mail Processing Facility Specification issued: 5/1/2014

Last revised: 9/4/2013

END OF SECTION 28 23 05 00



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SECTION 28 23 05 00 - CSF INTEGRATED SECURITY AND INVESTIGATIVE PLATFORM (ISIP) CCTV SYSTEM**

NOTE TO SPECIFIER

Use this Specification Section for Customer Service Facilities only.

****THIS ENTIRE SECTION CONSISTS OF REQUIRED PARTS OR ARTICLES. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

This is a Direct Vendor supplied system used by the Postal Inspection Service for Security, Criminal Investigative, Burglary, and Robbery Countermeasure purposes in Postal facilities.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Provide and install a complete IP Video System including, but not limited to:
 - a. IP Video Surveillance Cameras, housings, power supplies, cabling, and related equipment.
 - b. Video management software.
 - c. Video monitoring and recording equipment.
 - d. Equipment enclosures.
 - e. Network equipment including routers and switches

B. Direct Vendor

1. All equipment including the servers, monitors, network switch, etc. are to be procured directly from the Direct Vendor (Diebold) utilizing the pass through pricing process.
2. The cameras, servers, monitors and associated equipment shall be supplied and installed by DIEBOLD, INC the sole approved USPS CCTV Direct Vendor. The Direct Vendor is to provide a Bill of Materials, pricing, and installation costs. The General Contractor is responsible for power, conduit, cable tray, cable and cable pulling. For assistance contact the Direct Vendor at:

DIEBOLD, INC.
 Michael Tracey, USPS Account Manager
 44845 Falcon Place Suite 106
 Sterling, VA 20166
 Cell: 571-451-7629
 email: michael.tracey@diebold.com

3. Contract to Diebold should be addressed to:
 Diebold Inc.
 3 Westchester Plaza
 Elmsford, NY 10523

C. General Contractor

1. Responsible for providing power, conduit, cable tray, cable, and cable pulling and NEMA Enclosures to be used as part of the installation.
2. Provide camera placement drawings with field of view requirements to the Direct Vendor and any request documentation. This will include head end location and any monitors requested.
3. Verify customer location has 56 network available for installation of system via USPS site project manager or USPS IT.

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- D. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents including:
 - 1. System Installation Manuals (provided by the Direct Vendor) shall be left on-site during the final acceptance. Manuals will not be provided prior to installation completion.
- E. Prompt Payments. In accordance with the Contractor Certification on Postal Service Form 4211B, "Project Contract Payment Authorization", the contractor certifies that prompt payment, (within 30 days) to the subcontractor (Direct Vendor) will be made.
- F. Related Sections:
 - 1. Section 260500 – Common Work Results for Electrical
 - 2. Section 260533 – Raceway and Boxes for Electrical Systems
 - 3. Section 281600 - Intrusion Detection.
 - 4. Section 270500 - Common Work Results for Communications.

1.2 REFERENCES

- A. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code.
 - 2. ANSI / TIA / EIA 568-C Commercial Building Telecommunications Cabling Standard (2009)
 - 3. ANSI / TIA / EIA 569-B Commercial Building Standard for Telecommunications Pathways

1.3 SYSTEM DESCRIPTION

- A. Design Requirements: IP video system between points of surveillance indicated on Drawings and the central monitoring station consists of video IP cameras, camera outlets, camera controls, monitors, control stations, distribution components, video servers, Network Connections and accessories.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures:
 - 1. Product Data: Manufacturer's specification sheets for each component shall not be required for all products provided as part of this Direct Vendor agreement.
 - 2. Due to USPS security requirements, submittals will be limited to one electronic copy of the block diagram and one copy of the shop drawings to be provided to the General Contractor.
 - 3. Final As-Built Drawings, Operation and Installations Manual, will be supplied directly to USPS and stored within the rack per USPS COTR.
- B. Shop Drawings:
 - 1. The Direct Vendor will provide a Standard Drawing Package that shall be utilized for the installation of the CCTV system. This package shall include:
 - a. Block Diagram: System block diagrams noting major system components and interrelationships of each component.
 - b. Console and Equipment Racks: Rack elevation drawings showing console/equipment arrangement.
 - c. The shop drawings shall include camera placement (camera placements shall be provided by the project specific design entity).
- C. Sequence and Scheduling Plan: Direct Vendor shall provide installation scheduling plan for review and approval. Coordinate scheduling of software and revisions with the USPS.



- D. Section 017704 - Closeout Procedures and Training:
1. Operation and Maintenance Data: Include data for each type of product, including features and operating sequences, both automatic and manual. This information shall be supplied directly to the USPS by the Direct Vendor.
 2. Product Quick Reference cards for the operation of all key system components.
 3. Project Record Documents: Direct vendor shall provide field-accurate drawings that reflect actual locations of cameras and, indicating cable identifiers, layout, location and numbering of system devices to reflect as-built conditions. The General Contractor shall provide routing of cabling information.
 4. Provide a final materials list of equipment installed and spare parts on hand. Materials list shall include model number, serial number, and date installed.
 5. Project Completion Certification: Document signed by the direct vendor and a Postal Service representative indicating that the project is fully complete with all punch-listed items resolved. In new construction, the General Contractor will sign the project completion certification.
 6. OPERATING INSTRUCTION
 - a. Provide on-site instruction to review the operation of the system and detail any common troubleshooting or maintenance that is required to ensure normal operation. Authorized USPS (USPSIS & USPS OIG) Representatives will receive this training.
 - b. Provide one complete set of equipment operating, installation.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Keep devices and equipment in manufacturer's packaging in a secured location until system is ready for installation.
- C. Comply with Direct Vendor requirements. Coordinate storage location with the Postal Service.
- D. The equipment delivered must be insured at the contractor's expense through acceptance.

1.6 DIRECT VENDOR WARRANTY/SERVICE/TECHNICAL SUPPORT PLAN

- A. Warranty:
 1. Direct Vendor to include manufacturer warranty for three (3) years after facility acceptance and project completion certification for materials and labor.
 - a. Service plan shall include all parts and labor, and shall include return shipping. Failed equipment shall be repaired or replaced at no charge to the Postal Service during the Direct Vendor warranty period.
 - b. USPS shall not be required to process any paperwork in order to be entitled to service plan coverage. It is the Direct Vendor's sole responsibility to monitor and comply with warranty eligibility.
 - c. Where operational performance is substantially affected, all software and firmware shall be upgraded to the latest version supported by the purchased hardware platform throughout the service plan period and be provided at no cost to USPS. Such upgrades shall be covered under the warranty/service plan and are at the discretion of the Contracting Officers Technical Representative.
 - d. Any software bugs identified by the USPS and mutually agreed upon as 'level one' bugs (impacting operation with no work-around) shall be rectified within two (2) weeks of their being reported.
 - e. Any software bugs identified by the USPS and mutually agreed upon as 'level two' bugs (impacting operation but with a work-around) shall be rectified within 90 days of their being reported.
 - f. Turnaround time for all repairs (warranty and out-of-warranty) shall not exceed 72 hours.

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- g. Direct Vendor shall make advance replacement units available in cases where USPS operational issues require immediate replacement of a unit while minimizing down time.
- B. Technical Support
 - 1. Direct Vendor shall provide toll-free 24/7 technical support at no charge throughout the warranty period.
 - 2. Direct Vendor shall provide on-site installation support for systems with more than 40 total cameras. These visits shall include pre-construction site survey and project review, punch-list generation, and final inspection and system certification.
 - 3. Data Recovery — Direct Vendor shall provide a service to assist the USPS in recovering data from digital recording system hard drives and removable storage media in the event of a failure.
 - a. Turnaround time for data recovery shall be less than seven (7) days from receipt of hard drives at Direct Vendor's data recovery center.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Selected Direct Vendor

DIEBOLD, INC.
 Michael Tracey, USPS Account Manager
 44845 Falcon Place Suite 106
 Sterling, VA 20166
 Cell: 571-451-7629
 email: michael.tracey@diebold.com
- B. Section 016000 - Product Requirements:
 - 1. Product options and substitutions are not permitted without a written and USPS approved deviation.
 - 2. All equipment to be supplied under this specification shall be new and the current model of the Direct Vendor listed above.
 - 3. Systems and components shall have been thoroughly tested and proven in actual use.

2.2 VIDEO SERVER AND STORAGE

- A. Based on the Construction Documents, the General Contractor shall purchase all equipment from the Direct Vendor.
- B. Server:
 - 1. Server/Storage Requirements: Server storage, processor, and RAM requirements will be based off a mathematical formula from the information obtained during the site survey process. Once the number, type and classification of cameras are approved by all parties, it will calculate the required server(s) fit for the site. These servers are all HP Servers that contain USPS IT ACE images. These are approved CLINS and Assets by USPS.
 - a. Storage for 30 Days of Video with 30 % Expansion Capability. Depending on size of system storage may be either internal to the sever or external iSCSI attached NAS device.
 - b. Dual Network Interface Cards on board and 4 additional GB NIC ports via PCIe card per USPS requirements. The system also contains HP's integrated Lights Out management cards. This requires 1 connection on the USPS network per server. Thus each server will have (at minimum) 2 USPS 56 Network connections.



- c. UPS Power Supplies for Server and Storage
- d. Input Power: 120VAC, 60Hz (a power adaptor may be used to provide this voltage).
- e. Operating Temperature: Range shall be equal to or greater than 10 to 40 degrees Celsius.
- f. Humidity: Withstand a minimum of 10% to 80% humidity.
- g. Current Build of IpConfigure Network Video recording Software
- h. 17" Monitor
- i. Mouse
- j. Keyboard
- k. All items rack mounted

2.3 IP VIDEO SWITCH

A. CISCO NETWORK SWITCH (IP Video)

1. Based on the Construction Documents, the CISCO Switch is to be procured by the General Contractor from the Direct Vendor.

2.4 VIDEO ENCODER

A. Direct Vendor shall provide video encoders

B. The video encoder blade shall be equipped with six (6) analog video inputs and shall be able to provide simultaneous Motion JPEG and MPEG-4 video streams. Furthermore the blade shall, for each video channel, support resolutions up to 704x576 (PAL) / 704x480 (NTSC) pixels in full frame rate (25/30fps). The Encoder Shall meet or Exceed the following requirements:

1. Be equipped with 6 analog composite video inputs with PAL/NTSC auto sensing
2. Provide resolutions up to 704x576 (PAL) / 704x480 (NTSC) pixels at 25/30 frames per second for each video channel
3. Support simultaneous Motion JPEG, MPEG-4 and H264 individually configurable for each video channel
4. Support both unicast and multicast MPEG-4, individually configurable for each video channel
5. Provide the ability to control PTZ devices from third party manufacturer
6. Support both IPv4 and IPv6
7. Provide multiple user passwords, support for HTTPS and SSL/TLS and incorporate IEEE802.1X authentication
8. Be equipped with 4 alarm inputs and 4 alarm outputs
9. Include embedded event functionality, which may be triggered by alarm input, video loss or by video motion detection
10. Be supported by an open and published API
11. Be equipped with a 1000BaseT Gigabit Ethernet interface

C. The desktop Video Encoder shall be equipped with one analog video input and one channel of audio, provide simultaneous Motion JPEG and MPEG-4 video streams and shall support resolutions up to 704x576 (PAL) / 704x480 (NTSC) pixels in full frame rate (25/30fps). The Encoder Shall meet or Exceed the following requirements:

1. Be equipped with a 10BaseT/100BaseTX Ethernet interface
2. Be equipped with 1 analog video input, supporting composite and Y/C signals
3. Provide resolutions up to 704x576 (PAL) / 704x480 (NTSC) pixels at 25/30 frames per second
4. Support simultaneous Motion JPEG, MPEG-4 and H264
5. Support both unicast and multicast MPEG-4
6. Provide full duplex audio and be equipped with Line In and Line Out
7. Provide the ability to control PTZ devices from third party manufacturer
8. Support both IPv4 and IPv6



9. Provide multiple user passwords, support for HTTPS and SSL/TLS and incorporate IEEE802.1X authentication
 10. Be equipped with 4 alarm inputs and 4 alarm outputs
 11. Include embedded event functionality, which may be triggered by alarm input, video loss or by video motion or audio detection
 12. Be supported by an open and published API
- D. The Video Encoder Blade and Video Encoder Shall be available as Rack Mountable or Desk-top versions.

2.5 VIDEO DECODERS

- A. Video Decoders will support single monitor with full screen camera view or a Quad Decoder with multiple single screen display with a sequence of full screen or Quad cameras.
- B. Camera displays approved only by OIG and IS
 1. Video output- Analog PAL or NTSC or HDMI
 2. Video decoding- motion JPEG and MPEG-4 Unicast and Multicast
 3. Security – Password protected user access HTTPS encryption

2.6 VIDEO CAMERAS

- A. Direct Vendor Shall provide Cameras
- B. IP Color cameras for video surveillance and monitoring of specific areas as shown on the drawings and confirmed with Postal Inspection Service through Contracting Officer Technical Representative with the following minimum capacities
- C. Fixed H.264, indoor, dome type camera shall be a network camera with WDR, light finder, remote focus and zoom and shall incorporate Power over Ethernet. The camera shall meet or exceed the following requirements:
 1. Be equipped with a 10BaseT/100BaseTX Ethernet interface
 2. Include a vandal proof resistant casing with smoked transparent cover where required.
 3. Equipped with pixel counter.
 4. Image sensor: Progressive scan RGB CMOS 1/3 inch (effective).
 5. Lens: 6MM; 2.5 – 12MM, 105 degree – 49 degree view, F1.2 DC-IRIS.
 6. Minimum illumination:
 - a. Color: 0.1 LUX, F1.2.
 - b. B/W: 0.2 LUX, F1.2.
 7. Shutter time: 1/29500 to 2 seconds; 60 Hz.
 8. Pan/Tilt/Zoom: Digital PTZ, preset positions, guard tour.
 9. Angle Adjustment: Pan 360 degrees, tilt 170 degrees, rotation 340 degrees.
 10. Resolution: 1280x960 (1 MP) 160x90.
 11. Support simultaneous Motion JPEG, MPEG-4 and H264.
 12. Support both unicast and multicast MPEG-4.
 13. Support Power over Ethernet according to IEEE802.3af.
 14. Support both IPv4 and IPv6.
 15. Provide multiple user passwords, support for HTTPS and SSL/TLS and incorporate IEEE802.1X authentication.
 16. Be equipped with 1 alarm input and 1 alarm output.
 17. Include embedded event functionality, which may be triggered by alarm input or by video motion or audio detection.
 18. Be supported by an open and published API.



19. Casing: Indoor; aluminum inner camera module with encapsulated electronics (1.4 lbs).
 20. Processor and Memory: ARTPEC-3, 256 MB RAM, 128 MB Flash.
 21. Connectors: RJ45 10 BASE – T/100BASE-TX PoE terminal block for (1) alarm input and (1) alarm output.
 22. Operating Conditions: Indoor; 32 – 122 degrees F; 10 – 85 percent RH.
 23. Accessories: Indoor; mounting bracket, smoked transparent cover. Provide ceiling or pendant mounting kits.
 24. Basis of Design: Indoor, Axis #P3364.
- D. Standard Resolution camera shall be a network camera, providing simultaneous Motion JPEG, MPEG-4 and H264 video streams, support resolutions up to 640x480 pixels in full frame rate (30fps), be equipped with full duplex audio and incorporate Power over Ethernet. The camera shall meet or exceed the following requirements:
1. Be equipped with a 10BaseT/100BaseTX Ethernet interface
 2. Include a tamper resistant casing
 3. Feature a progressive scan sensor
 4. Provide images down to 1 lux at F1.3
 5. Provide resolutions up to 640x480 pixels at 30 frames per second
 6. Support simultaneous Motion JPEG, MPEG-4
 7. Support both unicast and multicast MPEG-4
 8. Support Power over Ethernet according to IEEE802.3af
 9. Support both IPv4 and IPv6
 10. Provide multiple user passwords, support for HTTPS and SSL/TLS and incorporate IEEE802.1X authentication
 11. Be equipped with 1 alarm input and 1 alarm output
 12. Include embedded event functionality, which may be triggered by alarm input or by video motion or audio detection
 13. Be supported by an open and published API
- E. PTZ camera shall be a network dome camera and shall incorporate 29x optical zoom, day/night functionality, and simultaneous Motion JPEG and MPEG-4 video streams. Camera shall meet or exceed the following requirements:
1. Be equipped with a 10BaseT/100BaseTX Ethernet interface
 2. Include a vandal proof resistant casing with smoked transparent cover.
 3. Feature a progressive scan CCD sensor with Wide Dynamic Range (WDR), Electronic Image Stabilizer and day/night functionality
 4. Be equipped with 29x optical zoom
 5. Image Sensor: ¼ Progressive scan CCD.
 6. Lens: F1.43, 3.67 – 104 mm angle of view – horizontal – 53.1 to 2.0 degrees.
 7. Minimum Illumination: 0.5 LUX @ 30IRE F1.4.
 8. Shutter Time: 1/30,000s to 1s.
 9. PTZ
 - a. E-Flip, 100 preset positions
 - b. 29x optical zoom and 12x digital zoom, total 348x zoom.
 - c. Pan: 360 degrees, 0.2 – 300 degrees/s.
 - d. Tilt: 180 degrees, 0.2 – 300 degrees/s
 10. Video Compression: H264 (MPEG – 4 part 10/AVC), motion J-PEG and H264.
 11. Resolution: D1 720x480 to 176x120
 12. Frame Rate: H.264 – Up to 30 fps in VGA at max zoom.
 13. Frame Rate Motion: J-PEG – Up to 30 fps at max zoom.
 14. Support simultaneous Motion JPEG, MPEG-4 and H264.
 15. Support both unicast and multicast MPEG-4.
 16. Support Power over Ethernet according to IEEE802.3af.
 17. Support both IPv4 and IPv6.



18. Provide multiple user passwords, support for HTTPS and SSL/TLS and incorporate IEEE802.1X authentication.
 19. Be equipped with full memory card for alarm triggers.
 20. Include embedded event functionality, which may be triggered by alarm input, camera temperature or by video motion or audio detection.
 21. Be supported by an open and published API.
 22. Casing:
 - a. Indoor; IK10 impact – resistant aluminum.
 23. Processor and Memory: 256 MB RAM, 128 MB Flash.
 24. Connectors: RJ45 10 BASE – T/100BASE-TX PoE terminal block for (2) alarm input and (2) alarm output.
 25. Operating Conditions:
 - a. Indoor; 32 – 122 degrees F; 20 – 80 percent RH.
 26. Security: Password protection, IP address filtering, HTTPS encryption, IEEE 8021x network access control.
 27. Power: 24 to 34 VDC max 15W indoor; power over Ethernet IEEE 802.3at.
 28. Accessories:
 - a. Indoor; ceiling or pendant mounting and connector kits. Provide pendant wall or pole attachment.
 29. Basis of Design: Indoor, Axis #P5532.
- F. Registry cage, Network Virtual PTZ camera shall be indoor dome type with remote focus and instant zoom, shall be equipped with full duplex audio and shall incorporate Power over Ethernet. The camera shall meet or exceed the following requirements:
1. Be equipped with a 10BaseT/100BaseTX Ethernet interface.
 2. Include a vandal proof resistant casing with smoked transparent cover.
 3. Equipped with pixel counter.
 4. Image Sensor -1/2 "Progressive scan C-MOS 3.1 mega-pixel.
 5. Lens – F1.8 fixed iris, 2.7 mm, angle of view – horizontal -44 to 140 degrees, vertical 35 to 105 degrees.
 6. Minimum illumination – 10 lux wide mode, 20 lux tele-mode.
 7. Shutter time 1/1000 s to 1/5 s.
 8. PTZ – 3x zoom, .1 s wide to tele, 20 preset positions, + 70 degrees pan, +52 degrees tilt, max speed 400 degrees /s, Guard tour, designed for continuous movement.
 9. Video Compression, MPEG-4 part 2, (ISO/ IEC 14496-2) motion J-PEG and H264.
 10. Resolutions- 160x 90 to 640x 480.
 11. Frame Rate MPEG-4 – Up to 30 fps in VGA at max zoom.
 12. Frame Rate Motion J-PEG – Up to 30 fps at max zoom.
 13. Video Streaming – Simultaneous M-PEG 4 and motion J-PEG controllable frame rate and band width, VBR/ CBR MPEG-4.
 14. Support both unicast and multicast MPEG-4.
 15. Support Power over Ethernet according to IEEE802.3af.
 16. Support both IPv4 and IPv6.
 17. Be equipped with 1 alarm input and 1 alarm output.
 18. Include embedded event functionality, which may be triggered by alarm input or by video motion or audio detection.
 19. Be supported by an open and published API.
 20. Casing: Indoor; aluminum inner camera module with encapsulated electronics.
 21. Processor and Memory: ARTPEC-A, 32 MB RAM, 8 MB Flash.
 22. Connectors: RJ45 10 BASE – T/100BASE-TX PoE terminal block for (1) alarm input and (1) alarm output.
 23. Security – Password protection, IP address filtering, HTTPS encryption, IEEE 802.1x network access control.
 24. Power – 4.9 to 5.1 VDC max 3.1 W power over Ethernet IEEE 802.3 af class 1



25. Operating Conditions – 5 to 40 degrees C.
 26. Accessories: Indoor; pendant mounting bracket with smoked transparent cover.
 27. Basis of Design: Indoor, Axis #212PTZ.
- G. Fixed (1) Mega pixel, outdoor, non-blue sky dome type camera shall be a network camera with WDR, light finder, remote focus and zoom, shall be equipped with full duplex audio and shall incorporate Power over Ethernet. The camera shall meet or exceed the following requirements:
1. Be equipped with a 10BaseT/100BaseTX Ethernet interface.
 2. Include a vandal proof resistant casing smoked transparent cover.
 3. Equipped with pixel counter.
 4. Image sensor: Progressive scan RGB CMOS 1/3 inch (effective).
 5. Lens: 2.5 – 12MM, 105 degree – 49 degree view, F1.2 P-IRIS.
 6. Day and Night: Automatically removable infrared-cut filter.
 7. Minimum illumination:
 - a. Color: 0.15 LUX, F1.4.
 - b. B/W: 0.03 LUX, F1.4.
 8. Shutter time: 1/29500 to 2 seconds; 60 Hz.
 9. Pan/Tilt/Zoom: Digital PTZ, preset positions, guard tour.
 10. Angle Adjustment: Pan 360 degrees, tilt 170 degrees, rotation 340 degrees.
 11. Resolution: 1280x960 (1 MP) 160x90.
 12. Support simultaneous Motion JPEG, MPEG-4 and H264.
 13. Frame Rate: H264; 30 fps in all resolutions; 60 Hz.
 14. Support both unicast and multicast MPEG-4.
 15. Support Power over Ethernet according to IEEE802.3af.
 16. Support both IPv4 and IPv6.
 17. Provide multiple user passwords, support for HTTPS and SSL/TLS and incorporate IEEE802.1X authentication.
 18. Be equipped with 1 alarm input and 1 alarm output.
 19. Include embedded event functionality, which may be triggered by alarm input or by video motion or audio detection.
 20. Be supported by an open and published API.
 21. Casing: Outdoor; IP66 and NEMA 4X, IK10 impact resistant aluminum with integrated dehumidifying membrane.
 22. Processor and Memory: 256 MB RAM, 128 MB Flash.
 23. Connectors: RJ45 10 BASE – T/100BASE-TX PoE terminal block for (1) alarm input and (1) alarm output.
 24. Operating Conditions: Outdoor; -40 – 131 degrees F; 10 – 100 percent RH.
 25. Accessories: Outdoor; Weather shield, cable shield, 16 ft. network cable with pre-mounted gasket. Provide pendant wall or pole attachment.
 26. Basis of Design: Outdoor, Axis #P3364-VE.
- H. Products shall utilize internal or external surge protection such that a normally occurring power surge shall not void any manufacturer's warranty

2.7 CAMERA POWER SUPPLIES:

- A. Based on the Construction Documents, the Direct Vendor will identify Camera power source. When required the Direct Vendor will provide Power Supplies for Camera
- B. Interior Fixed Cameras: Camera shall be powered by PoE from network switch. Maximum cable distance from switch to camera is 300 ft. Provide ethernet cable extenders for cable runs exceeding 300 ft., but less than 800 ft.
 1. Network switch shall be equipped with UPS power supply



- C. Interior PTZ Cameras: Camera shall be powered by PoE from network switch. Maximum cable distance from switch to camera is 300 ft. Provide ethernet cable extenders for cable runs exceeding 300 ft., but less than 800 ft. A mid-span device is required.
 - 1. Network switch shall be equipped with UPS power supply
- D. Exterior Fixed Cameras (non "Blue Sky"):
 - 1. Camera and enclosure shall be powered by PoE from network switch. Maximum cable distance from switch to camera is 300 ft. Provide ethernet cable extenders for cable runs exceeding 300 ft., but less than 800 ft.
 - 2. Wall mounted Environmental Enclosure power supplies (where necessary) shall be located in a suitably protected area near the camera. Provide individually fused power supplies.
 - 3. Pole mounted Environmental Enclosure power supplies shall be located within a NEMA 4 enclosure at the pole. Provide individually fused power supplies.
- E. Exterior PTZ Cameras:
 - 1. PTZ Exterior Cameras shall be powered from individually fused power supplies located within a NEMA 4 enclosure at the pole. Other options for powering these cameras are available based on the site design.
- F. Exterior fixed and PTZ cameras exposed to the elements ("Blue Sky" type) shall utilize fiber optic transmission equipment and shall be powered by individually fused power supplies.
- G. Provide a means for disconnecting camera power supplies from main power at the power supply enclosure, either through a detachable power cord, master fuse or circuit breaker located in the power supply cabinet, or other UL approved switching device.
 - 1. Power supplies shall be rated to support 200% of the actual (nominal) power loading.
 - 2. Each power supply shall be fed from a dedicated 120Volt circuit.
 - 3. Adjacent cameras shall be fed from different power supplies.
 - 4. Multiple camera power supplies are available in the correct application.

2.8 VIDEO CAMERA HOUSINGS AND MOUNTS

- A. Direct Vendor shall Provide indoor housings as required for all camera types with the following minimum capabilities:
 - 1. Interior Cameras:
 - a. All cameras shall be in a housing that is coordinated with adjacent finishes with the appropriate mounting hardware. Selection of housings and mounts, including incremental changes to paint colors, dome materials, and cosmetic finishes shall be approved by the USPS or their authorized agent.
 - b. All housings shall be sufficiently dust and moisture resistant to withstand normal environmental conditions in their chosen installation location.
 - c. Hardware shall be provided to ensure tamper-resistant mounting in public access areas after normal business hours without modification to the integrity of the housing.
 - d. Where used, pendant mounts shall be suitable for use as wall, ceiling and column mounts. Pendant mounts shall attach to the appropriate camera housing using Direct Dealer provided standard threaded schedule 40 rigid iron pipes. Pipe lengths of 10 feet or less are to be a minimum of 1-inch diameter. Pipe lengths exceeding 10 feet are to be a minimum of 1-1/2 inch in diameter. Exterior pipe shall be galvanized.
 - e. All mounts shall incorporate installer provided safety chain or cable of sufficient endurance to support 2 times the weight of the equipment
 - f. The General Contractor shall terminate the Ethernet, camera power and fiber optic cabling to the patch panels provided by the Direct Vendor and located in the upright racks.
 - 2. Exterior Cameras:



- a. Environmental: Thermostatically controlled heaters and blowers with defrosting capabilities.
- b. Moisture: Rainproof seals and gaskets.
- c. Wind Resistance: Rated for 80mph sustained winds, minimum.
- d. Ambient Temperature Rating: -10 to 60 degrees Celsius.
- e. Areas with more demanding environmental conditions will be granted a deviation from this specification.

2.9 FIBER OPTIC MEDIA CONVERTER MODULES

- A. Direct Vendor Shall Provide fiber optic media converters
- B. Fiber Optic transmission equipment shall be used when one or more of the following conditions are met:
 - 1. Camera cable runs exceed 800 linear feet.
 - 2. The camera is located outdoors and is exposed to the elements ("Blue Sky" type).
 - 3. Cameras protected by canopies or other architectural elements that shield them from direct view of the overhead sky are excluded from this requirement.
 - 4. The cable path is within 20 feet of a TIME or MIMS aerial.
- C. Modules located at field devices shall be low profile "miniaturized" type, and shall be mounted in the Power Supply/PoE Injector housing for both fixed and PTZ cameras.
 - 1. Fiber optic transmit modules shall derive power from the camera power supply, eliminating the need for an additional power supply. AC power is required for PoE injector and media converter.
- D. Modules located at head-end locations shall be standalone modular units unless four (4) or more modules are required, in which case they shall be enclosed in a fiber-optic rack mount.
 - 1. If more than one fiber optic rack is used, modules shall be distributed as evenly as possible among the racks to reduce the load on the rack power supply and minimize the impact of a failed rack.
- E. Fiber optic modules shall conform to the following minimum specifications:
 - 1. 10/100 Mbps RJ-45 Ethernet port, ST Fiber Port
 - 2. 62.5/125 Multi-mode fiber
 - 3. PoE (PD) device or locally powered
 - 4. Protocol independent
 - 5. -31 to 158 deg operating Temperature
 - 6. IEEE 802.3, IEEE 803.2u and IEEE 803.2af Compliant
- F. Remote Node Cabinet
 - 1. Remote Node Cabinet will house an IP video system network switch, patch panel, UPS and camera power supply.
 - a. The GC shall provide dedicated 110volt power, hang remote node cabinet, terminate fiber optic and CAT-6 cables.
- G. Patch Cables
 - 1. Direct Vendor will provide CAT-6 and fiber optic patch cables for connections, CAT-6, fiber optic patch pushed to devices.

2.10 ETHERNET CABLE EXTENDERS

- A. Direct Vender shall provide Ethernet Cable Extenders as required
- B. Cable Extenders, or fiber optics, shall be used at the discretion of the design engineer or when one or more of the following conditions are met:



1. Camera Cable run exceeds 300 ft. but is not more than 800 ft. It is not practical to use a remote switch and bridge to the head-end switch
- C. Modules located at the field devices shall be located in the camera enclosure or junction box close to the device. Field device module derives power from the head end module and does not require local power.
- D. Modules located at the head-end are standalone modules mounted in the equipment rack

2.11 CABLING

- A. Camera Ethernet Data Cabling:
 1. 4-Pair Category 6 Unshielded Twisted Pair Cable shall be provided and installed by the General Contractor.
 2. The General Contractor shall provide and install the RJ-45 jack as shown on the drawings. The General Contractor shall terminate and test the Cat 6 cable and RJ 45 jacks.
 3. Complies with individual characteristics established in ANSI/TIA/EIA-568-B terminated to T568A and all addendums for Category 6 cable performance specification.
 4. Cabling and wire ways shall be installed in accordance to sections 260533 and 270500
 - a. Power:
- B. Power cable shall be appropriately sized to ensure that any signal loss as a function of cable length does not prohibit the delivery of sufficient voltage and current from the power supply to the powered device. A separate power cable may be required by the design engineer as shown on the drawings.
- C. Cable shall have footage markings to identify CCTV system cable lengths.
- D. Fiber Optic - When fiber optic modules are required, the General Contractor shall provide fiber optic cable appropriate for the application. Cable shall conform to the following specifications:
 1. 62.5 micron glass multimode fiber.
 2. "ST" type connectors shall be used on all cable terminations, including junction boxes and break-out trays.
 3. Performance characteristics (including optical attenuation) shall be such that the Fiber Optic modules specified in Section 2.9 function to deliver signals end-to-end with sufficient bandwidth and quality to meet the specified application.
 4. Physical characteristics such that the cable has sufficient strength and endurance to withstand installation and environmental conditions without adversely affecting optical performance.

Cable Type	Signal	Use
Fiber Optic (Multi-Mode) General Cable CG0021ANU.BK or Approved Equal	Data	See Section 2.9
CAT6 Plenum with footage markings (General Cable 7131769 or Approved Equal)	Camera Data	Camera Data (see Section 2.8)

2.12 ACCESSORIES

- A. Lightning/Surge Protection: Products shall utilize internal or external (power and low voltage) surge protection such that a normally occurring power surge shall not void any manufacturer's warranty.



- B. All Servers and workstations shall utilize a standalone UPS sized for a minimum of 20 minutes of battery run-time. The UPS shall be provided by the Direct Vendor. GC contractor will provide dedicated 120VAC or 220 VAC power determined by the Direct Vendor based on the construction documents
- C. Upright Racks: The Direct Vender shall provide and install upright equipment racks to provide sufficient mounting space for the required equipment.
 - 1. Racks shall be all metal construction conforming to EIA standards with 19 inch equipment mounting opening and 1-3/4 inch vertical spacing of equipment. Rack rails shall be punched with captive nuts, 10-32 screws and nylon washers.
- D. The General Contractor shall terminate the Ethernet, camera power and Fiber Optic cabling to the patch panels provided by the Direct Vender and located in the Upright Racks.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting Work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates, and conditions are as required, and ready to receive Work.
 - 1. Verify that power and video outlets are in correct locations.
 - 2. Verify that building structure for attachment of equipment mounting devices is in place.
- C. Report in writing to Contracting Officer any prevailing conditions that will adversely affect satisfactory execution of Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Postal Service.
- E. Provide required power outlets, low voltage power supplies, interconnecting cables, hardware and equipment for a complete and operable system.
- F. Camera locations are to be reviewed and approved by a Postal Inspector, through the Contracting Officer, prior to installation.

3.2 INSTALLATION

- A. Install all equipment in accordance with Direct Vendor's published instructions. Installation must be done by the Direct Vendor to assure proper installation and accountability. This includes, but is not limited to the following:
 - 1. All hardware used to secure equipment to racking shall include nylon or other non-metallic washer or grommet between the screw head and equipment panel to prevent any damage to the equipment.
 - a. Rack mount screws shall be self-centering Philips-head configuration unless specialized tam-per-resistant hardware has been specified.
 - b. Screws shall be tightened in such a manner as to allow their removal with common hand tools.
 - 2. Any equipment placed on shelving mounted on an incline of greater than 2 degrees shall be secured to the rack or shelving in such a manner as to prevent movement of the equipment in the direction of the incline. Such fastening shall be done in a manner as to preserve the integrity of the equipment case and chassis, and shall in no way jeopardize warranty coverage of the device.



3. All equipment cabling shall be dressed in such a manner as to ensure a neat and clean appearance.
4. Cable break-outs shall be at 90-degree angles from the harness or chase, and all chases shall be parallel to or at 90-degree angles from the rack frame.
5. Cables are to be secured to the rack frames at sufficient intervals to ensure that the weight of the cable will not contribute to fatigue or early failure of that cable or the device and connector to which it is attached.
6. Sufficient excess cable shall be provided in "service loop locations" to ensure that the cable may be re-connected without requiring the addition of extension pieces.
7. All permanent cabling shall be mechanically numbered in a manner consistent with Direct Vendors written system documentation.
8. Wiring for all equipment shall be tie-wrapped (except as indicated below) so that all connectors in a bundle can be removed and re-installed without the possibility of cross connecting.
9. CAT-6 and Fiber Optic cables shall utilize Velcro fasteners in place of tie wraps to eliminate the risk of over-tightening cable bundles and affecting the strength or rated performance of the cable.
10. Where wiring is routed through sheet metal or over frame members, the metal edges shall be covered with flexible grommeting or edge dressing (such as automobile door edge trim).
11. Double-sided foam tape shall not be used to secure any equipment, terminal blocks, or accessory devices. All device mounting shall be of a permanent nature.
12. All excess length AC cords are to be tie-wrapped out of the way. Where possible, they shall be routed in a separate bundle a minimum of 6 inches away from any signal or control cable.
13. Exposed wires run to wall mounted cameras shall be fed through tubing or the body of the mount to present a professional appearance.
 - a. Any accessible cables that can be reached by an individual standing on the floor, a stool, or a small stepladder shall be encased in protective tubing or armored sheathing to prevent tampering or cutting with common hand tools.
14. Care shall be exercised at all times to protect Postal Service property. For example, ladders shall not be placed against wallpapered or finished surfaces, equipment or furnishings; desks or countertops shall not be used in lieu of ladders.
15. On pendant mounted cameras, label each camera on all four sides with three-inch numbers supplied by the Direct Vendor. Numbers shall be stenciled or laminated vinyl in a contrasting color to the camera housing. Camera number shall match and correspond to the Last Octet of camera IP Address and/or printed map provided by the Direct Vendor. Numbers shall not be placed on lower dome or any area that would obstruct camera viewing.
16. Ensure that pendant mounted cameras are hung from stable, vibration free mounting platforms, using guy-wires or other support mechanisms to ensure stability where required. Mount cameras below any suspended lighting to avoid glare or reflection on camera dome and/or lens.
17. Perform complete programming of the system, in coordination with the Contracting Officer and Postal Inspector, or designated representative. Programming shall include, but not be limited to, elimination of duplicate or redundant titling information, synchronization of system clocks, camera sequences, dome presets, salvos and tours. Programming of any system passwords or limiting of accessibility prior to commissioning and training is prohibited.
18. Provide the Direct Vendor Red Line drawings with job condition changes required to provide accurate close-out documentation

B. Power requirements shall be determined by actual equipment used.

C. Ensure that:

1. All applicable statutes, ordinances, regulations, license requirements and codes are fully complied with.
2. All required permits are obtained.
3. All required inspections are conducted.
4. All necessary certificates are issued, obtained, and delivered to the Postal Service.



5. All equipment installations and mounting are in strict accordance with requirements for applicable seismic classification.
 - D. Arrange all components to be mounted in the console(s)/rack(s) in accordance with Direct Vendor and/or Postal Service provided System Elevation drawings. Design shall provide a neat appearance and accessibility for servicing equipment.
 - E. Provide required power outlets, interconnecting cables, hardware and equipment for a complete and operable system.
 1. Power, 120VAC: As required by codes and standards for the facility.
 2. Where conduit is used, a minimum of 40% excess capacity shall be provided for future use.
 - F. Install cameras as shown on the drawings and in accordance with the USPS specifications.
 1. Provide 84-inch minimum headroom below cameras and their mountings. Where necessary modify mounting type to maintain clearance, except as noted on drawings (behind counter) and along slat wall.
 - G. All Cat6 cable connections must be made to 8 pin modular jacks or plugs at the device and to 8 pin modular patch panel at the head end to the T568A standard. Patch panel shall be terminated per direct vendors documentation/drawings by the General Contractor.
 - H. When not installed in cable trays, cable (CAT-6, fiber optic, and low voltage power) shall be supported with wide base cable hangers rated for proper support of CAT-6, fiber optic, and inner-duct cables (compliant with UL and NEC requirements for structured cabling).
 1. Cable hangers shall be installed every 3 to 6 feet and shall be rated to support the weight of the cable multiplied by a factor of three (3).
 2. Cable tray for camera wiring shall not include any low voltage AC wiring.
- 3.3 CONSTRUCTION COORDINATION
1. The Direct Vender shall interface with Other Work.
- 3.4 FIELD QUALITY CONTROL
- A. Section 014000 - Quality Requirements: Inspection and testing procedures.
 - B. Inspection:
 1. The Direct Vender shall inspect equipment installation, interconnection with system devices, mounting locations, and mounting methods.
 2. The Direct Vender shall verify that units and controls are properly installed, connected, and labeled and that interconnecting wires and terminals are identified.
 - C. Testing:
 1. The Direct Vender shall Perform tests and provide test equipment, tools, and personnel required to conduct system tests and inspections. These tests shall include video quality and PTZ operation (where applicable) for all cameras.
 2. The Direct Vender shall provide an actual demonstration of each system function.
 3. The Direct Vender shall conduct system acceptance test upon completion of installation using pre-approved procedures. Test shall consist of system, subsystem, and device level acceptance tests, including software.
 4. The Direct Vender shall use accepted Checklist for system testing.
 5. The Direct Vender shall ensure that test procedures confirm each specification statement and manufacturer requirement has been met or exceeded. An actual demonstration of each system function and a simulation of each system failure shall be provided.



6. An acceptance test period of thirty days shall begin at the start of the acceptance test. Any system failure during the acceptance test period will suspend the acceptance test. The thirty-day test period will restart when the required repairs have been made and certified.
7. Perform all tests in the presence of the Postal Service COTR. The Postal Service reserves the right to accept any portion or activate any phase prior to acceptance of entire system.

3.5 OPERATING INSTRUCTION

- A. The Direct Vender shall provide on-site instruction to review the operation of the system and detail any common troubleshooting or maintenance steps that are required to ensure normal operation to the USPS COTR.
- B. The Direct Vender shall provide two complete sets of equipment operating, installation, and programming manuals that will remain in the installed location.

3.6 CLEANING AND ADJUSTING

- A. Adjust manual lens irises to meet lighting conditions.
- B. Adjust field of view for each camera per USPS COTR direction.

USPS CSF Specifications issued: 10/1/2013
Last revised: 9/3/13

END OF SECTION 28 23 05 00



SECTION 28 31 00 00 - CSF FIRE DETECTION AND ALARM

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this Outline Specification Section for Customer Service Facilities only. This Specification defines "level of quality" for Customer Service Facility construction and is intended as a guide to the Architect/Engineer preparing the Construction Documents.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. This specification provides the minimum requirements for the Life Safety System. The system shall include, but not limited to all equipment, materials, labor, documentation and services necessary to furnish and install a complete, operational system to include but not limited to the following functions:
 - 1. Protected premises fire alarm systems.
 - 2. Initiating devices.
 - 3. Notification appliances.
 - 4. Inspection and testing.
 - 5. Auxiliary fire alarm equipment.
- B. Related Sections:
 - 1. [Section 210000 - Fire Suppression.]
 - 2. Section 260500 - Common Work Results for Electrical.
 - 3. [Section 281304 - Physical Access Control System.]

1.2 REFERENCES

- A. All work and materials shall conform to all applicable federal, state and local codes and regulations governing the installation. The equipment and installation shall comply with the current provisions of the following codes and standards.
- B. American National Standards Institute (ANSI):
 - 1. ANSIS3.411, Audible Emergency Evacuation Signals.
 - 2. ANSI/UL 1971, Standard for Safety Signaling devices for Hearing Impaired.
- C. National Fire Protection Association (NFPA):
 - 1. [NFPA 13, Installation of Sprinkler Systems.]



NOTE TO SPECIFIER

Use item #2 if Fire Pump Required

2. [NFPA 20, Installation of Centrifugal Fire Pumps.]
3. NFPA 70, National Electrical Code.
4. NFPA 72, National Fire Alarm Code.
5. NFPA 101, Life Safety Code.

D. Underwriters Laboratories, Inc.(UL):

1. UL864 – Control Units for Fire Protective Signaling Systems.
2. UL 268 - Smoke Detectors for Fire Protective Signaling Systems.
3. UL 268A - Smoke Detectors for Duct Applications.
4. UL 217 - Single and Multiple Station Smoke Alarms.
5. UL 521 - Heat Detectors for Fire Protective Signaling Systems.
6. [UL 228 - Door Closers-Holders, With or Without Integral Smoke Detectors.]
7. UL 464 - Audible Signaling Appliances.
8. UL 38 - Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems.
9. [UL 346 - Waterflow Indicators for Fire Protective Signaling Systems.]
10. [UL 1971 - Signaling Devices for the Hearing-Impaired.]
11. UL 1481 - Power Supplies for Fire Protective Signaling Systems.
12. UL 1635 - Digital Alarm Communicator System Units.

E. Federal Codes and Regulations

1. Americans with Disabilities Act (ADA)

F. International Standards Organization (ISO)

1. ISO-9000
2. ISO-9001

G. Factory Mutual (FM)

1. Provide factory mutual approval.

1.3 Definitions:

- A. Authority Having Jurisdiction: See Public Authorities.
- B. Engineer of Record: A Professional Engineer Registered in the State where the project is located who undertakes final design of the fire protection system.
- C. Owner: Building/facility owner, landlord/lessor, tenant/lessee, Insurance Carrier or any designated representative of these entities.
- D. Public Authorities: Local, State or Federal government body having jurisdiction over any portion of the project. This includes, but is not limited to: building departments, Fire Departments, Fire Marshals Offices, Aviation Authorities, Insurance Regulatory Boards, etc.

1.4 SYSTEM DESCRIPTION

A. General

1. The Contractor shall furnish all labor, services and materials necessary to furnish and install a complete, functional protected premises fire alarm system (System). The System shall comply in



- all respects with the requirements of the specifications, manufacturer's recommendations and Underwriters Laboratories Inc. (ULI) listings.
2. Certification that the entire system has been inspected and tested, is installed entirely in accordance with the applicable codes, standards, manufacturer's recommendations and UL listings, and is in proper working order. Contractor shall use "Fire Alarm System Certification and Description" as required by NFPA 72.
- B. 24VDC NACs
1. Provide and install a new fire detection and alarm system that shall consist of:
 - a. Fire Alarm Control Panel.
 - b. [LCD remote annunciator(s).]
 - c. [Area heat detectors.]
 - d. Duct smoke detectors.
 - e. [Sprinkler system waterflow(s) and valve supervisory switch(s).]
 - f. [Interface ancillary shutdown system(s)].
 - g. Audible notification appliances.
 - h. Synchronized visual notification appliances.
 - i. [Magnetic door holders.]
 - j. [Provide elevator recall functions for primary and alternate floors and elevator power shunt trip activation.]
 - k. Connection to a central station. The Owner shall arrange for two dedicated phone lines to be terminated as directed by the installing contractor.

1.5 Sequence of Operations

A. General 24 VDC NACs

1. The alarm activation of any area smoke detector, heat detector, manual pull station, [sprinkler waterflow], the following functions shall automatically occur:
 - a. The internal audible device shall sound at the control panel and remote annunciator.
 - b. The LCD display shall indicate all applicable information associated with the alarm condition including; device type, device location and time/date.
 - c. All system activity/events shall be documented in system history.
 - d. [Any remote or local annunciator LCD/LED's associated with the alarm shall be illuminated.]
 - e. Activate notification audible appliances throughout the building.
 - f. Activate visual strobes notification appliances throughout the building. The visual strobe shall continue to flash until the system has been reset. The visual strobe shall not stop operating when the "Alarm Silence" is pressed.
 - g. Transmit an alarm signal to the central station.
 - h. All automatic events programmed to the alarm point shall be executed and the associated outputs activated.
 - i. [All exit doors shall unlock throughout the building.]
 - j. [All self-closing fire/smoke doors held open shall be released.]

B. Duct Smoke Operation

1. The Alarm activation of any duct smoke detector, the following functions shall automatically occur:
 - a. The internal audible device shall sound at the control panel and remote annunciator.
 - b. The LCD display shall indicate all applicable information associated with the alarm condition including; device type, device location and time/date.
 - c. All system activity/events shall be recorded in the system history file.
 - d. [Any remote or local annunciator LED's associated with the alarm shall be illuminated.]
 - e. Transmit an alarm signal to the central station.
 - f. Shutdown the local air handling unit.
 - g. All automatic events programmed to the alarm point shall be executed and the associated outputs activated.

**NOTE TO SPECIFIER**

Include paragraph 1.5C below if the facility is equipped with a fire suppression sprinkler system.

C. Supervisory Operation

1. Upon supervisory activation of any sprinkler valve supervisory switch, the following functions shall automatically occur:
 - a. The internal audible device shall sound at the control panel and remote annunciator.
 - b. The LCD display shall indicate all applicable information associated with the supervisory condition including; device type, device location and time/date.
 - c. All system activity/events shall be documented in the system history file.
 - d. [Any remote or local annunciator LCD/LED's associated with the supervisory activation shall be illuminated.]
 - e. Transmit a supervisory signal to the central station.

D. Trouble Operation

1. Upon activation of a trouble condition or signal from any device on the system, the following functions shall automatically occur:
 - a. The internal audible device shall sound at the control panel and remote annunciator.
 - b. The LCD display shall indicate all applicable information associated with the trouble condition including; device type, device location and time/date.
 - c. All system activity/events shall be documented on the system printer and system history file.
 - d. Any remote or local annunciator LCD/LED's associated with the trouble zone shall be illuminated.
 - e. Transmit a trouble signal to the central station.

1.6 System Configuration**A. General**

1. All Life Safety System equipment shall be arranged and programmed to provide a system for the early detection of fire, the notification of building occupants, the automatic summoning of the local fire department, the override of the HVAC system operation, and the activation of other auxiliary systems to inhibit the spread of smoke and fire, and to facilitate the safe evacuation of building occupants.
2. The System shall utilize independently addressed, smoke detectors, heat detectors and input/output modules as described elsewhere in this specification.

B. Power Supply

1. The power supply shall be a high efficiency switch mode type with line monitoring to automatically switch to batteries for power failure or brown out conditions. The automatic battery charger shall have low battery discharge protection. The power supply shall provide internal power and 24 VDC at 4.5A continuous for notification appliance circuits. All outputs shall be power limited. The battery shall be sized to support the system for 60 hours of supervisory and trouble signal current plus general alarm for 5 minutes.
2. [Auxiliary power supplies shall be a high efficiency switch mode type with line monitoring to automatically switch to batteries for power failure or brown out conditions. The automatic battery charger shall have low battery discharge protection. The power supply shall provide internal power and 24 VDC at 6.4 continuous for notification appliance circuits. The power supply shall be capable of providing 8A to output circuits for a maximum period of 100 ms. All outputs shall be power limited. The battery shall be sized to support the system for 60 hours of supervisory and trouble signal current plus general alarm for 5 minutes. All supervision of the auxiliary supply shall be transmitted via addressable analog loop without additional equipment.]

C. Display



1. The display module shall be of membrane style construction with a 4 line by 20 character Liquid Crystal Display. The LCD shall use super-twist technology and backlighting for high contrast visual clarity. In the normal mode display the time, the total number of active events and the total number of disable points. In the alarm mode display the total number of events and the type of event on display. Reserve 40 characters of display space for user custom messages. The module shall have visual indicators for the following common control functions; AC Power, alarm, supervisory, monitor, trouble, disable, ground fault, CPU fail, and test. There shall be common control keys and visual indicators for; reset, alarm silence, trouble silence, drill, and one custom programmable key/indicator. Provide four pairs of display control keys for selection of event display by type (alarm, supervisory, monitor and trouble) and forward / backward scrolling through event listings. The operation of these keys shall be integrated with the related common control indicator that lights when an event of its type is active. Allow the first event of the highest priority to capture the LCD for display so that arriving fire fighters can view the first alarm event "hands free". Provide system function keys; status, reports, enable, disable, activate, restore, program, and test. The module shall have a numeric keypad, zero through nine with delete and enter keys.
- D. Initiating Device Circuits
1. The Initiating device circuits (IDC) used to monitor manual fire alarm stations, smoke and heat detectors, [waterflow switches, valve supervisory switches,] [and fire pump functions] shall be Class B.
- E. 24 VDC Notification Appliance Circuits
1. 24 VDC Notification appliance circuits (NAC) shall be Class B. All notification appliance circuits shall have a minimum circuit output rating of 2 amp @ 24 VDC. The notification circuits shall be power limited. Non-power limited circuits are not acceptable.
- F. Signaling Line Circuits (SLC-Data Circuits)
1. The signaling line circuit shall communicate from a panel/node to analog/addressable detectors, input modules, output modules, isolation modules and notification appliance circuits.
 2. Each signaling circuit connected to addressable/analog devices shall provide a minimum of 20 spare addresses.
 3. [When a signaling line circuit covers more than one fire/smoke compartments, a wire-to-wire short shall not effect the operation of the circuit from the other fire/smoke compartments.]
 4. The signaling line circuit (SLC) connecting all components Class B (style 4).
- G. DACT
1. The panel shall contain a dialer (alarm communicator transmitter (DACT)) module to transmit alarm, supervisory and trouble signals to a Central Monitoring Station (CMS). The DACT shall support dual telephone lines, 20 PPS 4/2 communications, and configured for dual tone multi-frequency (DTMF) or pulse modes. It shall be possible to delay AC power failure reports, auto test call, and site program using a touch tone phone and password.
- 1.7 SUBMITTALS
- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. Section 013300 - Submittal Procedures: Procedures for submittals.
1. Product Data:
 - a. Provide electrical characteristics and connection requirements.
 - b. Power and battery calculation.
 2. Shop Drawings: Provide [annunciator layout and] system wiring diagram showing each device and wiring connection required. Prior to commencement of installation, submit licensed Professional Engineer's system drawings (signed and sealed by Delegated Engineer) specified in "Quality Assurance" Article to Designated Reviewers. Include system calculations and equipment data. Submittals shall be complete and in bound sets. System drawings, prepared according to



Contract Documents. Submittals shall be made to Designated reviewers. Designated Reviewers are:

- a. Additional Submittal: Submit shop drawings, product data, and calculations to Public Authorities for approval. Submit proof of approval to Contracting Officer.
- b. Submittals to Contracting Officer:
- c. Submittals to Engineer of Record:
3. Assurance/Control Submittals:
 - a. Design Data: System operation description indicating method of operation and supervision of each component and each type of circuit, and sequence of operations for all manually and automatically initiated system inputs for this specific Project. Manufacturer's standard descriptions for generic systems not permitted.
 - b. Test Reports: Submit the following reports directly to Contracting Officer from Manufacturer's Quality Control Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
 - 1) Pre-test.
 - 2) Acceptance test.
 - c. Certificates: Manufacturer's certificate certifying that components and Products meet or exceed specified requirements.
 - d. Qualification Documentation:
 - 1) Submit documentation of manufacturer and installer experience indicating compliance with specified qualification requirements. Include lists of completed projects with project names and addresses, and names of Engineers and Owners.
 - 2) Fire alarm contractor license issued by State or local authority having jurisdiction.
 - e. Manufacturer's Field Reports: Submit the following reports directly to Contracting Officer from Manufacturer's Quality Control Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements.
 - 1) Preparatory inspection.
 - 2) Initial inspection.
 - 3) Follow-up inspection.
 - 4) Final inspection.
 - f. All drawings shall be reviewed and signed off by an individual having a minimum of a NICET certification in fire protection engineering technology, subfield of fire alarm systems.
 - g. A copy of the installing technician's NICET certification shall be provided.
 - h. System Calculations: Complete calculations shall be provided which show the electrical load on the following system components:
 - 1) Each system power supply[, including stand alone booster supplies].
 - 2) Each standby power supply (batteries).
 - 3) Each notification appliance circuit.
 - 4) Each auxiliary control circuit that draws power from any system power supply.
- C. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals:
 1. Operation and Maintenance Data: Project specific operating manuals covering the installed Life Safety System. A generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement. Include user's software data and recommendations for spare parts to be stocked at the site. Provide names, addresses, and telephone numbers of service organizations that stock repair parts for the system.
 2. Project Record Documents: As-Built drawings consisting of: a scaled plan of entire building showing the placement of each individual item of the Life Safety System equipment as well as cable and/or raceway sizes and routings. All drawings must reflect point to point wiring, device address and programmed characteristics. All drawings shall be provided in AutoCad format. A vellum plot of each sheet shall also be provided. Provide the application program listing for the system as installed at the time of acceptance (disk, hard copy printout, and all required passwords).
 3. Record of Completion: Figure 4.5.2.1 NFPA 72.



1.8 QUALITY ASSURANCE

- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. Manufacturer Qualifications: Firm experienced in manufacturing equipment of the types and capacities indicated that have record of successful in-service performance with minimum 5 years documented experience. Prime system manufacturer and manufacturers of major system components required to qualify separately.
 - 1. Service Center: The System Supplier shall maintain a service organization with adequate spare parts stock within 75 miles of the installation. Any defects that render the system inoperative shall be repaired within 24 hours of the Owner notifying the contractor.
- C. Installer Qualifications: Experience with systems of the type and scope indicated and certified as authorized service representative of the prime system manufacturer with minimum 5 years documented experience.
 - 1. System shall be installed by a single contractor that assumes responsibility for system components and their compatibility.
 - 2. Only manufacturer's certified installers with NICET Level III or higher shall be utilized.

NOTE TO SPECIFIER

Edit standards

- D. Regulatory Requirements:
 - 1. Calculations, Product Data, Shop Drawings: Provide stamp of approval from Public Authorities.
 - 2. Comply with requirements of Public Authorities for submittals, approvals, materials, installation, inspections, and testing.
 - 3. Comply with requirements of Contracting Officer and Owner's insurance underwriter for submittals, approvals, materials, installation, inspections, and testing.
 - 4. Provide certificate of compliance from Public Authorities indicating approval of field acceptance tests.
 - 5. Conform to applicable code for submission of design and calculations, reviewed shop and erection drawings and as required for acquiring permits.
 - 6. Cooperate with regulatory agency or authority and provide data as requested.
 - 7. Provide Smoke detector in room containing Fire Alarm Control Panel per NFPA 72, section 4.4.5.
- E. Pre-Installation Meetings:
 - 1. Convene a pre-installation meeting one week prior to commencing Work of this Section.
 - 2. Require attendance of parties directly affecting Work of this Section.
 - 3. Review conditions of operations, procedures and coordination with related Work.
 - 4. Agenda:
 - a. Tour, inspect, and discuss conditions of building and building structure.
 - b. Review system design and requirements.
 - c. Review required submittals, both completed and yet to be completed.
 - d. Review system Drawings and data.
 - e. Review and finalize construction schedule related to system and verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
 - f. Review required inspections, testing, certifying, and material usage accounting procedures.

1.9 MAINTENANCE

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Extra Materials: Furnish extra materials described below that match products installed, packaged with protective covering for storage and identified with labels clearly describing contents.



1. Fire Alarm Devices: Furnish quantity equal to 5 percent of the number of units of each type installed but not less than 1 of each type.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. All equipment and components shall be the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approval agency for use as part of a protected premises protective signaling (fire alarm) system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.
- B. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. Siemens, (800) 262-7976.
 2. Edwards (EST), (800) 655-4497.
 3. Honeywell/Notifier, (973) 455-2000.
 4. Simplex/Grinnell, (978) 731-2500
- C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted subject to approval of Contracting Officer.
 1. Conflicts, deviations, or change requests shall be submitted in writing to Contracting Officer with supporting documentation. Include written justification, designs, manufacturer's specifications, cost benefits, and any special circumstances dictated by local conditions. Documentation package shall be submitted in sufficient time to minimize any adverse effects of the proposed changes to the project construction schedule. Contracting Officer reserves the right to reject substitute and other systems.

2.2 PANEL COMPONENTS AND FUNCTIONS

- A. General
 1. The control panel(s) shall be a multi-processor-based system designed specifically for fire and releasing system applications. The control panel shall be listed and approved for the application standard(s) as listed under the General section.
 2. The control panel(s) shall include all required hardware, software and system programming to provide a complete and operational system. The control panel(s) shall assure that life safety takes precedence among all panel activities.
 3. The control panel(s) shall include the following capacities:
 - a. Support up to [250] [380] [500] analog/addressable points per panel (1,900 total with 5 networked panels)
 - b. [Support up to 5 fully supervised network remote annunciators.]
 - c. Support a DACT (dialer) for off premise notification
 - d. Support up to 576 chronological events in history.
 4. The control panel(s) shall include the following features:
 - a. Provide autoprogramming and electronic addressing and mapping of analog/addressable devices.



- b. Provide an operator interface display that shall include functions required for annunciation, command and control system functions.
- c. Provide a discreet system control switch provided for reset, alarm silence, local silence, drill switch, up/down switches, status switch, program switch, enable and disable switches, activate and restore switches, reports switch and test switch.
- d. Provide an authorized operator with the ability to operate or modify system functions like system time, date, passwords; and autoprogram, enable mapping, restart the system and clear control panel event history file.
- 5. Supervision of system components, wiring, initiating devices and software shall be provided by the control panel(s). Failure or fault of system component or wiring shall be indicated by type and location on the LCD display. Software and processor operation shall be independently monitored for failure. Control Panel:

NOTE TO SPECIFIER

Basis of Design for Customer Service Facilities under 20,000 sq. ft. shall be the "EST" io500 Series control panel. Facilities over 20,000 sq. ft. shall utilize the Edwards "EST3 Series panel. Edit sentence 2.2A.6. below accordingly.

- 6. Basis of Design: Edwards [io500] [EST3] Series.

B. Annunciation

- 1. The system shall be designed and equipped to receive, monitor, and annunciate signals from devices and circuits installed throughout the building. Manufacturer's standard control switches shall be acceptable if they provide the required operation, including performance, supervision and position indication. If the manufacturers' standard switches do not comply with these requirements, fabrication of custom manual controls acceptable to the contracting officer is required.
- 2. Receipt of alarm, trouble, and supervisory signals shall activate integral audible devices at the control panel(s) and at each remote annunciator panel.
- 3. The control panel(s) [and remote annunciator(s)] shall contain the following system status indicators:
 - a. 80 character Backlit Liquid Crystal Display.
 - b. System Power Indicator - green LED.
 - c. System Common Alarm - red LED.
 - d. System Common Trouble - yellow LED.
 - e. System Common Supervisory - yellow LED.
 - f. System Common Monitor - yellow LED.
 - g. System Ground Fault - yellow LED.
 - h. System CPU Fault - yellow LED.
 - i. System Disabled - yellow LED.
 - j. System Test Point(s) - yellow LED.
 - k. System Reset Switch with Integral yellow LED.
 - l. System Alarm Silence Switch with Integral yellow LED.
 - m. System Local Silence Switch with Integral yellow LED.
 - n. System Drill Switch with Integral yellow LED
 - o. System Message Queue Scroll Switches.
 - p. Additional buttons as required to provide system control and operator functions.
- 4. Basis of Design: Edwards [io500] [EST3] series.

C. Power Supply

- 1. Each system power supply shall be a minimum of 6 amps @ 24 VDC.
- 2. Upon failure of normal (AC) power, the affected portion(s) of the system shall automatically switch over to secondary power without losing any alarm, trouble or operator acknowledgment signals.
- 3. Each system power supply shall be individually annunciated and shall identify the inoperable power supply in the event of a trouble condition.



4. All standby batteries shall be continuously monitored by the system. Low battery and disconnection of battery power supply conditions shall immediately annunciate as a trouble signal, identifying the deficient batteries.
5. All system power supplies shall be capable of recharging their associated batteries, from a fully discharged condition to a capacity sufficient to allow the system to perform consistent with the requirements of this section, in 48 hours maximum.
6. All AC power connections shall be to the building's designated emergency electrical power circuit and shall meet the requirements of Section 4.4.1.4 of NFPA 72. The AC power circuit shall be installed in conduit raceway. The power circuit disconnect means shall be clearly labeled FIRE ALARM CIRCUIT CONTROL and shall have a red marking. The location of the circuit disconnect shall be labeled permanently inside the each control panel.
7. Basis of Design: Edwards model 2-PPS/6A.

D. Display

1. System Message Processing and Display Operations:
 - a. [The system shall allow message routing to be configured to any or all annunciators.]
 - b. All system printer port(s) shall be configurable to output any combination of alarm, supervisory, trouble, or monitor, event messages.
 - c. [Each LCD display on each annunciator shall be configurable to display the status of any combination of alarm, supervisory, trouble, or monitor, event messages.]
 - d. Clear distinction shall be provided between alarm, supervisory, trouble, and monitor status messages.
2. The system shall provide the ability to retrieve data from the analog/addressable detectors to a PC while the system is on-line and operational in the protected premises. The uploaded data may then be analyzed in a diagnostic program supplied by the system manufacturer.

E. Dialer -- DACT

1. The system shall provide an off premise Digital Alarm Communications Transmitter (DACT) capable of transmitting system alarm, trouble and supervisory events to a central monitoring station (CMS). The DACT shall support dual telephone lines, 20 PPS 4/2 communications, and configured for dual tone multi-frequency (DTMF) or pulse modes. It shall be possible to delay AC power failure reports, auto test call, and site program the DACT using a touch tone phone and password.
2. Basis of Design: Edwards model DL2

F. Pager Interface

1. The system shall provide a module capable of transmitting alphanumeric system activity, by event, to a commercial paging system using TAP pager protocol. The system module shall be equipped with a high speed (V.32BIS or greater 14.4Kbaud) modem.
2. Basis of Design: Edwards model API-8/232ME

G. Reports

1. The system shall provide the operator the ability to attain system reports that give detailed chronological description of the last 576 system events. The system shall provide a listing of the sensitivity and environmental compensation usage of all of the detectors on the system, or specified analog/addressable circuit.
2. The system report shall include facility name, compiled date, compiler revision, project revision and report date. The system shall output these reports via the main LCD, and reports shall be capable of being printed on a remote printer, (not part of this work).

2.3 FIELD-MOUNTED SYSTEM COMPONENTS

A. Smoke Detectors and Accessories

1. Analog Addressable Smoke General



- a. Each analog addressable smoke detector's sensitivity shall be capable of being programmed individually as: most sensitive, more sensitive, normal, less sensitive or least sensitive.
 - b. An alternate alarm sensitivity level shall be provided for each detector, which can be set to any of the five (5) sensitivity settings manually or automatically using a time of day event.
 - c. The detector's sensing element reference point shall automatically adjust, compensating for background environmental conditions such as dust, temperature, and pressure. Periodically, the sensing element real-time analog value shall be compared against its reference value. The detector shall provide a maintenance alert signal that 80 percent to 99 percent compensation has been used. The detector shall provide a dirty fault signal that 100 percent compensation has been used.
 - d. The system shall allow for changing of detector types for service replacement purposes without the need to reprogram the system. The replacement detector type shall automatically continue to operate with the same programmed sensitivity levels and functions as the detector it replaced. System shall display an off-normal condition until the proper detector type has been installed or change in the application program profile has been made.
2. Smoke Detector - Multi-Sensor Photo Thermal (Ceiling Mounted)
 - a. Provide analog/addressable multisensor combination photoelectric, thermal smoke detectors for all ceiling mounted locations. Alarm condition shall be based upon the combined input from the photoelectric and thermal detection elements. Separately mounted photoelectric detectors and heat detectors in the same location, clustered at the manufacturer's listed spacing is not an acceptable alternative. The system shall have the ability to set the sensitivity and alarm verification of each individual detector on the circuit. It shall be possible to automatically set the sensitivity of individual analog/addressable detectors for the day and night periods.
 - b. Each smoke detector shall be capable of transmitting alarm signals as well as normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each smoke detector may be individually programmed to operate at any one of five (5) sensitivity settings. Each detector microprocessor shall contain an environmental compensation algorithm that identifies and sets ambient environmental thresholds approximately six times an hour. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 80 percent and 100 percent of the allowable environmental compensation value.
 - c. Basis of Design: Edwards model SIGA-PHS.
 3. Smoke Detector - Photoelectric (Duct Mounted)
 - a. Provide analog/addressable photoelectric smoke detectors at all duct applications. The system shall have the ability to set the sensitivity and alarm verification of each of the individual detectors on the circuit. It shall be possible to automatically change the sensitivity of individual analog/addressable detectors for the day and night periods. Each smoke detector shall be capable of transmitting alarm signals as well as normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each smoke detector may be individually programmed to operate at any one of five (5) sensitivity settings. Each detector microprocessor shall contain an environmental compensation algorithm that identifies and sets ambient environmental thresholds approximately six times an hour. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 80 percent and 100 percent of the allowable environmental compensation value.
 - b. Provide key operated "normal-reset-test" switch at each duct smoke detector.
 - c. Basis of Design: Edwards model SIGA-PS.
 4. Duct Detector Mounting Plate
 - a. Where smoke detectors are directly inserted into a low velocity ducts 3 ft (0.91m) high x 3 ft (0.91m) wide, ceiling plenums, or raised floors, provide factory supplied mounting plate assemblies to facilitate mounting the detectors. The mounting plate shall be code gauge steel with corrosion resistant red enamel finish. The detector mounting plate shall support an analog/addressable detector along with a standard, relay or isolator detector-mounting base.



- b. Basis of Design: Edwards model SIGA-DMP.
 - 5. Duct Detector Housing
 - a. Provide smoke detector duct housing assemblies to mount an analog/addressable detector along with a standard, relay or isolator detector mounting base. The housing shall also protect the measuring chamber from damage and insects. The housing shall utilize an air exhaust tube and an air sampling inlet tube that extends into the duct air stream up to ten feet. Drilling templates and gaskets to facilitate locating and mounting the housing shall also be provided. The housing shall be finished in baked red enamel. Remote alarm LED indicators and remote test stations shall be provided.
 - b. Basis of Design: Edwards model SIGA-DH.
- B. Heat Detectors
 - 1. Fixed Temperature Heat Detector (Equipment Rooms)
 - a. Provide analog/addressable fixed temperature heat detectors within all equipment rooms. The heat detector shall have a nominal fixed temperature alarm point rating of 135°F (57°C). The heat detector shall be rated for ceiling installation at a minimum of 70 ft (21.3m) centers and be suitable for wall mount applications.
 - b. Basis of Design: Edwards model SIGA-HFS.
 - 2. Fixed Temperature-ROR Heat Detector (Ceiling Mounted)
 - a. Provide analog/addressable combination fixed temperature / rate-of-rise detectors for all ceiling mounted locations. The heat detector shall have a nominal fixed temperature alarm point rating of 135°F (57°C) and a rate of rise alarm point of 15°F(9°C) per minute. The heat detector shall be rated for ceiling installation at a minimum of 70 ft (21.3m) centers and be suitable for wall mount applications.
 - b. Basis of Design: Edwards model SIGA-HRS.
- C. Detector Bases
 - 1. Detector Base - Standard
 - a. Provide detector mounting base suitable for mounting on single gang, 3½ or 4 inch octagon box or 4 inch square box. The base shall, contain no electronics and support all series detector types.
 - b. Basis of Design: Edwards model SIGA-SB.
 - 2. Detector Base - Relay
 - a. Provide relay detector mounting base suitable for mounting on single gang, 3½ or 4 inch octagon box and 4 inch square box. The relay base shall support all detector types and have the following minimal requirements.
 - b. The relay shall be a bi-stable type and selectable for normally open or normally closed operation.
 - 1) The position of the contact shall be supervised.
 - 2) The relay shall automatically de-energize when a detector is removed.
 - 3) The operation of the relay base shall be controlled by its respective detector processor. Detectors operating standalone mode shall operate the relay upon changing to alarm state. Relay bases not controlled by the detector microprocessor shall not be acceptable.
 - 4) Form "C" Relay contacts shall have a minimum rating of 1 amp @ 30 VDC and be listed for pilot duty.
 - 5) Removal of the respective detector shall not affect communications with other detectors.
 - c. Basis of Design: Edwards model SIGA-RB.
- D. Manual Stations
 - 1. Manual Station - Double Action Single Stage
 - a. Provide analog/addressable double action, single stage fire alarm stations at the locations shown on the drawings. The fire alarm station shall be of polycarbonate construction and incorporate an internal toggle switch. A locked test feature shall be provided. The station shall be finished in red with silver "PULL IN CASE OF FIRE" lettering. The manual station



shall be suitable for mounting on 2 ½ (64mm) deep single gang boxes and 1 ½ (38mm) deep 4 square boxes with single gang covers.

- b. Provide factory manufactured boxes for all surface mounted applications.
- c. Basis of Design: Edwards model SIGA-278.

E. Notification Appliances

1. General

- a. All appliances which are supplied for the requirements of this specification shall be UL Listed for Fire Protective Service, and shall be capable of providing the "equivalent facilitation" which is allowed under the Americans with Disabilities Act Accessibilities Guidelines (ADA(AG)), and shall be UL 1971 Listed.
- b. All appliances shall be of the same manufacturer as the fire alarm control panel specified to insure absolute compatibility between the appliances and the control panels, and to insure that the application of the appliances are done in accordance with the single manufacturer's instructions.
- c. All notification appliances shall be [red][white] unless noted otherwise on the drawings.

2. Heavy Duty Horns (Exterior Locations)

- a. Provide heavy duty electronic horns for exterior locations. Horns shall be selectable for high or low dBA output and steady or temporal output. At the high output setting, the horn shall provide a 85 dBA continuous sound output or a 82 dBA temporal sound output, when measured in reverberation room per UL-464. In and out screw terminals shall be provided for wiring. Weatherproof wall boxes shall be provided for outdoor applications.
- b. Basis of Design: Edwards Integrity series.

3. Low Profile Horns (Interior Locations)

- a. Provide low profile wall mount horns within interior locations. The low profile horn shall not extend more than 1 inch (2.5cm) past the finished wall surface.
- b. When the cover is installed, no mounting hardware shall be visible. In and out screw terminals shall be provided for all wiring. The low profile speaker shall mount in a 4 inch x 2 1/8 inch square electrical box, without trims or extension rings.
- c. Provide factory manufactured boxes for all surface mounted applications.
- d. Basis of Design: Edwards Genesis series.

4. Low Profile Horn-Strobe

- a. Provide low profile wall mount horn/strobes at the locations shown on the drawings. The low profile horn/strobe shall not extend more than 1 inch (2.5cm) past the finished wall surface.
- b. Strobes shall provide synchronized flash output, that shall be switch selectable for output values of 15cd, 30cd, 75cd & 110cd. Wattage and candela settings shall be visible with the cover installed. When the cover is installed, no mounting hardware shall be visible. In and out screw terminals shall be provided for all wiring. The low profile horn/strobes shall mount in a 4 inch x 2 1/8 inch square electrical box, without trims or extension rings.
- c. Provide factory manufactured boxes for all surface mounted applications.
- d. Basis of Design: Edwards Genesis series.

5. Low Profile Strobes

- a. Provide low profile wall mounted strobes at the locations shown on the drawings. In and out screw terminals shall be provided for wiring. Strobes shall provide synchronized flash outputs. Strobe output shall be determined as required by its specific location and application from a family of 15cd, 30cd, 60cd, 75cd, or 110cd devices. Low profile strobes shall mount in a single gang box.
- b. Provide factory manufactured boxes for all surface mounted applications.
- c. Basis of Design: Edwards Genesis series.

2.4 INITIATION AND CONTROL MODULES

A. General

- 1. It shall be possible to address each intelligent module without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable. The personality of



multifunction modules shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. Modules requiring EPROM, PROM, ROM changes or DIP switch and/or jumper changes shall not be acceptable. The modules shall have a minimum of 2 diagnostic LEDs mounted behind a finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes which can be retrieved for troubleshooting assistance. Input and output circuit wiring shall be supervised for open and ground faults. The module shall be suitable for operation in the following environment:

- a. Temperature: 32oF to 120oF (0oC to 49oC)
- b. Humidity: 0-93 percent RH, non-condensing.

B. Control Relay Module

1. Provide intelligent control relay modules at the locations shown on the drawings. The Control Relay Module shall provide one form "C" dry relay contact rated at 2 amps @ 24 VDC to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems. The position of the relay contact shall be confirmed by the system firmware. The control relay module shall be suitable for mounting on 2 ½ inch (64mm) deep single gang boxes or 1 ½ inch (38mm) deep 4 inch square boxes with single gang covers.
2. Basis of Design: Edwards model SIGA-CR.

C. Dual Input Module

1. Provide intelligent dual input modules at the locations shown on the drawings. The Dual Input Module shall provide two (2) supervised Class B input circuits each capable of a minimum of 4 personalities, each with a distinct operation. The module shall be suitable for mounting on 2 ½ inch (64mm) deep single gang boxes or 1 ½ inch (38mm) deep 4 inch square boxes with single gang covers. The dual input module shall support the following circuit types:
 - a. Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.)
 - b. Normally-Open Alarm Delayed Latching (Waterflow Switches)
 - c. Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.)
 - d. Normally-Open Active Latching (Supervisory, Tamper Switches)
2. Basis of Design: Edwards model SIGA-CT2.

D. Dual Input Signal Module

1. Provide intelligent dual input signal modules at the locations shown on the drawings. The Dual Input (Dual Riser Select) Signal Module shall provide a means to selectively connect one of two (2) signaling circuit power risers to one (1) supervised output circuit. The module shall be suitable for mounting on 2 ½ inch (64mm) deep 2-gang boxes or 1 ½ inch (38mm) deep 4 inch square boxes with 2-gang covers. The dual input signal module shall support the following operation:
2. Audible/Visible Signal Power Selector (Polarized 24 VDC @ 2A, 25 Vrms @ 50w or 70 Vrms @ 35w of Audio).
3. Basis of Design: Edwards model SIGA-CC2.

E. Isolator Module

1. Provide intelligent fault isolators modules at the locations shown on the drawings. The Isolator Module shall be capable of isolating and removing a fault from a class A data circuit while allowing the remaining data loop to continue operating. The module shall be suitable for mounting on 2 ½ inch (64mm) deep 2-gang boxes or 1 ½ inch (38mm) deep 4 inch square boxes with 2-gang covers.
2. Basis of Design: Edwards model SIGA-IM.

F. Monitor Module

1. Provide intelligent monitor modules at the locations shown on the drawings. The Monitor Module shall be factory set to support one (1) supervised Class B Normally-Open Active Non-Latching Monitor circuit. The monitor module shall be suitable for mounting on 2 ½ inch (64mm) deep 1-gang boxes or 1 ½ inch (38mm) deep 4 inch square boxes with 1-gang covers.



2. Basis of Design: Edwards model SIGA-MM1.
- G. Single Input Module
1. Provide intelligent single input modules at the locations shown on the drawings. The Single Input Module shall provide one (1) supervised Class B input circuit capable of a minimum of 4 personalities, each with a distinct operation. The module shall be suitable for mounting on 2 ½ inch (64mm) deep 1-gang boxes or 1 ½ inch (38mm) deep 4 inch square boxes with 1-gang covers. The single input module shall support the following circuit types:
 - a. Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.)
 - b. Normally-Open Alarm Delayed Latching (Waterflow Switches)
 - c. Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.)
 - d. Normally-Open Active Latching (Supervisory, Tamper Switches)
 2. Basis of Design: Edwards model SIGA-CT1.
- H. Single Input Signal Module
1. Provide intelligent single input signal modules at the locations shown on the drawings. The Single Input (Single Riser Select) Signal Module shall provide one (1) supervised Class B output circuit capable of a minimum of 2 personalities, each with a distinct operation. When selected as a telephone power selector, the module shall be capable of generating its own "ring tone". The module shall be suitable for mounting on 2 ½ inch (64mm) deep 2-gang boxes or 1 ½ inch (38mm) deep 4 inch square boxes with 2-gang covers. The single input signal module shall support the following operations:
 - a. Audible/Visible Signal Power Selector (Polarized 24 VDC @ 2A, 25Vrms @50w or 70 Vrms @ 35 Watts of Audio)
 2. Basis of Design: Edwards model SIGA-CC1.
- I. [Suppression System Releasing Module]
1. Provide addressable suppression system releasing interface modules at the locations shown on the drawings. The interface shall be suitable for preaction and deluge sprinkler systems and clean extinguishing agent release. The interface shall provide supervised Class B circuits required for solenoid activation, manual release, system abort, and audible and visible notification of pending release. The interface shall provide all required release and abort timing functions. The interface shall be listed for use with solenoid releasing valves that has both ULI listing and FM approval. The solenoid release circuit shall be provided with a manual disconnect switch for system maintenance.
 2. Basis of Design: Edwards model SIGA-REL.
- J. [Universal Class AB Module]
1. Provide intelligent class A/B modules at the locations shown on the drawings. The Universal Class A/B Module shall be capable of a minimum of fifteen (15) distinct operations. The module shall be suitable for mounting on 2 ½ inch (64mm) deep 2-gang boxes or 1 ½ inch (38mm) deep 4 inch square boxes with 2-gang covers. The universal class A/B module shall support the following circuit types:
 - a. Two (2) supervised Class B Normally-Open Alarm Latching.
 - b. Two (2) supervised Class B Normally-Open Alarm Delayed Latching.
 - c. Two (2) supervised Class B Normally-Open Active Non-Latching.
 - d. Two (2) supervised Class B Normally-Open Active Latching.
 - e. One (1) form "C" dry relay contact rated at 2 amps @ 24 VDC.
 - f. One (1) supervised Class A Normally-Open Alarm Latching.
 - g. One (1) supervised Class A Normally-Open Alarm Delayed Latching.
 - h. One (1) supervised Class A Normally-Open Active Non-Latching.
 - i. One (1) supervised Class A Normally-Open Active Latching.
 - j. One (1) supervised Class A 2-wire Smoke Alarm Non-Verified.
 - k. One (1) supervised Class B 2-wire Smoke Alarm Non-Verified.
 - l. One (1) supervised Class A 2-wire Smoke Alarm Verified
 - m. One (1) supervised Class B 2-wire Smoke Alarm Verified
 - n. One (1) supervised Class A Signal Circuit, 24VDC @ 2A.



- o. One (1) supervised Class B Signal Circuit, 24VDC @ 2A.
- 2. Basis of Design: Edwards model SIGA-UM.

K. [Waterflow-Tamper Module]

- 1. Provide intelligent waterflow/tamper modules at the locations shown on the drawings. The Waterflow/Tamper Module shall be factory set to support two (2) supervised Class B input circuits. Channel A shall support a Normally-Open Alarm Delayed Latching Waterflow Switch circuit. Channel B shall support a Normally-Open Active Latching Tamper Switch. The waterflow/tamper module shall be suitable for mounting on 2 ½ inch (64mm) deep 1-gang boxes or 1 ½ inch (38mm) deep 4 inch square boxes with 1-gang covers.
- 2. Basis of Design: Edwards Model SIGA-WTM.

2.5 CONDUCTORS

- A. The requirement of this section apply to all system conductors, including all signaling line, initiating device, notification appliance, auxiliary function, remote signaling, AC and DC power and grounding/shield drain circuits, and any other wiring installed by the Contractor pursuant to the requirements of these Specifications.
- B. All circuits shall be rated power limited in accordance with NEC Article 760.
- C. [Installed in conduit or enclosed raceway.]
- D. All new system conductors shall be of the type(s) specified herein.
 - 1. All initiating circuit, signaling line circuit, AC power conductors, shield drain conductors and grounding conductors, shall be solid copper, stranded or bunch tinned (bonded) stranded copper.
 - 2. All signaling line circuits, including all addressable initiating device circuits shall be 18 AWG minimum multi-conductor jacketed twisted cable or twisted shielded or as per manufacturer's requirements.
 - 3. All non-addressable initiating device circuits, 24 VDC auxiliary function circuits shall be 18 AWG minimum or per manufacturer's requirements.
 - 4. All notification appliance circuit conductors shall be solid copper or bunch tinned (bonded) stranded copper. Where stranded conductors are utilized, a maximum of 19 strands shall be permitted for #12/AWG and larger conductors. Minimum size conductor shall be #12 AWG.
 - 5. All visual notification appliance circuits shall be #12 AWG minimum THHN or twisted pairs or twisted shielded pairs or per manufacturer's requirements.
 - 6. Color code fire alarm conductors as follows:

ITEM	COLOR
Initiating Device	Orange/Brown
Horn (Exterior)	Blue and Yellow
Flashing Lights	Blue and Yellow
Control Panel Power	[Black,] White and Green
Air Handler Shutdown	Purple
[Door Holders]	White

- 7. All conductors shall be terminated with crimp type, open end, space lugs using tool approved by lug manufacturer. Terminal cabinets shall be provided with screw type terminal strips and plywood backboards.

2.6 CONDUCTORS [AND RACEWAY]



- A. Except as otherwise required by Code and/or these Specifications, the installation of all system circuits shall conform to the requirements of Article 760 and raceway installation to the applicable sections of NFPA 70, National Electrical Code. Fire alarm circuit wiring shall include all circuits described in Section 760.1 including Fine Print Note No. 1 (FPN No. 1), and as defined by the manufacturer's UL listing.
- B. The entire system shall be installed in a skillful manner in accordance with approved manufacturer's installation manuals, shop drawings and wiring diagrams. The contractor shall furnish all conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices necessary for the complete installation. All wiring shall be of the type required by the NEC and approved by local authorities having jurisdiction for the purpose.
- C. Any shorts, opens, or grounds found on new or existing wiring shall be corrected prior to the connection of these wires to any panel component or field device.
- D. The contractor shall neatly tie-wrap all field-wiring conductors in the gutter spaces of the control panels and secure the wiring away from all circuit boards and control equipment components. All field-wiring circuits shall be neatly and legibly labeled in the control panel. No wiring except home runs from life safety system circuits and system power supply circuits shall be permitted in the control panel enclosures. No wiring splices shall be permitted in a control panel enclosure.
- E. All penetration of floor slabs and firewalls shall be fire stopped in accordance with all local fire codes.

2.7 [OPEN CABLE]

- A. Power-limited cable in accordance with NEC Article 760, where used, not installed in UL listed metal conduit or raceway shall be mechanically protected by building construction features:
- B. Installation shall be in areas not subjected to mechanical injury.
- C. All circuits shall be supported by the building structure. Cable shall be attached by straps to the building structure at intervals not greater than 10 feet. Wiring installed above drop ceilings, cable shall not be laid on ceiling tiles. Cable shall not be fastened in a manner that puts tension on the cable.
- D. Cable type shall be FPLP, FPLR or FPL, or permitted substitutions, selected for the installation application as required by NEC 70, Section 760-61.
- E. All cable that is not enclosed by conduit shall be supported and anchored with nylon straps or clamps. The use of staples is prohibited.]

2.8 [CONDUIT RACEWAY]

- A. All systems and system components listed to UL864 Control Units for Fire Protective Signaling Systems maybe installed within a common conduit raceway system, in accordance with the manufacture's recommendations. System(s) or system components not listed to the UL864 standard shall utilize a separate conduit raceway system for each of the sub-systems.
- B. The requirements of this section apply to all system conduits, raceways, electrical enclosures, junction boxes, pull boxes and device back boxes.
- C. All system conduits shall be of the sizes and types specified.
- D. All system conduits shall be EMT, 3/4 -inch minimum, except for flexible metallic conduit used for whips to devices only, maximum length 6 feet, 3/4-inch diameter, minimum.
- E. All system conduits, which are installed in areas, which may be subject to physical damage or weather, shall be IMC or rigid steel, 3/4 -inch minimum.



- F. Conduits shall be sized according to the conductors contained therein. Cross sectional area percentage fill for system conduits shall not exceed 40 percent.
- G. All fire alarm conduit systems shall be routed and installed to minimize the potential for physical, mechanical or by fire damage, and so as not to interfere with existing building systems, facilities or equipment, and to facilitate service and minimize maintenance.
- H. All conduits, except flexible conduit whips to devices, shall be solidly attached to building structural members, ceiling slabs or permanent walls. Conduits shall not be attached to existing conduit, duct work, cable trays, other ceiling equipment, drop ceiling hangers/grids or partition walls, except where necessary to connect to initiating, notification, or auxiliary function devices.
- I. All system conduits, junction boxes, pull boxes, terminal cabinets, electrical enclosures and device back boxes shall be readily accessible for inspection, testing, service and maintenance.]

PART 3 - EXECUTION

3.1 EXAMINATION

- A. As specified in Section 260500 - Common Work Results for Electrical.

3.2 INSTALLATION

- A. General
 - 1. All equipment shall be attached to walls and ceiling/floor assemblies and shall be mounted firmly in place. Detectors shall not be supported solely by suspended ceilings. Fasteners and supports shall be sized to support the required load.
- B. Installation Sequence
 - 1. Installation of the systems shall be conducted in stages and phased such that circuits and equipment are installed in the following order:
 - a. Riser conduits, AC power conduits and control cabinets.
 - b. Control panel(s), control component(s), remote annunciator(s), and printer(s).
 - c. [Conduits and] wiring for complete notification circuits and appliance installation throughout facility.
 - d. Pre-test the audible and visual notification appliance circuits.
 - e. Install all new detection devices.
 - f. Terminate between field devices and the associated control equipment.
 - g. Complete the interface to all suppression and ancillary shutdown systems.
 - h. Complete contractor pre-test of system.
 - i. Complete system testing
- C. Install products in accordance with NFPA Standards and manufacturer's published instructions.
- D. Install manual station with operating handle 48 inches (1.22 m) above floor. Install audible and visual signal devices in accordance with NFPA 72 and ANSI/UL 1971.
- E. Mount end-of-line device at the last easily accessible device or within separate box adjacent to the last device.
- F. [Flush mount outlet box for electric door holder to withstand 80 pounds pulling force.]



- G. Make wiring connections to [door release devices,] [sprinkler flow switches,] [sprinkler valve tamper switches,] [fire suppression system control panels,] and other devices. Conduct all testing, including HVAC Equipment shutdown, initiated by fire alarm devices.
- H. Automatic Detector Installation: Conform to NFPA 72.

3.3 PREPARATION

- A. Coordinate work of this Section with other affected work and construction schedule.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Test in accordance with NFPA 72 and local fire department requirements. Use "Record of Completion" Figure 4.5.2.1 (NFPA 72).
- C. Manufacturer's Field Services: Provide services of NICET certified Level III technician to supervise installation, adjustments, final connections, and system testing. Submit written certification on manufacturers letterhead to Contracting Officer that system has been installed in accordance with applicable codes and is functioning properly. Provide copy of "Certificate of Completion" and place inside plastic envelope at Fire Alarm Control Panel.
- D. Inspection:
 - 1. Inspect equipment installation, interconnection with system devices, mounting locations, and mounting methods.
 - 2. Verify that units and controls are properly installed, connected, and labeled and that interconnecting wires and terminals are identified.
- E. Pretesting: Align and adjust system and perform pretesting of components, wiring, and functions to verify conformance with specified requirements. Correct deficiencies by replacing malfunctioning or damaged items with new items. Retest until satisfactory performance and conditions are achieved.
- F. Acceptance Operational Tests:
 - 1. Perform operational system tests to verify conformance with specifications:
 - a. Each alarm initiating device installed shall be operationally tested in the presence of a contracting officer's representative. Each device shall be tested for alarm and trouble conditions. Contractor shall submit a written certification that the Fire Alarm System installation is complete including all punch-list items. Test battery operated emergency power supply. Test emergency power supply to minimum durations specified. Test Remote Station Signal Transmitter. Coordinate testing with the Public Authority and Remote Station monitoring firm/entity. Submit written documentation from Remote Station monitoring firm/entity that Fire Alarm Signal Transmitter is operating properly.
 - b. Test each Signal Appliance installed for proper operation. Submit written report indicating sound levels at specified distances.
 - c. Test Fire Alarm Control Panel [and Remote Annunciator].
 - 2. Provide minimum [10] days notice of acceptance test performance schedule to Contracting Officer, Remote Station monitoring firm/entity, and local fire authorities having jurisdiction.
 - 3. The Contractor shall provide certification that the system is installed entirely in accordance with the system manufacturer's recommendations and within the limitations of the required listings and approvals, that all system hardware and software has been visually inspected and functionally tested by a manufacturer's certified representative, and that the system is in proper working order.



- G. Retesting: Correct deficiencies and retest until total system meets the requirements of Specifications and complies with applicable standards.

3.5 WARRANTY AND MAINTENANCE

- A. Warranty: The contractor shall warranty all materials, installation and workmanship for [12 months][18 months] year from date of acceptance, unless otherwise specified. A copy of the manufacturer's warranty shall be provided with close-out documentation and included with the operation and installation manuals.
- B. Spare Parts
 - 1. The Contractor shall supply the following spare parts:
 - a. Automatic detection devices -Five (5) percent of the installed quantity of each type.
 - b. Manual fire alarm stations - Five (5) percent of the installed quantity of each type.
 - c. Glass rods or panels for break glass manual fire alarm stations (if used) – [Ten] percent of the installed quantity, but no less than [ten (10)] devices.
 - d. Audible and visible devices - Five (5) percent of the installed quantity of each type.
 - e. Keys - A minimum of [four (4)] sets of keys shall be provided and appropriately identified.

3.6 TRAINING

- A. The System Supplier shall schedule and present a minimum of [four (4)] hours of documented formalized instruction for the building owner, detailing the proper operation of the installed System.
- B. The instruction shall be presented in an organized and professional manner by a person factory trained in the operation and maintenance of the equipment and who is also thoroughly familiar with the installation.
- C. The instruction shall cover the schedule of maintenance required by NFPA 72 and any additional maintenance recommended by the system manufacturer.
- D. Instruction shall be made available to the Local Municipal Fire Department if requested by the Public Authority

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END OF SECTION 28 31 00 00



SECTION 28 31 00 00 - MPF FIRE DETECTION AND ALARM

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. This specification provides the minimum requirements for the Life Safety System. The system shall include, but not limited to all equipment, materials, labor, documentation and services necessary to furnish and install a complete, operational system to include but not limited to the following functions:
 - 1. Protected premises fire alarm systems.
 - 2. Initiating devices.
 - 3. Notification appliances.
 - 4. Inspection and testing.
 - 5. Auxiliary fire alarm equipment.
- B. Related Sections:
 - 1. Section 281304 – Physical Access Control System.
 - 2. Section 210000 - Fire Suppression.
 - 3. Section 260500 - Common Work Results for Electrical.
 - 4. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.
 - 5. Section 260533 – Raceway & Boxes for Electrical Systems.
 - 6. Section 260800 – Commissioning of Electrical Systems.

1.2 REFERENCES

- A. All work and materials shall conform to all applicable federal, state and local codes and regulations governing the installation. The equipment and installation shall comply with the current provisions of the following codes and standards.
- B. American National Standards Institute (ANSI):
 - 1. ANSI S3.411, Audible Emergency Evacuation Signals.
 - 2. ANSI/UL 1971, Standard for Safety Signaling devices for Hearing Impaired.
- C. National Fire Protection Association (NFPA):
 - 1. NFPA 13, Installation of Sprinkler Systems.
 - 2. [NFPA 20, Installation of Centrifugal Fire Pumps.]
 - 3. NFPA 70, National Electrical Code.
 - 4. NFPA 72, National Fire Alarm Code.
 - 5. NFPA 101, Life Safety Code.
- D. Underwriters Laboratories, Inc.(UL):
 - 1. UL 864 - Control Units for Fire Protective Signaling Systems.
 - 2. UL 268 - Smoke Detectors for Fire Protective Signaling Systems.
 - 3. UL 268A - Smoke Detectors for Duct Applications.



4. UL 217 - Single and Multiple Station Smoke Alarms.
5. UL 521 - Heat Detectors for Fire Protective Signaling Systems.
6. UL 228 - Door Closers-Holders, With or Without Integral Smoke Detectors.
7. UL 464 - Audible Signaling Appliances.
8. UL 38 - Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems.
9. UL 346 - Waterflow Indicators for Fire Protective Signaling Systems.
10. UL 1971 - Signaling Devices for the Hearing-Impaired.
11. UL 1481 - Power Supplies for Fire Protective Signaling Systems.
12. UL 1635 - Digital Alarm Communicator System Units.

- E. Federal Codes and Regulations
 1. Americans with Disabilities Act (ADA)
- F. International Standards Organization (ISO)
 1. ISO-9000
 2. ISO-9001
- G. Factory Mutual (FM)
 1. Provide factory mutual approval.

1.3 DEFINITIONS:

- A. Authority Having Jurisdiction: See Public Authorities.
- B. Engineer of Record: A Professional Engineer Registered in the State where the project is located who undertakes design of the fire protection system.
- C. Owner: Building/facility owner, landlord/lessor, tenant/lessee, Insurance Carrier or any designated representative of these entities.
- D. Public Authorities: Local, State or Federal government body having jurisdiction over any portion of the project. This includes, but is not limited to: Fire Departments, Fire Marshal Offices, Aviation Authorities, Insurance Regulatory Boards, etc.

1.4 SYSTEM DESCRIPTION

- A. General
 1. The Contractor shall furnish all labor, services and materials necessary to furnish and install a complete, functional protected premises fire alarm system (System). The System shall comply in all respects with the requirements of the specifications, manufacturer's recommendations and Underwriters Laboratories Inc. (ULI) listings.
 2. Certification that the entire system(s) has/have been inspected and tested, is/are installed entirely in accordance with the applicable codes, standards, manufacturer's recommendations and ULI listings, and is/are in proper working order. Contractor shall use "Fire Alarm System Certification and Description" as required by NFPA 72.
- B. 24VDC NACs
 1. Provide and install a new fire detection and alarm system that shall consist of:
 - a. Fire Alarm Control Panel.
 - b. LCD remote annunciator(s).
 - c. A system printer.
 - d. Manual pull stations.
 - e. Area smoke detectors.
 - f. Area heat detectors.
 - g. Duct smoke detectors.



- h. Sprinkler system waterflow(s) and valve supervisory switch(s).
- i. [Interface with suppression, smoke control and ancillary shutdown system(s)].
- j. Audible notification appliances.
- k. Synchronized visual notification appliances.
- l. Magnetic door holders.
- m. [Provide elevator recall functions for primary and alternate floors and elevator power shunt trip activation.]
- n. Connection to a central station. The Owner shall arrange for two dedicated phone lines to be terminated as directed by the installing contractor.

1.5 SEQUENCE OF OPERATIONS

A. General 24 VDC NACs

1. The alarm activation of any area smoke detector, heat detector, manual pull station, sprinkler waterflow, the following functions shall automatically occur:
 - a. The internal audible device shall sound at the control panel and remote annunciator.
 - b. The LCD display shall indicate all applicable information associated with the alarm condition including; device type, device location and time/date.
 - c. All system activity/events shall be documented in system history and on the system printer.
 - d. Any remote or local annunciator LCD/LED's associated with the alarm shall be illuminated.
 - e. Activate notification audible appliances throughout the building.
 - f. Activate visual strobes notification appliances throughout the building. The visual strobe shall continue to flash until the system has been reset. The visual strobe shall not stop operating when the "Alarm Silence" is pressed.
 - g. Transmit an alarm signal to the central station.
 - h. All automatic events programmed to the alarm point shall be executed and the associated outputs activated.
 - i. All exit doors shall unlock throughout the building.
 - j. All self-closing fire/smoke doors held open shall be released.

B. Duct Smoke Operation

1. The Alarm activation of any duct smoke detector, the following functions shall automatically occur:
 - a. The internal audible device shall sound at the control panel and remote annunciator.
 - b. The LCD display shall indicate all applicable information associated with the alarm condition including; device type, device location and time/date.
 - c. All system activity/events shall be recorded on the system printer and system history file.
 - d. Any remote or local annunciator LED's associated with the alarm shall be illuminated.
 - e. Transmit an alarm signal to the central station.
 - f. Shutdown the local air handling unit.
 - g. All automatic events programmed to the alarm point shall be executed and the associated outputs activated.

C. Supervisory Operation

1. Upon supervisory activation of any sprinkler valve supervisory switch, the following functions shall automatically occur:
 - a. The internal audible device shall sound at the control panel and remote annunciator.
 - b. The LCD display shall indicate all applicable information associated with the supervisory condition including; device type, device location and time/date.
 - c. All system activity/events shall be documented on the system printer and system history file.
 - d. Any remote or local annunciator LCD/LED's associated with the supervisory activation shall be illuminated.
 - e. Transmit a supervisory signal to the central station.

D. Trouble Operation



1. Upon activation of a trouble condition or signal from any device on the system, the following functions shall automatically occur:
 - a. The internal audible device shall sound at the control panel and remote annunciator.
 - b. The LCD display shall indicate all applicable information associated with the trouble condition including; device type, device location and time/date.
 - c. All system activity/events shall be documented on the system printer and system history file.
 - d. Any remote or local annunciator LCD/LED's associated with the trouble zone shall be illuminated.
 - e. Transmit a trouble signal to the central station.

1.6 SYSTEM CONFIGURATION

A. General

1. All Life Safety System equipment shall be arranged and programmed to provide a system for the early detection of fire, the notification of building occupants, the automatic summoning of the local fire department, the override of the HVAC system operation, and the activation of other auxiliary systems to inhibit the spread of smoke and fire, and to facilitate the safe evacuation of building occupants.
2. The System shall utilize independently addressed, smoke detectors, heat detectors and input/output modules as described elsewhere in this specification.

B. Power Supply

1. The power supply shall be a high efficiency switch mode type with line monitoring to automatically switch to batteries for power failure or brown out conditions. The automatic battery charger shall have low battery discharge protection. The power supply shall provide internal power and 24 Vdc at 4.5A continuous for notification appliance circuits. All outputs shall be power limited. The battery shall be sized to support the system for [24] [60] hours of supervisory and trouble signal current plus general alarm for 5 minutes.
2. Auxiliary power supplies shall be a high efficiency switch mode type with line monitoring to automatically switch to batteries for power failure or brown out conditions. The automatic battery charger shall have low battery discharge protection. The power supply shall provide internal power and 24 Vdc at 6.4 continuous for notification appliance circuits. The power supply shall be capable of providing 8A to output circuits for a maximum period of 100 ms. All outputs shall be power limited. The battery shall be sized to support the system for [24] [60] hours of supervisory and trouble signal current plus general alarm for 5 minutes. All supervision of the auxiliary supply shall be transmitted via addressable analog loop without additional equipment.

C. Display

1. The display module shall be of membrane style construction with a 4 line by 20 character Liquid Crystal Display. The LCD shall use super-twist technology and backlighting for high contrast visual clarity. In the normal mode display the time, the total number of active events and the total number of disable points. In the alarm mode display the total number of events and the type of event on display. Reserve 40 characters of display space for user custom messages. The module shall have visual indicators for the following common control functions; AC Power, alarm, supervisory, monitor, trouble, disable, ground fault, CPU fail, and test. There shall be common control keys and visual indicators for; reset, alarm silence, trouble silence, drill, and one custom programmable key/indicator. Provide four pairs of display control keys for selection of event display by type (alarm, supervisory, monitor and trouble) and forward / backward scrolling through event listings. The operation of these keys shall be integrated with the related common control indicator that lights when an event of its type is active. Allow the first event of the highest priority to capture the LCD for display so that arriving fire fighters can view the first alarm event "hands free". Provide system function keys; status, reports, enable, disable, activate, restore, program, and test. The module shall have a numeric keypad, zero through nine with delete and enter keys.



- D. Initiating Device Circuits
 - 1. The Initiating device circuits (IDC) used to monitor manual fire alarm stations, smoke and heat detectors, waterflow switches, valve supervisory switches, fire pump functions, and air pressure supervisory switches shall be Class B.
- E. 24 VDC Notification Appliance Circuits
 - 1. 24 VDC Notification appliance circuits (NAC) shall be Class B. All notification appliance circuits shall have a minimum circuit output rating of 2 amp @ 24 vdc. The notification circuits shall be power limited. Non-power limited circuits are not acceptable.
- F. Audio Notification Appliance Circuits
 - 1. One-way audio notification appliance circuits (NAC) shall be Class B. All notification appliance circuits shall have a minimum circuit output rating of 35W @70Vrms. The notification circuits shall be power limited. Non-power limited circuits are not acceptable.
- G. Signaling Line Circuits (SLC-Data Circuits)
 - 1. The signaling line circuit shall communicate from a panel/node to analog/addressable detectors, input modules, output modules, isolation modules and notification appliance circuits.
 - 2. Each signaling circuit connected to addressable/analog devices shall provide a minimum of 20 spare addresses.
 - 3. [When a signaling line circuit covers more than one fire/smoke compartments, a wire-to-wire short shall not effect the operation of the circuit from the other fire/smoke compartments.]
 - 4. The signaling line circuit (SLC) connecting all components Class B (style 4).
- H. DACT
 - 1. The panel shall contain a dialer (alarm communicator transmitter (DACT)) module to transmit alarm, supervisory and trouble signals to a Central Monitoring Station (CMS). The DACT shall support dual telephones lines, 20 PPS 4/2 communications, and configured for dual tone multi-frequency (DTMF) or pulse modes. It shall be possible to delay AC power failure reports, auto test call, and site program using a touch tone phone and password

1.7 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data:
 - a. Provide electrical characteristics and connection requirements.
 - b. Power and battery calculation.
 - 2. Shop Drawings: Provide (graphic) annunciator layout and system wiring diagram showing each device and wiring connection required. Prior to commencement of installation, submit licensed Professional Engineer's system drawings (signed and sealed by Delegated Engineer) specified in "Quality Assurance" Article to Designated Reviewers. Include system calculations and equipment data. Submittals shall be complete and in bound sets. System drawings, prepared according to Contract Documents. Submittals shall be made to Designated reviewers. Designated Reviewers are:
 - a. Additional Submittal: Submit shop drawings, product data, and calculations to Public Authorities for approval. Submit proof of approval to Contracting Officer.
 - b. Submittals to Contracting Officer:
 - c. Submittals to Engineer of Record:
 - 3. Assurance/Control Submittals:
 - a. Design Data: System operation description indicating method of operation and supervision of each component and each type of circuit, and sequence of operations for all manually and automatically initiated system inputs for this specific Project. Manufacturer's standard descriptions for generic systems not permitted.
 - b. Test Reports: Submit the following reports directly to Contracting Officer from Manufacturer's Quality Control Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:



- 1) Pre-test.
 - 2) Acceptance test.
 - c. Certificates: Manufacturer's certificate certifying that components and Products meet or exceed specified requirements.
 - d. Qualification Documentation:
 - 1) Submit documentation of manufacturer and installer experience indicating compliance with specified qualification requirements. Include lists of completed projects with project names and addresses, and names of Engineers and Owners.
 - 2) Fire alarm contractor license issued by State or local authority having jurisdiction.
 - e. Manufacturer's Field Reports: Submit the following reports directly to Contracting Officer from Manufacturer's Quality Control Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements.
 - 1) Preparatory inspection.
 - 2) Initial inspection.
 - 3) Follow-up inspection.
 - 4) Final inspection.
 - f. All drawings shall be reviewed and signed off by an individual having a minimum of a NICET certification in fire protection engineering technology, subfield of fire alarm systems.
 - g. A copy of the installing technician's NICET certification shall be provided.
 - h. System Calculations: Complete calculations shall be provided which show the electrical load on the following system components:
 - 1) Each system power supply, including stand alone booster supplies.
 - 2) Each standby power supply (batteries).
 - 3) Each notification appliance circuit.
 - 4) Each auxiliary control circuit that draws power from any system power supply.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals:
- 1. Operation and Maintenance Data: Project specific operating manuals covering the installed Life Safety System. A generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement. Include user's software data and recommendations for spare parts to be stocked at the site. Provide names, addresses, and telephone numbers of service organizations that stock repair parts for the system.
 - 2. Project Record Documents: As-Built drawings consisting of: a scaled plan of each building showing the placement of each individual item of the Life Safety System equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway. All drawings must reflect point to point wiring, device address and programmed characteristics. All drawings shall be provided in AutoCad format. A vellum plot of each sheet shall also be provided. Provide the application program listing for the system as installed at the time of acceptance (disk, hard copy printout, and all required passwords).
 - 3. Record of Completion: Figure 4.5.2.1 NFPA 72.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firm experienced in manufacturing equipment of the types and capacities indicated that have record of successful in-service performance with minimum 10 years documented experience. Prime system manufacturer and manufacturers of major system components required to qualify separately.
 - 1. Service Center: The System Supplier shall maintain a service organization with adequate spare parts stock within 75 miles of the installation. Any defects that render the system inoperative shall be repaired within 24 hours of the Owner notifying the contractor.
- B. Installer Qualifications: Experience with systems of the type and scope indicated and certified as authorized service representative of the prime system manufacturer with minimum 5 years documented experience.



1. System shall be installed by a single contractor that assumes responsibility for system components and their compatibility.
2. Only manufacturer's certified installers with NICET Level III or higher shall be utilized.

C. Regulatory Requirements:

1. Calculations, Product Data, Shop Drawings: Provide stamp of approval from Public Authorities.
2. Comply with requirements of Public Authorities for submittals, approvals, materials, installation, inspections, and testing.
3. Comply with requirements of Contracting Officer and Owner's insurance underwriter for submittals, approvals, materials, installation, inspections, and testing.
4. Provide certificate of compliance from Public Authorities indicating approval of field acceptance tests.
5. Conform to applicable code for submission of design and calculations, reviewed shop and erection drawings and as required for acquiring permits.
6. Cooperate with regulatory agency or authority and provide data as requested.

D. Pre-Installation Meetings:

1. Convene a pre-installation meeting one week prior to commencing Work of this Section.
2. Require attendance of parties directly affecting Work of this Section.
3. Review conditions of operations, procedures and coordination with related Work.
4. Agenda:
 - a. Tour, inspect, and discuss conditions of building and building structure.
 - b. Review system design and requirements.
 - c. Review required submittals, both completed and yet to be completed.
 - d. Review system Drawings and data.
 - e. Review and finalize construction schedule related to system and verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
 - f. Review required inspections, testing, certifying, and material usage accounting procedures.

1.9 POSITIVE ALARM SEQUENCE

- A. Positive Alarm Sequence: If permitted by the public authority, the fire alarm system shall be equipped with positive alarm sequence feature (per NFPA 72, 9.6.3.4) that allows initial fire alarm signals to be received at the constantly attended control panel location and for which human action is subsequently required to delay the general alarm by 180 seconds after the start of the alarm processing. The transmission of the alarm signal to the central station shall activate upon the initial alarm signal.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. All equipment and components shall be the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approval agency for use as part of a protected premises protective signaling (fire alarm) system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.
- B. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. UTC Fire and Security/Edward Systems Technologies, Inc. (EST), (800) 655-4497
 2. Siemens, 800-262-7976.
 3. Honeywell/Notifier, 973- 455-2000.
 4. Simplex/Grinnell, 978-731-2500



C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted subject to approval of Contracting Officer.

1. Conflicts, deviations, or change requests shall be submitted in writing to Contracting Officer with supporting documentation. Include written justification, designs, manufacturer's specifications, cost benefits, and any special circumstances dictated by local conditions. Documentation package shall be submitted in sufficient time to minimize any adverse effects of the proposed changes to the project construction schedule. Contracting Officer reserves the right to reject substitute and other systems.

2.2 PANEL COMPONENTS AND FUNCTIONS

A. General

1. The control panel(s) shall be a multi-processor-based system designed specifically for fire and releasing system applications. The control panel shall be listed and approved for the application standard(s) as listed under the General section.
2. The control panel(s) shall include all required hardware, software and system programming to provide a complete and operational system. The control panel(s) shall assure that life safety takes precedence among all panel activities.
3. The control panel(s) shall include the following capacities:
 - a. Support up to 380 analog/addressable points per panel (1,900 total with 5 networked panels)
 - b. Support up to 5 fully supervised network remote annunciators.
 - c. Support a DACT (dialer) for off premise notification
 - d. Support up to 576 chronological events in history.
4. The control panel(s) shall include the following features:
 - a. Provide autoprogramming and electronic addressing and mapping of analog/addressable devices.
 - b. Provide an operator interface display that shall include functions required for annunciation, command and control system functions.
 - c. Provide a discreet system control switch provided for reset, alarm silence, local silence, drill switch, up/down switches, status switch, program switch, enable and disable switches, activate and restore switches, reports switch and test switch.
 - d. Provide system reports that provide sensitivity and history details.
 - e. Provide an authorized operator with the ability to operate or modify system functions like system time, date, passwords; and autoprogram, enable mapping, restart the system and clear control panel event history file.
 - f. Provide an authorized operator to perform test functions within the installed system.
5. Supervision of system components, wiring, initiating devices and software shall be provided by the control panel(s). Failure or fault of system component or wiring shall be indicated by type and location on the LCD display. Software and processor operation shall be independently monitored for failure. Control Panel:
6. Basis of Design: EST, EST2 Series.

B. Annunciation

1. The system shall be designed and equipped to receive, monitor, and annunciate signals from devices and circuits installed throughout the building. Manufacturer's standard control switches shall be acceptable if they provide the required operation, including performance, supervision and position indication. If the manufacturers' standard switches do not comply with these requirements, fabrication of custom manual controls acceptable to the contracting officer is required.
2. Receipt of alarm, trouble, and supervisory signals shall activate integral audible devices at the control panel(s) and at each remote annunciator panel.
3. The control panel(s) and remote annunciator(s) shall contain the following system status indicators:
 - a. 80 character Backlit Liquid Crystal Display.



- b. System Power Indicator - green LED.
 - c. System Common Alarm - red LED.
 - d. System Common Trouble - yellow LED.
 - e. System Common Supervisory - yellow LED.
 - f. System Common Monitor - yellow LED.
 - g. System Ground Fault - yellow LED.
 - h. System CPU Fault - yellow LED.
 - i. System Disabled - yellow LED.
 - j. System Test Point(s) - yellow LED.
 - k. System Reset Switch with Integral yellow LED.
 - l. System Alarm Silence Switch with Integral yellow LED.
 - m. System Local Silence Switch with Integral yellow LED.
 - n. System Drill Switch with Integral yellow LED
 - o. System Message Queue Scroll Switches.
 - p. Additional buttons as required to provide system control and operator functions.
- 4. Basis of Design: EST EST2 series.
- C. Power Supply
 - 1. Each system power supply shall be a minimum of 6 amps @ 24 vdc.
 - 2. Upon failure of normal (AC) power, the affected portion(s) of the system shall automatically switch over to secondary power without losing any alarm, trouble or operator acknowledgment signals.
 - 3. Each system power supply shall be individually annunciated and shall identify the inoperable power supply in the event of a trouble condition.
 - 4. All standby batteries shall be continuously monitored by the system. Low battery and disconnection of battery power supply conditions shall immediately annunciate as a trouble signal, identifying the deficient batteries.
 - 5. All system power supplies shall be capable of recharging their associated batteries, from a fully discharged condition to a capacity sufficient to allow the system to perform consistent with the requirements of this section, in 48 hours maximum.
 - 6. All AC power connections shall be to the building's designated emergency electrical power circuit and shall meet the requirements of Section 4.4.1.4 of NFPA 72. The AC power circuit shall be installed in conduit raceway. The power circuit disconnect means shall be clearly labeled FIRE ALARM CIRCUIT CONTROL and shall have a red marking. The location of the circuit disconnect shall be labeled permanently inside the each control panel.
 - 7. Basis of Design: EST model 2-PPS/6A.
- D. Display
 - 1. System Message Processing and Display Operations:
 - a. The system shall allow message routing to be configured to any or all annunciators.
 - b. All system printer port(s) shall be configurable to output any combination of alarm, supervisory, trouble, or monitor, event messages.
 - c. Each LCD display on each annunciator shall be configurable to display the status of any combination of alarm, supervisory, trouble, or monitor, event messages.
 - d. Clear distinction shall be provided between alarm, supervisory, trouble, and monitor status messages.
 - 2. The system shall provide the ability to retrieve data from the analog/addressable detectors to a PC while the system is on-line and operational in the protected premises. The uploaded data may then be analyzed in a diagnostic program supplied by the system manufacturer.
 - 3. A standby power supply shall automatically supply electrical energy to the system upon primary power supply failure
- E. Dialer -- DACT
 - 1. The system shall provide an off premise Digital Alarm Communications Transmitter (DACT) capable of transmitting system alarm, trouble and supervisory events to a central monitoring station (CMS). The DACT shall support dual telephone lines, 20 PPS 4/2 communications, and configured for dual tone multi-frequency (DTMF) or pulse modes. It shall be possible to delay AC



power failure reports, auto test call, and site program the DACT using a touch tone phone and password.

2. Basis of Design: EST model DL2

F. One-Way Emergency Audio Communications

1. A supervised one-way dual-channel emergency communications system shall be provided in the main control panel located within the maintenance operation's office. The main one-way audio controller shall provide a push-to-talk microphone with coiled cord, and switches that allow the emergency user to page to the evacuation channel, page to the alert channel or quickly place evacuation or alert tones on the selected channels. Switches shall also be provided to permit paging on the evacuation or alert channel using the firefighters telephone system as the paging source.
2. Each channel shall have the capability to output a different tone or prerecorded message independent of each other. Each supervised branch audio circuit shall provide a connect/disconnect switch and indicators for active circuit selection and circuit trouble.
3. Basis of Design: One-way emergency audio communications module EST model 2-MIC/2-AAC; pre-recorded digital message unit EST model SIGA-MDM.

G. One-Way Emergency Audio Amplifiers

1. The One-Way amplifiers shall be high-efficiency switch-mode audio amplifiers. Each amplifier must support dual channel audio. The audio output shall be configurable as 25VRMS or 70VRMS in Class B wiring, rated at [30][50] watts. The amplifiers shall support speakers connected directly to the output of the amplifier or the amplifier output shall be capable of being run as an audio riser to switching modules where speaker zone selection is made.
2. Each amplifier shall have a built in back up 1kHz tone generator that automatically activates with loss of input signal. Each amplifier shall have provision for a back up amplifier. It shall be possible to default to back up tone or standby amplifier in the event of the loss of input signals. System remote amplifiers must communicate their status directly to the main control panel. External monitoring is not acceptable. Onboard status LEDs shall be provided for quick visual indication of amplifier status
3. Basis of Design: EST model SIGA-AAxx.

H. System Printer

1. The event and status printer shall be a 9-pin, impact, dot matrix printer with a minimum print speed of 232 characters per second. The printer shall be capable of serial communications protocol. The printer shall list the time, date, type and user defined message for each event printed.
2. Basis of Design: EST model PT-1S.

I. Pager Interface

1. The system shall provide a module capable of transmitting alphanumeric system activity, by event, to a commercial paging system using TAP pager protocol. The system module shall be equipped with a high speed (V.32BIS or greater 14.4Kbaud) modem.
2. Basis of Design: EST model API-8/232ME

J. Reports

1. The system shall provide the operator with system reports that give detailed chronological description of the last 576 system events. The system shall provide a report that gives a listing of the sensitivity and environmental compensation usage of all of the detectors on the system, or specified analog/addressable circuit.
2. The system report shall also include facility name, compiled date, compiler revision, project revision and report date. The system shall output these reports via the main LCD, and reports shall be capable of being printed on the system printer..



2.3 FIELD-MOUNTED SYSTEM COMPONENTS

A. Smoke Detectors and Accessories

1. Analog Addressable Smoke General
 - a. Each analog addressable smoke detector's sensitivity shall be capable of being programmed individually as: most sensitive, more sensitive, normal, less sensitive or least sensitive.
 - b. An alternate alarm sensitivity level shall be provided for each detector, which can be set to any of the five (5) sensitivity settings manually or automatically using a time of day event.
 - c. The detector's sensing element reference point shall automatically adjust, compensating for background environmental conditions such as dust, temperature, and pressure. Periodically, the sensing element real-time analog value shall be compared against its reference value. The detector shall provide a maintenance alert signal that 80% to 99% compensation has been used. The detector shall provide a dirty fault signal that 100% compensation has been used.
 - d. The system shall allow for changing of detector types for service replacement purposes without the need to reprogram the system. The replacement detector type shall automatically continue to operate with the same programmed sensitivity levels and functions as the detector it replaced. System shall display an off-normal condition until the proper detector type has been installed or change in the application program profile has been made.
2. Smoke Detector - Multi-Sensor Photo Thermal (Ceiling Mounted)
 - a. Provide analog/addressable multisensor combination photoelectric, thermal smoke detectors for all ceiling mounted locations. Alarm condition shall be based upon the combined input from the photoelectric and thermal detection elements. Separately mounted photoelectric detectors and heat detectors in the same location, clustered at the manufacturer's listed spacing is not an acceptable alternative. The system shall have the ability to set the sensitivity and alarm verification of each individual detector on the circuit. It shall be possible to automatically set the sensitivity of individual analog/addressable detectors for the day and night periods.
 - b. Each smoke detector shall be capable of transmitting alarm signals as well as normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each smoke detector may be individually programmed to operate at any one of five (5) sensitivity settings. Each detector microprocessor shall contain an environmental compensation algorithm that identifies and sets ambient environmental thresholds approximately six times an hour. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 80% and 100% of the allowable environmental compensation value.
 - c. Basis of Design: EST model SIGA-PHS.
3. Smoke Detector - Photoelectric (Duct Mounted)
 - a. Provide analog/addressable photoelectric smoke detectors at all duct applications. The system shall have the ability to set the sensitivity and alarm verification of each of the individual detectors on the circuit. It shall be possible to automatically change the sensitivity of individual analog/addressable detectors for the day and night periods. Each smoke detector shall be capable of transmitting alarm signals as well as normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each smoke detector may be individually programmed to operate at any one of five (5) sensitivity settings. Each detector microprocessor shall contain an environmental compensation algorithm that identifies and sets ambient environmental thresholds approximately six times an hour. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 80% and 100% of the allowable environmental compensation value.
 - b. Provide key operated "normal-reset-test" switch at each duct smoke detector.
 - c. Basis of Design: EST model SIGA-PS.
4. Duct Detector Mounting Plate
 - a. Where smoke detectors are directly inserted into a low velocity ducts 3 ft (0.91m) high x 3 ft (0.91m) wide, ceiling plenums, or raised floors, provide factory supplied mounting plate



assemblies to facilitate mounting the detectors. The mounting plate shall be code gauge steel with corrosion resistant red enamel finish. The detector mounting plate shall support an analog/addressable detector along with a standard, relay or isolator detector-mounting base.

- b. Basis of Design: EST model SIGA-DMP.
- 5. Duct Detector Housing
 - a. Provide smoke detector duct housing assemblies to mount an analog/addressable detector along with a standard, relay or isolator detector mounting base. The housing shall also protect the measuring chamber from damage and insects. The housing shall utilize an air exhaust tube and an air sampling inlet tube that extends into the duct air stream up to ten feet. Drilling templates and gaskets to facilitate locating and mounting the housing shall also be provided. The housing shall be finished in baked red enamel. Remote alarm LED indicators and remote test stations shall be provided.
 - b. Basis of Design: EST model SIGA-DH.

B. Heat Detectors

- 1. Fixed Temperature Heat Detector (Equipment Rooms)
 - a. Provide analog/addressable fixed temperature heat detectors within all equipment rooms. The heat detector shall have a nominal fixed temperature alarm point rating of 135°F (57°C). The heat detector shall be rated for ceiling installation at a minimum of 70 ft (21.3m) centers and be suitable for wall mount applications.
 - b. Basis of Design: EST model SIGA-HFS.
- 2. Fixed Temperature-ROR Heat Detector (Ceiling Mounted)
 - a. Provide analog/addressable combination fixed temperature / rate-of-rise detectors for all ceiling mounted locations. The heat detector shall have a nominal fixed temperature alarm point rating of 135°F (57°C) and a rate of rise alarm point of 15°F(9°C) per minute. The heat detector shall be rated for ceiling installation at a minimum of 70 ft (21.3m) centers and be suitable for wall mount applications.
 - b. Basis of Design: EST model SIGA-HRS..

C. Detector Bases

- 1. Detector Base - Standard
 - a. Provide detector mounting base suitable for mounting on single gang, 3½ or 4 inch octagon box or 4 inch square box. The base shall, contain no electronics and support all series detector types.
 - b. Basis of Design: EST model SIGA-SB.
- 2. Detector Base - Relay
 - a. Provide relay detector mounting base suitable for mounting on single gang, 3½ or 4 inch octagon box and 4 inch square box. The relay base shall support all detector types and have the following minimal requirements.
 - b. The relay shall be a bi-stable type and selectable for normally open or normally closed operation.
 - 1) The position of the contact shall be supervised.
 - 2) The relay shall automatically de-energize when a detector is removed.
 - 3) The operation of the relay base shall be controlled by its respective detector processor. Detectors operating standalone mode shall operate the relay upon changing to alarm state. Relay bases not controlled by the detector microprocessor shall not be acceptable.
 - 4) Form "C" Relay contacts shall have a minimum rating of 1 amp @ 30 Vdc and be listed for pilot duty.
 - 5) Removal of the respective detector shall not affect communications with other detectors.
 - c. Basis of Design: EST model SIGA-RB

D. Manual Stations

- 1. Manual Station - Double Action Single Stage



- a. Provide analog/addressable double action, single stage fire alarm stations at the locations shown on the drawings. The fire alarm station shall be of polycarbonate construction and incorporate an internal toggle switch. A locked test feature shall be provided. The station shall be finished in red with silver "PULL IN CASE OF FIRE" lettering. The manual station shall be suitable for mounting on 2 ½ (64mm) deep single gang boxes and 1 ½ (38mm) deep 4 square boxes with single gang covers.
 - b. Provide factory manufactured boxes for all surface mounted applications.
 - c. Basis of Design: EST model SIGA-278
- E. Notification Appliances
 - 1. General
 - a. All appliances which are supplied for the requirements of this specification shall be UL Listed for Fire Protective Service, and shall be capable of providing the "equivalent facilitation" which is allowed under the Americans with Disabilities Act Accessibilities Guidelines (ADA(AG)), and shall be UL 1971 Listed.
 - b. All appliances shall be of the same manufacturer as the fire alarm control panel specified to insure absolute compatibility between the appliances and the control panels, and to insure that the application of the appliances are done in accordance with the single manufacturer's instructions.
 - c. All notification appliances shall be [red][white] unless noted otherwise on the drawings.
 - 2. Heavy Duty Horns (Exterior Locations)
 - a. Provide heavy duty electronic horns for exterior locations. Horns shall be selectable for high or low dBA output and steady or temporal output. At the high output setting, the horn shall provide a 85 dBA continuous sound output or a 82 dBA temporal sound output, when measured in reverberation room per UL-464. In and out screw terminals shall be provided for wiring. Weatherproof wall boxes shall be provided for outdoor applications.
 - b. Basis of Design: EST Integrity series.
 - 3. Low Profile Speaker (Interior Locations)
 - a. Provide low profile wall mount speakers within interior locations. The low profile speaker shall not extend more than 1" (2.5cm) past the finished wall surface, and provide a switch selectable audible output of 2W (90dBA), 1W (87dBA), 1/2W (84dBA), or 1/4W (81dBA) at 10 ft. when measured in reverberation room per UL-464.
 - b. Wattage setting shall be visible with the cover installed. When the cover is installed, no mounting hardware shall be visible. In and out screw terminals shall be provided for all wiring. The low profile speaker shall mount in a 4" x 2 1/8" square electrical box, without trims or extension rings.
 - c. Provide factory manufactured boxes for all surface mounted applications.
 - d. Basis of Design: EST Genesis G4 series.
 - 4. Speaker-Ceiling Mount-8in
 - a. Provide 8" ceiling mounted speakers at the locations shown on the drawings. In and out screw terminals shall be provided for wiring. Speaker baffles shall be round <square> steel with white finish as required. Provide square surface mount boxes with matching finish where required. Speakers shall provide 1/2W, 1W, 2W, and 4W power taps for use with 25V or 70V systems. At the 4 watt setting, the speaker shall provide a 94 dBA sound output a frequency of 1000 Hz. when measured in an anechoic chamber at 10 ft.
 - b. Basis of Design: EST Integrity series.
 - 5. Low Profile Speaker-Strobe
 - a. Provide low profile wall mount speaker/strobes at the locations shown on the drawings. The low profile speaker/strobe shall not extend more than 1" (2.5cm) past the finished wall surface, and provide a switch selectable audible output of 2W (90dBA), 1W (87dBA), 1/2W (84dBA), or 1/4W (81dBA) at 10 ft. when measured in reverberation room per UL-464.
 - b. Strobes shall provide synchronized flash output, that shall be switch selectable for output values of 15cd, 30cd, 75cd & 110cd. Wattage and candela settings shall be visible with the cover installed. When the cover is installed, no mounting hardware shall be visible. In and out screw terminals shall be provided for all wiring. The low profile speaker/strobes shall mount in a 4" x 2 1/8" square electrical box, without trims or extension rings.
 - c. Provide factory manufactured boxes for all surface mounted applications.



- d. Basis of Design: EST Genesis G4 series.
- 6. Speaker-Strobe Ceiling Mount-8in
 - a. Provide 8" ceiling mounted speaker/strobes at the locations shown on the drawings. In and out screw terminals shall be provided for wiring. Speaker baffles shall be round or square, steel with white finish as required. Provide square surface mount boxes with matching white finish as required. Speakers shall provide 1/2w, 1w, 2w, and 4W power taps for use with 25V or 70V systems. At the 4 watt setting, the speaker shall provide a 94 dBA sound output a frequency of 1000 Hz. when measured in an anechoic chamber at 10 ft. Strobes shall provide synchronized flash outputs. Strobe output shall be determined as required by its specific location and application from a family of 15cd, 30cd, 75cd, and 110cd devices.
 - b. Basis of Design: EST Integrity series.
- 7. Low Profile Strobes
 - a. Provide low profile wall mounted strobes at the locations shown on the drawings. In and out screw terminals shall be provided for wiring. Strobes shall provide synchronized flash outputs. Strobe output shall be determined as required by its specific location and application from a family of 15cd, 30cd, 60cd, 75cd, or 110cd devices. Low profile strobes shall mount in a single gang box.
 - b. Provide factory manufactured boxes for all surface mounted applications.
 - c. Basis of Design: EST Genesis series.

2.4 INITIATION AND CONTROL MODULES

A. General

- 1. It shall be possible to address each intelligent module without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable. The personality of multifunction modules shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. Modules requiring EPROM, PROM, ROM changes or DIP switch and/or jumper changes shall not be acceptable. The modules shall have a minimum of 2 diagnostic LEDs mounted behind a finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes which can be retrieved for troubleshooting assistance. Input and output circuit wiring shall be supervised for open and ground faults. The module shall be suitable for operation in the following environment:
 - a. Temperature: 32oF to 120oF (0oC to 49oC)
 - b. Humidity: 0-93% RH, non-condensing

B. Control Relay Module

- 1. Provide intelligent control relay modules at the locations shown on the drawings. The Control Relay Module shall provide one form "C" dry relay contact rated at 2 amps @ 24 Vdc to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems. The position of the relay contact shall be confirmed by the system firmware. The control relay module shall be suitable for mounting on 2 ½" (64mm) deep single gang boxes or 1 ½" (38mm) deep 4" square boxes with single gang covers.
- 2. Basis of Design: EST model SIGA-CR.

C. Dual Input Module

- 1. Provide intelligent dual input modules at the locations shown on the drawings.. The Dual Input Module shall provide two (2) supervised Class B input circuits each capable of a minimum of 4 personalities, each with a distinct operation. The module shall be suitable for mounting on 2 ½" (64mm) deep single gang boxes or 1 ½" (38mm) deep 4" square boxes with single gang covers. The dual input module shall support the following circuit types:
 - a. Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.)
 - b. Normally-Open Alarm Delayed Latching (Waterflow Switches)
 - c. Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.)



- d. Normally-Open Active Latching (Supervisory, Tamper Switches)
 2. Basis of Design: EST model SIGA-CT2.
- D. Dual Input Signal Module
 1. Provide intelligent dual input signal modules at the locations shown on the drawings. The Dual Input (Dual Riser Select) Signal Module shall provide a means to selectively connect one of two (2) signaling circuit power risers to one (1) supervised output circuit. The module shall be suitable for mounting on 2 ½" (64mm) deep 2-gang boxes or 1 ½" (38mm) deep 4" square boxes with 2-gang covers. The dual input signal module shall support the following operation:
 2. Audible/Visible Signal Power Selector (Polarized 24 Vdc @ 2A, 25 Vrms @ 50w or 70 Vrms @ 35w of Audio).
 3. Basis of Design: EST model SIGA-CC2.
- E. Isolator Module
 1. Provide intelligent fault isolators modules at the locations shown on the drawings. The Isolator Module shall be capable of isolating and removing a fault from a class A data circuit while allowing the remaining data loop to continue operating. The module shall be suitable for mounting on 2 ½" (64mm) deep 2-gang boxes or 1 ½" (38mm) deep 4" square boxes with 2-gang covers.
 2. Basis of Design: EST model SIGA-IM.
- F. Monitor Module
 1. Provide intelligent monitor modules at the locations shown on the drawings. The Monitor Module shall be factory set to support one (1) supervised Class B Normally-Open Active Non-Latching Monitor circuit. The monitor module shall be suitable for mounting on 2 ½" (64mm) deep 1-gang boxes or 1 ½" (38mm) deep 4" square boxes with 1-gang covers.
 2. Basis of Design: EST model SIGA-MM1.
- G. Single Input Module
 1. Provide intelligent single input modules at the locations shown on the drawings. The Single Input Module shall provide one (1) supervised Class B input circuit capable of a minimum of 4 personalities, each with a distinct operation. The module shall be suitable for mounting on 2 ½" (64mm) deep 1-gang boxes or 1 ½" (38mm) deep 4" square boxes with 1-gang covers. The single input module shall support the following circuit types:
 - a. Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.)
 - b. Normally-Open Alarm Delayed Latching (Waterflow Switches)
 - c. Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.)
 - d. Normally-Open Active Latching (Supervisory, Tamper Switches)
 2. Basis of Design: EST model SIGA-CT1.
- H. Single Input Signal Module
 1. Provide intelligent single input signal modules at the locations shown on the drawings. The Single Input (Single Riser Select) Signal Module shall provide one (1) supervised Class B output circuit capable of a minimum of 2 personalities, each with a distinct operation. When selected as a telephone power selector, the module shall be capable of generating its own "ring tone". The module shall be suitable for mounting on 2 ½" (64mm) deep 2-gang boxes or 1 ½" (38mm) deep 4" square boxes with 2-gang covers. The single input signal module shall support the following operations:
 - a. Audible/Visible Signal Power Selector (Polarized 24 Vdc @ 2A, 25Vrms @50w or 70 Vrms @ 35 Watts of Audio)
 2. Basis of Design: EST model SIGA-CC1.
- I. Suppression System Releasing Module
 1. Provide addressable suppression system releasing interface modules at the locations shown on the drawings. The interface shall be suitable for preaction and deluge sprinkler systems and clean extinguishing agent release. The interface shall provide supervised Class B circuits required for solenoid activation, manual release, system abort, and audible and visible notification of pending release. The interface shall provide all required release and abort timing functions. The interface shall be listed for use with solenoid releasing valves that has both ULI listing and FM approval.



The solenoid release circuit shall be provided with a manual disconnect switch for system maintenance.

2. Basis of Design: EST model SIGA-REL.

J. Universal Class AB Module

1. Provide intelligent class A/B modules at the locations shown on the drawings. The Universal Class A/B Module shall be capable of a minimum of fifteen (15) distinct operations. The module shall be suitable for mounting on 2 ½" (64mm) deep 2-gang boxes or 1 ½" (38mm) deep 4" square boxes with 2-gang covers. The universal class A/B module shall support the following circuit types:
 - a. Two (2) supervised Class B Normally-Open Alarm Latching.
 - b. Two (2) supervised Class B Normally-Open Alarm Delayed Latching.
 - c. Two (2) supervised Class B Normally-Open Active Non-Latching.
 - d. Two (2) supervised Class B Normally-Open Active Latching.
 - e. One (1) form "C" dry relay contact rated at 2 amps @ 24 Vdc.
 - f. One (1) supervised Class A Normally-Open Alarm Latching.
 - g. One (1) supervised Class A Normally-Open Alarm Delayed Latching.
 - h. One (1) supervised Class A Normally-Open Active Non-Latching.
 - i. One (1) supervised Class A Normally-Open Active Latching.
 - j. One (1) supervised Class A 2-wire Smoke Alarm Non-Verified.
 - k. One (1) supervised Class B 2-wire Smoke Alarm Non-Verified.
 - l. One (1) supervised Class A 2-wire Smoke Alarm Verified
 - m. One (1) supervised Class B 2-wire Smoke Alarm Verified
 - n. One (1) supervised Class A Signal Circuit, 24Vdc @ 2A.
 - o. One (1) supervised Class B Signal Circuit, 24Vdc @ 2A.
2. Basis of Design: EST model SIGA-UM.

K. Waterflow-Tamper Module

1. Provide intelligent waterflow/tamper modules at the locations shown on the drawings. The Waterflow/Tamper Module shall be factory set to support two (2) supervised Class B input circuits. Channel A shall support a Normally-Open Alarm Delayed Latching Waterflow Switch circuit. Channel B shall support a Normally-Open Active Latching Tamper Switch. The waterflow/tamper module shall be suitable for mounting on 2 ½" (64mm) deep 1-gang boxes or 1 ½" (38mm) deep 4" square boxes with 1-gang covers.
2. Basis of Design: EST Model SIGA-WTM.

2.5 CONDUCTORS

- A. The requirement of this section apply to all system conductors, including all signaling line, initiating device, notification appliance, auxiliary function, remote signaling, AC and DC power and grounding/shield drain circuits, and any other wiring installed by the Contractor pursuant to the requirements of these Specifications.
- B. All circuits shall be rated power limited in accordance with NEC Article 760.
- C. [Installed in conduit or enclosed raceway.]
- D. All new system conductors shall be of the type(s) specified herein.
 1. All initiating circuit, signaling line circuit, AC power conductors, shield drain conductors and grounding conductors, shall be solid copper, stranded or bunch tinned (bonded) stranded copper.
 2. All signaling line circuits, including all addressable initiating device circuits shall be 18 AWG minimum multi-conductor jacketed twisted cable or twisted shielded or as per manufacturer's requirements.
 3. All non-addressable initiating device circuits, 24 VDC auxiliary function circuits shall be 18 AWG minimum or per manufacturer's requirements.



4. All notification appliance circuit conductors shall be solid copper or bunch tinned (bonded) stranded copper. Where stranded conductors are utilized, a maximum of 19 strands shall be permitted for #12/AWG and larger conductors. Minimum size conductor shall be #12 AWG.
5. All audible notification appliance circuits shall be 14 AWG minimum twisted pairs or twisted pairs shielded or per manufacturer's requirements.
6. All visual notification appliance circuits shall be #12 AWG minimum THHN or twisted pairs or twisted shielded pairs or per manufacturer's requirements.
7. Color code fire alarm conductors as follows:

<u>ITEM</u>	<u>COLOR</u>
Initiating Device	Orange/Brown
Horn (Exterior)	Blue and Yellow
Flashing Lights	Blue and Yellow
Control Panel Power	[Black,] White and Green
Air Handler Shutdown	Purple
Door Holders	White

8. All conductors shall be terminated with crimp type, open end, space lugs using tool approved by lug manufacturer. Terminal cabinets shall be provided with screw type terminal strips and plywood backboards.

2.6 CONDUCTORS [AND RACEWAY]

- A. Except as otherwise required by Code and/or these Specifications, the installation of all system circuits shall conform to the requirements of Article 760 and raceway installation to the applicable sections of NFPA 70, National Electrical Code. Fire alarm circuit wiring shall include all circuits described in Section 760.1 including Fine Print Note No. 1 (FPN No. 1), and as defined by the manufacturer's UL listing..
- B. The entire system shall be installed in a skillful manner in accordance with approved manufacturer's installation manuals, shop drawings and wiring diagrams. The contractor shall furnish all conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices necessary for the complete installation. All wiring shall be of the type required by the NEC and approved by local authorities having jurisdiction for the purpose.
- C. Any shorts, opens, or grounds found on new or existing wiring shall be corrected prior to the connection of these wires to any panel component or field device.
- D. The contractor shall neatly tie-wrap all field-wiring conductors in the gutter spaces of the control panels and secure the wiring away from all circuit boards and control equipment components. All field-wiring circuits shall be neatly and legibly labeled in the control panel. No wiring except home runs from life safety system circuits and system power supply circuits shall be permitted in the control panel enclosures. No wiring splices shall be permitted in a control panel enclosure.
- E. All penetration of floor slabs and firewalls shall be fire stopped in accordance with all local fire codes.

2.7 [OPEN CABLE]

- A. Power-limited cable in accordance with NEC Article 760, where used, not installed in UL listed metal conduit or raceway shall be mechanically protected by building construction features:
- B. Installation shall be in areas not subjected to mechanical injury.
- C. All circuits shall be supported by the building structure. Cable shall be attached by straps to the building structure at intervals not greater than 10 feet. Wiring installed above drop ceilings, cable shall not be laid on ceiling tiles. Cable shall not be fastened in a manner that puts tension on the cable.



- D. Cable type shall be FPLP, FPLR or FPL, or permitted substitutions, selected for the installation application as required by NEC 70, Section 760-61.
- E. All cable that is not enclosed by conduit shall be supported and anchored with nylon straps or clamps. The use of staples is prohibited.]

2.8 [CONDUIT RACEWAY

- A. All systems and system components listed to UL864 Control Units for Fire Protective Signaling Systems maybe installed within a common conduit raceway system, in accordance with the manufacture's recommendations. System(s) or system components not listed to the UL864 standard shall utilize a separate conduit raceway system for each of the sub-systems.
- B. The requirements of this section apply to all system conduits, raceways, electrical enclosures, junction boxes, pull boxes and device back boxes.
- C. All system conduits shall be of the sizes and types specified.
- D. All system conduits shall be EMT, 3/4 -inch minimum, except for flexible metallic conduit used for whips to devices only, maximum length 6 feet, 3/4-inch diameter, minimum.
- E. All system conduits, which are installed in areas, which may be subject to physical damage or weather, shall be IMC or rigid steel, 3/4 -inch minimum.
- F. Conduits shall be sized according to the conductors contained therein. Cross sectional area percentage fill for system conduits shall not exceed 40%.
- G. All fire alarm conduit systems shall be routed and installed to minimize the potential for physical, mechanical or by fire damage, and so as not to interfere with existing building systems, facilities or equipment, and to facilitate service and minimize maintenance.
- H. All conduits, except flexible conduit whips to devices, shall be solidly attached to building structural members, ceiling slabs or permanent walls. Conduits shall not be attached to existing conduit, duct work, cable trays, other ceiling equipment, drop ceiling hangers/grids or partition walls, except where necessary to connect to initiating, notification, or auxiliary function devices.
- I. All system conduits, junction boxes, pull boxes, terminal cabinets, electrical enclosures and device back boxes shall be readily accessible for inspection, testing, service and maintenance.]

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Examine areas in which Work of this Section is to be performed.
 - 2. Verify that surfaces and site conditions are ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.



- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. General
 - 1. All equipment shall be attached to walls and ceiling/floor assemblies and shall be mounted firmly in place. Detectors shall not be supported solely by suspended ceilings. Fasteners and supports shall be sized to support the required load.
- B. Installation Sequence
 - 1. Installation of the systems shall be conducted in stages and phased such that circuits and equipment are installed in the following order:
 - a. Riser conduits, AC power conduits and control cabinets.
 - b. Control panel(s), control component(s), remote annunciator(s), and printer(s).
 - c. [Conduits and] wiring for complete notification circuits and appliance installation throughout facility.
 - d. Pre-test the audible and visual notification appliance circuits.
 - e. Install all new detection devices.
 - f. Terminate between field devices and the associated control equipment.
 - g. Complete the interface to all suppression and ancillary shutdown systems.
 - h. Complete contractor pre-test of system.
 - i. Complete system testing
- C. Install products in accordance with NFPA standards and manufacturer's published instructions.
- D. Install manual station with operating handle 48 inches (1.22 m) above floor. Install audible and visual signal devices in accordance with NFPA 72 and ANSI/UL 1971.
- E. End-of-line resistor device at the last easily accessible mount device or separate box adjacent to last device.
- F. Flush mount outlet box for electric door holder to withstand 80 pounds pulling force.
- G. Make wiring connections to [door release devices,] [sprinkler flow switches,] [sprinkler valve tamper switches,] [fire suppression system control panels,] and all other devices.

3.3 PREPARATION

- A. Coordinate work of this Section with other affected work and construction schedule.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Test in accordance with NFPA 72 and local fire department requirements. Use "Record of Completion" Figure 4.5.2.1 (NFPA 72).
- C. Manufacturer's Field Services: Provide services of NICET certified Level III technician to supervise installation, adjustments, final connections, and system testing. Submit written certification on manufacturers letterhead to Contracting Officer that system has been installed in accordance with applicable codes and is functioning properly. Provide copy of "Certificate of Completion" and place inside plastic envelope at Fire Alarm Control Panel.
- D. Inspection:



1. Inspect equipment installation, interconnection with system devices, mounting locations, and mounting methods.
 2. Verify that units and controls are properly installed, connected, and labeled and that interconnecting wires and terminals are identified.
- E. Pretesting: Align and adjust system and perform pretesting of components, wiring, and functions to verify conformance with specified requirements. Correct deficiencies by replacing malfunctioning or damaged items with new items. Retest until satisfactory performance and conditions are achieved.
- F. Acceptance Operational Tests:
1. Perform operational system tests to verify conformance with specifications:
 - a. Each alarm initiating device installed shall be operationally tested in the presence of a contracting officer's representative. Each device shall be tested for alarm and trouble conditions. Contractor shall submit a written certification that the Fire Alarm System installation is complete including all punch-list items. Test battery operated emergency power supply. Test emergency power supply to minimum durations specified. Test Remote Station Signal Transmitter. Coordinate testing with the Public Authority and Remote Station monitoring firm/entity. Submit written documentation from Remote Station monitoring firm/entity that Fire Alarm Signal Transmitter is operating properly.
 - b. Test each Signal Appliance installed for proper operation. Submit written report indicating sound levels at specified distances.
 - c. Test Fire Alarm Control Panel(s) and Remote Annunciator(s).
 2. Provide minimum [10] days notice of acceptance test performance schedule to Contracting Officer, Remote Station monitoring firm/entity, and local fire authorities having jurisdiction.
 3. The Contractor shall provide certification that the system is installed entirely in accordance with the system manufacturer's recommendations and within the limitations of the required listings and approvals, that all system hardware and software has been visually inspected and functionally tested by a manufacturer's certified representative, and that the system is in proper working order.
- G. Retesting: Correct deficiencies and retest until total system meets the requirements of Specifications and complies with applicable standards.

3.5 WARRANTY AND MAINTENANCE

- A. Warranty: The contractor shall warranty all materials, installation and workmanship for [12 months][18 months] year from date of acceptance, unless otherwise specified. A copy of the manufacturer's warranty shall be provided with close-out documentation and included with the operation and installation manuals.
- B. Spare Parts
1. The Contractor shall supply the following spare parts:
 - a. Automatic detection devices -Five (5) percent of the installed quantity of each type.
 - b. Manual fire alarm stations - Five (5) percent of the installed quantity of each type.
 - c. Glass rods or panels for break glass manual fire alarm stations (if used) – [Ten] percent of the installed quantity, but no less than [ten (10)] devices.
 - d. Audible and visible devices - Five (5) percent of the installed quantity of each type.
 - e. Keys - A minimum of [four (4)] sets of keys shall be provided and appropriately identified.

3.6 TRAINING

- A. The System Supplier shall schedule and present a minimum of [four (4)] hours of documented formalized instruction for the building owner, detailing the proper operation of the installed System.



- B. The instruction shall be presented in an organized and professional manner by a person factory trained in the operation and maintenance of the equipment and who is also thoroughly familiar with the installation.
- C. The instruction shall cover the schedule of maintenance required by NFPA 72 and any additional maintenance recommended by the system manufacturer.
- D. Instruction shall be made available to the Local Municipal Fire Department if requested by the Public Authority

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SECTION 28 31 23 00 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for digital, addressable fire alarm system. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Fire-alarm control unit.
 - b. Manual fire-alarm boxes.
 - c. System smoke detectors.
 - d. Nonsystem smoke detectors.
 - e. Heat detectors.
 - f. Notification appliances.
 - g. Firefighters' two-way telephone communication service.
 - h. Magnetic door holders.
 - i. Remote annunciator.
 - j. Addressable interface device.
 - k. Digital alarm communicator transmitter.
 - l. Radio alarm transmitter.
 - m. System printer.

C. Definitions

1. LED: Light-emitting diode.
2. NICET: National Institute for Certification in Engineering Technologies.

D. System Description

1. Noncoded, UL-certified **OR** FMG-placarded, **as directed**, addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.
2. Noncoded addressable system, with automatic sensitivity control of certain smoke detectors and multiplexed signal transmission, dedicated to fire-alarm service only.

E. Performance Requirements

1. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event," **as directed**.

F. Submittals

1. General Submittal Requirements:
 - a. Submittals shall be approved by authorities having jurisdiction prior to submitting them to the Owner.
 - b. Shop Drawings shall be prepared by persons with the following qualifications:
 - 1) Trained and certified by manufacturer in fire-alarm system design.
 - 2) NICET-certified fire-alarm technician, Level III **OR** Level IV, **as directed**, minimum.
 - 3) Licensed or certified by authorities having jurisdiction.
2. Product Data: For each type of product indicated.
3. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.



- a. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
- b. Include voltage drop calculations for notification appliance circuits.
- c. Include battery-size calculations.
- d. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
- e. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
- f. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
- g. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.
4. Delegated-Design Submittal: For smoke and heat detectors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
 - b. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.
5. Qualification Data: For qualified Installer.
6. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
7. Field quality-control reports.
8. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. Deliver copies to authorities having jurisdiction and include the following:
 - a. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - b. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
 - c. Record copy of site-specific software.
 - d. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - 1) Frequency of testing of installed components.
 - 2) Frequency of inspection of installed components.
 - 3) Requirements and recommendations related to results of maintenance.
 - 4) Manufacturer's user training manuals.
 - e. Manufacturer's required maintenance related to system warranty requirements.
 - f. Abbreviated operating instructions for mounting at fire-alarm control unit.
 - g. Copy of NFPA 25.
9. Software and Firmware Operational Documentation:
 - a. Software operating and upgrade manuals.
 - b. Program Software Backup: On magnetic media or compact disk, complete with data files.
 - c. Device address list.
 - d. Printout of software application and graphic screens.



G. Quality Assurance

1. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
2. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II **OR** Level III **OR** Level IV, **as directed**, technician.
3. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.
4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
5. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL.
6. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.
7. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FMG-approved alarm company.
8. NFPA Certification: Obtain certification according to NFPA 72 by agency having jurisdiction.

H. Project Conditions

1. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of fire-alarm service.
 - b. Do not proceed with interruption of fire-alarm service without the Owner written permission.

I. Sequencing And Scheduling

1. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.
2. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

J. Software Service Agreement

1. Comply with UL 864.
2. Technical Support: Beginning with Final Completion, provide software support for two years.
3. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Final Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - a. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.2 PRODUCTS

A. Systems Operational Description

1. Fire-alarm signal initiation shall be by one or more of the following devices and systems, **as directed**:
 - a. Manual stations.
 - b. Heat detectors.
 - c. Flame detectors.
 - d. Smoke detectors.
 - e. Duct smoke detectors.
 - f. Verified automatic alarm operation of smoke detectors.
 - g. Automatic sprinkler system water flow.
 - h. Heat detectors in elevator shaft and pit.



- i. Fire-extinguishing system operation.
- j. Fire standpipe system.
- 2. Fire-alarm signal shall initiate the following actions:
 - a. Continuously operate alarm notification appliances.
 - b. Identify alarm at fire-alarm control unit and remote annunciators, **as directed**.
 - c. Transmit an alarm signal to the remote alarm receiving station.
 - d. Unlock electric door locks in designated egress paths.
 - e. Release fire and smoke doors held open by magnetic door holders.
 - f. Activate voice/alarm communication system.
 - g. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
 - h. Activate smoke-control system (smoke management) at firefighter smoke-control system panel.
 - i. Activate stairwell and elevator-shaft pressurization systems.
 - j. Close smoke dampers in air ducts of designated air-conditioning duct systems.
 - k. Recall elevators to primary or alternate recall floors.
 - l. Activate emergency lighting control.
 - m. Activate emergency shutoffs for gas and fuel supplies.
 - n. Record events in the system memory.
 - o. Record events by the system printer.
- 3. Supervisory signal initiation shall be by one or more of the following devices and actions:
 - a. Valve supervisory switch.
 - b. Low-air-pressure switch of a dry-pipe sprinkler system.
 - c. Elevator shunt-trip supervision.
- 4. System trouble signal initiation shall be by one or more of the following devices and actions:
 - a. Open circuits, shorts, and grounds in designated circuits.
 - b. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 - c. Loss of primary power at fire-alarm control unit.
 - d. Ground or a single break in fire-alarm control unit internal circuits.
 - e. Abnormal ac voltage at fire-alarm control unit.
 - f. Break in standby battery circuitry.
 - g. Failure of battery charging.
 - h. Abnormal position of any switch at fire-alarm control unit or annunciator.
 - i. Fire-pump power failure, including a dead-phase or phase-reversal condition.
 - j. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.
- 5. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators, **as directed**. Record the event on system printer.

B. Fire-Alarm Control Unit

- 1. General Requirements for Fire-Alarm Control Unit:
 - a. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
 - 1) System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
 - 2) Include a real-time clock for time annotation of events on the event recorder and printer.
 - b. Addressable initiation devices that communicate device identity and status.
 - 1) Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit, **as directed**.
 - 2) Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
 - c. Addressable control circuits for operation of mechanical equipment.



2. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
 - a. Annunciator and Display: Liquid-crystal type, 1 **OR** 2 **OR** 3, **as directed**, line(s) of 40 **OR** 80, **as directed**, characters, minimum.
 - b. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters, **as directed**.
3. Circuits:
 - a. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.
 - 1) Initiating Device Circuits: Style D **OR** Style E, **as directed**.
 - 2) Notification Appliance Circuits: Style Z.
 - 3) Signaling Line Circuits: Style 2 **OR** Style 5 **OR** Style 6 **OR** Style 7, **as directed**.
 - 4) Install no more than 50 addressable devices on each signaling line circuit.
 - b. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.
 - 1) Initiating Device Circuits: Style A **OR** Style B **OR** Style C, **as directed**.
 - 2) Notification Appliance Circuits: Style W **OR** Style X **OR** Style Y, **as directed**.
 - 3) Signaling Line Circuits: Style 0.5 **OR** Style 1 **OR** Style 3 **OR** Style 3.5 **OR** Style 4 **OR** Style 4.5, **as directed**.
 - 4) Install no more than 50 addressable devices on each signaling line circuit.
 - c. Serial Interfaces: Two RS-232 ports for printers.
4. Stairwell Pressurization: Provide an output signal using an addressable relay to start the stairwell pressurization system. Signal shall remain on until alarm conditions are cleared and fire-alarm system is reset. Signal shall not stop in response to alarm acknowledge or signal silence commands.
 - a. Pressurization starts when any alarm is received at fire-alarm control unit.
 - b. Alarm signals from smoke detectors at pressurization air supplies have a higher priority than other alarm signals that start the system.
5. Smoke-Alarm Verification:
 - a. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
 - b. Activate an NRTL-listed and -approved "alarm-verification" sequence at fire-alarm control unit and detector.
 - c. Record events by the system printer.
 - d. Sound general alarm if the alarm is verified.
 - e. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.
6. Notification Appliance Circuit: Operation shall sound in a <Insert pattern>.
7. Elevator Recall:
 - a. Smoke detectors at the following locations shall initiate automatic elevator recall. Alarm-initiating devices, except those listed, shall not start elevator recall, **as directed**.
 - 1) Elevator lobby detectors except the lobby detector on the designated floor.
 - 2) Smoke detector in elevator machine room.
 - 3) Smoke detectors in elevator hoistway.
 - b. Elevator lobby detectors located on the designated recall floors shall be programmed to move the cars to the alternate recall floor.
 - c. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.
 - 1) Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.
8. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be **OR** not be, **as directed**, connected to fire-alarm system.
9. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-



- adjustment schedule changes in system memory, and print out the final adjusted values on system printer.
10. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
 11. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided in a separate cabinet located in the fire command center **OR** as a special module that is part of fire-alarm control unit, **as directed**.
 - a. Indicated number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711 and be listed by an NRTL.
 - 1) Allow the application of and evacuation signal to indicated number of zones and, at same time, allow voice paging to the other zones selectively or in any combination.
 - 2) Programmable tone and message sequence selection.
 - 3) Standard digitally recorded messages for "Evacuation" and "All Clear."
 - 4) Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification appliance circuits of fire-alarm control unit.
 - b. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.
 - c. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.
 12. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.
 13. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals **OR** supervisory and digital alarm communicator transmitters **OR** digital alarm radio transmitters, **as directed**, shall be powered by 24-V dc source.
 - a. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
 14. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
 - a. Batteries: Sealed lead calcium **OR** Sealed, valve-regulated, recombinant lead acid **OR** Vented, wet-cell pocket, plate nickel cadmium, **as directed**.
 15. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

C. Manual Fire-Alarm Boxes

1. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
 - a. Single-action mechanism, breaking-glass or plastic-rod **OR** pull-lever, **as directed**, type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 - b. Double-action mechanism requiring two actions to initiate an alarm, breaking-glass or plastic-rod **OR** pull-lever, **as directed**, type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.



- c. Station Reset: Key- or wrench-operated switch.
 - d. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
 - e. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.
- D. System Smoke Detectors
1. General Requirements for System Smoke Detectors:
 - a. Comply with UL 268; operating at 24-V dc, nominal.
 - b. Detectors shall be four **OR** two, **as directed**, -wire type.
 - c. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
 - d. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 - e. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 - f. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status, **as directed**.
 - g. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
 - 1) Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.
 - 2) Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).
 - 3) Provide multiple levels of detection sensitivity for each sensor.
 2. Photoelectric Smoke Detectors:
 - a. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 - b. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - 1) Primary status.
 - 2) Device type.
 - 3) Present average value.
 - 4) Present sensitivity selected.
 - 5) Sensor range (normal, dirty, etc.).
 3. Ionization Smoke Detector:
 - a. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 - b. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - 1) Primary status.
 - 2) Device type.
 - 3) Present average value.
 - 4) Present sensitivity selected.
 - 5) Sensor range (normal, dirty, etc.).
 4. Duct Smoke Detectors: Photoelectric type complying with UL 268A.
 - a. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 - b. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - 1) Primary status.
 - 2) Device type.
 - 3) Present average value.



- 4) Present sensitivity selected.
- 5) Sensor range (normal, dirty, etc.).
- c. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
- d. Each sensor shall have multiple levels of detection sensitivity.
- e. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
- f. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

E. Nonsystem Smoke Detectors

1. Single-Station Smoke Detectors:

- a. Comply with UL 217; suitable for NFPA 101, residential occupancies; operating at 120-V ac with 9-V dc battery as the secondary power source. Provide with "low" or "missing" battery chirping-sound device, **as directed**.
- b. Auxiliary Relays: One Form C rated at 0.5 A **OR** Form A and one Form C, both rated at 0.5 A, **as directed**.
- c. Audible Notification Appliance: Piezoelectric sounder rated at 90 dBA at 10 feet (3 m) according to UL 464.
- d. Visible Notification Appliance: 177-cd strobe.
- e. Heat sensor, 135 deg F (57 deg C) combination rate-of-rise, **as directed**, and fixed temperature.
- f. Test Switch: Push to test; simulates smoke at rated obscuration.
- g. Tandem Connection: Allow tandem connection of number of indicated detectors; alarm on one detector shall actuate notification on all connected detectors.
- h. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
- i. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
- j. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status, **as directed**.

2. Single-Station Duct Smoke Detectors:

- a. Comply with UL 268A; operating at 120-V ac.
- b. Sensor: LED or infrared light source with matching silicon-cell receiver.
 - 1) Detector Sensitivity: Smoke obscuration between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) when tested according to UL 268A.
- c. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. The fixed base shall be designed for mounting directly to air duct. Provide terminals in the fixed base for connection to building wiring.
 - 1) Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
- d. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
- e. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

F. Heat Detectors

- 1. General Requirements for Heat Detectors: Comply with UL 521.
- 2. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.
 - a. Mounting: Adapter plate for outlet box mounting **OR** Twist-lock base interchangeable with smoke-detector bases, **as directed**.
 - b. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.



3. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F (88 deg C).
 - a. Mounting: Adapter plate for outlet box mounting **OR** Twist-lock base interchangeable with smoke-detector bases, **as directed**.
 - b. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
 4. Continuous Linear Heat-Detector System:
 - a. Detector Cable: Rated detection temperature 155 deg F (68 deg C). NRTL listed for "regular" service and a standard environment. Cable includes two steel actuator wires twisted together with spring pressure, wrapped with protective tape, and finished with PVC outer sheath. Each actuator wire is insulated with heat-sensitive material that reacts with heat to allow the cable twist pressure to short-circuit wires at the location of elevated temperature.
 - b. Control Unit: Two-zone or multizone unit as indicated. Provide same system power supply, supervision, and alarm features as specified for fire-alarm control unit.
 - c. Signals to Fire-Alarm Control Unit: Any type of local system trouble shall be reported to fire-alarm control unit as a composite "trouble" signal. Alarms on each detection zone shall be individually reported to central fire-alarm control unit as separately identified zones.
 - d. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
- G. Notification Appliances
1. General Requirements for Notification Appliances: Individually addressed, connected to a signaling line circuit, equipped for mounting as indicated and with screw terminals for system connections.
 2. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.
 - a. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.
 3. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.
 4. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.
 5. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.
 6. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
 - a. Rated Light Output:
 - 1) 15 **OR** 30 **OR** 75 **OR** 110 **OR** 177, **as directed**, cd.
OR
15/30/75/110 cd, selectable in the field.
 - b. Mounting: Wall mounted unless otherwise indicated.
 - c. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
 - d. Flashing shall be in a temporal pattern, synchronized with other units.
 - e. Strobe Leads: Factory connected to screw terminals.
 - f. Mounting Faceplate: Factory finished, red **OR** white, **as directed**.
 7. Voice/Tone Notification Appliances:
 - a. Appliances shall comply with UL 1480 and shall be listed and labeled by an NRTL.
 - b. High-Range Units: Rated 2 to 15 W.
 - c. Low-Range Units: Rated 1 to 2 W.
 - d. Mounting: Flush **OR** Semirecessed **OR** Surface mounted and bidirectional, **as directed**.



- e. Matching Transformers: Tap range matched to acoustical environment of speaker location.
- H. Firefighters' Two-Way Telephone Communication Service
1. Dedicated, two-way, supervised, telephone voice communication links between fire-alarm control unit, the fire command center, **as directed**, and remote firefighters' telephone stations. Supervised telephone lines shall be connected to talk circuits by controls in a control module. Provide the following:
 - a. Common-talk type for firefighter use only.
 - b. Selective-talk type for use by firefighters and fire wardens.
 - c. Controls to disconnect phones from talk circuits if too many phones are in use simultaneously.
 - d. Audible Pulse and Tone Generator, and High-Intensity Lamp: When a remote telephone is activated, it causes audible signal to sound and high-intensity lamp to flash.
 - e. Selector panel controls shall provide for simultaneous operation of up to six telephones in selected zones. Indicate ground faults and open or shorted telephone lines on the panel front by individual LEDs.
 - f. Display: Graphic **OR** Liquid-crystal digital, **as directed**, to indicate location of caller.
 - g. Remote Telephone Cabinet: Flush- or surface-mounted cabinet as indicated, factory-standard red finish, with handset.
 - 1) Install one-piece handset to cabinet with vandal-resistant armored cord. Silk-screened or engraved label on cabinet door, designating "Fire Warden Phone" **OR** "Fire Emergency Phone", **as directed**.
 - 2) With "break-glass" type door access lock.
 - h. Remote Telephone Jack Stations: Single-gang, stainless-steel-plate mounted plug, engraved "Fire Warden Phone" **OR** "Fire Emergency Phone", **as directed**.
 - i. Handsets: **<Insert number>** push-to-talk-type sets with noise-canceling microphone, **as directed**, stored in a cabinet adjacent to fire-alarm control unit **OR** in the fire command center, **as directed**.
- I. Magnetic Door Holders
1. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.
 - a. Electromagnet: Requires no more than 3 W to develop 25-lbf (111-N) holding force.
 - b. Wall-Mounted Units: Flush mounted unless otherwise indicated.
 - c. Rating: 24-V ac or dc.
 - d. Rating: 120-V ac.
 2. Material and Finish: Match door hardware.
- J. Remote Annunciator
1. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
 - a. Mounting: Flush **OR** Surface, **as directed**, cabinet, NEMA 250, Type 1.
 2. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.
- K. Addressable Interface Device
1. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.
 2. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall **OR** to circuit-breaker shunt trip for power shutdown, **as directed**.
- L. Digital Alarm Communicator Transmitter



1. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.
2. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture one **OR** two, **as directed**, telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either, **as directed**, line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
3. Local functions and display at the digital alarm communicator transmitter shall include the following:
 - a. Verification that both telephone lines are available.
 - b. Programming device.
 - c. LED display.
 - d. Manual test report function and manual transmission clear indication.
 - e. Communications failure with the central station or fire-alarm control unit.
4. Digital data transmission shall include the following:
 - a. Address of the alarm-initiating device.
 - b. Address **OR** Zone, **as directed**, of the supervisory signal.
 - c. Address **OR** Zone, **as directed**, of the trouble-initiating device.
 - d. Loss of ac supply or loss of power.
 - e. Low battery.
 - f. Abnormal test signal.
 - g. Communication bus failure.
5. Secondary Power: Integral rechargeable battery and automatic charger.
6. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

M. Radio Alarm Transmitter

1. Transmitter shall comply with NFPA 1221 and shall be listed and labeled by an NRTL.
2. Comply with 47 CFR 90.
3. Description: Manufacturer's standard commercial product; factory assembled, wired, tested, and ready for installation and operation.
 - a. Packaging: A single, modular, NEMA 250, Type 1 metal enclosure with a tamper-resistant flush tumbler lock.
 - b. Signal Transmission Mode and Frequency: VHF or UHF 2-W power output, coordinated with operating characteristics of the established remote alarm receiving station designated by Owner.
 - c. Normal Power Input: 120-V ac.
 - d. Secondary Power: Integral-sealed, rechargeable, 12-V battery and charger. Comply with NFPA 72 requirements for battery capacity; submit calculations.
 - e. Antenna: Omnidirectional, coaxial half-wave, dipole type with driving point impedance matched to transmitter and antenna cable output impedance. Wind-load strength of antenna and mounting hardware and supports shall withstand 100 mph (160 km/h), **as directed**, with a gust factor of 1.3 without failure.
 - f. Antenna Cable: Coaxial cable with impedance matched to the transmitter output impedance.
 - g. Antenna-Cable Connectors: Weatherproof.
 - h. Alarm Interface Devices: Circuit boards, modules, and other auxiliary devices, integral to the transmitter, matching fire-alarm and other system outputs to message-generating inputs of the transmitter that produce required message transmissions.
4. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit or from its own internal sensors or controls and shall automatically transmit signal along with a unique code that identifies the transmitting station to the remote alarm receiving station. Transmitted messages shall correspond to standard designations for fire-



reporting system to which the signal is being transmitted and shall include separately designated messages in response to the following events or conditions:

- a. Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.
- b. System Test Message: Initiated manually by a test switch within the transmitter cabinet, or automatically at an optionally preselected time, once every 24 hours, with transmission time controlled by a programmed timing device integral to transmitter controls.
- c. Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration, of the transmitter normal power source, derangement of the wiring of the transmitter, or any alarm input interface circuit or device connected to it.
- d. Local Fire-Alarm-System Trouble Message: Initiated by events or conditions that cause a trouble signal to be indicated on the building system.
- e. Local Fire-Alarm-System Alarm Message: Actuated when the building system goes into an alarm state. Identifies device that initiated the alarm.
- f. Local Fire-Alarm-System Supervisory-Alarm Message: Actuated when the building alarm system indicates a supervisory alarm, **as directed**.

N. System Printer

1. Printer shall be listed and labeled by an NRTL as an integral part of fire-alarm system.

O. Device Guards

1. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
 - a. Factory fabricated and furnished by manufacturer of device.
 - b. Finish: Paint of color to match the protected device.

1.3 EXECUTION

A. Equipment Installation

1. Comply with NFPA 72 for installation of fire-alarm equipment.
2. Equipment Mounting: Install fire-alarm control unit on concrete base with tops of cabinets not more than 72 inches (1830 mm) above the finished floor. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-place Concrete".
 - a. Install seismic bracing. Comply with requirements in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - c. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Equipment Mounting: Install fire-alarm control unit on finished floor with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
 - a. Comply with requirements for seismic-restraint devices specified in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
4. Install wall-mounted equipment, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
 - a. Comply with requirements for seismic-restraint devices specified in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
5. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
 - a. Connect new equipment to existing control panel in existing part of the building.
 - b. Connect new equipment to existing monitoring equipment at the supervising station.



- c. Expand, modify, and supplement existing control **OR** monitoring, **as directed**, equipment as necessary to extend existing control **OR** monitoring, **as directed**, functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.
 - 6. Smoke- or Heat-Detector Spacing:
 - a. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
 - b. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
 - c. Smooth ceiling spacing shall not exceed 30 feet (9 m)
 - d. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A or Appendix B in NFPA 72.
 - e. HVAC: Locate detectors not closer than 3 feet (1 m) **OR** 5 feet (1.5 m), **as directed**, from air-supply diffuser or return-air opening.
 - f. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture.
 - 7. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.
 - 8. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.
 - 9. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.
 - 10. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
 - 11. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
 - 12. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling.
 - 13. Device Location-Indicating Lights: Locate in public space near the device they monitor.
 - 14. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
 - 15. Annunciator: Install with top of panel not more than 72 inches (1830 mm) above the finished floor.
 - 16. Antenna for Radio Alarm Transmitter: Mount to building structure where indicated. Use mounting arrangement and substrate connection that will resist 100-mph (160-km/h), **as directed**, wind load with a gust factor of 1.3 without damage.
- B. Connections
- 1. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section "Door Hardware". Connect hardware and devices to fire-alarm system.
 - a. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.
 - 2. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
 - a. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.
 - b. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
 - c. Smoke dampers in air ducts of designated air-conditioning duct systems.
 - d. Alarm-initiating connection to elevator recall system and components.
 - e. Alarm-initiating connection to activate emergency lighting control.
 - f. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.



- g. Supervisory connections at valve supervisory switches.
 - h. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
 - i. Supervisory connections at elevator shunt trip breaker.
 - j. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
 - k. Supervisory connections at fire-pump engine control panel.
- C. Identification
 - 1. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".
 - 2. Install framed instructions in a location visible from fire-alarm control unit.
- D. Grounding
 - 1. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
- E. Field Quality Control
 - 1. Field tests shall be witnessed by authorities having jurisdiction.
 - 2. Tests and Inspections:
 - a. Visual Inspection: Conduct visual inspection prior to testing.
 - 1) Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - 2) Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 - b. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - c. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 - d. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 - e. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 - f. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - 3. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
 - 4. Fire-alarm system will be considered defective if it does not pass tests and inspections.
 - 5. Prepare test and inspection reports.
 - 6. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
 - 7. Annual Test and Inspection: One year after date of Final Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

END OF SECTION 28 31 23 00



SECTION 28 31 23 00a - ZONED (DC LOOP) FIRE-ALARM SYSTEM

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for zoned (DC loop) fire alarm system. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Fire-alarm control unit.
 - b. Manual fire-alarm boxes.
 - c. System smoke detectors.
 - d. Nonsystem smoke detectors.
 - e. Heat detectors.
 - f. Notification appliances.
 - g. Magnetic door holders.
 - h. Remote annunciator.
 - i. Digital alarm communicator transmitter.
 - j. Radio alarm transmitter.

C. Definitions

1. LED: Light-emitting diode.
2. NICET: National Institute for Certification in Engineering Technologies.

D. System Description

1. Noncoded system, dedicated to fire-alarm service only.

E. Submittals

1. General Submittal Requirements:
 - a. Submittals shall be approved by authorities having jurisdiction prior to submitting them to the Owner.
 - b. Shop Drawings shall be prepared by persons with the following qualifications:
 - 1) Trained and certified by manufacturer in fire-alarm system design.
 - 2) NICET-certified fire-alarm technician, Level III **OR** Level IV, **as directed**, minimum.
 - 3) Licensed or certified by authorities having jurisdiction.
2. Product Data: For each type of product indicated.
3. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.
 - a. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
 - b. Include voltage drop calculations for notification appliance circuits.
 - c. Include battery size calculations.
 - d. Include performance parameters and installation details for each detector, verifying that each detector is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 - e. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.



- f. Include floor plans to indicate final outlet locations showing zone designation of each device. Show size and route of cable and conduits.
 4. Delegated-Design Submittal: For smoke and heat detectors indicated to comply with performance requirements and design criteria, including analysis data, signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Drawings showing the location of each smoke and heat detector, the ratings of each, and installation details as needed to comply with the listing conditions of the detector.
 - b. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.
 5. Qualification Data: For qualified Installer.
 6. Field quality-control reports.
 7. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. Deliver copies to authorities having jurisdiction, **as directed**, and include the following:
 - a. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - b. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
 - c. Record copy of site-specific software.
 - d. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - 1) Frequency of testing of installed components.
 - 2) Frequency of inspection of installed components.
 - 3) Requirements and recommendations related to results of maintenance.
 - 4) Manufacturer's user training manuals.
 - e. Manufacturer's required maintenance related to system warranty requirements.
 - f. Abbreviated operating instructions for mounting at fire-alarm control unit.
 - g. Copy of NFPA 25.
- F. Quality Assurance
 1. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
 2. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II **OR** Level III **OR** Level IV, **as directed**, technician.
 3. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.
 4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Project Conditions
 1. Interruption of Existing Fire-alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of fire-alarm service.
 - b. Do not proceed with interruption of fire-alarm service without the Owner 's written permission.
- H. Sequencing And Scheduling
 1. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.



2. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.2 PRODUCTS

A. Systems Operational Description

1. Fire-alarm signal initiation shall be by one or more of the following devices and systems, **as directed**:
 - a. Manual stations.
 - b. Heat detectors.
 - c. Smoke detectors.
 - d. Duct smoke detectors.
 - e. Automatic sprinkler system water flow.
 - f. Fire-extinguishing system operation.
 - g. Fire standpipe system.
2. Fire-alarm signal shall initiate the following actions:
 - a. Continuously operate alarm notification appliances.
 - b. Identify alarm zone at fire-alarm control unit and remote annunciators, **as directed**.
 - c. Transmit an alarm signal to the remote alarm receiving station.
3. Supervisory signal initiation shall be by one or more of the following devices and systems:
 - a. Valve supervisory switch.
4. System trouble signal initiation shall be by one or more of the following devices and actions:
 - a. Open circuits, shorts, and grounds in designated circuits.
 - b. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 - c. Loss of primary power at fire-alarm control unit.
 - d. Ground or a single break in fire-alarm control unit internal circuits.
 - e. Abnormal ac voltage at fire-alarm control unit.
 - f. Break in standby battery circuitry.
 - g. Failure of battery charging.
 - h. Abnormal position of any switch at fire-alarm control unit or annunciator, **as directed**.
5. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators, **as directed**.

B. Fire-Alarm Control Unit

1. General Requirements for Fire-Alarm Control Unit:
 - a. Modular, power-limited design with electronic modules, UL 864 listed.
 - 1) Include a real-time clock for time annotation of events.
2. Alphanumeric Display and System Controls: Display alarm, supervisory, and component status messages and the programming and control menu.
 - a. Annunciator and Display: Liquid-crystal type, one line of 40 **OR** 80, **as directed**, characters, minimum.
3. Circuits:
 - a. No Fewer Than Five Initiating Device Circuits:
 - 1) Four circuits, NFPA 72, Class B.
 - 2) One circuit(s), NFPA 72, Class A, Style 6
 - b. No Fewer Than Two Notification Appliance Circuits: NFPA 72, Class B, Style Y.
4. Notification Appliance Circuit: Operation shall sound in a **<Insert pattern>**.
5. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be **OR** not be, **as directed**, connected to fire-alarm system.
6. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
7. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals **OR**



supervisory and digital alarm communicator transmitters **OR** digital alarm radio transmitters, **as directed**, shall be powered by the 24-V dc source.

- a. Alarm current draw of the entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
8. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
 - a. Batteries: Sealed lead calcium **OR** Sealed, valve-regulated, recombinant lead acid **OR** Vented, wet-cell pocket, plate nickel cadmium, **as directed**.
9. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

C. Manual Fire-Alarm Boxes

1. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
 - a. Single-action mechanism, breaking-glass or plastic-rod **OR** pull-lever, **as directed**, type.
 - b. Double-action mechanism requiring two actions to initiate an alarm, breaking-glass or plastic-rod **OR** pull-lever, **as directed**, type.
 - c. Station Reset: Key- or wrench-operated switch.
 - d. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
 - e. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

D. System Smoke Detectors

1. General Requirements for System Smoke Detectors:
 - a. Operating at 24-V dc, nominal.
 - b. Detectors shall be four **OR** two, **as directed**, -wire type.
 - c. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 - d. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 - e. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status, **as directed**.
 - f. Provide multiple levels of detection sensitivity for each sensor, with alarm-verification feature, **as directed**.
2. Photoelectric Smoke Detectors: Comply with UL 268.
3. Ionization Smoke Detector: Comply with UL 268.
4. Duct Smoke Detectors: Photoelectric type complying with UL 268A.
 - a. Remote indication and test, **as directed**, station. Operating key switch initiates an alarm test, **as directed**.
 - b. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
 - c. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
 - d. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

E. Nonsystem Smoke Detectors

1. Single-Station Smoke Detectors:



- a. Comply with UL 217; suitable for NFPA 101, residential occupancies; operating at 120-V ac with 9-V dc battery as the secondary power source. Provide with "low" or "missing" battery chirping-sound device, **as directed**.
- b. Auxiliary Relays: One Form C rated at 0.5 A **OR** Form A and one Form C, both rated at 0.5 A, **as directed**.
- c. Audible Notification Appliance: Piezoelectric sounder rated at 90 dBA at 10 feet (3 m) according to UL 464.
- d. Visible Notification Appliance: 177-cd strobe.
- e. Heat sensor, 135 deg F (57 deg C) combination rate-of-rise and fixed temperature, **as directed**.
- f. Test Switch: Push-to-test; simulates smoke at rated obscuration.
- g. Tandem Connection: Allow tandem connection of number of indicated detectors; alarm on one detector shall actuate notification on all connected detectors.
- h. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
- i. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
- j. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status, **as directed**.
- 2. Single-Station Duct Smoke Detectors:
 - a. Comply with UL 268A; operating at 120-V ac.
 - b. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. The fixed base shall be designed for mounting directly to air duct. Provide terminals in the fixed base for connection to building wiring.
 - 1) Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
 - c. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
 - d. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.
- F. Heat Detectors
 - 1. General Requirements for Heat Detectors: Comply with UL 521.
 - 2. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.
 - a. Mounting: Adapter plate for outlet box mounting **OR** Twist-lock base interchangeable with smoke-detector bases, **as directed**.
 - 3. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F (88 deg C).
 - a. Mounting: Adapter plate for outlet box mounting **OR** Twist-lock base interchangeable with smoke-detector bases, **as directed**.
- G. Notification Appliances
 - 1. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.
 - a. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.
 - 2. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.
 - 3. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.



4. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
 - a. Rated Light Output:
 - 1) Indicated on Drawings.
 - 2) **15 OR 30 OR 75 OR 110 OR 177, as directed**, cd.
OR
15/30/75/110 cd, selectable in the field.
 - b. Mounting: Indicated on Drawings **OR** Wall mounted, **as directed**.
 - c. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
 - d. Flashing shall be in a temporal pattern, synchronized with other units.
 - e. Strobe Leads: Factory connected to screw terminals.
 - f. Mounting Faceplate: Factory finished, red **OR** white, **as directed**.
- H. Magnetic Door Holders
 1. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.
 - a. Electromagnet: Requires no more than 3 W to develop 25-lbf (111-N) holding force.
 - b. Wall-Mounted Units: Flush mounted unless otherwise indicated.
 - c. Rating: 24-V ac or dc.
 - d. Rating: 120-V ac.
 2. Material and Finish: Match door hardware.
- I. Remote Annunciator
 1. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
 - a. Mounting: Flush **OR** Surface, **as directed**, cabinet, NEMA 250, Type 1.
 2. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.
- J. Digital Alarm Communicator Transmitter
 1. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.
 2. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture one **OR** two, **as directed**, telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either, **as directed**, line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
 3. Local functions and display at the digital alarm communicator transmitter shall include the following:
 - a. Verification that both telephone lines are available.
 - b. Programming device.
 - c. LED display.
 - d. Manual test report function and manual transmission clear indication.
 - e. Communications failure with the central station or fire-alarm control unit.
 4. Digital data transmission shall include the following:
 - a. Zone of the alarm initiating device.
 - b. Zone of the supervisory signal.
 - c. Zone of the trouble initiating device.



- d. Loss of ac supply or loss of power.
 - e. Low battery.
 - f. Abnormal test signal.
 - g. Communication bus failure.
 - 5. Secondary Power: Integral rechargeable battery and automatic charger.
 - 6. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.
- K. Radio Alarm Transmitter
- 1. Transmitter shall comply with NFPA 1221 and shall be listed and labeled by an NRTL.
 - 2. Comply with 47 CFR 90.
 - 3. Description: Manufacturer's standard commercial product; factory assembled, wired, tested, and ready for installation and operation.
 - a. Packaging: A single, modular, NEMA 250, Type 1 metal enclosure with a tamper-resistant flush tumbler lock.
 - b. Signal Transmission Mode and Frequency: VHF or UHF 2-W power output, coordinated with operating characteristics of the established remote alarm receiving station designated by Owner.
 - c. Normal Power Input: 120-V ac.
 - d. Secondary Power: Integral-sealed, rechargeable, 12-V battery and charger. Comply with NFPA 72 requirements for battery capacity; submit calculations.
 - e. Antenna: Omnidirectional, coaxial half-wave, dipole type with driving point impedance matched to transmitter and antenna cable output impedance. Wind-load strength of antenna and mounting hardware and supports shall withstand 100 mph (160 km/h) with a gust factor of 1.3 without failure.
 - f. Antenna Cable: Coaxial cable with impedance matched to the transmitter output impedance.
 - g. Antenna-Cable Connectors: Weatherproof.
 - h. Alarm Interface Devices: Circuit boards, modules, and other auxiliary devices, integral to the transmitter, matching fire-alarm and other system outputs to message-generating inputs of the transmitter that produce required message transmissions.
 - 4. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit or from its own internal sensors or controls and shall automatically transmit signal along with a unique code that identifies the transmitting station to the remote alarm receiving station. Transmitted messages shall correspond to standard designations for fire-reporting system to which the signal is being transmitted and shall include separately designated messages in response to the following events or conditions:
 - a. Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.
 - b. System Test Message: Initiated manually by a test switch within the transmitter cabinet, or automatically at an optionally preselected time, once every 24 hours, with transmission time controlled by a programmed timing device integral to transmitter controls.
 - c. Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration, of the transmitter normal power source, derangement of the wiring of the transmitter, or any alarm input interface circuit or device connected to it.
 - d. Local Fire-Alarm-System Trouble Message: Initiated by events or conditions that cause a trouble signal to be indicated on the building system.
 - e. Local Fire-Alarm-System Alarm Message: Actuated when the building system goes into an alarm state. Identifies device that initiated the alarm.
 - f. Local Fire-Alarm-System Supervisory-Alarm Message: Actuated when the building alarm system indicates a supervisory alarm, **as directed**.
- L. Device Guards
- 1. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
 - a. Factory fabricated and furnished by manufacturer of the device.
 - b. Finish: Paint of color to match the protected device.



1.3 EXECUTION

A. Equipment Installation

1. Comply with NFPA 72 for installation of fire-alarm equipment.
2. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
 - a. Connect new equipment to the existing control panel in the existing part of the building.
 - b. Connect new equipment to the existing monitoring equipment at the supervising station.
 - c. Expand, modify, and supplement the existing control **OR** monitoring, **as directed**, equipment as necessary to extend the existing control **OR** monitoring, **as directed**, functions to the new points. New components shall be capable of merging with the existing configuration without degrading the performance of either system.
3. Smoke- or Heat-Detector Spacing:
 - a. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
 - b. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
 - c. Smooth ceiling spacing shall not exceed 30 feet (9 m), **as directed**.
 - d. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A or Appendix B, **as directed**, in NFPA 72.
 - e. HVAC: Locate detectors not closer than 3 feet (1 m) **OR** 5 feet (1.5 m), **as directed**, from air-supply diffuser or return-air opening.
 - f. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture.
4. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.
5. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.
6. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.
7. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
8. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
9. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling.
10. Device Location-Indicating Lights: Locate in public space near the device they monitor.
11. Fire-Alarm Control Unit: Surface mounting, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
12. Annunciator: Install with top of panel not more than 72 inches (1830 mm) above the finished floor.
13. Antenna for Radio Alarm Transmitter: Mount to building structure where indicated. Use mounting arrangement and substrate connection that will resist 100-mph (160-km/h), **as directed**, wind load with a gust factor of 1.3 without damage.

B. Connections

1. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section "Door Hardware". Connect hardware and devices to fire-alarm system.
 - a. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.



2. Connect supervised interface devices to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled.
 - a. Smoke dampers in air ducts of designated air-conditioning duct systems.
 - b. Supervisory connections at valve supervisory switches.
 - c. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
 - d. Supervisory connections at fire-pump engine control panel.
- C. Identification
 1. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".
 2. Install framed instructions in a location visible from fire-alarm control unit.
- D. Grounding
 1. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
- E. Field Quality Control
 1. Field tests shall be witnessed by authorities having jurisdiction.
 2. Tests and Inspections:
 - a. Visual Inspection: Conduct the visual inspection prior to testing.
 - 1) Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - 2) Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 - b. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing, and Maintenance" Chapter in NFPA 72.
 - c. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 - d. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 - e. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 3. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
 4. Fire-alarm system will be considered defective if it does not pass tests and inspections.
 5. Prepare test and inspection reports.
 6. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
 7. Annual Test and Inspection: One year after date of Final Completion, test fire-alarm system complying with the visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

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SECTION 31 00 00 00 - EARTHWORK

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for earthwork. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses, and plants.
 - b. Excavating and backfilling for buildings and structures.
 - c. Drainage course for concrete slabs-on-grade.
 - d. Subbase course for concrete walks and pavements.
 - e. Subbase course and base course for asphalt paving.
 - f. Subsurface drainage backfill for walls and trenches.
 - g. Excavating and backfilling trenches for utilities and pits for buried utility structures.
 - h. Excavating well hole to accommodate elevator-cylinder assembly.

C. Definitions

1. Backfill: Soil material or controlled low-strength material used to fill an excavation.
 - a. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - b. Final Backfill: Backfill placed over initial backfill to fill a trench.
2. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.
3. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
4. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
5. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
6. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 - a. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by the Owner. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 - b. Bulk Excavation: Excavation more than 10 feet (3 m) in width and more than 30 feet (9 m) in length.
 - c. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by the Owner. Unauthorized excavation, as well as remedial work directed by the Owner, shall be without additional compensation.
7. Fill: Soil materials used to raise existing grades.
8. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. (0.76 cu. m) for bulk excavation or 3/4 cu. yd. (0.57 cu. m) for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
 - a. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- (1065-mm-) wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp (103-kW) flywheel power with bucket-curling force of not less than 28,700 lbf (128 kN) and stick-crowd force of not less than 18,400 lbf (82 kN) with extra-long reach boom; measured according to SAE J-1179.



- b. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp (172-kW) flywheel power and developing a minimum of 47,992-lbf (213.3-kN) breakout force with a general-purpose bare bucket; measured according to SAE J-732.
- 9. If Standard Penetration Values are used to Define Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. (0.57 cu. m) or more in volume that exceed a standard penetration resistance of 100 blows/2 inches (97 blows/50 mm) when tested by a geotechnical testing agency, according to ASTM D 1586.
- 10. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- 11. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- 12. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- 13. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

D. Submittals

- 1. Product Data: For each type of the following manufactured products required:
 - a. Geotextiles.
 - b. Controlled low-strength material, including design mixture.
 - c. Geofoam.
 - d. Warning tapes.
- 2. Samples: For the following products, in sizes indicated below:
 - a. Geotextile: 12 by 12 inches (300 by 300 mm).
 - b. Warning Tape: 12 inches (300 mm) long; of each color.
- 3. Qualification Data: For qualified testing agency.
- 4. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
 - a. Classification according to ASTM D 2487.
 - b. Laboratory compaction curve according to ASTM D 698 **OR** ASTM D 1557, **as directed**.
- 5. Blasting plan approved by authorities having jurisdiction.
- 6. Seismic survey report from seismic survey agency.
- 7. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

E. Quality Assurance

- 1. Blasting:
 - a. Blasting will not be allowed.

OR

Comply with applicable requirements in NFPA 495, "Explosive Materials Code," and prepare a blasting plan reporting the following:

 - 1) Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
 - 2) Seismographic monitoring during blasting operations.
- 2. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services:
 - a. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.



- b. Seismographic monitoring during blasting operations.
- 3. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.
- 4. Pre-excavation Conference: Conduct conference at Project site.

F. Project Conditions

- 1. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
 - a. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - b. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- 2. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
- 3. Do not proceed with work on adjoining property until directed by the Owner.
- 4. Utility Locator Service: Notify utility locator service **OR** "Miss Utility" **OR** "Call Before You Dig" **OR** "Dig Safe System" **OR** "One Call", **as directed**, for area where Project is located before beginning earth moving operations.
- 5. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Division 01 Section(s) "Temporary Facilities And Controls" **OR** Division 31 Section(s) "Site Clearing", **as directed**, are in place.
- 6. Do not commence earth moving operations until plant-protection measures specified in Division 01 Section "Temporary Tree And Plant Protection" are in place.
- 7. The following practices are prohibited within protection zones:
 - a. Storage of construction materials, debris, or excavated material.
 - b. Parking vehicles or equipment.
 - c. Foot traffic.
 - d. Erection of sheds or structures.
 - e. Impoundment of water.
 - f. Excavation or other digging unless otherwise indicated.
 - g. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- 8. Do not direct vehicle or equipment exhaust towards protection zones.
- 9. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

1.2 PRODUCTS

A. Soil Materials

- 1. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- 2. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487 **OR** Groups A-1, A-2-4, A-2-5, and A-3 according to AASHTO M 145, **as directed**, or a combination of these groups; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- 3. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 **OR** Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, **as directed**, or a combination of these groups.
 - a. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- 4. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.
- 5. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.



6. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.
7. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.
8. Drainage Course: Narrowly graded mixture of washed, **as directed**, crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.
9. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.
10. Sand: ASTM C 33; fine aggregate.
11. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

B. Geotextiles

1. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - a. Survivability: Class 2; AASHTO M 288.
 - b. Apparent Opening Size: No. 40 (0.425-mm) **OR** No. 60 (0.250-mm) **OR** No. 70 (0.212-mm), **as directed**, sieve, maximum; ASTM D 4751.
 - c. Permittivity: 0.5 **OR** 0.2 **OR** 0.1, **as directed**, per second, minimum; ASTM D 4491.
 - d. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.
2. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - a. Survivability: Class 2; AASHTO M 288.
 - b. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.
 - c. Permittivity: 0.02 per second, minimum; ASTM D 4491.
 - d. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

C. Controlled Low-Strength Material

1. Controlled Low-Strength Material: Self-compacting, low-density, **as directed**, flowable concrete material produced from the following:
 - a. Portland Cement: ASTM C 150, Type I **OR** Type II **OR** Type III, **as directed**.
 - b. Fly Ash: ASTM C 618, Class C or F.
 - c. Normal-Weight Aggregate: ASTM C 33, 3/4-inch (19-mm) **OR** 3/8-inch (10-mm), **as directed**, nominal maximum aggregate size.
 - d. Foaming Agent (if low-density, controlled low-strength material is required): ASTM C 869.
 - e. Water: ASTM C 94/C 94M.
 - f. Air-Entraining Admixture (not required for low-density, controlled low-strength material using foaming agent): ASTM C 260.
2. Produce low-density, controlled low-strength material with the following physical properties:
 - a. As-Cast Unit Weight: 30 to 36 lb/cu. ft. (480 to 576 kg/cu. m) **OR** 36 to 42 lb/cu. ft. (576 to 675 kg/cu. m), **as directed**, at point of placement, when tested according to ASTM C 138/C 138M.
 - b. Compressive Strength: 80 psi (550 kPa) **OR** 140 psi (965 kPa), **as directed**, when tested according to ASTM C 495.

OR

Produce conventional-weight, controlled low-strength material with 80-psi (550-kPa) **OR** 140-psi (965-kPa), **as directed**, compressive strength when tested according to ASTM C 495.

D. Geofoam



1. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.55-lb/cu. ft. (25-kg/cu. m) density, 25-psi (173-kPa) compressive strength **OR** Type X, 1.30-lb/cu. ft. (21-kg/cu. m) density, 15-psi (104-kPa) compressive strength **OR** Type VI, 1.80-lb/cu. ft. (29-kg/cu. m) density, 40-psi (276-kPa) compressive strength **OR** Type VII, 2.20-lb/cu. ft. (35-kg/cu. m) density, 60-psi (414-kPa) compressive strength **OR** Type V, 3.00-lb/cu. ft. (48-kg/cu. m) density, 100-psi (690-kPa) compressive strength, **as directed**.
 2. Molded-Polystyrene Board Insulation: ASTM C 578, Type I, 0.90-lb/cu. ft. (15-kg/cu. m) density, 10-psi (69-kPa) compressive strength **OR** Type VIII, 1.15-lb/cu. ft. (18-kg/cu. m) density, 13-psi (90-kPa) compressive strength **OR** Type II, 1.35-lb/cu. ft. (22-kg/cu. m) density, 15-psi (104-kPa) compressive strength, **as directed**.
 - a. Manufacture molded polystyrene with an inorganic mineral registered with the EPA and suitable for application as a termite deterrent.
 3. Rigid Cellular Polystyrene Geofoam: ASTM D 6817, Type EPS 19, 1.15-lb/cu. ft. (18.4-kg/cu. m) density, 5.8-psi (40-kPa) compressive strength at 1 percent deformation; 16-psi (110-kPa) compressive strength at 10 percent deformation **OR** Type EPS 39, 2.40-lb/cu. ft. (38.4-kg/cu. m) density, 15-psi (103-kPa) compressive strength at 1 percent deformation; 40-psi (276-kPa) compressive strength at 10 percent deformation, **as directed**.
 4. Connectors: Geofoam manufacturer's multibarbed, galvanized-steel sheet connectors **OR** Deformed steel reinforcing bars, 3/4 inch (19 mm) in diameter, **as directed**.
- E. Accessories
1. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored as follows:
 - a. Red: Electric.
 - b. Yellow: Gas, oil, steam, and dangerous materials.
 - c. Orange: Telephone and other communications.
 - d. Blue: Water systems.
 - e. Green: Sewer systems.

OR

Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:

 - f. Red: Electric.
 - g. Yellow: Gas, oil, steam, and dangerous materials.
 - h. Orange: Telephone and other communications.
 - i. Blue: Water systems.
 - j. Green: Sewer systems.

1.3 EXECUTION

- A. Preparation
1. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
 2. Protect and maintain erosion and sedimentation controls during earth moving operations.
 3. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.
- B. Dewatering
1. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.



2. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - a. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

C. Explosives

1. Explosives: Do not use explosives.

OR

Explosives: Obtain written permission from authorities having jurisdiction before bringing explosives to Project site or using explosives on Project site.

- a. Perform blasting without damaging adjacent structures, property, or site improvements.
- b. Perform blasting without weakening the bearing capacity of rock subgrade and with the least-practicable disturbance to rock to remain.

D. Excavation, General

1. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 - a. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 - b. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
 - 1) 24 inches (600 mm) outside of concrete forms other than at footings.
 - 2) 12 inches (300 mm) outside of concrete forms at footings.
 - 3) 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
 - 4) Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - 5) 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.
 - 6) 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.
2. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by the Owner. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.
 - a. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
 - 1) Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
 - b. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
 - 1) 24 inches (600 mm) outside of concrete forms other than at footings.
 - 2) 12 inches (300 mm) outside of concrete forms at footings.
 - 3) 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
 - 4) Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - 5) 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.
 - 6) 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.



E. Excavation For Structures

1. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - a. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 - b. Pile Foundations: Stop excavations 6 to 12 inches (150 to 300 mm) above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
 - c. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.
2. Excavations at Edges of Tree- and Plant-Protection Zones:
 - a. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
 - b. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree And Plant Protection".

F. Excavation For Walks And Pavements

1. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

G. Excavation For Utility Trenches

1. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - a. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
2. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.
 - a. Clearance: 12 inches (300 mm) each side of pipe or conduit **OR** As indicated, **as directed**.
3. Trench Bottoms (if a bedding course is not required under pipe and conduit): Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 - a. For pipes and conduit less than 6 inches (150 mm) in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 - b. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
 - c. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
 - d. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
4. Trench Bottoms (if a bedding course is required under pipe and conduit): Excavate trenches 4 inches (100 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
 - a. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
5. Trenches in Tree- and Plant-Protection Zones:
 - a. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.



- b. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
 - c. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree And Plant Protection".
- H. Excavation For Elevator Cylinder
 - 1. Drill well hole plumb in elevator pit to accommodate installation of elevator-cylinder assembly. Coordinate with applicable requirements for diameter and tolerances in Division 14 Section(s) "Hydraulic Elevators" OR "Hydraulic Freight Elevators", **as directed**.
 - 2. Provide well casing as necessary to retain walls of well hole.
- I. Subgrade Inspection
 - 1. Notify the Owner when excavations have reached required subgrade.
 - 2. If the Owner determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
 - 3. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes) to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - a. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
 - b. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by the Owner, and replace with compacted backfill or fill as directed.
 - 4. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 - 5. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Owner, without additional compensation.
- J. Unauthorized Excavation
 - 1. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by the Owner.
 - a. Fill unauthorized excavations under other construction, pipe, or conduit as directed by the Owner.
- K. Storage Of Soil Materials
 - 1. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - a. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
- L. Backfill
 - 1. Place and compact backfill in excavations promptly, but not before completing the following:
 - a. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 - b. Surveying locations of underground utilities for Record Documents.
 - c. Testing and inspecting underground utilities.
 - d. Removing concrete formwork.
 - e. Removing trash and debris.
 - f. Removing temporary shoring and bracing, and sheeting.
 - g. Installing permanent or temporary horizontal bracing on horizontally supported walls.
 - 2. Place backfill on subgrades free of mud, frost, snow, or ice.
- M. Utility Trench Backfill
 - 1. Place backfill on subgrades free of mud, frost, snow, or ice.



2. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
3. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 03 Section "Cast-in-place Concrete".
4. Trenches under Roadways: Provide 4-inch- (100-mm-) thick, concrete-base slab support for piping or conduit less than 30 inches (750 mm) below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches (100 mm) of concrete before backfilling or placing roadway subbase course. Concrete is specified in Division 03 Section "Cast-in-place Concrete".
5. Backfill voids with satisfactory soil while removing shoring and bracing.
6. If soil material is required as initial backfill, place and compact initial backfill of subbase material **OR** satisfactory soil, **as directed**, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.
 - a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
7. Controlled Low-Strength Material: If controlled low-strength material is permitted or required as initial backfill, place initial backfill of controlled low-strength material to a height of 12 inches (300 mm) over the pipe or conduit. Coordinate backfilling with utilities testing.
8. If satisfactory soil material is required as final backfill, place and compact final backfill of satisfactory soil to final subgrade elevation.
9. Controlled Low-Strength Material: If controlled low-strength material is permitted or required as final backfill, place final backfill of controlled low-strength material to final subgrade elevation.
10. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

N. Soil Fill

1. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
2. Place and compact fill material in layers to required elevations as follows:
 - a. Under grass and planted areas, use satisfactory soil material.
 - b. Under walks and pavements, use satisfactory soil material.
 - c. Under steps and ramps, use engineered fill.
 - d. Under building slabs, use engineered fill.
 - e. Under footings and foundations, use engineered fill.
3. Place soil fill on subgrades free of mud, frost, snow, or ice.

O. Geofoam Fill

1. Place a leveling course of sand, 2 inches (50 mm) thick, over subgrade. Finish leveling course to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.
 - a. Place leveling course on subgrades free of mud, frost, snow, or ice.
 - b. Install geofoam blocks in layers with abutting edges and ends and with the long dimension of each block at right angles to blocks in each subsequent layer. Offset joints of blocks in successive layers.
 - c. Install geofoam connectors at each layer of geofoam to resist horizontal displacement according to geofoam manufacturer's written instructions.
2. Cover geofoam with subdrainage **OR** separation, **as directed**, geotextile before placing overlying soil materials.

P. Soil Moisture Control

1. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - a. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.



- b. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

Q. Compaction Of Soil Backfills And Fills

1. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.
2. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
3. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698 **OR** ASTM D 1557, **as directed**:
 - a. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 - b. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 92 percent.
 - c. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 85 percent.
 - d. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

R. Grading

1. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - a. Provide a smooth transition between adjacent existing grades and new grades.
 - b. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
2. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - a. Turf or Unpaved Areas: Plus or minus 1 inch (25 mm).
 - b. Walks: Plus or minus 1 inch (25 mm).
 - c. Pavements: Plus or minus 1/2 inch (13 mm).
3. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

S. Subsurface Drainage

1. Subdrainage Pipe: Specified in Division 33 Section "Storm Utility Drainage Piping".
2. Subsurface Drain: If nonwoven geotextile is used in subsurface drainage applications, place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch (150-mm) course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches (300 mm) of filter material, placed in compacted layers 6 inches (150 mm) thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).
 - a. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 **OR** with a minimum of two passes of a plate-type vibratory compactor, **as directed**.
3. Drainage Backfill: If using free-draining granular backfill against walls, place and compact filter material over subsurface drain, in width indicated, to within 12 inches (300 mm) of final subgrade, in compacted layers 6 inches (150 mm) thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).
 - a. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 **OR** with a minimum of two passes of a plate-type vibratory compactor, **as directed**.



- b. Place and compact impervious fill over drainage backfill in 6-inch- (150-mm-) thick compacted layers to final subgrade.
- T. Subbase And Base Courses Under Pavements And Walks
 1. Place subbase course and base course, **as directed**, on subgrades free of mud, frost, snow, or ice.
 2. On prepared subgrade, place subbase course and base course, **as directed**, under pavements and walks as follows:
 - a. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 - b. Place base course material over subbase course under hot-mix asphalt pavement.
 - c. Shape subbase course and base course, **as directed**, to required crown elevations and cross-slope grades.
 - d. Place subbase course and base course, **as directed**, 6 inches (150 mm) or less in compacted thickness in a single layer.
 - e. Place subbase course and base course, **as directed**, that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
 - f. Compact subbase course and base course, **as directed**, at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698 **OR** ASTM D 1557, **as directed**.
 3. Pavement Shoulders: Place shoulders along edges of subbase course and base course, **as directed**, to prevent lateral movement. Construct shoulders, at least 12 inches (300 mm) wide, of satisfactory soil materials and compact simultaneously with each subbase and base, **as directed**, layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698 **OR** ASTM D 1557, **as directed**.
- U. Drainage Course Under Concrete Slabs-On-Grade
 1. Place drainage course on subgrades free of mud, frost, snow, or ice.
 2. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
 - a. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 - b. Place drainage course 6 inches (150 mm) or less in compacted thickness in a single layer.
 - c. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
 - d. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.
- V. Field Quality Control
 1. Special Inspections: If special inspections are required by code, engage a qualified special inspector to perform the following special inspections:
 - a. Determine prior to placement of fill that site has been prepared in compliance with requirements.
 - b. Determine that fill material and maximum lift thickness comply with requirements.
 - c. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.
 2. Testing Agency: Engage a qualified geotechnical engineering testing agency to perform tests and inspections.
 3. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
 4. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing



subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by the Owner.

5. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 - a. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab, but in no case fewer than three tests.
 - b. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet (30 m) or less of wall length, but no fewer than two tests.
 - c. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet (46 m) or less of trench length, but no fewer than two tests.
6. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

W. Protection

1. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
2. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - a. Scarify or remove and replace soil material to depth as directed by the Owner; reshape and recompact.
3. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - a. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

X. Disposal Of Surplus And Waste Materials

1. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.
OR
Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by the Owner.
 - a. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 00 00 00



Task	Specification	Specification Description
31 05 13 00	31 00 00 00	Earthwork
31 05 16 00	01 22 16 00	No Specification Required
31 05 16 00	31 00 00 00	Earthwork



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SECTION 31 10 00 00 - CSF SITE CLEARING**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where clearing of existing site is necessary.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.31 10 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cleaning site of debris, grass, trees and other plant life in preparation for site or building excavation Work.
 - 2. Protection of existing structures, trees or vegetation indicated to remain.
 - 3. Stripping topsoil from areas indicated.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 013543 - Environmental Procedures: Recycling and reuse of waste materials.
 - 2. Section 024113 - Selective Site Demolition: Demolition and removal of site structures.
 - 3. Section 312000 - Earth Moving: Cutting, filling, and grading for proposed site improvements.

1.2 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Obtain required permits and licenses in accordance with requirements of Federal Clean Water Act (CWA) and Water Quality Act (WQA). File Notice of Intent (NOI) with United States Environmental Protection Agency, or appropriate state agency where project is located.
 - 2. Provide temporary erosion control systems as indicated on Drawings or as directed by Owner's Representative to protect adjacent properties and water resources from erosion and sedimentation.
 - 3. CWA (1972) and WQA (1987) Requirements:
 - a. Where Work on this project will disturb 5 or more acres, do not start Work without obtaining a "National Pollution Discharge Elimination System" (NPDES) permit governing discharge of storm water from project site for duration of Contract. Prepare and obtain approval of a



"Storm Water Pollution Prevention Plan" (SWP³) that includes monitoring of erosion control measures for duration of Contract.

- b. Provide storm water management in accordance with NPDES permit, SWP³ and for any enforcement action taken or imposed by Federal or State agencies, including cost of fines, construction delays and remedial actions resulting from failure to comply with all provisions of NPDES permit and SWP³.
- c. Keep SWP³ on site and make available for inspection by appropriate authority having jurisdiction at any time.

1.3 PROJECT CONDITIONS OR SITE CONDITIONS

A. Existing Conditions:

- 1. Notify the Contracting Officer of variations to conditions or discrepancies in actual site conditions prior to start of site preparation Work.
- 2. Traffic: Conduct operations and removal of debris with minimum interference to roads, streets, walks, and other adjacent facilities. Do not close or obstruct streets, walks or other facilities without permission from authorities having jurisdiction.
- 3. Protections: Provide protection for safe passage of persons around area of site preparation. Take precautions and conduct operations to prevent injury to adjacent buildings, structures, other facilities, and persons.
 - a. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement or collapse of structures to be demolished and adjacent facilities to remain.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

OPTION 1: Use "Not Used" where NO TOPSOIL material used for Site Preparation.

NOTE TO SPECIFIER

OPTION 2: Use MATERIALS when topsoil material is used for Site Preparation. Edit paragraph "Topsoil" for the specific conditions of the project site.

2.1 MATERIALS

- A. Topsoil: Friable clay loam surface soil containing humus, organic matter, found in a depth of not less than 4 inches free of subsoil, clay lumps, stones, and other objects over 2 inches in diameter, and without weeds, roots, and other unsuitable material.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.



1. Locate existing utilities as specified in Section 312000.
 2. Verify that survey benchmark and intended elevations for the Work are as indicated and are not located in an area that may be damaged.
 3. Verify that existing plant life and clearing limits are clearly tagged, identified and marked in such a manner as to insure their safety throughout construction operations.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Provide temporary erosion control systems as indicated on Drawings or as directed by Contracting Officer to protect project site and adjacent properties and water resources from erosion and sedimentation.

3.3 CLEARING

- A. Clear areas required for access to site and execution of Work.
- B. Remove trees, shrubs, grass, other vegetation, improvements, or obstructions interfering with installation of Work as indicated on Drawings. Removal includes digging out stumps and roots. Fill depressions caused by clearing and grubbing operations to subgrade elevation. Prevent water ponding. Place suitable fill material in horizontal layers not exceeding 8 inches loose depth, and compact as specified herein and in Section 312000.

NOTE TO SPECIFIER

*“**REQUIRED Article follows. Do not revise this Article, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer.”*

- C. Remove grass, trees, plant life, stumps and all other construction debris from site.
1. Collect, recycle, reuse, and dispose of demolished materials as specified in Section 013543 - Environmental Procedures and as approved by the U.S. Postal Service in the Solid Waste Management and Environmental Protection Plan.
 - a. Mulch: Identify organic debris that is free of disease, pest infestation, and chemical contamination and that is suitable for recycling on site. Chip and compost suitable organic debris for use as mulch on site. Stockpile where indicated on Drawings or directed by Contracting Officer. Coordinate with mulch requirements of Section 329200 - Turf and Grasses and Section 329300 - Plants.

3.4 TOPSOIL EXCAVATION

- A. Strip topsoil from areas that are indicated to be filled, excavated, landscaped, or re-graded to depth that prevents contact with underlying subsoil or unsuitable material. Where trees are indicated to remain, stop topsoil stripping sufficient distance from tree to prevent damage to main root system.
- B. Cut heavy growths of grass from areas prior to start of stripping. Remove heavy growths of grass along with clearing of other vegetation materials.
- C. Topsoil: Organic surface soil found in depth not less than 6 inches.



- D. Satisfactory Topsoil: Soil reasonably free of subsoil, clay lumps, stones and other objects over 2 inches in diameter, weeds, roots, and other unsuitable material.
- E. Stockpile topsoil where indicated on Drawings or directed by Contracting Officer. Construct stockpile areas to positively drain surface water. Cover stockpile areas as required to prevent windblown dust. Dispose of unsuitable topsoil off-site as specified clearing, unless directed otherwise by Contracting Officer. Dispose of excess topsoil off-site as specified for clearing, unless directed otherwise by Contracting Officer.

3.5 REMOVAL

- A. Remove debris, rock, extracted plant life, paving, curbs, and other structures indicated on Drawings as specified in Section 024113.
 - 1. Collect, recycle, reuse, and dispose of demolished materials as specified in Section 013543 - Environmental Procedures and as approved by the U.S. Postal Service in the Solid Waste Management and Environmental Protection Plan.

3.6 PROTECTION

- A. Protect existing streets, structures, and utilities as specified in Section 312000.
- B. Protect trees, plant growth, and features indicated to remain.
- C. Protect natural resources as specified in Section 013543 - Environmental Procedures and as approved by the U.S. Postal Service in the Solid Waste Management and Environmental Protection Plan.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



SECTION 31 10 00 00 - MPF SITE CLEARING**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

Use this section where clearing of existing site is necessary.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.31 10 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cleaning site of debris, grass, trees and other plant life in preparation for site or building excavation Work.
 - 2. Protection of existing structures, trees or vegetation indicated to remain.
 - 3. Stripping topsoil from areas indicated.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 013543 - Environmental Procedures: Recycling and reuse of waste materials.
 - 2. Section 024113 - Selective Site Demolition: Demolition and removal of site structures.
 - 3. Section 312000 - Earth Moving: Cutting, filling, and grading for proposed site improvements.

1.2 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Obtain required permits and licenses in accordance with requirements of Federal Clean Water Act (CWA) and Water Quality Act (WQA). File Notice of Intent (NOI) with United States Environmental Protection Agency, or appropriate state agency where project is located.
 - 2. Provide temporary erosion control systems as indicated on Drawings or as directed by Owner's Representative to protect adjacent properties and water resources from erosion and sedimentation.
 - 3. CWA (1972) and WQA (1987) Requirements:
 - a. Where Work on this project will disturb 5 or more acres, do not start Work without obtaining a "National Pollution Discharge Elimination System" (NPDES) permit governing discharge of storm water from project site for duration of Contract. Prepare and obtain approval of a



"Storm Water Pollution Prevention Plan" (SWP³) that includes monitoring of erosion control measures for duration of Contract.

- b. Provide storm water management in accordance with NPDES permit, SWP³ and for any enforcement action taken or imposed by Federal or State agencies, including cost of fines, construction delays and remedial actions resulting from failure to comply with all provisions of NPDES permit and SWP³.
- c. Keep SWP³ on site and make available for inspection by appropriate authority having jurisdiction at any time.

1.3 PROJECT CONDITIONS OR SITE CONDITIONS

A. Existing Conditions:

- 1. Notify the Contracting Officer of variations to conditions or discrepancies in actual site conditions prior to start of site preparation Work.
- 2. Traffic: Conduct operations and removal of debris with minimum interference to roads, streets, walks, and other adjacent facilities. Do not close or obstruct streets, walks or other facilities without permission from authorities having jurisdiction.
- 3. Protections: Provide protection for safe passage of persons around area of site preparation. Take precautions and conduct operations to prevent injury to adjacent buildings, structures, other facilities, and persons.
 - a. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement or collapse of structures to be demolished and adjacent facilities to remain.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

OPTION 1: Use "Not Used" where NO TOPSOIL material used for Site Preparation.

NOTE TO SPECIFIER

OPTION 2: Use MATERIALS when topsoil material is used for Site Preparation. Edit paragraph "Topsoil" for the specific conditions of the project site.

2.1 MATERIALS

- A. Topsoil: Friable clay loam surface soil containing humus, organic matter, found in a depth of not less than 4 inches free of subsoil, clay lumps, stones, and other objects over 2 inches in diameter, and without weeds, roots, and other unsuitable material.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.



1. Locate existing utilities as specified in Section 312000.
 2. Verify that survey benchmark and intended elevations for the Work are as indicated and are not located in an area that may be damaged.
 3. Verify that existing plant life and clearing limits are clearly tagged, identified and marked in such a manner as to insure their safety throughout construction operations.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Provide temporary erosion control systems as indicated on Drawings or as directed by Contracting Officer to protect project site and adjacent properties and water resources from erosion and sedimentation.

3.3 CLEARING

- A. Clear areas required for access to site and execution of Work.
- B. Remove trees, shrubs, grass, other vegetation, improvements, or obstructions interfering with installation of Work as indicated on Drawings. Removal includes digging out stumps and roots. Fill depressions caused by clearing and grubbing operations to subgrade elevation. Prevent water ponding. Place suitable fill material in horizontal layers not exceeding 8 inches loose depth, and compact as specified herein and in Section 312000.

NOTE TO SPECIFIER

*“**REQUIRED Article follows. Do not revise this Article, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer.”*

- C. Remove grass, trees, plant life, stumps and all other construction debris from site.
1. Collect, recycle, reuse, and dispose of demolished materials as specified in Section 013543 - Environmental Procedures and as approved by the U.S. Postal Service in the Solid Waste Management and Environmental Protection Plan.
 - a. Mulch: Identify organic debris that is free of disease, pest infestation, and chemical contamination and that is suitable for recycling on site. Chip and compost suitable organic debris for use as mulch on site. Stockpile where indicated on Drawings or directed by Contracting Officer. Coordinate with mulch requirements of Section 329200 - Turf and Grasses and Section 329300 - Plants.

3.4 TOPSOIL EXCAVATION

- A. Strip topsoil from areas that are indicated to be filled, excavated, landscaped, or re-graded to depth that prevents contact with underlying subsoil or unsuitable material. Where trees are indicated to remain, stop topsoil stripping sufficient distance from tree to prevent damage to main root system.
- B. Cut heavy growths of grass from areas prior to start of stripping. Remove heavy growths of grass along with clearing of other vegetation materials.
- C. Topsoil: Organic surface soil found in depth not less than 6 inches.



- D. Satisfactory Topsoil: Soil reasonably free of subsoil, clay lumps, stones and other objects over 2 inches in diameter, weeds, roots, and other unsuitable material.
- E. Stockpile topsoil where indicated on Drawings or directed by Contracting Officer. Construct stockpile areas to positively drain surface water. Cover stockpile areas as required to prevent windblown dust. Dispose of unsuitable topsoil off-site as specified clearing, unless directed otherwise by Contracting Officer. Dispose of excess topsoil off-site as specified for clearing, unless directed otherwise by Contracting Officer.

3.5 REMOVAL

- A. Remove debris, rock, extracted plant life, paving, curbs, and other structures indicated on Drawings as specified in Section 024113.
 - 1. Collect, recycle, reuse, and dispose of demolished materials as specified in Section 013543 - Environmental Procedures and as approved by the U.S. Postal Service in the Solid Waste Management and Environmental Protection Plan.

3.6 PROTECTION

- A. Protect existing streets, structures, and utilities as specified in Section 312000.
- B. Protect trees, plant growth, and features indicated to remain.
- C. Protect natural resources as specified in Section 013543 - Environmental Procedures and as approved by the U.S. Postal Service in the Solid Waste Management and Environmental Protection Plan.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 6/10/2011

END OF SECTION



SECTION 31 20 00 00 - MPF EARTH MOVING

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

Use this section where Earthwork is part of the Work. Before editing this Section, obtain the "Report of Subsurface Investigation" prepared by the Geotechnical Engineer. Read the report and incorporate the recommendations included in the report for earthwork into this section.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE. The degree of complexity of this section is related to the amount of earthwork required for a particular Project Site. Engineer of Record editing this section must make decisions on the amount of detail for earthwork requirements remaining in completed section based on conditions of the Project Site.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparation of subgrade for building, slabs, walks, pavements, and other sitework.
2. Rough and finish grading.
3. Excavation for filling and grading.
4. Filling and subgrade preparation.
5. Geotechnical Data

B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:

1. Section 013543 - Environmental Procedures: Recycling and reuse of waste materials, and protection of natural resources
2. Section 024113 - Selective Site Demolition: Demolition and removal of designated existing site items.
3. Section 311000 - Site Clearing: Clearing site of debris, grass, trees, and other plant life.
4. Section 312300 - Excavation and Fill: Earthwork for structures, utilities, and pavement.
5. Section 313200 - Soil Stabilization: Lime, cement, fly ash, and geotextile subgrade stabilizers.
6. Section 312500 - Erosion and Sedimentation Controls: Temporary and permanent erosion control and slope protection systems.
7. Section 312317 - Rock Excavation: Removal of rock during excavation.
8. Section 329113 - Soil Preparation: Placing topsoil and fine grading.



1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 1. ASTM C 136 - Method for Sieve Analysis of Fine and Course Aggregates.
 2. ASTM D 698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort.
 3. ASTM D 1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.
 4. ASTM D 1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
 5. ASTM D 2167 - Test Method for Density and Unit Weight of Soil In-Place by the Rubber Balloon Method.
 6. ASTM D 2487 - Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 7. ASTM D 2922 - Test Methods for Density of Soil and Soil- Aggregate in Place by Nuclear Methods (Shallow Depth).
 8. ASTM D 3017 - Test Method for Moisture Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
 9. STM D 4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- B. American Association of State Highway and Transportation Officials (AASHTO):
 1. AASHTO T 88 - Particle Size Analysis of Soils

1.3 DEFINITIONS

- A. Building Area Subgrade Pad: Portion of site directly beneath and within a line 10 feet 0 inches beyond building and appurtenances including limits of any future building expansion areas indicated on Drawings.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 1. Shop Drawings:
 - a. Submit drawings or details indicating proposed alternate earthwork procedures or proposed procedures not indicated in Contract Documents.
 - b. Submit drawings or details of design for use of fabrics or geogrids.
 2. Assurance/Control Submittals:
 - a. Material Source: Submit name of imported materials suppliers. Provide materials from same source throughout the Work. Change of source requires Contracting Officer approval.
 - b. Test Reports: Submit the following reports directly to Contracting Officer from Testing Laboratory, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
 - 1) Test reports on borrow material.
 - 2) Verification of each footing subgrade.
 - 3) Field density test reports.
 - 4) Optimum moisture-maximum density curve for each type of soil encountered.
 - 5) Report of actual unconfined compressive strength and bearing tests/results for each strata tested. Give "three-dimensional" description of each test location.
 - c. Certificates: Gradation and certification of aggregate material for Testing Laboratory review.
 - d. Qualification Documentation: Submit earthwork company documentation of experience indicating compliance with specified qualification requirements.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.



1. Project Record Documents: Accurately record final grade contours, spot elevations, and slope gradients.

1.5 QUALITY ASSURANCE

- A. Qualifications: Earthwork company specializing in performing the Work of this Section with minimum 5 years documented experience.
- B. Regulatory Requirements: Perform earthwork in accordance with applicable requirements of governing authorities having jurisdiction.
- C. Pre-Installation Meetings:
 1. Convene a pre-installation meeting one week prior to commencing Work of this Section.
 2. Require attendance of parties directly affecting Work of this Section.
 3. Review conditions of earthwork operations, earthwork procedures and coordination with related Work.
 4. Agenda:
 - a. Tour, inspect, and discuss conditions of existing soils and soil substrates.
 - b. Review dust control measures and their requirements.
 - c. Review required submittals, both completed and yet to be completed.
 - d. Review Survey and Civil sitework Drawings.
 - e. Approve proposed earthwork equipment.
 - f. Approve excess material dump location.
 - g. Approve import material storage location.
 - h. Review and finalize construction schedule related to earthwork and verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
 - i. Review required inspections, testing, certifying, and material usage accounting procedures.
 - j. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.
 - k. Review safety precautions relating to earthwork operations.
 - l. Review environmental procedures.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Existing Conditions:
 1. Geotechnical Data:
 - a. Soils investigation reports and data are not a part of Contract Documents.
 - b. Soil and subsurface investigations were conducted at site by an Independent Testing Laboratory and a report with log of borings prepared. Report was obtained for Architect and Engineer design use only.

NOTE TO SPECIFIER

"Report of Substance Investigation" may not be available. Verify that Report is available from Contracting Officer. If not, delete sub-paragraph below. A copy of the report is available from Contracting Officer.

- c. Soils investigation data is not warranted to indicate actual conditions. U.S. Postal Service, Architect, and Engineer do not assume responsibility for variations in kind, depth, quantity and condition of soils. U.S. Postal Service, Architect and Engineer disclaim responsibility for accuracy, true location, and extent of soils investigation prepared by others; and further disclaim responsibility for interpretation of data by Contractor such as projecting soil bearing values, rock profiles, soil stability, and presence, level, and extent of underground water.
- d. Contractor may make additional test borings and other exploratory operations at no additional cost to U.S. Postal Service. Coordinate tests with Contracting Officer.



2. Classification of Excavations: Contractor acknowledges that Contractor has investigated project site to determine type, quantity, quality, and character of excavation work to be performed. Consider excavation as unclassified excavation, except where Rock Excavation is required. Rock Excavation criteria is as follows:

NOTE TO SPECIFIER

Edit below to indicate conditions for specific site as indicated in "Report of Subsurface Investigation."

- a. Rock Excavation: [Igneous, metamorphic, or sedimentary rock that cannot be removed by rippers or other mechanical methods requiring drilling and blasting] [____]
 - b. Rock Excavation Indicated by Report of Subsurface Exploration: _____]
 - c. Rock Excavation Not Indicated in Report of Subsurface Exploration:
 - 1) Notify Contracting Officer immediately, and in writing, prior to start of Rock Excavation operations.
 - 2) Contracting Officer will visit Project Site, verify requirement for Rock Excavation, determine estimated quantity Rock Excavation required, and provide Contractor written authorization to proceed.
 - 3) Contracting Officer will verify measurements and quantities of actual Rock Excavation required and make adjustments to Contract as specified in Section 012600.
 - d. Rock excavation specified in Section 312317.
3. Existing Utilities: Contact local utility companies and make arrangements to obtain utility company location and marking service prior to start of Earthwork operations.
- a. Locate existing underground utilities in areas of Work. If utilities are to remain in place, provide means of support and protection during Earthwork operations.
 - 1) Pothole and locate existing underground utilities at locations to assure that no conflict with Work of this Contract will occur and required clearance is available to prevent damage to existing utilities.
 - 2) Perform potholing minimum 10 days before start of excavation or underground work.
 - b. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility company and Contracting Officer immediately for directions.
 - c. Coordinate with Contracting Officer and utility companies to keep existing utility services and facilities in operation.
 - d. Repair damaged utilities to satisfaction of utility company, at no additional cost to U.S. Postal Service.
 - e. Do not interrupt existing utilities serving facilities occupied and used by U.S. Postal Service or others, during occupied hours, except when permitted in writing by Contracting Officer and then only after acceptable temporary utility services have been provided and approved by Contracting Officer.
 - f. Demolish and completely remove from site existing underground utilities indicated on Drawings to be removed as specified in Section 024113. Coordinate with utility companies for shut-off of services if lines are active.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

The following is for information only; from ASTM D 2487 Table 1 "Soil Classification Chart."

COARSE-GRAINED SOILS		FINE-GRAINED SOILS	
GW	Well-Graded Gravel	CL	Lean Clay
GP	Poorly Graded Gravel	ML	Silt



GM	Silty Gravel	OL	Organic Clay or Silt
GC	Clayey Gravel		
SW	Well-Graded Sand	CH	Fat Clay
SP	Poorly Graded Sand	MH	Elastic Silt
SM	Silty Sand	OH	Organic Clay or Silt
SC	Clayey Sand	PT	Peat

2.1 MATERIALS

NOTE TO SPECIFIER

Edit below for appropriate subsoil type.

- A. Subsoil: Approved by Testing Laboratory and Contracting Officer.
1. [Excavated and re-used material] [Imported Borrow] [Select or local borrow] [Structural].
 2. Graded.
 3. Free of lumps larger than [3] [____] inches, rocks larger than [2] [____] inches, and debris.
 4. Conforming to ASTM D 2487 [CL] [OL] [____].

NOTE TO SPECIFIER

Edit below for appropriate aggregate type.

- B. Aggregate: Approved by Testing Laboratory and Contracting Officer.
1. Coarse Aggregate: [Recycled Concrete] [Coarse Stone] [Crushed] [Gravel] [Pit Run] [Angular Crushed] [Natural] [Washed] [____] stone; free of shale, clay, friable material and debris; graded in accordance with ASTM D 2487 Group Symbol [GW] [GP] [GM] [GC]; within the following limits:

SIEVE SIZE	PERCENT PASSING
2 inches	100
1 inch	95
3/4 inch	95 to 100
5/8 inch	75 to 100
3/8 inch	55 to 85
No. 4	35 to 60
No. 16	15 to 35
No. 40	10 to 25
No. 200	5 to 10
 2. Pea Gravel: Natural Stone; washed, free of clay, shale, organic matter; graded in accordance with ASTM D 2487 Group Symbol [GM] [GC] [____]; to the following limits:
 - a. Minimum Size: 1/4 inch.
 - b. Maximum Size: 5/8 inch.
 3. Fine Sand: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter; graded in accordance with ASTM D 2487 Group Symbol [SW] [SP] [SM] [SC] [____]; within the following limits:

SIEVE SIZE	PERCENT PASSING
No. 4	100
No. 14	10 to 100
No. 50	5 to 90
No. 100	4 to 30
No. 200	0

**NOTE TO SPECIFIER**

OPTION 1: Use below for re-use of existing, select, or unclassified topsoil.

- C. Topsoil: Approved by Testing Laboratory and Contracting Officer.
1. [Excavated and reused material.] [Select] [Unclassified].
 2. Graded.
 3. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds, and foreign matter.
 4. Conforming to ASTM D 2487 Group Symbol [OH] [PT] [____].

NOTE TO SPECIFIER

OPTION 2: Use below for imported borrow topsoil.

- D. Topsoil: Approved by Testing Laboratory and Contracting Officer.
1. Imported borrow.
 2. Friable loam.
 3. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds, and foreign matter.
 4. Acidity range (pH) of [5.5 to 7.5] [____ to ____].
 5. Containing a minimum of [4] [____] percent and a maximum of [25] [____] percent inorganic matter.
 6. Conforming to ASTM D 2487 Group Symbol [OH] [PT] [____].
 7. Limit decaying matter to [____] percent of total content by volume.
- E. Filter/Drainage Fabrics:
1. Mirafi 140N.
 2. Amoco Style #4546.
 3. DuPont Typar 3341.
- F. Soil Stabilization Materials: Specified in Section 313200.

2.2 SOURCE QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Testing Laboratory services.

NOTE TO SPECIFIER

Edit below for appropriate ASTM test method for the specified material type in accordance with the "Report of Subsurface Investigation."

- B. Testing and Analysis:
1. Soil: Perform in accordance with [ASTM D 698], [ASTM D 1557], [ASTM D 2167], [ASTM D 2922], and [ASTM D 3017].
 2. Aggregate: Perform in accordance with [ASTM D 698], [ASTM D 1557], [ASTM D 2167], [ASTM D 2922], [ASTM D 3017], [ASTM D 4318], and [ASTM C 136].
- C. If tests indicate materials do not meet specified requirements, change material and retest.
- D. Provide materials from same source throughout the Work.



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to for earthwork operations to begin.
 - 1. Verify that existing site soils and soil conditions encountered are as indicated in Geotechnical Data.
 - 2. Verify quantity and type of each soil material before start of material installation.
 - 3. Backfilling:
 - a. Verify imported fill and stockpiled fill to be reused is approved.
 - b. Verify foundation perimeter drainage installation has been inspected and approved.
 - c. Verify foundation or basement walls are braced to support surcharge forces imposed by backfilling operations.
 - d. Verify areas to be backfilled are free of debris, snow, ice, or water, and ground surfaces are not frozen.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Clear site as specified in Section 311000.
- B. Identify required lines, elevations, levels, contours, grades, and datum necessary to perform earthwork operations as indicated on Drawings.
- C. Examine Project Site with Contracting Officer before start of earthwork operations. Identify areas and prepare to brace or shore areas of adjacent property subject to rotation, slumping, or cave-in to prevent dislocation of adjacent soil, pavement, utilities, structures, or other items to remain.
- D. Verify that survey benchmark and intended elevations for Work are as indicated on Drawings. Short form contour designations are intended to be a continuing of the long form bench mark.
- E. Locate, identify, and protect existing utilities to remain and previously installed utilities that may be damaged by construction operations.
 - 1. Notify Contracting Officer and utility company immediately of utilities, not indicated on Drawings, encountered.
 - 2. Maintain existing utilities, active utilities, and drainage systems in operating condition.
 - 3. Comply with utility company requirements and directions of Contracting Officer to keep utilities in operation.
 - 4. Repair damage to utilities as directed by Contracting Officer.
- F. Protect plant life, lawns, fences, existing structures, sidewalks, paving and curbs from earthwork operations, excavating equipment, and vehicular traffic.
- G. Protect benchmarks, property corners, and other survey monuments from damage or displacement. Where markers are required to be removed, provide removal and reinstallation by licensed land surveyor licensed in State where project is located.



- H. Remove material encountered in grading operations that is unsuitable for backfilling, subgrade or foundation purposes as determined by Testing Laboratory and as directed by Contracting Officer. Dispose of materials off-site in an approved manner in accordance with requirements of authorities having jurisdiction.
- I. Prior to placing fill in low areas, such as previously existing creeks, ponds, or lakes, perform following procedures:
 - 1. Drain water out by gravity with ditch having flow line lower than lowest elevation in low area. If drainage cannot be performed by gravity ditch, use pumping equipment.
 - 2. After drainage of low area is complete, remove mulch, mud, debris, and other unsuitable material by using equipment and methods keeping natural soils underlying low areas dry and undisturbed.
 - 3. If proposed for fill, dry muck, mud, and other materials removed from low areas on-site by spreading in thin layers for inspection by Testing Laboratory and Contracting Officer. Place material determined by the Testing Laboratory and contracting Officer suitable for use as fill material into lowest elevation of site filling operation. Do not place under building subgrade pad or paving subgrade. If material is determined by the Testing Laboratory and Contracting Officer to be unsuitable, remove material from site.

3.3 EXCAVATION FOR FILLING AND GRADING

- A. Provide dewatering, drainage, and ground water management to control moisture of soils when performing grading operations during periods of wet weather.
- B. Shore, brace, and drain excavations to maintain excavations safe, secure, and free of water at all times.
- C. Provide protection for workers within trench areas in accordance with local, State, and Federal Occupational Safety and Health requirements and regulations.
- D. Unacceptable Fill Material for Building and Paving Areas: Excavated material containing rock or stone greater than 6 inches in largest dimension.
- E. Acceptable Fill Material:
 - 1. Rock or stone less than 6 inches in largest dimension as fill to within 24 inches of surface of proposed subgrade when mixed with suitable material.
 - 2. Rock or stone less than 2 inches in largest dimension mixed with suitable material as fill within the upper 24 inches of proposed subgrade.

3.4 FILLING AND SUBGRADE PREPARATION

- A. Fill areas to contours and elevations as indicated on Drawings with materials specified herein.
- B. Place fill in continuous lifts as specified herein.
- C. Refer to Section 312300 for filling requirements for structures, utilities, and pavements.

NOTE TO SPECIFIER

Edit below for appropriate minimum depths, percentages, and moisture content in accordance with the "Report of Subsurface Investigation."

- D. Areas Exposed by Excavation or Stripping:
 - 1. Scarify areas exposed by excavation or stripping on which building subgrade preparations are to be performed to minimum [8] [____] inch depth.



2. Compact to minimum [95] [____] percent optimum density in accordance with ASTM D 698 or [92] [____] percent optimum density in accordance with ASTM D 1557 at minimum moisture content [1] [____] percent below and maximum [3] [____] percent above optimum moisture content.
3. Proofroll to detect any areas of insufficient compaction by making minimum of [2] [____] complete passes with fully-loaded tandem-axle dump truck, or Contracting Officer approved equivalent, in each of two perpendicular directions under supervision and direction of Testing Laboratory and Contracting Officer.
4. Excavate and recompact areas failing to meet specified requirements.

NOTE TO SPECIFIER

Edit below for appropriate minimum depths, percentages, and moisture content in accordance with the "Report of Subsurface Investigation."

- E. Fill Material Placement:
 1. Place in [8] [____] inch maximum lifts compacted minimum [95] [____] percent optimum density in accordance with ASTM D 698 or [92] [____] percent optimum density in accordance with ASTM D 1557 at minimum moisture content of [1] [____] percent below and maximum moisture content [3] [____] percent above optimum moisture content.
- F. Provide material imported from off-site with CBR (California Bearing Ratio) or LBR (Limerock Bearing Ratio) value equal to or above pavement design subgrade CBR or LBR value indicated on Drawings.

3.5 MAINTENANCE OF SUBGRADE

- A. Verify finished subgrades for conformance to elevations as indicated on Drawings and for specified conditions for subgrade.
- B. Protect subgrade from excessive wheel loading during construction, including concrete trucks and dump trucks.
- C. Remove areas of finished subgrade with compaction density below specified density to depth required as directed by Testing Laboratory and Contracting Officer. Fill removed areas and compact to specified compaction density
- D. Provide surface of subgrade after compaction hard, uniform, smooth, stable, and true to grade and cross-section.

3.6 FINISH GRADING

- A. Grade areas other than paved areas and building pad areas to finish grade elevations or contours as indicated on Drawings including the following:
 1. Excavated areas.
 2. Filled and transition areas.
 3. Landscaped areas.
- B. Provide finish graded areas uniform and smooth, free from rocks, debris, or irregular surface changes with maximum tolerance of 0.10 feet above or below established finish subgrade elevation. Provide graded surfaces sloping uniformly between indicated elevations.
- C. Provide drainage ditches graded with uniform slope to allow drainage without ponding, minimizing potential for erosion. Refer to Section 312500 for procedures to protect slopes and control erosion.
- D. Refer to Section 313200 for soil stabilization using lime, cement, fly ash and geotextile fabric methods for subbase materials.
- E. Refer to Section 329113 for placing topsoil and fine grading in landscaped areas.



3.7 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Excavation: Notify Testing Laboratory and Contracting Officer for visual inspection of bearing surfaces, 48 hours prior to backfilling and other subsequent Work.

NOTE TO SPECIFIER

Edit below for extent of earthwork testing in accordance with the "Report of Subsurface Investigation." Engineer of Record will determine if Site Testing of earthwork is required based on conditions at Project Site and revise or delete Site Testing accordingly.

- C. Site Tests - Quantity:
 - 1. Building Area Subgrade Pad:
 - a. Cut Areas: Minimum [one] [_____] compaction test for every [2500] [_____] square feet.
 - b. Fill Areas: Minimum [one] [_____] compaction test for every [2500] [_____] square feet for each [8] [_____] inch lift, measured loose.
 - 2. Areas Outside Building Area Subgrade Pad:
 - a. Cut Areas: Minimum [one] [_____] compaction test for every [10,000] [_____] square feet.
 - b. Fill Areas: Minimum [one] [_____] compaction test for every [10,000] [_____] square feet for each [8] [_____] inch lift, measured loose.
- D. Site Tests - Methods:
 - 1. Perform tests on each type of existing on-site or imported off-site material used for compacted fill.
 - a. Moisture and Density Relationship: ASTM D 698 or ASTM D 1557.
 - b. Mechanical Analysis: AASHTO T-88
 - c. Plasticity Index: ASTM D 4318
 - 1) One optimum moisture-maximum density curve for each type of soil encountered.
 - 2) Report of actual unconfined compressive strength and bearing tests/results for each strata tested. Give "three-dimensional" description of each test location.
 - 2. Perform field density tests for in-place materials in accordance to one of the following standards:
 - a. Sand-Cone Method: ASTM D 1556
 - b. Balloon Method: ASTM D 2167
 - c. Nuclear Method: ASTM D 2922 (Method B-Direct Transmission)
 - 3. Perform a CBR (California Bearing Ratio) or LBR (Limerock Bearing Ratio) test for each type of imported off-site material in areas where pavement will be placed.
- E. If tests indicate the Work does not meet specified requirements, remove Work, replace, compact, and retest at no additional cost to United States Postal Service.

3.8 PROTECTION

- A. Protect building subgrade pad and building related earthwork from damage by construction operations and erosion.
- B. Prohibit vehicles from entering building subgrade pad area. Vehicles not permitted.
- C. Scarify surface, reshape, and compact areas damaged by construction operations or weather erosion.



END OF SECTION 31 20 00 00



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SECTION 31 20 00 00 - CSF EARTH MOVING

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Earthwork is part of the Work. Before editing this Section, obtain the "Report of Subsurface Investigation" prepared by the Geotechnical Engineer. Read the report and incorporate the recommendations included in the report for earthwork into this section.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE. The degree of complexity of this section is related to the amount of earthwork required for a particular Project Site. Engineer of Record editing this section must make decisions on the amount of detail for earthwork requirements remaining in completed section based on conditions of the Project Site.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Preparation of subgrade for building, slabs, walks, pavements, and other sitework.
 2. Rough and finish grading.
 3. Excavation for filling and grading.
 4. Filling and subgrade preparation.
 5. Geotechnical Data
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 1. Section 013543 - Environmental Procedures: Recycling and reuse of waste materials, and protection of natural resources
 2. Section 024113 - Selective Site Demolition: Demolition and removal of designated existing site items.
 3. Section 311000 - Site Clearing: Clearing site of debris, grass, trees, and other plant life.
 4. Section 312300 - Excavation and Fill: Earthwork for structures, utilities, and pavement.
 5. Section 313200 - Soil Stabilization: Lime, cement, fly ash, and geotextile subgrade stabilizers.
 6. Section 312500 - Erosion and Sedimentation Controls: Temporary and permanent erosion control and slope protection systems.
 7. Section 312317 - Rock Excavation: Removal of rock during excavation.
 8. Section 329113 - Soil Preparation: Placing topsoil and fine grading.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM C 136 - Method for Sieve Analysis of Fine and Course Aggregates.
 - 2. ASTM D 698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort.
 - 3. ASTM D 1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.
 - 4. ASTM D 1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
 - 5. ASTM D 2167 - Test Method for Density and Unit Weight of Soil In-Place by the Rubber Balloon Method.
 - 6. ASTM D 2487 - Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 - 7. ASTM D 2922 - Test Methods for Density of Soil and Soil- Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 8. ASTM D 3017 - Test Method for Moisture Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
 - 9. STM D 4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- B. American Association of State Highway and Transportation Officials (AASHTO):
 - 1. AASHTO T 88 - Particle Size Analysis of Soils

1.3 DEFINITIONS

- A. Building Area Subgrade Pad: Portion of site directly beneath and within a line 10 feet 0 inches beyond building and appurtenances including limits of any future building expansion areas indicated on Drawings.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Shop Drawings:
 - a. Submit drawings or details indicating proposed alternate earthwork procedures or proposed procedures not indicated in Contract Documents.
 - b. Submit drawings or details of design for use of fabrics or geogrids.
 - 2. Assurance/Control Submittals:
 - a. Material Source: Submit name of imported materials suppliers. Provide materials from same source throughout the Work. Change of source requires Contracting Officer approval.
 - b. Test Reports: Submit the following reports directly to Contracting Officer from Testing Laboratory, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
 - 1) Test reports on borrow material.
 - 2) Verification of each footing subgrade.
 - 3) Field density test reports.
 - 4) Optimum moisture-maximum density curve for each type of soil encountered.
 - 5) Report of actual unconfined compressive strength and bearing tests/results for each strata tested. Give "three-dimensional" description of each test location.
 - c. Certificates: Gradation and certification of aggregate material for Testing Laboratory review.
 - d. Qualification Documentation: Submit earthwork company documentation of experience indicating compliance with specified qualification requirements.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.



1. Project Record Documents: Accurately record final grade contours, spot elevations, and slope gradients.

1.5 QUALITY ASSURANCE

- A. Qualifications: Earthwork company specializing in performing the Work of this Section with minimum 5 years documented experience.
- B. Regulatory Requirements: Perform earthwork in accordance with applicable requirements of governing authorities having jurisdiction.
- C. Pre-Installation Meetings:
 1. Convene a pre-installation meeting one week prior to commencing Work of this Section.
 2. Require attendance of parties directly affecting Work of this Section.
 3. Review conditions of earthwork operations, earthwork procedures and coordination with related Work.
 4. Agenda:
 - a. Tour, inspect, and discuss conditions of existing soils and soil substrates.
 - b. Review dust control measures and their requirements.
 - c. Review required submittals, both completed and yet to be completed.
 - d. Review Survey and Civil sitework Drawings.
 - e. Approve proposed earthwork equipment.
 - f. Approve excess material dump location.
 - g. Approve import material storage location.
 - h. Review and finalize construction schedule related to earthwork and verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
 - i. Review required inspections, testing, certifying, and material usage accounting procedures.
 - j. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.
 - k. Review safety precautions relating to earthwork operations.
 - l. Review environmental procedures.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Existing Conditions:
 1. Geotechnical Data:
 - a. Soils investigation reports and data are not a part of Contract Documents.
 - b. Soil and subsurface investigations were conducted at site by an Independent Testing Laboratory and a report with log of borings prepared. Report was obtained for Architect and Engineer design use only.

NOTE TO SPECIFIER

"Report of Substance Investigation" may not be available for CSF Small. Verify that Report is available from Contracting Officer. If not, delete sub-paragraph below. A copy of the report is available from Contracting Officer.

- c. Soils investigation data is not warranted to indicate actual conditions. U.S. Postal Service, Architect, and Engineer do not assume responsibility for variations in kind, depth, quantity and condition of soils. U.S. Postal Service, Architect and Engineer disclaim responsibility for accuracy, true location, and extent of soils investigation prepared by others; and further disclaim responsibility for interpretation of data by Contractor such as projecting soil bearing values, rock profiles, soil stability, and presence, level, and extent of underground water.
- d. Contractor may make additional test borings and other exploratory operations at no additional cost to U.S. Postal Service. Coordinate tests with Contracting Officer.



2. Classification of Excavations: Contractor acknowledges that Contractor has investigated project site to determine type, quantity, quality, and character of excavation work to be performed. Consider excavation as unclassified excavation, except where Rock Excavation is required. Rock Excavation criteria is as follows:

NOTE TO SPECIFIER

Edit below to indicate conditions for specific site as indicated in "Report of Subsurface Investigation."

- a. Rock Excavation: [Igneous, metamorphic, or sedimentary rock that cannot be removed by rippers or other mechanical methods requiring drilling and blasting] []
 - b. Rock Excavation Indicated by Report of Subsurface Exploration: []
 - c. Rock Excavation Not Indicated in Report of Subsurface Exploration:
 - 1) Notify Contracting Officer immediately, and in writing, prior to start of Rock Excavation operations.
 - 2) Contracting Officer will visit Project Site, verify requirement for Rock Excavation, determine estimated quantity Rock Excavation required, and provide Contractor written authorization to proceed.
 - 3) Contracting Officer will verify measurements and quantities of actual Rock Excavation required and make adjustments to Contract as specified in Section 012600.
 - d. Rock excavation specified in Section 312317.
3. Existing Utilities: Contact local utility companies and make arrangements to obtain utility company location and marking service prior to start of Earthwork operations.
- a. Locate existing underground utilities in areas of Work. If utilities are to remain in place, provide means of support and protection during Earthwork operations.
 - 1) Pothole and locate existing underground utilities at locations to assure that no conflict with Work of this Contract will occur and required clearance is available to prevent damage to existing utilities.
 - 2) Perform potholing minimum 10 days before start of excavation or underground work.
 - b. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility company and Contracting Officer immediately for directions.
 - c. Coordinate with Contracting Officer and utility companies to keep existing utility services and facilities in operation.
 - d. Repair damaged utilities to satisfaction of utility company, at no additional cost to U.S. Postal Service.
 - e. Do not interrupt existing utilities serving facilities occupied and used by U.S. Postal Service or others, during occupied hours, except when permitted in writing by Contracting Officer and then only after acceptable temporary utility services have been provided and approved by Contracting Officer.
 - f. Demolish and completely remove from site existing underground utilities indicated on Drawings to be removed as specified in Section 024113. Coordinate with utility companies for shut-off of services if lines are active.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

The following is for information only; from ASTM D 2487 Table 1 "Soil Classification Chart."

COARSE-GRAINED SOILS		FINE-GRAINED SOILS	
GW	Well-Graded Gravel	CL	Lean Clay
GP	Poorly Graded Gravel	ML	Silt



GM	Silty Gravel	OL	Organic Clay or Silt
GC	Clayey Gravel		
SW	Well-Graded Sand	CH	Fat Clay
SP	Poorly Graded Sand	MH	Elastic Silt
SM	Silty Sand	OH	Organic Clay or Silt
SC	Clayey Sand	PT	Peat

2.1 MATERIALS

NOTE TO SPECIFIER

Edit below for appropriate subsoil type.

- A. Subsoil: Approved by Testing Laboratory and Contracting Officer.
1. [Excavated and re-used material] [Imported Borrow] [Select or local borrow] [Structural].
 2. Graded.
 3. Free of lumps larger than [3] [____] inches, rocks larger than [2] [____] inches, and debris.
 4. Conforming to ASTM D 2487 [CL] [OL] [____].

NOTE TO SPECIFIER

Edit below for appropriate aggregate type.

- B. Aggregate: Approved by Testing Laboratory and Contracting Officer.
1. Coarse Aggregate: [Recycled Concrete] [Coarse Stone] [Crushed] [Gravel] [Pit Run] [Angular Crushed] [Natural] [Washed] [____] stone; free of shale, clay, friable material and debris; graded in accordance with ASTM D 2487 Group Symbol [GW] [GP] [GM] [GC]; within the following limits:

SIEVE SIZE	PERCENT PASSING
2 inches	100
1 inch	95
3/4 inch	95 to 100
5/8 inch	75 to 100
3/8 inch	55 to 85
No. 4	35 to 60
No. 16	15 to 35
No. 40	10 to 25
No. 200	5 to 10
 2. Pea Gravel: Natural Stone; washed, free of clay, shale, organic matter; graded in accordance with ASTM D 2487 Group Symbol [GM] [GC] [____]; to the following limits:
 - a. Minimum Size: 1/4 inch.
 - b. Maximum Size: 5/8 inch.
 3. Fine Sand: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter; graded in accordance with ASTM D 2487 Group Symbol [SW] [SP] [SM] [SC] [____]; within the following limits:

SIEVE SIZE	PERCENT PASSING
No. 4	100
No. 14	10 to 100
No. 50	5 to 90
No. 100	4 to 30
No. 200	0

**NOTE TO SPECIFIER**

OPTION 1: Use below for re-use of existing, select, or unclassified topsoil.

- C. Topsoil: Approved by Testing Laboratory and Contracting Officer.
1. [Excavated and reused material.] [Select] [Unclassified].
 2. Graded.
 3. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds, and foreign matter.
 4. Conforming to ASTM D 2487 Group Symbol [OH] [PT] [____].

NOTE TO SPECIFIER

OPTION 2: Use below for imported borrow topsoil.

- D. Topsoil: Approved by Testing Laboratory and Contracting Officer.
1. Imported borrow.
 2. Friable loam.
 3. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds, and foreign matter.
 4. Acidity range (pH) of [5.5 to 7.5] [____ to ____].
 5. Containing a minimum of [4] [____] percent and a maximum of [25] [____] percent inorganic matter.
 6. Conforming to ASTM D 2487 Group Symbol [OH] [PT] [____].
 7. Limit decaying matter to [____] percent of total content by volume.
- E. Filter/Drainage Fabrics:
1. Mirafi 140N.
 2. Amoco Style #4546.
 3. DuPont Typar 3341.
- F. Soil Stabilization Materials: Specified in Section 313200.

2.2 SOURCE QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Testing Laboratory services.

NOTE TO SPECIFIER

Edit below for appropriate ASTM test method for the specified material type in accordance with the "Report of Subsurface Investigation."

- B. Testing and Analysis:
1. Soil: Perform in accordance with [ASTM D 698], [ASTM D 1557], [ASTM D 2167], [ASTM D 2922], and [ASTM D 3017].
 2. Aggregate: Perform in accordance with [ASTM D 698], [ASTM D 1557], [ASTM D 2167], [ASTM D 2922], [ASTM D 3017], [ASTM D 4318], and [ASTM C 136].
- C. If tests indicate materials do not meet specified requirements, change material and retest.
- D. Provide materials from same source throughout the Work.



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to for earthwork operations to begin.
 - 1. Verify that existing site soils and soil conditions encountered are as indicated in Geotechnical Data.
 - 2. Verify quantity and type of each soil material before start of material installation.
 - 3. Backfilling:
 - a. Verify imported fill and stockpiled fill to be reused is approved.
 - b. Verify foundation perimeter drainage installation has been inspected and approved.
 - c. Verify foundation or basement walls are braced to support surcharge forces imposed by backfilling operations.
 - d. Verify areas to be backfilled are free of debris, snow, ice, or water, and ground surfaces are not frozen.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Clear site as specified in Section 311000.
- B. Identify required lines, elevations, levels, contours, grades, and datum necessary to perform earthwork operations as indicated on Drawings.
- C. Examine Project Site with Contracting Officer before start of earthwork operations. Identify areas and prepare to brace or shore areas of adjacent property subject to rotation, slumping, or cave-in to prevent dislocation of adjacent soil, pavement, utilities, structures, or other items to remain.
- D. Verify that survey benchmark and intended elevations for Work are as indicated on Drawings. Short form contour designations are intended to be a continuing of the long form bench mark.
- E. Locate, identify, and protect existing utilities to remain and previously installed utilities that may be damaged by construction operations.
 - 1. Notify Contracting Officer and utility company immediately of utilities, not indicated on Drawings, encountered.
 - 2. Maintain existing utilities, active utilities, and drainage systems in operating condition.
 - 3. Comply with utility company requirements and directions of Contracting Officer to keep utilities in operation.
 - 4. Repair damage to utilities as directed by Contracting Officer.
- F. Protect plant life, lawns, fences, existing structures, sidewalks, paving and curbs from earthwork operations, excavating equipment, and vehicular traffic.
- G. Protect benchmarks, property corners, and other survey monuments from damage or displacement. Where markers are required to be removed, provide removal and reinstallation by licensed land surveyor licensed in State where project is located.



- H. Remove material encountered in grading operations that is unsuitable for backfilling, subgrade or foundation purposes as determined by Testing Laboratory and as directed by Contracting Officer. Dispose of materials off-site in an approved manner in accordance with requirements of authorities having jurisdiction.
- I. Prior to placing fill in low areas, such as previously existing creeks, ponds, or lakes, perform following procedures:
 - 1. Drain water out by gravity with ditch having flow line lower than lowest elevation in low area. If drainage cannot be performed by gravity ditch, use pumping equipment.
 - 2. After drainage of low area is complete, remove mulch, mud, debris, and other unsuitable material by using equipment and methods keeping natural soils underlying low areas dry and undisturbed.
 - 3. If proposed for fill, dry muck, mud, and other materials removed from low areas on-site by spreading in thin layers for inspection by Testing Laboratory and Contracting Officer. Place material determined by the Testing Laboratory and contracting Officer suitable for use as fill material into lowest elevation of site filling operation. Do not place under building subgrade pad or paving subgrade. If material is determined by the Testing Laboratory and Contracting Officer to be unsuitable, remove material from site.

3.3 EXCAVATION FOR FILLING AND GRADING

- A. Provide dewatering, drainage, and ground water management to control moisture of soils when performing grading operations during periods of wet weather.
- B. Shore, brace, and drain excavations to maintain excavations safe, secure, and free of water at all times.
- C. Provide protection for workers within trench areas in accordance with local, State, and Federal Occupational Safety and Health requirements and regulations.
- D. Unacceptable Fill Material for Building and Paving Areas: Excavated material containing rock or stone greater than 6 inches in largest dimension.
- E. Acceptable Fill Material:
 - 1. Rock or stone less than 6 inches in largest dimension as fill to within 24 inches of surface of proposed subgrade when mixed with suitable material.
 - 2. Rock or stone less than 2 inches in largest dimension mixed with suitable material as fill within the upper 24 inches of proposed subgrade.

3.4 FILLING AND SUBGRADE PREPARATION

- A. Fill areas to contours and elevations as indicated on Drawings with materials specified herein.
- B. Place fill in continuous lifts as specified herein.
- C. Refer to Section 312300 for filling requirements for structures, utilities, and pavements.

NOTE TO SPECIFIER

Edit below for appropriate minimum depths, percentages, and moisture content in accordance with the "Report of Subsurface Investigation."

- D. Areas Exposed by Excavation or Stripping:
 - 1. Scarify areas exposed by excavation or stripping on which building subgrade preparations are to be performed to minimum [8] [____] inch depth.



2. Compact to minimum [95] [____] percent optimum density in accordance with ASTM D 698 or [92] [____] percent optimum density in accordance with ASTM D 1557 at minimum moisture content [1] [____] percent below and maximum [3] [____] percent above optimum moisture content.
3. Proofroll to detect any areas of insufficient compaction by making minimum of [2] [____] complete passes with fully-loaded tandem-axle dump truck, or Contracting Officer approved equivalent, in each of two perpendicular directions under supervision and direction of Testing Laboratory and Contracting Officer.
4. Excavate and recompact areas failing to meet specified requirements.

NOTE TO SPECIFIER

Edit below for appropriate minimum depths, percentages, and moisture content in accordance with the "Report of Subsurface Investigation."

- E. Fill Material Placement:
 1. Place in [8] [____] inch maximum lifts compacted minimum [95] [____] percent optimum density in accordance with ASTM D 698 or [92] [____] percent optimum density in accordance with ASTM D 1557 at minimum moisture content of [1] [____] percent below and maximum moisture content [3] [____] percent above optimum moisture content.
- F. Provide material imported from off-site with CBR (California Bearing Ratio) or LBR (Limerock Bearing Ratio) value equal to or above pavement design subgrade CBR or LBR value indicated on Drawings.

3.5 MAINTENANCE OF SUBGRADE

- A. Verify finished subgrades for conformance to elevations as indicated on Drawings and for specified conditions for subgrade.
- B. Protect subgrade from excessive wheel loading during construction, including concrete trucks and dump trucks.
- C. Remove areas of finished subgrade with compaction density below specified density to depth required as directed by Testing Laboratory and Contracting Officer. Fill removed areas and compact to specified compaction density
- D. Provide surface of subgrade after compaction hard, uniform, smooth, stable, and true to grade and cross-section.

3.6 FINISH GRADING

- A. Grade areas other than paved areas and building pad areas to finish grade elevations or contours as indicated on Drawings including the following:
 1. Excavated areas.
 2. Filled and transition areas.
 3. Landscaped areas.
- B. Provide finish graded areas uniform and smooth, free from rocks, debris, or irregular surface changes with maximum tolerance of 0.10 feet above or below established finish subgrade elevation. Provide graded surfaces sloping uniformly between indicated elevations.
- C. Provide drainage ditches graded with uniform slope to allow drainage without ponding, minimizing potential for erosion. Refer to Section 312500 for procedures to protect slopes and control erosion.
- D. Refer to Section 313200 for soil stabilization using lime, cement, fly ash and geotextile fabric methods for subbase materials.
- E. Refer to Section 329113 for placing topsoil and fine grading in landscaped areas.



3.7 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Excavation: Notify Testing Laboratory and Contracting Officer for visual inspection of bearing surfaces, 48 hours prior to backfilling and other subsequent Work.

NOTE TO SPECIFIER

Edit below for extent of earthwork testing in accordance with the "Report of Subsurface Investigation." Engineer of Record will determine if Site Testing of earthwork is required based on conditions at Project Site and revise or delete Site Testing accordingly.

- C. Site Tests - Quantity:
1. Building Area Subgrade Pad:
 - a. Cut Areas: Minimum [one] [] compaction test for every [2500] [] square feet.
 - b. Fill Areas: Minimum [one] [] compaction test for every [2500] [] square feet for each [8] [] inch lift, measured loose.
 2. Areas Outside Building Area Subgrade Pad:
 - a. Cut Areas: Minimum [one] [] compaction test for every [10,000] [] square feet.
 - b. Fill Areas: Minimum [one] [] compaction test for every [10,000] [] square feet for each [8] [] inch lift, measured loose.
- D. Site Tests - Methods:
1. Perform tests on each type of existing on-site or imported off-site material used for compacted fill.
 - a. Moisture and Density Relationship: ASTM D 698 or ASTM D 1557.
 - b. Mechanical Analysis: AASHTO T-88
 - c. Plasticity Index: ASTM D 4318
 - 1) One optimum moisture-maximum density curve for each type of soil encountered.
 - 2) Report of actual unconfined compressive strength and bearing tests/results for each strata tested. Give "three-dimensional" description of each test location.
 2. Perform field density tests for in-place materials in accordance to one of the following standards:
 - a. Sand-Cone Method: ASTM D 1556
 - b. Balloon Method: ASTM D 2167
 - c. Nuclear Method: ASTM D 2922 (Method B-Direct Transmission)
 3. Perform a CBR (California Bearing Ratio) or LBR (Limerock Bearing Ratio) test for each type of imported off-site material in areas where pavement will be placed.
- E. If tests indicate the Work does not meet specified requirements, remove Work, replace, compact, and retest at no additional cost to United States Postal Service.

3.8 PROTECTION

- A. Protect building subgrade pad and building related earthwork from damage by construction operations and erosion.
- B. Prohibit vehicles from entering building subgrade pad area. Vehicles not permitted.
- C. Scarify surface, reshape, and compact areas damaged by construction operations or weather erosion.



END OF SECTION 31 20 00 00



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SECTION 31 23 00 00 - MPF EXCAVATION AND FILL

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

Use this section where Excavation and Fill is part of the Work. Before editing this Section, obtain the "Report of Subsurface Investigation" prepared by the Geotechnical Engineer. Read the report and incorporate the recommendations included in the report for excavation and fill into this Section.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE. The degree of complexity of this section is related to the amount of excavation and fill required for a particular Project Site. Engineer of Record editing this section must make decisions on the amount of detail for excavation and fill requirements remaining in completed section based on conditions of the Project Site.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Excavating and backfilling for structures, utilities, and pavement.
 - 2. Pipe bedding.
 - 3. Compacting fill materials.
 - 4. Borings and casings under roads.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 312000 - Earth Moving: Cutting, filling, and grading for proposed site improvements.
 - 2. Section 312317 - Rock Excavation: Removal of rock during excavation.
 - 3. Section 313200 - Soil Stabilization: Lime, cement, fly ash, and geotextile subgrade stabilizers.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM D698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort.
 - 2. ASTM D1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
- B. American Association of State Highway and Transportation Officials (AASHTO):



1. AASHTO T 180 - Moisture-Density relations of Soils Using a 10 Pound Rammer and an 18 Inch Drop.

C. American Water Works Association (AWWA):

1. AWWA C 200 - Steel Water Pipe, 6 Inch and Larger.
2. AWWA C 206 - Field Welding of Steel Water Pipe.

D. National Fire Protection Association (NFPA):

1. NFPA 70 - National Electric code.

1.3 DEFINITIONS

- A. Building Area Subgrade Pad: Portion of site directly beneath and within a line 10 feet beyond building and appurtenances including limits of any future building expansion areas indicated on Drawings.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

1. Shop Drawings:
 - a. Submit drawings or details indicating proposed alternate earthwork procedures or proposed procedures not indicated in Contract Documents.
 - b. Shop Drawings or details pertaining to Site Utilities are not required unless required by regulatory authorities or unless use of materials, methods, equipment, or procedures are contrary to Drawings or these specifications are proposed. Do not perform work until required shop drawings have been approved by Contracting Officer.
2. Assurance/Control Submittals:
 - a. Material Source: Submit name of imported materials suppliers. Provide materials from same source throughout the work. Change of source requires Contracting Officer approval.
 - b. Test Reports: Submit the following reports directly to Contracting Officer from Testing Laboratory, with copy to Contractor:
 - 1) Test reports on borrow material.
 - 2) Verification of each footing subgrade.
 - 3) Field density test reports.
 - 4) Optimum moisture-maximum density curve for each type of soil encountered.
 - 5) Report of actual unconfined compressive strength and bearing tests/results for each strata tested. Give "three-dimensional" description of each test location.
 - c. Certificates: Gradation and certification of aggregate material for Testing Laboratory review.
 - d. Qualification Documentation: Submit earthwork company documentation of experience indicating compliance with specified qualification requirements.

B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.

1. Project Record Documents: Accurately record the following.
 - a. Spot elevations for building area subgrade pad.
 - b. Location of existing utilities remaining, re-routed utilities, new utilities by horizontal dimensions, elevations or inverts, and slope gradients.

1.5 QUALITY ASSURANCE

- A. Qualifications: Earthwork company specializing in performing the Work of this Section with minimum 5 years documented experience.



- B. Regulatory Requirements: Perform earthwork in accordance with applicable requirements of governing authorities having jurisdiction.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Existing Conditions: Requirements specified in Section 312000.
- B. Existing Utilities: Requirements specified in Section 312000.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stockpiled on-site fill and backfill material specified in Section 312000, tested by Testing Laboratory and approved by Contracting Officer.
- B. Imported off-site fill and backfill material specified in Section 312000, tested by Testing Laboratory and approved by Contracting Officer.
- C. Pipe Bedding Material: Processed sand and gravel free from clay lumps, organic, or other deleterious material complying with the following gradation requirements:

SIEVE SIZE	PERCENT PASSING
1 Inch	100
3/4 Inch	90 to 100
3/8 Inch	20 to 55
No. 4	0 to 10
No. 8	0 to 5

- D. Steel Casing Pipe: AWWA C 200, minimum grade B; size and wall thickness as indicated on Drawings.
- E. Stabilization Fabrics and Geogrids:
 - 1. Mirafi 500X or 600X.
 - 2. Amoco Style #2002 Woven.
 - 3. Reemay Typar 3401 and 3601.
 - 4. Trevira S1114 and S1120.
 - 5. Tensar 1100 and 1200.
- F. Filter/Drainage Fabrics:
 - 1. Mirafi 140 N.
 - 2. Amoco Style #4546.
 - 3. Reemay Typar 3341.
 - 4. Carthage Mills, Carthage 6%.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.



- B. Verification of Conditions: Verify that field measurements, surfaces, and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to United States Postal Service.

3.2 PREPARATION

- A. Identify required lines, elevations, levels, contours, grades, and datum necessary to perform earthwork operations as indicated on Drawings.
- B. Verify that survey benchmark and intended elevations for the Work are as indicated on Drawings.
- C. Locate, identify, and protect existing utilities to remain and previously installed utilities that may be damaged by construction operations.
 - 1. Notify Contracting Officer, municipality, and utility company immediately of utilities, not indicated on Drawings, encountered.
 - 2. Maintain existing utilities, active utilities, and drainage systems in operating condition.
 - 3. Comply with utility company requirements and directions of Construction Manager to keep utilities in operation.
 - 4. Repair damage to utilities as directed by Contracting Officer.
- D. Protect plant life, lawns, fences, existing structures, sidewalks, paving and curbs from earthwork operations, excavating equipment, and vehicular traffic.
- E. Protect bench marks, property corners, and other survey monuments from damage or displacement. Where markers are required to be removed, provide removal and reinstallation by licensed land surveyor licensed in State where project is located.
- F. Overexcavate areas of building subgrade found consisting of unsuitable materials as determined by Testing Laboratory and Contracting Officer. Prepare, fill with suitable material, and compact as specified. Stabilize areas as specified in Section 313200.

3.3 EXCAVATION

- A. Excavation for filling and grading specified in Section 312000.
- B. Rock excavation specified in Section 312317.
- C. Excavation for Structures:
 - 1. Excavate subbase for building foundations, slabs-on-grade and site structures to width and depth indicated on Drawings.
 - a. Cut excavation banks vertically.
 - b. Remove rocks, loose soil, and debris from bottom of excavation.
 - c. Overexcavate wet or unsuitable soil from bottom of excavation.
 - d. Provide stable base for concrete reinforcing installation and concrete placement.
 - e. Hand trim to indicated lines and grades just prior to concrete reinforcing installation.
 - 2. Provide protection for workers within trench areas in accordance with local, state, and national Occupational Safety and Health requirements and regulations.
 - a. Trenches minimum 4 feet in depth.



3. During excavation, stockpile materials suitable for backfilling away from excavation to prevent overloading, slides, or cave-ins.
 4. Remove material encountered in excavating operations that is unsuitable for backfilling, subgrade or foundation purposes as determined by Testing Laboratory and Contracting Officer. Dispose of materials off-site in an approved manner in accordance with requirements of authorities having jurisdiction.
 5. Prevent surface water from flowing into excavations by temporary grading or other approved methods.
 - a. Do not allow water to accumulate in excavations.
 - b. Remove accumulated water in excavations.
 - c. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components required to remove water from excavations.
- D. Excavation for Utilities:
1. Excavate trench width and depth required for laying pipe, conduit, or cable. Cut trench banks vertical. Remove stones from bottom of trench as required to avoid point-bearing. Over excavate wet or unstable soil, if encountered, from trench bottom as required to provide suitable base for continuous and uniform bedding.
 2. During excavation, stockpile materials suitable for backfilling away from trench bank to prevent overloading, slides, or cave-ins.
 3. Remove material encountered in trenching operations that is unsuitable for backfilling, subgrade or foundation purposes as determined by Testing Laboratory and Contracting Officer. Dispose of materials off-site in an approved manner in accordance with requirements of authorities having jurisdiction.
 4. Prevent surface water from flowing into trenches or other excavations by temporary grading or other approved methods.
 - a. Do not allow water to accumulate in excavations.
 - b. Remove accumulated water in excavations.
 - c. Provide and maintain pumps, well points, sumps, suction and discharge lines and other dewatering system components required to remove water from excavations.
 5. Open cut excavation using trenching machine or backhoe. Do not use dirt clods for backfill created by use of machines other than ladder or wheel-type trenching machines.
 6. Grade trench bottom to provide uniform bearing and support for each section of pipe on bedding material along entire trench length, except where necessary to excavate for bell holes, proper sealing of pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Do not excavate trench deeper, longer, or wider than required to make proper joint connection.
 7. Excavate trench width below the top of pipe minimum 300 mm wide and maximum 460 mm wider than outside surface of pipe or conduit installed to elevations and grades indicated on Drawings. Excavate trench width for other pipe, conduit, or cable to least practical width allowing for proper compaction of trench backfill.
 8. Excavate trench depth measured from finished grade or paved surface to the following requirements or applicable codes and ordinances:
 - a. Water Mains: 30 inches to top of pipe barrel or 6 inches below frost line established by local building official, whichever is deeper.
 - b. Sanitary Sewer: Elevations, and grades indicated on Drawings.
 - c. Storm Sewer: Depths, elevations, and grades indicated on Drawings.
 - d. Electrical Conduits: 24 inches minimum to top of conduit or as required by NFPA 70, or local utility company requirements, whichever is deeper.
 - e. TV Conduits: 18 inches minimum to top of conduit or as required by local utility company, whichever is deeper.
 - f. Telephone Conduits: 18 inches minimum to top of conduit, or as required by local utility company, whichever is deeper.
 - g. Gas Mains and Service: 30 inches minimum to top of pipe, or as required by local utility company, whichever is deeper.



9. Provide shoring, sheeting, and bracing, as required, in trenches and other excavations where protection of construction personnel is required. Sheeting may be removed after sufficient backfilling to protect against damaging or injurious caving.

E. Excavation for Pavement:

1. Excavate roadway and pavement areas to line and grade indicated on Drawings.
2. Stockpile excavated material suitable for backfilling on-site.
3. Remove excavated materials not required or not suitable for backfill from site.
4. Overexcavate areas of pavement subgrade found to contain unsuitable material. Prepare, fill with suitable material, and compact as specified. Stabilize areas as specified in Section 313200.

3.4 PIPE BEDDING

- A. Excavate trenches, for pipe or conduit installed to elevations indicated on Drawings, 4 inches below bottom of pipe and to width as specified. Place 4 inches of bedding material, compact in bottom of trench, and shape to conform to lower portion of pipe barrel. After pipe installation, backfill and compact to top of trench.
- B. Place geotextile fabric as indicated on Drawings.

3.5 BACKFILLING AND SUBGRADE PREPARATION

- A. Backfilling:
 1. Verify that imported off-site fill and stockpiled on-site fill is tested and approved.
 2. Verify that foundation perimeter drainage installation is inspected and approved.
 3. Verify that foundation or below grade structure walls are braced to support surcharge forces imposed by backfilling operations.
 4. Verify that backfill areas are free of debris, snow, ice, or water, and that ground surfaces are not frozen.
- B. Prepare building area subgrade pad in accordance with foundation subsurface preparation information indicated on Drawings and specified herein. Do not use rock larger than 6 inches for building subgrade fill.

NOTE TO SPECIFIER

Edit below for appropriate minimum depths, percentages, and moisture content in accordance with the "Report of Subsurface Investigation."

- C. Areas Exposed by Excavation or Stripping:
 1. Scarify areas exposed by excavation or stripping on which building subgrade preparations are to be performed to minimum [8] [____] inch depth.
 2. Compact to minimum [95] [____] percent optimum density in accordance with ASTM D1557 (Modified Proctor) at minimum moisture content [1] [____] percent below and maximum [3] [____] percent above optimum moisture content.
 3. Proofroll to detect any areas of insufficient compaction by making minimum of 2 complete passes with fully-loaded tandem-axle dump truck, or Contracting Officer approved equivalent, in each of two perpendicular directions under supervision and direction of Contracting Officer.
 4. Excavate and recompact areas failing to meet specified requirements.

NOTE TO SPECIFIER

Edit below for appropriate minimum depths, percentages, moisture content, and plasticity index in accordance with the "Report of Subsurface Investigation."



D. Fill Material Placement:

1. Place in [8] [____] inch maximum lifts compacted minimum [95] [____] percent optimum density in accordance with ASTM D1557 (Modified Proctor) at minimum moisture content of [1] [____] percent below and maximum moisture content [3] [____] percent above optimum moisture content.
2. Maximum allowable values for plasticity index (PI) and liquid limit (LL) of suitable fill materials to be used as fill in the specified areas, unless indicated otherwise on Drawings:

a. LOCATION	PI	LL
b. Building area, below upper 4 feet	[30] [____]	[40] [____]
c. of proposed subgrade elevation		
d. Building area, upper 4 feet	[20] [____]	[30] [____]
e. of proposed subgrade elevation		
f. Paving area, below upper 4 feet	[30] [____]	[40] [____]
g. of proposed subgrade elevation		
h. Paving area, upper 4 feet	[20] [____]	[30] [____]
i. of proposed subgrade elevation		

- E. Provide material imported from off-site with CBR (California Bearing Ratio) or LBR (Limerock Bearing Ratio) value equal to or above pavement design subgrade CBR or LBR value indicated on Drawings.

3.6 MAINTENANCE OF SUBGRADE

- A. Verify finished subgrades for elevations indicated on Drawings and specified conditions for construction above subgrade.
- B. Protect subgrade from excessive wheel loading during construction, including concrete trucks and dump trucks.
- C. Remove areas of finished subgrade found to have insufficient compaction density. Replace in a manner that will comply with compaction requirements as directed by Contracting Officer. Provide hard, uniform, smooth, stable surface, true to grade and cross-section after completion of compaction.

3.7 BORINGS AND CASINGS UNDER ROADS

- A. Install street, road, or highway crossings for utility mains by jacking and boring method in accordance with requirements of governing authorities having jurisdiction.
- B. Locate approach pits and trenches within right- of-way of street, road, highway, or railroad distance from paving permitting traffic to pass without interference. Tamp backfill for approach pits and trenches within right- of-way in layers not greater than 6 inches thick for entire length and depth of trench or pit. Compact backfill to 95 percent of maximum density obtained at optimum moisture as determined by AASHTO T 180, Method A (Modified Proctor). Mechanical tampers may be used after cover of 6 inches has been obtained over top of pipe barrel.
- C. Use commercial type boring rig providing hole bored to proper alignment and grade within 2 inches of same diameter as largest outside joint diameter of pipe installed. Install pipe in hole immediately after bore has been made, and in no instance shall hole be left open while unattended.
- D. Clean and prime interior and exterior of casing pipe; apply two coats of asphalt in accordance with requirements of governing authorities having jurisdiction.
- E. Butt weld steel casing. Weld using full penetration single butt-welds in accordance with AWWA C 206.



- F. Install casing and utility pipe with end seals, vent pipe, and other special equipment in accordance with requirements of governing authorities having jurisdiction.
- G. Paving Damage Caused by Contractor Construction Operations:
 - 1. Repair paving where cracks occur on either side of line where pipe was installed by removing damaged paving between cracks, sawcutting paving in straight line at a point sufficiently beyond location of cracks for repair, and placing new paving to match existing in areas where paving removed.
 - 2. Make repairs to the satisfaction of paving owner.
 - 3. Make repairs at no additional cost to United States Postal Service within one year from Date of Substantial Completion.

3.8 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Excavation: Notify Testing Laboratory and Contracting Officer for visual inspection of bearing surfaces, 48 hours prior to backfilling and other subsequent Work.

NOTE TO SPECIFIER

Edit below for extent of earthwork testing accordance with the "Report of Subsurface Investigation." Engineer of Record will determine if Site Testing of earthwork is required based on conditions at Project Site and revise or delete Site Testing accordingly.

- C. Site Tests:
 - 1. Specified in Section 312000.
 - 2. Tests for Building Area Subgrade Pad:
 - a. Cut Areas: Minimum [one] [____] compaction test for every [2500] [____] square feet.
 - b. Fill Areas: Minimum [one] [____] compaction test for every [2500] [____] square feet for each [8] [____] inch lift measured loose.
 - 3. Tests for areas outside building area subgrade pad specified in Section 312000.
- D. If tests indicate the Work does not meet specified requirements, remove Work, replace, compact and retest at no additional cost to United States Postal Service.

3.9 PROTECTION

- A. Protect building subgrade pad and building related earthwork from damage by construction operations and erosion.
- B. Prohibit vehicles from entering building subgrade pad area. Vehicles not permitted.
- C. Scarify surface, reshape, and compact areas damaged by construction operations or weather erosion.

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END OF SECTION 31 23 00 00



SECTION 31 23 00 00 - CSF EXCAVATION AND FILL

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Excavation and Fill is part of the Work. Before editing this Section, obtain the "Report of Subsurface Investigation" prepared by the Geotechnical Engineer. Read the report and incorporate the recommendations included in the report for excavation and fill into this Section.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE. The degree of complexity of this section is related to the amount of excavation and fill required for a particular Project Site. Engineer of Record editing this section must make decisions on the amount of detail for excavation and fill requirements remaining in completed section based on conditions of the Project Site.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Excavating and backfilling for structures, utilities, and pavement.
 2. Pipe bedding.
 3. Compacting fill materials.
 4. Borings and casings under roads.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 1. Section 312000 - Earth Moving: Cutting, filling, and grading for proposed site improvements.
 2. Section 312317 - Rock Excavation: Removal of rock during excavation.
 3. Section 313200 - Soil Stabilization: Lime, cement, fly ash, and geotextile subgrade stabilizers.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 1. ASTM D698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort.
 2. ASTM D1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
- B. American Association of State Highway and Transportation Officials (AASHTO):



1. AASHTO T 180 - Moisture-Density relations of Soils Using a 10 Pound Rammer and an 18 Inch Drop.

C. American Water Works Association (AWWA):

1. AWWA C 200 - Steel Water Pipe, 6 Inch and Larger.
2. AWWA C 206 - Field Welding of Steel Water Pipe.

D. National Fire Protection Association (NFPA):

1. NFPA 70 - National Electric code.

1.3 DEFINITIONS

- A. Building Area Subgrade Pad: Portion of site directly beneath and within a line 10 feet beyond building and appurtenances including limits of any future building expansion areas indicated on Drawings.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

1. Shop Drawings:

- a. Submit drawings or details indicating proposed alternate earthwork procedures or proposed procedures not indicated in Contract Documents.
- b. Shop Drawings or details pertaining to Site Utilities are not required unless required by regulatory authorities or unless use of materials, methods, equipment, or procedures are contrary to Drawings or these specifications are proposed. Do not perform work until required shop drawings have been approved by Contracting Officer.

2. Assurance/Control Submittals:

- a. Material Source: Submit name of imported materials suppliers. Provide materials from same source throughout the work. Change of source requires Contracting Officer approval.
- b. Test Reports: Submit the following reports directly to Contracting Officer from Testing Laboratory, with copy to Contractor:
 - 1) Test reports on borrow material.
 - 2) Verification of each footing subgrade.
 - 3) Field density test reports.
 - 4) Optimum moisture-maximum density curve for each type of soil encountered.
 - 5) Report of actual unconfined compressive strength and bearing tests/results for each strata tested. Give "three-dimensional" description of each test location.
- c. Certificates: Gradation and certification of aggregate material for Testing Laboratory review.
- d. Qualification Documentation: Submit earthwork company documentation of experience indicating compliance with specified qualification requirements.

B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.

1. Project Record Documents: Accurately record the following.

- a. Spot elevations for building area subgrade pad.
- b. Location of existing utilities remaining, re-routed utilities, new utilities by horizontal dimensions, elevations or inverts, and slope gradients.

1.5 QUALITY ASSURANCE

- A. Qualifications: Earthwork company specializing in performing the Work of this Section with minimum 5 years documented experience.



- B. Regulatory Requirements: Perform earthwork in accordance with applicable requirements of governing authorities having jurisdiction.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Existing Conditions: Requirements specified in Section 312000.
- B. Existing Utilities: Requirements specified in Section 312000.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stockpiled on-site fill and backfill material specified in Section 312000, tested by Testing Laboratory and approved by Contracting Officer.
- B. Imported off-site fill and backfill material specified in Section 312000, tested by Testing Laboratory and approved by Contracting Officer.
- C. Pipe Bedding Material: Processed sand and gravel free from clay lumps, organic, or other deleterious material complying with the following gradation requirements:

SIEVE SIZE	PERCENT PASSING
1 Inch	100
3/4 Inch	90 to 100
3/8 Inch	20 to 55
No. 4	0 to 10
No. 8	0 to 5

- D. Steel Casing Pipe: AWWA C 200, minimum grade B; size and wall thickness as indicated on Drawings.
- E. Stabilization Fabrics and Geogrids:
 - 1. Mirafi 500X or 600X.
 - 2. Amoco Style #2002 Woven.
 - 3. Reemay Typar 3401 and 3601.
 - 4. Trevira S1114 and S1120.
 - 5. Tensar 1100 and 1200.
- F. Filter/Drainage Fabrics:
 - 1. Mirafi 140 N.
 - 2. Amoco Style #4546.
 - 3. Reemay Typar 3341.
 - 4. Carthage Mills, Carthage 6%.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.



- B. Verification of Conditions: Verify that field measurements, surfaces, and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to United States Postal Service.

3.2 PREPARATION

- A. Identify required lines, elevations, levels, contours, grades, and datum necessary to perform earthwork operations as indicated on Drawings.
- B. Verify that survey benchmark and intended elevations for the Work are as indicated on Drawings.
- C. Locate, identify, and protect existing utilities to remain and previously installed utilities that may be damaged by construction operations.
 - 1. Notify Contracting Officer, municipality, and utility company immediately of utilities, not indicated on Drawings, encountered.
 - 2. Maintain existing utilities, active utilities, and drainage systems in operating condition.
 - 3. Comply with utility company requirements and directions of Construction Manager to keep utilities in operation.
 - 4. Repair damage to utilities as directed by Contracting Officer.
- D. Protect plant life, lawns, fences, existing structures, sidewalks, paving and curbs from earthwork operations, excavating equipment, and vehicular traffic.
- E. Protect bench marks, property corners, and other survey monuments from damage or displacement. Where markers are required to be removed, provide removal and reinstallation by licensed land surveyor licensed in State where project is located.
- F. Overexcavate areas of building subgrade found consisting of unsuitable materials as determined by Testing Laboratory and Contracting Officer. Prepare, fill with suitable material, and compact as specified. Stabilize areas as specified in Section 313200.

3.3 EXCAVATION

- A. Excavation for filling and grading specified in Section 312000.
- B. Rock excavation specified in Section 312317.
- C. Excavation for Structures:
 - 1. Excavate subbase for building foundations, slabs-on-grade and site structures to width and depth indicated on Drawings.
 - a. Cut excavation banks vertically.
 - b. Remove rocks, loose soil, and debris from bottom of excavation.
 - c. Overexcavate wet or unsuitable soil from bottom of excavation.
 - d. Provide stable base for concrete reinforcing installation and concrete placement.
 - e. Hand trim to indicated lines and grades just prior to concrete reinforcing installation.
 - 2. Provide protection for workers within trench areas in accordance with local, state, and national Occupational Safety and Health requirements and regulations.
 - a. Trenches minimum 4 feet in depth.



3. During excavation, stockpile materials suitable for backfilling away from excavation to prevent overloading, slides, or cave-ins.
 4. Remove material encountered in excavating operations that is unsuitable for backfilling, subgrade or foundation purposes as determined by Testing Laboratory and Contracting Officer. Dispose of materials off-site in an approved manner in accordance with requirements of authorities having jurisdiction.
 5. Prevent surface water from flowing into excavations by temporary grading or other approved methods.
 - a. Do not allow water to accumulate in excavations.
 - b. Remove accumulated water in excavations.
 - c. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components required to remove water from excavations.
- D. Excavation for Utilities:
1. Excavate trench width and depth required for laying pipe, conduit, or cable. Cut trench banks vertical. Remove stones from bottom of trench as required to avoid point-bearing. Over excavate wet or unstable soil, if encountered, from trench bottom as required to provide suitable base for continuous and uniform bedding.
 2. During excavation, stockpile materials suitable for backfilling away from trench bank to prevent overloading, slides, or cave-ins.
 3. Remove material encountered in trenching operations that is unsuitable for backfilling, subgrade or foundation purposes as determined by Testing Laboratory and Contracting Officer. Dispose of materials off-site in an approved manner in accordance with requirements of authorities having jurisdiction.
 4. Prevent surface water from flowing into trenches or other excavations by temporary grading or other approved methods.
 - a. Do not allow water to accumulate in excavations.
 - b. Remove accumulated water in excavations.
 - c. Provide and maintain pumps, well points, sumps, suction and discharge lines and other dewatering system components required to remove water from excavations.
 5. Open cut excavation using trenching machine or backhoe. Do not use dirt clods for backfill created by use of machines other than ladder or wheel-type trenching machines.
 6. Grade trench bottom to provide uniform bearing and support for each section of pipe on bedding material along entire trench length, except where necessary to excavate for bell holes, proper sealing of pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Do not excavate trench deeper, longer, or wider than required to make proper joint connection.
 7. Excavate trench width below the top of pipe minimum 300 mm wide and maximum 460 mm wider than outside surface of pipe or conduit installed to elevations and grades indicated on Drawings. Excavate trench width for other pipe, conduit, or cable to least practical width allowing for proper compaction of trench backfill.
 8. Excavate trench depth measured from finished grade or paved surface to the following requirements or applicable codes and ordinances:
 - a. Water Mains: 30 inches to top of pipe barrel or 6 inches below frost line established by local building official, whichever is deeper.
 - b. Sanitary Sewer: Elevations, and grades indicated on Drawings.
 - c. Storm Sewer: Depths, elevations, and grades indicated on Drawings.
 - d. Electrical Conduits: 24 inches minimum to top of conduit or as required by NFPA 70, or local utility company requirements, whichever is deeper.
 - e. TV Conduits: 18 inches minimum to top of conduit or as required by local utility company, whichever is deeper.
 - f. Telephone Conduits: 18 inches minimum to top of conduit, or as required by local utility company, whichever is deeper.
 - g. Gas Mains and Service: 30 inches minimum to top of pipe, or as required by local utility company, whichever is deeper.



9. Provide shoring, sheeting, and bracing, as required, in trenches and other excavations where protection of construction personnel is required. Sheeting may be removed after sufficient backfilling to protect against damaging or injurious caving.

E. Excavation for Pavement:

1. Excavate roadway and pavement areas to line and grade indicated on Drawings.
2. Stockpile excavated material suitable for backfilling on-site.
3. Remove excavated materials not required or not suitable for backfill from site.
4. Overexcavate areas of pavement subgrade found to contain unsuitable material. Prepare, fill with suitable material, and compact as specified. Stabilize areas as specified in Section 313200.

3.4 PIPE BEDDING

- A. Excavate trenches, for pipe or conduit installed to elevations indicated on Drawings, 4 inches below bottom of pipe and to width as specified. Place 4 inches of bedding material, compact in bottom of trench, and shape to conform to lower portion of pipe barrel. After pipe installation, backfill and compact to top of trench.
- B. Place geotextile fabric as indicated on Drawings.

3.5 BACKFILLING AND SUBGRADE PREPARATION

- A. Backfilling:
 1. Verify that imported off-site fill and stockpiled on-site fill is tested and approved.
 2. Verify that foundation perimeter drainage installation is inspected and approved.
 3. Verify that foundation or below grade structure walls are braced to support surcharge forces imposed by backfilling operations.
 4. Verify that backfill areas are free of debris, snow, ice, or water, and that ground surfaces are not frozen.
- B. Prepare building area subgrade pad in accordance with foundation subsurface preparation information indicated on Drawings and specified herein. Do not use rock larger than 6 inches for building subgrade fill.

NOTE TO SPECIFIER

Edit below for appropriate minimum depths, percentages, and moisture content in accordance with the "Report of Subsurface Investigation."

- C. Areas Exposed by Excavation or Stripping:
 1. Scarify areas exposed by excavation or stripping on which building subgrade preparations are to be performed to minimum [8] [____] inch depth.
 2. Compact to minimum [95] [____] percent optimum density in accordance with ASTM D1557 (Modified Proctor) at minimum moisture content [1] [____] percent below and maximum [3] [____] percent above optimum moisture content.
 3. Proofroll to detect any areas of insufficient compaction by making minimum of 2 complete passes with fully-loaded tandem-axle dump truck, or Contracting Officer approved equivalent, in each of two perpendicular directions under supervision and direction of Contracting Officer.
 4. Excavate and recompact areas failing to meet specified requirements.

NOTE TO SPECIFIER

Edit below for appropriate minimum depths, percentages, moisture content, and plasticity index in accordance with the "Report of Subsurface Investigation."



D. Fill Material Placement:

1. Place in [8] [____] inch maximum lifts compacted minimum [95] [____] percent optimum density in accordance with ASTM D1557 (Modified Proctor) at minimum moisture content of [1] [____] percent below and maximum moisture content [3] [____] percent above optimum moisture content.
2. Maximum allowable values for plasticity index (PI) and liquid limit (LL) of suitable fill materials to be used as fill in the specified areas, unless indicated otherwise on Drawings:

a. LOCATION	PI	LL
b. Building area, below upper 4 feet	[30] [____]	[40] [____]
c. of proposed subgrade elevation		
d. Building area, upper 4 feet	[20] [____]	[30] [____]
e. of proposed subgrade elevation		
f. Paving area, below upper 4 feet	[30] [____]	[40] [____]
g. of proposed subgrade elevation		
h. Paving area, upper 4 feet	[20] [____]	[30] [____]
i. of proposed subgrade elevation		

- E. Provide material imported from off-site with CBR (California Bearing Ratio) or LBR (Limerock Bearing Ratio) value equal to or above pavement design subgrade CBR or LBR value indicated on Drawings.

3.6 MAINTENANCE OF SUBGRADE

- A. Verify finished subgrades for elevations indicated on Drawings and specified conditions for construction above subgrade.
- B. Protect subgrade from excessive wheel loading during construction, including concrete trucks and dump trucks.
- C. Remove areas of finished subgrade found to have insufficient compaction density. Replace in a manner that will comply with compaction requirements as directed by Contracting Officer. Provide hard, uniform, smooth, stable surface, true to grade and cross-section after completion of compaction.

3.7 BORINGS AND CASINGS UNDER ROADS

- A. Install street, road, or highway crossings for utility mains by jacking and boring method in accordance with requirements of governing authorities having jurisdiction.
- B. Locate approach pits and trenches within right- of-way of street, road, highway, or railroad distance from paving permitting traffic to pass without interference. Tamp backfill for approach pits and trenches within right- of-way in layers not greater than 6 inches thick for entire length and depth of trench or pit. Compact backfill to 95 percent of maximum density obtained at optimum moisture as determined by AASHTO T 180, Method A (Modified Proctor). Mechanical tampers may be used after cover of 6 inches has been obtained over top of pipe barrel.
- C. Use commercial type boring rig providing hole bored to proper alignment and grade within 2 inches of same diameter as largest outside joint diameter of pipe installed. Install pipe in hole immediately after bore has been made, and in no instance shall hole be left open while unattended.
- D. Clean and prime interior and exterior of casing pipe; apply two coats of asphalt in accordance with requirements of governing authorities having jurisdiction.
- E. Butt weld steel casing. Weld using full penetration single butt-welds in accordance with AWWA C 206.



- F. Install casing and utility pipe with end seals, vent pipe, and other special equipment in accordance with requirements of governing authorities having jurisdiction.
- G. Paving Damage Caused by Contractor Construction Operations:
 - 1. Repair paving where cracks occur on either side of line where pipe was installed by removing damaged paving between cracks, sawcutting paving in straight line at a point sufficiently beyond location of cracks for repair, and placing new paving to match existing in areas where paving removed.
 - 2. Make repairs to the satisfaction of paving owner.
 - 3. Make repairs at no additional cost to United States Postal Service within one year from Date of Substantial Completion.

3.8 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Excavation: Notify Testing Laboratory and Contracting Officer for visual inspection of bearing surfaces, 48 hours prior to backfilling and other subsequent Work.

NOTE TO SPECIFIER

Edit below for extent of earthwork testing accordance with the "Report of Subsurface Investigation." Engineer of Record will determine if Site Testing of earthwork is required based on conditions at Project Site and revise or delete Site Testing accordingly.

- C. Site Tests:
 - 1. Specified in Section 312000.
 - 2. Tests for Building Area Subgrade Pad:
 - a. Cut Areas: Minimum [one] [____] compaction test for every [2500] [____] square feet.
 - b. Fill Areas: Minimum [one] [____] compaction test for every [2500] [____] square feet for each [8] [____] inch lift measured loose.
 - 3. Tests for areas outside building area subgrade pad specified in Section 312000.
- D. If tests indicate the Work does not meet specified requirements, remove Work, replace, compact and retest at no additional cost to United States Postal Service.

3.9 PROTECTION

- A. Protect building subgrade pad and building related earthwork from damage by construction operations and erosion.
- B. Prohibit vehicles from entering building subgrade pad area. Vehicles not permitted.
- C. Scarify surface, reshape, and compact areas damaged by construction operations or weather erosion.

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Last revised: 4/12/2011

END OF SECTION 31 23 00 00

SECTION 31 23 16 13 - EXCAVATION SUPPORT AND PROTECTION**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for excavation support and protection. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Performance Requirements

1. Design, **as directed**, furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.
 - a. Delegated Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
 - b. Prevent surface water from entering excavations by grading, dikes, or other means.
 - c. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.
 - d. Monitor vibrations, settlements, and movements.

C. Submittals

1. Shop Drawings: For excavation support and protection system.
2. Delegated-Design Submittal: For excavation support and protection system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Quality Assurance

1. Preinstallation Conference: Conduct conference at Project site.

E. Project Conditions

1. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of utility.
 - b. Do not proceed with interruption of utility without the Owner's written permission.
2. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
 - a. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify the Owner if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

1.2 PRODUCTS**A. Materials**

1. General: Provide materials that are either new or in serviceable condition.
2. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.
3. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.



- a. Corners: Site-fabricated mechanical interlock **OR** Roll-formed corner shape with continuous interlock, **as directed**.
- 4. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of size and strength required for application, **OR** 3 inches (75 mm) **OR** 4 inches (100 mm), **as directed**.
- 5. Shotcrete: Comply with Division 03 Section "Shotcrete" for shotcrete materials and mixes, reinforcement, and shotcrete application.
- 6. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.
- 7. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- 8. Tiebacks: Steel bars, ASTM A 722/A 722M.
- 9. Tiebacks: Steel strand, ASTM A 416/A 416M.

1.3 EXECUTION

A. Preparation

- 1. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
 - a. Shore, support, and protect utilities encountered.
- 2. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - a. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- 3. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces are not impeded.
- 4. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.
- 5. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

B. Soldier Piles And Lagging

- 1. Install steel soldier piles before starting excavation. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches (50 mm) from a horizontal line and not more than 1:120 out of vertical alignment.
- 2. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.
- 3. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

C. Sheet Piling

- 1. Before starting excavation, install one-piece sheet piling lengths and tightly interlock to form a continuous barrier. Accurately place the piling, using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer. Limit vertical offset of adjacent sheet piling to 60 inches (1500 mm). Accurately align exposed faces of sheet piling to vary not more than 2 inches (50 mm) from a horizontal line and not more than 1:120 out of vertical alignment. Cut tops of sheet piling to uniform elevation at top of excavation.

D. Tiebacks

- 1. Tiebacks: Drill, install, grout, and tension tiebacks. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.
 - a. Test loading shall be observed by a qualified professional engineer responsible for design of excavation support and protection system.



- b. Maintain tiebacks in place until permanent construction is able to withstand lateral soil and hydrostatic pressures.
- E. Bracing
 - 1. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.
 - a. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by the Owner.
 - b. Install internal bracing, if required, to prevent spreading or distortion of braced frames.
 - c. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.
- F. Removal And Repairs
 - 1. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.
 - a. Remove excavation support and protection systems to a minimum depth of 48 inches (1200 mm) below overlaying construction and abandon remainder.
 - b. Fill voids immediately with approved backfill compacted to density specified in Division 31 Section "Earth Moving".
 - c. Repair or replace, as approved by the Owner, adjacent work damaged or displaced by removing excavation support and protection systems.
 - 2. Leave excavation support and protection systems permanently in place.

END OF SECTION 31 23 16 13



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Task	Specification	Specification Description
31 23 16 13	31 00 00 00	Earthwork
31 23 16 26	31 00 00 00	Earthwork
31 23 16 33	31 00 00 00	Earthwork
31 23 16 36	31 23 16 13	Excavation Support And Protection
31 23 16 36	31 00 00 00	Earthwork
31 23 16 43	31 23 16 13	Excavation Support And Protection
31 23 16 43	31 00 00 00	Earthwork



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SECTION 31 23 17 00 - MPF ROCK EXCAVATION

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

Use this section where Rock Excavation is part of the Work. Before editing this Section, obtain the "Report of Subsurface Investigation" prepared by the Geotechnical Engineer. Read the report and incorporate the recommendations included in the report for Rock Excavation into this section.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Removal of identified and discovered rock during excavation.
 - 2. Incorporating removed rock into fills and embankments.

NOTE TO SPECIFIER

Use subparagraph below when EXPLOSIVES are PERMITTED.

- 3. Use of explosives to assist rock removal.

- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

- C. Related Sections:
 - 1. Section 312000 - Earth Moving: Cutting, Filling, and grading for site improvements.

- 2. Section 312300 - Excavation and Fill: Earthwork for structures, utilities and pavement.

NOTE TO SPECIFIER

Use REFERENCES below when EXPLOSIVES are PERMITTED.

1.2 REFERENCES

- A. National Fire Protection Association (NFPA):
 - 1. NFPA 495 - Code For Explosive Materials.



NOTE TO SPECIFIER

Use *SUBMITTALS* below when *EXPLOSIVES* are *PERMITTED*.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
1. Explosives: Indicate proposed method of blasting, delay pattern, explosive types, type of blasting mat or cover, and intended rock recovery method.
 2. Assurance/Control Submittals.
 - a. Qualification Documentation: Submit seismic survey firm and explosives firm documentation of experience indicating compliance with specified qualification requirements.

1.4 QUALITY ASSURANCE

NOTE TO SPECIFIER

Use *QUALIFICATIONS FOR EXPLOSIVES* below when *EXPLOSIVES* are *PERMITTED*.

- A. Qualifications for Explosives:
1. Seismic Survey Firm: Company specializing in seismic surveys with five years documented experience.
 2. Explosives Firm: Company specializing in explosives for destruction for removal of subsurface rock with five years documented experience.
- B. Regulatory Requirements:
1. Perform rock removal in accordance with applicable requirements of governing authorities having jurisdiction.

NOTE TO SPECIFIER

Use subparagraphs 2 & 3 below when *EXPLOSIVES* are *PERMITTED*.

2. Comply with all laws, rules, and regulations of Federal, State and local authorities which govern storage, use, manufacture, sale, handling, transportation, licensing, or other disposition of explosives. Take special precautions for proper use of explosives to prevent harm to human life and damage to surface structures, all utility lines, or other subsurface structures. Do not conduct blasting operations until persons in vicinity have had ample notice and have reached positions of safety.
3. Obtain permits from authorities having jurisdiction before explosives are brought to site or drilling for setting of explosives is started.
 - a. Notify Contracting Officer of schedule and procedures prior to explosive use.

NOTE TO SPECIFIER

Use *PRE-INSTALLATION MEETING* below when *EXPLOSIVES* are *PERMITTED*.

- C. Pre-Installation Meeting:
1. Convene a pre-installation meeting one week prior to commencing Work of this Section.
 2. Require attendance of parties directly affecting Work of this Section.
 3. Review conditions for use of explosives in rock removal operations, explosive rock removal procedures and coordination with related Work.



4. Agenda:
 - a. Tour, inspect and discuss conditions of existing soils and rock encountered.
 - b. Review blast control measures and requirements.
 - c. Review safety precautions relating to use of explosives
 - d. Review types of explosives to be used.
 - e. Review required submittals, both completed and yet to be completed.
 - f. Review and finalize construction schedule relating to explosive rock removal, and verify availability of materials, personnel, equipment and facilities needed to make progress and avoid delays.
 - g. Review required inspections, certifying, and material usage accounting procedures.
 - h. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.

1.5 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements: Determine all environmental effects associated with proposed rock removal Work and safeguard those concerns as regulated by law and authorities having jurisdiction by approved methods.

NOTE TO SPECIFIER

OPTION 1: Use paragraph below when EXPLOSIVES are NOT Permitted.

- B. Explosives: Not permitted.

NOTE TO SPECIFIER

OPTION 2: Use paragraph below when EXPLOSIVES are PERMITTED.

- C. Explosives: Do not bring explosives onto site or use in Work without prior written permission from Contracting Officer and authorities having jurisdiction. Comply with requirements of NFPA 495. Contractor is solely responsible for handling, storage, and use of explosive materials when their use is permitted.
 1. Hold harmless the Architect, Engineer and United States Postal Service from any claim resulting from use of explosives. Removal of materials of any nature by blasting shall be done in such a manner and such time as to avoid damage affecting the integrity of design and to avoid damage to any new or existing structure included in or adjacent to work. It shall be contractors responsibility to determine method of operation to ensure desired results and integrity of completed work.
- D. Existing Conditions:
 1. Geotechnical Data:
 - a. Reports of Subsurface Investigation and data are not a part of Contract Documents.
 - b. Soil and subsurface investigations were conducted at the site by an independent testing laboratory and a report with log of borings prepared. This report was obtained for USPS design use only.
 - c. A copy of the report is provided by Contracting Officer and is made available for convenience of the Contractor.
 - d. Soils investigation data is not warranted to indicate actual conditions. Owner and Architect/Engineer do not assume responsibility for variations in kind, depth, quantity and condition of soils; they disclaim responsibility for accuracy, true location, and extent of soils investigation that has been prepared by others; and they further disclaim responsibility for interpretation of that data by Contractor as in projecting soil bearing values, rock profiles, soil stability, and presence, level, and extent of underground water.
 - e. Additional test borings and other exploratory operations may be made by Contractor at no additional cost to United States Postal Service.



2. Immediately report any discrepancy between Contract Documents and amount and type of rock to be removed to Contracting Officer.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

OPTION 1: Use "Not Used" below when EXPLOSIVES are NOT Permitted.

NOTE TO SPECIFIER

OPTION 2: Use MATERIALS below when EXPLOSIVES are PERMITTED.

2.1 MATERIALS

- A. Explosives, Detonator/Delay Devices and Blasting Mat Materials: NFPA 495; Type recommended by explosive firm following a seismic survey and required by authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to for rock excavation to begin.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 ROCK EXCAVATION

- A. Perform rock excavation in a manner that will produce material of such size as to permit it being placed in embankments in accordance with Section 312000. Remove rock to limits indicated. Remove loose or shattered rock, overhanging ledges and boulders which might dislodge.
- B. Rock Excavation - Mechanical Method:
 1. Excavate for and remove rock by mechanical method. Drill holes and utilize expansive tools and wedges to fracture rock.
 2. Cut away rock at excavation bottom to form level bearing. Remove shaled layers to provide sound and unshattered base for foundations.
 3. In utility trenches, excavate to 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter.
 4. Remove shaled layers to provide sound unshattered base for footings and foundations.



5. Re-use excavated rock materials on-site in accordance with Section 312000.
6. Remove excavated rock materials not re-used off-site.

NOTE TO SPECIFIER

Use ROCK EXCAVATION - EXPLOSIVES METHOD below when EXPLOSIVES are PERMITTED.

- C. Rock Excavation - Explosives Method:
 1. Where igneous, metamorphic, or sedimentary rock is encountered that cannot be removed by rippers or other mechanical methods, remove rock by explosives method.
 2. Comply with requirements of NFPA 495.
- D. Use lean concrete or suitable materials to replace rock overblast or overexcavation in building area and in expansion area to facilitate placement of utilities and future footings.

3.3 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection.
- B. Inspection: Contracting Officer will inspect bearing surfaces and cavities formed by removed rock.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 6/10/2011

END OF SECTION 31 23 17 00



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SECTION 31 23 17 00 - CSF ROCK EXCAVATION

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Rock Excavation is part of the Work. Before editing this Section, obtain the "Report of Subsurface Investigation" prepared by the Geotechnical Engineer. Read the report and incorporate the recommendations included in the report for Rock Excavation into this section.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Removal of identified and discovered rock during excavation.
 2. Incorporating removed rock into fills and embankments.

NOTE TO SPECIFIER

Use subparagraph below when EXPLOSIVES are PERMITTED.

3. Use of explosives to assist rock removal.

- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:

1. Section 312000 - Earth Moving: Cutting, Filling, and grading for site improvements.

2. Section 312300 - Excavation and Fill: Earthwork for structures, utilities and pavement.

NOTE TO SPECIFIER

Use REFERENCES below when EXPLOSIVES are PERMITTED.

1.2 REFERENCES

- A. National Fire Protection Association (NFPA):
1. NFPA 495 - Code For Explosive Materials.



NOTE TO SPECIFIER

Use *SUBMITTALS* below when *EXPLOSIVES* are *PERMITTED*.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
1. Explosives: Indicate proposed method of blasting, delay pattern, explosive types, type of blasting mat or cover, and intended rock recovery method.
 2. Assurance/Control Submittals.
 - a. Qualification Documentation: Submit seismic survey firm and explosives firm documentation of experience indicating compliance with specified qualification requirements.

1.4 QUALITY ASSURANCE

NOTE TO SPECIFIER

Use *QUALIFICATIONS FOR EXPLOSIVES* below when *EXPLOSIVES* are *PERMITTED*.

- A. Qualifications for Explosives:
1. Seismic Survey Firm: Company specializing in seismic surveys with five years documented experience.
 2. Explosives Firm: Company specializing in explosives for destruction for removal of subsurface rock with five years documented experience.
- B. Regulatory Requirements:
1. Perform rock removal in accordance with applicable requirements of governing authorities having jurisdiction.
- *****

NOTE TO SPECIFIER

Use subparagraphs 2 & 3 below when *EXPLOSIVES* are *PERMITTED*.

2. Comply with all laws, rules, and regulations of Federal, State and local authorities which govern storage, use, manufacture, sale, handling, transportation, licensing, or other disposition of explosives. Take special precautions for proper use of explosives to prevent harm to human life and damage to surface structures, all utility lines, or other subsurface structures. Do not conduct blasting operations until persons in vicinity have had ample notice and have reached positions of safety.
 3. Obtain permits from authorities having jurisdiction before explosives are brought to site or drilling for setting of explosives is started.
 - a. Notify Contracting Officer of schedule and procedures prior to explosive use.
- *****

NOTE TO SPECIFIER

Use *PRE-INSTALLATION MEETING* below when *EXPLOSIVES* are *PERMITTED*.

- C. Pre-Installation Meeting:
1. Convene a pre-installation meeting one week prior to commencing Work of this Section.
 2. Require attendance of parties directly affecting Work of this Section.
 3. Review conditions for use of explosives in rock removal operations, explosive rock removal procedures and coordination with related Work.



4. Agenda:
 - a. Tour, inspect and discuss conditions of existing soils and rock encountered.
 - b. Review blast control measures and requirements.
 - c. Review safety precautions relating to use of explosives
 - d. Review types of explosives to be used.
 - e. Review required submittals, both completed and yet to be completed.
 - f. Review and finalize construction schedule relating to explosive rock removal, and verify availability of materials, personnel, equipment and facilities needed to make progress and avoid delays.
 - g. Review required inspections, certifying, and material usage accounting procedures.
 - h. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.

1.5 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements: Determine all environmental effects associated with proposed rock removal Work and safeguard those concerns as regulated by law and authorities having jurisdiction by approved methods.

NOTE TO SPECIFIER

OPTION 1: Use paragraph below when EXPLOSIVES are NOT Permitted.

- B. Explosives: Not permitted.

NOTE TO SPECIFIER

OPTION 2: Use paragraph below when EXPLOSIVES are PERMITTED.

- C. Explosives: Do not bring explosives onto site or use in Work without prior written permission from Contracting Officer and authorities having jurisdiction. Comply with requirements of NFPA 495. Contractor is solely responsible for handling, storage, and use of explosive materials when their use is permitted.
 1. Hold harmless the Architect, Engineer and United States Postal Service from any claim resulting from use of explosives. Removal of materials of any nature by blasting shall be done in such a manner and such time as to avoid damage affecting the integrity of design and to avoid damage to any new or existing structure included in or adjacent to work. It shall be contractors responsibility to determine method of operation to ensure desired results and integrity of completed work.
- D. Existing Conditions:
 1. Geotechnical Data:
 - a. Reports of Subsurface Investigation and data are not a part of Contract Documents.
 - b. Soil and subsurface investigations were conducted at the site by an independent testing laboratory and a report with log of borings prepared. This report was obtained for USPS design use only.
 - c. A copy of the report is provided by Contracting Officer and is made available for convenience of the Contractor.
 - d. Soils investigation data is not warranted to indicate actual conditions. Owner and Architect/Engineer do not assume responsibility for variations in kind, depth, quantity and condition of soils; they disclaim responsibility for accuracy, true location, and extent of soils investigation that has been prepared by others; and they further disclaim responsibility for interpretation of that data by Contractor as in projecting soil bearing values, rock profiles, soil stability, and presence, level, and extent of underground water.
 - e. Additional test borings and other exploratory operations may be made by Contractor at no additional cost to United States Postal Service.



2. Immediately report any discrepancy between Contract Documents and amount and type of rock to be removed to Contracting Officer.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

OPTION 1: Use "Not Used" below when EXPLOSIVES are NOT Permitted.

NOTE TO SPECIFIER

OPTION 2: Use MATERIALS below when EXPLOSIVES are PERMITTED.

2.1 MATERIALS

- A. Explosives, Detonator/Delay Devices and Blasting Mat Materials: NFPA 495; Type recommended by explosive firm following a seismic survey and required by authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to for rock excavation to begin.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 ROCK EXCAVATION

- A. Perform rock excavation in a manner that will produce material of such size as to permit it being placed in embankments in accordance with Section 312000. Remove rock to limits indicated. Remove loose or shattered rock, overhanging ledges and boulders which might dislodge.
- B. Rock Excavation - Mechanical Method:
 1. Excavate for and remove rock by mechanical method. Drill holes and utilize expansive tools and wedges to fracture rock.
 2. Cut away rock at excavation bottom to form level bearing. Remove shaled layers to provide sound and unshattered base for foundations.
 3. In utility trenches, excavate to 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter.
 4. Remove shaled layers to provide sound unshattered base for footings and foundations.



5. Re-use excavated rock materials on-site in accordance with Section 312000.
6. Remove excavated rock materials not re-used off-site.

NOTE TO SPECIFIER

Use ROCK EXCAVATION - EXPLOSIVES METHOD below when EXPLOSIVES are PERMITTED.

- C. Rock Excavation - Explosives Method:
 1. Where igneous, metamorphic, or sedimentary rock is encountered that cannot be removed by rippers or other mechanical methods, remove rock by explosives method.
 2. Comply with requirements of NFPA 495.
- D. Use lean concrete or suitable materials to replace rock overblast or overexcavation in building area and in expansion area to facilitate placement of utilities and future footings.

3.3 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection.
- B. Inspection: Contracting Officer will inspect bearing surfaces and cavities formed by removed rock.

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END OF SECTION 31 23 17 00



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Task	Specification	Specification Description
31 23 19 00	22 05 23 00	Piped Utilities Basic Materials And Methods
31 23 23 23	31 00 00 00	Earthwork
31 24 13 00	31 00 00 00	Earthwork



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SECTION 31 25 00 00 - MPF EROSION AND SEDIMENTATION CONTROLS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

Use this section where Slope Protection and Erosion Control is part of the Work. Before editing this Section, obtain the "Report of Subsurface Investigation" prepared by the Geotechnical Engineer. Read the report and incorporate the recommendations included in the report for Slope Protection and Erosion Control (if any) into this section.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Temporary and permanent erosion control systems.
 - 2. Slope protection systems.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 313200 - Soil Stabilization: Lime, cement, fly ash, and geotextile subgrade stabilizers.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for Quality Assurance/Control submittals.
 - 1. Material Source: Submit name of material suppliers.
 - 2. Provide materials from same source throughout Work. Change of source requires Contracting Officer approval.

1.3 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements: Protect adjacent properties and water resources from erosion and sediment damage throughout Work.



PART 2 - PRODUCTS

2.1 MATERIALS

- A. Quick Growing Grasses: Wheat, rye, or oats.
- B. Straw Bales: Free of weed seed.
- C. Fencing for Siltation Control: Indicated on Drawings.
- D. Erosion Control Blankets and/or Erosion Control Geotextiles.
- E. Bale Stakes:
 - 1. Minimum 4 feet length.
 - 2. 2 No. 4 steel reinforcing bars or,
 - 3. 2 steel pickets or,
 - 4. 2 - 2x2 inch hardwood stakes driven 18 inches to 24 inches into ground.
- F. Temporary Mulches: Loose straw, netting, wood cellulose, or agricultural silage free of seed.
- G. Metal Fence Stakes: Minimum 8 foot length.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting Work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to U.S. Postal Service.

3.2 PREPARATION

- A. Review Stormwater Pollution Prevention Plan SWP³.
- B. Notify Contracting Officer of deficiencies or changes in Stormwater Pollution Prevention Plan SWP³ required by current site conditions. Revisions of plan will be made as determined by Contracting Officer.

3.3 EROSION CONTROL AND SLOPE PROTECTION IMPLEMENTATION

- A. Contracting Officer may direct Contractor to limit surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and embankment operations and may direct Contractor to provide immediate permanent or temporary pollution control measures.



- B. Provide permanent erosion control measures at earliest practical time to minimize requirement for temporary erosion controls. Permanently seed and mulch cut slopes as excavation proceeds.
- C. Maintain temporary erosion control systems installed by Contractor as directed by Contracting Officer to control siltation at all times throughout Work. Provide maintenance or additional Work directed by Contracting Officer within 48 hours of notification by Contracting Officer.
- D. Apply soil stabilization as specified in Section 313200 or seed slopes that may be easily eroded with wheat, rye or oat grasses.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 6/10/2011

END OF SECTION 31 25 00 00



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SECTION 31 25 00 00 - CSF EROSION AND SEDIMENTATION CONTROLS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Slope Protection and Erosion Control is part of the Work. Before editing this Section, obtain the "Report of Subsurface Investigation" prepared by the Geotechnical Engineer. Read the report and incorporate the recommendations included in the report for Slope Protection and Erosion Control (if any) into this section.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Temporary and permanent erosion control systems.
 - 2. Slope protection systems.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 313200 - Soil Stabilization: Lime, cement, fly ash, and geotextile subgrade stabilizers.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for Quality Assurance/Control submittals.
 - 1. Material Source: Submit name of material suppliers.
 - 2. Provide materials from same source throughout Work. Change of source requires Contracting Officer approval.

1.3 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements: Protect adjacent properties and water resources from erosion and sediment damage throughout Work.



PART 2 - PRODUCTS

2.1 MATERIALS

- A. Quick Growing Grasses: Wheat, rye, or oats.
- B. Straw Bales: Free of weed seed.
- C. Fencing for Siltation Control: Indicated on Drawings.
- D. Erosion Control Blankets and/or Erosion Control Geotextiles.
- E. Bale Stakes:
 - 1. Minimum 4 feet length.
 - 2. 2 No. 4 steel reinforcing bars or,
 - 3. 2 steel pickets or,
 - 4. 2 - 2x2 inch hardwood stakes driven 18 inches to 24 inches into ground.
- F. Temporary Mulches: Loose straw, netting, wood cellulose, or agricultural silage free of seed.
- G. Metal Fence Stakes: Minimum 8 foot length.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting Work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to U.S. Postal Service.

3.2 PREPARATION

- A. Review Stormwater Pollution Prevention Plan SWP³.
- B. Notify Contracting Officer of deficiencies or changes in Stormwater Pollution Prevention Plan SWP³ required by current site conditions. Revisions of plan will be made as determined by Contracting Officer.

3.3 EROSION CONTROL AND SLOPE PROTECTION IMPLEMENTATION

- A. Contracting Officer may direct Contractor to limit surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and embankment operations and may direct Contractor to provide immediate permanent or temporary pollution control measures.



- B. Provide permanent erosion control measures at earliest practical time to minimize requirement for temporary erosion controls. Permanently seed and mulch cut slopes as excavation proceeds.
- C. Maintain temporary erosion control systems installed by Contractor as directed by Contracting Officer to control siltation at all times throughout Work. Provide maintenance or additional Work directed by Contracting Officer within 48 hours of notification by Contracting Officer.
- D. Apply soil stabilization as specified in Section 313200 or seed slopes that may be easily eroded with wheat, rye or oat grasses.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION 31 25 00 00



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Task	Specification	Specification Description
31 25 14 23	32 01 11 53	Cement Concrete Pavement
31 25 14 23	32 13 13 17	Roller Compacted Concrete Pavement
31 25 53 00	01 22 16 00	No Specification Required



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SECTION 31 31 00 00 - MPF SOIL TREATMENT

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

Use this section where Project is located in an area subject to termite damage and Termite Control is a part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information must be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Soil treatment for termite control.
 - 2. Application below grade and at interior and exterior foundation perimeter.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 REFERENCES

- A. United States Environmental Protection Agency (EPA):
 - 1. EPA - Federal Insecticide, Fungicide, and Rodenticide Act.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - a. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, and intended application rate.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Project Record Documents: Accurately record moisture content of soil before treatment, date and rate of application, areas of application, diary of meter readings and corresponding soil coverage.
 - 2. Warranty: Submit manufacturer warranty with forms completed in United States Postal Service name and registered with manufacturer.

1.4 QUALITY ASSURANCE



- A. Applicator Qualifications: Company specializing in performing the Work of this Section with minimum 5 years documented experience and licensed in accordance with regulations of authorities having jurisdiction for application of chemical toxicant.
- B. Regulatory Requirements: Conform to applicable code for application requirements, application licensing, authority to use toxicant chemicals, and in accordance with EPA regulations.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver products in manufacturer's original unopened containers with labels intact, identifying Product and manufacturer, application instructions, and EPA federal registration number.
- C. Do not store Products on site. Deliver Products to site at time of application.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements: Do not apply soil treatment to frozen or wet soils or during rain or snow.

1.7 WARRANTY

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Special Warranty:
 - 1. Submit written warranty signed by soil treatment applicator and Contractor certifying that applied chemical toxicant treatment will prevent infestation of subterranean termites.
 - a. State that application was made at concentration, rates, and methods as specified.
 - b. State that if subterranean termite activity is discovered during warranty period, Contractor will retreat soil and repair damage caused by termite infestation at no additional cost to United States Postal Service.
 - 2. Cover against invasion or propagation of subterranean termites, damage to building or building contents caused by termites; repairs to building or building contents so caused.
 - 3. Provide for inspection of Work annually; report in writing to designated U.S. Postal Service personnel.
 - 4. Warranty Period: 5 years.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. EPA and local authority having jurisdiction approved chemical toxicant; water based emulsion, uniform composition, with synthetic dye to permit visual identification of treated soil, bearing Federal registration number of the EPA.
- B. Specially formulated to prevent infestation by termites.
- C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.



2.2 MIX DILUTION

- A. Dilute and mix toxicant chemical to manufacturer's published instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify the soil surfaces are unfrozen, sufficiently dry to absorb toxicant, ready to receive treatment.
 - 2. Verify final grading is complete.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Remove foreign matter, loosen, rake, and level soil to be treated, except previously compacted areas under slabs and foundations.

3.3 APPLICATION

- A. Apply toxicant within 12 hours before installation of vapor retardant under slab-on-grade.
- B. Apply toxicant to soil in strict accordance with federal and local jurisdiction requirements and manufacturer's printed application rates.
- C. Apply toxicant as a coarse spray; provide uniform metered distribution.
- D. Post signs in areas of application to warn workers that toxicant has been applied to soil. Remove signs after areas are covered by other construction.
- E. Reapply toxicant to areas disturbed by subsequent excavation, landscape grading, or other construction activities occurring after initial toxicant application.

3.4 CONSTRUCTION

- A. Interface with Other Work:
 - 1. Coordinate application of toxicant at foundation perimeter with finish grading and landscaping work; avoid disturbance of treated soil.

3.5 FIELD QUALITY CONTROL



- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Inspect and test soil areas where toxicant was applied to determine the presence of any remaining termites before covering with subsequent construction.
- C. Reapply toxicant to areas where inspection or testing identifies the presence of termites. Use same toxicant as for original treatment.

USPS Mail Processing Facility Specification issued: 10/1/2013
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END OF SECTION 31 31 00 00



SECTION 31 31 00 00 - CSF SOIL TREATMENT

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Project is located in an area subject to termite damage and Termite Control is a part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information must be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Soil treatment for termite control.
 - 2. Application below grade and at interior and exterior foundation perimeter.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 REFERENCES

- A. United States Environmental Protection Agency (EPA):
 - 1. EPA - Federal Insecticide, Fungicide, and Rodenticide Act.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - a. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, and intended application rate.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Project Record Documents: Accurately record moisture content of soil before treatment, date and rate of application, areas of application, diary of meter readings and corresponding soil coverage.
 - 2. Warranty: Submit manufacturer warranty with forms completed in United States Postal Service name and registered with manufacturer.

1.4 QUALITY ASSURANCE



- A. Applicator Qualifications: Company specializing in performing the Work of this Section with minimum 5 years documented experience and licensed in accordance with regulations of authorities having jurisdiction for application of chemical toxicant.
- B. Regulatory Requirements: Conform to applicable code for application requirements, application licensing, authority to use toxicant chemicals, and in accordance with EPA regulations.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver products in manufacturer's original unopened containers with labels intact, identifying Product and manufacturer, application instructions, and EPA federal registration number.
- C. Do not store Products on site. Deliver Products to site at time of application.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements: Do not apply soil treatment to frozen or wet soils or during rain or snow.

1.7 WARRANTY

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Special Warranty:
 - 1. Submit written warranty signed by soil treatment applicator and Contractor certifying that applied chemical toxicant treatment will prevent infestation of subterranean termites.
 - a. State that application was made at concentration, rates, and methods as specified.
 - b. State that if subterranean termite activity is discovered during warranty period, Contractor will retreat soil and repair damage caused by termite infestation at no additional cost to United States Postal Service.
 - 2. Cover against invasion or propagation of subterranean termites, damage to building or building contents caused by termites; repairs to building or building contents so caused.
 - 3. Provide for inspection of Work annually; report in writing to designated U.S. Postal Service personnel.
 - 4. Warranty Period: 5 years.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. EPA and local authority having jurisdiction approved chemical toxicant; water based emulsion, uniform composition, with synthetic dye to permit visual identification of treated soil, bearing Federal registration number of the EPA.
- B. Specially formulated to prevent infestation by termites.
- C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.



2.2 MIX DILUTION

- A. Dilute and mix toxicant chemical to manufacturer's published instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify the soil surfaces are unfrozen, sufficiently dry to absorb toxicant, ready to receive treatment.
 - 2. Verify final grading is complete.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Remove foreign matter, loosen, rake, and level soil to be treated, except previously compacted areas under slabs and foundations.

3.3 APPLICATION

- A. Apply toxicant within 12 hours before installation of vapor retardant under slab-on-grade.
- B. Apply toxicant to soil in strict accordance with federal and local jurisdiction requirements and manufacturer's printed application rates.
- C. Apply toxicant as a coarse spray; provide uniform metered distribution.
- D. Post signs in areas of application to warn workers that toxicant has been applied to soil. Remove signs after areas are covered by other construction.
- E. Reapply toxicant to areas disturbed by subsequent excavation, landscape grading, or other construction activities occurring after initial toxicant application.

3.4 CONSTRUCTION

- A. Interface with Other Work:
 - 1. Coordinate application of toxicant at foundation perimeter with finish grading and landscaping work; avoid disturbance of treated soil.

3.5 FIELD QUALITY CONTROL



- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Inspect and test soil areas where toxicant was applied to determine the presence of any remaining termites before covering with subsequent construction.
- C. Reapply toxicant to areas where inspection or testing identifies the presence of termites. Use same toxicant as for original treatment.

USPS CSF Specifications issued: 10/1/2013
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END OF SECTION 31 31 00 00



SECTION 31 32 00 00 - CSF SOIL STABILIZATION

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Soil Stabilization of Soil Stabilization is part of the Work. Before editing this Section, obtain the "Report of Subsurface Investigation" prepared by the Geotechnical Engineer. Read the report and incorporate the recommendations included in the report for Soil Stabilization into this section.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Lime stabilized subgrade.
 2. Cement stabilized subgrade.
 3. Fly ash stabilized subgrade.
 4. Geotextile fabric stabilized subgrade.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 1. Section 312000 - Earth Moving: Cutting, filling, and grading for site improvements.
 2. Section 313200 - Excavation and Fill: Earthwork for structures., utilities, and pavement.

1.2 REFERENCES

- A. American Society for Testing Materials (ASTM):
 1. ASTM C 150 - Specification for Portland Cement
 2. ASTM C 618 - Specification for Fly Ash and Raw of Calcinated Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
 3. ASTM C 977 - Specification for Quicklime and Hydrated Lime for Soil Stabilization
 4. ASTM D 698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 Pound Rammer and 12 Inch Drop.
 5. ASTM D 1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 10 Pound Rammer and 18 Inch Drop.



1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
 - 1. Material Source:
 - a. Submit name of imported materials suppliers.
 - b. Provide materials from same source throughout the work. Change of source requires Contracting Officer approval.
 - 2. Samples: Submit two samples of each type of imported off-site fill material in air-tight, 10 pound container for Contracting Officer testing or submit gradation and certification of aggregate material for Contracting Officer review.
 - 3. Mix Design: Submit mix design and materials mix ratio that will achieve specified requirements for soil stabilization by state and local agencies.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Perform soil stabilization work in accordance with applicable requirements of governing authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Examine soil stabilization materials upon delivery to site. Verify that materials are as specified and match approved samples. Remove non-complying materials from site.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements:
 - 1. Do not begin mixing operation when subgrade is frozen or when air temperature is less than 40 degrees F.
 - 2. Do not install mixed materials in wind above 10 miles per hour.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Quicklime or Hydrated Lime: ASTM C 977.
- B. Portland Cement: ASTM C 150.
- C. Fly Ash: ASTM C 618.
- D. Fine and Coarse Aggregate: In accordance with applicable State Highway Standard Specification regarding source, quality, gradation, liquid limit, plasticity index, and mix proportioning.
- E. Subsoil: Existing reused.

NOTE TO SPECIFIER

Provide brief description of subsoil type where applicable and appropriate.

- 1. [_____].



2. [_____].

- F. Degradable natural fiber erosion control blankets
 1. Provide and install materials in accordance with applicable state highway standard specification.

2.2 EQUIPMENT

- A. Perform operations using suitable, well maintained equipment capable of excavating subsoil, mixing and placing materials, wetting, consolidation and compaction of material.

2.3 SOIL MIX

NOTE TO SPECIFIER

OPTION 1: Use reference to State Highway Standard Specification where applicable and appropriate.

- A. Mix materials in accordance with referenced State Highway Standard Specification.

NOTE TO SPECIFIER

OPTION 2: Specify mix based on recommendations included in "Report of Subsurface Exploration" for areas of application.

- B. Mix materials as follows:

1. [_____].
2. [_____].
3. [_____].
4. [_____].

- C. Add water to mix to achieve a consistent mixture without lumping yet not create a wet plastic consistency.
- D. Addition of lime may be specified or approved to facilitate mixing fly ash with soil materials. When specified, or directed by Contracting Officer in writing, use lime to prevent fly ash "flash set" or retard soil-fly ash reactivity occurring during final mixing.
1. Uniformly blend lime additive with fly ash on surface for incorporation with soil materials during first mixing operations unless other methods of application are approved.
 2. Proportion of lime additive with the fly ash will be based on laboratory testing and field trial procedures necessary to determine proper soil modification.
 3. Addition of lime will permit a reduction of fly ash requirement on a replacement basis as approved by Contracting Officer.
- E. Obtain Contracting Officer approval of mix before proceeding with placement.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.



1. Verify that existing site soils and soil conditions encountered are as indicated in Geotechnical Data.
 2. Verify quantity and type of soil stabilization materials before beginning material installation.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to United States Postal Service.

3.2 PREPARATION

- A. Obtain Contracting Officer approval of mix design before proceeding with placement.
- B. Do not start stabilization without weather and soil conditions being favorable for successful application of proposed material.
- C. Proof roll subgrade to identify areas in need of stabilization.
- D. Prior to stabilization of soils, prepare surface areas in accordance with applicable State Highway Standard Specifications.

3.3 EXCAVATION

- A. Excavate subsoil to a depth sufficient to accommodate soil stabilization.
- B. Remove lumped subsoil, boulders and rock that interfere with achieving uniform subsoil conditions.

3.4 SOIL TREATMENT AND BACKFILLING

- A. Do not backfill over frozen or spongy subgrade surfaces.
- B. Lime Stabilized Subgrade: Where indicated on Drawings, treat prepared subgrade with hydrated lime in accordance with applicable State Highway Standard Specification. Compact to minimum [95] [____] percent optimum density in accordance with ASTM D 698 or [92] [____] percent optimum density in accordance with ASTM D 1557.
- C. Cement Stabilized Subgrade: Where indicated on Drawings, treat prepared subgrade with Portland cement in accordance with applicable State Highway Standard Specification. Compact to minimum [95] [____] percent optimum density in accordance with ASTM D 698 or [92] [____] percent optimum density in accordance with ASTM D 1557.
- D. Fly Ash Stabilized Subgrade: Where indicated on Drawings, treat prepared subgrade with fly ash in accordance with applicable State Highway Standard Specification. Compact to minimum [95] [____] percent optimum density as determined by ASTM D 698 or [92] [____] percent optimum density, in accordance with ASTM D 1557.
- E. Fine and Course Aggregates: Treat prepared subgrade with fine or course aggregates in accordance with applicable State Highway Standard Specification. Compact to minimum [95] [____] percent optimum density as determined by ASTM D 698 or [92] [____] percent optimum density, in accordance with ASTM D 1557.



- F. Maintain optimum moisture of mix materials to attain required stabilization and compaction.
- G. Finish subgrade surface as specified in Section 312000.

3.5 GEOTEXTILE FABRIC

- A. Place fabric in areas indicated on Drawings or in areas requiring additional stabilization prior to placement of base course.
- B. Place fabric in accordance with manufacturers published instructions.

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END OF SECTION 31 32 00 00



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SECTION 31 32 00 00 - MPF SOIL STABILIZATION

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

Use this section where Soil Stabilization of Soil Stabilization is part of the Work. Before editing this Section, obtain the "Report of Subsurface Investigation" prepared by the Geotechnical Engineer. Read the report and incorporate the recommendations included in the report for Soil Stabilization into this section.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Lime stabilized subgrade.
 2. Cement stabilized subgrade.
 3. Fly ash stabilized subgrade.
 4. Geotextile fabric stabilized subgrade.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 1. Section 312000 - Earth Moving: Cutting, filling, and grading for site improvements.
 2. Section 313200 - Excavation and Fill: Earthwork for structures., utilities, and pavement.

1.2 REFERENCES

- A. American Society for Testing Materials (ASTM):
 1. ASTM C 150 - Specification for Portland Cement
 2. ASTM C 618 - Specification for Fly Ash and Raw of Calcinated Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
 3. ASTM C 977 - Specification for Quicklime and Hydrated Lime for Soil Stabilization
 4. ASTM D 698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 Pound Rammer and 12 Inch Drop.
 5. ASTM D 1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 10 Pound Rammer and 18 Inch Drop.



1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
1. Material Source:
 - a. Submit name of imported materials suppliers.
 - b. Provide materials from same source throughout the work. Change of source requires Contracting Officer approval.
 2. Samples: Submit two samples of each type of imported off-site fill material in air-tight, 10 pound container for Contracting Officer testing or submit gradation and certification of aggregate material for Contracting Officer review.
 3. Mix Design: Submit mix design and materials mix ratio that will achieve specified requirements for soil stabilization by state and local agencies.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Perform soil stabilization work in accordance with applicable requirements of governing authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Examine soil stabilization materials upon delivery to site. Verify that materials are as specified and match approved samples. Remove non-complying materials from site.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements:
1. Do not begin mixing operation when subgrade is frozen or when air temperature is less than 40 degrees F.
 2. Do not install mixed materials in wind above 10 miles per hour.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Quicklime or Hydrated Lime: ASTM C 977.
- B. Portland Cement: ASTM C 150.
- C. Fly Ash: ASTM C 618.
- D. Fine and Coarse Aggregate: In accordance with applicable State Highway Standard Specification regarding source, quality, gradation, liquid limit, plasticity index, and mix proportioning.
- E. Subsoil: Existing reused.

NOTE TO SPECIFIER

Provide brief description of subsoil type where applicable and appropriate.

1. [_____].



2. [_____].

- F. Degradable natural fiber erosion control blankets
 1. Provide and install materials in accordance with applicable state highway standard specification.

2.2 EQUIPMENT

- A. Perform operations using suitable, well maintained equipment capable of excavating subsoil, mixing and placing materials, wetting, consolidation and compaction of material.

2.3 SOIL MIX

NOTE TO SPECIFIER

OPTION 1: Use reference to State Highway Standard Specification where applicable and appropriate.

- A. Mix materials in accordance with referenced State Highway Standard Specification.

NOTE TO SPECIFIER

OPTION 2: Specify mix based on recommendations included in "Report of Subsurface Exploration" for areas of application.

- B. Mix materials as follows:

1. [_____].
2. [_____].
3. [_____].
4. [_____].

- C. Add water to mix to achieve a consistent mixture without lumping yet not create a wet plastic consistency.
- D. Addition of lime may be specified or approved to facilitate mixing fly ash with soil materials. When specified, or directed by Contracting Officer in writing, use lime to prevent fly ash "flash set" or retard soil-fly ash reactivity occurring during final mixing.
1. Uniformly blend lime additive with fly ash on surface for incorporation with soil materials during first mixing operations unless other methods of application are approved.
 2. Proportion of lime additive with the fly ash will be based on laboratory testing and field trial procedures necessary to determine proper soil modification.
 3. Addition of lime will permit a reduction of fly ash requirement on a replacement basis as approved by Contracting Officer.
- E. Obtain Contracting Officer approval of mix before proceeding with placement.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.



1. Verify that existing site soils and soil conditions encountered are as indicated in Geotechnical Data.
 2. Verify quantity and type of soil stabilization materials before beginning material installation.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to United States Postal Service.

3.2 PREPARATION

- A. Obtain Contracting Officer approval of mix design before proceeding with placement.
- B. Do not start stabilization without weather and soil conditions being favorable for successful application of proposed material.
- C. Proof roll subgrade to identify areas in need of stabilization.
- D. Prior to stabilization of soils, prepare surface areas in accordance with applicable State Highway Standard Specifications.

3.3 EXCAVATION

- A. Excavate subsoil to a depth sufficient to accommodate soil stabilization.
- B. Remove lumped subsoil, boulders and rock that interfere with achieving uniform subsoil conditions.

3.4 SOIL TREATMENT AND BACKFILLING

- A. Do not backfill over frozen or spongy subgrade surfaces.
- B. Lime Stabilized Subgrade: Where indicated on Drawings, treat prepared subgrade with hydrated lime in accordance with applicable State Highway Standard Specification. Compact to minimum [95] [____] percent optimum density in accordance with ASTM D 698 or [92] [____] percent optimum density in accordance with ASTM D 1557.
- C. Cement Stabilized Subgrade: Where indicated on Drawings, treat prepared subgrade with Portland cement in accordance with applicable State Highway Standard Specification. Compact to minimum [95] [____] percent optimum density in accordance with ASTM D 698 or [92] [____] percent optimum density in accordance with ASTM D 1557.
- D. Fly Ash Stabilized Subgrade: Where indicated on Drawings, treat prepared subgrade with fly ash in accordance with applicable State Highway Standard Specification. Compact to minimum [95] [____] percent optimum density as determined by ASTM D 698 or [92] [____] percent optimum density, in accordance with ASTM D 1557.
- E. Fine and Course Aggregates: Treat prepared subgrade with fine or course aggregates in accordance with applicable State Highway Standard Specification. Compact to minimum [95] [____] percent optimum density as determined by ASTM D 698 or [92] [____] percent optimum density, in accordance with ASTM D 1557.



- F. Maintain optimum moisture of mix materials to attain required stabilization and compaction.
- G. Finish subgrade surface as specified in Section 312000.

3.5 GEOTEXTILE FABRIC

- A. Place fabric in areas indicated on Drawings or in areas requiring additional stabilization prior to placement of base course.
- B. Place fabric in accordance with manufacturers published instructions.

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END OF SECTION 31 32 00 00



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SECTION 31 32 13 16 - SOIL STABILIZATION-LIME**1.1 GENERAL****A. Description Of Work**

1. This specification covers furnishing of materials and the preparation and production of a stabilized subgrade by the addition of hydrated lime to the native material.

1.2 PRODUCTS**A. Hydrated lime material requirements shall be as follows:**

1. Available Lime Index as Calcium Hydroxide: 90 percent minimum.
2. Residue retained on No. 30 Sieve: 1 percent maximum.
3. Residue retained on No. 200 Sieve: 20 percent maximum.

1.3 EXECUTION:

- A. Preparation: Scarify the subgrade to the depth required and pulverize the material until it is substantially free of lumps greater than three inches in diameter.
- B. Installation: Lime shall be applied to the pulverized material as a slurry, unless otherwise directed. Water shall be added as needed to provide a moisture content of not less than 20 percent. Surface-applied lime slurry shall be plowed and/or disked into the soil as necessary. The resulting mixture shall be aged for not less than 48 hours before compaction.

END OF SECTION 31 32 13 16



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Task	Specification	Specification Description
31 32 13 19	31 32 13 16	Soil Stabilization-Lime
31 32 13 29	31 32 13 16	Soil Stabilization-Lime
31 32 19 13	31 32 13 16	Soil Stabilization-Lime
31 32 19 16	22 05 23 00	Piped Utilities Basic Materials And Methods
31 32 19 16	31 32 13 16	Soil Stabilization-Lime
31 37 00 00	01 22 16 00	No Specification Required
31 41 16 13	31 23 16 13	Excavation Support And Protection



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SECTION 31 62 19 00 - CSF TIMBER PILES

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section for Medium Standard Buildings where pile and grade beam foundation system is required and Timber Piles are a part of the Work. Before editing this Section, obtain the "Report of Subsurface Investigation" prepared by the Geotechnical Engineer. Read the report and incorporate the recommendations included in the report for Pile and Grade Beam foundation system into this section.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Preservative treated wood piles.
 - 2. Pile inspection and load tests.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 012200 - Unit Prices: Procedures related to Work performed under unit price method.
 - 2. Section 033000 - Cast-In-Place Concrete: Pile caps and grade beams.
- D. Unit Prices:
 - 1. Base proposals on the number and spacing of piles and on length from point to cut-off as indicated on Structural Drawings. Provide test piles two feet longer than pile lengths indicated on Structural Drawings.
 - 2. Determine number and lengths of piles based on Project Record Documents.
 - 3. Adjustment in price due to changes in number or length of piles will be based on unit prices established as specified in Section 012200 - Unit Prices.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM D 25 - Specification for Round Timber Piles.

NOTE TO SPECIFIER



Include ASTM D 1143, D 3689 and D 3966 when used in body of Specification. Delete if not used.

2. ASTM D 1143 - Method of Testing Piles Under Static Axial Compressive Load.
3. ASTM D 3689 - Method of Testing Individual Piles Under Static and Axial Tensile Load.
4. ASTM D 3966 - Method of Testing Piles under Lateral Loads.

B. American Wood-Preservers' Association (AWPA):

1. AWPA C3 - Preservative Treatment of Piles by Pressure Processes.
2. AWPA M4 - Standard for the Care of Pressure Treated Wood Products.

1.3 DEFINITIONS

- A. Refusal: 12 blows per foot or more as specified by project structural engineer.
- B. Non-Conforming Piles: Piles that fail field tests, are driven out of position, are driven below cut-off elevation, or are damaged.

1.4 SYSTEM DESCRIPTION

- A. Design Requirements
 1. Load Carrying Capacity: Indicated on Structural Drawings.

1.5 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 1. Product Data: Pile tip and collar.
 2. Shop Drawings:
 - a. Details and schedule of pile installation sequence and testing.
 - b. Pile lengths and diameters.
 3. Assurance/Control Submittals:
 - a. Certificate: Provide certification from pile fabrication shop that each pile meets or exceeds specified requirements.
 - b. Qualification Documentation: Submit installer documentation of experience indicating compliance with specified qualification requirements.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals:
 1. Project Record Documents: Submit log of the following, recorded at time of pile placement.
 - a. Sizes, lengths, and locations of piles.
 - b. Sequence of placing.
 - c. Number of blows per foot for entire length of pile and measured set for last 10 blows.
 - d. Final base and top of pile elevations.
 - e. Driving force of each hammer blow.
 - f. Time and load settlement measurements of load tested piles.
 - g. Difficulties encountered during pile driving.
 - h. Type and size of equipment.
 - i. Alignment deviations.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing Work of this Section with minimum 10 years documented experience.



- B. Pile Component Selection: Under supervision of professional Structural Engineer experienced in pile design licensed in State where project is located.
- C. Pre-Installation Meeting:
 - 1. Convene a pre-installation meeting at site, one week prior to commencing Work of this Section.
 - 2. Require attendance of parties directly affecting Work of this Section.
 - 3. Review conditions of installation, installation procedures, and coordination with related work.
 - 4. Agenda:
 - a. Tour, inspect and discuss condition of soil substrate, pile locations and other preparatory work performed by other trades.
 - b. Review structural loading requirements.
 - c. Review pile system requirements (drawings, specifications and other contract documents).
 - d. Review pile driving methods and equipment.
 - e. Review and finalize construction schedule related to pile work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
 - f. Review required inspections, testing, and certifying procedures.
 - g. Review weather and forecasted weather conditions, and procedures for resolving unfavorable conditions.
 - h. Review safety precautions relating to timber pile installation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Preservative treated, clean-peeled Southern Pine, ASTM D 25, pressure impregnated with Grade 1, AWPAC P1 creosote in accordance with AWPAC C3 for land and fresh water piles with minimum retention of 8 pounds per cubic foot.
- B. One-piece friction piles with minimum butt diameter and minimum tip diameter as indicated on Structural Drawings. Splices not permitted.

2.2 SOURCE QUALITY CONTROL

- A. Certification: Provide shop inspection and certification of wood piles.
- B. Inspection: Inspect wood piles at source of supply for conformance with ASTM D 25. Hammer mark pile butt to indicate conformance with specified requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify site conditions will support pile driving equipment for performance of pile driving operations and testing.



2. Verify that survey benchmark and intended elevations for the Work are as indicated on Drawings and are not located in an area that may be damaged.

- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Obtain Contracting Officer approval for pile driving hammer.
- B. Use driving method which will not cause damage to existing adjacent structures and site improvements.
- C. Notify adjacent property owners with written notice, approved by Contracting Officer, prior to start of Work.
- D. Protect adjacent structures and site improvements from damage.

3.3 INSTALLATION

- A. Protect pile head during driving, using cushion cap. Provide full bearing on piles for distribution of hammer blow. Do not damage piles during driving operations.
- B. Deliver hammer blows on central axis of pile.
- C. Drive piles to length indicated on Structural Drawings. Avoid damaging piles by over driving.
- D. If driving is interrupted before refusal, drive pile an additional 6 inches before resuming recording of performance data.
- E. Re-drive piles which have lifted due to driving adjacent piles, or by soil uplift.
- F. Cut off tops of piles to elevations indicated on Structural Drawings and prepare pile top to receive pile cap or grade beams.
- G. Prevent surface damage to piles.
- H. Apply preservative to exposed ends of cut-off piles, compatible with preservative treatment and in accordance with pile manufacturer's recommendation.

3.4 CONSTRUCTION

- A. Site Tolerances:
 1. Maximum Variation From Vertical For Plumb Piers: 1 in 48.
 2. Minimum Variation From Required Angle for Batter Piers: 1 in 24.
 3. Maximum Variation From Top of Pier Elevation: 2 inches.
 4. Maximum Out-of Position: 4 inches.



3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Inspection and testing procedures.
- B. Inspection: Obtain Contracting Officer inspection of pile installations, locations, and elevations.
- C. Site Tests:

NOTE TO SPECIFIER

Select appropriate ASTM testing specifications for specific site conditions. Indicate number of test piles required to determine acceptability of pile and grade beam foundation system for the specific site conditions. Select loading factor for tests.

1. Perform testing using equipment, load carrying device, load, and instrumentation in conformance with [ASTM D 1143] [and] [ASTM D 3689, and ASTM D 3966].
 2. Verify site conditions will support cribbing and load for testing purposes.
 3. Establish stable working elevation for test equipment.
 4. Provide materials and equipment for testing except hydraulic jack.
 5. Provide test piles same diameter and type specified for piles, constructed in same manner.
 6. Test [6] [____] indicator piles at locations as directed by Contracting Officer.
 7. Subject piles to [1-3/4] [2] [____] times design load.
 8. Document test equipment used and method of calibrating and recording.
- D. Acceptable Permanent Set of Piles After Load Testing: [1/8] [1/4] [____] inch.
 - E. Accepted test piers may be used in Work.
 - F. Non-Conforming Piles: Provide additional piles or supplement piles to conform to specified requirements at non-conforming piles.

3.6 PROTECTION

- A. Prevent surface damage to treated piles.
- B. Treat repairs to treated piles in accordance with AWP4 M4.

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Last revised: 4/12/2011

END OF SECTION 31 62 19 00



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SECTION 31 62 19 00 - MPF TIMBER PILES

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

Use this section where pile and grade beam foundation system is required and Timber Piles are a part of the Work. Before editing this Section, obtain the "Report of Subsurface Investigation" prepared by the Geotechnical Engineer. Read the report and incorporate the recommendations included in the report for Pile and Grade Beam foundation system into this section.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Preservative treated wood piles.
 - 2. Pile inspection and load tests.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 012200 - Unit Prices: Procedures related to Work performed under unit price method.
 - 2. Section 033000 - Cast-In-Place Concrete: Pile caps and grade beams.
- D. Unit Prices:
 - 1. Base proposals on the number and spacing of piles and on length from point to cut-off as indicated on Structural Drawings. Provide test piles two feet longer than pile lengths indicated on Structural Drawings.
 - 2. Determine number and lengths of piles based on Project Record Documents.
 - 3. Adjustment in price due to changes in number or length of piles will be based on unit prices established as specified in Section 012200 - Unit Prices.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM D 25 - Specification for Round Timber Piles.

NOTE TO SPECIFIER



Include ASTM D 1143, D 3689 and D 3966 when used in body of Specification. Delete if not used.

2. ASTM D 1143 - Method of Testing Piles Under Static Axial Compressive Load.
3. ASTM D 3689 - Method of Testing Individual Piles Under Static and Axial Tensile Load.
4. ASTM D 3966 - Method of Testing Piles under Lateral Loads.

B. American Wood-Preservers' Association (AWPA):

1. AWPA C3 - Preservative Treatment of Piles by Pressure Processes.
2. AWPA M4 - Standard for the Care of Pressure Treated Wood Products.

1.3 DEFINITIONS

- A. Refusal: 12 blows per foot or more as specified by project structural engineer.
- B. Non-Conforming Piles: Piles that fail field tests, are driven out of position, are driven below cut-off elevation, or are damaged.

1.4 SYSTEM DESCRIPTION

- A. Design Requirements
 1. Load Carrying Capacity: Indicated on Structural Drawings.

1.5 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 1. Product Data: Pile tip and collar.
 2. Shop Drawings:
 - a. Details and schedule of pile installation sequence and testing.
 - b. Pile lengths and diameters.
 3. Assurance/Control Submittals:
 - a. Certificate: Provide certification from pile fabrication shop that each pile meets or exceeds specified requirements.
 - b. Qualification Documentation: Submit installer documentation of experience indicating compliance with specified qualification requirements.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals:
 1. Project Record Documents: Submit log of the following, recorded at time of pile placement.
 - a. Sizes, lengths, and locations of piles.
 - b. Sequence of placing.
 - c. Number of blows per foot for entire length of pile and measured set for last 10 blows.
 - d. Final base and top of pile elevations.
 - e. Driving force of each hammer blow.
 - f. Time and load settlement measurements of load tested piles.
 - g. Difficulties encountered during pile driving.
 - h. Type and size of equipment.
 - i. Alignment deviations.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing Work of this Section with minimum 10 years documented experience.



- B. Pile Component Selection: Under supervision of professional Structural Engineer experienced in pile design licensed in State where project is located.
- C. Pre-Installation Meeting:
 - 1. Convene a pre-installation meeting at site, one week prior to commencing Work of this Section.
 - 2. Require attendance of parties directly affecting Work of this Section.
 - 3. Review conditions of installation, installation procedures, and coordination with related work.
 - 4. Agenda:
 - a. Tour, inspect and discuss condition of soil substrate, pile locations and other preparatory work performed by other trades.
 - b. Review structural loading requirements.
 - c. Review pile system requirements (drawings, specifications and other contract documents).
 - d. Review pile driving methods and equipment.
 - e. Review and finalize construction schedule related to pile work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
 - f. Review required inspections, testing, and certifying procedures.
 - g. Review weather and forecasted weather conditions, and procedures for resolving unfavorable conditions.
 - h. Review safety precautions relating to timber pile installation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Preservative treated, clean-peeled Southern Pine, ASTM D 25, pressure impregnated with Grade 1, AWPAC P1 creosote in accordance with AWPAC C3 for land and fresh water piles with minimum retention of 8 pounds per cubic foot.
- B. One-piece friction piles with minimum butt diameter and minimum tip diameter as indicated on Structural Drawings. Splices not permitted.

2.2 SOURCE QUALITY CONTROL

- A. Certification: Provide shop inspection and certification of wood piles.
- B. Inspection: Inspect wood piles at source of supply for conformance with ASTM D 25. Hammer mark pile butt to indicate conformance with specified requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify site conditions will support pile driving equipment for performance of pile driving operations and testing.



2. Verify that survey benchmark and intended elevations for the Work are as indicated on Drawings and are not located in an area that may be damaged.

- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Obtain Contracting Officer approval for pile driving hammer.
- B. Use driving method which will not cause damage to existing adjacent structures and site improvements.
- C. Notify adjacent property owners with written notice, approved by Contracting Officer, prior to start of Work.
- D. Protect adjacent structures and site improvements from damage.

3.3 INSTALLATION

- A. Protect pile head during driving, using cushion cap. Provide full bearing on piles for distribution of hammer blow. Do not damage piles during driving operations.
- B. Deliver hammer blows on central axis of pile.
- C. Drive piles to length indicated on Structural Drawings. Avoid damaging piles by over driving.
- D. If driving is interrupted before refusal, drive pile an additional 6 inches before resuming recording of performance data.
- E. Re-drive piles which have lifted due to driving adjacent piles, or by soil uplift.
- F. Cut off tops of piles to elevations indicated on Structural Drawings and prepare pile top to receive pile cap or grade beams.
- G. Prevent surface damage to piles.
- H. Apply preservative to exposed ends of cut-off piles, compatible with preservative treatment and in accordance with pile manufacturer's recommendation.

3.4 CONSTRUCTION

- A. Site Tolerances:
 1. Maximum Variation From Vertical For Plumb Piers: 1 in 48.
 2. Minimum Variation From Required Angle for Batter Piers: 1 in 24.
 3. Maximum Variation From Top of Pier Elevation: 2 inches.
 4. Maximum Out-of Position: 4 inches.



3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Inspection and testing procedures.
- B. Inspection: Obtain Contracting Officer inspection of pile installations, locations, and elevations.
- C. Site Tests:

NOTE TO SPECIFIER

Select appropriate ASTM testing specifications for specific site conditions. Indicate number of test piles required to determine acceptability of pile and grade beam foundation system for the specific site conditions. Select loading factor for tests.

1. Perform testing using equipment, load carrying device, load, and instrumentation in conformance with [ASTM D 1143] [and] [ASTM D 3689, and ASTM D 3966].
 2. Verify site conditions will support cribbing and load for testing purposes.
 3. Establish stable working elevation for test equipment.
 4. Provide materials and equipment for testing except hydraulic jack.
 5. Provide test piles same diameter and type specified for piles, constructed in same manner.
 6. Test [6] [____] indicator piles at locations as directed by Contracting Officer.
 7. Subject piles to [1-3/4] [2] [____] times design load.
 8. Document test equipment used and method of calibrating and recording.
- D. Acceptable Permanent Set of Piles After Load Testing: [1/8] [1/4] [____] inch.
 - E. Accepted test piers may be used in Work.
 - F. Non-Conforming Piles: Provide additional piles or supplement piles to conform to specified requirements at non-conforming piles.

3.6 PROTECTION

- A. Prevent surface damage to treated piles.
- B. Treat repairs to treated piles in accordance with AWP4 M4.

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END OF SECTION 31 62 19 00



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SECTION 31 62 23 00 - CSF COMPOSITE PILES

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where pile and grade beam foundation system is required and Composite Piles are a part of the Work. Before editing this Section, obtain the "Report of Subsurface Investigation" prepared by the Geotechnical Engineer. Read the report and incorporate the recommendations included in the report for Pile and Grade Beam foundation system into this section.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wood concrete composite piles.
 - 2. Pile inspection and load tests.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 012200 - Unit Prices: Procedures related to Work performed under unit price method.
 - 2. Section 033000 - Cast-In-Place Concrete: Pile caps, grade beams and concrete pile section.
- D. Unit Prices:
 - 1. Base proposals on number and spacing of piles and on length from point to cut-off as indicated on Structural Drawings. Provide test piles two feet longer than pile lengths indicated on Structural Drawings.
 - 2. Determine number and length of piles based on Project Record Documents.
 - 3. Adjustment in price due to changes in number or length of piles will be based on unit prices established as specified in Section 012200 – Unit Prices.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM D25 - Specification for Round Timber Piles.



1.3 DEFINITIONS

- A. Refusal: 12 blows per foot or more as specified by project structural engineer.
- B. Non-Conforming Piles: Piles that fail field tests, are driven out of position, are driven below cut-off elevation, or are damaged.

1.4 DESIGN REQUIREMENTS

- A. Load Carrying Capacity: Indicated on Structural Drawings.

1.5 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Connector and drive shoe.
 - 2. Shop Drawings:
 - a. Details and schedule of pile installation sequence and testing.
 - b. Pile lengths and diameters.
 - c. Reinforcing quantities, sizes, and lengths for each pile.
 - 3. Assurance/Control Submittals:
 - a. Mix Design: Pile concrete as specified herein for Section 033000 mix design.
 - b. Qualification Documentation: Submit installer documentation of experience indicating compliance with specified qualification requirements.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals:
 - 1. Project Record Documents: Submit log of the following, recorded at time of pile placement.
 - a. Sizes, lengths, and locations of piles.
 - b. Sequence of placing.
 - c. Number of blows per foot for entire length of pile and measured set for last 10 blows.
 - d. Final base and top of pile elevations.
 - e. Driving force of each hammer blow.
 - f. Time and load settlement measurements of load tested piles.
 - g. Difficulties encountered during pile driving.
 - h. Type and size of equipment.
 - i. Alignment deviations.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing Work of this Section with minimum 10 years documented experience.
- B. Pile Component Selection: Under supervision of professional Structural Engineer experienced in pile design licensed in State where project is located.
- C. Pre-Installation Meeting:
 - 1. Convene a pre-installation meeting at site, one week prior to commencing Work of this Section.
 - 2. Require attendance of parties directly affecting Work of this Section.
 - 3. Review conditions of installation, installation procedures and coordination with related work.
 - 4. Agenda:
 - a. Tour, inspect, and discuss condition of soil substrate, pile locations, and other preparatory work.
 - b. Review structural loading requirements.



- c. Review pile system requirements (drawings, specifications, and other contract documents).
- d. Review pile driving methods and equipment.
- e. Review and finalize construction schedule related to pile work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
- f. Review required inspections, testing and certifying procedures.
- g. Review weather and forecasted weather conditions, and procedures for resolving unfavorable conditions.
- h. Review safety precautions relating to composite pile installation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Wood-concrete composite type consisting of concrete upper section untreated Southern Pine, ASTM D2 5, timber lower section.
- B. Untreated Timber Section: Round timber piles, rough peeled, Southern Pine, with minimum butt diameter and minimum tip diameter as indicated on Structural Drawings. Splices not permitted.
- C. Concrete Section Casing: Steel of strength and gage to prevent distortion during driving of pile and adjacent piles; water tight to exclude water and foreign matter during placing of concrete. Minimum inside diameter as indicated on Structural Drawings.
- D. Connector; Drive-Shoe:
 - 1. Structural grade steel with drive-shoe minimum 12 gage or material firmly attached to steel casing.
 - 2. Drive-shoe penetrating capability: Minimum of 4 inches into timber section.
 - 3. Other connector requirements: Conform to local building code.
 - 4. Design splice to withstand minimum moment capacity of 4 foot kips, with no applied axial load, and to withstand minimum tensile force of 20 tons.

NOTE TO SPECIFIER

Select concrete type, aggregate size, strength, and slump requirements as required by project site conditions.

- E. Concrete Materials and Mix: Specified in Section 033000 using Type [I] [____] cement, [3/4] [____] inch aggregate size, [3000] [____] psi 28 day strength, [6] [____] inch slump.

2.2 SOURCE QUALITY CONTROL

- A. Certification: Provide shop inspection and certification of timber pile sections.
- B. Timber Section Inspection: Inspect at source of supply and hammer mark in the butt to indicate conformance with specified requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution Requirements: Verification of existing conditions before starting work.



- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify site conditions will support pile driving equipment for performance of pile driving operations and testing.
 - 2. Verify that survey benchmark and intended elevations for the Work are as indicated on Drawings and are not located in an area that may be damaged.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Obtain Contracting Officer approval for pile driving hammer.
- B. Use driving method which will not cause damage to existing adjacent structures, and site improvements.
- C. Notify adjacent property owners with written notice, approved by Contracting Officer, prior to start of Work.
- D. Protect adjacent structures and site improvements from damage.
- E. Clean casing of debris and dry casing prior to placing concrete.

3.3 INSTALLATION

- A. Protect pile head during driving, using cushion cap. Provide full bearing on piles for distribution of hammer blow. Do not damage piles during driving operations.
- B. Deliver hammer blows to central axis of pile.
- C. Drive piles to length indicated on Structural Drawings. Avoid damaging piles by overdriving.
- D. Refusal: Contact Contracting Officer for instructions when refusal is encountered.
- E. If driving is interrupted before refusal, drive pile an additional 6 inches before resuming recording of performance data.
- F. Re-drive piles which have lifted due to driving adjacent piles, or by soil uplift.
- G. Cut off tops of piles to elevations indicated on Structural Drawings and prepare pile top to receive pile cap or grade beams.
- H. Prevent surface damage to piles.

3.4 CONSTRUCTION

- A. Site Tolerances:



1. Maximum Variation From Vertical For Plumb Piles: 1 in 48.
2. Minimum Variation From Required Angle for Batter Piles: 1 in 24.
3. Maximum Variation From Top of Pile Elevation: 2 inches.
4. Maximum Out-of Position: 4 inches.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Control: Inspection and testing procedures.
- B. Inspection: Obtain Contracting Officer inspection of pile installations, locations, and elevations.
- C. Site Tests:

NOTE TO SPECIFIER

Select appropriate ASTM testing specifications for specific site conditions. Indicate number of test piles required to determine acceptability of pile and grade beam foundation system for the specific site conditions. Select loading factor for tests.

1. Perform testing using equipment, load carrying device, load, and instrumentation in conformance with [ASTM D 1143] [and] [ASTM D 3689, and ASTM D 3966].
2. Verify site conditions will support cribbing and load for testing purposes.
3. Establish stable working elevation for test equipment.
4. Provide materials and equipment for testing except hydraulic jack.
5. Provide test piles same diameter and type specified for piles, constructed in same manner.
6. Test [6] [____] indicator piles at locations as directed by Contracting Officer.
7. Subject piles to [1-3/4] [2] [____] times design load.
8. Document test equipment used and method of calibrating and recording.

NOTE TO SPECIFIER

Select acceptable permanent set.

- D. Acceptable Permanent Set of Piles After Load Testing: [1/8] [1/4] [____] inch.
- E. Accepted test piles may be used in Work.
- F. Non-Conforming Piles: Provide additional piles or supplement piles to conform to specified requirements at non-conforming piles.

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END OF SECTION 31 62 23 00



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SECTION 31 62 23 00 - MPF COMPOSITE PILES

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

Use this section where pile and grade beam foundation system is required and Composite Piles are a part of the Work. Before editing this Section, obtain the "Report of Subsurface Investigation" prepared by the Geotechnical Engineer. Read the report and incorporate the recommendations included in the report for Pile and Grade Beam foundation system into this section.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wood concrete composite piles.
 - 2. Pile inspection and load tests.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 012200 - Unit Prices: Procedures related to Work performed under unit price method.
 - 2. Section 033000 - Cast-In-Place Concrete: Pile caps, grade beams and concrete pile section.
- D. Unit Prices:
 - 1. Base proposals on number and spacing of piles and on length from point to cut-off as indicated on Structural Drawings. Provide test piles two feet longer than pile lengths indicated on Structural Drawings.
 - 2. Determine number and length of piles based on Project Record Documents.
 - 3. Adjustment in price due to changes in number or length of piles will be based on unit prices established as specified in Section 012200 – Unit Prices.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM D25 - Specification for Round Timber Piles.



1.3 DEFINITIONS

- A. Refusal: 12 blows per foot or more as specified by project structural engineer.
- B. Non-Conforming Piles: Piles that fail field tests, are driven out of position, are driven below cut-off elevation, or are damaged.

1.4 DESIGN REQUIREMENTS

- A. Load Carrying Capacity: Indicated on Structural Drawings.

1.5 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Connector and drive shoe.
 - 2. Shop Drawings:
 - a. Details and schedule of pile installation sequence and testing.
 - b. Pile lengths and diameters.
 - c. Reinforcing quantities, sizes, and lengths for each pile.
 - 3. Assurance/Control Submittals:
 - a. Mix Design: Pile concrete as specified herein for Section 033000 mix design.
 - b. Qualification Documentation: Submit installer documentation of experience indicating compliance with specified qualification requirements.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals:
 - 1. Project Record Documents: Submit log of the following, recorded at time of pile placement.
 - a. Sizes, lengths, and locations of piles.
 - b. Sequence of placing.
 - c. Number of blows per foot for entire length of pile and measured set for last 10 blows.
 - d. Final base and top of pile elevations.
 - e. Driving force of each hammer blow.
 - f. Time and load settlement measurements of load tested piles.
 - g. Difficulties encountered during pile driving.
 - h. Type and size of equipment.
 - i. Alignment deviations.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing Work of this Section with minimum 10 years documented experience.
- B. Pile Component Selection: Under supervision of professional Structural Engineer experienced in pile design licensed in State where project is located.
- C. Pre-Installation Meeting:
 - 1. Convene a pre-installation meeting at site, one week prior to commencing Work of this Section.
 - 2. Require attendance of parties directly affecting Work of this Section.
 - 3. Review conditions of installation, installation procedures and coordination with related work.
 - 4. Agenda:
 - a. Tour, inspect, and discuss condition of soil substrate, pile locations, and other preparatory work.
 - b. Review structural loading requirements.



- c. Review pile system requirements (drawings, specifications, and other contract documents).
- d. Review pile driving methods and equipment.
- e. Review and finalize construction schedule related to pile work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
- f. Review required inspections, testing and certifying procedures.
- g. Review weather and forecasted weather conditions, and procedures for resolving unfavorable conditions.
- h. Review safety precautions relating to composite pile installation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Wood-concrete composite type consisting of concrete upper section untreated Southern Pine, ASTM D2 5, timber lower section.
- B. Untreated Timber Section: Round timber piles, rough peeled, Southern Pine, with minimum butt diameter and minimum tip diameter as indicated on Structural Drawings. Splices not permitted.
- C. Concrete Section Casing: Steel of strength and gage to prevent distortion during driving of pile and adjacent piles; water tight to exclude water and foreign matter during placing of concrete. Minimum inside diameter as indicated on Structural Drawings.
- D. Connector; Drive-Shoe:
 - 1. Structural grade steel with drive-shoe minimum 12 gage or material firmly attached to steel casing.
 - 2. Drive-shoe penetrating capability: Minimum of 4 inches into timber section.
 - 3. Other connector requirements: Conform to local building code.
 - 4. Design splice to withstand minimum moment capacity of 4 foot kips, with no applied axial load, and to withstand minimum tensile force of 20 tons.

NOTE TO SPECIFIER

Select concrete type, aggregate size, strength, and slump requirements as required by project site conditions.

- E. Concrete Materials and Mix: Specified in Section 033000 using Type [I] [____] cement, [3/4] [____] inch aggregate size, [3000] [____] psi 28 day strength, [6] [____] inch slump.

2.2 SOURCE QUALITY CONTROL

- A. Certification: Provide shop inspection and certification of timber pile sections.
- B. Timber Section Inspection: Inspect at source of supply and hammer mark in the butt to indicate conformance with specified requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution Requirements: Verification of existing conditions before starting work.



- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify site conditions will support pile driving equipment for performance of pile driving operations and testing.
 - 2. Verify that survey benchmark and intended elevations for the Work are as indicated on Drawings and are not located in an area that may be damaged.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Obtain Contracting Officer approval for pile driving hammer.
- B. Use driving method which will not cause damage to existing adjacent structures, and site improvements.
- C. Notify adjacent property owners with written notice, approved by Contracting Officer, prior to start of Work.
- D. Protect adjacent structures and site improvements from damage.
- E. Clean casing of debris and dry casing prior to placing concrete.

3.3 INSTALLATION

- A. Protect pile head during driving, using cushion cap. Provide full bearing on piles for distribution of hammer blow. Do not damage piles during driving operations.
- B. Deliver hammer blows to central axis of pile.
- C. Drive piles to length indicated on Structural Drawings. Avoid damaging piles by overdriving.
- D. Refusal: Contact Contracting Officer for instructions when refusal is encountered.
- E. If driving is interrupted before refusal, drive pile an additional 6 inches before resuming recording of performance data.
- F. Re-drive piles which have lifted due to driving adjacent piles, or by soil uplift.
- G. Cut off tops of piles to elevations indicated on Structural Drawings and prepare pile top to receive pile cap or grade beams.
- H. Prevent surface damage to piles.

3.4 CONSTRUCTION

- A. Site Tolerances:



1. Maximum Variation From Vertical For Plumb Piles: 1 in 48.
2. Minimum Variation From Required Angle for Batter Piles: 1 in 24.
3. Maximum Variation From Top of Pile Elevation: 2 inches.
4. Maximum Out-of Position: 4 inches.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Control: Inspection and testing procedures.
- B. Inspection: Obtain Contracting Officer inspection of pile installations, locations, and elevations.
- C. Site Tests:

NOTE TO SPECIFIER

Select appropriate ASTM testing specifications for specific site conditions. Indicate number of test piles required to determine acceptability of pile and grade beam foundation system for the specific site conditions. Select loading factor for tests.

1. Perform testing using equipment, load carrying device, load, and instrumentation in conformance with [ASTM D 1143] [and] [ASTM D 3689, and ASTM D 3966].
2. Verify site conditions will support cribbing and load for testing purposes.
3. Establish stable working elevation for test equipment.
4. Provide materials and equipment for testing except hydraulic jack.
5. Provide test piles same diameter and type specified for piles, constructed in same manner.
6. Test [6] [____] indicator piles at locations as directed by Contracting Officer.
7. Subject piles to [1-3/4] [2] [____] times design load.
8. Document test equipment used and method of calibrating and recording.

NOTE TO SPECIFIER

Select acceptable permanent set.

- D. Acceptable Permanent Set of Piles After Load Testing: [1/8] [1/4] [____] inch.
- E. Accepted test piles may be used in Work.
- F. Non-Conforming Piles: Provide additional piles or supplement piles to conform to specified requirements at non-conforming piles.

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END OF SECTION 31 62 23 00



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SECTION 31 63 29 00 - MPF DRILLED CONCRETE PIERS AND SHAFTS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

Use this section where pile and grade beam foundation system is required and Drilled Concrete Piers are a part of the Work. Before editing this Section, obtain the "Report of Subsurface Investigation" prepared by the Geotechnical Engineer. Read the report and incorporate the recommendations included in the report for Pier and Grade Beam foundation system into this section.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Bored end bearing belled cast-in-place concrete piers with reinforcing steel.
 - 2. Pier inspection and load tests.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 032000 - Concrete Reinforcement: Drilled pier reinforcing.
 - 2. Section 033000 - Cast-In-Place Concrete: Concrete for drilled piers, pier caps, and grade beams.
- D. Unit Prices:
 - 1. Base bids on number, spacing, and length of piers indicated on Structural Drawings. Provide test piers two feet longer than pier lengths indicated on Structural Drawings.
 - 2. Determine number and length of piers based on Project Record Documents.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A 252 - Specification for Welded and Seamless Steel Pipe Piles.

NOTE TO SPECIFIER

Include ASTM D 1143, D 3689 and D 3966 when used in body of Specification. Delete if not used.



2. ASTM D 1143 - Method of Testing Piles Under Static Axial Compressive Load.
3. ASTM D 3689 - Method of Testing Individual Piles Under Static and Axial Tensile Load.
4. ASTM D 3966 - Method of Testing Piles under Lateral Loads.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements:
 1. Load Carrying Capacities: Indicated on Structural Drawings.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 1. Shop Drawings:
 - a. Details and schedule of pier installation and testing.
 - b. Pier lengths and diameters.
 - c. Reinforcing quantities, sizes, and lengths for each pier.
 2. Section 014000 - Quality Requirements: Procedures for Quality Assurance/Control submittals.
 - a. Mix Design: Pier concrete as specified herein for Section 033000 mix design.
 - b. Qualification Documentation: Submit installer documentation of experience indicating compliance with specified qualification requirements.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals:
 1. Project Record Documents : Submit log of the following, recorded at time of pier placement.
 - a. Top of pier elevation.
 - b. Pier shaft and under ream diameters.
 - c. Depth of bottom of pier.
 - d. Date pier was drilled and poured.
 - e. Soil stratum at bottom of pier.
 - f. Sequence of pier placing.
 - g. Alignment deviations.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing Work of this Section with minimum 10 years documented experience.
- B. Pre-Installation Meeting:
 1. Convene a pre-installation meeting at site, one week prior to commencing Work of this Section.
 2. Require attendance of parties directly affecting Work of this Section.
 3. Review conditions of installation, installation procedures and coordination with related work.
 4. Agenda:
 - a. Tour, inspect and discuss condition of soil substrate, pier locations and other preparatory work performed by other trades.
 - b. Review structural loading requirements.
 - c. Review pier system requirements (drawings, specifications and other contract documents).
 - d. Review pier drilling methods and equipment.
 - e. Review and finalize construction schedule related to pier work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
 - f. Review required inspections, testing and certifying procedures.



- g. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.
- h. Review safety precautions relating to drilled concrete pier and shaft installation.

PART 2 - PRODUCTS

2.1 MATERIALS

NOTE TO SPECIFIER

Verify casing material type and specifics. Modify as required for project site requirements.

- A. Casing: ASTM A 252, Grade 1, Grade 2, and Grade 3 single length steel pipe.
 - 1. Wall: Plain.
 - 2. Ends: Plain.
 - 3. Diameter: Indicated on Structural Drawings.
 - 4. Wall Thickness: Indicated on Structural Drawings.

NOTE TO SPECIFIER

Select concrete type, aggregate, size, strength, and slump requirements as required by project site conditions.

- B. Concrete Materials and Mix: Specified in Section 033000 using Type [I] [____] cement, [3/4] [____] inch aggregate size, [3000] [____] psi 28 day strength, [6] [____] inch slump.
- C. Reinforcement: Specified in Section 032000.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify site conditions will support drilling equipment for performance of pier drilling operations.
 - 2. Verify that survey benchmark and intended elevations for the Work are as indicated on Drawings and are not located in an area that may be damaged.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Drill vertical concentric pier shafts to diameters and depths indicated on Structural Drawings.



- B. Provide shaft liners as drilling progresses or immediately after drilling and inspection of pier shafts as indicated on Structural Drawings.
- C. Clean shaft bottom of loose material. Maintain shafts free of water.
- D. Obtain Contracting Officer inspection and approval of pier shafts prior to reinforcing and concrete placement. Prevent foreign matter from falling into shaft.
- E. Set tops of piers to elevations indicated on Structural Drawings.
- F. Place reinforcing steel as specified in Section 032000.
- G. Place concrete in single pour, in accordance with Section 033000. Use equipment designed for vertical placement of concrete. Vibrate concrete full depth of pier.
- H. Progressively raise shaft liner during concrete placement. Do not permit top of pier to deform to a mushroom shape due to premature removal of liner.
- I. Install dowels at top of pier as indicated on Structural Drawings for connection to grade beams.
- J. Install anchor bolts with setting templates at top of pier as indicated on Structural Drawings.
- K. Place concrete through tremie if an inflow of subsurface water occurs. Place concrete to height sufficient to effect seal.
- L. Provide protection for open pier holes. Do not leave pier holes open overnight.

3.3 CONSTRUCTION

- A. Site Tolerances:
 1. Maximum Variation From Vertical For Plumb Piers: 1 in 48.
 2. Minimum Variation From Required Angle for Batter Piers: 1 in 24.
 3. Maximum Variation From Top of Pier Elevation: 2 inches.
 4. Maximum Out-of Position: 4 inches.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Inspection and testing procedures.
- B. Inspection: Obtain Contracting Officer inspection and approval of pier shafts before reinforcing and concrete placement.
- C. Site Tests:

NOTE TO SPECIFIER

Select appropriate ASTM testing specifications for specific site conditions. Indicate number of test piers required to determine acceptability of pier and grade beam foundation system for the specific site conditions. Select loading factor for tests.

1. Perform testing using equipment, load carrying device, load, and instrumentation in conformance with [ASTM D 1143] [and] [ASTM D 3689, and ASTM D 3966].
2. Verify site conditions will support cribbing and load for testing purposes.
3. Establish stable working elevation for test equipment.



4. Provide materials and equipment for testing except hydraulic jack.
5. Provide test piers same diameter and type specified for piers, constructed in same manner.
6. Test [6] [____] indicator piers at locations as directed by Contracting Officer.
7. Subject piers to [1 3/4] [2] [____] times design load.
8. Perform concrete testing for pier concrete as specified in Section 033000.
9. Document test equipment used and method of calibrating and recording.

NOTE TO SPECIFIER

Select acceptable permanent set.

- D. Acceptable Permanent Set of Piers After Load Testing: [1/8] [1/4] [____] inch.
- E. Accepted test piers may be used in Work.
- F. Non-Conforming Piers: Provide additional piers or supplement piers to conform to specified requirements at non-conforming piers.

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END OF SECTION 31 63 29 00



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SECTION 31 63 29 00 - CSF DRILLED CONCRETE PIERS AND SHAFTS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where pile and grade beam foundation system is required and Drilled Concrete Piers are a part of the Work. Before editing this Section, obtain the "Report of Subsurface Investigation" prepared by the Geotechnical Engineer. Read the report and incorporate the recommendations included in the report for Pier and Grade Beam foundation system into this section.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Bored end bearing belled cast-in-place concrete piers with reinforcing steel.
 - 2. Pier inspection and load tests.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 032000 - Concrete Reinforcement: Drilled pier reinforcing.
 - 2. Section 033000 - Cast-In-Place Concrete: Concrete for drilled piers, pier caps, and grade beams.
- D. Unit Prices:
 - 1. Base bids on number, spacing, and length of piers indicated on Structural Drawings. Provide test piers two feet longer than pier lengths indicated on Structural Drawings.
 - 2. Determine number and length of piers based on Project Record Documents.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A 252 - Specification for Welded and Seamless Steel Pipe Piles.

NOTE TO SPECIFIER

Include ASTM D 1143, D 3689 and D 3966 when used in body of Specification. Delete if not used.



2. ASTM D 1143 - Method of Testing Piles Under Static Axial Compressive Load.
3. ASTM D 3689 - Method of Testing Individual Piles Under Static and Axial Tensile Load.
4. ASTM D 3966 - Method of Testing Piles under Lateral Loads.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements:
1. Load Carrying Capacities: Indicated on Structural Drawings.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
1. Shop Drawings:
 - a. Details and schedule of pier installation and testing.
 - b. Pier lengths and diameters.
 - c. Reinforcing quantities, sizes, and lengths for each pier.
 2. Section 014000 - Quality Requirements: Procedures for Quality Assurance/Control submittals.
 - a. Mix Design: Pier concrete as specified herein for Section 033000 mix design.
 - b. Qualification Documentation: Submit installer documentation of experience indicating compliance with specified qualification requirements.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals:
1. Project Record Documents : Submit log of the following, recorded at time of pier placement.
 - a. Top of pier elevation.
 - b. Pier shaft and under ream diameters.
 - c. Depth of bottom of pier.
 - d. Date pier was drilled and poured.
 - e. Soil stratum at bottom of pier.
 - f. Sequence of pier placing.
 - g. Alignment deviations.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing Work of this Section with minimum 10 years documented experience.
- B. Pre-Installation Meeting:
1. Convene a pre-installation meeting at site, one week prior to commencing Work of this Section.
 2. Require attendance of parties directly affecting Work of this Section.
 3. Review conditions of installation, installation procedures and coordination with related work.
 4. Agenda:
 - a. Tour, inspect and discuss condition of soil substrate, pier locations and other preparatory work performed by other trades.
 - b. Review structural loading requirements.
 - c. Review pier system requirements (drawings, specifications and other contract documents).
 - d. Review pier drilling methods and equipment.
 - e. Review and finalize construction schedule related to pier work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
 - f. Review required inspections, testing and certifying procedures.



- g. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.
- h. Review safety precautions relating to drilled concrete pier and shaft installation.

PART 2 - PRODUCTS

2.1 MATERIALS

NOTE TO SPECIFIER

Verify casing material type and specifics. Modify as required for project site requirements.

- A. Casing: ASTM A 252, Grade 1, Grade 2, and Grade 3 single length steel pipe.
 - 1. Wall: Plain.
 - 2. Ends: Plain.
 - 3. Diameter: Indicated on Structural Drawings.
 - 4. Wall Thickness: Indicated on Structural Drawings.

NOTE TO SPECIFIER

Select concrete type, aggregate, size, strength, and slump requirements as required by project site conditions.

- B. Concrete Materials and Mix: Specified in Section 033000 using Type [I] [____] cement, [3/4] [____] inch aggregate size, [3000] [____] psi 28 day strength, [6] [____] inch slump.
- C. Reinforcement: Specified in Section 032000.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify site conditions will support drilling equipment for performance of pier drilling operations.
 - 2. Verify that survey benchmark and intended elevations for the Work are as indicated on Drawings and are not located in an area that may be damaged.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Drill vertical concentric pier shafts to diameters and depths indicated on Structural Drawings.



- B. Provide shaft liners as drilling progresses or immediately after drilling and inspection of pier shafts as indicated on Structural Drawings.
- C. Clean shaft bottom of loose material. Maintain shafts free of water.
- D. Obtain Contracting Officer inspection and approval of pier shafts prior to reinforcing and concrete placement. Prevent foreign matter from falling into shaft.
- E. Set tops of piers to elevations indicated on Structural Drawings.
- F. Place reinforcing steel as specified in Section 032000.
- G. Place concrete in single pour, in accordance with Section 033000. Use equipment designed for vertical placement of concrete. Vibrate concrete full depth of pier.
- H. Progressively raise shaft liner during concrete placement. Do not permit top of pier to deform to a mushroom shape due to premature removal of liner.
- I. Install dowels at top of pier as indicated on Structural Drawings for connection to grade beams.
- J. Install anchor bolts with setting templates at top of pier as indicated on Structural Drawings.
- K. Place concrete through tremie if an inflow of subsurface water occurs. Place concrete to height sufficient to effect seal.
- L. Provide protection for open pier holes. Do not leave pier holes open overnight.

3.3 CONSTRUCTION

- A. Site Tolerances:
 1. Maximum Variation From Vertical For Plumb Piers: 1 in 48.
 2. Minimum Variation From Required Angle for Batter Piers: 1 in 24.
 3. Maximum Variation From Top of Pier Elevation: 2 inches.
 4. Maximum Out-of Position: 4 inches.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Inspection and testing procedures.
- B. Inspection: Obtain Contracting Officer inspection and approval of pier shafts before reinforcing and concrete placement.
- C. Site Tests:

NOTE TO SPECIFIER

Select appropriate ASTM testing specifications for specific site conditions. Indicate number of test piers required to determine acceptability of pier and grade beam foundation system for the specific site conditions. Select loading factor for tests.

1. Perform testing using equipment, load carrying device, load, and instrumentation in conformance with [ASTM D 1143] [and] [ASTM D 3689, and ASTM D 3966].
2. Verify site conditions will support cribbing and load for testing purposes.
3. Establish stable working elevation for test equipment.



4. Provide materials and equipment for testing except hydraulic jack.
5. Provide test piers same diameter and type specified for piers, constructed in same manner.
6. Test [6] [____] indicator piers at locations as directed by Contracting Officer.
7. Subject piers to [1 3/4] [2] [____] times design load.
8. Perform concrete testing for pier concrete as specified in Section 033000.
9. Document test equipment used and method of calibrating and recording.

NOTE TO SPECIFIER

Select acceptable permanent set.

- D. Acceptable Permanent Set of Piers After Load Testing: [1/8] [1/4] [____] inch.
- E. Accepted test piers may be used in Work.
- F. Non-Conforming Piers: Provide additional piers or supplement piers to conform to specified requirements at non-conforming piers.

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Last revised: 4/12/2011

END OF SECTION 31 63 29 00



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SECTION 32 01 11 53 - CEMENT CONCRETE PAVEMENT

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for cement concrete pavement. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Driveways.
 - b. Roadways.
 - c. Parking lots.
 - d. Curbs and gutters.
 - e. Walks.

C. Definitions

1. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

D. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
 - b. Design Mixtures for Credit ID 1.1: For each concrete mixture containing fly ash as a replacement for portland cement or other portland cement replacements. For each design mixture submitted, include an equivalent concrete mixture that does not contain portland cement replacements, to determine amount of portland cement replaced.
3. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.
4. Samples: For each type of product or exposed finish, prepared as Samples of size indicated below:
 - a. Exposed Aggregate: 10-lb (4.5-kg) Sample of each mix.
 - b. Wheel Stops: 6 inches (150 mm) long showing cross section; with fasteners.
 - c. Preformed Traffic-Calming Devices: 6 inches (150 mm) long showing cross section; with fasteners.
5. Other Action Submittals:
 - a. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
6. Qualification Data: For qualified Installer of detectable warnings, ready-mix concrete manufacturer and testing agency.
7. Material Certificates: For the following, from manufacturer:
 - a. Cementitious materials.
 - b. Steel reinforcement and reinforcement accessories.
 - c. Fiber reinforcement.
 - d. Admixtures.
 - e. Curing compounds.
 - f. Applied finish materials.



- g. Bonding agent or epoxy adhesive.
- h. Joint fillers.
- 8. Material Test Reports: For each of the following:
 - a. Aggregates. Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.
- 9. Field quality-control reports.

E. Quality Assurance

- 1. Detectable Warning Installer Qualifications: An employer of workers trained and approved by manufacturer of stamped concrete paving systems.
- 2. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - a. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").
- 3. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 - a. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- 4. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.
- 5. ACI Publications: Comply with ACI 301 (ACI 301M) unless otherwise indicated.
- 6. Preinstallation Conference: Conduct conference at Project site.

F. Project Conditions

- 1. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
- 2. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F (4.4 deg C) for oil-based materials **OR** 55 deg F (12.8 deg C) for water-based materials, **as directed**, and not exceeding 95 deg F (35 deg C).

1.2 PRODUCTS

A. Forms

- 1. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
 - a. Use flexible or uniformly curved forms for curves with a radius of 100 feet (30.5 m) or less. Do not use notched and bent forms.
- 2. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

B. Steel Reinforcement

- 1. Recycled Content: Provide steel reinforcement with an average recycled content of steel so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- 2. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn steel **OR** galvanized-steel, **as directed**, wire into flat sheets.
- 3. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.
- 4. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884/A 884M, Class A, plain steel.
- 5. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420); deformed.
- 6. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A 615/A 615M, Grade 60 (Grade 420) deformed bars.



7. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M; with ASTM A 615/A 615M, Grade 60 (Grade 420) deformed bars.
8. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars; assembled with clips.
9. Plain-Steel Wire: ASTM A 82/A 82M, as drawn **OR** galvanized, **as directed**.
10. Deformed-Steel Wire: ASTM A 496/A 496M.
11. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A coated, plain **OR** deformed, **as directed**.
12. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) plain-steel bars; zinc coated (galvanized) after fabrication according to ASTM A 767/A 767M, Class I coating, **as directed**. Cut bars true to length with ends square and free of burrs.
13. Epoxy-Coated, Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars.
14. Tie Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
OR
Hook Bolts: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.
15. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:
 - a. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
 - b. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
16. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.
17. Zinc Repair Material: ASTM A 780.

C. Concrete Materials

1. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:
 - a. Portland Cement: ASTM C 150, gray **OR** white, **as directed**, portland cement Type I **OR** Type II **OR** Type I/II **OR** Type III **OR** Type V, **as directed**. Supplement with the following, **as directed**:
 - 1) Fly Ash: ASTM C 618, Class C or Class F.
 - 2) Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
 - b. Blended Hydraulic Cement: ASTM C 595, Type IS, portland blast-furnace slag **OR** Type IP, portland-pozzolan, **as directed**, cement.
2. Normal-Weight Aggregates: ASTM C 33, Class 4S **OR** Class 4M **OR** Class 1N, **as directed**, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials, **as directed**.
 - a. Maximum Coarse-Aggregate Size: 1-1/2 inches (38 mm) **OR** 1 inch (25 mm) **OR** 3/4 inch (19 mm), **as directed**, nominal.
 - b. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
3. Exposed Aggregate: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, with gap-graded coarse aggregate as follows:
 - a. Aggregate Sizes: 3/4 to 1 inch (19 to 25 mm) **OR** 1/2 to 3/4 inch (13 to 19 mm) **OR** 3/8 to 5/8 inch (10 to 16 mm), **as directed**, nominal.
 - b. Aggregate Source, Shape, and Color: **As required to meet Project requirements**.
4. Water: Potable and complying with ASTM C 94/C 94M.
5. Air-Entraining Admixture: ASTM C 260.



6. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
 - a. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - b. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - c. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - d. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - e. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - f. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
7. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, **as directed**, nonfading, and resistant to lime and other alkalis.

D. Fiber Reinforcement

1. Synthetic Fiber: Monofilament or fibrillated polypropylene fibers engineered and designed for use in concrete paving, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches (13 to 38 mm) long.

E. Curing Materials

1. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry or cotton mats.
2. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
3. Water: Potable.
4. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
5. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
6. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.

F. Related Materials

1. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork in preformed strips.
2. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
3. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
4. Epoxy Bonding Adhesive: ASTM C 881/C 881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:
 - a. Types I and II, non-load bearing **OR** Types IV and V, load bearing, **as directed**, for bonding hardened or freshly mixed concrete to hardened concrete.
5. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch (3 to 6 mm).
6. Pigmented Mineral Dry-Shake Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.
7. Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing 3/8-inch (9.5-mm) sieve and 85 percent retained on a No. 8 (2.36-mm) sieve.

G. Detectable Warning Materials



1. Detectable Warning Stamp: Semirigid polyurethane mats with formed underside capable of imprinting detectable warning pattern on plastic concrete; perforated with a vent hole at each dome.
 - a. Size of Stamp: One piece matching detectable warning area shown on Drawings **OR** 24 by 24 inches (610 by 610 mm) **OR** 24 by 36 inches (610 by 914 mm) **OR** 24 by 48 inches (610 by 1220 mm) **OR** 26 by 26 inches (660 by 660 mm) **OR** 26 by 36 inches (660 by 914 mm), **as directed**.
 2. Liquid Release Agent: Manufacturer's standard, clear, evaporating formulation designed to facilitate release of stamp mats.
- H. Pavement Markings
1. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type N **OR** Type F **OR** Type S, **as directed**; colors complying with FS TT-P-1952.
 - a. Color: White **OR** Yellow **OR** Blue **OR** As indicated, **as directed**.
 2. Pavement-Marking Paint: MPI #32 Alkyd Traffic Marking Paint.
 - a. Color: White **OR** Yellow **OR** Blue **OR** As indicated, **as directed**.
 3. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than three **OR** 45, **as directed**, minutes.
 - a. Color: White **OR** Yellow **OR** Blue **OR** As indicated, **as directed**.
 4. Pavement-Marking Paint: MPI #97 Latex Traffic Marking Paint.
 - a. Color: White **OR** Yellow **OR** Blue **OR** As indicated, **as directed**.
 5. Glass Beads: AASHTO M 247, Type 1 **OR** FS TT-B-1325, Type 1A, **as directed**.
- I. Wheel Stops
1. Wheel Stops: Precast, air-entrained concrete, 2500-psi (17.2-MPa) minimum compressive strength, 4-1/2 inches (115 mm) high by 9 inches (225 mm) wide by 72 inches (1820 mm) long. Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.
 - a. Dowels: Galvanized steel, 3/4 inch (19 mm) in diameter, 10-inch (254-mm) minimum length.
 2. Wheel Stops: Solid, integrally colored, 96 percent recycled HDPE, or commingled postconsumer and postindustrial recycled rubber or plastic; UV stabilized; 4 inches (100 mm) high by 6 inches (150 mm) wide by 72 inches (1820 mm) long. Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.
 - a. Color: Black **OR** Yellow **OR** Gray **OR** Green **OR** Blue, **as directed**.
 - b. Dowels: Galvanized steel, 3/4 inch (19 mm) in diameter, 10-inch (254-mm) minimum length.
 - c. Adhesive: As recommended by wheel stop manufacturer for application to concrete pavement.
- J. Preformed Traffic-Calming Devices
1. Speed Bumps **OR** Humps **OR** Cushions, **as directed**: Solid, integrally colored, 100 percent postconsumer or commingled postconsumer and postindustrial recycled rubber or plastic; UV stabilized. Provide holes for anchoring to substrate.
 - a. Bump Size: Modular 2 inches (50 mm) high by 10 inches (254 mm) wide by 72 inches (1800 mm) long, with overall length as dimensioned on Drawings.
 - b. Hump **OR** Cushion, **as directed**, Size: Modular assemblies 3 inches (75 mm) high by 12 feet (3.7 m) in overall width **OR** 4 inches (100 mm) high by 14 feet (4.3 m) in overall width, **as directed**, with overall length as dimensioned on Drawings.
 - c. Color: Black **OR** Yellow, **as directed**.
 - d. Mounting Hardware: Galvanized-steel lag screw, shield, and washers; 1/2-inch (13-mm) diameter, 8-inch (200-mm) minimum length **OR** hardware as standard with device manufacturer for use with concrete paving, **as directed**.
 - e. Adhesive: As recommended by device manufacturer.

K. Concrete Mixtures

1. Prepare design mixtures, proportioned according to ACI 301 (ACI 301M), for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
 - a. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
 - b. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.
2. Proportion mixtures to provide normal-weight concrete with the following properties:
 - a. Compressive Strength (28 Days): 4500 psi (31 MPa) **OR** 4000 psi (27.6 MPa) **OR** 3500 psi (24.1 MPa) **OR** 3000 psi (20.7 MPa), **as directed**.
 - b. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45 **OR** 0.50, **as directed**.
 - c. Slump Limit: 4 inches (100 mm) **OR** 5 inches (125 mm) **OR** 8 inches (200 mm), **as directed**, plus or minus 1 inch (25 mm).
3. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
 - a. Air Content: 5-1/2 **OR** 4-1/2 **OR** 2-1/2, **as directed**, percent plus or minus 1.5 percent for 1-1/2-inch (38-mm) nominal maximum aggregate size.
 - b. Air Content: 6 **OR** 4-1/2 **OR** 3, **as directed**, percent plus or minus 1.5 percent for 1-inch (25-mm) nominal maximum aggregate size.
 - c. Air Content: 6 **OR** 5 **OR** 3-1/2, **as directed**, percent plus or minus 1.5 percent for 3/4-inch (19-mm) nominal maximum aggregate size.
4. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 **OR** 0.30, **as directed**, percent by weight of cement.
5. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
 - a. Use water-reducing admixture **OR** high-range, water-reducing admixture **OR** high-range, water-reducing and retarding admixture **OR** plasticizing and retarding admixture, **as directed**, in concrete as required for placement and workability.
 - b. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
6. Cementitious Materials: Limit percentage by weight of cementitious materials other than portland cement according to ACI 301 (ACI 301M) requirements for concrete exposed to deicing chemicals **OR** as follows, **as directed**:
 - a. Fly Ash or Pozzolan: 25 percent.
 - b. Ground Granulated Blast-Furnace Slag: 50 percent.
 - c. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.
7. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd. (0.60 kg/cu. m) **OR** 1.5 lb/cu. yd. (0.90 kg/cu. m), **as directed**.
8. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

L. Concrete Mixing

1. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, **as directed**. Furnish batch certificates for each batch discharged and used in the Work.
 - a. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
2. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 - a. For concrete batches of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.



- b. For concrete batches larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
- c. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

1.3 EXECUTION

A. Examination

- 1. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- 2. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.
 - a. Completely proof-roll subbase in one direction and repeat in perpendicular direction, **as directed**. Limit vehicle speed to 3 mph (5 km/h).
 - b. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
 - c. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch (13 mm) according to requirements in Division 31 Section "Earth Moving".
- 3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

- 1. Remove loose material from compacted subbase surface immediately before placing concrete.

C. Edge Forms And Screed Construction

- 1. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- 2. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

D. Steel Reinforcement

- 1. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- 2. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- 3. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- 4. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- 5. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.
- 6. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.
- 7. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch (50-mm) overlap of adjacent mats.

E. Joints

- 1. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
 - a. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.



2. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
 - a. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
 - b. Provide tie bars at sides of paving strips where indicated.
 - c. Butt Joints: Use bonding agent **OR** epoxy bonding adhesive, **as directed**, at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - d. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
 - e. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
 3. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
 - a. Locate expansion joints at intervals of 50 feet (15.25 m) unless otherwise indicated.
 - b. Extend joint fillers full width and depth of joint.
 - c. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished surface if joint sealant is indicated.
 - d. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 - e. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 - f. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
 4. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows, to match jointing of existing adjacent concrete paving:
 - a. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch (6-mm) **OR** 3/8-inch (10-mm), **as directed**, radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces, **as directed**.
 - 1) Tolerance: Ensure that grooved joints are within 3 inches (75 mm) either way from centers of dowels.
 - b. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
 - 1) Tolerance: Ensure that sawed joints are within 3 inches (75 mm) either way from centers of dowels.
 - c. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
 - d. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch (6-mm) **OR** 3/8-inch (10-mm), **as directed**, radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces, **as directed**.
- F. Concrete Placement
1. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
 2. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.



3. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
4. Comply with ACI 301 (ACI 301M) requirements for measuring, mixing, transporting, and placing concrete.
5. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.
6. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
7. Consolidate concrete according to ACI 301 (ACI 301M) by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
 - a. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
8. Screed paving surface with a straightedge and strike off.
9. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
10. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.
11. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.
 - a. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.
12. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
 - a. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
 - b. Do not use frozen materials or materials containing ice or snow.
 - c. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.
13. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and as follows when hot-weather conditions exist:
 - a. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - b. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 - c. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

G. Float Finishing

1. General: Do not add water to concrete surfaces during finishing operations.
2. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
 - a. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.



- b. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
- c. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch (1.6 to 3 mm) deep with a stiff-bristled broom, perpendicular to line of traffic.

H. Special Finishes

1. Monolithic Exposed-Aggregate Finish: Expose coarse aggregate in paving surface as follows:
 - a. Immediately after float finishing, spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
 - b. Cover paving surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.
 - c. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
 - d. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.
2. Seeded Exposed-Aggregate Finish: Immediately after initial floating, spread a single layer of aggregate uniformly on paving surface. Tamp aggregate into plastic concrete and float finish to entirely embed aggregate with mortar cover of 1/16 inch (1.6 mm).
 - a. Spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
 - b. Cover paving surface with plastic sheeting, sealing laps with tape, and remove sheeting when ready to continue finishing operations.
 - c. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
 - d. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.
3. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on paving surface according to manufacturer's written instructions and as follows:
 - a. Uniformly spread 25 lb/100 sq. ft. (12 kg/10 sq. m) **OR** 40 lb/100 sq. ft. (19.5 kg/10 sq. m) **OR** 60 lb/100 sq. ft. (29 kg/10 sq. m), **as directed**, of dampened, slip-resistive aggregate over paving surface in two applications. Tamp aggregate flush with surface using a steel trowel, but do not force below surface.
 - b. Uniformly distribute approximately two-thirds of slip-resistive aggregate over paving surface with mechanical spreader, allow to absorb moisture, and embed by power floating. Follow power floating with a second slip-resistive aggregate application, uniformly distributing remainder of material at right angles to first application to ensure uniform coverage, and embed by power floating.
 - c. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.
 - d. After curing, lightly work surface with a steel wire brush or abrasive stone and water to expose nonslip aggregate.
4. Rock-Salt Finish: After initial floating **OR** troweling **OR** brooming, **as directed**, uniformly spread rock salt over paving surface at the rate of 5 lb/100 sq. ft. (0.2 kg/10 sq. m).
 - a. Embed rock salt into plastic concrete with roller or magnesium float.
 - b. Cover paving surface with 1-mil- (0.025-mm-) thick polyethylene sheet and remove sheet when concrete has hardened and seven-day curing period has elapsed.
 - c. After seven-day curing period, saturate concrete with water and broom-sweep surface to dissolve remaining rock salt, thereby leaving pits and holes.
5. Pigmented Mineral Dry-Shake Hardener Finish: After initial floating, apply dry-shake materials to paving surface according to manufacturer's written instructions and as follows:



- a. Uniformly spread dry-shake hardener at a rate of 100 lb/100 sq. ft. (49 kg/10 sq. m), unless greater amount is recommended by manufacturer to match paving color required.
- b. Uniformly distribute approximately two-thirds of dry-shake hardener over the concrete surface with mechanical spreader; allow hardener to absorb moisture and embed it by power floating. Follow power floating with a second application of pigmented mineral dry-shake hardener, uniformly distributing remainder of material at right angles to first application to ensure uniform color, and embed hardener by final power floating.
- c. After final power floating, apply a hand-trowel finish followed by a broom finish.
- d. Cure concrete with curing compound recommended by dry-shake hardener manufacturer. Apply curing compound immediately after final finishing.

I. Detectable Warnings

1. Blockouts: Form blockouts in concrete for installation of detectable paving units specified in Division 32 Section "Unit Paving".
 - a. Tolerance for Opening Size: Plus 1/4 inch (6 mm), no minus.
2. Stamped Detectable Warnings: Install stamped detectable warnings as part of a continuous concrete paving placement and according to stamp-mat manufacturer's written instructions.
 - a. Before using stamp mats, verify that the vent holes are unobstructed.
 - b. Apply liquid release agent to the concrete surface and the stamp mat.
 - c. Stamping: While initially finished concrete is plastic **OR** After application and final floating of pigmented mineral dry-shake hardener, **as directed**, accurately align and place stamp mats in sequence. Uniformly load, gently vibrate, and press mats into concrete to produce imprint pattern on concrete surface. Load and tamp mats directly perpendicular to the stamp-mat surface to prevent distortion in shape of domes. Press and tamp until mortar begins to come through all of the vent holes. Gently remove stamp mats.
 - d. Trimming: After 24 hours, cut off the tips of mortar formed by the vent holes.
 - e. Remove residual release agent according to manufacturer's written instructions, but no fewer than three days after stamping concrete. High-pressure-wash surface and joint patterns, taking care not to damage stamped concrete. Control, collect, and legally dispose of runoff.

J. Concrete Protection And Curing

1. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
2. Comply with ACI 306.1 for cold-weather protection.
3. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.
4. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
5. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
 - a. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - 1) Water.
 - 2) Continuous water-fog spray.
 - 3) Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 - b. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm) and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period using cover material and waterproof tape.
 - c. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to



heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

K. Paving Tolerances

1. Comply with tolerances in ACI 117 and as follows:
 - a. Elevation: 3/4 inch (19 mm).
 - b. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
 - c. Surface: Gap below 10-foot- (3-m-) long, unleveled straightedge not to exceed 1/2 inch (13 mm).
 - d. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches (13 mm per 300 mm) of tie bar.
 - e. Lateral Alignment and Spacing of Dowels: 1 inch (25 mm).
 - f. Vertical Alignment of Dowels: 1/4 inch (6 mm).
 - g. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches (6 mm per 300 mm) of dowel.
 - h. Joint Spacing: 3 inches (75 mm).
 - i. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
 - j. Joint Width: Plus 1/8 inch (3 mm), no minus.

L. Pavement Marking

1. Do not apply pavement-marking paint until layout, colors, and placement have been verified with the Owner.
2. Allow concrete paving to cure for a minimum of 28 days and be dry before starting pavement marking.
3. Sweep and clean surface to eliminate loose material and dust.
4. Apply paint with mechanical equipment to produce markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).
 - a. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.
 - b. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal. (0.72 kg/L).

M. Wheel Stops

1. Install wheel stops in bed of adhesive applied as recommended by manufacturer.
2. Securely attach wheel stops to paving with not less than two steel **OR** galvanized-steel, **as directed**, dowels located at one-quarter to one-third points. Install dowels in drilled holes in the paving and bond dowels to wheel stop. Recess head of dowel beneath top of wheel stop.

N. Preformed Traffic-Calming Devices

1. Install preformed speed bumps **OR** humps **OR** cushions, **as directed**, in bed of adhesive applied as recommended by manufacturer for heavy traffic.
2. Securely attach preformed speed bumps **OR** humps **OR** cushions, **as directed**, to paving with hardware spaced as recommended by manufacturer for heavy traffic. Recess head of hardware beneath top surface.

O. Field Quality Control

1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - a. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) **OR** 5000 sq. ft. (465 sq. m), **as directed**, or fraction thereof of each concrete mixture placed each day.



- 1) When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - b. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - c. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - d. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when it is 80 deg F (27 deg C) and above, and one test for each composite sample.
 - e. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 - f. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
 - 1) A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
 3. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
 4. Test results shall be reported in writing to the Owner, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 5. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by the Owner but will not be used as sole basis for approval or rejection of concrete.
 6. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by the Owner.
 7. Concrete paving will be considered defective if it does not pass tests and inspections.
 8. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 9. Prepare test and inspection reports.
- P. Repairs And Protection
1. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by the Owner.
 2. Drill test cores, where directed by the Owner, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.
 3. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
 4. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Final Completion inspections.

END OF SECTION 32 01 11 53



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SECTION 32 01 16 71 - GRINDING/GROOVING PAVEMENT

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of grinding/grooving pavement. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS - Not Used

1.3 EXECUTION

A. Grinding: This covers grinding asphalt concrete or portland cement concrete pavement and roadway surfaces of structures as shown on the plans and as specified in these specifications and the special provisions

1. Grinding shall be performed with abrasive grinding equipment utilizing diamond cutting blades.
2. Existing portland cement concrete pavement not constructed as part of the project shall be ground as follows:
 - a. Grinding shall be performed so that the pavement surface on both sides of all transverse joints and cracks has essentially the same depth of texture and does not vary from a true plane enough to permit a 1.9 mm thick shim 75 mm wide to pass under a one-meter straightedge adjacent to either side of the joint or crack when the straightedge is laid on the pavement parallel to centerline with its midpoint at the joint or crack. After grinding has been completed, the pavement shall conform to the straightedge and profile requirements specified in paving specification, paragraph "Final Finishing," except that pavement on tangent alignment and on horizontal curves of any radius shall have a profile index of 19 mm or less per 0.1-km.
 - b. Abnormally depressed areas due to subsidence or other localized causes will be excluded from testing with the profilograph and 3.6-m \pm 0.06-m straightedge. The accumulated total of the excluded areas shall not exceed 5 percent of the total area to be ground. Profilograph testing shall end 8 m prior to excluded areas and shall resume 8 m following the excluded areas.
3. Existing asphalt concrete pavement not constructed as part of the project shall be ground so that the finished surface shall not vary from a true plane enough to permit a 3-mm thick shim 75 mm wide to pass under a straightedge 3.6 m \pm 0.06-m long when the straightedge is laid on the finished surface parallel with the centerline. The transverse slope of the finished surface shall be uniform to a degree such that a 6 mm thick shim 75 mm wide will not pass under a straightedge 3.6 m \pm 0.06-m long when the straightedge is laid on the finished surface in a direction transverse to the centerline and extending from edge to edge of a 3.6-m traffic lane.
4. Ground areas on structures, approach slabs and the adjacent 15 m of approach pavement shall conform to the provisions for smoothness and concrete cover over reinforcing steel.
5. Ground surfaces shall not be smooth or polished and, except as otherwise specified, shall have a coefficient of friction of not less than 0.30.
6. Residue from grinding operations shall be picked up by means of a vacuum attachment to the grinding machine and shall not be allowed to flow across the pavement nor be left on the surface of the pavement. Residue from grinding portland cement concrete pavement shall be disposed of



as directed. Residue from grinding asphalt concrete shall be disposed of outside the highway right of way.

7. At the option of the Contractor, the residue from grinding portland cement concrete pavement may be disposed of as directed by the authorities having jurisdiction over the site. A copy of the approval shall be delivered to the Engineer before disposing of residue at the site.
8. The noise level created by the combined grinding operation shall not exceed 86 dBA at a distance of 15 m at right angles to the direction of travel.

B. Grooving: This work shall consist of grooving the surface of asphalt concrete or Portland cement concrete pavement and bridge decks as shown on the plans and as specified in these specifications and the special provisions

1. Grooved areas shall begin and end at lines normal to the pavement center line and shall be centered within the lane width. If new concrete pavement is grooved, the grooving in any lane shall cover the full lane width.
2. Grooving blades shall be 2.41 mm \pm 0.13-mm wide and shall be spaced 19 mm on centers. The grooves shall be cut not less than 3 mm nor more than 7 mm deep. The grooves on bridge decks shall be cut not less than 3 mm nor more than 5 mm deep. Grooves over inductive loop detectors shall be cut not less than 2 mm nor more than 3 mm deep.
3. At the beginning of each work shift, all grooving machines shall be equipped with a full complement of grooving blades that are capable of cutting grooves of the specified width, depth and spacing.
4. If during the course of work a single grooving blade on any individual grooving machine becomes incapable of cutting a groove, work will be permitted to continue for the remainder of the work shift, and the Contractor will not be required to otherwise cut the groove omitted because of the failed blade. Should 2 or more grooving blades on any individual grooving machine become incapable of cutting grooves the Contractor shall either:
 - a. Discontinue work with the affected grooving machine within 15 m of the location where more than one blade became incapable, in which event the Contractor will not be required to otherwise cut the grooves omitted because of the failed blades; **OR**
Continue work with the affected grooving machine for the remainder of the work shift and by other means cut all grooves omitted, including grooves omitted because a single blade was incapable, by the affected grooving machine within that work shift. The omitted grooves shall be cut before any of the grooving work performed during the time the grooves were omitted will be accepted.
5. The actual grooved area of any selected 0.6-m by 30 m longitudinal area of pavement specified to be grooved shall be not less than 95 percent of the selected area. Grooves which are omitted as permitted for blades which become incapable will be measured as being actually grooved. No area will be measured until omitted grooves, which are required to be cut before the area is accepted, have been cut. Except as provided for omitted grooves due to an incapable blade, any area within the selected area not grooved shall be due only to irregularities in the pavement surface and for no other reason.
6. Residue from grooving operations shall be picked up by means of a vacuum attachment to the grooving machine and shall not be allowed to flow across the pavement nor be left on the surface of the pavement. Residue from grooving portland cement concrete pavement shall be disposed of as directed. Residue from grooving asphalt concrete shall be disposed of outside the highway right of way.
7. At the option of the Contractor, the residue from grooving portland cement concrete pavement may be disposed as directed by the authorities having jurisdiction over the site. A copy of the approval shall be delivered to the Engineer before disposing of residue at the site.
8. The noise level created by the combined grooving operation shall not exceed 86 dBA at a distance of 15 m at right angles to the direction of travel.

C. Highway or Street Grooving: AASHTO recommends the following groove specifications: 2.4 mm wide; depth of 3.2 to 4.8 mm, and a center-to-center spacing of 19.1 mm (0.75 inches) (7). The center 10-foot portion of a 12-foot lane is typically grooved, leaving a 1-foot strip ungrooved at the edge of each lane.



- D. Boat Ramp Grooving: Grooves shall be non-skid V-grooves spaced 2 inches on center, 1/2-inch radius, 1/2-inch deep.
- E. Runway Grooving
1. General
 - a. The grooving dimensions shall be as follows:
 - 1) Depth - One-quarter (1/4) inch \pm one sixteenth (1/16) inch
 - 2) Width - One-quarter (1/4) inch \pm one sixteenth (1/16) inch
 - 3) Center to center - One and one-half (1 1/2) inch \pm one eighth (1/8) inch
 - b. Grooving shall not begin until new pavement has properly cooled/cured and permission is given.
 - c. In no case shall final painted pavement markings be applied prior to grooving.
 2. The pavement must be grooved by approved diamond bladed saw-cutting equipment. Variations in the grooving contour will not be permitted without approval. All reasonable precautions shall be taken to avoid breaking or chipping the pavement surfaces between grooves. Excessive spalling of the grooved edges will not be permitted.
 3. The Contractor shall groove bituminous concrete and portland cement concrete pavements according to the following specifications (from FAA Advisory Circular 150/5320-12B, Section IV):
 - a. The depth of 90 percent or more of the groove shall not be less than 1/4 inch.
 - b. The grooves shall be continuous for the entire runway length and transverse (perpendicular) to the direction of aircraft landing and takeoff operations.
 - c. The grooves shall be continued to the end of the runway where the concrete meets the asphalt.
 - d. The grooves shall not vary more than 3 inches in alignment for 75 feet, allowing for realignment every 500 feet.
 - e. Grooves shall not be closer than 3 inches or more than 9 inches from transverse joints in concrete pavements.
 - f. Grooving through longitudinal or diagonal saw kerfs where lighting cables are installed shall be avoided. Grooves may be continued through longitudinal construction joints.
 - g. Grooves shall be sawed no closer than 6 inches and no more than 18 inches from in-pavement light fixtures.
 4. Cleanup is extremely important and should be continuous throughout the grooving operations. Accumulation of debris resulting from the grooving operations shall be cleaned from the grooves and removed from the pavement by air jets, high pressure water streams, or other approved methods, after each grooving operation at hourly intervals. The Contractor shall provide water for cleanup operations. The waste material shall not be flushed into the storm or sanitary sewer system. The waste material shall not be allowed to drain onto the shoulders or left on the runway surface in order to prevent foreign object damage.

END OF SECTION 32 01 16 71



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Task	Specification	Specification Description
32 01 26 71	32 01 16 71	Grinding/Grooving Pavement



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SECTION 32 01 90 00 - CSF OPERATION AND MAINTENANCE OF PLANTING**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

The use of this section requires approval of the Contracting Officer. Use this section for Medium Standard Buildings and Small Standard Buildings where planting and irrigation system maintenance is part of the Work and as approved by USPS Contracting Officer.

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Contractor maintenance of exterior plants, lawns, and grasses.
 - 2. Contractor maintenance of irrigation system.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 017704 - Closeout Procedures and Training: Maintenance data and Maintenance Manuals.
 - 2. Section 329200 - Turf and Grasses: Grass, sod, and sprigs.
 - 3. Section 329300 - Plants: Planting materials.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Operation and Maintenance Data:
 - a. Instructions indicating procedures to be used by United States Postal Service personnel for maintenance of plants and groundcover during one typical year including variations of maintenance for climatic conditions throughout the year. Include instructions and procedures including but not limited to the following:
 - 1) Watering.
 - 2) Promotion of growth.
 - 3) Fertilizing.
 - 4) Mowing.



- 5) Pruning.
 - 6) Pesticides.
 - 7) Maintenance of irrigation system components.
- b. Submit in conformance with requirements for maintenance data specified in Section 017704.
- c. Include approved Maintenance Instructions into Operation and Maintenance Manual prepared as part of requirements specified in Section 017704.
- 2. Application Records: Maintain record of chemical applications, indicating the following. Include records as part of maintenance data specified in Section 017704.
 - a. Dates of application.
 - b. Type of chemical applied.
 - c. Location and planting area applied.
 - d. Application rate.
- 3. Assurance/Control Submittals:
 - a. Qualification Documentation: Submit planting and irrigation maintenance provider documentation of experience indicating compliance with specified requirements.

1.3 QUALITY ASSURANCE

- A. Qualifications: Company specializing in performing the Work of this Section with minimum 5 years documented experience.
- B. Pre-Installation Meetings:
 - 1. Convene a pre-installation meeting one week prior to commencing start of plant maintenance period.
 - 2. Require attendance of parties directly affecting Work of this Section.
 - 3. Review conditions of operations, procedures and coordination with related Work.
 - 4. Agenda:
 - a. Tour, inspect, and discuss conditions of exterior plants, lawns, grasses, and irrigation system.
 - b. Review plant maintenance, irrigation system maintenance, and their requirements.
 - c. Review required inspections.
 - d. Review environmental procedures.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Resource Management:
 - 1. Renewable Resources: Plants specified are indigenous, low maintenance varieties, tolerant of site's existing soils and climate without supplemental irrigation or fertilization once established.
 - a. Soil amendments: No chemical fertilizers; use organic matter to support establishment of indigenous plants; use inorganic materials such as sand or gypsum to improve workability and drainage of soil as appropriate to indigenous plants.
 - b. Mulch: Provide organic mulch products.
 - 2. Recycled Content:
 - a. Wood fiber mulch: Provide products manufactured from 100 percent post-consumer paper content and yard trimming composts.
 - b. Mulch from recycled site debris: Coordinate with Section 311000 - Site Clearing to identify and prepare suitable organic debris for use as mulch on site.
 - c. Soil amendment from recycled scrap gypsum: Coordinate with Section 092900 - Gypsum Board to prepare scrap gypsum board for use as soil amendment.



1.5 WARRANTY

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Special Warranty:
 - 1. Warrant to remove defective plants, including those that have died, have unsatisfactory growth, and have lost their original form, and replace with new healthy plants of same genus, species, variety, and size, within 10 days of discovery.
 - 2. Warranty does not include plants damaged by vandalism or severe weather.
 - 3. Warranty Period: 1 year maintenance period.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Specified in Section 329200 and Section 329300.
- B. Indicated on Drawings.

PART 3 - EXECUTION

3.1 ESTABLISHMENT PERIOD

- A. Specified in Section 329200 and Section 329300.

3.2 MAINTENANCE PERIOD

- A. One year from date of initial acceptance. Maintenance Period end date established by Contracting Officer.

NOTE TO SPECIFIER

Delete below if no irrigation.

3.3 IRRIGATION SYSTEM

- A. Remove sand and debris from irrigation piping causing restrictions within emitter discharge orifices.
- B. Program automatic electric controllers for optimum watering of plant materials while maintaining water conservation practices. Adjust irrigation program to compensate for seasonal water requirements.
- C. Operate flush valves on emitter lateral lines.
- D. Repair damage caused by maintenance work. Replace damaged irrigation components which cannot be repaired with new functioning components.

3.4 WATERING



- A. Water landscaping at programmed intervals to maintain good color and sturdy growth of plant materials.

3.5 CHEMICAL CONTROLS

- A. Fertilize to promote healthy plant growth without encouraging excessive top foliar growth. Do not apply high nitrogen fertilizer in late fall. Application at that time may promote frost tender foliar growth.
- B. No chemical fertilizers; use organic/natural matter to support establishment of indigenous plants; use inorganic materials such as sand or gypsum to improve workability and drainage of soil as appropriate to indigenous plants.

3.6 WEED CONTROL

- A. Control weeds with use of herbicides, filter fabric weed barrier and, preferably, by manual removal of weeds.
- B. Remove noxious weeds common to the area from planting areas by mechanical means.
- C. Apply herbicide in accordance with manufacturer's published instructions.
- D. Do not apply pre-emergent herbicides in areas to be seeded for lawns or native seed areas.

3.7 PEST AND DISEASE CONTROL

- A. Apply pest and disease control chemicals in accordance with manufacturer's published instructions.
- B. Spray or dust using appropriate insecticide, miticide and fungicide and as necessary to maintain plants in healthy and vigorous growing condition.
- C. No chemical pesticides; use organic/natural matter for pest and disease control.

3.8 TREE STAKING AND GUYING

- A. Stake or guy trees as specified in Section 329300 and as indicated on Drawings.
- B. Inspect staking and guying at least two times per year and make necessary adjustments to prevent girdling or chafing of bark.

3.9 PRUNING

- A. Prune or head back plants in keeping with nature and character of plants.
- B. Seal 1 inch or greater cuts with tree seal.
- C. Establish radial branch orientation and eliminate narrow V-shaped forks, cross-over branching, and branches that rub against each other.

3.10 TOPSOIL EROSION



- A. Replace topsoil in areas experiencing noticeable soil erosion and make minor repairs necessary to avoid further erosion.
- B. Notify Contracting Officer of unusual causes of erosion immediately.

3.11 CLEANING

- A. Remove litter and dead vegetation from job site within 24 hours of discovery.
- B. Broom clean paved surfaces at minimum 21 day intervals.

3.12 END OF MAINTENANCE

- A. Within 2 weeks prior to end of maintenance period, apply an approved commercial fertilizer at rate recommended by manufacturer uniformly over planted areas.
- B. At end of maintenance period and when ground covers have established and landscaping and irrigation work is complete, request End of Maintenance Period Inspection by Contracting Officer.
- C. When landscaping work is found to be satisfactory, maintenance period will end on Date of Final Acceptance established by Contracting Officer.
- D. When work is found to be unsatisfactory, maintenance period will be extended at no additional cost to United States Postal Service until work has been completed, inspected and accepted by Contracting Officer.
- E. Contractor is to maintain plants for one year from completion.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION 32 01 90 00



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SECTION 32 01 90 00 - MPF OPERATION AND MAINTENANCE OF PLANTING**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

The use of this section requires approval of the Contracting Officer. Use this section for Medium Standard Buildings and Small Standard Buildings where planting and irrigation system maintenance is part of the Work and as approved by USPS Contracting Officer.

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

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PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
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 - 2. Contractor maintenance of irrigation system.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 017704 - Closeout Procedures and Taining: Maintenance data and Maintenance Manuals.
 - 2. Section 329200 - Turf and Grasses: Grass, sod, and sprigs.
 - 3. Section 329300 - Plants: Planting materials.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Operation and Maintenance Data:
 - a. Instructions indicating procedures to be used by United States Postal Service personnel for maintenance of plants and groundcover during one typical year including variations of maintenance for climatic conditions throughout the year. Include instructions and procedures including but not limited to the following:
 - 1) Watering.
 - 2) Promotion of growth.
 - 3) Fertilizing.
 - 4) Mowing.



- 5) Pruning.
 - 6) Pesticides.
 - 7) Maintenance of irrigation system components.
- b. Submit in conformance with requirements for maintenance data specified in Section 017704.
- c. Include approved Maintenance Instructions into Operation and Maintenance Manual prepared as part of requirements specified in Section 017704.
- 2. Application Records: Maintain record of chemical applications, indicating the following. Include records as part of maintenance data specified in Section 017704.
 - a. Dates of application.
 - b. Type of chemical applied.
 - c. Location and planting area applied.
 - d. Application rate.
- 3. Assurance/Control Submittals:
 - a. Qualification Documentation: Submit planting and irrigation maintenance provider documentation of experience indicating compliance with specified requirements.

1.3 QUALITY ASSURANCE

- A. Qualifications: Company specializing in performing the Work of this Section with minimum 5 years documented experience.
- B. Pre-Installation Meetings:
 - 1. Convene a pre-installation meeting one week prior to commencing start of plant maintenance period.
 - 2. Require attendance of parties directly affecting Work of this Section.
 - 3. Review conditions of operations, procedures and coordination with related Work.
 - 4. Agenda:
 - a. Tour, inspect, and discuss conditions of exterior plants, lawns, grasses, and irrigation system.
 - b. Review plant maintenance, irrigation system maintenance, and their requirements.
 - c. Review required inspections.
 - d. Review environmental procedures.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Resource Management:
 - 1. Renewable Resources: Plants specified are indigenous, low maintenance varieties, tolerant of site's existing soils and climate without supplemental irrigation or fertilization once established.
 - a. Soil amendments: No chemical fertilizers; use organic matter to support establishment of indigenous plants; use inorganic materials such as sand or gypsum to improve workability and drainage of soil as appropriate to indigenous plants.
 - b. Mulch: Provide organic mulch products.
 - 2. Recycled Content:
 - a. Wood fiber mulch: Provide products manufactured from 100 percent post-consumer paper content and yard trimming composts.
 - b. Mulch from recycled site debris: Coordinate with Section 311000 - Site Clearing to identify and prepare suitable organic debris for use as mulch on site.
 - c. Soil amendment from recycled scrap gypsum: Coordinate with Section 092900 - Gypsum Board to prepare scrap gypsum board for use as soil amendment.



1.5 WARRANTY

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Special Warranty:
 - 1. Warrant to remove defective plants, including those that have died, have unsatisfactory growth, and have lost their original form, and replace with new healthy plants of same genus, species, variety, and size, within 10 days of discovery.
 - 2. Warranty does not include plants damaged by vandalism or severe weather.
 - 3. Warranty Period: 1 year maintenance period.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Specified in Section 329200 and Section 329300.
- B. Indicated on Drawings.

PART 3 - EXECUTION

3.1 ESTABLISHMENT PERIOD

- A. Specified in Section 329200 and Section 329300.

3.2 MAINTENANCE PERIOD

- A. One year from date of initial acceptance. Maintenance Period end date established by Contracting Officer.

NOTE TO SPECIFIER

Delete below if no irrigation.

3.3 IRRIGATION SYSTEM

- A. Remove sand and debris from irrigation piping causing restrictions within emitter discharge orifices.
- B. Program automatic electric controllers for optimum watering of plant materials while maintaining water conservation practices. Adjust irrigation program to compensate for seasonal water requirements.
- C. Operate flush valves on emitter lateral lines.
- D. Repair damage caused by maintenance work. Replace damaged irrigation components which cannot be repaired with new functioning components.

3.4 WATERING



- A. Water landscaping at programmed intervals to maintain good color and sturdy growth of plant materials.

3.5 CHEMICAL CONTROLS

- A. Fertilize to promote healthy plant growth without encouraging excessive top foliar growth. Do not apply high nitrogen fertilizer in late fall. Application at that time may promote frost tender foliar growth.
- B. No chemical fertilizers; use organic/natural matter to support establishment of indigenous plants; use inorganic materials such as sand or gypsum to improve workability and drainage of soil as appropriate to indigenous plants.

3.6 WEED CONTROL

- A. Control weeds with use of herbicides, filter fabric weed barrier and, preferably, by manual removal of weeds.
- B. Remove noxious weeds common to the area from planting areas by mechanical means.
- C. Apply herbicide in accordance with manufacturer's published instructions.
- D. Do not apply pre-emergent herbicides in areas to be seeded for lawns or native seed areas.

3.7 PEST AND DISEASE CONTROL

- A. Apply pest and disease control chemicals in accordance with manufacturer's published instructions.
- B. Spray or dust using appropriate insecticide, miticide and fungicide and as necessary to maintain plants in healthy and vigorous growing condition.
- C. No chemical pesticides; use organic/natural matter for pest and disease control.

3.8 TREE STAKING AND GUYING

- A. Stake or guy trees as specified in Section 329300 and as indicated on Drawings.
- B. Inspect staking and guying at least two times per year and make necessary adjustments to prevent girdling or chafing of bark.

3.9 PRUNING

- A. Prune or head back plants in keeping with nature and character of plants.
- B. Seal 1 inch or greater cuts with tree seal.
- C. Establish radial branch orientation and eliminate narrow V-shaped forks, cross-over branching, and branches that rub against each other.

3.10 TOPSOIL EROSION



- A. Replace topsoil in areas experiencing noticeable soil erosion and make minor repairs necessary to avoid further erosion.
- B. Notify Contracting Officer of unusual causes of erosion immediately.

3.11 CLEANING

- A. Remove litter and dead vegetation from job site within 24 hours of discovery.
- B. Broom clean paved surfaces at minimum 21 day intervals.

3.12 END OF MAINTENANCE

- A. Within 2 weeks prior to end of maintenance period, apply an approved commercial fertilizer at rate recommended by manufacturer uniformly over planted areas.
- B. At end of maintenance period and when ground covers have established and landscaping and irrigation work is complete, request End of Maintenance Period Inspection by Contracting Officer.
- C. When landscaping work is found to be satisfactory, maintenance period will end on Date of Final Acceptance established by Contracting Officer.
- D. When work is found to be unsatisfactory, maintenance period will be extended at no additional cost to United States Postal Service until work has been completed, inspected and accepted by Contracting Officer.
- E. Contractor is to maintain plants for one year from completion.

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END OF SECTION 32 01 90 00



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Task	Specification	Specification Description
32 01 90 19	01 22 16 00	No Specification Required



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SECTION 32 12 16 00 - MPF ASPHALT PAVING

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

Before editing this Section, obtain the "Report of Subsurface Investigation" prepared by the Geotechnical Engineer. Read the report and incorporate the recommendations included in the report for Bituminous Concrete Pavement into this section.

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

NOTE TO SPECIFIER

The decision to use bituminous concrete pavement (this section) or plain cement concrete pavement (section 321313) for the paving of vehicular areas should be made by the Site A/E in consultation with the USPS Contracting Officer. This decision should be based on local climate and construction practices, and must consider not only initial costs but also life cycle costs.

- A. Section Includes:
 - 1. Bituminous concrete paving.
 - 2. Surface course.
 - 3. Binder course.
 - 4. Paving base course.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 312000 - Earth Moving: Earthwork for Pavement.
 - 2. Section 321313 - Concrete Paving: Concrete paving, curbs and sidewalks.
 - 3. Section 321723 - Pavement Markings: Painted pavement markings.

1.2 REFERENCES

- A. Asphalt Institute (AI):
 - 1. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot Mix Types.

2. AI MS-3 - Asphalt Plant Manual.
3. AI MS-8 - Asphalt Paving Manual.
4. AI MS-19 - Basic Asphalt Emulsion Manual.

B. American Society for Testing and Materials (ASTM):

1. ASTM D 242 - Specification for Mineral Fiber for Bituminous Paving Mixtures.
2. ASTM D 698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 Pound Rammer and 12 inch Drop.
3. ASTM D 1188 - Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens.
4. ASTM D 1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 Pound Rammer and 18 inch Drop.
5. ASTM D 1560 - Test Method for Resistance to Deformation and Cohesion of Bituminous Mixtures by Means of Hveem Apparatus.
6. ASTM D 2397 - Specification for Cationic Emulsified Asphalt.
7. ASTM D 2399 - Practice for Selection of Cutback Asphalt.
8. ASTM D 2726 - Test Method for Bulk Specific Gravity and Density of Nonabsorbative Compacted Bituminous Mixtures.
9. ASTM D 3381 - Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.
10. ASTM D 3549 - Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
11. ASTM D 4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

C. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO T 88 - Particle Size Analysis of Soils.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements: Provide asphalt-aggregate mixture as recommended by local or state paving authorities to suit project conditions. Use locally available materials and gradations which meet standard state highway specifications and exhibit satisfactory records of previous installations.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

1. Assurance/Control Submittals:
 - a. Design Data:
 - 1) Submit design mix following format indicated Asphalt Institute Manual MS-2, Marshall Stability Method; including type/name of mix, gradation analysis, grade of asphalt cement used, Marshall Stability (pounds), flow, effective asphalt content (percent), and direct references to applicable state highway department specification sections for each material.
 - 2) Provide design mixture listed in current edition of applicable state highway department specifications.
 - 3) Use mix designs prepared within 3 years maximum.
 - 4) Provide documentation of state highway limitations, if any, on use of recycled content materials.
 - b. Certificates: Submit materials certificate to Testing Laboratory signed by material supplier and Contractor, certifying that materials comply with, or exceed, the requirements specified herein.
 - c. Qualification Documentation: Paving installer documentation of experience indicating compliance with specified qualification requirements.



1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with AI MS-8
- B. Installer Qualifications: Company specializing in performing the Work of this Section with minimum 5 years documented experience.
- C. Regulatory Requirements:
 - 1. Conform to applicable requirements for paving work on public property.
 - 2. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Use temporary striping, flagmen, barricades, warning signs, and warning lights as required.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Jobsite Requirements:
 - 1. Apply prime and tack coats when ambient temperature is above 40 degrees F, and when temperature has been above 35 degrees F for 12 hours immediately prior to application. Do not apply when base is wet, contains excess moisture, or during rain.
 - 2. Construct bituminous concrete paving when atmospheric temperature is above 40 degrees F.

NOTE TO SPECIFIER

***REQUIRED Article (ENVIRONMENTAL REQUIREMENTS) follows. Do not revise without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer.*

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Resource Management:
 - 1. Recycled Content: Provide aggregate fabricated from a minimum of 30% recycled rubble or concrete. Provide asphalt cement fabricated from recycled content asphalt.

PART 2 - PRODUCTS

2.1 MATERIALS

NOTE TO SPECIFIER

***REQUIRED Articles (Base Course and Asphalt Cement) follows. Do not revise without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer.*

- A. Base Course: As indicated on Drawings, complying with applicable state highway specifications regarding source, quality, gradation, liquid limit, plasticity index and mix proportioning.
 - 1. Unless otherwise specified in applicable state highway specifications, provide base course aggregate fabricated from minimum 30 percent recycled rubble or concrete.
- B. Asphalt Cement: Fabricated from minimum 15 percent recycled asphalt and complying with ASTM D 3381; Table 2 AC-10, AC-20, or AC-30, viscosity grade, depending on local mean annual air temperature as indicated below:

TEMPERATURE CONDITION

ASPHALT GRADES



Cold, mean annual air temperature at 45 degrees F or lower	AC-10 85/100 pen.
Warm, mean annual air temperature between 45 degrees F and 75 degrees F	AC-20 60/70 pen.
Hot, mean annual air temperature at 75 degrees F or higher	AC-30

NOTE TO SPECIFIER

Delete paragraph below when prime coat is not to be included.

- C. Prime Coat: A medium curing cut-back asphalt or an asphalt penetrating prime coat consisting of either ASTM D 2397 or ASTM D 2399, MC- 30 or SS-1h.
- D. Tack Coat: Emulsified asphalt; ASTM D 2397 or ASTM D 2399, SS-1h, CSS-1, or CSS-1h, diluted with one part water to one part emulsified asphalt.
- E. Mineral Filler: Rock or slag dust, hydraulic cement, or other inert material complying with AASHTO M-17/ASTM D 242, if recommended by applicable state highway department standards.
- F. Asphalt-Aggregate Mixture: Unless otherwise indicated on Drawings, the Design Mix shall have a minimum stability based on a 50-blow Marshall complying with ASTM D 1559 of 1000 pounds with a flow between 8 and 16. The Design Mix shall be within sieve analysis and bitumen ranges below:

NOTE TO SPECIFIER

Use paragraph below and delete paragraph above where CALTRANS standard is used in place of Marshall test.

- G. Asphalt-Aggregate Mixture: Unless otherwise indicated on Drawings, the Design Mix shall have a minimum stability based on CALTRANS AR4000. The Design Mix shall be within sieve analysis and bitumen ranges below:

SIEVE ANALYSIS OF MIX

Square Sieve	Total Percent Passing	Percent Tolerance
1/2 inch	80 - 100	5
3/8 inch	65 - 93	4
No. 8	0 - 55	4
No. 50	2 - 27	2
No. 200	0 - 10	2

Percent Bitumen by Weight of Total Mix: 5.0 - 8.5.

Percent Air Voids: 3-6.

Percent Aggregate Voids Filled with Asphalt Cement: 70 - 82.

Allowable Variance of Percent Bitumen by Weight of Total Mix: 0.4.

2.2 EQUIPMENT

- A. Maintain equipment in satisfactory operating condition and correct breakdowns in a manner that will not delay or be detrimental to progress of paving operations.



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to for earthwork operations to begin.
 - 1. Verify gradients and elevations of base are correct, and base is dry.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 BASE COURSE PLACEMENT

NOTE TO SPECIFIER

Minimum thickness as per project site requirements. Coordinate with geotechnical engineer.

- A. Perform base course construction in a manner that will drain surface properly at all times and at the same time prevent runoff from adjacent areas from draining onto base course construction.
- B. Compact base material to not less than 98 percent of optimum density as determined by ASTM D 698 or 95 percent of optimum density, as determined by ASTM D 1557, unless otherwise indicated on the Drawings.
- C. Granular Base: Construct to thickness indicated on Drawings. Apply in lifts or layers not exceeding 8 inches, measured loose.
- D. Sand/Shell Base: Construct to thickness indicated on Drawings. Apply in lifts or layers not exceeding 4 inches, measured loose.
- E. Asphalt Institute Type IV Mix for Full Depth Asphalt Base: Construct to thickness indicated on Drawings in lifts or layers not exceeding 3 inches, measured loose.
- F. Asphalt Institute Type VI, VII, or VIII Mixes for Hot-Mix Sand Asphalt Bases: Construct to thickness indicated on Drawings. Apply in lifts or layers not exceeding 3 inches, measured loose.
- G. Soil Cement Stabilized Base: Construct to thickness and strength as indicated on Drawings and in accordance with applicable state highway specifications. If not indicated on the Drawings, the minimum compressive strength shall be 500 pounds per square inch, tested at 28 days.

3.3 APPLICATIONS

- A. Prime Coat:
 - 1. Apply bituminous prime coat to all base material surfaces where bituminous concrete paving will be constructed.
 - 2. Apply bituminous prime coat in accordance with applicable state highway specifications.



3. Apply at minimum rate of 0.25 gallon per square yard over compacted base material. Apply to penetrate and seal, but not flood surface.
4. Make necessary precautions to protect adjacent areas from overspray.
5. Cure and dry as long as necessary to attain penetration of compacted base and evaporation of volatile substances.

B. Tack Coat:

1. Apply to contact surfaces of previously constructed bituminous concrete base courses or portland cement concrete and surfaces abutting or projecting into bituminous concrete or into bituminous concrete pavement.
2. Apply tack coat to bituminous concrete base course or sand asphalt base course. Apply emulsified asphalt tack coat between each lift or layer of full depth bituminous concrete and sand asphalt bases and on surface of all such bases where bituminous concrete paving will be constructed.
3. Apply emulsified asphalt tack coat in accordance with applicable state highway specifications.
4. Apply at minimum rate of 0.05 gallon per square yard of surface.
5. Allow to dry until at proper condition to receive paving.

3.4 BITUMINOUS CONCRETE PLACEMENT

- A. Place bituminous concrete mixture on completed compacted subgrade surface, spread, and strike off. Spread mixture at following minimum temperatures:
1. When ambient temperature is between 40 degrees F and 50 degrees F, mixture temperature equal to 285 degrees F.
 2. When ambient temperature is between 50 degrees F and 60 degrees F, mixture temperature equal to 280 degrees F.
 3. When ambient temperature is higher than 60 degrees F, mixture temperature equal to 275 degrees F.
- B. Whenever possible, all pavement shall be spread by a finishing machine; however, inaccessible or irregular areas may be placed by hand methods. The hot mixture shall be spread uniformly to the required depth with hot shovels and rakes. After spreading, the hot mixture shall be carefully smoothed to remove all segregated course aggregate and rake marks. Rakes and lutes used for hand spreading shall be of the type designed for use on asphalt mixtures. Loads shall not be dumped faster than they can be properly spread. Workers shall not stand on the loose mixture while spreading.
- C. Paving Machine Placement: Apply successive lifts of bituminous concrete in transverse directions with the surface course placed in the direction of surface-water flow. Place in typical strips not less than 10 feet wide.
- D. Joints: Make joints between old and new pavements, or between successive days and work in a manner that will provide a continuous bond between adjoining work. Construction joints shall have same texture, density, and smoothness as other sections of bituminous concrete course. Clean contact surfaces of all joints and apply tack coat.

3.5 ROLLING AND COMPACTION

- A. The mixture, after being spread, shall be thoroughly compacted by rolling as soon as it will bear the weight of the rollers without undue displacement. The number, weight, and types of rollers and sequences of rolling operations shall be such that the required density and surface are consistently attained while the mixture is in a workable condition.
- B. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.



- C. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling, and repair displaced areas by loosening and filling with hot material.
- D. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been thoroughly compacted.
- E. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.
- F. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh, hot bituminous concrete. Compact by rolling to maximum surface density and smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.6 CONSTRUCTION

- A. Site Tolerances:
 - 1. Paving Surface Smoothness: Maximum allowable 10 foot straightedge tolerance for smoothness.
 - a. Base Course Surface: 1/4 inch.
 - b. Wearing Surface Course: 3/16 inch.

3.7 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection and testing procedures
- B. Site Tests:
 - 1. Paving Base Course: Perform testing of in-place base courses for compliance with requirements for thickness, compaction, density, and tolerance.
 - a. Moisture/Density Test: ASTM D 698 or ASTM D 1557.
 - b. Mechanical Analysis Test: AASHTO T-88.
 - c. Plasticity Index Test: ASTM D 4318.
 - d. Base Material Thickness Test: Minimum one test for every 20,000 square feet.
 - e. Base Material Compaction Test: Minimum one test for every 20,000 square feet.
 - f. Field Density Tests: Perform testing of in-place base courses for compliance with requirements for density using one of the following methods:
 - 1) Sand-cone Method: ASTM D 1556.
 - 2) Balloon Method: ASTM D 2167.
 - 3) Nuclear Method: ASTM D 2922, Method B (Direct Transmission).
 - g. Test each source of base material for compliance with applicable state highway specifications.
 - 2. Asphalt Concrete Paving: Perform testing of in-place asphalt concrete paving courses for compliance with requirements for thickness, compaction, and surface smoothness.
 - a. Thickness: ASTM D 3549; Thickness shall not be less than thickness specified on Drawings.
 - b. Surface Smoothness: Testing shall be performed on the finished surface of each asphalt paving course using 10 foot straightedge applied parallel with, and at right angles to centerline of paved areas. Smoothness shall not be less than tolerances specified herein.
 - 3. Compaction: Field density test for in place materials shall be performed by examination of field cores in accordance with one of the following standards:
 - a. Bulk Specific Gravity of Paraffin-Coated Specimens: ASTM D 1188, minimum one core per 20,000 square feet.



- 1) Standard Duty Areas: Minimum 3 cores.
 - 2) Heavy Duty Areas: Minimum 3 cores.
- b. Bulk Specific Gravity Using Saturated Surface-Dry Specimens: ASTM D 2726, minimum one core per 20,000 square feet.
 - 1) Standard Duty Areas: Minimum 3 cores.
 - 2) Heavy Duty Areas: Minimum 3 cores.

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END OF SECTION 32 12 16 00



SECTION 32 12 16 00 - CSF ASPHALT PAVING

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Before editing this Section, obtain the "Report of Subsurface Investigation" prepared by the Geotechnical Engineer. Read the report and incorporate the recommendations included in the report for Bituminous Concrete Pavement into this section.

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

NOTE TO SPECIFIER

For Small Standard Buildings: The decision to use bituminous concrete pavement (this section) or plain cement concrete pavement (section 321313) for the paving of vehicular areas should be made by the Site A/E in consultation with the USPS Contracting Officer. This decision should be based on local climate and construction practices, and must consider not only initial costs but also life cycle costs.

- A. Section Includes:
 - 1. Bituminous concrete paving.
 - 2. Surface course.
 - 3. Binder course.
 - 4. Paving base course.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 312000 - Earth Moving: Earthwork for Pavement.
 - 2. Section 321313 - Concrete Paving: Concrete paving, curbs and sidewalks.
 - 3. Section 321723 - Pavement Markings: Painted pavement markings.

1.2 REFERENCES

- A. Asphalt Institute (AI):
 - 1. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot Mix Types.

2. AI MS-3 - Asphalt Plant Manual.
3. AI MS-8 - Asphalt Paving Manual.
4. AI MS-19 - Basic Asphalt Emulsion Manual.

B. American Society for Testing and Materials (ASTM):

1. ASTM D 242 - Specification for Mineral Fiber for Bituminous Paving Mixtures.
2. ASTM D 698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 Pound Rammer and 12 inch Drop.
3. ASTM D 1188 - Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens.
4. ASTM D 1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 Pound Rammer and 18 inch Drop.
5. ASTM D 1560 - Test Method for Resistance to Deformation and Cohesion of Bituminous Mixtures by Means of Hveem Apparatus.
6. ASTM D 2397 - Specification for Cationic Emulsified Asphalt.
7. ASTM D 2399 - Practice for Selection of Cutback Asphalt.
8. ASTM D 2726 - Test Method for Bulk Specific Gravity and Density of Nonabsorbative Compacted Bituminous Mixtures.
9. ASTM D 3381 - Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.
10. ASTM D 3549 - Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
11. ASTM D 4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

C. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO T 88 - Particle Size Analysis of Soils.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements: Provide asphalt-aggregate mixture as recommended by local or state paving authorities to suit project conditions. Use locally available materials and gradations which meet standard state highway specifications and exhibit satisfactory records of previous installations.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

1. Assurance/Control Submittals:
 - a. Design Data:
 - 1) Submit design mix following format indicated Asphalt Institute Manual MS-2, Marshall Stability Method; including type/name of mix, gradation analysis, grade of asphalt cement used, Marshall Stability (pounds), flow, effective asphalt content (percent), and direct references to applicable state highway department specification sections for each material.
 - 2) Provide design mixture listed in current edition of applicable state highway department specifications.
 - 3) Use mix designs prepared within 3 years maximum.
 - 4) Provide documentation of state highway limitations, if any, on use of recycled content materials.
 - b. Certificates: Submit materials certificate to Testing Laboratory signed by material supplier and Contractor, certifying that materials comply with, or exceed, the requirements specified herein.
 - c. Qualification Documentation: Paving installer documentation of experience indicating compliance with specified qualification requirements.



1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with AI MS-8
- B. Installer Qualifications: Company specializing in performing the Work of this Section with minimum 5 years documented experience.
- C. Regulatory Requirements:
 - 1. Conform to applicable requirements for paving work on public property.
 - 2. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Use temporary striping, flagmen, barricades, warning signs, and warning lights as required.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Jobsite Requirements:
 - 1. Apply prime and tack coats when ambient temperature is above 40 degrees F, and when temperature has been above 35 degrees F for 12 hours immediately prior to application. Do not apply when base is wet, contains excess moisture, or during rain.
 - 2. Construct bituminous concrete paving when atmospheric temperature is above 40 degrees F.

NOTE TO SPECIFIER

***REQUIRED Article (ENVIRONMENTAL REQUIREMENTS) follows. Do not revise without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer.*

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Resource Management:
 - 1. Recycled Content: Provide aggregate fabricated from a minimum of 30% recycled rubble or concrete. Provide asphalt cement fabricated from recycled content asphalt.

PART 2 - PRODUCTS

2.1 MATERIALS

NOTE TO SPECIFIER

***REQUIRED Articles (Base Course and Asphalt Cement) follows. Do not revise without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer.*

- A. Base Course: As indicated on Drawings, complying with applicable state highway specifications regarding source, quality, gradation, liquid limit, plasticity index and mix proportioning.
 - 1. Unless otherwise specified in applicable state highway specifications, provide base course aggregate fabricated from minimum 30 percent recycled rubble or concrete.
- B. Asphalt Cement: Fabricated from minimum 15 percent recycled asphalt and complying with ASTM D 3381; Table 2 AC-10, AC-20, or AC-30, viscosity grade, depending on local mean annual air temperature as indicated below:

TEMPERATURE CONDITION

ASPHALT GRADES



Cold, mean annual air temperature at 45 degrees F or lower	AC-10 85/100 pen.
Warm, mean annual air temperature between 45 degrees F and 75 degrees F	AC-20 60/70 pen.
Hot, mean annual air temperature at 75 degrees F or higher	AC-30

NOTE TO SPECIFIER

Delete paragraph below when prime coat is not to be included.

- C. Prime Coat: A medium curing cut-back asphalt or an asphalt penetrating prime coat consisting of either ASTM D 2397 or ASTM D 2399, MC- 30 or SS-1h.
- D. Tack Coat: Emulsified asphalt; ASTM D 2397 or ASTM D 2399, SS-1h, CSS-1, or CSS-1h, diluted with one part water to one part emulsified asphalt.
- E. Mineral Filler: Rock or slag dust, hydraulic cement, or other inert material complying with AASHTO M-17/ASTM D 242, if recommended by applicable state highway department standards.
- F. Asphalt-Aggregate Mixture: Unless otherwise indicated on Drawings, the Design Mix shall have a minimum stability based on a 50-blow Marshall complying with ASTM D 1559 of 1000 pounds with a flow between 8 and 16. The Design Mix shall be within sieve analysis and bitumen ranges below:

NOTE TO SPECIFIER

Use paragraph below and delete paragraph above where CALTRANS standard is used in place of Marshall test.

- G. Asphalt-Aggregate Mixture: Unless otherwise indicated on Drawings, the Design Mix shall have a minimum stability based on CALTRANS AR4000. The Design Mix shall be within sieve analysis and bitumen ranges below:

SIEVE ANALYSIS OF MIX

Square Sieve	Total Percent Passing	Percent Tolerance
1/2 inch	80 - 100	5
3/8 inch	65 - 93	4
No. 8	0 - 55	4
No. 50	2 - 27	2
No. 200	0 - 10	2

Percent Bitumen by Weight of Total Mix: 5.0 - 8.5.

Percent Air Voids: 3-6.

Percent Aggregate Voids Filled with Asphalt Cement: 70 - 82.

Allowable Variance of Percent Bitumen by Weight of Total Mix: 0.4.

2.2 EQUIPMENT

- A. Maintain equipment in satisfactory operating condition and correct breakdowns in a manner that will not delay or be detrimental to progress of paving operations.



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to for earthwork operations to begin.
 - 1. Verify gradients and elevations of base are correct, and base is dry.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 BASE COURSE PLACEMENT

NOTE TO SPECIFIER

Minimum thickness as per CSF Small or [] as per project site requirements. Coordinate with geotechnical engineer.

- A. Perform base course construction in a manner that will drain surface properly at all times and at the same time prevent runoff from adjacent areas from draining onto base course construction.
- B. Compact base material to not less than 98 percent of optimum density as determined by ASTM D 698 or 95 percent of optimum density, as determined by ASTM D 1557, unless otherwise indicated on the Drawings.
- C. Granular Base: Construct to thickness indicated on Drawings. Apply in lifts or layers not exceeding 8 inches, measured loose.
- D. Sand/Shell Base: Construct to thickness indicated on Drawings. Apply in lifts or layers not exceeding 4 inches, measured loose.
- E. Asphalt Institute Type IV Mix for Full Depth Asphalt Base: Construct to thickness indicated on Drawings in lifts or layers not exceeding 3 inches, measured loose.
- F. Asphalt Institute Type VI, VII, or VIII Mixes for Hot-Mix Sand Asphalt Bases: Construct to thickness indicated on Drawings. Apply in lifts or layers not exceeding 3 inches, measured loose.
- G. Soil Cement Stabilized Base: Construct to thickness and strength as indicated on Drawings and in accordance with applicable state highway specifications. If not indicated on the Drawings, the minimum compressive strength shall be 500 pounds per square inch, tested at 28 days.

3.3 APPLICATIONS

- A. Prime Coat:
 - 1. Apply bituminous prime coat to all base material surfaces where bituminous concrete paving will be constructed.



2. Apply bituminous prime coat in accordance with applicable state highway specifications.
3. Apply at minimum rate of 0.25 gallon per square yard over compacted base material. Apply to penetrate and seal, but not flood surface.
4. Make necessary precautions to protect adjacent areas from overspray.
5. Cure and dry as long as necessary to attain penetration of compacted base and evaporation of volatile substances.

B. Tack Coat:

1. Apply to contact surfaces of previously constructed bituminous concrete base courses or portland cement concrete and surfaces abutting or projecting into bituminous concrete or into bituminous concrete pavement.
2. Apply tack coat to bituminous concrete base course or sand asphalt base course. Apply emulsified asphalt tack coat between each lift or layer of full depth bituminous concrete and sand asphalt bases and on surface of all such bases where bituminous concrete paving will be constructed.
3. Apply emulsified asphalt tack coat in accordance with applicable state highway specifications.
4. Apply at minimum rate of 0.05 gallon per square yard of surface.
5. Allow to dry until at proper condition to receive paving.

3.4 BITUMINOUS CONCRETE PLACEMENT

- A. Place bituminous concrete mixture on completed compacted subgrade surface, spread, and strike off. Spread mixture at following minimum temperatures:
1. When ambient temperature is between 40 degrees F and 50 degrees F, mixture temperature equal to 285 degrees F.
 2. When ambient temperature is between 50 degrees F and 60 degrees F, mixture temperature equal to 280 degrees F.
 3. When ambient temperature is higher than 60 degrees F, mixture temperature equal to 275 degrees F.
- B. Whenever possible, all pavement shall be spread by a finishing machine; however, inaccessible or irregular areas may be placed by hand methods. The hot mixture shall be spread uniformly to the required depth with hot shovels and rakes. After spreading, the hot mixture shall be carefully smoothed to remove all segregated course aggregate and rake marks. Rakes and lutes used for hand spreading shall be of the type designed for use on asphalt mixtures. Loads shall not be dumped faster than they can be properly spread. Workers shall not stand on the loose mixture while spreading.
- C. Paving Machine Placement: Apply successive lifts of bituminous concrete in transverse directions with the surface course placed in the direction of surface-water flow. Place in typical strips not less than 10 feet wide.
- D. Joints: Make joints between old and new pavements, or between successive days and work in a manner that will provide a continuous bond between adjoining work. Construction joints shall have same texture, density, and smoothness as other sections of bituminous concrete course. Clean contact surfaces of all joints and apply tack coat.

3.5 ROLLING AND COMPACTION

- A. The mixture, after being spread, shall be thoroughly compacted by rolling as soon as it will bear the weight of the rollers without undue displacement. The number, weight, and types of rollers and sequences of rolling operations shall be such that the required density and surface are consistently attained while the mixture is in a workable condition.
- B. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.



- C. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling, and repair displaced areas by loosening and filling with hot material.
- D. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been thoroughly compacted.
- E. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.
- F. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh, hot bituminous concrete. Compact by rolling to maximum surface density and smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.6 CONSTRUCTION

- A. Site Tolerances:
 - 1. Paving Surface Smoothness: Maximum allowable 10 foot straightedge tolerance for smoothness.
 - a. Base Course Surface: 1/4 inch.
 - b. Wearing Surface Course: 3/16 inch.

3.7 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection and testing procedures
- B. Site Tests:
 - 1. Paving Base Course: Perform testing of in-place base courses for compliance with requirements for thickness, compaction, density, and tolerance.
 - a. Moisture/Density Test: ASTM D 698 or ASTM D 1557.
 - b. Mechanical Analysis Test: AASHTO T-88.
 - c. Plasticity Index Test: ASTM D 4318.
 - d. Base Material Thickness Test: Minimum one test for every 20,000 square feet.
 - e. Base Material Compaction Test: Minimum one test for every 20,000 square feet.
 - f. Field Density Tests: Perform testing of in-place base courses for compliance with requirements for density using one of the following methods:
 - 1) Sand-cone Method: ASTM D 1556.
 - 2) Balloon Method: ASTM D 2167.
 - 3) Nuclear Method: ASTM D 2922, Method B (Direct Transmission).
 - g. Test each source of base material for compliance with applicable state highway specifications.
 - 2. Asphalt Concrete Paving: Perform testing of in-place asphalt concrete paving courses for compliance with requirements for thickness, compaction, and surface smoothness.
 - a. Thickness: ASTM D 3549; Thickness shall not be less than thickness specified on Drawings.
 - b. Surface Smoothness: Testing shall be performed on the finished surface of each asphalt paving course using 10 foot straightedge applied parallel with, and at right angles to centerline of paved areas. Smoothness shall not be less than tolerances specified herein.
 - 3. Compaction: Field density test for in place materials shall be performed by examination of field cores in accordance with one of the following standards:



- a. Bulk Specific Gravity of Paraffin-Coated Specimens: ASTM D 1188, minimum one core per 20,000 square feet.
 - 1) Standard Duty Areas: Minimum 3 cores.
 - 2) Heavy Duty Areas: Minimum 3 cores.
- b. Bulk Specific Gravity Using Saturated Surface-Dry Specimens: ASTM D 2726, minimum one core per 20,000 square feet.
 - 1) Standard Duty Areas: Minimum 3 cores.
 - 2) Heavy Duty Areas: Minimum 3 cores.

USPS CSF Specifications issued: 10/1/2013

Last revised: 6/9/2011

END OF SECTION 32 12 16 00



Task	Specification	Specification Description
32 12 16 39	31 32 13 16	Soil Stabilization-Lime
32 12 73 00	32 01 11 53	Cement Concrete Pavement



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SECTION 32 13 13 00 - CSF CONCRETE PAVING

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Before editing this Section, obtain the "Report of Subsurface Investigation" prepared by the Geotechnical Engineer. Read the report and incorporate the recommendations included in the report for Plain Cement Concrete Pavement into this section.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items at end of Section.32 13 13 00

PART 1 - GENERAL

1.1 SUMMARY

NOTE TO SPECIFIER

For Small Standard Buildings: The decision to use bituminous concrete pavement (section 321216) or plain cement concrete pavement (this section) for the paving of vehicular areas should be made by the Site A/E in consultation with the USPS Contracting Officer. This decision should be based on local climate and construction practices, and must consider not only initial costs but also life cycle costs.

- A. Section Includes:
 - 1. Concrete Pavement
 - 2. Concrete walks and terraces.
 - 3. Concrete curbs, and curb and gutters.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 312000 - Earth Moving: Earthwork for pavement.
 - 2. Section 321216 - Asphalt Paving.
 - 3. Section 033000 - Cast-In-Place Concrete: Concrete requirements for pavement.

1.2 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 301 - Specifications for Structural Concrete.
 - 2. ACI 308 - Standard Practice for Curing Concrete.

- B. American society for Testing and Materials (ASTM):
1. ASTM A 185 - Specification for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement.
 2. ASTM A 615 - Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 3. ASTM C 494 - Standard Specification for Chemical Admixtures for Concrete.
 4. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
 5. ASTM D 1751 - Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
1. Product Data: Submit product data for the following:
 - a. Joint filler.
 - b. Joint sealant.
 - c. Concrete admixtures.
 - d. Concrete curing compounds.
 2. Assurance/Control Submittals:
 - a. Concrete Mix Design: Submit three copies of each proposed mix design for each class of concrete in accordance with ACI 301, Sections 3.9 "Proportioning on the basis of previous field experience or trial mixture", or 3.10 "Proportioning based on empirical data". Submit separate mix design for concrete to be placed by pumping, in addition to the mix design for concrete to be placed directly from the truck chute.
 - b. Include the following information in concrete mix design:
 - 1) Proportions of cement, fine and coarse aggregate, and water.
 - 2) Water-cement ratio, 28-day compressive design strength, slump, and air content.
 - 3) Type of cement and aggregate.
 - 4) Aggregate gradation.
 - 5) Type and dosage of admixtures.
 - 6) Special requirements for pumping.
 - 7) Range of ambient temperature and humidity for which design is valid.
 - 8) Special characteristics of mix which require precautions in mixing, placing, or finishing techniques to achieve finished product specified.

1.4 QUALITY ASSURANCE

- A. Perform work in accordance with ACI 301.
- B. Conform to ACI 305R when mixing and placing concrete during hot weather.
- C. Conform to ACI 306R when mixing and placing concrete during cold weather.
- D. Regulatory Requirements:
1. Conform to applicable requirements for paving work on public property.
 2. Contractor shall maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS**2.1 FORM AND REINFORCING MATERIAL**

- A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required.
1. APA Exterior Plyform BB with a medium density, smooth, hard, fused resin fiber overlay, or metal forms.
 2. Form Oil: Coat forms with nonstaining type coating that will not discolor or deface surface of concrete. Subject to compliance with requirements, manufacturers offering specified items which may be incorporated in the work include the following.
 - a. "Eucoslip" - Euclid Chemical Co., Cleveland, OH (800) 321-7628.
 - b. "Form Coating" - Nox-Crete Chemicals, Omaha, NE (800) 669-2738.
 - c. Substitutions: Under provisions of Section 016000.
- B. Curb, Curb and Gutter Forms: Use flexible spring-steel forms or laminated boards to form radius bends. Tolerance: Not to deviate more than 1/4 inch in 10 feet in grade and alignment.
- C. Reinforcing:
1. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A 185. Furnish in flat sheets, not rolls, unless otherwise acceptable to Owner.
 2. Reinforcing Bars: Deformed steel bars, ASTM A 615, Grade 60.
 3. Fiber reinforced concrete mixtures having the same strength or exceeding as specified for concrete mixes, as verified by Manufacturer's testing laboratory procedures, shall be considered as an alternate for welded wire mesh in exterior flat work, curbs and sidewalks.
- D. Reinforcing Accessories:
1. Reinforcing Accessories: Subject to compliance with requirements, manufacturers offering specified items which may be incorporated in the work include the following.
 - a. Dayton Superior Corp., Miamisburg, OH (800) 745-3700.
 - b. Heckmann Building Products, Inc., Chicago, IL (800) 621-4140.
 - c. Hohmann & Barnard, Inc., Hauppauge, NY (800) 645-0616.
 - d. Richmond Screw Anchor Co., Inc., Ft. Worth, TX (817) 284-4981.
 2. Conform to Concrete Reinforcing Steel Institute Manual of Standard Practice. Include spacers and chairs with plastic tipped legs, ties and other devices necessary for properly assembling, placing, spacing and supporting forms and reinforcement in place.
 3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 CONCRETE MATERIALS

- A. Comply with requirements of applicable Section 033000 for concrete materials, admixtures, bonding materials, curing materials, surface sealers and others as required.
- B. Cement:
1. Portland Cement: ASTM C150 Type 1.
 2. High-early Strength Portland Cement: ASTM C150, Type III.
- C. Aggregates: ASTM C33.
1. Fine aggregate shall be natural sand, or sand prepared from stone or gravel. Grains shall; be clean, hard, durable, uncoated and free from silt, loam and clay.
 2. Coarse Aggregates: Crushed stone, gravel, or other approved inert materials of similar characteristics, or combinations thereof, having hard, strong, durable pieces free from adherent



coatings. Maximum size of pieces shall be 3/4" to #4 except for footings, which may be 1-1/2". The maximum size of aggregate may also be not larger than one fifth of the narrowest dimension between forms, nor larger than three fourths of the minimum clear spacing between reinforcing bars.

- D. Water: Clean and free from injurious amounts of oil, acids, salts, organic or other deleterious matter.
- E. Air Entrainment: ASTM C260.
 - 1. Use air-entrained concrete for exterior exposed concrete including walls, walks, paving, etc. where minimum daily temperatures are expected below 38 degrees F during pouring or subsequent 38 day curing period.
 - 2. Proportion air-entraining concrete to attain minimum 28-day compressive strength specified.
 - 3. Total Air Entrainment in Concrete: Not less than four percent nor more than six percent volume of concrete.
- F. Admixtures:
 - 1. May be used at contractors option to provide workability at low slumps, increased compressive strength, retardation or acceleration of the concrete.
 - 2. Chemical Admixtures: ASTM C494. Mineral Admixtures: ASTM C618.
 - 3. The cement factor shall not be reduced and changes shall be made in the other mix proportions to ensure the minimum strength requirements.
 - 4. Use of admixtures approved in writing by Architect. No additional expense to the Owner will be allowed.
 - 5. No calcium chloride shall be used.
 - 6. Before any admixture is accepted for use, the Contractor shall submit certified laboratory reports on each additive material to the architectural consultant. The report shall show the following:
 - a. Confirmation of compliance with the applicable ASTM Standard.
 - b. Evaluation of the effects of the admixture on the properties of the concrete to be made on the job, including consideration of the anticipated ambient conditions on the job, and proposed construction procedures.
 - c. Determination of within-lot uniformity of product proposed for use.

2.3 CONCRETE MIXES

- A. Concrete Proportions:
 - 1. Concrete shall be homogenous, and when hardened, shall have the required strength, resistance to deterioration, durability, water tightness and the properties as specified.
 - 2. Minimum concrete strength at 28 days shall be;
 - a. 3,000 psi for walks, terraces, curbs and gutters.
 - b. 4,000 psi for concrete pavement and pads.
 - 3. Slump of concrete:
 - a. Pavement: 2-1/2 inch minimum to 4 inch maximum.
 - b. Ramps and sloping surfaces: Not more than 3 inches.
- B. Ready-Mix Concrete:
 - 1. Ready-mix concrete shall conform to ASTM C94. The mixing agitation shall begin within 30 minutes, and the concrete shall be discharged from the truck within one hour after the water has been added to the concrete mix.
 - 2. Delivery tickets are to accompany each concrete truck and shall be kept in the job superintendent's file. Delivery tickets must indicate the following information or be subject to rejection:
 - a. Name of project.
 - b. Supplier of concrete.
 - c. Truck identity and ticket serial number.
 - d. Date of delivery.



- e. Brand of cement.
 - f. Cement content.
 - g. Strength classification.
 - h. Batching time.
 - i. Point of deposit.
 - j. Total amount of water.
 - k. Weight of aggregate.
 - l. Daily temperature.
 - m. Number of cubic yards in load.
 - n. Admixture content.
 - o. Name of Contractor.
 - p. Name of driver.
 - q. Time loaded and first mixing of concrete.
 - r. Reading of revolution counter.
3. Quantity of water used for each batch shall be accurately measured.

2.4 JOINT MATERIALS

- A. Sealed expansion and contraction joints: Filler of nonbituminous rubber or cork conforming to ASTM D1752.
- B. Non-sealed joints:
 - 1. Non-sealed Joints: Subject to compliance with requirements, manufacturers offering specified items which may be incorporated in the work include the following.
 - a. "Flexcell" - Celotex Corp., Tampa, FL (813) 873-1700.
 - b. "Seal Tight Fiber Expansion Joint" - W.R. Meadows, Inc., Hampshire, IL (800) 342-5976.
 - 2. Filler premolded bituminous type conforming to ASTM D1751.
 - 3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- C. Noncompressive Filler:
 - 1. Noncompressive Filler: Subject to compliance with requirements, manufacturers offering specified items which may be incorporated in the work include the following.
 - a. "Styrofoam SM" - Dow Chemical Co., Midland, MI (517) 636-0754.
 - b. "Foamular" - Owens Corning, Toledo, OH (800) 828-7155.
 - 2. 2 inch or 1 inch thick sheets.
 - 3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- D. Compressive Filler:
 - 1. Compressive Filler: Subject to compliance with requirements, manufacturers offering specified items which may be incorporated in the work include the following.
 - a. "Ethafoam" - Dow Chemical Co., Midland, MI (800) 322-8723.
 - b. "Rodofast" - Sternson Group, Brampton, ON (800) 265-8417.
 - 2. 2 inch or 1 inch thick sheets, compression modulus within the range of 15 to 25 pounds per square inch per inch.
 - 3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- E. Filler Adhesive for Noncompressive Filler and Compressive Filler:
 - 1. Filler Adhesive: Subject to compliance with requirements, manufacturers offering specified items which may be incorporated in the work include the following.
 - a. "General Purpose Mastic No. 11" - Dow Chemical Co., Midland, MI (800) 322-8723.
 - b. "Rodofast" - Sternson Group, Brampton, ON (800) 265-8417.
 - 2. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.



- F. Slab-on-grade Construction Joints: Provide a full slab depth 24 gauge metal preshaped key, approximate depth of key to be 1/4 slab thickness and a key width of about 1/10 slab thickness.
- G. Joint Sealants: ASTM C920. Non-priming, pourable, self-leveling polyurethane. Subject to compliance with project requirements manufacturers offering joint sealants which may be incorporated in the Work include, but are not limited to the following:
 - 1. Sonolastic Paving Joint Sealant, by Sonneborn, Shakopee, MN (800) 433-9517.
 - 2. Sonomeric CT 1 Sealant, by Sonneborn, Shakopee, MN (800) 433-9517.
 - 3. Sonomeric CT 2 Sealant, by Sonneborn, Shakopee, MN (800) 433-9517.
 - 4. Vulkem 45, by Mameco, Cleveland, OH (800) 321-6412.
 - 5. Chem-Caulk, by Bostik, Middleton, MA (800) 726-7845.
 - 6. "THC-900" - Tremco, Beachwood, OH (800) 562-2728.
 - 7. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.5 CURING MATERIALS

- A. Sealers:
 - 1. Sealers: Subject to compliance with requirements, manufacturers offering specified items which may be incorporated in the work include the following.
 - a. "Polyseal" - W.R. Meadows, Inc., Hampshire, IL (800) 342-5976.
 - b. "Kure-N-Seal" - Sonneborn, Shakopee, MN (800) 433-9517.
 - c. "Cure-Hard" - W.R. Meadows, Inc., Elgin, IL (312) 683-4500.
 - 2. ASTM C156 and ASTM C309, Type I. Material shall become integral part of concrete and leave slab free of residue or film.
 - 3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Membrane: Opaque-white polyethylene sheet, 0.006 inch thick, meeting requirements of ASTM C171.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution Requirements: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to for earthwork operations to begin.
 - 1. Verify gradients and elevations of base are correct, and base is dry.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 SUBGRADE PREPARATION

- A. Conform with the requirements specified in Section 312000 .



- B. Thoroughly wet subgrade and then compact with two passes of a 500 pound roller.
- C. Pumping: Where concrete paving or sidewalks, and curbs are to be placed, yielding material deflecting more than 1/2 inch under a 500 lb. roller shall be removed to a depth of not less than 4 inches below subgrade elevation and replaced with an approved granular material which shall then be compacted as described above.
- D. The subgrade shall be in a moist condition when the concrete is placed. In cold weather the subgrade shall be prepared and protected so as to provide a subgrade free from frost when the concrete is deposited.

3.3 FORM CONSTRUCTION

- A. Comply with the requirements of Section 033000. Install sufficient quantity of forms to allow continuous progress of the work and so that forms can remain in place at least 24 hours after concrete placement.
- B. Check complete formwork for grade and alignment to the following tolerances:
 - 1. Top of form: Not more than 1/8 inch in 10 feet.
 - 2. Vertical face: Longitudinal axis not more than 1/4 inch in 10 feet.

3.4 PLACING REINFORCEMENT

- A. Support reinforcing and wire securely together to prevent displacement by construction loads and traffic, or the placing of concrete. For slabs on grade, supporting pieces of concrete blocks or bricks may be used.
- B. Place wire mesh reinforcing two inches above bottom of slab unless otherwise indicated.
- C. Reinforcement shall be kept clean from oil, dirt and loose mill scale or other coatings which might destroy the concrete bond. Remove tags and markings prior to concrete placement.
- D. Do not place concrete until reinforcement has been inspected and approved by local authorities, if required.

3.5 CONCRETE PLACEMENT AND FINISHING

- A. Tamp and consolidate concrete with a suitable wood or metal tamping bar and the surface shall be finished to grade with a wood float.
- B. Finished surfaces shall not vary more than 3/16 inch from the testing edge of a 10 foot straightedge.
- C. Curb Expansion Joints: Fill joints with 1/2 inch thick joint filler strips conforming to ASTM D1751 or ASTM D1752.
- D. Contraction Joints: Divide the surface of paving, walks and terraces into rectangular areas not to exceed 5 feet 0 inches each way.
 - 1. Cut a groove in the top portion of the slab to a depth of at least one-fourth of the slab thickness using a jointer or by sawing a groove in the hardened concrete with a power-driven saw.
 - 2. Membrane-cured surface damaged during the sawing operations shall be resprayed as soon as the surface becomes dry.
- E. Slab Finishes: ACI 301, paragraph 11.7 and as follows:



1. Broom Finish: On stair treads with abrasive nosings and on walks, unless other finishes have been indicated or specified.
2. Broom or Belt Finish: On level walks. Broom in direction perpendicular to travel and approved sample panel. Submit joint pattern layout prior to starting work.

3.6 TOLERANCES

- A. Horizontal slabs: Finished surfaces true with no deviation in excess of 1/8 inch when tested with a 10 foot straightedge, non-accumulative. No coarse aggregate showing.
- B. Steps:
 1. Variation in steps within a flight of stairs:
 - a. Rise: 1/8 inch.
 - b. Tread: 1/4 inch.
 2. Variation in consecutive steps:
 - a. Rise: 1/16 inch.
 - b. Tread: 1/8 inch.

3.7 EXPANSION JOINTS

- A. Install transverse expansion joints at returns and 15 feet on center.
- B. Install longitudinal expansion joints where curbs and paved areas abut each other, buildings, other concrete slabs and pads or vertical restraints.
- C. Place joint filler with top edge 1/4 inch below the surface and shall be held in place with steel pins or other devices to prevent warping of the filler during floating and finishing.
- D. Immediately after finishing operations are completed, round joint edges with edging tool having a radius of 1/8 inch. Remove concrete over the joint filler.
- E. At the end of the curing period, clean and fill expansion joints with joint sealer. Fill joints flush with concrete surface. Dummy groove joints shall not be sealed.

3.8 CURING

- A. Immediately after the finishing operations, the exposed concrete surface shall be cured for 7 days by the mat, impervious sheet, or membrane-curing method.

3.9 BACKFILLING

- A. After curing, remove debris and backfill the adjoining areas, grade and compact to conform to the surrounding area in accordance with the lines and grades indicated.

3.10 PROTECTION

- A. Protect the completed work from damage. Repair damaged concrete and clean concrete discolored during construction. Remove work that is damaged and reconstruct to entire length between regularly scheduled joints. Refinishing damaged portion is not acceptable.



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- B. Prevent cars and trucks from driving on new pavement for a minimum of 14 days.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



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SECTION 32 13 13 00 - MPF CONCRETE PAVING

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

Before editing this Section, obtain the "Report of Subsurface Investigation" prepared by the Geotechnical Engineer. Read the report and incorporate the recommendations included in the report for Plain Cement Concrete Pavement into this section.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location. Drawing Coordination Items at end of Section.32 13 13 00

PART 1 - GENERAL

1.1 SUMMARY

NOTE TO SPECIFIER

The decision to use bituminous concrete pavement (section 321216) or plain cement concrete pavement (this section) for the paving of vehicular areas should be made by the Site A/E in consultation with the USPS Contracting Officer. This decision should be based on local climate and construction practices, and must consider not only initial costs but also life cycle costs.

- A. Section Includes:
 - 1. Concrete Pavement
 - 2. Concrete walks and terraces.
 - 3. Concrete curbs, and curb and gutters.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 312000 - Earth Moving: Earthwork for pavement.
 - 2. Section 321216 - Asphalt Paving.
 - 3. Section 033000 - Cast-In-Place Concrete: Concrete requirements for pavement.

1.2 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 301 - Specifications for Structural Concrete.
 - 2. ACI 308 - Standard Practice for Curing Concrete.



- B. American society for Testing and Materials (ASTM):
 - 1. ASTM A 185 - Specification for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement.
 - 2. ASTM A 615 - Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - 3. ASTM C 494 - Standard Specification for Chemical Admixtures for Concrete.
 - 4. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
 - 5. ASTM D 1751 - Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Submit product data for the following:
 - a. Joint filler.
 - b. Joint sealant.
 - c. Concrete admixtures.
 - d. Concrete curing compounds.
 - 2. Assurance/Control Submittals:
 - a. Concrete Mix Design: Submit three copies of each proposed mix design for each class of concrete in accordance with ACI 301, Sections 3.9 "Proportioning on the basis of previous field experience or trial mixture", or 3.10 "Proportioning based on empirical data". Submit separate mix design for concrete to be placed by pumping, in addition to the mix design for concrete to be placed directly from the truck chute.
 - b. Include the following information in concrete mix design:
 - 1) Proportions of cement, fine and coarse aggregate, and water.
 - 2) Water-cement ratio, 28-day compressive design strength, slump, and air content.
 - 3) Type of cement and aggregate.
 - 4) Aggregate gradation.
 - 5) Type and dosage of admixtures.
 - 6) Special requirements for pumping.
 - 7) Range of ambient temperature and humidity for which design is valid.
 - 8) Special characteristics of mix which require precautions in mixing, placing, or finishing techniques to achieve finished product specified.

1.4 QUALITY ASSURANCE

- A. Perform work in accordance with ACI 301.
- B. Conform to ACI 305R when mixing and placing concrete during hot weather.
- C. Conform to ACI 306R when mixing and placing concrete during cold weather.
- D. Regulatory Requirements:
 - 1. Conform to applicable requirements for paving work on public property.
 - 2. Contractor shall maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS**2.1 FORM AND REINFORCING MATERIAL**

- A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required.
 - 1. APA Exterior Plyform BB with a medium density, smooth, hard, fused resin fiber overlay, or metal forms.
 - 2. Form Oil: Coat forms with nonstaining type coating that will not discolor or deface surface of concrete. Subject to compliance with requirements, manufacturers offering specified items which may be incorporated in the work include the following.
 - a. "Eucoslip" - Euclid Chemical Co., Cleveland, OH (800) 321-7628.
 - b. "Form Coating" - Nox-Crete Chemicals, Omaha, NE (800) 669-2738.
 - c. Substitutions: Under provisions of Section 016000.
- B. Curb, Curb and Gutter Forms: Use flexible spring-steel forms or laminated boards to form radius bends. Tolerance: Not to deviate more than 1/4 inch in 10 feet in grade and alignment.
- C. Reinforcing:
 - 1. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A 185. Furnish in flat sheets, not rolls, unless otherwise acceptable to Owner.
 - 2. Reinforcing Bars: Deformed steel bars, ASTM A 615, Grade 60.
 - 3. Fiber reinforced concrete mixtures having the same strength or exceeding as specified for concrete mixes, as verified by Manufacturer's testing laboratory procedures, shall be considered as an alternate for welded wire mesh in exterior flat work, curbs and sidewalks.
- D. Reinforcing Accessories:
 - 1. Reinforcing Accessories: Subject to compliance with requirements, manufacturers offering specified items which may be incorporated in the work include the following.
 - a. Dayton Superior Corp., Miamisburg, OH (800) 745-3700.
 - b. Heckmann Building Products, Inc., Chicago, IL (800) 621-4140.
 - c. Hohmann & Barnard, Inc., Hauppauge, NY (800) 645-0616.
 - d. Richmond Screw Anchor Co., Inc., Ft. Worth, TX (817) 284-4981.
 - 2. Conform to Concrete Reinforcing Steel Institute Manual of Standard Practice. Include spacers and chairs with plastic tipped legs, ties and other devices necessary for properly assembling, placing, spacing and supporting forms and reinforcement in place.
 - 3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 CONCRETE MATERIALS

- A. Comply with requirements of applicable Section 033000 for concrete materials, admixtures, bonding materials, curing materials, surface sealers and others as required.
- B. Cement:
 - 1. Portland Cement: ASTM C150 Type 1.
 - 2. High-early Strength Portland Cement: ASTM C150, Type III.
- C. Aggregates: ASTM C33.
 - 1. Fine aggregate shall be natural sand, or sand prepared from stone or gravel. Grains shall; be clean, hard, durable, uncoated and free from silt, loam and clay.
 - 2. Coarse Aggregates: Crushed stone, gravel, or other approved inert materials of similar characteristics, or combinations thereof, having hard, strong, durable pieces free from adherent



coatings. Maximum size of pieces shall be 3/4" to #4 except for footings, which may be 1-1/2". The maximum size of aggregate may also be not larger than one fifth of the narrowest dimension between forms, nor larger than three fourths of the minimum clear spacing between reinforcing bars.

- D. Water: Clean and free from injurious amounts of oil, acids, salts, organic or other deleterious matter.
- E. Air Entrainment: ASTM C260.
 - 1. Use air-entrained concrete for exterior exposed concrete including walls, walks, paving, etc. where minimum daily temperatures are expected below 38 degrees F during pouring or subsequent 38 day curing period.
 - 2. Proportion air-entraining concrete to attain minimum 28-day compressive strength specified.
 - 3. Total Air Entrainment in Concrete: Not less than four percent nor more than six percent volume of concrete.
- F. Admixtures:
 - 1. May be used at contractors option to provide workability at low slumps, increased compressive strength, retardation or acceleration of the concrete.
 - 2. Chemical Admixtures: ASTM C494. Mineral Admixtures: ASTM C618.
 - 3. The cement factor shall not be reduced and changes shall be made in the other mix proportions to ensure the minimum strength requirements.
 - 4. Use of admixtures approved in writing by Architect. No additional expense to the Owner will be allowed.
 - 5. No calcium chloride shall be used.
 - 6. Before any admixture is accepted for use, the Contractor shall submit certified laboratory reports on each additive material to the architectural consultant. The report shall show the following:
 - a. Confirmation of compliance with the applicable ASTM Standard.
 - b. Evaluation of the effects of the admixture on the properties of the concrete to be made on the job, including consideration of the anticipated ambient conditions on the job, and proposed construction procedures.
 - c. Determination of within-lot uniformity of product proposed for use.

2.3 CONCRETE MIXES

- A. Concrete Proportions:
 - 1. Concrete shall be homogenous, and when hardened, shall have the required strength, resistance to deterioration, durability, water tightness and the properties as specified.
 - 2. Minimum concrete strength at 28 days shall be;
 - a. 3,000 psi for walks, terraces, curbs and gutters.
 - b. 4,000 psi for concrete pavement and pads.
 - 3. Slump of concrete:
 - a. Pavement: 2-1/2 inch minimum to 4 inch maximum.
 - b. Ramps and sloping surfaces: Not more than 3 inches.
- B. Ready-Mix Concrete:
 - 1. Ready-mix concrete shall conform to ASTM C94. The mixing agitation shall begin within 30 minutes, and the concrete shall be discharged from the truck within one hour after the water has been added to the concrete mix.
 - 2. Delivery tickets are to accompany each concrete truck and shall be kept in the job superintendent's file. Delivery tickets must indicate the following information or be subject to rejection:
 - a. Name of project.
 - b. Supplier of concrete.
 - c. Truck identity and ticket serial number.
 - d. Date of delivery.



- e. Brand of cement.
 - f. Cement content.
 - g. Strength classification.
 - h. Batching time.
 - i. Point of deposit.
 - j. Total amount of water.
 - k. Weight of aggregate.
 - l. Daily temperature.
 - m. Number of cubic yards in load.
 - n. Admixture content.
 - o. Name of Contractor.
 - p. Name of driver.
 - q. Time loaded and first mixing of concrete.
 - r. Reading of revolution counter.
3. Quantity of water used for each batch shall be accurately measured.

2.4 JOINT MATERIALS

- A. Sealed expansion and contraction joints: Filler of nonbituminous rubber or cork conforming to ASTM D1752.
- B. Non-sealed joints:
 - 1. Non-sealed Joints: Subject to compliance with requirements, manufacturers offering specified items which may be incorporated in the work include the following.
 - a. "Flexcell" - Celotex Corp., Tampa, FL (813) 873-1700.
 - b. "Seal Tight Fiber Expansion Joint" - W.R. Meadows, Inc., Hampshire, IL (800) 342-5976.
 - 2. Filler premolded bituminous type conforming to ASTM D1751.
 - 3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- C. Noncompressive Filler:
 - 1. Noncompressive Filler: Subject to compliance with requirements, manufacturers offering specified items which may be incorporated in the work include the following.
 - a. "Styrofoam SM" - Dow Chemical Co., Midland, MI (517) 636-0754.
 - b. "Foamular" - Owens Corning, Toledo, OH (800) 828-7155.
 - 2. 2 inch or 1 inch thick sheets.
 - 3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- D. Compressive Filler:
 - 1. Compressive Filler: Subject to compliance with requirements, manufacturers offering specified items which may be incorporated in the work include the following.
 - a. "Ethafoam" - Dow Chemical Co., Midland, MI (800) 322-8723.
 - b. "Rodofast" - Sternson Group, Brampton, ON (800) 265-8417.
 - 2. 2 inch or 1 inch thick sheets, compression modulus within the range of 15 to 25 pounds per square inch per inch.
 - 3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- E. Filler Adhesive for Noncompressive Filler and Compressive Filler:
 - 1. Filler Adhesive: Subject to compliance with requirements, manufacturers offering specified items which may be incorporated in the work include the following.
 - a. "General Purpose Mastic No. 11" - Dow Chemical Co., Midland, MI (800) 322-8723.
 - b. "Rodofast" - Sternson Group, Brampton, ON (800) 265-8417.
 - 2. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.



- F. Slab-on-grade Construction Joints: Provide a full slab depth 24 gauge metal preshaped key, approximate depth of key to be 1/4 slab thickness and a key width of about 1/10 slab thickness.
- G. Joint Sealants: ASTM C920. Non-priming, pourable, self-leveling polyurethane. Subject to compliance with project requirements manufacturers offering joint sealants which may be incorporated in the Work include, but are not limited to the following:
 - 1. Sonolastic Paving Joint Sealant, by Sonneborn, Shakopee, MN (800) 433-9517.
 - 2. Sonomeric CT 1 Sealant, by Sonneborn, Shakopee, MN (800) 433-9517.
 - 3. Sonomeric CT 2 Sealant, by Sonneborn, Shakopee, MN (800) 433-9517.
 - 4. Vulkem 45, by Mameco, Cleveland, OH (800) 321-6412.
 - 5. Chem-Caulk, by Bostik, Middleton, MA (800) 726-7845.
 - 6. "THC-900" - Tremco, Beachwood, OH (800) 562-2728.
 - 7. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.5 CURING MATERIALS

- A. Sealers:
 - 1. Sealers: Subject to compliance with requirements, manufacturers offering specified items which may be incorporated in the work include the following.
 - a. "Polyseal" - W.R. Meadows, Inc., Hampshire, IL (800) 342-5976.
 - b. "Kure-N-Seal" - Sonneborn, Shakopee, MN (800) 433-9517.
 - c. "Cure-Hard" - W.R. Meadows, Inc., Elgin, IL (312) 683-4500.
 - 2. ASTM C156 and ASTM C309, Type I. Material shall become integral part of concrete and leave slab free of residue or film.
 - 3. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Membrane: Opaque-white polyethylene sheet, 0.006 inch thick, meeting requirements of ASTM C171.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution Requirements: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to for earthwork operations to begin.
 - 1. Verify gradients and elevations of base are correct, and base is dry.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 SUBGRADE PREPARATION

- A. Conform with the requirements specified in Section 312000 .



- B. Thoroughly wet subgrade and then compact with two passes of a 500 pound roller.
- C. Pumping: Where concrete paving or sidewalks, and curbs are to be placed, yielding material deflecting more than 1/2 inch under a 500 lb. roller shall be removed to a depth of not less than 4 inches below subgrade elevation and replaced with an approved granular material which shall then be compacted as described above.
- D. The subgrade shall be in a moist condition when the concrete is placed. In cold weather the subgrade shall be prepared and protected so as to provide a subgrade free from frost when the concrete is deposited.

3.3 FORM CONSTRUCTION

- A. Comply with the requirements of Section 033000. Install sufficient quantity of forms to allow continuous progress of the work and so that forms can remain in place at least 24 hours after concrete placement.
- B. Check complete formwork for grade and alignment to the following tolerances:
 - 1. Top of form: Not more than 1/8 inch in 10 feet.
 - 2. Vertical face: Longitudinal axis not more than 1/4 inch in 10 feet.

3.4 PLACING REINFORCEMENT

- A. Support reinforcing and wire securely together to prevent displacement by construction loads and traffic, or the placing of concrete. For slabs on grade, supporting pieces of concrete blocks or bricks may be used.
- B. Place wire mesh reinforcing two inches above bottom of slab unless otherwise indicated.
- C. Reinforcement shall be kept clean from oil, dirt and loose mill scale or other coatings which might destroy the concrete bond. Remove tags and markings prior to concrete placement.
- D. Do not place concrete until reinforcement has been inspected and approved by local authorities, if required.

3.5 CONCRETE PLACEMENT AND FINISHING

- A. Tamp and consolidate concrete with a suitable wood or metal tamping bar and the surface shall be finished to grade with a wood float.
- B. Finished surfaces shall not vary more than 3/16 inch from the testing edge of a 10 foot straightedge.
- C. Curb Expansion Joints: Fill joints with 1/2 inch thick joint filler strips conforming to ASTM D1751 or ASTM D1752.
- D. Contraction Joints: Divide the surface of paving, walks and terraces into rectangular areas not to exceed 5 feet 0 inches each way.
 - 1. Cut a groove in the top portion of the slab to a depth of at least one-fourth of the slab thickness using a jointer or by sawing a groove in the hardened concrete with a power-driven saw.
 - 2. Membrane-cured surface damaged during the sawing operations shall be resprayed as soon as the surface becomes dry.
- E. Slab Finishes: ACI 301, paragraph 11.7 and as follows:



1. Broom Finish: On stair treads with abrasive nosings and on walks, unless other finishes have been indicated or specified.
2. Broom or Belt Finish: On level walks. Broom in direction perpendicular to travel and approved sample panel. Submit joint pattern layout prior to starting work.

3.6 TOLERANCES

- A. Horizontal slabs: Finished surfaces true with no deviation in excess of 1/8 inch when tested with a 10 foot straightedge, non-accumulative. No coarse aggregate showing.
- B. Steps:
 1. Variation in steps within a flight of stairs:
 - a. Rise: 1/8 inch.
 - b. Tread: 1/4 inch.
 2. Variation in consecutive steps:
 - a. Rise: 1/16 inch.
 - b. Tread: 1/8 inch.

3.7 EXPANSION JOINTS

- A. Install transverse expansion joints at returns and 15 feet on center.
- B. Install longitudinal expansion joints where curbs and paved areas abut each other, buildings, other concrete slabs and pads or vertical restraints.
- C. Place joint filler with top edge 1/4 inch below the surface and shall be held in place with steel pins or other devices to prevent warping of the filler during floating and finishing.
- D. Immediately after finishing operations are completed, round joint edges with edging tool having a radius of 1/8 inch. Remove concrete over the joint filler.
- E. At the end of the curing period, clean and fill expansion joints with joint sealer. Fill joints flush with concrete surface. Dummy groove joints shall not be sealed.

3.8 CURING

- A. Immediately after the finishing operations, the exposed concrete surface shall be cured for 7 days by the mat, impervious sheet, or membrane-curing method.

3.9 BACKFILLING

- A. After curing, remove debris and backfill the adjoining areas, grade and compact to conform to the surrounding area in accordance with the lines and grades indicated.

3.10 PROTECTION

- A. Protect the completed work from damage. Repair damaged concrete and clean concrete discolored during construction. Remove work that is damaged and reconstruct to entire length between regularly scheduled joints. Refinishing damaged portion is not acceptable.



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- B. Prevent cars and trucks from driving on new pavement for a minimum of 14 days.

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Last revised: 6/10/2011

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SECTION 32 13 13 17 - ROLLER COMPACTED CONCRETE PAVEMENT

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of roller compacted concrete pavement. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS

A. Cementitious Materials:

1. Portland cement shall conform to ASTM C 150, Type I. Low alkali is to be used with aggregates when directed. In lieu of low-alkali cement, the Contractor may use a combination of Portland cement that does not meet the low-alkali requirement with a suitable pozzolan or ground granulated blast-furnace slag (GGBFS) provided the following requirement is met. The expansion of the proposed combination shall be equal to or less than the expansion of a low-alkali cement meeting the requirements of ASTM C 150 when tested in conformance with ASTM C 441. These two tests shall be performed concurrently at an independent certified laboratory at the Contractor's expense. the Owner reserves the right to confirm the test results and to adjust the percentage of pozzolan or GGBFS in the combination to suit other requirements at no additional cost to the Owner. Portland cement shall be furnished in bulk.
2. Pozzolan shall conform to ASTM C 618, and, in addition, limits in Table 2A, Uniformity Requirements (for air content) shall apply to all fly ash. Table 1A, Supplementary Optional Chemical Requirement for Maximum Alkalies, shall apply when it is to be used with aggregates listed to require low-alkali cement. Pozzolan shall be furnished in bulk.
3. The temperature of the cementitious materials as delivered to the site shall not exceed 150 degrees F.

B. Admixtures: All chemical admixtures furnished as liquids shall be in a solution of suitable viscosity and dilution for field use as determined by the Owner.

1. Water-Reducing Admixture (WRA) shall meet the requirements of ASTM C 494, Type D.
2. Air-entraining admixture shall conform to ASTM C 260.

C. Water for washing aggregates and for mixing and curing concrete shall be free from injurious amounts of oil, acid, salt, alkali, organic matter, or other deleterious substances and shall comply with COE CRD-C 400.

D. Aggregates

1. Composition: Fine aggregate shall consist of natural sand, manufactured sand, or a combination of natural and manufactured sands. Coarse aggregate shall consist of gravel, crushed gravel, crushed stone, air-cooled blast-furnace slag, or a combination thereof.

OR

All concrete mixtures will be proportioned by the Owner except that proportions for the slipformed facing concrete mixture will be selected by the Contractor. RCC shall be composed of cementitious materials, water, fine and coarse aggregates, and possibly admixtures. The cementitious material shall be portland cement, or portland cement in combination with pozzolan. An admixture when approved or directed will be a water-reducing/retarding admixture. Air-entraining admixture will be used in the bedding concrete and other conventional concrete.



1.3 EXECUTION

- A. **Concrete Mixing Plant:** A continuous mixing plant(s) shall be capable of producing RCC of the same quality and uniformity as would be produced in a conventional redi-mix batch plant and shall be capable of producing a uniform continuous product (at both maximum and minimum production rates) that is mixed so that complete intermingling of all ingredients occurs without balling, segregation, and wet or dry portions.
- B. **Trucks:** Truck mixers or agitators used for transporting central-mixed conventional concrete shall conform to the applicable requirements of ASTM C 94. Truck mixers shall not be used to transport concrete with larger than 37.5 mm (1-1/2-inch) nominal maximum size aggregate (NMSA) or 2 inch slump, or less. Nonagitator trucks may be used for transporting conventional central-mixed concrete over a smooth road when the hauling time is less than 15 minutes and the slump is less than 3 inches. Bodies of nonagitator trucks shall be smooth, water-tight, metal containers specifically designed to transport concrete, shaped with rounded corners to minimize segregation.
- C. **Belt Conveyors:** Belt conveyors shall be designed and operated to assure a uniform flow of concrete from mixer or delivery truck to final place of deposit without segregation of ingredients or loss of mortar and shall be provided with positive means for preventing segregation of the concrete or loss of mortar at transfer points and the point of placing. The NMSA required in mixture proportions furnished by the Owner will not be changed to accommodate the belt width.
- D. **Spreading and Remixing Equipment:** The primary spreading procedure shall be accomplished by dozer. Graders or other equipment not specified may be used to facilitate the RCC spreading process only when approved. For open, unrestricted areas, the dozer shall be a minimum size and weight equivalent to a Caterpillar D-6. For restricted placement areas, such as placement of RCC near the dam crest or next to abutments, the dozer shall have as a minimum a size and weight equivalent to a Caterpillar D-4. There shall be a minimum of one operating dozer for each 200 cubic yards of RCC placed each hour. The dozers shall be equipped with well-maintained grousers. A front-end loader with operator shall be available to assist with deposition and spreading of RCC as needed in confined areas. The equipment shall be maintained in good operating condition. The equipment shall not leak or drip oil, grease, or other visible contaminants onto the RCC surface. All equipment used for spreading and remixing that leaves the surface of the structure for maintenance or repairs or, for any other reason, must be cleaned of all contaminants by an approved method before returning to the structure surface. Under no conditions shall a dozer or other tracked vehicle be operated on other than fresh uncompacted RCC except to facilitate startup operations for each lift and by approved procedures.
- E. **Compaction Equipment:**
 - 1. Self-propelled vibratory rollers shall be used for primary rolling and shall be double-drum. They shall transmit a dynamic impact to the surface through a smooth steel drum by means of revolving weights, eccentric shafts, or other equivalent methods. The compactor shall have a minimum gross mass of 20,000 pounds and shall produce a minimum dynamic force of 350 pounds per linear inch of drum width. The operating frequency shall be variable in the approximate range of 1,700 to 3,000 cycles per minute. The amplitude shall be adjustable between 0.015 and 0.04 inches. The roller shall be capable of full compaction in both forward and reverse directions. The roller shall be operated at speeds not exceeding 2.2 ft/s. Within the range of the operating capability of the equipment, the Owner may direct or approve variations to the frequency, amplitude, and speed of operation which result in the specified density at the fastest production rate.
 - 2. Small vibratory rollers shall be used to compact the RCC where the larger vibratory rollers specified above cannot maneuver. The rollers shall compact the RCC to the required density and shall be so demonstrated during construction of the test section. Small vibratory rollers cannot compact the RCC to the same density and thickness as the primary rollers. When small rollers are used, total lift thickness of the RCC layer or lift shall be reduced to not over 6 inches



- uncompacted thickness to permit adequate compaction. Rollers shall have independent speed and vibration controls and shall be capable of a wide range of speed adjustments.
3. The tampers shall compact the RCC to the required density and shall be so demonstrated during construction of the test section. Tampers cannot compact the RCC to the same density and thickness as the primary rollers. When tampers are used, thickness of each RCC layer that is to be compacted shall be reduced to not more than 6 inches uncompacted thickness to assure adequate compaction.
- F. Placing During Rain: RCC shall not be placed during rainfall of 0.1 inch/hr or more. During periods of lesser rainfall, placement of RCC may continue if, in the opinion of the Owner, no damage to the RCC is occurring. Work shall commence only after excess free surface water and contaminated paste or RCC have been removed. The surface shall have gained sufficient strength (no less than 4 hours after the RCC placement was suspended) to prevent rutting, pumping, intermixing of rainwater with the RCC, or other damage to the RCC. When the RCC surface has been contaminated or damaged in any manner, the RCC surface shall be washed to break up and remove laitance and/or mud-like coatings from the surface. Any undercut coarse aggregate shall be removed. All waste shall be removed and disposed of in an approved manner.
- G. Hot-Weather Placement: In hot-weather placement the temperature of the RCC shall be controlled so that it does not exceed 75.0 degrees F when placed. Placement shall be suspended as soon as the RCC temperature exceeds 75 degrees F. Measures that can be taken to prevent temperatures exceeding 75 degrees F include, but are not limited to; 1.) chilling mixing water, 2.) sprinkling aggregate stockpiles, 3.) use of a canopy to shade the RCC placement areas, 4.) placing during nighttime and early morning hours, or 5.) restricting placements to cloudy days. Use of any of these systems shall not be reason for extension of completion dates specified in these specifications. In addition, to prevent potential damage to the RCC due to hot-weather related placement conditions, all RCC operation shall be suspended between June 15 and October 31, unless directed otherwise.

END OF SECTION 32 13 13 17



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Task	Specification	Specification Description
32 13 13 17	32 01 11 53	Cement Concrete Pavement
32 13 16 13	32 01 11 53	Cement Concrete Pavement
32 13 43 00	32 01 11 53	Cement Concrete Pavement
32 14 11 00	32 01 11 53	Cement Concrete Pavement
32 14 13 16	32 01 11 53	Cement Concrete Pavement
32 14 16 00	32 01 11 53	Cement Concrete Pavement
32 14 40 00	32 01 11 53	Cement Concrete Pavement



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SECTION 32 14 43 00 - POROUS UNIT PAVING**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for porous unit paving. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Porous paving consisting of concrete pavers set in aggregate setting beds.
 - b. Edge restraints.
 - c. Cast-in-place concrete edge restraints.
 - d. Precast concrete curbs.
 - e. Granite curbs.

C. Submittals

1. Product Data: For materials other than aggregates.
2. Sieve Analyses: For aggregate materials, according to ASTM C 136.
3. Samples:
 - a. Full-size units of each type of unit paver indicated.
 - b. Exposed edge restraints.
 - c. Precast concrete curbs.
 - d. Granite curbs.
 - e. Aggregate fill.
4. Material Certificates: For unit pavers. Include statements of material properties indicating compliance with requirements, including compliance with standards. Provide for each type and size of unit.

D. Quality Assurance

1. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling

1. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.
2. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

1.2 PRODUCTS**A. Concrete Unit Pavers**

1. Concrete Grid Pavers: Grid paving units complying with ASTM C 1319, made from normal-weight aggregates.
2. Solid Concrete Pavers for Porous Paving: Solid interlocking paving units of shapes that provide openings between units, complying with ASTM C 936, resistant to freezing and thawing when tested according to ASTM C 67, **as directed**, and made from normal-weight aggregates.
 - a. Thickness: 2-3/8 inches (60 mm) **OR** 3-1/8 inches (80 mm) **OR** 3-1/2 inches (90 mm) **OR** 4 inches (100 mm), **as directed**.
 - b. Face Size and Shape: As indicated.
 - c. Color: As indicated by manufacturer's designations **OR** Match the Owner's sample **OR** As selected by the Owner from manufacturer's full range, **as directed**.



B. Accessories

1. Plastic Edge Restraints: Triangular PVC extrusions, 1-3/4 inches (45 mm) high by 3-1/2 inches (90mm) wide **OR** 3-1/8 inches (80 mm) high by 9-1/2 inches (240 mm) wide, **as directed**, designed to serve as edge restraints for unit pavers; rigid type for straight edges and flexible type for curved edges, with pipe connectors and 3/8-inch- (9.5-mm-) diameter by 12-inch- (300-mm-) long steel spikes.
2. Steel Edge Restraints: Painted steel edging, 3/16 inch (4.8 mm) thick by 4 inches (100 mm) high **OR** 1/4 inch (6.4 mm) thick by 5 inches (125 mm) high, **as directed**, with loops pressed from or welded to face to receive stakes at 36 inches (900 mm) o.c., and with steel stakes 15 inches (380 mm) long for each loop.
 - a. Color: As indicated by manufacturer's designations **OR** Match the Owner's sample **OR** As selected by the Owner from manufacturer's full range, **as directed**.
3. Aluminum Edge Restraints: Straight, 1/8-inch- (3.2-mm-) thick by 4-inch- (100-mm-) high **OR** Straight, 3/16-inch- (4.8-mm-) thick by 4-inch- (100-mm-) high **OR** L-shaped, 1/8-inch- (3.2-mm-) thick by 1-3/8-inch- (35-mm-) high **OR** L-shaped, 3/16-inch- (4.8-mm-) thick by 2-1/4-inch- (57-mm-) high, **as directed**, extruded-aluminum edging, with loops pressed from face to receive stakes at 12 inches (300 mm) o.c., and with aluminum stakes 12 inches (300 mm) long for each loop.
4. Precast Concrete Curbs: Made from normal-weight concrete with a compressive strength not less than 5000 psi (35 MPa) **OR** 6000 psi (41 MPa), **as directed**, and water absorption not more than 5 percent, in shapes and sizes indicated.
 - a. Color and Texture: As indicated by manufacturer's designations **OR** Match the Owner's sample **OR** As selected by the Owner from manufacturer's full range, **as directed**.
5. Granite Curbs: Granite curbing, with face battered 1 inch per foot (1:12), produced in random lengths not less than 36 inches (900 mm) from granite complying with ASTM C 615.
 - a. Granite Color and Grain: Light gray **OR** Dark gray **OR** Buff **OR** White **OR** Black **OR** Pink, **as directed**, with fine **OR** medium **OR** coarse, **as directed**, grain.
 - b. Top Width: 4 inches (100 mm) **OR** 5 inches (125 mm) **OR** 6 inches (150 mm), **as directed**.
 - c. Face Height: 4 inches (100 mm) **OR** 6 inches (150 mm) **OR** 8 inches (200 mm), **as directed**.
 - d. Total Height: 12 inches (300 mm) **OR** 16 inches (400 mm) **OR** 18 inches (450 mm), **as directed**.
 - e. Top Finish: Sawed **OR** Thermal **OR** Bushhammered, **as directed**.
 - f. Face Finish: Split **OR** Sawed **OR** Thermal **OR** Bushhammered, **as directed**.

C. Aggregate Setting-Bed Materials

1. Graded Aggregate for Subbase: Sound crushed stone or gravel complying with ASTM D 448 for Size No. 57 **OR** ASTM D 448 for Size No. 5 **OR** ASTM D 2940, subbase material **OR** requirements in Division 31 Section "Earth Moving" for subbase material, **as directed**.
2. Graded Aggregate for Base Course: Sound crushed stone or gravel complying with ASTM D 448 for Size No. 8 **OR** ASTM D 448 for Size No. 57 **OR** ASTM D 2940, base-course material **OR** requirements in Division 31 Section "Earth Moving" for base-course material, **as directed**.
3. Sand for Leveling Course: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C 33 for fine aggregate.
4. Soil Mix for Leveling Course: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C 33 for fine aggregate blended with planting soil mix complying with requirements in Division 32 Section(s) "Turf And Grasses" **OR** "Plants", **as directed**. Use blend consisting of 1/2 sand and 1/2 soil mix **OR** 2/3 sand and 1/3 soil mix, **as directed**.
5. Graded Aggregate for Leveling Course: Sound crushed stone or gravel complying with ASTM D 448 for Size No. 8 **OR** 9, **as directed**.
6. Soil for Porous Paver Fill: Planting soil mix complying with requirements in Division 32 Section(s) "Turf And Grasses" **OR** "Plants", **as directed**.



7. Graded Aggregate for Porous Paver Fill: Sound crushed stone or gravel complying with ASTM D 448 for Size No. 8 **OR** 9, **as directed**.
 - a. Provide stone of color indicated **OR** to match the Owner's sample, **as directed**.
8. Grass Seed: Comply with requirements in Division 32 Section "Turf And Grasses".
9. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications; made from polyolefins or polyesters, with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - a. Survivability: Class 2; AASHTO M 288.
 - b. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.
 - c. Permittivity: 0.02 per second, minimum; ASTM D 4491.
 - d. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.
10. Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - a. Survivability: Class 2; AASHTO M 288.
 - b. Apparent Opening Size: No. 40 (0.425-mm) sieve, maximum; ASTM D 4751.
 - c. Permittivity: 0.5 per second, minimum; ASTM D 4491.
 - d. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

1.3 EXECUTION

A. Preparation

1. Proof-roll prepared subgrade according to requirements in Division 31 Section "Earth Moving" to identify soft pockets and areas of excess yielding. Proceed with porous paver installation only after deficient subgrades have been corrected and are ready to receive subbase and base **OR** base, **as directed**, course for porous paving.

B. Installation, General

1. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be structurally unsound or visible in finished work.
2. Cut unit pavers with motor-driven masonry saw equipment or a block splitter, **as directed**, to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.
3. Tolerances:
 - a. Variation in Plane between Adjacent Units (Lipping): Do not exceed 1/16-inch (1.5-mm) unit-to-unit offset from flush.
 - b. Variation from Level or Indicated Slope: Do not exceed 1/8 inch in 24 inches (3 mm in 600 mm) and 1/4 inch in 10 feet (6 mm in 3 m) or a maximum of 1/2 inch (13 mm).
4. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.
 - a. Install edge restraints to comply with manufacturer's written instructions. Install stakes at intervals required to hold edge restraints in place during and after porous paver installation.
 - b. For metal edge restraints with top edge exposed, drive stakes at least 1 inch (25 mm) below top edge.
 - c. Install job-built concrete edge restraints to comply with requirements in Division 32 Section "Concrete Paving".
5. Provide curbs as indicated. Install curbs before placing unit pavers.
 - a. Install precast concrete **OR** granite, **as directed**, curbs on a bedding of compacted base-course material over compacted subgrade. Install curbs before placing base course for pavers. Set curbs at elevations indicated, accurately aligned, and place and compact base-course material behind curbs as indicated.
 - b. Install precast concrete curbs on aggregate base course after placing and compacting base course for pavers. Set curbs with top edge 1 inch (25 mm) below top of pavers. Anchor curbs with metal stakes driven through holes in curbs into base-course material.



- c. Install precast concrete curbs on aggregate-base course after placing and compacting base course for pavers. Set curbs with top surface 1/2 inch (13 mm) **OR** 2 inches (50 mm) **OR** 4 inches (100 mm), **as directed**, above top of pavers. Anchor curbs with metal stakes driven behind curbs into base-course material.

C. Setting-Bed Installation

1. Compact soil subgrade uniformly to at least 95 percent of ASTM D 698 **OR** ASTM D 1557, **as directed**, laboratory density.
2. Proof-roll prepared subgrade to identify soft pockets and areas of excess yielding. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by the Owner, and replace with compacted backfill or fill as directed.
3. Place separation **OR** drainage, **as directed**, geotextile over prepared subgrade, overlapping ends and edges at least 12 inches (300 mm).
4. For light-traffic uses, place aggregate subbase **OR** subbase and base, **as directed**, compact by tamping with plate vibrator, and screed to depth indicated.
5. For heavy-duty applications, place aggregate subbase **OR** subbase and base, **as directed**, compact to 100 percent of ASTM D 1557 maximum laboratory density, and screed to depth indicated.
6. Place drainage geotextile over compacted subbase, overlapping ends and edges at least 12 inches (300 mm).
7. Place drainage geotextile over compacted base course, overlapping ends and edges at least 12 inches (300 mm).
8. Place leveling course and screed to a thickness of 1 to 1-1/2 inches (25 to 38 mm) **OR** 2 to 2-1/2 inches (50 to 64 mm) **OR** 3 inches (76 mm), **as directed**, taking care that moisture content remains constant and density is loose and constant until pavers are set and compacted.

D. Paver Installation

1. Set unit pavers on leveling course, being careful not to disturb leveling base. If pavers have lugs or spacer bars to control spacing, place pavers hand tight against lugs or spacer bars. If pavers do not have lugs or spacer bars, place pavers with a 1/16-inch- (1.6-mm-) minimum and 1/8-inch- (3.2-mm-) maximum joint width. Use string lines to keep straight lines. Fill gaps between units that exceed 3/8 inch (10 mm) with pieces cut to fit from full-size pavers.
 - a. When installation is performed with mechanical equipment, use only unit pavers with lugs or spacer bars on sides of each unit.
2. Compact pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf (16- to 22-kN) compaction force at 80 to 90 Hz. Use vibrator with neoprene mat on face of plate or other means as needed to prevent cracking and chipping of pavers. Perform at least three passes across paving with vibrator.
 - a. Compact pavers when there is sufficient surface to accommodate operation of vibrator, leaving at least 36 inches (900 mm) of uncompacted pavers adjacent to temporary edges.
 - b. Before ending each day's work, compact installed concrete pavers except for 36-inch (900 mm) width of uncompacted pavers adjacent to temporary edges (laying faces).
 - c. As work progresses to perimeter of installation, compact installed pavers that are adjacent to permanent edges unless they are within 36 inches (90 mm) of laying face.
 - d. Before ending each day's work and when rain interrupts work, cover pavers that have not been compacted and leveling course on which pavers have not been placed with nonstaining plastic sheets to protect them from rain.
3. Place soil fill as follows, immediately after vibrating pavers into leveling course. Spread and screed soil fill level with tops of pavers. Vibrate pavers and add soil fill until porous paving is filled to about 3/4 inch (19 mm) from top surface; remove excess soil fill if any.
 - a. Before ending each day's work, place soil fill in installed porous paving except for 42-inch (1067-mm) width of unfilled paving adjacent to temporary edges (laying faces).
 - b. As work progresses to perimeter of installation, place soil fill in installed paving that is adjacent to permanent edges unless it is within 42 inches (1067 mm) of laying face.



- c. Before ending each day's work and when rain interrupts work, cover paving that has not been filled with nonstaining plastic sheets to protect it from rain.
 4. After filling pavers with soil, sow seed to comply with requirements in Division 32 Section "Turf And Grasses". except sow seed at half the rate specified for seeding lawns. Sweep seed from surfaces of pavers into voids and water with fine spray.
 - a. Within 24 hours after sowing seed, spread an additional 3/16 inch (4.8 mm) of soil fill over seed and soak with water.
 5. Place graded aggregate fill immediately after vibrating pavers into leveling course. Spread and screed aggregate fill level with tops of pavers.
 - a. Before ending each day's work, place aggregate fill in installed porous paving except for 42-inch (1067-mm) width of unfilled paving adjacent to temporary edges (laying faces).
 - b. As work progresses to perimeter of installation, place aggregate fill in installed paving that is adjacent to permanent edges unless it is within 42 inches (1067 mm) of laying face.
 - c. Before ending each day's work and when rain interrupts work, cover paving that has not been filled with nonstaining plastic sheets to protect it from rain.
 6. Remove and replace pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.
- E. Maintenance And Protection
 1. Water newly planted grass and keep moist until grass is established. Maintain grass that is planted in paving to comply with requirements in Division 32 Section "Turf And Grasses".
 2. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades for 60 days after planting.

END OF SECTION 32 14 43 00



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SECTION 32 14 43 00a - VITRIFIED BRICK PAVEMENT REPLACEMENT**1.1 GENERAL****A. General**

1. Limits of Brick Pavement Replacement shall be as per the detail entitled "Payment Limits for Surface Restoration" shown in the plans, plus one foot on each side. Alternate individual bricks may have to be removed in order to maintain staggered joint pattern along the edge of the undisturbed brick pavement.

1.2 PRODUCT**A. Preparation**

1. Base shall be provided and shaped to match level, kind and thickness (4" min.) of adjoining base. The base material shall be compacted to meet the density standards. 4" 2500 PSI concrete base may be used for irregular patches and where compaction is otherwise impractical. Concrete shall be properly placed, consolidated and cured. One inch of sand, or good grade dirt, free from clay, loam or other foreign matter shall be used for cushion to hold the bricks in place. The sand shall be shaped to a true surface parallel to required finished pavement surface.

B. Materials

1. Existing bricks shall be cleaned, stored, and secured by the Contractor.

1.3 EXECUTION**A. Reinstallation of Bricks**

1. The bricks shall be installed in rows, better face upward, sorted by size with joints staggered, then rolled daily with a static tandem wheel roller. Additional bricks, if required, will be supplied by the Owner. City Personnel shall inspect work daily. After inspection, the bricks shall be sprayed with a solution of lime and water, using 26 lbs. of lime to 55 gallons of water. Asphalt steep 7330 or equal shall be used for joint filler. The steep shall be heated until fluid and poured over bricks and removed when cool with square pointed shovels dipped in lime water. Removed asphalt may be reused. If adjoining bricks are grouted, new filler shall be grout (8:1, builders sand: cement).

B. Acceptance

1. Upon completion of the work, and before acceptance and final payment, the Contractor shall remove all false work, equipment, rubbish, surplus, and discarded materials. The Contractor shall restore in an acceptable manner all property, both public and private, damaged during the prosecution of the work. The Contractor shall leave the roadway in a neat and presentable condition each day.

END OF SECTION 32 14 43 00a



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Task	Specification	Specification Description
32 14 43 00	32 01 11 53	Cement Concrete Pavement
32 16 13 13	32 01 11 53	Cement Concrete Pavement
32 16 13 14	32 01 11 53	Cement Concrete Pavement
32 16 13 16	32 01 11 53	Cement Concrete Pavement
32 16 13 19	32 01 11 53	Cement Concrete Pavement
32 16 13 26	32 01 11 53	Cement Concrete Pavement
32 16 13 33	32 01 11 53	Cement Concrete Pavement
32 16 13 43	32 01 11 53	Cement Concrete Pavement
32 16 13 43	32 14 43 00	Porous Unit Paving
32 16 23 00	32 01 11 53	Cement Concrete Pavement



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SECTION 32 17 23 00 - CSF PAVEMENT MARKINGS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Pavement Marking is part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Painted pavement markings.
 - 2. Painted curbs, guard posts, and light pole bases.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 321216 - Asphalt Paving: Asphalt paving substrate for marking application.
 - 2. Section 321313 - Concrete Paving: Concrete paving substrate for marking application.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Technical data sheets indicating manufacturer's catalog number, paint type description, and VOC content for each paint type specified.
 - 2. Assurance/Control Submittals:
 - a. Certificates: Manufacturer certificate that Products meet or exceed specified requirements.
 - b. Test Reports: Manufacturer Material Safety Data Sheets (MSDS) for each paint type specified.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements: Provide paint materials that conform to Federal, State, and local restrictions for Volatile Organic Compounds (VOC) and lead free content.



1.4 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Deliver paint materials in sealed original labeled containers, bearing manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and/or reducing.
- C. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's published instructions.

1.5 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize flagmen, barricades, warning signs and warning lights as required.

1.6 MAINTENANCE

- A. Section 017704 - Closeout Procedures and Training: Requirements for Closeout Submittals.
 - 1. Extra Materials:
 - a. Provide 1 gallon of each color to Contracting Officer.
 - b. Label each container with color and type, in addition to manufacturer's label.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering specified Products which may be incorporated into the Work include the following:
 - 1. ICI Dulux Paints, Cleveland, OH (800) 984-5444.
 - 2. Sherwin-Williams Company, Cleveland, OH (800) 321-8194.
 - 3. McCormick Paint Works, Rockville, MD (877) PAINT-55
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

- A. Ready-mixed; pigments fully ground maintaining a soft paste consistency, capable of readily and uniformly dispersing to a complete homogeneous mixture providing good flowing and brushing properties capable of drying or curing free of streaks or sags. Dry to traffic and touch in 2 hours.
- B. Traffic Paint: Flat, Water Base, Acrylic, complying with Federal Specifications TT-P 1952D
 - 1. 1st Coat:
 - a. Devoe: Traffic-Line Interior-Exterior Water Borne Traffic Marking Paint, 850XX; MDF 7 mils.
 - b. Sherwin-Williams: Setfast Acrylic Waterborne Traffic Marking Paint, MDF 7 mils.
 - c. McCormick: Acrylic Latex Traffic Marking Paint #01705.
 - 2. 2nd Coat:
 - a. Devoe: Traffic-Line Interior-Exterior Water Borne Traffic Marking Paint, 850XX; MDF 7 mils.



- b. Sherwin-Williams: Setfast Acrylic Waterborne Traffic Marking Paint, MDF 7 mils.
- c. McCormick: Acrylic Latex Traffic Marking Paint #01705.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Sweep pavement and surfaces to receive paint markings clean of dust and dirt. Allow pavement to cure a minimum of 60 days prior to application of paint markings.
- B. Clean surfaces free of glaze and grease, road film, and other foreign materials.

NOTE TO SPECIFIER

Use Paragraph below where removal of existing markings is a part of the Work.

- C. Where existing pavement markings are indicated on Drawings to be removed or would interfere with the adhesion of new paint, use a motorized abrasive device to remove existing markings.
 - 1. Use equipment that will not damage existing paving or create surface hazardous to vehicle or pedestrian traffic.
 - 2. Use marking removal methods approved by governing authority having jurisdiction in areas within public rights-of-way.

3.3 APPLICATION

- A. Apply paint products in accordance with manufacturer's published instructions using application procedures approved for the particular application and substrate to the specified Minimum Dry Film Thickness (MDF). Apply each coat to uniform finish.
- B. Do not apply paint markings on surfaces that are not dry and if rain is expected within 24 hours.
- C. Do not apply paint markings when surface or air temperature is below 50 degrees F.
- D. Apply 2 coats at manufacturer recommended rate without addition of thinner. Apply with mechanical equipment to produce uniform straight edges. At sidewalk curbs and crosswalks, use straightedge to provide uniform, clean, and straight stripe.



NOTE TO SPECIFIER

Edit marking colors to coordinate with colors indicated on Drawings and per local code requirements.

3.4 PAINT MARKING SCHEDULE

A. Paint the following items with colors indicated below:

1. Pedestrian Crosswalks: [White] [Yellow].

NOTE TO SPECIFIER

Delete painting of bollards if plastic covers are used.

2. Bollards: Yellow.
3. Fire Lanes: Red or per local code.
4. Lane Striping Where Separating Traffic in Opposite Directions: Yellow.
5. Lane Striping Where Separating Traffic in Same Direction: White.
6. Handicap Symbols: Per local code.
7. Parking Stall Striping: [White] [Yellow]

USPS CSF Specifications issued: 10/1/2013

Last revised: 4/12/2011

END OF SECTION 32 17 23 00



SECTION 32 17 23 00 - MPF PAVEMENT MARKINGS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

Use this section where Pavement Marking is part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Painted pavement markings.
 - 2. Painted curbs, guard posts, and light pole bases.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 321216 - Asphalt Paving: Asphalt paving substrate for marking application.
 - 2. Section 321313 - Concrete Paving: Concrete paving substrate for marking application.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Technical data sheets indicating manufacturer's catalog number, paint type description, and VOC content for each paint type specified.
 - 2. Assurance/Control Submittals:
 - a. Certificates: Manufacturer certificate that Products meet or exceed specified requirements.
 - b. Test Reports: Manufacturer Material Safety Data Sheets (MSDS) for each paint type specified.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements: Provide paint materials that conform to Federal, State, and local restrictions for Volatile Organic Compounds (VOC) and lead free content.



1.4 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Deliver paint materials in sealed original labeled containers, bearing manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and/or reducing.
- C. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's published instructions.

1.5 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize flagmen, barricades, warning signs and warning lights as required.

1.6 MAINTENANCE

- A. Section 017704 – Closeout Procedures and Training: Requirements for Closeout Submittals.
 - 1. Extra Materials:
 - a. Provide 1 gallon of each color to Contracting Officer.
 - b. Label each container with color and type, in addition to manufacturer's label.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering specified Products which may be incorporated into the Work include the following:
 - 1. ICI Dulux Paints, Cleveland, OH (800) 984-5444.
 - 2. Sherwin-Williams Company, Cleveland, OH (800) 321-8194.
 - 3. McCormick Paint Works, Rockville, MD (877) PAINT-55
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

- A. Ready-mixed; pigments fully ground maintaining a soft paste consistency, capable of readily and uniformly dispersing to a complete homogeneous mixture providing good flowing and brushing properties capable of drying or curing free of streaks or sags. Dry to traffic and touch in 2 hours.
- B. Traffic Paint: Flat, Water Base, Acrylic, complying with Federal Specifications TT-P 1952D
 - 1. 1st Coat:
 - a. Devoe: Traffic-Line Interior-Exterior Water Borne Traffic Marking Paint, 850XX; MDF 7 mils.
 - b. Sherwin-Williams: Setfast Acrylic Waterborne Traffic Marking Paint, MDF 7 mils.
 - c. McCormick: Acrylic Latex Traffic Marking Paint #01705.
 - 2. 2nd Coat:
 - a. Devoe: Traffic-Line Interior-Exterior Water Borne Traffic Marking Paint, 850XX; MDF 7 mils.



- b. Sherwin-Williams: Setfast Acrylic Waterborne Traffic Marking Paint, MDF 7 mils.
- c. McCormick: Acrylic Latex Traffic Marking Paint #01705.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Sweep pavement and surfaces to receive paint markings clean of dust and dirt. Allow pavement to cure a minimum of 60 days prior to application of paint markings.
- B. Clean surfaces free of glaze and grease, road film, and other foreign materials.

NOTE TO SPECIFIER

Use Paragraph below where removal of existing markings is a part of the Work.

- C. Where existing pavement markings are indicated on Drawings to be removed or would interfere with the adhesion of new paint, use a motorized abrasive device to remove existing markings.
 - 1. Use equipment that will not damage existing paving or create surface hazardous to vehicle or pedestrian traffic.
 - 2. Use marking removal methods approved by governing authority having jurisdiction in areas within public rights-of-way.

3.3 APPLICATION

- A. Apply paint products in accordance with manufacturer's published instructions using application procedures approved for the particular application and substrate to the specified Minimum Dry Film Thickness (MDF). Apply each coat to uniform finish.
- B. Do not apply paint markings on surfaces that are not dry and if rain is expected within 24 hours.
- C. Do not apply paint markings when surface or air temperature is below 50 degrees F.
- D. Apply 2 coats at manufacturer recommended rate without addition of thinner. Apply with mechanical equipment to produce uniform straight edges. At sidewalk curbs and crosswalks, use straightedge to provide uniform, clean, and straight stripe.



NOTE TO SPECIFIER

Edit marking colors to coordinate with colors indicated on Drawings and per local code requirements.

3.4 PAINT MARKING SCHEDULE

A. Paint the following items with colors indicated below:

1. Pedestrian Crosswalks: [White] [Yellow].

NOTE TO SPECIFIER

Delete painting of bollards if plastic covers are used.

2. Bollards: Yellow.
3. Fire Lanes: Red or per local code.
4. Lane Striping Where Separating Traffic in Opposite Directions: Yellow.
5. Lane Striping Where Separating Traffic in Same Direction: White.
6. Handicap Symbols: Per local code.
7. Parking Stall Striping: [White] [Yellow]

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Last revised: 6/10/2011

END OF SECTION 32 17 23 00



Task	Specification	Specification Description
32 17 23 13	32 01 11 53	Cement Concrete Pavement
32 17 23 23	32 01 11 53	Cement Concrete Pavement
32 17 23 33	32 01 11 53	Cement Concrete Pavement



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SECTION 32 17 26 00 - TACTILE/DETECTABLE WARNING TILE

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for tactile/detectable warning tile. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product data for each specified product.
2. Shop drawings, showing detailed plans of tile profile, fastener locations, and installation methods
3. Two (2) tile samples, minimum size 6" x 8" of the kind proposed for use.
4. Material Test Reports: Submit test reports from qualified independent testing laboratory indicating that materials proposed for use are in compliance with requirements and meet the properties indicated. All test reports shall be conducted on a cast-in-place tactile panel system as certified by a qualified independent testing laboratory.
5. Maintenance Instructions: Submit copies of manufacturer's specified maintenance practices for each type of tactile tile and accessory as required.

C. Quality Control

1. Americans with Disabilities Act (ADA): Provide tactile warning surfaces, which comply with the detectable warnings on walking surfaces, section of the Americans with Disabilities Act (Title 49 CFR TRANSPORTATION, PART 37.9 STANDARDS FOR ACCESSIBLE TRANSPORTATION FACILITIES, Appendix A, Section 4.29.2 DETECTABLE WARNINGS ON WALKING SURFACES.
2. California Code of Regulations (CCR): Provide only approved DSAAC detectable warning products as provided in the California Code of Regulations (CCR). Title 24, Part 1, Articles 2, 3 and 4 and Part 2, Section 205 definition of "Detectable Warning". Section 1127B.5 for "Curb Ramps" and Section 1133B.8.5 for "Detectable Warnings at Hazardous Vehicle Area's".
3. Performance: Tiles shall meet or exceed the following criteria:
 - a. Water Absorption: 0.35% maximum, when tested in accordance with ASTM D570.
 - b. Slip Resistance: 0.90 minimum combined wet/ dry static coefficient of friction on top of domes and field area, when tested in accordance with ASTM C1028.
 - c. Compressive Strength: 18,000 psi minimum, when tested in accordance with ASTM D695.
 - d. Tensile Strength: 10,000 psi minimum, when tested in accordance with ASTM D638.
 - e. Flexural Strength: 24,000 psi minimum, when tested in accordance with ASTM C293.
 - f. Gardner Impact: 450 inch-pounds per inch minimum, when tested in accordance with Geometry "GE" of ASTM D5420.
 - g. Chemical Stain Resistance: No reaction to 1% hydrochloric acid, urine, calcium chloride, stamp pad ink, gum and red aerosol paint, when tested in accordance with ASTM D543.
 - h. Wear Depth: 0.03" maximum, after 1000 abrasion cycles of 40 grit Norton Metallite sandpaper, when tested in accordance with ASTM D2486-Modified.
 - i. Flame Spread: 25 maximum, when tested in accordance with ASTM E84.
 - j. Accelerated Weathering: No deterioration, fading or chalking for 2000 hours, when tested in accordance with ASTM D2565.
4. Tactile warning tiles embedded in or adhered to concrete shall meet or exceed the following performance criteria:
 - a. Accelerated Aging and Freeze Thaw of Adhesive System: No cracking, delamination, warping, checking, blistering, color change, loosening, etc. when tested in accordance with ASTM D1037.
 - b. Salt and Spray Performance: No deterioration after 100 hours of exposure, when tested in accordance with ASTM B117.



- D. Delivery, Storage And Handling
 - 1. Tiles shall be suitably packaged or crated to prevent damage in shipment or handling. Finished surfaces shall be protected by sturdy wrappings, and tile type shall be identified by part number.
 - 2. Tiles shall be delivered to location at building site for storage prior to installation.
- E. Warranty
 - 1. Installed tiles shall be warranted for a minimum of five (5) years against failure of adhesives, fasteners and sealants.

1.2 PRODUCT

- A. Materials
 - 1. Vitrified Polymer Composite (VPC) tiles shall be an epoxy polymer composition with an ultra violet stabilized coating employing aluminum oxide particles in the truncated domes. The tile shall incorporate an in-line dome pattern of truncated domes. For wheelchair safety the field area shall consist of a non-slip surface with a minimum of 40 - 90° raised points 0.045" high, per square inch.
 - 2. Color: Safety Yellow, (Federal Color # 33538) colorfast, UV stabilized coating. Color shall be homogeneous throughout the tile.
- B. Cast-In-Place Tactile Tile
 - 1. Tile shall be minimum 1-3/8" thick, with minimum 3/8" thick face and ribs designed for after-pour embedment in concrete.
- C. Surface Applied Detectable Warning Surface Tile
 - 1. The tile shall have with countersunk fastening holes and perimeter beveled edges.
 - 2. Accessories:
 - a. Fasteners: Color matched, corrosion resistant, flat head drive anchor, 1/4" diameter x 1-3/4" long.
 - b. Adhesive: Urethane elastomeric adhesive.
 - c. Sealants: Epoxy two component sealant.
- D. Modular Paver Tactile Tile
 - 1. Pre-cast with a 1-3/8" thick reinforced epoxy polymer concrete core.
 - a. Polymer Concrete and/or epoxy resin properties shall meet or exceed the following criteria:

Tensile Strength of Resin:	greater than 7,000psi; ASTM D638
Modulus of Elasticity of Resin:	greater than 4,000psi; ASTM D638
Bond Strength of Polymeric Concrete:	greater than 8,000psi; ASTM C551
 - 2. Accessories:
 - a. Adhesive: Urethane elastomeric adhesive.
 - b. Backer Rod: ASTM C 1330, Type C (closed-cell material with a surface skin) **OR** Type O (open-cell material) **OR** Type B (bicellular material with a surface skin), **as directed**, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance
- E. Surface Applied Detectable Guidance Tiles
 - 1. Accessories:
 - a. Adhesive: Heavy-duty polyurethane elastomeric adhesive.
 - b. Sealants: Heavy-duty polyurethane elastomeric sealant.
- F. Surface Applied Detectable Directional Bar Tiles
 - 1. Accessories:
 - a. Fasteners: Stainless steel low profile expansion anchors, 3/16" diameter by 2" long.



- b. Adhesive: Heavy-duty polyurethane elastomeric adhesive.
- c. Sealants: Heavy-duty polyurethane elastomeric sealant.

1.3 EXECUTION

A. Installation

1. Installation shall be in strict compliance with manufacturer's printed instructions.

END OF SECTION 32 17 26 00



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SECTION 32 18 26 00 - LAWNS AND GRASSES**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for lawns and grasses. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Seeding.
 - b. Hydroseeding.
 - c. Sodding.
 - d. Plugging.
 - e. Sprigging.
 - f. Meadow grasses and wildflowers.
 - g. Turf renovation.
 - h. Erosion-control material(s).
 - i. Grass paving.

C. Definitions

1. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
2. Finish Grade: Elevation of finished surface of planting soil.
3. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
4. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
5. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
6. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
7. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.
8. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
9. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

D. Submittals

1. Product Data: For each type of product indicated.
2. Certification of Grass Seed.
 - a. Certification of each seed mixture for turfgrass sod **OR** plugs, **as directed**.
3. Product Certificates: For soil amendments and fertilizers, from manufacturer.
4. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of turf and meadows during a calendar year. Submit before expiration of required initial maintenance periods.



E. Quality Assurance

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 - a. Pesticide Applicator: State licensed, commercial.
2. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory.
 - a. The soil-testing laboratory shall oversee soil sampling.
 - b. Report suitability of tested soil for turf growth.
 - 1) State recommendations for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
 - 2) Report presence of problem salts, minerals, or heavy metals; if present, provide additional recommendations for corrective action.

F. Delivery, Storage, And Handling

1. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.
2. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.
3. Bulk Materials:
 - a. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 - b. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 - c. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

G. Maintenance Service

1. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 1.3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:
 - a. Seeded Turf: 60 days from date of planting completion **OR** Final Completion, **as directed**.
 - 1) When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.
 - b. Sodded Turf: 30 days from date of planting completion **OR** Final Completion, **as directed**.
 - c. Plugged Turf: 30 days from date of planting completion **OR** Final Completion, **as directed**.
 - d. Sprigged Turf: 30 days from date of planting completion **OR** Final Completion, **as directed**.
2. Initial Meadow Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 1.3. Begin maintenance immediately after each area is planted and continue until acceptable meadow is established, but for not less than 40 days from date of planting completion **OR** Final Completion, **as directed**.
3. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.



1.2 PRODUCTS

A. Seed

1. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.
2. Seed Species: If grass seed is required to be certified by the State Department of Agriculture, State-certified seed of grass species as follows:
OR
 Seed Species: If grass seed is not required to be certified by the State Department of Agriculture, seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:
 - a. Warm-season grass
 - 1) Full Sun: Bermudagrass (*Cynodon dactylon*).
 - b. Cool-season grass
 - 1) Full Sun: Kentucky bluegrass (*Poa pratensis*), a minimum of three cultivars.
 - 2) Sun and Partial Shade: Proportioned by weight as follows:
 - a) 50 percent Kentucky bluegrass (*Poa pratensis*).
 - b) 30 percent chewings red fescue (*Festuca rubra* variety).
 - c) 10 percent perennial ryegrass (*Lolium perenne*).
 - d) 10 percent redtop (*Agrostis alba*).
 - 3) Shade: Proportioned by weight as follows:
 - a) 50 percent chewings red fescue (*Festuca rubra* variety).
 - b) 35 percent rough bluegrass (*Poa trivialis*).
 - c) 15 percent redtop (*Agrostis alba*).
3. Grass Seed Mix: Proprietary seed mix as directed by the Owner.

B. Turfgrass Sod

1. Turfgrass Sod: Certified **OR** Approved **OR** Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, **as directed**, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.
2. Turfgrass Species (warm-season grass): Bermudagrass (*Cynodon dactylon*) **OR** Carpetgrass (*Axonopus affinis*) **OR** Centipedegrass (*Eremochloa ophiuroides*) **OR** St. Augustinegrass (*Stenotaphrum secundatum*) **OR** Zoysiagrass (*Zoysia japonica*) **OR** Zoysiagrass (*Zoysia matrella*), **as directed**.
3. Turfgrass Species (cool-season grass): Sod of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:
 - a. Full Sun: Kentucky bluegrass (*Poa pratensis*), a minimum of three cultivars.
 - b. Sun and Partial Shade: Proportioned by weight as follows:
 - 1) 50 percent Kentucky bluegrass (*Poa pratensis*).
 - 2) 30 percent chewings red fescue (*Festuca rubra* variety).
 - 3) 10 percent perennial ryegrass (*Lolium perenne*).
 - 4) 10 percent redtop (*Agrostis alba*).
 - c. Shade: Proportioned by weight as follows:
 - 1) 50 percent chewings red fescue (*Festuca rubra* variety).
 - 2) 35 percent rough bluegrass (*Poa trivialis*).
 - 3) 15 percent redtop (*Agrostis alba*).

C. Plugs

1. Plugs: Turfgrass sod, certified **OR** approved **OR** Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, **as directed**, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, cut into square or round plugs, strongly rooted,



and capable of vigorous growth and development when planted; of the following turfgrass species and plug size:

- a. Turfgrass Species (warm-season grass): Bermudagrass (*Cynodon dactylon*) **OR** Carpetgrass (*Axonopus affinis*) **OR** Centipedegrass (*Eremochloa ophiuroides*) **OR** St. Augustinegrass (*Stenotaphrum secundatum*) **OR** Zoysiagrass (*Zoysia japonica*) **OR** Zoysiagrass (*Zoysia matrella*), **as directed**.
- b. Plug Size: 2 inches (50 mm) **OR** 3 inches (75 mm) **OR** 4 inches (100 mm), **as directed**.

D. Sprigs

1. Sod Sprigs: Healthy living stems, rhizomes, or stolons with a minimum of two nodes and attached roots free of soil, of the following turfgrass species:
 - a. Turfgrass Species (warm-season grass): Bermudagrass (*Cynodon dactylon*) **OR** Carpetgrass (*Axonopus affinis*) **OR** Centipedegrass (*Eremochloa ophiuroides*) **OR** St. Augustinegrass (*Stenotaphrum secundatum*) **OR** Zoysiagrass (*Zoysia japonica*) **OR** Zoysiagrass (*Zoysia matrella*), **as directed**.
 - b. Turfgrass Species (cool-season grass): Creeping bentgrass (*Agrostis palustris*).

E. Meadow Grasses And Wildflowers

1. Wildflower Seed: Fresh, clean, and dry new seed, of mixed species as directed.
2. Native Grass Seed: Fresh, clean, and dry new seed, of mixed species as directed.
3. Wildflower and Native Grass Seed: Fresh, clean, and dry new seed, of mixed species as directed.
4. Seed Carrier: Inert material, sharp clean sand or perlite, mixed with seed at a ratio of not less than two parts seed carrier to one part seed.

F. Inorganic Soil Amendments

1. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
 - a. Class T, with a minimum of 99 percent passing through No. 8 (2.36-mm) sieve and a minimum of 75 percent passing through No. 60 (0.25-mm) sieve.
OR
Class O, with a minimum of 95 percent passing through No. 8 (2.36-mm) sieve and a minimum of 55 percent passing through No. 60 (0.25-mm) sieve.
 - b. Provide lime in form of ground dolomitic limestone **OR** calcitic limestone **OR** mollusk shells, **as directed**.
2. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No. 6 (3.35-mm) sieve and a maximum of 10 percent passing through No. 40 (0.425-mm) sieve.
3. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
4. Aluminum Sulfate: Commercial grade, unadulterated.
5. Perlite: Horticultural perlite, soil amendment grade.
6. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 (0.30-mm) sieve.
7. Sand: Clean, washed, natural or manufactured, and free of toxic materials.
8. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.
OR
Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

G. Organic Soil Amendments

1. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm) **OR** 3/4-inch (19-mm) **OR** 1/2-inch (12.5-mm), **as directed**, sieve; soluble salt content of 5 to 10



- decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
- a. Organic Matter Content: 50 to 60 percent of dry weight.
 - b. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
 2. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture, with a pH range of 3.4 to 4.8.
 3. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.
 4. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.
 - a. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. (2.4 kg/cu. m) of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. (4 kg/cu. m) of loose sawdust or ground bark.
 5. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

H. Fertilizers

1. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 1 **OR** 4, **as directed**, percent nitrogen and 10 **OR** 20, **as directed**, percent phosphoric acid.
2. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
3. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - a. Composition: 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
 - b. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.
4. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - a. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
OR
Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

I. Planting Soils

1. Planting Soil: ASTM D 5268 topsoil, with pH range of 5.5 to 7, a minimum of 2 percent organic material content **OR** Existing, native surface topsoil formed under natural conditions with the duff layer retained during excavation process **OR** Existing, in-place surface soil **OR** Imported topsoil or manufactured topsoil from off-site sources; do not obtain from agricultural land, bogs or marshes, **as directed**. Verify suitability of soil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth. Mix soil with the following soil amendments and fertilizers in the following quantities to produce planting soil:
 - a. Ratio of Loose Compost to Topsoil by Volume: 1:4 **OR** 1:3 **OR** 1:2, **as directed**.
 - b. Ratio of Loose Sphagnum **OR** Muck, **as directed**, Peat to Topsoil by Volume: as directed by the Owner .
 - c. Ratio of Loose Wood Derivatives to Topsoil by Volume: as directed by the Owner.
 - d. Weight of Lime per 1000 Sq. Ft. (92.9 Sq. m): as directed by the Owner.



- e. Weight of Sulfur **OR** Iron Sulfate **OR** Aluminum Sulfate, **as directed**, per 1000 Sq. Ft. (92.9 Sq. m): as directed by the Owner.
- f. Weight of Agricultural Gypsum per 1000 Sq. Ft. (92.9 Sq. m): as directed by the Owner.
- g. Volume of Sand Plus 10 Percent Diatomaceous Earth **OR** Zeolites, **as directed**, per 1000 Sq. Ft. (92.9 Sq. m): as directed by the Owner.
- h. Weight of Bonemeal per 1000 Sq. Ft. (92.9 Sq. m): as directed by the Owner.
- i. Weight of Superphosphate per 1000 Sq. Ft. (92.9 Sq. m): as directed by the Owner.
- j. Weight of Commercial Fertilizer per 1000 Sq. Ft. (92.9 Sq. m): as directed by the Owner.
- k. Weight of Slow-Release Fertilizer per 1000 Sq. Ft. (92.9 Sq. m): as directed by the Owner.

J. Mulches

- 1. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
- 2. Sphagnum Peat Mulch: Partially decomposed sphagnum peat moss, finely divided or of granular texture, and with a pH range of 3.4 to 4.8.
- 3. Muck Peat Mulch: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.
- 4. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm) sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
 - a. Organic Matter Content: 50 to 60 percent of dry weight.
 - b. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- 5. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.
- 6. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.
- 7. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

K. Pesticides

- 1. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- 2. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- 3. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

L. Erosion-Control Materials

- 1. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.
- 2. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd. (0.5 kg/sq. m), with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.
- 3. Erosion-Control Mats: Cellular, non-biodegradable slope-stabilization mats designed to isolate and contain small areas of soil over steeply sloped surface, of 3-inch (75-mm) **OR** 4-inch (100-mm) **OR** 6-inch (150-mm), **as directed**, nominal mat thickness. Include manufacturer's recommended anchorage system for slope conditions.



M. Grass-Paving Materials

1. Grass Paving: Cellular, non-biodegradable plastic mats, designed to contain small areas of soil and enhance the ability of turf to support vehicular and pedestrian traffic, of 1-inch (25-mm) **OR** 1-3/4-inch (45-mm) **OR** 2-inch (50-mm) **OR** manufacturer's standard, **as directed**, nominal mat thickness. Include manufacturer's recommended anchorage system for slope conditions.
2. Base Course: Sound crushed stone or gravel complying with ASTM D 448 for Size No. 8 **OR** Division 31 Section "Earth Moving" for base-course material, **as directed**.
3. Sand: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C 33 for fine aggregate.
4. Proprietary Growing Mix: As submitted and acceptable to the Owner.
5. Sandy Loam Soil Mix: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C 33 for fine aggregate blended with planting soil as specified. Use blend consisting of 1/2 sand and 1/2 planting soil **OR** 2/3 sand and 1/3 planting soil, **as directed**.
6. Soil for Paving Fill: Planting soil as specified.

1.3 EXECUTION

A. Preparation

1. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
 - a. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
 - b. Protect grade stakes set by others until directed to remove them.
2. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

B. Turf Area Preparation

1. Limit turf subgrade preparation to areas to be planted.
2. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 4 inches (100 mm) **OR** 6 inches (150 mm) **OR** 8 inches (200 mm), **as directed**. Remove stones larger than 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - a. Apply superphosphate fertilizer directly to subgrade before loosening.
 - b. Thoroughly blend planting soil off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
 - 1) Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
 - 2) Mix lime with dry soil before mixing fertilizer.
 - c. Spread planting soil to a depth of 4 inches (100 mm) **OR** 6 inches (150 mm) **OR** 8 inches (200 mm), **as directed**, but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
 - 1) Spread approximately 1/2 the thickness of planting soil over loosened subgrade. Mix thoroughly into top 2 inches (50 mm) **OR** 4 inches (100 mm), **as directed**, of subgrade. Spread remainder of planting soil.
 - 2) Reduce elevation of planting soil to allow for soil thickness of sod.
3. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:
 - a. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
 - b. Loosen surface soil to a depth of at least 6 inches (150 mm) **OR** 8 inches (200 mm), **as directed**. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, of soil. Till soil to a homogeneous mixture of fine texture.
 - 1) Apply superphosphate fertilizer directly to surface soil before loosening.
 - c. Remove stones larger than 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, in any dimension and sticks, roots, trash, and other extraneous matter.



- d. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.
 4. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch (13 mm) of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.
 5. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
 6. Before planting, obtain the Owner's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.
- C. Preparation For Erosion-Control Materials
1. Prepare area as specified in "Turf Area Preparation" Article.
 2. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.
 3. Fill cells of erosion-control mat with planting soil and compact before planting.
 4. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.
 5. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- D. Preparation For Grass-Paving Materials
1. Reduce subgrade elevation soil to allow for thickness of grass-paving system. Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade so that installed paving is within plus or minus 1/2 inch (13 mm) of finish elevation. Roll and rake, remove ridges, and fill depressions.
 2. Install base course **OR** sand course **OR** base course and sand course, **as directed**, and sandy loam soil mix **OR** proprietary growing mix **OR** soil for paving fill, **as directed**, as recommended by paving-material manufacturer for site conditions; comply with details shown on Drawings. Compact according to paving-material manufacturer's written instructions.
 3. Install paving mat and fasten according to paving-material manufacturer's written instructions.
 4. Before planting, fill cells of paving mat with planting soil **OR** sandy loam soil mix **OR** proprietary growing mix **OR** sand half full, **as directed**, and compact according to manufacturer's written instructions.
 5. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- E. Seeding
1. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
 - a. Do not use wet seed or seed that is moldy or otherwise damaged.
 - b. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
 2. Sow seed at a total rate of 2 lb/1000 sq. ft. (0.9 kg/92.9 sq. m) **OR** 3 to 4 lb/1000 sq. ft. (1.4 to 1.8 kg/92.9 sq. m) **OR** 5 to 8 lb/1000 sq. ft. (2.3 to 3.6 kg/92.9 sq. m), **as directed**.
 3. Rake seed lightly into top 1/8 inch (3 mm) of soil, roll lightly, and water with fine spray.
 4. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets and 1:6 with erosion-control fiber mesh installed and stapled according to manufacturer's written instructions.
 5. Protect seeded areas with erosion-control mats where shown on Drawings; install and anchor according to manufacturer's written instructions.
 6. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre (42 kg/92.9 sq. m) to form a continuous blanket 1-1/2 inches (38 mm) in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.



- a. Anchor straw mulch by crimping into soil with suitable mechanical equipment.
 - b. Bond straw mulch by spraying with asphalt emulsion at a rate of 10 to 13 gal./1000 sq. ft. (38 to 49 L/92.9 sq. m). Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.
 7. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch **OR** peat mulch **OR** planting soil, **as directed**, within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch (4.8 mm), and roll surface smooth.
- F. Hydroseeding
 1. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
 - a. Mix slurry with nonasphaltic **OR** asphalt-emulsion **OR** fiber-mulch manufacturer's recommended, **as directed**, tackifier.
 - b. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre (15.6-kg/92.9 sq. m) dry weight, and seed component is deposited at not less than the specified seed-sowing rate.
OR
Apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry coat at a rate so that mulch component is deposited at not less than 500-lb/acre (5.2-kg/92.9 sq. m) dry weight, and seed component is deposited at not less than the specified seed-sowing rate. Apply slurry cover coat of fiber mulch (hydromulching) at a rate of 1000 lb/acre (10.4 kg/92.9 sq. m).
- G. Sodding
 1. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.
 2. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
 - a. Lay sod across angle of slopes exceeding 1:3.
 - b. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.
 3. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches (38 mm) below sod.
- H. Plugging
 1. Plant plugs in holes or furrows, spaced 12 inches (300 mm) **OR** 18 inches (450 mm), **as directed**, apart in both directions. On slopes, contour furrows to near level.
- I. Sprigging
 1. Plant freshly shredded sod sprigs in furrows 1 to 1-1/2 inches (25 to 38 mm) **OR** 1-1/2 to 2 inches (38 to 50 mm) **OR** 2-1/2 to 3 inches (64 to 75 mm), **as directed**, deep. Place individual sprigs with roots and portions of stem in moistened soil, 6 inches (150 mm) **OR** 12 inches (300 mm), **as directed**, apart in rows 10 inches (250 mm) **OR** 18 inches (450 mm), **as directed**, apart, and fill furrows without covering growing tips. Lightly roll and firm soil around sprigs after planting.
 2. Broadcast sprigs uniformly over prepared surface at a rate of 10 cu. ft./1000 sq. ft. (0.28 cu. m/92.9 sq. m) and mechanically force sprigs into lightly moistened soil.
 - a. Spread a 1/4-inch- (6-mm-) thick layer of compost mulch **OR** peat mulch **OR** planting soil, **as directed**, on sprigs.
 - b. Lightly roll and firm soil around sprigs after planting.



- c. Water sprigs immediately after planting and keep moist by frequent watering until well rooted.

J. Turf Renovation

1. Renovate existing turf.
2. Renovate existing turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.
 - a. Reestablish turf where settlement or washouts occur or where minor regrading is required.
 - b. Install new planting soil as required.
3. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.
4. Remove topsoil containing foreign materials such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.
5. Mow, dethatch, core aerate, and rake existing turf.
6. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.
7. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.
8. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches (150 mm).
9. Apply soil amendments and initial fertilizers required for establishing new turf and mix thoroughly into top 4 inches (100 mm) of existing soil. Install new planting soil to fill low spots and meet finish grades.
10. Apply seed and protect with straw mulch **OR** sod, **as directed**, as required for new turf.
11. Water newly planted areas and keep moist until new turf is established.

K. Turf Maintenance

1. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
 - a. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
 - b. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
 - c. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
2. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches (100 mm).
 - a. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
 - b. Water turf with fine spray at a minimum rate of 1 inch (25 mm) per week unless rainfall precipitation is adequate.
3. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
 - a. Mow bentgrass to a height of 1/2 inch (13 mm) or less.
 - b. Mow bermudagrass to a height of 1/2 to 1 inch (13 to 25 mm).
 - c. Mow carpetgrass, centipedegrass, perennial ryegrass, and zoysiagrass to a height of 1 to 2 inches (25 to 50 mm).
 - d. Mow Kentucky bluegrass, buffalograss, annual ryegrass, and chewings red fescue to a height of 1-1/2 to 2 inches (38 to 50 mm).



- e. Mow bahiagrass, turf-type tall fescue, and St. Augustinegrass to a height of 2 to 3 inches (50 to 75 mm).
 - 4. Turf Postfertilization: Apply fertilizer after initial mowing and when grass is dry.
 - a. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) to turf area.
- L. Satisfactory Turf
 - 1. Turf installations shall meet the following criteria as determined by Architect:
 - a. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. (0.92 sq. m) and bare spots not exceeding 5 by 5 inches (125 by 125 mm).
 - b. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
 - c. Satisfactory Plugged Turf: At end of maintenance period, the required number of plugs has been established as well-rooted, viable patches of grass, and areas between plugs are free of weeds and other undesirable vegetation.
 - d. Satisfactory Sprigged Turf: At end of maintenance period, the required number of sprigs has been established as well-rooted, viable plants, and areas between sprigs are free of weeds and other undesirable vegetation.
 - 2. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.
- M. Meadow
 - 1. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
 - a. Do not use wet seed or seed that is moldy or otherwise damaged.
 - 2. Sow seed at a total rate of 4 oz./1000 sq. ft. (113 g/92.9 sq. m) **OR** 5 oz./1000 sq. ft. (142 g/92.9 sq. m) **OR** 6 oz./1000 sq. ft. (170 g/92.9 sq. m), **as directed**.
 - 3. Brush seed into top 1/16 inch (1.6 mm) of soil, roll lightly, and water with fine spray.
 - 4. Protect seeded areas from hot, dry weather or drying winds by applying peat or compost mulch within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch (4.8 mm), and roll surface smooth.
 - 5. Water newly planted areas and keep moist until meadow is established.
- N. Meadow Maintenance
 - 1. Maintain and establish meadow by watering, weeding, mowing, trimming, replanting, and performing other operations as required to establish a healthy, viable meadow. Roll, regrade, and replant bare or eroded areas and remulch. Provide materials and installation the same as those used in the original installation.
 - a. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and meadow damaged or lost in areas of subsidence.
 - b. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
 - c. Apply treatments as required to keep meadow and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
 - 2. Watering: Install and maintain temporary piping, hoses, and meadow-watering equipment to convey water from sources and to keep meadow uniformly moist.
 - a. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
 - b. Water meadow with fine spray at a minimum rate of 1/2 inch (13 mm) per week for four **OR** six **OR** eight, **as directed**, weeks after planting unless rainfall precipitation is adequate.



- O. Pesticide Application
 - 1. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
 - 2. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.
- P. Cleanup And Protection
 - 1. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
 - 2. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.
 - 3. Remove nondegradable erosion-control measures after grass establishment period.

END OF SECTION 32 18 26 00



SECTION 32 31 13 00 - CSF CHAIN LINK FENCES AND GATES**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Chain Link Fences and Gates is part of the Work.

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information must be inserted at that location. Drawing Coordination Items at end of Section.32 31 13 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Chain link fence framework, fabric, and accessories.
 - 2. Excavation for post bases, concrete footings for posts, and center drop for gates.
 - 3. Chain link manual gates and related hardware.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 033000 - Cast-In-Place Concrete: Post footings.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A 90 - Tests for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
 - 2. ASTM A 116 - Specification for Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric.
 - 3. ASTM F 1184 - Specification for Industrial and Commercial Horizontal Slide Gates, Type II, Class
 - 4. ASTM A 123 - Specification for Zinc (Hot- Dip Galvanized) Coatings on Iron and Steel Products.

NOTE TO SPECIFIER

Use ASTM A 392 below if galvanized finish fabric is selected for Project.

- 5. ASTM A 392 - Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
- 6. ASTM F 567 - Standard Practice for Installation of Chain Link Fence.
- 7. ASTM A 824 - Specification for Metallic-Coated Steel Marcellled Tension Wire Use with Chain Link Fence.



8. ASTM F 1043 - Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.

NOTE TO SPECIFIER

Use ASTM 668 below if PVC COATED galvanized fabric is selected for Project.

9. ASTM F 668 - Specification for Poly (Vinyl Chloride) (PVC) Coated Steel Chain Link Fence Fabric.
 10. ASTM F 900 - Specification for Industrial and Commercial Swing Gates.
 11. ASTM F 1083 - Specification for Pipe, Steel, Hot-Dipped Zinc Coated (Galvanized) Welded, For Fence Structures.

B. Underwriter's Laboratories (UL):

1. UL325, Door, Drapery, Gate, Louver, Window Operators, and Systems.

C. Chain Link Fence Manufacturer's Institute (CLFMI):

1. CLF-PM0610 (July 2011) - Product Manual.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

1. Product Data: Submit product data for fabric, posts, accessories, fittings, and hardware.
 2. Shop Drawings: Include plan layout, grid, spacing of components, accessories, fittings, hardware, anchorage's, and schedule of components.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with CLFMI PM.

- B. Installer Qualifications:** Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site, store, and protect products under provisions of Section 016000.**

NOTE TO SPECIFIER

****REQUIRED PART (PRODUCTS) FOLLOWS. DO NOT REVISE THIS PART, EXCEPT AS NOTED BELOW, WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Use MANUFACTURERS below where specific companies are selected to meet specific Project requirements. Verify manufacturer information at time of Project Manual preparation for Project. Consult with USPS Contracting Officer for modification to manufacturer list for regional manufacturers.



2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Allied Tube & Conduit, Harvey, IL (800) 882-5543.
 2. Anchor Fence Division, Master-Halco, Incorporated, Baltimore, MD (800) 229-5615.
 3. Merchant's Metals, Houston, TX (800) 254-0080.
 4. The Tymetal Corporation, Fort Miller, NY (518) 695-9000.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

- A. Conform to CLFMI Product Manual.
- B. Steel Framing:

NOTE TO SPECIFIER

OPTION 1: Select one of the following for galvanized framing. Coordinate fabric to match.

1. Type I: ASTM F 1083 Schedule 40, standard weight galvanized steel pipe, welded construction, minimum yield strength of 25 ksi; coating conforming to ASTM F 1043 Group IA on pipe exterior and interior.
2. Type II: ASTM F 1043, cold-formed and welded galvanized steel pipe with minimum yield strength of 50 ksi ; coating conforming to ASTM F 1043 Group IC on pipe exterior and Group ID on pipe interior.
3. Type III (Roll-formed "C" sections): ASTM F 1043, cold-formed galvanized steel post cold-formed and welded galvanized steel pipe with minimum yield strength of 45 ksi ; coating conforming to ASTM F 1043 on post exterior and interior.

NOTE TO SPECIFIER

OPTION 2: Select the following for polymer coated framing. Coordinate fabric to match.

4. External, Type B, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. (0.27 kg/sq. m) of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film. Internal, Type D, consisting of 81 percent, not less than 0.3-mil- (0.0076-mm-) thick, zinc pigmented coating.

NOTE TO SPECIFIER

OPTION 1: Use ASTM A 392 below for galvanized finish fabric.

- C. Fabric: ASTM A 392; [Class 1: 1.2 ounce zinc][Class 2: 2 ounce zinc] 9 gage (0.148 inch diameter) galvanized steel wire, 2 inch diamond mesh interwoven wire, top and bottom selvages knuckled or knuckled and twist.

NOTE TO SPECIFIER

OPTION 2: Use ASTM 668 below for PVC COATED galvanized fabric. If PVC fabric finish is selected, coordinate steel framing and accessory finish to match.



- D. Fabric: ASTM F 668; 9 gage (0.148 inch diameter) polyolefin ASTM F668-2b coated galvanized steel wire, 2 inch diamond mesh interwoven wire, top and bottom selvages knuckled or knuckled and twist.

2.3 MIXES

- A. Footing Concrete: 3,000 psi Portland cement concrete.
- B. Grout: Premixed, factory packaged, non staining, non corrosive grout. Provide type formulated for exterior application.

2.4 COMPONENTS

- A. End, Corner, and Pull Posts: Minimum sizes and weights as follows:
1. Up to 6 Foot Fabric Height:
 - a. Type I Posts: 2.375 inch outside diameter pipe, 3.65 pounds per lineal foot.
 - b. Type II Posts: 2.375 inch outside diameter pipe, 3.12 pounds per lineal foot.
 2. Over 6 Foot to 13 Foot Fabric Height:
 - a. Type I Posts: 2.875 inch outside diameter pipe, 5.79 pounds per lineal foot.
 - b. Type II Posts: 2.875 inch outside diameter pipe, 4.64 pounds per lineal foot.
 3. 13 Foot and Over Fabric Height (If required):
 - a. Type I Posts: Round; 4.0 inch outside diameter pipe, 9.10 pounds per lineal foot.
 - b. Type II Posts: 4.0 inch outside diameter pipe, 6.56 pounds per lineal foot.
- B. Line (Intermediate) Posts: Minimum sizes and weights as follows:
1. Up to 6 Foot Fabric Height:
 - a. Type I Posts: Round; 1.90 inch outside diameter pipe, 2.72 pounds per lineal foot.
 - b. Type II Posts: 1.90 inch outside diameter pipe, 2.28 pounds per lineal foot.
 - c. Type III Posts: 1.875 inch x 1.625 inch, 2.26 pounds per lineal foot.

NOTE TO SPECIFIER

Fences over 6 feet in height allowed only with an approved deviation supported by a risk analysis.

2. Over 6 Foot to 8 Foot Fabric Height:
 - a. Type I Posts: Round; 2.375 inch outside diameter pipe, 3.65 pounds per lineal foot.
 - b. Type II Posts: 2.375 inch outside diameter pipe, 3.12 pounds per lineal foot.
 - c. Type III Posts: 1.875 inch x 1.625 inch, 2.26 pounds per lineal foot.
 3. Over 8 Foot Fabric Height:
 - a. Type I Posts: 2.875 inch outside diameter pipe, 5.79 pounds per lineal foot.
 - b. Type II Posts: 2.875 inch outside diameter pipe, 4.64 pounds per lineal foot.
 - c. Type III Posts: 2.25 inch x 1.7 inch, 2.64 pounds per lineal foot.
- C. Swinging Gate Posts: For leaf widths, as follows:
1. Up to 4 Feet Width:
 - a. Type I Posts: 2.875 inch outside diameter pipe, 5.79 pounds per lineal foot.
 - b. Type II Posts: 2.875 inch outside diameter pipe, 4.64 pounds per lineal foot.
 2. Between 4 Feet and 10 Feet Width:
 - a. Type I Posts: Round; 4.00 inch outside diameter pipe, 9.10 pounds per lineal foot.
 - b. Type II Posts: 4.00 inch outside diameter pipe, 6.56 pounds per lineal foot.
 3. Between 10 Feet and 15 Feet Width:



- a. Type I Posts: 6.625 inch outside diameter pipe, 8.97 pounds per lineal foot.
- D. Sliding Gate Posts:
1. All leaf widths:
 - a. Type I Posts: Round; 4.00 inch outside diameter pipe, 9.10 pounds per lineal foot.
 - b. Type II Posts: 4.00 inch outside diameter pipe, 6.56 pounds per lineal foot.
- E. Bottom Rail and Intermediate Rails: Manufacturer's longest lengths.
1. Typical:
 - a. Type I: Round; 1.66 inch outside diameter pipe, 2.27 pounds per lineal foot.
 - b. Type II: 1.66 inch outside diameter pipe 1.83 pounds per lineal foot.
 - c. Type III Posts: 1.625 inch x 1.25 inch, 1.37 pounds per lineal foot.
 2. Couplings: Expansion type, approximately 6 inches long.
 3. Attaching Devices: Means of attaching bottom rail securely to each gate, corner, pull, and end post.
- F. Swinging Gate Hardware:
1. Hinges: Size and material to suit gate size; offset to permit 180 degree gate opening. Provide 1-1/2 pair of hinges for each leaf over 6 foot 0 inch nominal height.
 2. Latch: Forked type or plunger-bar type to permit operation from both sides of gate, with padlock eye.
 3. Double Gate Hardware: In addition to the above, provide gate stops for double gates, consisting of mushroom type flush plate with anchors set in concrete to engage center drop rod or plunger bar. Configure for use of one padlock to lock both gate leaves.
 4. Sliding Gate Hardware: Provide manufacturer's standard heavy duty track, ball-bearing hanger sheaves, overhead framing and supports, guides, stays, bracing, and accessories required.
- G. Sliding Gate Hardware:
1. Provide manufacturer's standard heavy duty track, ball-bearing hanger sheaves, overhead framing and supports, guides, stays, bracing, and accessories required.
 2. For 10 feet to 30 feet opening:
 - a. Frame shall be fabricated from 6063-T6 aluminum alloy extrusion. The top member shall be 3 inch x 5 inch aluminum structural channel/tube extrusion weighing not less than 3.9 lbs/lf. The top member shall be "keyed" to interlock with the "keyed" track member. The bottom member shall be a single horizontal aluminum structural tube weighing not less than 2.0 lbs/lf or a spliced 2 inch x 5 inch aluminum structural channel weighing not less than 2.65 lbs/lf. The two horizontal sections may be spliced in the field.
 - b. SPLICING: A 1/4 inch x 5 inch x 24 inch galvanized steel splice plate shall be used to secure the two 5 inch channel bottom members together utilizing eight 3/8 inch x 1 1/2 inch plated carriage bolts with lock nuts. The top members shall be spliced together on the side opposite the track member using a 1/4 inch x 2 inch x 24 inch aluminum splice plate secured with six 1/4 inch x 1/2 inch drive rivets on one side and welded to the top member on the other side. On the track side, the track is to be overlapped 24 inch onto the opposing section, interlocked with the top member and vertically secured in place using six 1/4 inch x 1/2 inch drive rivets and horizontally secured in place using six 5/16 inch x 1 inch plated hex head cap screws. The respective splice end vertical member shall be 1 inch x 2 inch, weighing not less than 0.82 lbs/lf. The 1 inch x 2 inch members will be joined utilizing 5/16 inch x 2 3/4 inch plated hex head cap screws, quantity varying by height of gate.
 - c. The vertical members shall alternate between 2 inch x 2 inch and 1 inch x 2 inch in cross section weighing not less 1.1 lbs/lf and 0.82 lbs/lf respectively. The spacing for the vertical intermediates shall be no greater than half the height of the gate.
 - d. The gate frame shall have a separate semi-enclosed "keyed" track, extruded from 6105-T5 aluminum alloy, weighing not less than 2.9 lbs/lf. Track member to be located on only one side of the top member. When interlocked with the "keyed" top member and welded to it, it forms a composite structure with the top of the gate frame. Welds to be placed alternately along the top and side of the track at 9 inch centers and a minimum of 2 inches long.



- e. The gate frame is to be supported from the track by two swivel type, self aligning, 4-wheeled, sealed lubricant, ball-bearing truck assemblies. The bottom of the support posts shall be equipped with two pairs of 3 inch rubber guide wheels.
 - f. Diagonal "X" bracing of 3/16 inch minimum diameter stainless steel aircraft cable shall be installed to brace the gate panels and to provide a ready means of vertical alignment.
3. For 31 feet to 40 feet opening:
 - a. Frame shall be fabricated from 6063-T6 aluminum alloy extrusion. The top member shall be 3 inch x 5 inch aluminum structural channel/tube extrusion weighing not less than 3.0 lbs/lf. The top member shall be "keyed" to interlock with the "keyed" track member. The bottom member shall be a single horizontal aluminum structural tube weighing not less than 2.0 lbs/lf or a spliced 2 inch x 5 inch aluminum structural channel weighing not less than 2.65 lbs/lf. The two horizontal sections may be spliced in the field.
 - b. SPLICING: A 1/4 inch x 5 inch x 24 inch galvanized steel splice plate shall be used to secure the two 5 inch channel bottom members together utilizing eight 3/8 inch x 1 1/2 inch plated carriage bolts with lock nuts. The top members shall be spliced together on the side opposite the track member using a 1/4 inch x 2 inch x 24 inch aluminum splice plate secured with six 1/4 inch x 1/2 inch drive rivets on one side and welded to the top member on the other side. On the track side, the track is to be overlapped 24 inch onto the opposing section, interlocked with the top member and vertically secured in place using six 1/4 inch x 1/2 inch drive rivets and horizontally secured in place using six 5/16 inch x 1 inch plated hex head cap screws. The respective splice end vertical member shall be 1 inch x 2 inch, weighing not less than 0.82 lbs/lf. The 1 inch x 2 inch members will be joined utilizing 5/16 inch x 2 3/4 inch plated hex head cap screws, quantity varying by height of gate.
 - c. The vertical members at the ends of the opening portion of the frame shall be "P" shaped in cross section with a nominal base dimension of no less than 2 inch x 2 inch and weighing not less than 1.6 lbs/lf. The intermediate vertical members shall alternate between 2 inch x 2 inch and 1 inch x 2 inch in cross section weighing not less 1.1 lbs/lf and 0.82 lbs/lf respectively. The spacing for the vertical intermediates shall be no greater than half the height of the gate.
 - d. The gate frame shall have two separate semi-enclosed "keyed" track, extruded from 6105-T5 aluminum alloy, weighing not less than 2.9 lbs/lf. Track member to be located on only one side of the top member. When interlocked with the "keyed" top member and welded to it, it forms a composite structure with the top of the gate frame. Welds to be placed alternately along the top and side of the track at 9 inch centers and a minimum of 2 inches long.
 - e. The gate frame is to be supported from the track by two swivel type, self aligning, 8-wheeled, sealed lubricant, ball-bearing truck assemblies. These are to be attached to double 4 inch O.D. support posts. The bottom of the support posts shall be equipped with two pairs of 3 inch rubber guide wheels. Openings of 28 feet or less shall use 4-wheeled truck assemblies.
 - f. Diagonal "X" bracing of 3/16 inch minimum diameter stainless steel aircraft cable shall be installed to brace the gate panels and to provide a ready means of vertical alignment.
 4. For 41 feet to 65 feet opening:
 - a. Frame shall be fabricated from 6063-T6 aluminum alloy extrusion. The top and bottom members shall be "P" shaped in cross section with no less than 2 inches on a side and weighing not less than 1.6 lbs/lf. The top member shall be "keyed" to interlock with the "keyed" track member. The bottom member shall be a single horizontal aluminum structural tube weighing not less than 2.0 lbs/lf or a spliced 2 inch x 5 inch aluminum structural channel weighing not less than 2.65 lbs/lf. The two horizontal sections may be spliced in the field.
 - b. SPLICING: A 1/4 inch x 5 inch x 24 inch galvanized steel splice plate shall be used to secure the two 5 inch channel bottom members together utilizing eight 3/8 inch x 1 1/2 inch plated carriage bolts with lock nuts. The top members shall be spliced together on the side opposite the track member using a 1/4 inch x 2 inch x 24 inch aluminum splice plate



secured with six 1/4 inch x 1/2 inch drive rivets on one side and welded to the top member on the other side. On the track side, the track is to be overlapped 24 inch onto the opposing section, interlocked with the top member and vertically secured in place using six 1/4 inch x 1/2 inch drive rivets and horizontally secured in place using six 5/16 inch x 1 inch plated hex head cap screws. The respective splice end vertical member shall be 1 inch x 2 inch, weighing not less than 0.82 lbs/lf. The 1 inch x 2 inch members will be joined utilizing 5/16 inch x 2 3/4 inch plated hex head cap screws, quantity varying by height of gate.

- c. The vertical members shall alternate between 2 inch x 2 inch and 1 inch x 2 inch in cross section weighing not less 1.1 lbs/lf and 0.82 lbs/lf respectively. The spacing for the vertical members shall be no greater than the height of the gate. Intermediate vertical members shall be 1 inch x 1 inch in cross section weighing not less than 0.52 lbs/lf. And spaced at a maximum 3 feet on center. The gate shall be constructed in "box" form with the width between the frames measuring 2'-0" from outside to outside. Between these frames there shall be a continuous series of 1 inch x 1 inch diagonal and horizontal bracing with the diagonals welded at 45 degrees to the frame.
- d. The gate frame shall have a semi-enclosed "keyed" track, extruded from 6105-T5 aluminum alloy, weighing not less than 2.9 lbs/lf. Track member to be located on each side of the frame. When interlocked with the "keyed" top member and welded to it, it forms a composite structure with the top of the gate frame. Welds to be placed alternately along the top and side of the track at 9 inch centers and a minimum of 2 inches long.
- e. The gate frame is to be supported from the track by four swivel type, self aligning, 8-wheeled, sealed lubricant, ball-bearing truck assemblies. The bottom of the support posts shall be equipped with a single 3 inch rubber guide wheel.
- f. Diagonal "X" bracing of 3/16 inch minimum diameter stainless steel aircraft cable shall be installed to brace the gate panels and to provide a ready means of vertical alignment. A ground roller assembly shall be included to support the back end of the gate in the open position, as required.

2.5 ACCESSORIES

- A. Sleeves: Galvanized steel pipe with inside diameter not less than 1/2 inch greater than outside diameter of fence posts. Provide steel plate closure welded to bottom of sleeves of width and length not less than 1 inch greater than outside diameter of sleeve.
 - 1. Up to 6 Foot Fabric Height: Provide sleeve not less than 12 inches long.
 - 2. Over 6 Foot Fabric Height: Provide sleeve not less than 24 inches long.
 - 3. Fabric Installed Tight to Roof Deck (Posts Braced to Roof Structure): Provide sleeve not less than 12 inches long.
- B. Tension Wire: 7 gage steel, metallic-coated coil spring wire, in accordance with ASTM A 824, located at the top of fence fabric.
- C. Wire Ties: 11 gage galvanized steel.
- D. Post Brace Assembly: Manufacturer's standard adjustable brace at end and gate posts and at both sides of corner and pull posts, with horizontal brace located at mid-height of fabric. Use same materials as top rail for brace, and truss to line posts with 0.375 inch diameter rod and adjustable tightener.
- E. Post Tops: Galvanized steel, weather tight closure cap for tubular posts, one cap for each post. Furnish cap with openings to permit passage of top rail.
- F. Stretcher Bars: Galvanized steel, one piece lengths equal to full height of fabric; with minimum cross section of 3/16 inch x 3/4 inch. Provide one stretcher bar for each gate and end post, one for each bottom rail, and two for each corner and pull post.
- G. Stretcher Bar Bands: Manufacturer's standard.



- H. Gate Cross-Bracing: 3/8 inch diameter galvanized steel adjustable length truss rods.

2.6 FABRICATION

- A. Fabricate swing gate perimeter frames of 1.90 inch outside diameter galvanized steel pipe. Provide horizontal and vertical members to ensure proper gate operation and for attachment of fabric, hardware, and accessories. Space frame members maximum 8 feet apart.
- B. Assemble gate frames rigidly by welding or with special fittings and rivets. Use same fabric as for fence. Install fabric with stretcher bars at vertical edges. Bars may also be used at top and bottom edges. Attach stretchers to frame at not more than 15 inches on center. Install diagonal cross-bracing on gates as required to ensure frame rigidity without sag or twist.
- C. Attach hardware to provide security against removal or breakage.

2.7 FINISHES

- A. All fence posts, fabric, components, and accessories shall be galvanized.

NOTE TO SPECIFIER

Retain paragraph above or below depending on the desired finish.

- B. All fence posts, fabric, components, and accessories shall be galvanized with black-colored Polyvinyl Chloride (PVC) Coating.

NOTE TO SPECIFIER

Use GATE OPERATORS below if selected for Project and for facilities equipped with Physical Access Control System (PACS) provide requirement for coordination of conduit runs and electrical connections with PACS and Structured Wiring.

2.8 GATE OPERATORS

- A. Gate operators must conform to UL325, Standards for Safety. The operator must be tested by an independent testing laboratory such as UL or ETL and found to conform to these standards. The completed installation shall conform to applicable ASTM and UL requirements.
- B. Basis of Design: H4 Security 50VF2.
- C. All electrical work is to be done by qualified electricians and is to conform to all applicable local, state, and federal codes.
- D. General Operation
1. The operator must be designed for high-cycle applications and low maintenance. The operator shall be capable of actuating gates up to 50 feet in overall length. The gate operator must be able to operate gates up to 5,000 pounds (2300 kg) at 2.2 (66cm) feet per second.
 2. All fasteners, except structural bolts, are to be stainless steel, or other non-corrosive material.
 3. The operator is to provide wear compensating, spring-loaded, friction-feed type drive mechanism. The drive mechanism is to consist of two drive wheels that can be manually disconnected by a toggle style disconnect. This disconnect is to instantly disengage the drive wheels for manual



operation. The operator, upon returning to automatic operation by engaging the drive mechanism, shall function properly without regard to the gate's actual position.

E. Housing Construction

1. The housing cover must swing open to allow access to the internal components.
2. The housing cover must be lockable.
3. All operator cover locks are to be keyed alike.
4. The housing, chassis and cover to be galvanized for corrosion resistance per ASTM 123 M.

F. Electric Motor

1. The electric motor used in the gate operators must have a continuous-duty rating of two horsepower with a service factor of 1.15 or greater and shall be available in all voltages and phases to suit the installation requirements of the site.
2. The electric motors must have built-in overload protection and resettable with a sealed pushbutton reset.

G. Hydraulic System

1. The hydraulic system must be self-contained and contain pump, reservoir, two position control valve, hydraulic hoses, fittings and hydraulic motors.
2. All hydraulic hoses are shall have a minimum burst pressure of 12,000 pounds per square inches.
3. The hydraulic motors must be automatically locked when the control valve is in the de-energized to prevent slippage of the drive wheels.
4. The hydraulic system must be soft-start and soft-stop to minimize shock loads transmitted to the gate system including a reverse delay to maximize gate hardware life.

H. Electrical

1. Built in "warn before operate" system.
2. Anti-tailgate mode.
3. 26 programmable user relay output options.
4. Built-in power surge/lightning strike protection.
5. Control circuit: 24VDC.
6. Electrical enclosure: Oversized, metal, with hinged lid gasketed for protection from intrusion of foreign objects, and providing ample space for the addition of accessories.
7. Menu configuration, event logging and system diagnostics easily accessible with integral touchpad or a PC and free START software.
8. Limit switch shall feature a built in LED "tripped" indicator light. The limit switch must be readily accessible, adjustable, and replaceable with normal hand tools.
9. The limit switches are to provide the ability to remote monitor the gate position when in the fully closed and fully open positions.

I. Accessories

1. Through beam type photo eyes.
2. Heater with thermostat for cold damp climates.
3. Snow brushes and blades for cold snowy climates
4. Strobe or other similar visual beacon to operate simultaneously with standard gate operator "warn before operate" audible beacon.

J. Inductive vehicle loop detectors

1. Inside and outside obstruction loops are to be installed to prevent the gate from closing when vehicle traffic is present. Anti-Tailgating logic is to be applied to entrance lane gates.
2. Free exit loops are to be installed for exit lane gates.
3. Loops for gates with heavy truck traffic will have no side of the loop less than 6'.
4. Loop wire to be stranded Thhn or XLPE, crosslink poly-ethylene jacketed type acceptable for direct burial.
5. Refer to detail drawings for specific loop placement or refer to manufacturers recommendations.



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install fence in accordance with ASTM F 567 and manufacturer's published instructions.
- B. Install gates in accordance with ASTM F 900, ASTM F2200 or ASTM 1184 as applicable and to manufacturer's published instructions.
- C. Space line posts 10 feet 0 inches on center maximum, unless otherwise indicated on Drawings.
- D. Grade-set Posts:
 - 1. Drill or hand excavate.
 - 2. Excavate each post hole to 12 inch diameter, or not less than four times diameter of post.
 - 3. Excavate approximately 3 inches lower than post bottom; set post bottom not less than 36 inches below finish grade.
 - 4. Hold post in position while placing, consolidating, and finishing concrete.
- E. Sleeve-set Posts: Anchor posts in concrete by means of pipe sleeves preset and anchored into concrete. After posts have been inserted into sleeves, fill annular space between post and sleeve solid with grout, mixed and placed to manufacturer's recommendations.
- F. Rails: Run rail between post, bending smoothly for curved runs located at the bottom of the fence fabric. Provide expansion couplings as recommended by fencing manufacturer.
- G. Center Rails: Provide center rails where indicated. Install in one piece between posts and flush with post on fabric side, using offset fittings where necessary.
- H. Brace Assemblies: Install braces so posts are plumb with rod in tension.
- I. Tension Wire: Install tension wires through post cap loops before stretching fabric and tie to each post cap with not less than 6 gage galvanized wire. Fasten fabric to tension wire using 11 gage galvanized steel hog rings spaces 24 inches on center.
- J. Fabric: The fence fabric must be installed within 2 inches between finish grade and bottom selvage. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on the exterior side of the fence, and anchor to framework so fabric remains in tension after pulling force is released.
- K. Stretcher Bars: To secure end, corner, pull, and gate posts, thread through or clamp to fabric 4 inches on center and secure to posts with metal bands spaced 15 inches on center.



- L. Tie Wires:
 - 1. Use U-shaped wire conforming with diameter of pipe to which attached, clasp pipe and fabric firmly with ends twisted two full turns. Bend wire ends to minimize hazards to persons or clothing.
 - 2. Tie fabric to line posts with wire ties spaced 12 inches on center. Tie fabric to rails and braces with wire ties spaced 24 inches on center. Manufacturer's standard procedure will be accepted if of equal strength and durability.
- M. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.
- N. Gates: Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

3.3 CONSTRUCTION

- A. Site Tolerances:
 - 1. Maximum Variation from Plumb: 1/4 inch.
 - 2. Maximum Offset from True Position: 1 inch.
 - 3. Locate fencing components completely within site boundaries. Do not infringe adjacent property lines.
 - 4. Maximum Fence Distance from Ground: 1 1/2 inches.
 - 5. Maximum Gate Distance from Ground: 4 inches.

3.4 FIELD QUALITY CONTROL

- A. Test gate operator through ten full cycles and adjust for operation without binding, scraping or uneven motion. Test limit switches for proper "at rest" gate position.
- B. All anchor bolts shall be fully concealed in the finished installation.
- C. Owner, or owner's representative, shall complete "punch list" with installing contractor prior to final acceptance of the installation and submit completed warranty documentation to manufacturers where applicable.

3.5 CONTINUED SERVICE AND DOCUMENTATION

- A. Train owner's personnel on how to safely shut off electrical power, release and manually operate the gates. Additionally, demonstrate the general maintenance of the gate operator and accessories and provide one copy of "Installation and Reference" manual for the Owner's use (a second manual is available upon request). Manuals will identify parts of the equipment for future procurement. Direct maintenance personnel to HySecurity's website, specifically the technical support sections.

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END OF SECTION



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SECTION 32 31 13 00 - MPF CHAIN LINK FENCES AND GATES**

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE THIS SECTION WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Chain link fence framework, fabric, and accessories.
 - 2. Excavation for post bases, concrete footings for posts, and center drop for gates.
 - 3. Chain link manual and motorized gates and related hardware.
- B. Related Sections:
 - 1. Section 033000 - Cast-In-Place Concrete: Post footings.
 - 2. Section 281304 - Physical Access Control System
 - 3. Section 270500 - Common Work Results for Communications.
 - 4. Section 271500 - Communications Horizontal Cabling.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A 90 - Tests for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
 - 2. ASTM A 116 - Specification for Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric.
 - 3. ASTM F 1184 - Specification for Industrial and Commercial Horizontal Slide Gates, Type II, Class 2.
 - 4. ASTM A 123 - Specification for Zinc (Hot- Dip Galvanized) Coatings on Iron and Steel Products.

NOTE TO SPECIFIER

Use ASTM A 392 below if galvanized finish fabric is selected for Project.

- 5. ASTM A 392 - Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
- 6. ASTM F 567 - Standard Practice for Installation of Chain Link Fence.
- 7. ASTM A 824 - Specification for Metallic-Coated Steel Marcellled Tension Wire Use with Chain Link Fence.
- 8. ASTM F 1043 - Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.

NOTE TO SPECIFIER

Use ASTM 668 below if PVC COATED galvanized fabric is selected for Project.



9. ASTM F 668 - Specification for Poly (Vinyl Chloride) (PVC) Coated Steel Chain Link Fence Fabric.
10. ASTM F 900 - Specification for Industrial and Commercial Swing Gates.
11. ASTM F 1083 - Specification for Pipe, Steel, Hot-Dipped Zinc Coated (Galvanized) Welded, For Fence Structures.
12. ASTM F 2200 – Specification for gates to be automated.

B. Underwriter's Laboratories (UL):

1. UL325, Door, Drapery, Gate, Louver, Window Operators, and Systems.

C. Chain Link Fence Manufacturer's Institute (CLFMI):

1. CLF-PM0610 (July 2011) - Product Manual.

1.3 SUBMITTALS

A. Procedures for submittals.

1. Product Data: Submit product data for fabric, posts, accessories, fittings, and hardware.
2. Shop Drawings: Include plan layout, grid, spacing of components, accessories, fittings, hardware, anchorage's, and schedule of components.
3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate certifying that Products meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with CLFMI PM.

B. Installer Qualifications: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site, store, and protect products.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Use MANUFACTURERS below where specific companies are selected to meet specific Project requirements. Verify manufacturer information at time of Project Manual preparation for Project. Consult with USPS Contracting Officer for modification to manufacturer list for regional manufacturers.

2.1 MANUFACTURERS

A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:

1. Allied Tube & Conduit, Harvey, IL (800) 882-5543.
2. Anchor Fence Division, Master-Halco, Incorporated, Baltimore, MD (800) 229-5615.
3. Merchant's Metals, Houston, TX (800) 254-0080.
4. The Tymetal Corporation, Fort Miller, NY (518) 695-9000.
5. HySecurity, Kent, Washington, (800) 321-9947.

B. Product Requirements: Product options and substitutions. Substitutions: Permitted.



2.2 MATERIALS

- A. Conform to CLFMI Product Manual.
- B. Steel Framing:
 - 1. Type I: ASTM F 1083 Schedule 40, standard weight galvanized steel pipe, welded construction, minimum yield strength of 25 ksi; coating conforming to ASTM F 1043 Group IA on pipe exterior and interior.
 - 2. Type II: ASTM F 1043, cold-formed and welded galvanized steel pipe with minimum yield strength of 50 ksi ; coating conforming to ASTM F 1043 Group IC on pipe exterior and Group ID on pipe interior.
 - 3. Type III (Roll-formed "C" sections): ASTM F 1043, cold-formed galvanized steel post cold-formed and welded galvanized steel pipe with minimum yield strength of 45 ksi ; coating conforming to ASTM F 1043 on post exterior and interior.

NOTE TO SPECIFIER

OPTION 1: Use ASTM A 392 below for galvanized finish fabric.

- C. Fabric: ASTM A 392; [Class 1: 1.2 ounce zinc][Class 2: 2 ounce zinc] 9 gage (0.148 inch diameter) galvanized steel wire, 2 inch diamond mesh interwoven wire, top and bottom selvages knuckled or knuckled and twist.

NOTE TO SPECIFIER

OPTION 2: Use ASTM 668 below for PVC COATED galvanized fabric.

- C. Fabric: ASTM A 668-2b; 9 gage (0.148 inch diameter) polyolefin ASTM F668-2b coated galvanized steel wire, 2 inch diamond mesh interwoven wire, top and bottom selvages knuckled or knuckled and twist.

2.3 MIXES

- A. Footing Concrete: 3,000 psi Portland cement concrete.
- B. Grout: Premixed, factory-packaged, non-staining, non-corrosive grout. Provide type formulated for exterior application.

2.4 COMPONENTS

- A. End, Corner, and Pull Posts: Minimum sizes and weights as follows:
 - 1. Up to 6 Foot Fabric Height:
 - a. Type I Posts: 2.375 inch outside diameter pipe, 3.65 pounds per lineal foot.
 - b. Type II Posts: 2.375 inch outside diameter pipe, 3.12 pounds per lineal foot.
 - 2. Over 6 Foot to 13 Foot Fabric Height:
 - a. Type I Posts: 2.875 inch outside diameter pipe, 5.79 pounds per lineal foot.
 - b. Type II Posts: 2.875 inch outside diameter pipe, 4.64 pounds per lineal foot.
 - 3. 13 Foot and Over Fabric Height (If required):
 - a. Type I Posts: Round; 4.0 inch outside diameter pipe, 9.10 pounds per lineal foot.
 - b. Type II Posts: 4.0 inch outside diameter pipe, 6.56 pounds per lineal foot.
- B. Line (Intermediate) Posts: Minimum sizes and weights as follows:
 - 1. Up to 6 Foot Fabric Height:
 - a. Type I Posts: Round; 1.90 inch outside diameter pipe, 2.72 pounds per lineal foot.
 - b. Type II Posts: 1.90 inch outside diameter pipe, 2.28 pounds per lineal foot.
 - c. Type III Posts: 1.875 inch x 1.625 inch, 2.28 pounds per lineal foot.



NOTE TO SPECIFIER

Fences over 6 feet in height allowed only with an approved deviation supported by a risk analysis.

C. Swinging Gate Posts: For leaf widths, as follows:

1. Up to 4 Feet Width:
 - a. Type I Posts: 2.875 inch outside diameter pipe, 5.79 pounds per lineal foot.
 - b. Type II Posts: 2.875 inch outside diameter pipe, 4.64 pounds per lineal foot.
2. Between 4 Feet and 10 Feet Width:
 - a. Type I Posts: Round; 4.00 inch outside diameter pipe, 9.10 pounds per lineal foot.
 - b. Type II Posts: 4.00 inch outside diameter pipe, 6.56 pounds per lineal foot.
3. Between 10 Feet and 15 Feet Width:
 - a. Type I Posts: 6.625 inch outside diameter pipe, 8.97 pounds per lineal foot.

D. Sliding Gate Posts:

1. All leaf widths:
 - a. Type I Posts: Round; 4.00 inch outside diameter pipe, 9.10 pounds per lineal foot.
 - b. Type II Posts: 4.00 inch outside diameter pipe, 6.56 pounds per lineal foot.

E. Bottom Rail and Intermediate Rails: Manufacturer's longest lengths.

1. Typical:
 - a. Type I: Round; 1.66 inch outside diameter pipe, 2.27 pounds per lineal foot.
 - b. Type II: 1.66 inch outside diameter pipe 1.83 pounds per lineal foot.
 - c. Type III Posts: 1.625 inch x 1.25 inch, 1.37 pounds per lineal foot.
2. Couplings: Expansion type, approximately 6 inches long.
3. Attaching Devices: Means of attaching bottom rail securely to each gate, corner, pull, and end post.

F. Swinging Gate Hardware:

1. Hinges: Size and material to suit gate size; offset to permit 180 degree gate opening. Provide 1-1/2 pair of hinges for each leaf over 6 foot 0 inch nominal height.
2. Latch: Forked type or plunger-bar type to permit operation from both sides of gate, with padlock eye.
3. Double Gate Hardware: In addition to the above, provide gate stops for double gates, consisting of mushroom type flush plate with anchors set in concrete to engage center drop rod or plunger bar. Configure for use of one padlock to lock both gate leaves.
4. Sliding Gate Hardware: Provide manufacturer's standard heavy duty track, ball-bearing hanger sheaves, overhead framing and supports, guides, stays, bracing, and accessories required.

G. Sliding Gate Hardware:

1. Provide manufacturer's standard heavy duty track, ball-bearing hanger sheaves, overhead framing and supports, guides, stays, bracing, and accessories required. Tymetal, Fortress type gate is basis of design. Gates may not exceed 30 feet in width.
2. For 10 feet to 30 feet opening:
 - a. Frame shall be fabricated from 6063-T6 aluminum alloy extrusion. The top member shall be 3 inch x 5 inch aluminum structural channel/tube extrusion weighing not less than 3.9 lbs/lf. The top member shall be "keyed" to interlock with the "keyed" track member. The bottom member shall be a single horizontal aluminum structural tube weighing not less than 2.0 lbs/lf or a spliced 2 inch x 5 inch aluminum structural channel weighing not less than 2.65 lbs/lf. The two horizontal sections may be spliced in the field.
 - b. SPLICING: A 1/4 inch x 5 inch x 24 inch galvanized steel splice plate shall be used to secure the two 5 inch channel bottom members together utilizing eight 3/8 inch x 1 1/2 inch plated carriage bolts with lock nuts. The top members shall be spliced together on the side opposite the track member using a 1/4 inch x 2 inch x 24 inch aluminum splice plate secured with six



- 1/4 inch x 1/2 inch drive rivets on one side and welded to the top member on the other side. On the track side, the track is to be overlapped 24 inch onto the opposing section, interlocked with the top member and vertically secured in place using six 1/4 inch x 1/2 inch drive rivets and horizontally secured in place using six 5/16 inch x 1 inch plated hex head cap screws. The respective splice end vertical member shall be 1 inch x 2 inch, weighing not less than 0.82 lbs/lf. The 1 inch x 2 inch members will be joined utilizing 5/16 inch x 2 3/4 inch plated hex head cap screws, quantity varying by height of gate.
- c. The vertical members shall alternate between 2 inch x 2 inch and 1 inch x 2 inch in cross section weighing not less 1.1 lbs/lf and 0.82 lbs/lf respectively. The spacing for the vertical intermediates shall be no greater than half the height of the gate.
 - d. The gate frame shall have a separate semi-enclosed "keyed" track, extruded from 6105-T5 aluminum alloy, weighing not less than 2.9 lbs/lf. Track member to be located on only one side of the top member. When interlocked with the "keyed" top member and welded to it, it forms a composite structure with the top of the gate frame. Welds to be placed alternately along the top and side of the track at 9 inch centers and a minimum of 2 inches long.
 - e. The gate frame is to be supported from the track by two swivel type, self aligning, 4-wheeled, sealed lubricant, ball-bearing truck assemblies. The bottom of the support posts shall be equipped with two pairs of 3 inch rubber guide wheels.
 - f. Diagonal "X" bracing of 3/16 inch minimum diameter stainless steel aircraft cable shall be installed to brace the gate panels and to provide a ready means of vertical alignment.

2.5 ACCESSORIES

- A. Sleeves: Galvanized steel pipe with inside diameter not less than 1/2 inch greater than outside diameter of fence posts. Provide steel plate closure welded to bottom of sleeves of width and length not less than 1 inch greater than outside diameter of sleeve.
 - 1. Up to 6 Foot Fabric Height: Provide sleeve not less than 12 inches long.
- B. Tension Wire: 7 gage steel, metallic-coated coil spring wire, in accordance with ASTM A 824, located at the top of fence fabric.
- C. Wire Ties: 11 gage galvanized steel.
- D. Post Brace Assembly: Manufacturer's standard adjustable brace at end and gate posts and at both sides of corner and pull posts, with horizontal brace located at mid-height of fabric. Use same materials as top rail for brace, and truss to line posts with 0.375 inch diameter rod and adjustable tightener.
- E. Post Tops: Galvanized steel, weather tight closure cap for tubular posts, one cap for each post. Furnish cap with openings to permit passage of top rail.
- F. Stretcher Bars: Galvanized steel, one piece lengths equal to full height of fabric; with minimum cross section of 3/16 inch x 3/4 inch. Provide one stretcher bar for each gate and end post, one for each bottom rail, and two for each corner and pull post.
- G. Stretcher Bar Bands: Manufacturer's standard.
- H. Gate Cross-Bracing: 3/8 inch diameter galvanized steel adjustable length truss rods.

2.6 FABRICATION

- A. Fabricate swing gate perimeter frames of 1.90 inch outside diameter galvanized steel pipe. Provide horizontal and vertical members to ensure proper gate operation and for attachment of fabric, hardware, and accessories. Space frame members maximum 8 feet apart.
- B. Assemble gate frames rigidly by welding or with special fittings and rivets. Use same fabric as for fence. Install fabric with stretcher bars at vertical edges. Bars may also be used at top and bottom edges.



Attach stretchers to frame at not more than 15 inches on center. Install diagonal cross-bracing on gates as required to ensure frame rigidity without sag or twist.

- C. Attach hardware to provide security against removal or breakage.

2.7 FINISHES

- A. All fence posts, fabric, and accessories shall be galvanized.

NOTE TO SPECIFIER

Retain paragraph above or below depending on the desired finish.

- B. All fence posts, fabric, components, and accessories shall be galvanized with black-colored Polyvinyl Chloride (PVC) Coating.

2.8 GATE OPERATORS

- A. Gate operators must conform to UL325, Standards for Safety. The operator must be tested by an independent testing laboratory such as UL or ETL and found to conform to these standards. The completed installation shall conform to applicable ASTM and UL requirements.

- B. Basis of Design: HySecurity Slide Driver Unit.

- C. All electrical work is to be done by qualified electricians and is to conform to all applicable local, state, and federal codes.

- D. General Operation

1. The operator must be designed for high-cycle applications and low maintenance. The operator shall be capable of actuating gates up to 30 feet in overall length. The gate operator must be able to operate gates up to 150 per cent of weight of actual gate at 2.2feet (66 cm) per second.
2. All fasteners, except structural bolts, are to be stainless steel, or other non-corrosive material.
3. The operator is to provide wear compensating, spring-loaded, friction-feed type drive mechanism. The drive mechanism is to consist of two drive wheels that can be manually disconnected by a toggle style disconnect. This disconnect is to instantly disengage the drive wheels for manual operation. The operator, upon returning to automatic operation by engaging the drive mechanism, shall function properly without regard to the gate's actual position.

- E. Housing Construction

1. The housing cover must swing open to allow access to the internal components.
2. The housing cover must be lockable.
3. All operator cover locks are to be keyed alike.
4. The housing, chassis and cover to be galvanized for corrosion resistance per ASTM 123 M.

- F. Electric Motor

1. The electric motor used in the gate operators must have a continuous-duty rating of two horsepower with a service factor of 1.15 or greater and shall be available in all voltages and phases to suit the installation requirements of the site.
2. The electric motors must have built-in overload protection and resettable with a sealed pushbutton reset.

- G. Hydraulic System

1. The hydraulic system must be self-contained and contain pump, reservoir, two position control valve, hydraulic hoses, fittings and hydraulic motors.



2. All hydraulic hoses shall have a minimum burst pressure of 12,000 pounds per square inches.
 3. The hydraulic motors must be automatically locked when the control valve is in the de-energized to prevent slippage of the drive wheels.
 4. The hydraulic system must be soft-start and soft-stop to minimize shock loads transmitted to the gate system including a reverse delay to maximize gate hardware life.
- H. Electrical
1. Built in "warn before operate" system.
 2. Anti-tailgate mode.
 3. 26 programmable user relay output options.
 4. Built-in power surge/lightning strike protection.
 5. Control circuit: 24VDC.
 6. Electrical enclosure: Oversized, metal, with hinged lid gasketed for protection from intrusion of foreign objects, and providing ample space for the addition of accessories.
 7. Menu configuration, event logging and system diagnostics easily accessible with integral touchpad or a PC and free START software.
 8. Limit switch shall feature a built in LED "tripped" indicator light. The limit switch must readily accessible, adjustable and replaceable with normal hand tools.
 9. The limit switches are to provide the ability to remote monitor the gate position when in the fully closed and fully open positions.
- I. Accessories
1. Through beam type photo eyes.
 2. Heater with thermostat for cold damp climates.
 3. Snow brushes and blades for cold snowy climates
 4. Strobe or other similar visual beacon to operate simultaneously with standard gate operator "warn before operate" audible beacon.
- J. Inductive vehicle loop detectors
1. Inside and outside obstruction loops are to be installed to prevent the gate from closing when vehicle traffic is present. Anti-Tailgating logic is to be applied to entrance lane gates.
 2. Free exit loops are to be installed for exit lane gates.
 3. Loops for gates with heavy truck traffic will have no side of the loop less than 6'.
 4. Loop wire to be stranded Thhn or XLPE, crosslink poly-ethylene jacketed type acceptable for direct burial.
 5. Refer to detail drawings for specific loop placement or refer to manufacturers recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Execution Requirements: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install fence in accordance with ASTM F 567 and manufacturer's published instructions.



- B. Install gates in accordance with ASTM F 900, ASTM F2200 or ASTM 1184 as applicable and to manufacturer's published instructions.
 - C. Space line posts 10 feet 0 inches on center maximum, unless otherwise indicated on Drawings.
 - D. Grade-set Posts:
 - 1. Drill or hand excavate.
 - 2. Excavate each post hole to 12 inch diameter, or not less than four times diameter of post.
 - 3. Excavate approximately 3 inches lower than post bottom; set post bottom not less than 36 inches below finish grade.
 - 4. Hold post in position while placing, consolidating, and finishing concrete.
 - E. Sleeve-set Posts: Anchor posts in concrete by means of pipe sleeves preset and anchored into concrete. After posts have been inserted into sleeves, fill annular space between post and sleeve solid with grout, mixed and placed to manufacturer's recommendations.
 - F. Rails: Run rail between post, bending smoothly for curved runs located at the bottom of the fence fabric. Provide expansion couplings as recommended by fencing manufacturer.
 - G. Center Rails: Provide center rails where indicated. Install in one piece between posts and flush with post on fabric side, using offset fittings where necessary.
 - H. Brace Assemblies: Install braces so posts are plumb with rod in tension.
 - I. Tension Wire: Install tension wires through post cap loops before stretching fabric and tie to each post cap with not less than 6 gage galvanized wire. Fasten fabric to tension wire using 11 gage galvanized steel hog rings spaces 24 inches on center.
 - J. Fabric: The fence fabric must be installed within 2 inches between finish grade and bottom selvage. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on the exterior side of the fence, and anchor to framework so fabric remains in tension after pulling force is released.
 - K. Stretcher Bars: To secure end, corner, pull, and gate posts, thread through or clamp to fabric 4 inches on center and secure to posts with metal bands spaced 15 inches on center.
 - L. Tie Wires:
 - 1. Use U-shaped wire conforming with diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted two full turns. Bend wire ends to minimize hazards to persons or clothing.
 - 2. Tie fabric to line posts with wire ties spaced 12 inches on center. Tie fabric to rails and braces with wire ties spaced 24 inches on center. Manufacturer's standard procedure will be accepted if of equal strength and durability.
 - M. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.
 - N. Gates: Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.
- 3.3 CONSTRUCTION
- A. Site Tolerances:
 - 1. Maximum Variation from Plumb: 1/4 inch.
 - 2. Maximum Offset from True Position: 1 inch.
 - 3. Locate fencing components completely within site boundaries. Do not infringe adjacent property lines.



4. Maximum Fence Distance from Ground: 1 1/2 inches.
 5. Maximum Gate Distance from Ground: 4 inches.
- B. Gate Operator:
1. Coordinate conduit runs and electrical connections with Access Control Section 281304, Common Work Results for Communications Section 270500, and Communications Horizontal Cabling Section 271500.
- 3.4 FIELD QUALITY CONTROL
- A. Test gate operator through ten full cycles and adjust for operation without binding, scraping or uneven motion. Test limit switches for proper "at rest" gate position.
 - B. All anchor bolts shall be fully concealed in the finished installation.
Owner, or owner's representative, shall complete "punch list" with installing contractor prior to final acceptance of the installation and submit completed warranty documentation to manufacturers where applicable.
- 3.5 CONTINUED SERVICE AND DOCUMENTATION
- A. Train owner's personnel on how to safely shut off electrical power, release and manually operate the gates. Additionally, demonstrate the general maintenance of the gate operator and accessories and provide one copy of "Installation and Reference" manual for the Owner's use (a second manual is available upon request). Manuals will identify parts of the equipment for future procurement. Direct maintenance personnel to HySecurity's website, specifically the technical support sections.

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Task	Specification	Specification Description
32 31 13 00	01 22 16 00	No Specification Required



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SECTION 32 31 19 00 - ORNAMENTAL METAL FENCES AND GATES**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of ornamental metal fences and gates. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Decorative metallic-coated steel tubular picket fences.
 - b. Decorative metallic-coated steel wire fences.
 - c. Decorative metallic-coated steel security fences.
 - d. Decorative steel fences.
 - e. Decorative aluminum fences.
 - f. Swing gates.
 - g. Horizontal-slide gates.
 - h. Gate operators, including controls.

C. Performance Requirements

1. Lightning-Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

D. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For gates. Include plans, elevations, sections, details, and attachments to other work.
 - a. Wiring Diagrams: For power, signal, and control wiring.
3. Samples: For each fence material and for each color specified.
 - a. Provide Samples 12 inches (300 mm) in length for linear materials.
 - b. Provide Samples 12 inches (300 mm) square for wire mesh, bar grating, and sheet or plate materials.
4. Welding certificates.
5. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for decorative metallic-coated steel tubular picket fences, including finish, indicating compliance with referenced standard and other specified requirements.
6. Maintenance Data: For gate operators to include in maintenance manuals.

E. Quality Assurance

1. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel **OR** AWS D1.2/D1.2M, "Structural Welding Code - Aluminum", **as directed**.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. UL Standard: Provide gate operators that comply with UL 325.
4. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for automatic gate operators on gates that must provide emergency access.
5. Preinstallation Conference: Conduct conference at Project site.



1.2 PRODUCTS

A. Aluminum

1. Aluminum, General: Provide alloys and tempers with not less than the strength and durability properties of alloy and temper designated in paragraphs below for each aluminum form required.
2. Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
3. Tubing: ASTM B 429, Alloy 6063-T6.
4. Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.
5. Die and Hand Forgings: ASTM B 247 (ASTM B 247M), Alloy 6061-T6.
6. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

B. Steel And Iron

1. Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Bars (Pickets): Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.
3. Tubing: ASTM A 500, cold formed steel tubing.
4. Bar Grating: NAAMM MBG 531.
 - a. Bars: Hot-rolled steel strip, ASTM A 1011/A 1011M, Commercial Steel, Type B.
 - b. Wire Rods: ASTM A 510 (ASTM A 510M).
5. Uncoated Steel Sheet: Hot-rolled steel sheet, ASTM A 1011/A 1011M, Structural Steel, Grade 45 (Grade 310) or cold-rolled steel sheet, ASTM A 1008/A 1008M, Structural Steel, Grade 50 (Grade 340).
6. Galvanized-Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 50 (Grade 340), with G90 (Z275) **OR** G60 (Z180), **as directed**, coating.
7. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, structural quality, Grade 50 (Grade 340), with AZ60 (AZM180) coating.
8. Castings: Either gray or malleable iron unless otherwise indicated.
 - a. Gray Iron: ASTM A 48/A 48M, Class 30.
 - b. Malleable Iron: ASTM A 47/A 47M.

C. Coating Materials

1. Shop Primers for Steel: Provide primers that comply with Division 09 Section(s) "Exterior Painting" **OR** "High-performance Coatings", **as directed**.
2. Epoxy Zinc-Rich Primer for Steel: Complying with MPI #20 and compatible with coating specified to be applied over it.
 - a. Use primer with a VOC content of 420 g/L **OR** 400 g/L **OR** 340 g/L, **as directed**, or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Epoxy Primer for Galvanized Steel: Complying with MPI #101 and compatible with coating specified to be applied over it.
 - a. Use primer with a VOC content of 420 g/L **OR** 400 g/L **OR** 300 g/L, **as directed**, or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.
 - a. Use product with a VOC content of 420 g/L **OR** 400 g/L **OR** 250 g/L, **as directed**, or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
5. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.
 - a. Use product with a VOC content of 420 g/L **OR** 400 g/L **OR** 250 g/L, **as directed**, or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Miscellaneous Materials

1. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 - a. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for strength and compatibility in fabricated items.
2. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Division 03 Section "Miscellaneous Cast-in-place Applications) Concrete" with a minimum 28-day compressive strength of 3000 psi (20 MPa), 3-inch (75-mm) slump, and 1-inch (25-mm)



maximum aggregate size or dry, packaged, normal-weight concrete mix complying with ASTM C 387 mixed with potable water according to manufacturer's written instructions.

3. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107 and specifically recommended by manufacturer for exterior applications.

E. Grounding Materials

1. Grounding Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
 - a. Material above Finished Grade: Copper **OR** Aluminum, **as directed**.
 - b. Material on or below Finished Grade: Copper.
 - c. Bonding Jumpers: Braided copper tape, 1 inch (25 mm) wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.
2. Grounding Connectors and Grounding Rods: Comply with UL 467.
 - a. Connectors for Below-Grade Use: Exothermic-welded type.
 - b. Grounding Rods: Copper-clad steel.
 - 1) Size: 5/8 by 96 inches (16 by 2440 mm).

F. Decorative Metallic-Coated Steel Tubular Picket Fences

1. Decorative Metallic-Coated Steel Tubular Picket Fences: Comply with ASTM F 2408, for residential **OR** light industrial (commercial) **OR** industrial, **as directed**, application (class) unless otherwise indicated.
2. Metallic-Coated Steel Sheet: Galvanized-steel sheet or aluminum-zinc alloy-coated steel sheet.
3. Interior surface of tubes formed from uncoated steel sheet shall be hot-dip zinc coated same as exterior or coated with zinc-rich thermosetting coating to comply with ASTM F 2408.
4. Posts:
 - a. End and Corner Posts: Square tubes 2-1/2 by 2-1/2 inches (64 by 64 mm) **OR** 3 by 3 inches (76 by 76 mm), **as directed**, formed from 0.108-inch (2.74-mm) nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch (2.66-mm) nominal-thickness steel sheet and hot-dip galvanized after fabrication.
 - b. Swing Gate Posts:
 - 1) Square tubes 3 by 3 inches (76 by 76 mm) formed from 0.108-inch (2.74-mm) nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch (2.66-mm) nominal-thickness steel sheet and hot-dip galvanized after fabrication.
OR
Square steel tubing 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm), **as directed**, with 3/16-inch (4.76-mm) wall thickness, hot-dip galvanized.
 - c. Horizontal-Slide Gate Post, Openings up to 12 Feet (3.7 m): Square steel tubing 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm), **as directed**, with 3/16-inch (4.76-mm) wall thickness, hot-dip galvanized.
 - d. Horizontal-Slide Gate Post, Openings Wider Than 12 Feet (3.7 m): Square steel tubing 4 by 4 inches (102 by 102 mm) with 3/16-inch (4.76-mm) wall thickness, hot-dip galvanized.
 - e. Guide Posts for Class 1 Horizontal-Slide Gates:
 - 1) Square tubes 3 by 3 inches (76 by 76 mm) formed from 0.108-inch (2.74-mm) nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch (2.66-mm) nominal-thickness steel sheet and hot-dip galvanized after fabrication; installed adjacent to gate post to permit gate to slide in space between.
OR
Square steel tubing 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm), **as directed**, with 3/16-inch (4.76-mm) wall thickness, hot-dip galvanized; installed adjacent to gate post to permit gate to slide in space between.
5. Post Caps: Formed from steel sheet and hot-dip galvanized after forming **OR** UV-resistant plastic **OR** Aluminum castings **OR** Aluminum castings with round ball finials, **as directed**.
6. Rails: Square tubes **OR** Double-wall channels, **as directed**.
 - a. Size: 1-1/2 by 1-1/2 inches (38 by 38 mm) **OR** 1-3/4 by 1-3/4 inches (45 by 45 mm), **as directed**.



- b. Metal and Thickness: 0.079-inch (2.01-mm) nominal-thickness, metallic-coated steel sheet or 0.075-inch (1.90-mm) nominal-thickness, uncoated steel sheet, hot-dip galvanized after fabrication.
- 7. Pickets: Square tubes.
 - a. Terminate tops of pickets at top rail for flush top appearance **OR** Extend pickets beyond top rail as indicated and terminate with UV-resistant plastic caps **OR** Extend pickets beyond top rail as indicated and terminate with galvanized-steel caps **OR** Extend pickets beyond top rail as indicated and press flat and trim to produce spear point shape, **as directed**.
 - b. Picket Spacing: 6 inches (152.4 mm) **OR** 4 inches (101.6 mm) **OR** 1-3/4 inches (44 mm), **as directed**, clear, maximum.
- 8. Fasteners: Manufacturer's standard concealed fastening system.
- 9. Fasteners: Manufacturer's standard tamperproof, **as directed**, corrosion-resistant, color-coated fasteners matching fence components, with resilient polymer washers, **as directed**.
- 10. Galvanizing: For components indicated to be galvanized and for which galvanized coating is not specified in ASTM F 2408, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
- 11. Finish: Organic coating complying with requirements in ASTM F 2408 **OR** Powder coating, **as directed**.

G. Decorative Metallic-Coated Steel Wire Fences

- 1. Metallic-Coated Steel Wire: Welded-wire fence fabric, hot-dip galvanized after fabrication. Weight of zinc coating shall be not less than 1.0 oz./sq. ft. (305 g/sq. m).
 - a. Spacing of Vertical Wires: 1-3/4 inches (44 mm) **OR** 2 inches (51 mm) **OR** 3-1/2 inches (89 mm) **OR** 4 inches (102 mm) **OR** As indicated, **as directed**.
 - b. Vertical Wire Size: 0.187 inch (4.76 mm) **OR** 0.192 inch (4.88 mm) **OR** 0.225 inch (5.72 mm) **OR** 0.25 inch (6.35 mm) **OR** 0.262 inch (6.67 mm), **as directed**.
 - c. Spacing of Horizontal Wires: 1-3/4 inches (44 mm) **OR** 2 inches (51 mm) **OR** 4 inches (102 mm) **OR** 8 inches (203 mm) **OR** As indicated, **as directed**.
 - d. Horizontal Wire Size: 0.187 inch (4.76 mm) **OR** 0.192 inch (4.88 mm) **OR** 0.225 inch (5.72 mm) **OR** 0.25 inch (6.35 mm) **OR** 0.312 inch (7.94 mm), **as directed**.
- 2. Metallic-Coated Steel Sheet: Galvanized-steel sheet or aluminum-zinc alloy-coated steel sheet.
- 3. Interior surface of tubes formed from uncoated steel sheet shall be hot-dip zinc coated same as exterior or coated with zinc-rich thermosetting coating to comply with ASTM F 2408.
- 4. Posts:
 - a. Line Posts: Square tubes 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm) **OR** 3 by 3 inches (76 by 76 mm), **as directed**, formed from 0.064-inch (1.63-mm) **OR** 0.079-inch (2.01-mm) **OR** 0.108-inch (2.74-mm), **as directed**, nominal-thickness, metallic-coated steel sheet or formed from 0.060-inch (1.52-mm) **OR** 0.075-inch (1.90-mm) **OR** 0.105-inch (2.66-mm), **as directed**, nominal-thickness steel sheet and hot-dip galvanized after fabrication.
 - b. End and Corner Posts: Square tubes 2-1/2 by 2-1/2 inches (64 by 64 mm) **OR** 3 by 3 inches (76 by 76 mm), **as directed**, formed from 0.108-inch (2.74-mm) nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch (2.66-mm) nominal-thickness steel sheet and hot-dip galvanized after fabrication.
 - c. Swing Gate Posts:
 - 1) Square tubes 3 by 3 inches (76 by 76 mm) formed from 0.108-inch (2.74-mm) nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch (2.66-mm) nominal-thickness steel sheet and hot-dip galvanized after fabrication.
OR
Square steel tubing 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm), **as directed**, with 3/16-inch (4.76-mm) wall thickness, hot-dip galvanized.
 - d. Horizontal-Slide Gate Post, Openings up to 12 Feet (3.7 m): Square steel tubing 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm), **as directed**, with 3/16-inch (4.76-mm) wall thickness, hot-dip galvanized.



- e. Horizontal-Slide Gate Post, Openings Wider Than 12 Feet (3.7 m): Square steel tubing 4 by 4 inches (102 by 102 mm) with 3/16-inch (4.76-mm) wall thickness, hot-dip galvanized.
 - f. Guide Posts for Class 1 Horizontal-Slide Gates:
 - 1) Square tubes 3 by 3 inches (76 by 76 mm) formed from 0.108-inch (2.74-mm) nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch (2.66-mm) nominal-thickness steel sheet and hot-dip galvanized after fabrication; installed adjacent to gate post to permit gate to slide in space between.
OR
Square steel tubing 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm), **as directed**, with 3/16-inch (4.76-mm) wall thickness, hot-dip galvanized; installed adjacent to gate post to permit gate to slide in space between.
 - 5. Post Caps: Formed from steel sheet and hot-dip galvanized after forming **OR** UV-resistant plastic **OR** Aluminum castings **OR** Aluminum castings with round ball finials, **as directed**.
 - 6. Rails: Square tubes.
 - a. Size: 1-3/16 by 1-1/2 inches (30 by 38 mm) **OR** 1-3/8 by 1-1/2 inches (35 by 38 mm) **OR** 1-1/2 by 1-1/2 inches (38 by 38 mm), **as directed**.
 - b. Metal and Thickness: 0.064-inch (1.63-mm) **OR** 0.079-inch (2.01-mm), **as directed**, nominal-thickness, metallic-coated steel sheet or 0.060-inch (1.52-mm) **OR** 0.075-inch (1.90-mm), **as directed**, nominal-thickness, uncoated steel sheet, hot-dip galvanized after fabrication.
 - 7. Fasteners: Manufacturer's standard tamperproof, **as directed**, corrosion-resistant, color-coated fasteners matching fence components with resilient polymer washers or clips, **as directed**.
 - 8. Galvanizing: For components indicated to be galvanized and for which galvanized coating is not specified, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
 - 9. Finish: Organic coating complying with requirements in ASTM F 2408 **OR** Powder coating, **as directed**.
- H. Decorative Metallic-Coated Steel Security Fences
- 1. Posts: 1-3/4-by-4-inch (45-by-102-mm) double-thickness, I-shaped sections.
 - a. Metal and Thickness: 0.108-inch (2.74-mm) nominal-thickness, metallic-coated steel sheet or 0.105-inch (2.66-mm) nominal-thickness, uncoated steel sheet, hot-dip galvanized after fabrication.
 - 2. Post Caps: Aluminum castings.
 - 3. Rails: 2-by-2-1/2-inch (50-by-64-mm) pentagon-shaped box channel designed to shed water and to enclose wire rope reinforcement.
 - a. Metal and Thickness: 0.108-inch (2.74-mm) nominal-thickness, metallic-coated steel sheet or 0.105-inch (2.66-mm) nominal-thickness, uncoated steel sheet, hot-dip galvanized after fabrication.
 - b. Wire Rope Reinforcement: 3/4-inch (19-mm) zinc-coated steel wire rope.
 - 4. Pickets: 3/4-by-2-3/4-inch (19-by-70-mm) M-shaped pales.
 - a. Metal and Thickness: 0.079-inch (2.01-mm) nominal-thickness, metallic-coated steel sheet or 0.075-inch (1.90-mm) nominal-thickness, uncoated steel sheet, hot-dip galvanized after fabrication.
 - b. Extend pickets beyond top rail as indicated and terminate with rounded edge **OR** cut and split to form three points, **as directed**.
 - c. Picket Spacing: 6 inches (152.4 mm) o.c.
 - 5. Fasteners: Stainless-steel carriage bolts with tamperproof nuts.
 - 6. Galvanizing: For components indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M unless otherwise indicated. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
 - 7. Finish: Powder coating.
- I. Decorative Steel Fences
- 1. Decorative Steel Fences: Fences made from steel tubing bars, **as directed**, and shapes, hot-dip galvanized, **as directed**.



2. Posts: Square steel tubing.
 - a. Line Posts: 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm) **OR** 3 by 3 inches (76 by 76 mm), **as directed**, with 1/8-inch (3.2-mm) **OR** 3/16-inch (4.76-mm), **as directed**, wall thickness.
 - b. End and Corner Posts: 2-1/2 by 2-1/2 inches (64 by 64 mm) **OR** 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm), **as directed**, with 1/8-inch (3.2-mm) **OR** 3/16-inch (4.76-mm), **as directed**, wall thickness.
 - c. Swing Gate Posts: 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm), **as directed**, with 3/16-inch (4.76-mm) wall thickness.
 - d. Horizontal-Slide Gate Post, Openings up to 12 Feet (3.7 m): 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm), **as directed**, with 3/16-inch (4.76-mm) wall thickness.
 - e. Horizontal-Slide Gate Post, Openings Wider Than 12 Feet (3.7 m): 4 by 4 inches (102 by 102 mm) with 3/16-inch (4.76-mm) wall thickness.
 - f. Guide Posts for Class 1 Horizontal-Slide Gates: 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm), **as directed**, with 3/16-inch (4.76-mm) wall thickness; installed adjacent to gate post to permit gate to slide in space between.
3. Post Caps: Formed from steel sheet **OR** Formed from steel sheet and hot-dip galvanized after forming **OR** Aluminum castings **OR** Aluminum castings with round ball finials, **as directed**.
4. Rails:
 - a. Steel Tube Rails: Square steel tubing 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm), **as directed**, with 1/8-inch (3.2-mm) wall thickness.
 - b. Steel Channel Rails: Steel channels 2 by 1 inch (50 by 25 mm) **OR** 1-1/2 by 3/4 inch (38 by 19 mm) **OR** 1-1/2 by 1/2 inch (38 by 13 mm), **as directed**.
5. Pickets: 1/2-inch- (13-mm-) square steel bars **OR** 3/4-inch- (19-mm-) square steel bars **OR** Decorative steel bars of pattern and size indicated **OR** 5/8 inch (16 mm) square by 0.065-inch (1.65-mm) steel tubes **OR** 5/8 inch (16 mm) square by 0.083-inch (2.11-mm) steel tubes **OR** 3/4 inch (19 mm) square by 0.065-inch (1.65-mm) steel tubes **OR** 3/4 inch (19 mm) square by 0.083-inch (2.11-mm) steel tubes **OR** 1 inch (25 mm) square by 0.065-inch (1.65-mm) steel tubes **OR** 1 inch (25 mm) square by 0.083-inch (2.11-mm) steel tubes, **as directed**.
 - a. Terminate tops of pickets at top rail for flush top appearance **OR** Extend pickets beyond top rail as indicated and mill ends to pyramid shaped points **OR** Extend pickets beyond top rail as indicated and press flat and trim to produce spear point shape **OR** Extend pickets beyond top rail as indicated and cap with metal spear point finial **OR** Extend pickets beyond top rail as indicated and cap with metal tripoint finial, **as directed**.
 - b. Picket Spacing: 6 inches (152.4 mm) **OR** 4 inches (101.6 mm) **OR** 1-3/4 inches (44 mm), **as directed**, clear, maximum.
 - c. Treillage: Provide iron castings of pattern indicated between each pair of pickets.
6. Infill: Forge-welded steel bar grating.
 - a. Perimeter Bars: Steel flat bars 1 by 1/8 inch (25 by 3.2 mm).
 - b. Vertical Main Bars: Steel flat bars 1 by 1/8 inch (25 by 3.2 mm) **OR** 1-3/16 by 5/32 inch (30 by 4 mm), **as directed**.
 - c. Vertical Main Bar Spacing: 1-21/32 inches (42 mm) **OR** 1-7/8 inches (48 mm) **OR** 2-7/16 inches (62 mm), **as directed**, o.c.
 - d. Horizontal Cross Rods: 3/16-inch- (4.8-mm-) **OR** 1/4-inch- (6.4-mm-), **as directed**, diameter, steel rods.
 - e. Horizontal Cross Rod Spacing: 1-3/4 inches (45 mm) **OR** 2-19/32 inches (66 mm) **OR** 5-3/16 inches (132 mm), **as directed**, o.c.
7. Infill: Custom design as indicated on Drawings.
 - a. Bars: 1/2-inch- (12.7 -mm-) square steel bars **OR** 3/4-inch- (19-mm-) square steel bars **OR** 1/2-inch- (12.7 -mm-) diameter, round steel bars **OR** 3/4-inch- (19-mm-) diameter, round steel bars **OR** 1-by-1/8-inch (25-by-3.2-mm) steel flat bars **OR** 1-by-1/4-inch (25-by-6.4-mm) steel flat bars **OR** 1-by-1/2-inch (25-by-12.7 -mm) steel flat bars, **as directed**, unless otherwise indicated.



- b. Square Tubes: Square steel tubing 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm), **as directed**, with 1/8-inch (3.2-mm) wall thickness unless otherwise indicated.
 - c. Round Tubes: 1-inch- (25-mm-) **OR** 1-1/2-inch- (38-mm-) **OR** 2-inch- (50-mm-) **OR** 2-1/2-inch- (64-mm-), **as directed**, diameter, round steel tubing with 1/8-inch (3.2-mm) wall thickness unless otherwise indicated.
 - d. Steel Plate: 1/8 inch (3.2 mm) **OR** 3/16 inch (4.8 mm) **OR** 1/4 inch (6.4 mm), **as directed**, thick unless otherwise indicated.
 - e. Perforated Metal Sheet: Uncoated steel sheet, perforated as indicated, 0.060-inch (1.52-mm) **OR** 0.075-inch (1.90-mm) **OR** 0.105-inch (2.66-mm), **as directed**, nominal thickness.
 - 8. Fasteners: Stainless-steel carriage bolts and tamperproof, **as directed**, nuts.
 - 9. Fabrication:
 - a. Assemble fences into sections by welding pickets to rails.
 - 1) Fabricate sections with clips welded to rails for fastening to posts in field.
 - 2) Drill posts and clips for fasteners before finishing to maximum extent possible.
 - b. Fabricate bar grating infill into sections of size indicated.
 - 1) Fabricate rails with clips welded to rails for fastening to posts in field.
 - 2) Drill posts, clips, **as directed**, and bar grating for fasteners before finishing to maximum extent possible.
 - 10. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay **OR** Finish #3 - partially dressed weld with splatter removed **OR** Finish #4 - good-quality, uniform undressed weld with minimal splatter, **as directed**.
 - 11. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
 - a. Hot-dip galvanize posts and rails, **as directed**.
 - b. Hot-dip galvanize rail and picket assemblies after fabrication.
 - c. Hot-dip galvanize bar grating infill after fabrication.
 - d. Hot-dip galvanize custom-design rail and infill assemblies after fabrication.
 - 12. Finish for Bar Grating Infill: Powder coating.
 - 13. Finish for Steel Items Other than Bar Grating Infill: Primed **OR** Shop painted **OR** High-performance coating, **as directed**.
 - 14. Finish for Metallic-Coated Steel Items Other than Bar Grating Infill: High-performance coating **OR** Galvanized finish, **as directed**.
- J. Decorative Aluminum Fences
- 1. Decorative Aluminum Fences: Fences made from aluminum extrusions.
 - 2. Posts: Square extruded tubes.
 - a. Line Posts: 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm) **OR** 3 by 3 inches (76 by 76 mm), **as directed**, with 0.062-inch (1.57-mm) **OR** 0.080-inch (2.03-mm) **OR** 0.093-inch (2.36-mm) **OR** 0.100-inch (2.54-mm) **OR** 0.125-inch (3.18-mm), **as directed**, wall thickness.
 - b. End and Corner Posts: 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm) **OR** 3 by 3 inches (76 by 76 mm), **as directed**, with 0.062-inch (1.57-mm) **OR** 0.080-inch (2.03-mm) **OR** 0.093-inch (2.36-mm) **OR** 0.100-inch (2.54-mm) **OR** 0.125-inch (3.18-mm), **as directed**, wall thickness.
 - c. Swing Gate Posts: 2-1/2 by 2-1/2 inches (64 by 64 mm) **OR** 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm), **as directed**, with 0.125-inch (3.18-mm) **OR** 0.250-inch (6.35-mm), **as directed**, wall thickness.
 - d. Horizontal-Slide Gate Post, Openings up to 12 Feet (3.7 m): 2-1/2 by 2-1/2 inches (64 by 64 mm) **OR** 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm), **as directed**, with 0.125-inch (3.18-mm) **OR** 0.250-inch (6.35-mm), **as directed**, wall thickness.
 - e. Horizontal-Slide Gate Post, Openings Wider Than 12 Feet (3.7 m): 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm) **OR** 6 by 6 inches (152 by 152 mm), **as directed**, with 0.125-inch (3.18-mm) **OR** 0.250-inch (6.35-mm), **as directed**, wall thickness.



- f. Guide Posts for Class 1 Horizontal-Slide Gates: 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm) **OR** 3 by 3 inches (76 by 76 mm), **as directed**, with 0.062-inch (1.57-mm) **OR** 0.093-inch (2.36-mm) **OR** 0.125-inch (3.18-mm), **as directed**, wall thickness; installed adjacent to gate post to permit gate to slide in space between.
 3. Post Caps: Aluminum castings that cover entire top of posts **OR** project at least 1/4 inch (6 mm) beyond posts, **as directed**, with round ball finial, **as directed**.
 4. Rails: Extruded-aluminum channels, 1-1/2 by 1-1/2 inches (38 by 38 mm), with 0.100-inch- (2.54-mm-) thick sidewalls and 0.070-inch- (1.78-mm-) thick top **OR** 1 by 1-1/2 inches (25 by 38 mm), with 0.082-inch- (2.08-mm-) thick sidewalls and 0.055-inch- (1.40-mm-) thick top **OR** 1-1/4 by 1-1/4 inches (32 by 32 mm), with 0.078-inch- (1.98-mm-) thick sidewalls and 0.062-inch- (1.57-mm-) thick top **OR** 1 by 1 inch (25 by 25 mm), with 0.080-inch- (2.03-mm-) thick sidewalls and 0.055-inch- (1.40-mm-) thick top **OR** 1 by 1 inch (25 by 25 mm), with 0.078-inch- (1.98-mm-) thick sidewalls and 0.062-inch- (1.57-mm-) thick top, **as directed**.
 5. Pickets: Extruded-aluminum tubes, 1 inch (25 mm) square, with 0.062-inch (1.57-mm) wall thickness **OR** 1 inch (25 mm) square, with 0.060-inch (1.52-mm) wall thickness **OR** 3/4 inch (19 mm) square, with 0.050-inch (1.27-mm) wall thickness **OR** 1 by 5/8 inch (25 by 16 mm), with 0.050-inch (1.27-mm) wall thickness **OR** 5/8 inch (16 mm) square, with 0.050-inch (1.27-mm) wall thickness, **as directed**.
 - a. Terminate tops of pickets at top rail for flush top appearance **OR** Extend pickets beyond top rail as indicated and terminate with UV-resistant plastic caps **OR** Extend pickets beyond top rail as indicated and terminate with cast-aluminum caps **OR** Extend pickets beyond top rail as indicated and press flat and trim to produce spear point shape **OR** Extend pickets beyond top rail as indicated and terminate with cast-aluminum spear point finial **OR** Extend pickets beyond top rail as indicated and terminate with cast-aluminum tripoint finial, **as directed**.
 - b. Picket Spacing: 6 inches (152.4 mm) **OR** 4 inches (101.6 mm) **OR** 1-3/4 inches (44 mm), **as directed**, clear, maximum.
 6. Fasteners:
 - a. Manufacturer's standard concealed fastening system.
OR
Manufacturer's standard tamperproof, **as directed**, corrosion-resistant, color-coated fasteners matching fence components with resilient polymer washers, **as directed**.
 7. Fabrication: Assemble fences into sections by welding **OR** fastening, **as directed**, pickets to rails.
 - a. Fabricate sections with clips welded to rails for fastening to posts in field.
 - b. Drill clips for fasteners before finishing.
 8. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay **OR** Finish #3 - partially dressed weld with splatter removed **OR** Finish #4 - good-quality, uniform undressed weld with minimal splatter, **as directed**.
 9. Finish: Baked enamel or powder coating.
- K. Swing Gates
1. Gate Configuration: Single leaf **OR** Double leaf, **unless directed otherwise**.
 2. Gate Frame Height: 72 inches (1830 mm), **unless directed otherwise**.
 3. Gate Opening Width: 36 inches (914 mm), **unless directed otherwise**.
 4. Galvanized-Steel Frames and Bracing: Fabricate members from square tubes 1-1/2 by 1-1/2 inches (38 by 38 mm) **OR** 1-3/4 by 1-3/4 inches (45 by 45 mm) **OR** 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm), **as directed**, formed from 0.108-inch (2.74-mm) nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch (2.66-mm) nominal-thickness steel sheet and hot-dip galvanized after fabrication.
 5. Steel Frames and Bracing: Fabricate members from square steel tubing 1-1/2 by 1-1/2 inches (38 by 38 mm) **OR** 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm), **as directed**, with 1/8-inch (3.2-mm) wall thickness. Hot-dip galvanize frames after fabrication, **as directed**.



6. Aluminum Frames and Bracing: Fabricate members from square extruded-aluminum tubes 1-1/2 by 1-1/2 inches (38 by 38 mm) **OR** 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm), **as directed**, with 0.100-inch (2.54-mm) **OR** 0.125-inch (3.18-mm) **OR** 0.140-inch (3.56-mm) **OR** 0.154-inch (3.91-mm), **as directed**, wall thickness.
7. Frame Corner Construction: Welded or assembled with corner fittings and 5/16-inch- (7.9-mm-) diameter, adjustable truss rods for panels 5 feet (1.52 m) wide or wider.
8. Additional Rails: Provide as indicated, complying with requirements for fence rails.
9. Infill: Comply with requirements for adjacent fence.
10. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.
 - a. Treillage: Provide iron castings of pattern indicated between each pair of pickets. Finish as specified for adjacent fence **OR** gates, **as directed**.
11. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf more than 5 feet (1.52 m) wide. Provide center gate stops and cane bolts for pairs of gates. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate, **as directed**.
12. Spring Hinges: BHMA A156.17, Grade 1, suitable for exterior use.
 - a. Function: 320 - Gate spring pivot hinge. Adjustable tension **OR** 321 - Gate spring pivot hinge. Fixed tension, **as directed**.
 - b. Material: Malleable iron.
13. Hinges: BHMA A156.1, Grade 1, suitable for exterior use.
 - a. Function: 39 - Full surface, triple weight, antifriction bearing.
 - b. Material: Wrought steel, forged steel, cast steel, or malleable iron.
14. Rim Locks: BHMA A156.5, Grade 1, suitable for exterior use.
 - a. Function: 621 - Latchbolt by key from outside and by turn from inside. Latchbolt is held retracted by device from inside **OR** 622 - Deadbolt by key from outside and by turn from inside **OR** 629 - Deadlocking latchbolt by key from outside and by turn from inside **OR** 626 - Interlocking deadbolt operated by key from either side **OR** 627 - Interlocking deadbolt operated by key from outside and by turn from inside, **as directed**.
 - b. Material: Cast, forged, or extruded brass or bronze.
 - c. Mounting Plate: Configuration necessary for mounting locks. Fabricate from 1/8-inch- (3.2-mm-) thick, steel **OR** aluminum, **as directed**, plate.
15. Mortise Locks: BHMA A156.13, Grade 1, suitable for exterior use.
 - a. Function: F06 - Holdback lock **OR** F07 - Storeroom or closet lock **OR** F09 - Apartment, exit, or public toilet lock **OR** F16 - Double-cylinder dead lock **OR** F17 - Dead lock, **as directed**.
 - b. Material: Brass or bronze.
 - c. Levers: Cast, forged, or extruded brass or bronze.
 - d. Mounting Box: Configuration necessary to enclose locks. Fabricate from 1/8-inch- (3.2-mm-) thick, steel **OR** aluminum, **as directed**, plate.
16. Electric Strikes: BHMA A156.31, Grade 1, of configuration required for use with lock specified, fail safe **OR** fail secure, **as directed**, and suitable for exterior use.
 - a. Mounting Plate: Configuration necessary for mounting electric strikes. Fabricate from 1/8-inch- (3.2-mm-) thick, steel **OR** aluminum, **as directed**, plate.
 - b. Mounting: Mortise into post.
17. Exit Hardware: BHMA A156.3, Grade 1, Type 1 (rim exit device), with push pad actuating bar, suitable for exterior use.
 - a. Function: 01 - Exit only, no trim or blank escutcheon **OR** 04 - Entrance by trim when latch bolt is released by key or set in a retracted position by key **OR** 08 - Entrance by lever. Key locks or unlocks lever **OR** 09 - Entrance by lever only when released by key. Key removable only when locked, **as directed**.
 - b. Mounting Channel: Bent-plate channel formed from 1/8-inch- (3.2-mm-) thick, steel **OR** aluminum, **as directed**, plate. Channel spans gate frame. Exit device is mounted on channel web, recessed between flanges, with flanges extending 1/8 inch (3.2 mm) beyond push pad surface.
18. Cane Bolts: Provide for inactive leaf of pairs of gates. Fabricated from 1/2-inch- (12.7 -mm-) **OR** 3/4-inch- (19-mm-), **as directed**, diameter, round steel bars, hot-dip galvanized after fabrication.



Finish to match gates. Provide galvanized-steel pipe strikes to receive cane bolts in closed position **OR** both open and closed positions, **as directed**.

19. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay **OR** Finish #3 - partially dressed weld with splatter removed **OR** Finish #4 - good-quality, uniform undressed weld with minimal splatter, **as directed**.
20. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M unless otherwise indicated. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
21. Metallic-Coated Steel Finish: High-performance coating **OR** Galvanized finish, **as directed**.
22. Steel Finish: Primed **OR** Shop painted **OR** High-performance coating, **as directed**.
23. Aluminum Finish: Baked enamel or powder coating.

L. Horizontal-Slide Gates

1. Gate Configuration: Single leaf **OR** Double leaf **OR** As indicated, **as directed**.
 - a. Type:
 - 1) Overhead slide.
OR
Cantilever slide, with external **OR** internal, **as directed**, roller assemblies.
2. Gate Frame Height: 72 inches (1830 mm), **unless directed otherwise**.
3. Gate Opening Width: 36 inches (914 mm), **unless directed otherwise**.
4. Galvanized-Steel Frames and Bracing: Fabricate members from square tubing.
 - a. Frame Members: Square tubes 1-1/2 by 1-1/2 inches (38 by 38 mm) **OR** 1-3/4 by 1-3/4 inches (45 by 45 mm) **OR** 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm), **as directed**, formed from 0.108-inch (2.74-mm) nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch (2.66-mm) nominal-thickness steel sheet and hot-dip galvanized after fabrication.
 - b. Bracing Members: Square tubes 1-1/2 by 1-1/2 inches (38 by 38 mm) **OR** 1-3/4 by 1-3/4 inches (45 by 45 mm) **OR** 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm), **as directed**, formed from 0.108-inch (2.74-mm) nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch (2.66-mm) nominal-thickness steel sheet and hot-dip galvanized after fabrication.
5. Steel Frames and Bracing: Fabricate members from square tubing. Hot-dip galvanize frames after fabrication, **as directed**.
 - a. Frame Members: Steel tubing 1-1/2 by 1-1/2 inches (38 by 38 mm) **OR** 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm), **as directed**, with 1/8-inch (3.2-mm) wall thickness.
 - b. Bracing Members: Steel tubing 1-1/2 by 1-1/2 inches (38 by 38 mm) **OR** 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm), **as directed**, with 1/8-inch (3.2-mm) wall thickness.
6. Aluminum Frames and Bracing: Fabricate members from square tubing.
 - a. Frame Members: Extruded-aluminum tubes 1-1/2 by 1-1/2 inches (38 by 38 mm) **OR** 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm), **as directed**, with 0.100-inch (2.54-mm) **OR** 0.125-inch (3.18-mm) **OR** 0.140-inch (3.56-mm) **OR** 0.154-inch (3.91-mm), **as directed**, wall thickness.
 - b. Bracing Members: Extruded-aluminum tubes 1-1/2 by 1-1/2 inches (38 by 38 mm) **OR** 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm), **as directed**, with 0.100-inch (2.54-mm) **OR** 0.125-inch (3.18-mm) **OR** 0.140-inch (3.56-mm) **OR** 0.154-inch (3.91-mm), **as directed**, wall thickness.
7. Frame Corner Construction:
 - a. Welded frame with panels assembled with bolted or riveted corner fittings and 5/16-inch- (7.9-mm-) diameter, adjustable truss rods for panels 5 feet (1.52 m) wide or wider.
 - b. Overhead Slide Gates: Welded or assembled with corner fittings including 5/16-inch- (7.9-mm-) diameter, adjustable truss rods for panels 5 feet (1.52 m) wide or wider.
8. Additional Rails: Provide as indicated, complying with requirements for fence rails.
9. Infill: Comply with requirements for adjacent fence.



10. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.
 - a. Treillage: Provide iron castings of pattern indicated between each pair of pickets. Finish as specified for adjacent fence **OR** gates, **as directed**.
11. Overhead Track Assembly: Manufacturer's standard track, with overhead framing supports, bracing, and accessories, engineered to support size, weight, width, operation, and design of gate and roller assemblies.
12. Hardware: Latches permitting operation from both sides of gate, locking devices, hangers, roller assemblies, and stops fabricated from galvanized steel **OR** galvanized malleable iron **OR** mill-finished, Grade 319 aluminum-alloy casting with stainless-steel fasteners, **as directed**. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate, **as directed**.
13. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay **OR** Finish #3 - partially dressed weld with splatter removed **OR** Finish #4 - good-quality, uniform undressed weld with minimal splatter, **as directed**.
14. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M unless otherwise indicated. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
15. Metallic-Coated Steel Finish: High-performance coating **OR** Galvanized finish, **as directed**.
16. Steel Finish: Primed **OR** Shop painted **OR** High-performance coating, **as directed**.
17. Aluminum Finish: Baked enamel or powder coating.

M. Gate Operators

1. General: Provide factory-assembled automatic operating system designed for gate size, type, weight, and operation frequency. Provide operation control system with characteristics suitable for Project conditions, with remote-control stations, safety devices, and weatherproof enclosures; coordinate electrical requirements with building electrical system.
 - a. Provide operator designed so motor may be removed without disturbing limit-switch adjustment and without affecting auxiliary emergency operator.
 - b. Provide operator with UL approval **OR** UL-approved components, **as directed**.
 - c. Provide electronic components with built-in troubleshooting diagnostic feature.
 - d. Provide unit designed and wired for both right-hand/left-hand opening, permitting universal installation.
 - e. Provide controllers, electrical devices, and wiring that comply with requirements specified in Division 22.
2. Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 11 Section "Common Motor Requirements For Equipment".
 - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Horsepower: Not less than 1/4 **OR** 1/3 **OR** 1/2 **OR** 3/4, **as directed**.
 - c. Enclosure: Open dripproof **OR** Totally enclosed **OR** Manufacturer's standard, **as directed**.
 - d. Duty: Continuous duty at ambient temperature of 105 deg F (40 deg C) and at altitude of 3300 feet (1005 m) above sea level.
 - e. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
 - f. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 22.
3. Gate Operators: Gate **OR** Concrete base **OR** Post **OR** In-ground, **as directed**, mounted and as follows:
 - a. Hydraulic Swing **OR** Slide, **as directed**, Gate Operators:
 - 1) Duty: Light **OR** Medium **OR** Heavy, **as directed**, duty, residential **OR** commercial/industrial, **as directed**.
 - 2) Gate Speed: Minimum 45 feet (13.7 m) **OR** 60 feet (18.2 m), **as directed**, per minute.
 - 3) Maximum Gate Weight: Not to exceed operator manufacturer's recommendations.
 - 4) Frequency of Use: 10 cycles per hour **OR** 25 cycles per hour **OR** Continuous duty, **as directed**.



- 5) Locking: Hydraulic in both directions.
- 6) Heater: Manufacturer's standard track and roller heater with thermostatic control, as directed.
- 7) Operating Type: Crank arm **OR** Wheel and rail drive **OR** Roller chain, **as directed**, with manual release, **as directed**.
- b. Mechanical Swing **OR** Slide, **as directed**, Gate Operators:
 - 1) Duty: Light **OR** Medium **OR** Heavy, **as directed**, duty, residential **OR** commercial/industrial, **as directed**.
 - 2) Gate Speed: Minimum 45 feet (13.7 m) per minute **OR** 60 feet (18.2 m) per minute **OR** variable speed, **as directed**.
 - 3) Maximum Gate Weight: 600 lb (272 kg) **OR** 800 lb (363 kg), **as directed**.
 - 4) Frequency of Use: 10 cycles per hour **OR** 25 cycles per hour **OR** 60 cycles per hour **OR** Continuous duty, **as directed**.
 - 5) Operating Type: Crank arm **OR** Wheel and rail drive **OR** Roller chain, **as directed**, with manual release, **as directed**.
 - 6) Drive Type:
 - a) Enclosed worm gear and chain-and-sprocket, **as directed**, reducers, roller-chain drive.
OR
V-belt and worm gear **OR** chain-and-sprocket, **as directed**, reducers, roller-chain drive.
4. Remote Controls: Electric controls separated from gate and motor and drive mechanism, with NEMA ICS 6, Type 1 **OR** NEMA ICS 6, Type 4, **as directed**, enclosure for surface **OR** recessed or flush, **as directed**, concrete base **OR** pedestal, **as directed**, mounting, and with space for additional optional equipment. Provide the following remote-control device(s):
 - a. Control Station:
 - 1) Keyed, two-position **OR** three-position, **as directed**, switch with open, stop, **as directed**, and close function; located remotely from gate. Provide two keys per station.
OR
Momentary-contact, single-button-operated **OR** three-button-operated, **as directed**, with open, stop, **as directed**, and close function; located remotely from gate. Key switch to lock out open and close buttons, **as directed**.
 - b. Card Reader: Functions only when authorized card is presented. Programmable, multiple-code **OR** single-code, **as directed**, system, permitting four different access time periods, **as directed**, face-lighted unit fully visible at night, **as directed**.
 - 1) Reader Type: Touch plate **OR** Swipe **OR** Insertion **OR** Proximity, **as directed**.
 - 2) Features: Timed antipassback **OR** Limited-time usage **OR** Capable of monitoring and auditing gate activity, **as directed**.
 - c. Digital Keypad Entry Unit: Multiple-programmable **OR** Multiple-code, **as directed**, capability of not less than 5 **OR** 500 **OR** 2500, **as directed**, possible individual codes, consisting of 1- to 7 **OR** 4 **OR** 5, **as directed**, -digit codes, and permitting 4 different access time periods, **as directed**.
 - 1) Features: Timed antipassback **OR** Limited-time usage **OR** Capable of monitoring and auditing gate activity, **as directed**.
 - 2) Face-lighted unit with metal-keyed **OR** keyless-membrane, **as directed**, keypad fully visible at night.
 - d. Radio Control: Digital system consisting of code-compatible universal receiver for each gate, located where indicated, with remote antenna with coaxial cable and mounting brackets designed to operate gates. Provide 1 **OR** 2, **as directed**, programmable transmitter(s) with multiple-code capability permitting validating or voiding of not less than 1000 **OR** 10,000, **as directed**, codes per channel configured for the following functions:
 - 1) Transmitters: Single **OR** Three, **as directed**, -button operated, with open and close, **as directed**, function.



- 2) Channel Settings: Two **OR** Three **OR** Four, **as directed**, independent channel settings controlling separate receivers for operating more than one gate from each transmitter.
- e. Telephone Entry System: Hands-free, voice-communication system for connection to building telephone system with digital-entry code activation of gate operator and auxiliary keypad entry, **as directed**.
 - 1) Residential System: Designed to be wired to same line with telephone.
 - 2) Multiunit System: Designed to be wired to a dedicated telephone line, with capacity to access 20 **OR** 100, **as directed**, telephones, and with electronic directory, **as directed**.
- f. Vehicle Loop Detector: System including automatic closing timer with adjustable time delay before closing, timer cutoff switch, **as directed**, and loop detector designed to open and close gate **OR** hold gate open until traffic clears **OR** reverse gate, **as directed**. Provide electronic detector with adjustable detection patterns, adjustable sensitivity and frequency settings, and panel indicator light designed to detect presence or transit of a vehicle over an embedded loop of wire and to emit a signal activating the gate operator. Provide number of loops consisting of multiple strands of wire, number of turns, loop size, and method of placement at location shown on Drawings, as recommended in writing by detection system manufacturer for function indicated.
 - 1) Loop:
 - a) Wire, in size indicated for field assembly, for pave-over **OR** saw cut with epoxy-grouted, **as directed**, installation.
OR
Loop: Factory preformed in size indicated; style for pave-over **OR** saw cut with epoxy-grouted, **as directed**, installation.
- g. Vehicle Presence Detector: System including automatic closing timer with adjustable time delay before closing, timer cutoff switch, **as directed**, and presence detector designed to open and close gate **OR** hold gate open until traffic clears **OR** reverse gate, **as directed**. Provide retroreflective **OR** emitter/receiver, **as directed**, detector with adjustable detection zone pattern and sensitivity, designed to detect the presence or transit of a vehicle in gate pathway when infrared beam in zone pattern is interrupted, and to emit a signal activating the gate operator.
5. Obstruction Detection Devices: Provide each motorized gate with automatic safety sensor(s). Activation of sensor(s) causes operator to immediately function as follows:
 - a. Action:
 - 1) Reverse gate in both opening and closing cycles and hold until clear of obstruction.
OR
Stop gate in opening cycle and reverse gate in closing cycle and hold until clear of obstruction.
 - b. Internal Sensor: Built-in torque or current monitor senses gate is obstructed.
 - c. Sensor Edge: Contact-pressure-sensitive safety edge, profile, and sensitivity designed for type of gate and component indicated, in locations as follows. Connect to control circuit using take-up cable reel **OR** self-coiling cable **OR** gate edge transmitter and operator receiver system, **as directed**.
 - 1) Along entire gate leaf leading edge **OR** Along entire gate leaf trailing edge **OR** Across entire gate leaf bottom edge **OR** Along entire length of gate posts **OR** Along entire length of gate guide posts **OR** Where indicated on Drawings, **as directed**.
 - d. Photoelectric/Infrared Sensor System: Designed to detect an obstruction in gate's path when infrared beam in the zone pattern is interrupted.
6. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop gate at fully retracted and fully extended positions.
7. Emergency Release Mechanism: Quick-disconnect release of operator drive system of the following type of mechanism, permitting manual operation if operator fails. Design system so control-circuit power is disconnected during manual operation.
 - a. Type:



- 1) Integral fail-safe release, allowing gate to be pushed open without mechanical devices, keys, cranks, or special knowledge.
OR
Mechanical device, key, or crank-activated release.
8. Operating Features:
 - a. Digital Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features with capability for monitoring and auditing gate activity, **as directed**. Provide unit that is isolated from voltage spikes and surges.
 - b. System Integration: With controlling circuit board capable of accepting any type of input from external devices.
 - c. Master/Slave Capability: Control stations designed and wired for gate pair operation.
 - d. Automatic Closing Timer: With adjustable time delay before closing and timer cutoff switch, **as directed**.
 - e. Open Override Circuit: Designed to override closing commands.
 - f. Reversal Time Delay: Designed to protect gate system from shock load on reversal in both directions.
 - g. Maximum Run Timer: Designed to prevent damage to gate system by shutting down system if normal time to open gate is exceeded.
 - h. Clock Timer: 24-hour **OR** Seven-day, **as directed**, programmable for regular events.
9. Accessories:
 - a. Warning Module: Audio **OR** Visual, **as directed**, ADA/ABA-compliant, constant-light **OR** strobe-light, **as directed**, alarm sounding three to five seconds in advance of gate operation and continuing until gate stops moving.
 - b. Battery Backup System: Battery-powered drive and access-control system, independent of primary drive system:
 - 1) Fail Safe: Gate opens and remains open until power is restored.
 - 2) Fail Secure: Gate cycles on battery power, then fail safe when battery is discharged.
 - c. External electric-powered solenoid **OR** magnetic, **as directed**, lock with delay timer allowing time for lock to release before gate operates.
 - d. Fire **OR** Postal, **as directed**, box.
 - e. Fire strobe **OR** siren, **as directed**, alarm.
 - f. Intercom System: as directed by the Owner.
 - g. Instructional, Safety, and Warning Labels and Signs: According to UL 325 **OR** Manufacturer's standard for components and features specified **OR** As indicated on Drawings, **as directed**.
- N. Aluminum Finishes
 1. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 2 mils (0.05 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - a. Color and Gloss: As selected from manufacturer's full range.
- O. Steel Finishes
 1. Surface Preparation: Clean surfaces according to SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning", **as directed**.
 - a. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
 2. Powder Coating: Immediately after cleaning, apply 2-coat finish consisting of epoxy primer and TGIC polyester topcoat, with a minimum total dry film thickness of not less than 8 mils (0.20 mm). Comply with coating manufacturer's written instructions.
 - a. Color and Gloss: As selected from manufacturer's full range.
 3. Primer Application: Apply zinc-rich epoxy primer immediately after cleaning, to provide a minimum dry film thickness of 2 mils (0.05 mm) per applied coat, to surfaces that will be exposed after assembly and installation, and to concealed surfaces.



4. Shop-Painted Finish: Comply with Division 09 Section(s) "Exterior Painting" OR "High-performance Coatings", **as directed**.
5. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.
 - a. Match approved Samples for color, texture, and coverage. Remove and refinish, or recoat work that does not comply with specified requirements.

P. Metallic-Coated Steel Finishes

1. Galvanized Finish: Clean welds, mechanical connections, and abraded areas and repair galvanizing to comply with ASTM A 780.
2. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a zinc-phosphate, **as directed**, conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and repair galvanizing to comply with ASTM A 780.
3. Powder Coating: Immediately after cleaning and pretreating, apply TGIC polyester powder-coat finish, with a minimum dry film thickness of 2 mils (0.05 mm).
 - a. Color and Gloss: As selected from manufacturer's full range.
4. Powder Coating: Immediately after cleaning and pretreating, apply 2-coat finish consisting of zinc-rich, **as directed**, epoxy prime coat and TGIC polyester topcoat, with a minimum dry film thickness of 2 mils (0.05 mm) for topcoat. Comply with coating manufacturer's written instructions to achieve a minimum total dry film thickness of 4 mils (0.10 mm).
 - a. Color and Gloss: As selected from manufacturer's full range.
 - b. Comply with surface finish testing requirements in ASTM F 2408 except change corrosion-resistance requirement to 3000 hours without failure, **as directed**.
5. High-Performance Coating: Apply epoxy primer, epoxy intermediate coat, and polyurethane topcoat to prepared surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.
 - a. Match approved Samples for color, texture, and coverage. Remove and refinish, or recoat work that does not comply with specified requirements.

1.3 EXECUTION

A. Examination

1. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.
2. Do not begin installation before final grading is completed unless otherwise permitted by the Owner.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

1. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152.5 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

C. Decorative Fence Installation

1. Install fences according to manufacturer's written instructions.
OR
Install fences by setting posts as indicated and fastening rails and infill panels to posts. Peen threads of bolts after assembly to prevent removal, **as directed**.



2. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches (600 mm) plus 3 inches (75 mm) for each foot (300 mm) or fraction of a foot (300 mm) that fence height exceeds 4 feet (1200 mm).
3. Post Setting: Set posts in concrete **OR** with mechanical anchors **OR** by mechanically driving into soil, **as directed**, at indicated spacing into firm, undisturbed soil.
 - a. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 - b. Concrete Fill: Place concrete around posts and sleeves, **as directed**, and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - 1) Exposed Concrete: Extend 2 inches (50 mm) above grade. Finish and slope top surface to drain water away from post.
 - 2) Concealed Concrete: Top 2 inches (50 mm) below grade as indicated on Drawings to allow covering with surface material. Slope top surface of concrete to drain water away from post.
 - c. Posts Set in Concrete: Extend post to within 6 inches (150 mm) of specified excavation depth, but not closer than 3 inches (75 mm) to bottom of concrete.
 - d. Posts Set into Concrete in Sleeves: Use galvanized-steel pipe sleeves with inside diameter at least 3/4 inch (20 mm) larger than outside diagonal dimension of post, preset and anchored into concrete for installing posts.
 - 1) Extend posts at least 5 inches (125 mm) into sleeve.
 - 2) After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions; shape and smooth to shed water. Finish and slope top surface of grout to drain water away from post.
 - e. Posts Set into Voids in Concrete: Form or core drill holes not less than 3/4 inch (20 mm) larger than outside diagonal dimension of post.
 - 1) Extend posts at least 5 inches (125 mm) into concrete.
 - 2) Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions. Finish and slope top surface of grout to drain water away from post.
 - f. Mechanically Driven Posts: Drive into soil to depth of 30 inches (762 mm) **OR** 36 inches (914 mm), **as directed**. Protect post top to prevent distortion.
 - g. Space posts uniformly at 6 feet (1.83 m) **OR** 8 feet (2.44 m), **as directed**, o.c.

D. Gate Installation

1. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

E. Gate Operator Installation

1. General: Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.
2. Excavation for Support Posts **OR** Pedestals **OR** Concrete Bases, **as directed**: Hand-excavate holes for bases, in firm, undisturbed soil to dimensions and depths and at locations as required by gate operator component manufacturer's written instructions and as indicated.
3. Concrete Bases: Cast-in-place or precast concrete, depth not less than 12 inches (300 mm) **OR** 6 to 12 inches (150 to 300 mm) below frost line, **as directed**, dimensioned and reinforced according to gate operator component manufacturer's written instructions and as indicated on Drawings.
4. Vehicle Loop Detector System: Cut grooves in pavement, **as directed**, and bury and seal wire loop according to manufacturer's written instructions. Connect to equipment operated by detector.



5. Comply with NFPA 70 and manufacturer's written instructions for grounding of electric-powered motors, controls, and other devices.
- F. Grounding And Bonding
1. Fence Grounding: Install at maximum intervals of 1500 feet (450 m) except as follows:
 - a. Fences within 100 Feet (30 m) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet (225 m).
 - 1) Gates and Other Fence Openings: Ground fence on each side of opening.
 - a) Bond metal gates to gate posts.
 - b) Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches (460 mm) below finished grade.
 2. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet (45 m) on each side of crossing.
 3. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.
 4. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches (150 mm) below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location.
 5. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.
 6. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - a. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
 - b. Make connections with clean, bare metal at points of contact.
 - c. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 - d. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
 - e. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
 7. Bonding to Lightning-Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.
- G. Field Quality Control
1. Grounding-Resistance Testing: Engage a qualified testing agency to perform tests and inspections.
 - a. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
 - b. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify the Owner promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
 - c. Report: Prepare test reports certified by a testing agency of grounding resistance at each test location. Include observations of weather and other phenomena that may affect test results.
- H. Adjusting
1. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire



operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

2. Automatic Gate Operators: Energize circuits to electrical equipment and devices. Adjust operators, controls, safety devices, alarms, **as directed**, and limit switches.
 - a. Hydraulic Operators: Purge Operating System, Adjust Pressure And Fluid Levels, And Check For Leaks.
 - b. Operational Test: After Electrical Circuitry Has Been Energized, Start Units To Confirm Proper Motor Rotation And Unit Operation.
 - c. Test And Adjust Controls, Alarms, **as directed**, And Safeties. Replace Damaged And Malfunctioning Controls And Equipment.
 3. Lubricate hardware, gate operators, **as directed**, and other moving parts.
- I. Demonstration
1. Train Owner's personnel to adjust, operate, and maintain gates.

END OF SECTION 32 31 19 00



Task	Specification	Specification Description
32 31 19 00	01 22 16 00	No Specification Required
32 31 23 00	01 22 16 00	No Specification Required
32 31 29 00	01 22 16 00	No Specification Required



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SECTION 32 33 00 00 - CSF SITE FURNISHINGS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Site Furnishings are part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items listed at end of Section.32 33 00 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Bicycle racks.
 - 2. Parking blocks.
- B. Related Documents: The Contract Documents, as defined in Section 011000- Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Indicate materials, construction, configuration, dimensions, and finishes.
 - 2. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Bicycle Rack and Parking Blocks are included below. If other Site Furnishings are required, specify them in this Section. Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.



2.1 BICYCLE RACK

- A. Manufacturer: Subject to compliance with project requirements, manufacturers offering products which may be incorporated in the Work include the following:
 - 1. Brandir International, New York, NY (212) 505-6500.
 - 2. Huntco Supply, LLC, Portland, OR (800) 547-5909.
 - 3. Trilary, Incorporated, Middleton, WI (800) 448-7931.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- C. Model:
 - 1. Brandair: #RB-051G.
 - 2. Huntco: #BR 5 SF-G.
 - 3. Trilary: #H36-5-SF-G.
- D. Ribbon Rack; 5 bicycle capacity, ground anchored.
 - 1. ASTM A 53, Schedule 40 galvanized pipe with 2.375 inch O.D. x 0.154 inch thick wall, hot-dipped galvanized after fabrication.

2.2 PARKING BLOCKS

- A. Parking Blocks:
 - 1. Manufacturers: Subject to compliance with project requirements, manufacturers offering products which may be incorporated in the Work include the following:
 - a. Amazing Recycled Products, Denver, CO (800) 241-2174.
 - b. American Recreational Products, Ronkonkoma, NY (800) 663-4096.
 - c. The Parking Block Store, Sherwood, MD (800) 683-9963.
 - d. Phoenix Recycled Plastics Corporation, Ambler, PA (215) 653-0300.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- C. Model:
 - 1. Amazing: #ARP8150.
 - 2. American: #PB4-6
 - 3. Parking Block Store: Saver Block.
 - 4. Phoenix: Paving Maintenance Products (stops).
- D. Design: Solid block, 6 feet long by 4 inches high. Manufactured from 100% recycled plastic. Anchoring as recommended by manufacturer.
- E. Color: Homogenous. Gray.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.



- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's published instructions at locations indicated on Drawings.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION



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Task	Specification	Specification Description
32 39 16 00	12 93 13 00	Miscellaneous Site and Street Furnishings



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SECTION 32 84 13 00 - IRRIGATION SYSTEMS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for irrigation systems. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Piping.
 - b. Encasement for piping.
 - c. Manual valves.
 - d. Pressure-reducing valves.
 - e. Automatic control valves.
 - f. Automatic drain valves.
 - g. Transition fittings.
 - h. Dielectric fittings.
 - i. Miscellaneous piping specialties.
 - j. Sprinklers.
 - k. Quick couplers.
 - l. Drip irrigation specialties.
 - m. Controllers.
 - n. Boxes for automatic control valves.

C. Definitions

1. Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.
2. Drain Piping: Downstream from circuit-piping drain valves. Piping is not under pressure.
3. Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.
4. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

D. Performance Requirements

1. Irrigation zone control shall be automatic operation with controller and automatic control **OR** manual operation with manual, **as directed**, valves.
2. Location of Sprinklers and Specialties: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards. Maintain 100 percent irrigation coverage of areas indicated.
3. Delegated Design: Design 100 percent coverage irrigation system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
 - a. Available land records indicate the following soil conditions:
 - 1) Type: Coarse **OR** Medium **OR** Fine, **as directed**.
 - 2) Texture:
 - a) Sand: as directed by the Owner.
 - b) Silt: as directed by the Owner .
 - c) Clay: as directed by the Owner.
 - 3) Particle Size:
 - a) Sand: as directed by the Owner.
 - b) Silt: as directed by the Owner.



- c) Clay: as directed by the Owner.
 - 4) Structure: Single grained **OR** Granular **OR** Platy **OR** Blocky, **as directed**.
 - 5) Density: as directed by the Owner.
 - 6) Moisture Content: as directed by the Owner.
 - 7) Infiltration Rate: as directed by the Owner.
- 4. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties unless otherwise indicated:
 - a. Irrigation Main Piping: 200 psig (1380 kPa).
 - b. Circuit Piping: 150 psig (1035 kPa).

E. Submittals

- 1. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- 2. Wiring Diagrams: For power, signal, and control wiring.
- 3. Delegated-Design Submittal: For irrigation systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- 4. Zoning Chart: Show each irrigation zone and its control valve.
- 5. Controller Timing Schedule: Indicate timing settings for each automatic controller zone.
- 6. Field quality-control reports.
- 7. Operation and maintenance data.

F. Quality Assurance

- 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Delivery, Storage, And Handling

- 1. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- 2. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

H. Project Conditions

- 1. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of water service.
 - b. Do not proceed with interruption of water service without the Owner's written permission.

1.2 PRODUCTS

A. Pipes, Tubes, And Fittings

- 1. Comply with requirements in the piping schedule for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.
- 2. Galvanized-Steel Pipe: ASTM A 53/A 53M, Standard Weight, Type E, Grade B.
 - a. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Standard Weight, seamless-steel pipe with threaded ends.
 - b. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
 - c. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface, and female threaded ends.
 - d. Cast-Iron Flanges: ASME B16.1, Class 125.
- 3. Ductile-Iron Pipe with Mechanical Joints: AWWA C151, with mechanical-joint bell and spigot ends.



- a. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - 1) Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
 4. Ductile-Iron Pipe with Push-on Joint: AWWA C151, with push-on-joint bell and spigot ends.
 - a. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - 1) Gaskets: AWWA C111, rubber.
 5. Soft Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), water tube, annealed temper.
 - a. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - b. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
 - c. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
 6. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), and ASTM B 88, Type M (ASTM B 88M, Type C), water tube, drawn temper.
 - a. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - b. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
 - c. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
 7. PE Pipe with Controlled ID: ASTM F 771, PE 3408 compound; SDR 11.5 and SDR 15.
 - a. Insert Fittings for PE Pipe: ASTM D 2609, nylon or propylene plastic with barbed ends. Include bands or other fasteners.
 8. PE Pipe with Controlled OD: ASTM F 771, PE 3408 compound, SDR 11.
 - a. PE Butt, Heat-Fusion Fittings: ASTM D 3261.
 - b. PE Socket-Type Fittings: ASTM D 2683.
 9. PE Pressure Pipe: AWWA C906, with DR of 7.3, 9, or 9.3 and PE compound number required to give pressure rating not less than 160 psig (1100 kPa) **OR** 200 psig (1380 kPa), **as directed**.
 - a. PE Butt, Heat-Fusion Fittings: ASTM D 3261.
 - b. PE Socket-Type Fittings: ASTM D 2683.
 10. PVC Pipe: ASTM D 1785, PVC 1120 compound, Schedule 40 **OR** Schedule 80, **as directed**.
 - a. PVC Socket Fittings: ASTM D 2466, Schedule 40 **OR** Schedule 80, **as directed**.
 - b. PVC Threaded Fittings: ASTM D 2464, Schedule 80.
 - c. PVC Socket Unions: Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket ends.
 11. PVC Pipe, Pressure Rated: ASTM D 2241, PVC 1120 compound, SDR 21 and SDR 26.
 - a. PVC Socket Fittings: ASTM D 2467, Schedule 80.
 - b. PVC Socket Unions: Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket or threaded ends.
- B. Piping Joining Materials
 1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick unless otherwise indicated; full-face or ring type unless otherwise indicated.
 2. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
 3. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
 4. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
 5. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 6. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.
- C. Encasement For Piping
 1. Standard: ASTM A 674 or AWWA C105.



2. Form: Sheet **OR** Tube, **as directed**.
3. Material: LLDPE film of 0.008-inch (0.20-mm) **OR** LLDPE film of 0.008-inch (0.20-mm) minimum thickness or high-density, cross-laminated PE film of 0.004-inch (0.10-mm) **OR** High-density, cross-laminated PE film of 0.004-inch (0.10-mm), **as directed**, minimum thickness.
4. Color: Black **OR** Natural, **as directed**.

D. Manual Valves

1. Curb Valves:
 - a. Description:
 - 1) Standard: AWWA C800.
 - 2) NPS 1 (DN 25) and Smaller Pressure Rating: 100 psig (690 kPa) minimum **OR** 150 psig (1035 kPa), **as directed**.
 - 3) NPS 1-1/4 to NPS 2 (DN 32 to DN 50) Pressure Rating: 80 psig (550 kPa) minimum **OR** 150 psig (1035 kPa), **as directed**.
 - 4) Body Material: Brass or bronze with ball or ground-key plug.
 - 5) End Connections: Matching piping.
 - 6) Stem: With wide-tee head.
2. Curb-Valve Casing:
 - a. Standard: Similar to AWWA M44 for cast-iron valve casings.
 - b. Top Section: Telescoping, of length required for depth of burial of curb valve.
 - c. Barrel: Approximately 3-inch (75-mm) diameter.
 - d. Plug: With lettering "WATER."
 - e. Bottom Section: With base of size to fit over valve.
 - f. Base Support: Concrete collar **OR** wood frame, **as directed**.
3. Shutoff Rods for Curb-Valve Casings: Furnish one **OR** two, **as directed**, steel, tee-handle shutoff rod(s) with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve for Project.
4. Brass Ball Valves:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Forged brass.
 - 6) Ends: Threaded or solder joint if indicated.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Brass.
 - 9) Ball: Chrome-plated brass.
 - 10) Port: Full **OR** regular, but not reduced, **as directed**.
5. Bronze Ball Valves:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Bronze.
 - 6) Ends: Threaded or solder joint if indicated.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Bronze.
 - 9) Ball: Chrome-plated brass.
 - 10) Port: Full **OR** regular, but not reduced, **as directed**.
6. Iron Ball Valves:
 - a. Description:
 - 1) Standard: MSS SP-72.
 - 2) CWP Rating: 200 psig (1380 kPa).



- 3) Body Design: Split body.
- 4) Body Material: ASTM A 126, gray iron.
- 5) Ends: Flanged.
- 6) Seats: PTFE or TFE.
- 7) Stem: Stainless steel.
- 8) Ball: Stainless steel.
- 9) Port: Full.
7. Plastic Ball Valves:
 - a. Description:
 - 1) Standard: MSS SP-122.
 - 2) Pressure Rating: 125 psig (860 kPa) minimum **OR** 150 psig (1035 kPa), **as directed**.
 - 3) Body Material: PVC.
 - 4) Type: Union.
 - 5) End Connections: Socket or threaded.
 - 6) Port: Full.
8. Bronze Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) Class: 125.
 - 3) CWP Rating: 200 psig (1380 kPa).
 - 4) Body Material: ASTM B 62 bronze with integral seat and screw-in bonnet.
 - 5) Ends: Threaded or solder joint.
 - 6) Stem: Bronze, nonrising.
 - 7) Disc: Solid wedge; bronze.
 - 8) Packing: Asbestos free.
 - 9) Handwheel: Malleable iron, bronze, or aluminum.
9. Iron Gate Valves, Resilient Seated:
 - a. Description:
 - 1) Standard: AWWA C509.
 - 2) Pressure Rating: 200 psig (1380 kPa) **OR** 250 psig (1725 kPa), **as directed**, minimum.
 - 3) Body Material: Ductile or gray iron with bronze trim.
 - 4) End Connections: Mechanical joint or push-on joint.
 - 5) Interior Coating: Comply with AWWA C550.
 - 6) Body Design: Nonrising stem.
 - 7) Operator: Stem nut.
 - 8) Disc: Solid wedge with resilient coating.
10. Iron Gate Valve Casings:
 - a. Standard: AWWA M44 for cast-iron valve casings.
 - b. Top Section: Adjustable extension of length required for depth of burial of valve.
 - c. Barrel: Approximately 5-inch (125-mm) diameter.
 - d. Plug: With lettering "WATER."
 - e. Bottom Section: With base of size to fit over valve.
 - f. Base Support: Concrete collar **OR** wood frame, **as directed**.
11. Operating Wrenches for Iron Gate Valve Casings: Furnish one **OR** two, **as directed**, steel, tee-handle operating wrench(es) with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut for Project.
12. Iron Gate Valves, NRS:
 - a. Description:
 - 1) Standard: MSS SP-70, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 4) Ends: Flanged.
 - 5) Trim: All bronze.
 - 6) Disc: Solid wedge.



- 7) Packing and Gasket: Asbestos free.
13. Iron Gate Valves, OS&Y:
 - a. Description:
 - 1) Standard: MSS SP-70, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 4) Ends: Flanged.
 - 5) Trim: All bronze.
 - 6) Disc: Solid wedge.
 - 7) Packing and Gasket: Asbestos free.
- E. Pressure-Reducing Valves
 1. Water Regulators:
 - a. Description:
 - 1) Standard: ASSE 1003.
 - 2) Body Material: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).
 - 3) Pressure Rating: Initial pressure of 150 psig (1035 kPa).
 - 4) End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).
 2. Water Control Valves:
 - a. Description: Pilot-operation, diaphragm-type, single-seated main water control valve. Include small pilot control valve, restrictor device, specialty fittings, and sensor piping.
 - 1) Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.
 - 2) Pattern: Angle-valve **OR** Globe-valve, **as directed**, design.
 - 3) Trim: Stainless steel.
 - 4) Pressure Rating: Initial pressure of 150 psig (1035 kPa) minimum.
 - 5) End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
- F. Automatic Control Valves
 1. Bronze, Automatic Control Valves:
 - a. Description: Cast-bronze body, normally closed, diaphragm type with manual-flow adjustment, and operated by 24-V ac solenoid.
 2. Plastic, Automatic Control Valves:
 - a. Description: Molded-plastic body, normally closed, diaphragm type with manual-flow adjustment, and operated by 24-V ac solenoid.
- G. Automatic Drain Valves
 1. Description: Spring-loaded-ball type of corrosion-resistant construction and designed to open for drainage if line pressure drops below 2-1/2 to 3 psig (17 to 20 kPa).
- H. Transition Fittings
 1. General Requirements: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
 2. Transition Couplings:
 - a. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.
 3. Plastic-to-Metal Transition Fittings:
 - a. Description: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-socket or threaded end.
 4. Plastic-to-Metal Transition Unions:



- a. Description: MSS SP-107, PVC four-part union. Include one brass or stainless-steel threaded end, one solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.
- I. Dielectric Fittings
1. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
 2. Dielectric Unions:
 - a. Description: Factory-fabricated union, NPS 2 (DN 50) and smaller.
 - 1) Pressure Rating: 150 psig (1035 kPa) minimum **OR** 250 psig (1725 kPa), **as directed**, at 180 deg F (82 deg C).
 - 2) End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.
 3. Dielectric Flanges:
 - a. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 (DN 65 to DN 100) and larger.
 - 1) Pressure Rating: 150 psig (1035 kPa) minimum **OR** 175 psig (1200 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - 2) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
 4. Dielectric-Flange Kits:
 - a. Description: Nonconducting materials for field assembly of companion flanges, NPS 2-1/2 (DN 65) and larger.
 - 1) Pressure Rating: 150 psig (1035 kPa) minimum.
 - 2) Gasket: Neoprene or phenolic.
 - 3) Bolt Sleeves: Phenolic or polyethylene.
 - 4) Washers: Phenolic with steel backing washers.
 5. Dielectric Couplings:
 - a. Description: Galvanized-steel coupling.
 - 1) Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
 - 2) End Connections: Female threaded.
 - 3) Lining: Inert and noncorrosive, thermoplastic lining.
 6. Dielectric Nipples:
 - a. Description: Electroplated steel nipple complying with ASTM F 1545.
 - 1) Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
 - 2) End Connections: Male threaded or grooved.
 - 3) Lining: Inert and noncorrosive, propylene.
- J. Miscellaneous Piping Specialties
1. Water Hammer Arresters: ASSE 1010 or PDI WH 201, with bellows or piston-type pressurized cushioning chamber and in sizes complying with PDI WH 201, Sizes A to F.
 2. Pressure Gages: ASME B40.1. Include 4-1/2-inch- (115-mm-) diameter dial, dial range of two times system operating pressure, and bottom outlet.
- K. Sprinklers
1. General Requirements: Designed for uniform coverage over entire spray area indicated at available water pressure.
 2. Metal, Exposed, Impact-Drive Rotary Sprinklers:
 - a. Description:
 - 1) Construction: Brass and other corrosion-resistant metals.
 - 2) Mounting: Aboveground, exposed on riser.
 3. Plastic, Exposed, Impact-Drive Rotary Sprinklers:
 - a. Description:
 - 1) Construction: ABS and corrosion-resistant metals.
 - 2) Mounting: Aboveground, exposed on riser.
 4. Plastic, Pop-up, Gear-Drive Rotary Sprinklers:

- a. Description:
 - 1) Body Material: ABS.
 - 2) Nozzle: ABS **OR** Brass, **as directed**.
 - 3) Retraction Spring: Stainless steel.
 - 4) Internal Parts: Corrosion resistant.
- 5. Metal, Pop-up, Impact-Drive Rotary Sprinklers:
 - a. Description:
 - 1) Case: Brass.
 - 2) Body Material: Brass.
 - 3) Pop-up Height: Approximately 3 inches (75 mm).
 - 4) Sprinkler Construction: Brass and other corrosion-resistant metals.
- 6. Plastic, Pop-up, Impact-Drive Rotary Sprinklers:
 - a. Description:
 - 1) Case: ABS.
 - 2) Pop-up Height: Approximately 3 inches (75 mm).
 - 3) Sprinkler Construction: ABS and other corrosion-resistant metals.
- 7. Metal, Surface Spray Sprinklers:
 - a. Description:
 - 1) Body Material and Flange: Brass.
 - 2) Nozzle: Brass.
 - 3) Pattern: Fixed, with flow adjustment.
- 8. Plastic, Surface Spray Sprinklers:
 - a. Description:
 - 1) Body Material and Flange: ABS.
 - 2) Pattern: Fixed, with flow adjustment.
- 9. Metal, Surface, Pop-up Spray Sprinklers:
 - a. Description:
 - 1) Body Material and Flange: Brass.
 - 2) Nozzle: Brass.
 - 3) Pattern: Fixed, with flow adjustment.
- 10. Plastic, Surface, Pop-up Spray Sprinklers:
 - a. Description:
 - 1) Body Material and Flange: ABS.
 - 2) Pattern: Fixed, with flow adjustment.
- 11. Plastic, Pop-up Spray Sprinklers:
 - a. Description:
 - 1) Body Material: ABS.
 - 2) Nozzle: ABS **OR** Brass, **as directed**.
 - 3) Retraction Spring: Stainless steel.
 - 4) Internal Parts: Corrosion resistant.
 - 5) Pattern: Fixed, with flow adjustment.
- 12. Metal Shrub Sprinklers:
 - a. Description:
 - 1) Body Material: Brass.
 - 2) Nozzle: Brass.
 - 3) Pattern: Fixed, with flow adjustment.
- 13. Plastic Shrub Sprinklers:
 - a. Description:
 - 1) Body Material: ABS or other plastic.
 - 2) Pattern: Fixed, with flow adjustment.

L. Quick Couplers

- 1. Description: Factory-fabricated, bronze or brass, two-piece assembly. Include coupler water-seal valve; removable upper body with spring-loaded or weighted, rubber-covered cap; hose swivel with ASME B1.20.7, 3/4-11.5NH threads for garden hose on outlet; and operating key.



- a. Locking-Top Option: Vandal-resistant locking feature. Include one **OR** two, **as directed**, matching key(s).

M. Drip Irrigation Specialties

1. Freestanding Emitters: Device to deliver water at approximately 20 psig (138 kPa).
 - a. Body Material: PE or vinyl, with flow control.
 - b. Riser to Emitter: PE or PVC flexible tubing.
2. Manifold Emitter Systems: Manifold with tubing and emitters.
 - a. Manifold: With multiple outlets to deliver water to emitters.
 - 1) Body Material: Plastic.
 - 2) Outlet Caps: Plastic, for outlets without installed tubing.
 - 3) Operation: Automatic pressure compensating.
 - b. Tubing: PE or PVC; 1/8-inch (3-mm) minimum ID.
 - c. Emitter: Device to deliver water at approximately 20 psig (138 kPa).
 - 1) Body Material: PE or vinyl, with flow control.
3. Multiple-Outlet Emitter Systems: Emitter with tubing and button-type outlets.
 - a. Emitter: With multiple outlets to deliver water to remote outlets.
 - 1) Body Material: Plastic, with flow control.
 - 2) Outlet Caps: Plastic, for outlets without installed tubing.
 - 3) Operation: Automatic pressure compensating.
 - 4) Emitters: Devices to deliver water at approximately 20 psig (138 kPa).
 - b. Tubing: PE or PVC; 1/8-inch (3-mm) minimum ID.
4. Drip Tubes with Direct-Attached Emitters:
 - a. Tubing: Flexible PE or PVC with plugged end.
 - b. Emitters: Devices to deliver water at approximately 20 psig (138 kPa).
 - 1) Body Material: PE or vinyl, with flow control.
 - 2) Mounting: Inserted into tubing at set intervals.
5. Drip Tubes with Remote Discharge:
 - a. Tubing: Flexible PE or PVC with plugged end.
 - b. Emitters: Devices to deliver water at approximately 20 psig (138 kPa).
 - 1) Body Material: PE or vinyl, with flow control.
 - 2) Mounting: Inserted into tubing at set intervals.
6. Off-Ground Supports: Plastic stakes.
7. Application Pressure Regulators: Brass or plastic housing, NPS 3/4 (DN 20), with corrosion-resistant internal parts; capable of controlling outlet pressure to approximately 20 psig (138 kPa).
8. Filter Units: Brass or plastic housing, with corrosion-resistant internal parts; of size and capacity required for devices downstream from unit.
9. Air Relief Valves: Brass or plastic housing, with corrosion-resistant internal parts.
10. Vacuum Relief Valves: Brass or plastic housing, with corrosion-resistant internal parts.

N. Controllers

1. Description:
 - a. Controller Stations for Automatic Control Valves: Each station is variable from approximately 5 to 60 minutes. Include switch for manual or automatic operation of each station.
 - b. Exterior Control Enclosures: NEMA 250, Type 4, weatherproof, with locking cover and two matching keys; include provision for grounding.
 - 1) Body Material: Enameled-steel sheet metal **OR** Stainless-steel sheet metal **OR** Molded plastic, **as directed**.
 - 2) Mounting: Freestanding type for concrete base **OR** Surface type for wall, **as directed**.
 - c. Interior Control Enclosures: NEMA 250, Type 12, dripproof, with locking cover and two matching keys.
 - 1) Body Material: Enameled-steel sheet metal **OR** Stainless-steel sheet metal **OR** Molded plastic, **as directed**.



- 2) Mounting: Freestanding type for concrete base **OR** Surface type for wall, **as directed**.
- d. Control Transformer: 24-V secondary, with primary fuse.
- e. Timing Device: Adjustable, 24-hour, 14-day clock, with automatic operations to skip operation any day in timer period, to operate every other day, or to operate two or more times daily.
 - 1) Manual or Semiautomatic Operation: Allows this mode without disturbing preset automatic operation.
 - 2) Nickel-Cadmium Battery and Trickle Charger: Automatically powers timing device during power outages.
 - 3) Surge Protection: Metal-oxide-varistor type on each station and primary power.
- f. Moisture Sensor: Adjustable from one to seven days, to shut off water flow during rain.
- g. Wiring: UL 493, Type UF multiconductor, with solid-copper conductors; insulated cable; suitable for direct burial.
 - 1) Feeder-Circuit Cables: No. 12 AWG minimum, between building and controllers.
 - 2) Low-Voltage, Branch-Circuit Cables: No. 14 AWG minimum, between controllers and automatic control valves; color-coded different from feeder-circuit-cable jacket color; with jackets of different colors for multiple-cable installation in same trench.
 - 3) Splicing Materials: Manufacturer's packaged kit consisting of insulating, spring-type connector or crimped joint and epoxy resin moisture seal; suitable for direct burial.
- h. Concrete Base: Reinforced precast concrete not less than 36 by 24 by 4 inches (900 by 600 by 100 mm) thick, and 6 inches (150 mm) greater in each direction than overall dimensions of controller. Include opening for wiring.

O. Boxes For Automatic Control Valves

- 1. Plastic Boxes:
 - a. Description: Box and cover, with open bottom and openings for piping; designed for installing flush with grade.
 - 1) Size: As required for valves and service.
 - 2) Shape: Round **OR** Square **OR** Rectangular, **as directed**.
 - 3) Sidewall Material: PE **OR** PE, ABS, or FRP, **as directed**.
 - 4) Cover Material: PE **OR** PE, ABS, or FRP, **as directed**.
 - a) Lettering: "VALVE BOX" **OR** "IRRIGATION," **as directed**.
- 2. Polymer-Concrete Boxes:
 - a. Description: Box and cover, with open bottom and openings for piping; designed for installing flush with grade.
 - 1) Size: As required for valves and service.
 - 2) Shape: Round **OR** Square **OR** Rectangular, **as directed**.
 - 3) Sidewall Material: Polymer concrete with lateral and vertical sidewall design loading of 5000 lb (2268 kg) **OR** 10,000 lb (4536 kg) **OR** 15,000 lb (6800 kg), **as directed**, minimum over 10 by 10 inches (254 by 254 mm) square.
 - 4) Cover Material: Polymer concrete **OR** Reinforced polymer concrete, **as directed**, with cover design loading of 5000 lb (2268 kg) **OR** 10,000 lb (4536 kg) **OR** 15,000 lb (6800 kg), **as directed**, minimum over 10 by 10 inches (254 by 254 mm) square.
 - a) Lettering: "VALVE BOX" **OR** "IRRIGATION," **as directed**.
- 3. Drainage Backfill: Cleaned gravel or crushed stone, graded from 3/4 inch (19 mm) minimum to 3 inches (75 mm) maximum.

1.3 EXECUTION

A. Earthwork

- 1. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving".
- 2. Install warning tape directly above pressure piping, 12 inches (300 mm) below finished grades, except 6 inches (150 mm) below subgrade under pavement and slabs.



3. Drain Pockets: Excavate to sizes indicated. Backfill with cleaned gravel or crushed stone, graded from 3/4 to 3 inches (19 to 75 mm), to 12 inches (300 mm) below grade. Cover gravel or crushed stone with sheet of asphalt-saturated felt and backfill remainder with excavated material.
 4. Provide minimum cover over top of underground piping according to the following:
 - a. Irrigation Main Piping: Minimum depth of 36 inches (900 mm) below finished grade, or not less than 18 inches (450 mm) below average local frost depth, whichever is deeper.
 - b. Circuit Piping: 12 inches (300 mm).
 - c. Drain Piping: 12 inches (300 mm)
 - d. Sleeves: 24 inches (600 mm).
- B. Piping Installation
1. Location and Arrangement: Drawings indicate location and arrangement of piping systems. Install piping as indicated unless deviations are approved on Coordination Drawings.
 2. Install piping at minimum uniform slope of 0.5 percent down toward drain valves.
 3. Install piping free of sags and bends.
 4. Install groups of pipes parallel to each other, spaced to permit valve servicing.
 5. Install fittings for changes in direction and branch connections.
 6. Install unions adjacent to valves and to final connections to other components with NPS 2 (DN 50) or smaller pipe connection.
 7. Install flanges adjacent to valves and to final connections to other components with NPS 2-1/2 (DN 65) or larger pipe connection.
 8. Install underground thermoplastic piping according to ASTM D 2774 and ASTM F 690.
 9. Install expansion loops in control-valve boxes for plastic piping.
 10. Lay piping on solid subbase, uniformly sloped without humps or depressions.
 11. Install ductile-iron piping according to AWWA C600.
 12. Install PVC piping in dry weather when temperature is above 40 deg F (5 deg C). Allow joints to cure at least 24 hours at temperatures above 40 deg F (5 deg C) before testing.
 13. Install water regulators with shutoff valve and strainer on inlet and pressure gage on outlet. Install shutoff valve on outlet. Install aboveground or in control-valve boxes.
 14. Water Hammer Arresters: Install between connection to building main and circuit valves aboveground or in control-valve boxes.
 15. Install piping in sleeves under parking lots, roadways, and sidewalks.
 16. Install sleeves made of Schedule 40 **OR** Schedule 80, **as directed**, PVC pipe and socket fittings, and solvent-cemented joints.
 17. Install transition fittings for plastic-to-metal pipe connections according to the following:
 - a. Underground Piping:
 - 1) NPS 1-1/2 (DN 40) and Smaller: Plastic-to-metal transition fittings.
 - 2) NPS 2 (DN 50) and Larger: AWWA transition couplings.
 - b. Aboveground Piping:
 - 1) NPS 2 (DN 50) and Smaller: Plastic-to-metal transition fittings **OR** unions, **as directed**.
 - 2) NPS 2 (DN 50) and Larger: Use dielectric flange kits with one plastic flange.
 18. Install dielectric fittings for dissimilar-metal pipe connections according to the following:
 - a. Underground Piping:
 - 1) NPS 2 (DN 50) and Smaller: Dielectric coupling or dielectric nipple.
 - 2) NPS 2-1/2 (DN 65) and Larger: Prohibited except in control-valve box.
 - b. Aboveground Piping:
 - 1) NPS 2 (DN 50) and Smaller: Dielectric union.
 - 2) NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Dielectric flange.
 - 3) NPS 5 (DN 125) and Larger: Dielectric flange kit.
 - c. Piping in Control-Valve Boxes:
 - 1) NPS 2 (DN 50) and Smaller: Dielectric union.
 - 2) NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Dielectric flange.
 - 3) NPS 5 (DN 125) and Larger: Dielectric flange kit.

C. Joint Construction



1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
4. Flanged Joints: Select rubber gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
5. Ductile-Iron Piping Gasketed Joints: Comply with AWWA C600 and AWWA M41.
6. Copper-Tubing Brazed Joints: Construct joints according to CDA's "Copper Tube Handbook," using copper-phosphorus brazing filler metal.
7. Copper-Tubing Soldered Joints: Apply ASTM B 813 water-flushable flux to tube end unless otherwise indicated. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.
8. PE Piping Fastener Joints: Join with insert fittings and bands or fasteners according to piping manufacturer's written instructions.
9. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - a. Plain-End PE Pipe and Fittings: Use butt fusion.
 - b. Plain-End PE Pipe and Socket Fittings: Use socket fusion.
10. PVC Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. PVC Pressure Piping: Join schedule number, ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - c. PVC Nonpressure Piping: Join according to ASTM D 2855.

D. Valve Installation

1. Underground Curb Valves: Install in curb-valve casings with tops flush with grade.
2. Underground Iron Gate Valves, Resilient Seat: Comply with AWWA C600 and AWWA M44. Install in valve casing with top flush with grade.
 - a. Install valves and PVC pipe with restrained, gasketed joints.
3. Aboveground Valves: Install as components of connected piping system.
4. Pressure-Reducing Valves: Install in boxes for automatic control valves or aboveground between shutoff valves. Install full-size valved bypass, **as directed**.
5. Throttling Valves: Install in underground piping in boxes for automatic control valves.
6. Drain Valves: Install in underground piping in boxes for automatic control valves.

E. Sprinkler Installation

1. Install sprinklers after hydrostatic test is completed.
2. Install sprinklers at manufacturer's recommended heights.
3. Locate part-circle sprinklers to maintain a minimum distance of 4 inches (100 mm) from walls and 2 inches (50 mm) from other boundaries unless otherwise indicated.

F. Drip Irrigation Specialty Installation

1. Install freestanding emitters on pipe riser to mounting height indicated.
2. Install manifold emitter systems with tubing to emitters. Plug unused manifold outlets. Install emitters on off-ground supports at height indicated.



3. Install multiple-outlet emitter systems with tubing to outlets. Plug unused emitter outlets. Install outlets on off-ground supports at height indicated.
 4. Install drip tubes with direct-attached emitters on ground.
 5. Install drip tubes with remote-discharge on ground with outlets on off-ground supports at height indicated.
 6. Install off-ground supports of length required for indicated mounted height of device.
 7. Install application pressure regulators and filter units in piping near device being protected, and aboveground **OR** in control-valve boxes, **as directed**.
 8. Install air relief valves and vacuum relief valves in piping, and aboveground **OR** in control-valve boxes, **as directed**.
- G. Automatic Irrigation-Control System Installation
1. Equipment Mounting: Install interior controllers on floor **OR** concrete bases **OR** wall, **as directed**.
 - a. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - b. Install anchor bolts to elevations required for proper attachment to supported equipment.
 2. Equipment Mounting: Install exterior freestanding controllers on precast concrete bases.
 - a. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - b. Install anchor bolts to elevations required for proper attachment to supported equipment.
 3. Install control cable in same trench as irrigation piping and at least 2 inches (51 mm) below or beside piping. Provide conductors of size not smaller than recommended by controller manufacturer. Install cable in separate sleeve under paved areas.
- H. Connections
1. Comply with requirements for piping specified in Division 22 Section "Facility Water Distribution Piping" for water supply from exterior water service piping, water meters, protective enclosures, and backflow preventers. Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Install piping adjacent to equipment, valves, and devices to allow service and maintenance.
 3. Connect wiring between controllers and automatic control valves.
- I. Identification
1. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification For Plumbing Piping And Equipment".
 2. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplates and signs on each automatic controller.
 - a. Text: In addition to identifying unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
 3. Warning Tapes: Arrange for installation of continuous, underground, detectable warning tapes over underground piping during backfilling of trenches. See Division 31 Section "Earth Moving" for warning tapes.
- J. Field Quality Control
1. Perform tests and inspections.
 2. Tests and Inspections:
 - a. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - b. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.
 - c. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 3. Any irrigation product will be considered defective if it does not pass tests and inspections.
 4. Prepare test and inspection reports.

- K. Adjusting
1. Adjust settings of controllers.
 2. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.
 3. Adjust sprinklers and devices, except those intended to be mounted aboveground, so they will be flush with, or not more than 1/2 inch (13 mm) above, finish grade.
- L. Cleaning
1. Flush dirt and debris from piping before installing sprinklers and other devices.
- M. Piping Schedule
1. Install components having pressure rating equal to or greater than system operating pressure.
 2. Piping in control-valve boxes and aboveground may be joined with flanges or unions instead of joints indicated.
 3. Aboveground irrigation main piping, NPS 4 (DN 100) and smaller, shall be one of the following:
 - a. Galvanized-steel pipe and galvanized-steel pipe nipples; galvanized, gray-iron threaded fittings; and threaded joints.
 - b. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube, wrought- or cast-copper fittings, and brazed **OR** soldered, **as directed**, joints.
 - c. Schedule 40 **OR** Schedule 80, **as directed**, PVC pipe; socket-type PVC fittings; and solvent-cemented joints.
 - d. Schedule 80, PVC pipe; Schedule 80, threaded PVC fittings; and threaded joints.
 4. Aboveground irrigation main piping, NPS 5 (DN 125) and larger, shall be one of the following:
 - a. Galvanized-steel pipe and galvanized-steel pipe nipples; galvanized, gray-iron threaded fittings; and threaded joints.
 - b. Schedule 40 **OR** Schedule 80, **as directed**, PVC pipe and socket fittings; and solvent-cemented joints.
 - c. Schedule 80, PVC pipe; Schedule 80, threaded PVC fittings; and threaded joints.
 5. Underground irrigation main piping, NPS 4 (DN 100) and smaller, shall be one of the following:
 - a. NPS 3 and NPS 4 (DN 80 and DN 100) ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings, glands, bolts, and nuts; and gasketed joints.
 - b. NPS 3 and NPS 4 (DN 80 and DN 100) ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings and gaskets; and gasketed joints.
 - c. Type L (Type B) soft copper tube, wrought-copper fittings, and brazed joints.
 - d. NPS 4 (DN 100) PE pressure pipe; PE butt, heat-fusion or socket-type fittings; and heat-fusion joints.
 - e. Schedule 40 **OR** Schedule 80, **as directed**, PVC pipe and socket fittings, and solvent-cemented joints.
 - f. Schedule 80, PVC pipe; Schedule 80, threaded PVC fittings; and threaded joints.
 - g. SDR 21, PVC, pressure-rated pipe; Schedule 80, PVC socket fittings; and solvent-cemented joints.
 6. Underground irrigation main piping, NPS 5 (DN 125) and larger, shall be one of the following:
 - a. NPS 6 (DN 150) and larger ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings, glands, bolts, and nuts; and gasketed joints.
 - b. NPS 6 (DN 150) and larger ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings and gaskets; and gasketed joints.
 - c. PE pressure pipe; PE butt, heat-fusion fittings; and heat-fusion joints.
 - d. Schedule 40 **OR** Schedule 80, **as directed**, PVC pipe and socket fittings; and solvent-cemented joints.
 - e. SDR 21, PVC, pressure-rated pipe; Schedule 80, PVC socket fittings; and solvent-cemented joints.
 7. Circuit piping, NPS 2 (DN 50) and smaller, shall be one of the following:
 - a. SDR 7 **OR** SDR 9, **as directed**, PE, controlled ID pipe; insert fittings for PE pipe; and fastener joints.



- b. DR 9 **OR** DR 11, **as directed**, PE, controlled OD pipe; PE butt, heat-fusion, or PE socket-type fittings; and heat-fusion joints.
 - c. Schedule 40, PVC pipe and socket fittings; and solvent-cemented joints.
 - d. SDR 26, PVC, pressure-rated pipe; Schedule 40, PVC socket fittings; and solvent-cemented joints.
 - 8. Circuit piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100), shall be one of the following:
 - a. SDR 7 **OR** SDR 9, **as directed**, PE, controlled ID pipe; insert fittings for PE pipe; and banded or fastener joints.
 - b. DR 9 **OR** DR 11, **as directed**, PE, controlled OD pipe; PE socket or butt-fusion fittings; and heat-fusion joints. NPS 3 (DN 80) pipe and fittings if NPS 2-1/2 (DN 65) pipe and fittings are not available.
 - c. Schedule 40, PVC pipe and socket fittings; and solvent-cemented joints.
 - d. SDR 26, PVC, pressure-rated pipe; Schedule 40, PVC socket fittings; and solvent-cemented joints.
 - 9. Underground Branches and Offsets at Sprinklers and Devices: Schedule 80, PVC pipe; threaded PVC fittings; and threaded joints.
 - a. Option: Plastic swing-joint assemblies, with offsets for flexible joints, manufactured for this application.
 - 10. Risers to Aboveground Sprinklers and Specialties: Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube, wrought-copper fittings, and brazed **OR** soldered, **as directed**, joints.
 - 11. Risers to Aboveground Sprinklers and Specialties: Schedule 80, PVC pipe and socket fittings; and solvent-cemented joints.
 - 12. Drain piping shall be one of the following:
 - a. SDR 9, 11.5, or 15, PE, controlled ID pipe; insert fittings for PE pipe; and banded or fastener joints.
 - b. Schedule 40, PVC pipe and socket fittings; and solvent-cemented joints.
 - c. SDR 21, 26, or 32.5, PVC, pressure-rated pipe; Schedule 40, PVC socket fittings; and solvent-cemented joints.
- N. Valve Schedule
- 1. Underground, Shutoff-Duty Valves: Use the following:
 - a. NPS 2 (DN 50) and Smaller: Curb valve, curb-valve casing, and shutoff rod.
 - b. NPS 3 (DN 80) and Larger: Iron gate valve, resilient seated; iron gate valve casing; and operating wrench(es).
 - 2. Aboveground, Shutoff-Duty Valves:
 - a. NPS 2 (DN 50) and Smaller: Brass **OR** Bronze **OR** Plastic, **as directed**, ball valve.
 - b. NPS 2 (DN 50) and Smaller: Bronze gate valve.
 - c. NPS 2-1/2 (DN 65) and Larger: Iron ball valve.
 - d. NPS 2-1/2 (DN 65) and Larger: Iron gate valve, NRS **OR** OS&Y, **as directed**.
 - 3. Throttling-Duty Valves:
 - a. NPS 2 (DN 50) and Smaller: Bronze **OR** Plastic, **as directed**, automatic control valve.
 - b. NPS 2 (DN 50) and Smaller: Brass **OR** Bronze **OR** Plastic, **as directed**, ball valve.
 - c. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): Bronze **OR** Plastic, **as directed**, automatic control valve.
 - d. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): Iron ball valve.
 - 4. Drain Valves:
 - a. NPS 1/2 and NPS 3/4 (DN 15 and DN 20): Automatic drain valve.
 - b. NPS 1/2 and NPS 3/4 (DN 15 and DN 20): Brass **OR** Bronze **OR** Plastic, **as directed**, ball valve.
 - c. NPS 1/2 and NPS 3/4 (DN 15 and DN 20): Bronze gate valve.
 - d. NPS 1 to NPS 2 (DN 25 to DN 50): Brass **OR** Bronze **OR** Plastic, **as directed**, ball valve.
 - e. NPS 1 to NPS 2 (DN 25 to DN 50): Bronze gate valve.

END OF SECTION 32 84 13 00



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Task	Specification	Specification Description
32 84 23 00	01 22 16 00	No Specification Required
32 84 23 00	32 84 13 00	Irrigation Systems
32 84 23 00	21 05 00 00	Common Work Results for Fire Suppression



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SECTION 32 91 13 00 - CSF SOIL PREPARATION

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Soil Preparation is a part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information must be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. pH Adjusters.
 - 2. Soil Conditioners.
 - 3. Fertilizer.
 - 4. Pesticides.
 - 5. Application of topsoil.
 - 6. Landscape grading.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 312000 - Earth Moving: Topsoil.
 - 2. Section 329200 - Turf and Grasses: Groundcover materials.
 - 3. Section 329300 - Plants: Plants, trees, and shrubs.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Requirements: Procedures for submittals.
 - 1. Product Data: Manufacturer's data including installation and storage instructions for each product specified.
 - 2. Assurance/Control Submittals:
 - a. Pesticide Control Plan: Proposed sequence of pesticide work. Include common name, chemical composition, formulation, concentration, rate and method of application, for all products furnished; and names of state certified applicator(s), in the appropriate category.
 - b. Test Reports: Topsoil composition, in duplicate.
 - c. Certifications: In duplicate. Certify that topsoil, peat, lime, aluminum sulfate perlite and vermiculite conforms with requirements specified.



- d. Field Reports: Pesticide application, in duplicate.
- e. Qualification Documentation: Pesticide applicator documentation of experience indicating compliance with specified qualification requirements.

1.3 QUALITY ASSURANCE

- A. Applicator Qualification: Applicator specializing in performing Work of this Section with minimum 5 years documented experience.
 - 1. Pesticide applicator; state certified, using procedures, materials and equipment of type required for Work.
- B. Regulatory Requirements: Conform to applicable requirements of the Local and State Department of Agriculture Extension Service of the state in which the project is located.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver materials to job site in unopened containers bearing manufacturer's name and content identification, Environmental Protection Agency (EPA) registration number and manufacturer's registered uses.
- C. Store materials as recommended by manufacturer.

1.5 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements:
 - 1. Protection of Personnel Property: Apply pesticides so damage will not result to personnel or property from wither direct spray of drifting of chemicals both on and off site.
 - 2. Disposal of Excess Chemicals and Containers: In accordance with Federal, State laws and local rules and regulations.

PART 2 - PRODUCTS

2.1 TOPSOIL

- A. Specified in Section 312000.

NOTE TO SPECIFIER

Edit t pH ADJUSTERS for type selected for specific Project.

2.2 pH ADJUSTERS

- A. Lime:
 - 1. Commercial grade [ground] [hydrated] [or] [burnt] limestone containing not less than 50 percent of total oxides, [____] percent calcium and [____] percent magnesium oxide.
 - 2. Gradation: Minimum 75 percent passing 100-mesh sieve and 100 percent passing 20-mesh sieve.



- B. Ferrous Sulfate: Commercial grade.

2.3 SOIL CONDITIONERS

- A. Use singly or in combinations required to meet requirements for topsoil.
- B. Soil Conditioners: Nontoxic to plants.

NOTE TO SPECIFIER

Edit PEAT for type selected for specific Project.

- C. Peat:
1. [Sphagnum moss peat] [Peat moss] [Hypnum moss peat] [Reedsedge peat] [Peat humus] derived from a freshwater site and conforming to ASTM D 2607 as modified herein.
 2. Shred and granulate peat to pass 1/2 inch mesh screen and condition in storage pile for minimum six months after excavation.
- D. Sand: Clean and free of materials harmful to plants.
- E. Perlite: Horticultural grade for planters.
- F. Vermiculite: Horticultural grade for planters.
- G. Rotted Manure:
1. Well rotted horse or cattle manure containing maximum 25 percent by volume of straw, sawdust, or other bedding materials; free of stones, sticks and soil.
- H. Composted Wood Derivatives:
1. Ground bark, sawdust, or other wood waste material free of stones, sticks, and soil stabilized with nitrogen having the following properties:
 - a. Particle Size: Minimum percent by weight passing:

1) No. 4 mesh screen	95 percent
2) No. 8 mesh screen	80 percent
 - b. Nitrogen Content: Minimum percent based on dry weight:

1) Redwood Sawdust	0.5 percent
2) Fir Sawdust	0.7 percent
3) Fir or Pine Bark	1.0 percent
- I. Calcined Clay:
1. Granular particles produced from montmorillonite clay calcined to minimum temperature of 1200 degrees F to the following gradation:
 - a. Minimum 90 percent passing 8-mesh screen.
 - b. 99 percent retained on 60-mesh screen.
 - c. Maximum 2 percent passing 100-mesh screen.
 2. Bulk Density: 40 pounds maximum per cubic foot.

2.4 FERTILIZER

- A. Specified in Section 329200 and 329300.

**NOTE TO SPECIFIER**

Edit PESTICIDES for type selected for specific Project.

2.5 PESTICIDES

- A. [Soil Fumigant] [Herbicide] [Insecticide] [and] [Fungicide]: EPA registered and approved, for [pre-emergence] [and] [broadleaf weed control].

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Subgrade:
1. After areas required to be landscaped have been brought to required subgrade, thoroughly till to minimum depth of 6 inches by scarifying, disking, harrowing, or other approved methods.
 2. Remove debris and stones larger than one inch in any dimension remaining on surface after tillage.

3.3 TOPSOIL APPLICATION

- A. Immediately prior to placing topsoil, scarify subgrade to a 2 inch depth for bonding of topsoil with subsoil.
- B. Lawns: Spread topsoil evenly to [indicated depth] [a minimum depth of 4 inches]. Do not spread topsoil when frozen or excessively wet or dry.

NOTE TO SPECIFIER

OPTION 1: Use paragraph below for TILLING of Topsoil. Edit for type of soil conditioner and minimum depth selected for specific Project.

- C. Plant Beds: Till to minimum depth of 6 inches. Spread [peat] [manure] uniformly over bed to minimum depth of [____] inches and thoroughly incorporate into existing soil to a minimum depth of 6 inches to obtain a uniform and well pulverized soil mix. During tillage operations remove all sticks, stones, roots,



and other objectionable materials, Bring plant beds to a smooth and even surface conforming to established grades.

NOTE TO SPECIFIER

OPTION 1: Use paragraph below for EXCAVATION OF EXISTING AND REPLACEMENT. Edit for type of soil selected for specific Project.

- D. Plant Beds: Excavate existing soil in plant beds to minimum depth of 4 inches and replace with [planting soil mixture] [topsoil]. Bring plant beds to smooth and even surface conforming to established grades.
- E. Correct irregularities in finished surfaces to eliminate depressions.
- F. Protect finished topsoil areas from damage by vehicular or pedestrian traffic.

3.4 FERTILIZER, pH ADJUSTERS, AND SOIL CONDITIONERS

- A. Application:
 - 1. Apply [fertilizer] [pH adjuster] [and] [soil conditioner] at rates and analysis determined by laboratory soil tests of [soils at job site] [topsoil supplied].
 - 2. [Apply at rates of [_____] pounds per acre.] [_____] pounds per 1000 square feet.]
- B. Tillage: Incorporate [fertilizer,] [pH adjusters,] [and] [soil conditioners] into soil to minimum depth of 6 inches. This may be done as part of the subgrade tillage operation specified above.

USPS CSF Specifications issued: 10/1/2013
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END OF SECTION 32 91 13 00



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Task	Specification	Specification Description
32 91 13 33	31 00 00 00	Earthwork
32 91 13 33	32 18 26 00	Lawns And Grasses
32 91 13 36	32 18 26 00	Lawns And Grasses



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SECTION 32 91 19 13 - SEPTIC TANK SYSTEMS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for septic tank systems. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Septic tanks.
 - b. Distribution boxes.
 - c. Pipe and fittings.
 - d. Absorption systems

C. Submittals

1. Product Data: For each type of product indicated.
 - a. Include construction details, material descriptions, dimensions of individual components, and profiles.
 - b. Include manhole openings, covers, and pipe connections.
2. Shop Drawings: For [trench absorption systems] [bed absorption systems].
 - a. Include manhole openings, covers, pipe connections, and accessories.
 - b. Include piping with sizes and invert elevations.
 - c. Include underground structures.
 - d. Include other utilities.

1.2 PRODUCTS

A. Septic Tanks

1. Precast Concrete Septic Tanks: ASTM C 1227, single-chamber **OR** two-chamber, **as directed**, precast, reinforced-concrete tank with internal baffle, **as directed**, and covers.
 - a. Design: For A-8 (H10-44) **OR** A-12 (HS15-44) **OR** A-16 (HS20-44), **as directed**, traffic loading according to ASTM C 890.
 - b. Manholes: 20-inch- (508-mm-) **OR** 22-inch- (559-mm-) **OR** 24-inch- (610-mm-), **as directed**, minimum diameter opening with reinforced-concrete risers to grade and access lid with steel lift rings. Include manhole in center of each septic tank compartment top.
 - c. Filter Access: Reinforced-concrete access hole, large enough to remove filter, over filter position.
 - d. Inlet and Outlet Access: 12-inch- (300-mm-) minimum diameter, reinforced-concrete access lids with steel lift rings. Include access centered over inlet and outlet.
 - e. Resilient Connectors: ASTM C 923 (ASTM C 923M), of size required for piping, fitted into inlet and outlet openings.
2. Fiberglass Septic Tanks: UL 1316, single-chamber, FRP construction; fabricated for septic tank application with at least one access riser and manhole.
 - a. Manholes: 22-inch- (559-mm-) **OR** 24-inch- (610-mm-), **as directed**, minimum diameter opening with FRP access risers to grade and cover.
 - b. Filter Access: Include access hole, large enough to remove filter, over filter position.
 - c. Resilient Connectors: ASTM C 923 (ASTM C 923M) or other watertight seal, of size required for piping, fitted into inlet and outlet openings.
3. Polyethylene Septic Tanks: Single-chamber, molded, HDPE or PE construction; fabricated for septic tank application, with baffle, **as directed**, and at least one access riser and manhole.



4. Polyethylene Septic Tanks: Two-chamber, molded, HDPE or PE construction; fabricated for septic tank application, with access risers and manholes.
 - a. Manholes: 18-inch- (457-mm-) **OR** 20-inch- (508-mm-) **OR** 22-inch- (559-mm-), **as directed**, minimum diameter opening with HDPE or PE access risers to grade and cover.
 - b. Filter Access: Include access hole, large enough to remove filter, over filter position.
 - c. Resilient Connectors: ASTM C 923 (ASTM C 923M) or other watertight seal, of size required for piping, fitted into inlet and outlet openings.
- B. Filters
1. Description: Removable, septic-tank-outlet filter that restricts discharge solids to 1/8 inch (3.2 mm).
 - a. Housing: HDPE or PVC.
 - b. Outlet Size: NPS 4 (DN 100) **OR** NPS 6 (DN 150), **as directed**.
- C. Dosing Tanks
1. Dosing Tanks: Comply with ASTM C 913 for precast, reinforced-concrete tank and cover; designed for structural loading according to ASTM C 890.
 - a. Design: For effluent pump, **OR** automatic siphon, **as directed**, installation and A-8 (H10-44) **OR** A-12 (HS15-44) **OR** A-16 (HS20-44), **as directed**, traffic loading according to ASTM C 890.
 - b. Manholes: 20-inch- (508-mm-) **OR** 22-inch- (559-mm-) **OR** 24-inch- (610-mm-), **as directed**, minimum diameter opening with reinforced-concrete risers to grade and access lid with steel lift rings. Include manhole in center of each septic tank compartment top.
 - c. Resilient Connectors: ASTM C 923 (ASTM C 923M), of size required for piping, fitted into inlet and outlet openings.
- D. Automatic Siphons
1. Description: Manufactured siphon assembly of molded-HDPE trap, pipe, and bell, with PVC vent piping and stainless-steel bolts.
- E. Distribution Boxes
1. Description: Precast concrete, single-chamber box and cover.
 - a. Design: Made according to ASTM C 913, and for A-8 (H10-44) **OR** A-12 (HS15-44) **OR** A-16 (HS20-44), **as directed**, traffic loading according to ASTM C 890. Include baffle opposite inlet.
 - b. Manholes: 20-inch- (508-mm-) **OR** 22-inch- (559-mm-) **OR** 24-inch- (610-mm-), **as directed**, minimum diameter opening with reinforced-concrete risers to grade and cover with steel lift rings in center of distribution box cover.
 - c. Pipe Connections: ASTM C 923 (ASTM C 923M) resilient connectors, of size required for piping, fitted into inlet and outlet openings. Include watertight plugs in outlets not required.
 2. Description: Molded-HDPE or -PE, single-chamber box and cover.
 - a. Manholes: 18-inch- (457-mm-) **OR** 20-inch- (508-mm-) **OR** 22-inch- (559-mm-), **as directed**, minimum diameter opening with HDPE or PE access risers to grade and cover. Access for PE distribution boxes may be a removable plastic cover and is usually small.
OR
Manufacturer's standard cover or other access opening of size that permits access to distribution-box inlet and outlets.
 - b. Pipe Connections: With seal that prevents leakage. Include watertight plugs in outlets not required.
- F. Leaching Pipes And Fittings
1. Pipe: PE, complying with ASTM F 810, perforated.
 - a. Fittings: ASTM D 2729 PVC for loose joints; ASTM D 3034, PVC for gasketed joints; or ASTM D 2751, ABS for gasketed joints.



2. Tube and Fittings: PE, complying with ASTM F 405, perforated corrugated tube with solid-wall fittings.
 - a. Couplings: PE band, matching tube and fitting dimensions.
 3. Pipe and Fittings: PVC, complying with ASTM D 2729, perforated, for solvent-cement joints.
 - a. Solvent Cement: ASTM D 2564. Include primer according to ASTM F 656
 4. Drainage Tile: Clay drain tile, complying with ASTM C 4, Standard class, drain tile with regular and smooth ends, for open joints.
- G. Nonpressure-Type Pipe Couplings
1. Description: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - a. Sleeve Materials:
 - 1) For Concrete Pipes: ASTM C 443 (ASTM C 443M), rubber.
 - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 3) For Vitrified-Clay Pipes: ASTM C 425, rubber.
 - 4) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- H. Leaching Chambers
1. Description: Arched, molded-PE structures with solid top, perforated sides, open ends, and open bottom.
 - a. End Pieces: Solid and solid with pipe opening types.
 - b. Effluent Distribution Piping: PE or PVC pipe, with holes or slots along pipe, attached to underside of top of chambers.
- I. Trench **OR** Bed, **as directed**, Absorption-System Materials
1. Filtering Material: ASTM D 448, Size No. 24, 3/4 to 2-1/2 inches (19 to 63 mm), washed, crushed stone or gravel; or broken, hard-burned clay brick.
 2. Filter Mat: Geotextile woven or spun filter fabric, in 1 or more layers, for minimum total unit weight of 3 oz./sq. yd. (101 g/sq. m) **OR** Untreated building paper or similar porous material, **as directed**.
 3. Cover for Distribution Pipe: Geotextile woven filter fabric, in 1 or more layers, for minimum total unit weight of 3 oz./sq. yd. (101 g/sq. m).
 4. Fill Material: Soil removed from trench.
- J. Mound Absorption-System Materials
1. Sand Filtering Material: 25 percent or more of very coarse, coarse, or medium sand or combination; maximum of 50 percent fine or very fine sand or combination; and silt and clay combination not to exceed 25 percent. If clay exceeds 60 percent in combination with silt, mixture cannot exceed 15 percent of sand filtering material.
 2. Aggregate Filtering Material: Coarse, 1/2 to 2-1/2 inches (13 to 63 mm).
 3. Cap: Clay, silt, or combination of clay and silt.
 4. Topsoil: Good quality, free of stones, metal, and glass.
 5. Vegetation Cover: Grass compatible with adjacent ground cover. No shrubs or trees.
 6. Filter Mat: Geotextile woven or spun filter fabric, in 1 or more layers, for minimum total unit weight of 3 oz./sq. yd. (101 g/sq. m) **OR** Untreated building paper or similar porous material, **as directed**.
 7. Cover for Distribution Pipe: Geotextile woven filter fabric, in 1 or more layers, for minimum total unit weight of 3 oz./sq. yd. (101 g/sq. m).
- K. Chamber Absorption-System Materials
1. Chamber: Arched, molded-PE structures with solid top, perforated sides, open ends, and open bottom.
 2. End Pieces: Blank without opening for distribution pipe at end of last chamber in row, and with opening for distribution pipe where pipe penetrates chamber.

3. Retain first paragraph below to run piping through chambers to improve distribution.
4. Effluent Distribution Piping: PE or PVC pipe, with holes or slots along pipe, attached to underside of top of chambers.

L. Seepage Pit Absorption-System Materials

1. Constructed-in-Place-Type Seepage Pit: Include the following materials.
 - a. Pit Lining: ASTM C 62, Type SW, clay bricks; ASTM C 55, concrete bricks; ASTM C 90, hollow, concrete masonry units; or precast concrete rings with notches or weep holes.
 - b. Filtering Material: ASTM D 448, Size No. 24, 3/4 to 2-1/2 inches (19 to 63 mm), washed, crushed stone or gravel; or broken, hard-burned clay brick.
 - c. Cover: Precast concrete slab; designed for A-8 (H10-44) **OR** A-12 (HS15-44) **OR** A-16 (HS20-44), **as directed**, traffic loading according to ASTM C 890 and made according to ASTM C 913. Include slab dimensions that will extend minimum of 12 inches (300 mm) beyond edge of excavation. Cast cover with opening for manhole in center.
 - d. Manholes: 20-inch- (508-mm-) **OR** 22-inch- (559-mm-) **OR** 24-inch- (610-mm-), **as directed**, minimum diameter opening with reinforced-concrete risers to grade and access lid with steel lift rings.

1.3 EXECUTION

A. Earthwork

1. Excavating, trenching, and backfilling for piping and seepage pits are specified in Division 31 Section "Earth Moving".
 - a. Stockpile topsoil for reuse in finish grading without intermixing with other excavated material. Stockpile materials away from edge of excavation and do not store within drip line of remaining trees.
 - b. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
2. Excavating and Backfilling for Septic and Dosing Tanks:
 - a. Excavate sufficient width and length for tanks to depth determined by tank inlet elevation. Provide level bottom.
 - b. Backfill with excavated soil, mounding soil above original grade without compacting.
3. Excavating and Backfilling for Trench **OR** Bed, **as directed**, Absorption Fields:
 - a. Excavate for trench absorption fields 30 inches (760 mm) wide and 24 inches (600 mm) deep, minimum.
 - b. Backfill trench absorption fields with excavated soil, mounding soil above original grade without compacting.
 - c. Excavate for bed absorption fields of width indicated and 24 inches (600 mm) deep, minimum.
 - d. Backfill bed absorption fields with excavated soil, mounding soil above original grade without compacting.

B. Excavating and Backfilling for Chamber Absorption Systems:

1. Excavate for trench-type chamber absorption systems **30 inches (762 mm)** wide and **24 inches (610 mm)** deep, minimum.
2. Excavate for bed-type chamber absorption systems of width indicated and **24 inches (610 mm)** deep, minimum.
3. Backfill chamber absorption systems with excavated soil, mounding soil above original grade without compacting.

C. Excavating and Backfilling for Seepage-Pit Absorption Systems:

1. Excavate sufficient hole diameter for pits to depth determined by tank inlet and bottom elevations. Provide level bottom.
2. Backfill with excavated soil, mounding soil above original grade without compacting.



- D. Septic Tank Installation
1. Install precast concrete septic tanks level according to ASTM C 891.
 2. Install septic tanks level.
 3. Connect septic tank to concrete ballast pad.
 4. Install filter in septic tank outlet. Secure filter to septic tank wall. Make direct connections to distribution piping.
 5. Install insulation on exterior sides and top of septic tank.
 6. Fill septic tank with water.
- E. Dosing Tank Installation
1. Install dosing tanks level and according to ASTM C 891.
 2. Install automatic siphons embedded in precast concrete dosing tank. Make direct connections to distribution piping.
 3. Set submersible effluent pumps on dosing tank floor. Make direct connections to distribution piping.
 4. Fill dosing tanks with water.
- F. Distribution Box Installation
1. Install precast concrete distribution boxes according to ASTM C 891 and at invert elevations indicated. Set level and plumb.
 2. Install PE distribution boxes at invert elevations indicated and according to manufacturer's written instructions. Set level and plumb.
- G. Piping Installation
1. Install leaching piping according to the following:
 - a. Use perforated pipe and fittings for trench **OR** bed **OR** mound, **as directed**, absorption fields with perforations at bottom.
 - b. PE Tube and Fittings: ASTM F 481.
 - c. PVC Sewer Pipe and Fittings: ASTM F 481.
- H. Pipe Joint Construction
1. Basic piping joint construction is specified in Division 33 Section "Common Work Results For Utilities". Where specific joint construction is not indicated, follow piping manufacturer's written instructions.
 2. Join distribution piping with or according to the following:
 - a. Install leaching pipe and fittings for trench **OR** bed **OR** mound, as directed, absorption fields with closed joints, unless otherwise indicated.
 - b. PE Tube and Fittings: With PE band couplings.
 - c. PVC Sewer Pipe and Fittings: With solvent-cemented joints according to ASTM F 402 and ASTM D 2321.
 3. Join dissimilar pipe materials according to ASTM D 5926, with couplings and gaskets compatible with pipe materials being joined.
- I. Cleanout Installation
1. Install cleanouts according to the following:
 - a. Inlet and Outlet of Septic Tanks: Cast-iron cleanouts.
 - b. Inlet and Outlet of Dosing Tanks: Cast-iron cleanouts.
 - c. Inlet and Outlet of Distribution Boxes: Cast-iron **OR** PVC cleanouts.
 - d. At Each Change in Direction of Sewer Piping: Cast-iron **OR** PVC cleanouts.
 - e. At Ends of Each Row and at Each Change in Direction of Distribution Piping: Cast-iron **OR** PVC cleanouts.
 2. Cast-Iron Cleanouts: Install with PVC fitting riser from distribution and leaching piping to cast-iron cleanout housing at grade. Use NPS 4 (DN 100) PVC sewer pipe and fittings with solvent-cemented joints for risers. Attach riser to cleanout housing with rubber gasket or coupling.



3. PVC Cleanouts: Install with PVC riser from distribution and leaching piping to PVC cleanout at grade. Use NPS 4 (DN 100) PVC sewer pipe and fittings with solvent-cemented joints for risers and cleanout fitting.
 4. Cleanout Support: Set cleanouts in concrete blocks 18 by 18 by 12 inches (457 by 457 by 305 mm) deep, unless location is in concrete pavement. Formwork, reinforcement, and concrete are specified in Division 03 Section "Cast-in-place Concrete".
 5. Set top of cleanout 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**, above surrounding rough grade, or set flush with grade if installed in pavement.
- J. Trench **OR** Bed **OR** Absorption-Field, **as directed**, Installation
1. Filtering Material: Place supporting layer of filtering material over the compacted trench **OR** bed, **as directed**, base to a compacted depth not less than 6 inches (150 mm) below bottom of pipe.
 2. Refer to Part 1.3 "Piping Installation" and "Pipe Joint Construction" articles for specific piping material installation.
 3. Install distribution piping at minimum slope of 1 percent and maximum slope of 2 percent.
 4. Install leaching piping solidly bedded in filtering material, with full bearing for each pipe section throughout its length. Maintain pipe alignment with no slope.
 - a. Install perforated pipe with perforations down and joints tightly closed. Install collars and couplings as required.
 - b. Install open-joint pipe with 1/2-inch (13-mm) space, maximum, between ends, unless otherwise indicated. Cover top two-thirds of joint opening with joint cover, and tie with corrosion-resistant wire. Commercial joint-cover assemblies may be provided.
 - c. Install elbow fittings with tight joints.
 - d. Place additional filtering material around sides to a minimum compacted depth of 8 inches (200 mm) above the top of leaching piping.
 5. Install filter mat over filter material before backfilling.
 6. Install leaching chambers with no slope in bottom of trench **OR** bed, **as directed**.
 - a. Install leaching chamber distribution piping with tight joints throughout chambers.
 7. Backfill according to Part 1.3 "Earthwork" Article.
- K. Mound Absorption-Field Installation
1. Plow top 6 inches (150 mm) of surface.
 2. Place layers of sand, aggregate, **as directed**, cap, and topsoil above plowed area. Provide grass topping to match adjacent vegetation. Provide side slope not steeper than 3:1. Tie slope toe smoothly into existing grade.
 3. Refer to Part 1.3 "Piping Installation" and "Pipe Joint Construction" articles for specific piping material installation.
 4. Provide solid vent pipe with vent cap extending 12 inches (300 mm) above top of mounds.
 5. Install distribution piping with no slope for pressurized effluent system.
 6. Install distribution piping at a minimum slope of 1 percent and a maximum slope of 2 percent for gravity effluent system.
 7. Install leaching piping solidly bedded in filtering material, with full bearing for each pipe section throughout its length. Maintain pipe alignment with no slope.
 - a. Install perforated pipe with perforations down and joints tightly closed. Install collars and couplings as required.
 - b. Install open-joint pipe with 1/2-inch (13-mm) space, maximum, between ends, unless otherwise indicated. Cover top two-thirds of joint opening with joint cover, and tie with corrosion-resistant wire. Commercial joint-cover assemblies may be provided.
 - c. Install elbow fittings with tight joints.
 8. Install leaching chambers with no slope above plowed area.
 - a. Install leaching chamber distribution piping with tight joints throughout chambers.
 9. Provide adequate grading around mound absorption field to prevent storm runoff from washing away a portion of mound absorption field and to prevent exposing pipes.
- L. Seepage Pit Installation



1. Excavate hole to minimum diameter of 6 inches (150 mm) greater than outside of pit lining.
 2. Do not extend pit depth into ground-water table.
 3. Install constructed-in-place seepage pits according to the following procedure if no requirements of authorities having jurisdiction apply:
 - a. Install brick pit lining material dry and laid flat with staggered joints for seepage.
 - b. Install block pit lining material dry with staggered joints and a minimum of 20 percent of blocks on side for seepage. Install precast concrete rings with notches or weep holes for seepage.
 - c. Extend pit lining material so top of manhole will be approximately 8 inches (200 mm) below finished grade.
 - d. Backfill bottom of inside of pit with filtering material at least 12 inches (300 mm) above bottom of lining material.
 - e. Extend effluent inlet pipe 12 inches (300 mm) into seepage pit and terminate into side of tee fitting.
 - f. Backfill around outside of pit lining with filtering material to top of lining.
 - g. Install manhole risers from top of pit to grade. Support cover on undisturbed soil. Do not support cover on pit lining.
- M. Identification
1. Identification materials and their installation are specified in Division 31 Section "Earth Moving". Arrange for installation of green warning tape directly over piping (including absorption-field piping), at outside edges of underground structures, and at outside edges of absorption fields.
 2. Use detectable warning tape over piping, over edges of underground structures, and over edges of absorption fields.
- N. Field Quality Control
1. System Tests: Perform testing of completed septic tank system piping and structures according to authorities having jurisdiction.
 2. Additional Tests: Fill underground structures with water and let stand overnight. If water level recedes, locate and repair leaks and retest. Repeat tests and repairs until no leaks exist.
- O. Cleaning
1. Clear interior of piping and structures of dirt and other superfluous material as work progresses.
 2. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of workday or when work stops.

END OF SECTION 32 91 19 13



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Task	Specification	Specification Description
32 91 19 13	02 41 13 13	Portland Cement Concrete Removal
32 91 19 13	31 00 00 00	Earthwork
32 91 19 13	32 18 26 00	Lawns And Grasses
32 91 19 16	02 41 13 13	Portland Cement Concrete Removal
32 91 19 16	31 00 00 00	Earthwork
32 91 19 16	32 91 19 13	Septic Tank Systems
32 91 19 16	32 18 26 00	Lawns And Grasses



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**SECTION 32 92 00 00 - MPF TURF AND GRASSES****

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information must be inserted at that location.

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes:
 - 1. Seed.
 - 2. Sod.
 - 3. Sprigs.
 - 4. Mulches.
 - 5. Asphalt Adhesive.
 - 6. Water.
 - 7. Erosion Control Material.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 311000 - Site Clearing: Mulch from recycled site debris.
 - 2. Section 312000 - Earth Moving: Topsoil material.
 - 3. Section 313200 - Soil Stabilization: Stabilization materials and procedures.
 - 4. Section 312500 - Erosion and Sedimentation Controls: Slope and erosion protection materials.
 - 5. Section 329200 - Plants: Planting materials.
 - 6. Section 092900 - Gypsum Board: Soil amendment from recycled scrap gypsum.

1.2 REFERENCES

- A. American Society For Testing and Materials (ASTM):
 - 1. ASTM C 602 - Specification for Agricultural Liming Materials.
 - 2. ASTM D 977 - Specification for Emulsified Asphalt.
- B. American Sod Producers Association (ASPA):
 - 1. ASPA STSMT - Specification for Turfgrass Sod Materials and Transplanting/Installing.



1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Assurance/Control Submittals:
 - a. Certificates:
 - 1) Submit certificate from seed supplier for each grass-seed mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
 - 2) Submit certificate from sod supplier for each seed mixture, identifying sod source, including name and telephone number of supplier.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Operation and Maintenance Data: Include maintenance instructions, cutting method and maximum grass height, types of application frequency, and recommended coverage of fertilizer for one full growing cycle.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Conform to applicable requirements of the Local and State Department of Agriculture Extension Service of the state in which the project is located.

NOTE TO SPECIFIER

****REQUIRED Article (ENVIRONMENTAL REQUIREMENTS) follows. Do not revise without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer.**

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Resource Management:
 - 1. Renewable Resources: Plants specified are indigenous, low maintenance varieties, tolerant of site's existing soils and climate without supplemental irrigation or fertilization once established.
 - a. Soil amendments: No chemical fertilizers; use organic/natural matter to support establishment of indigenous plants; use inorganic materials such as sand or gypsum to improve workability and drainage of soil as appropriate to indigenous plants.
 - b. Mulch: Provide organic mulch products.
 - 2. Recycled Content:
 - a. Wood fiber mulch: Provide products manufactured from 100 % post-consumer paper content and yard trimming composts.
 - b. Mulch from recycled site debris: Coordinate with Section 311000 - Site Clearing to identify and prepare suitable organic debris for use as mulch on site.
 - c. Soil amendment from recycled scrap gypsum: Coordinate with Section 092900 - Gypsum Board to prepare scrap gypsum board for use as soil amendment.

PART 2 - PRODUCTS

2.1 SEED

NOTE TO SPECIFIER

Edit paragraph below for classification appropriate for location of Project Site.



A. Classification:

1. [State-Certified] [State Approved] of latest season's crop delivered in original sealed packages bearing producer's guaranteed analysis for percentages of mixtures, purity, germination, weedseed content, and inert material.
2. Label in conformance with applicable state seed laws.
3. Wet, moldy, or damaged seed will be rejected.

2.2 SOD

NOTE TO SPECIFIER

Edit paragraph below for classification appropriate for location of Project Site.

A. Classification:

1. [Nursery grown] [Field] [Certified] as classified in ASPA STSMT.
2. Machine cut sod at a uniform thickness of 3/4 inch with a tolerance of 1/4 inch, excluding top growth and thatch. Each individual sod piece capable of supporting its own weight when lifted by ends.
3. Broken pads, irregularly shaped pieces, torn or uneven ends will be rejected.
4. Wood pegs and wire staples for anchorage as recommended by sod supplier.

2.3 SPRIGS

A. Healthy living stems, stolons, or rhizomes and attached roots of locally adapted grass without adhering soil, including two to three nodes, from 4 to 6 inches long, obtained from heavy and dense sod.

1. Provide sprigs which have been grown under climatic conditions similar to those in locality of Project Site.
2. Coordinate harvesting and planting operations to prevent exposure of sprigs to sun for more than 30 minutes before covering and moistening.
3. Sprigs containing weeds or other detrimental material or that are heat damaged will be rejected.

2.4 MULCHES

A. Provide mulch free from noxious weeds, mold, and other deleterious materials.

NOTE TO SPECIFIER

OPTION 1: Use paragraph below when STRAW is selected for Project.

B. Straw: Stalks from oats, wheat, rye, barley, or rice. Air-dry condition of proper consistency for placing with commercial mulch blowing equipment.

NOTE TO SPECIFIER

OPTION 2: Use paragraph below when HAY is selected for Project.

C. Hay: Use only marsh hay for lawn areas. Air-dry condition of proper consistency for placing with commercial mulch blowing equipment.

NOTE TO SPECIFIER



OPTION 3: Use paragraph below when WOOD FIBER is selected for Project.

- D. Wood Cellulose Fiber:
1. Processed to contain no growth or germination-inhibiting factors, dyed with non toxic, biodegradable dye to an appropriate color to facilitate visual metering of materials application.
 2. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 3.5 to 5.0
 3. Use with hydraulic application of grass seed and fertilizer.
 4. Provide organic mulch products manufactured from 100 percent post-consumer paper content and yard trimming composts.
 5. Manufacturers:
 - a. National Fiber, Belcher, MA, (800) 282-7711 or (413) 283-8747.
 - b. Wood Recycling Inc., Woburn, MA, (800) 982-8732 or (617) 937-0855.
 - c. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.5 TABILIZING MATERIALS

- A. Specified in Section 313200.
- B. Asphalt Adhesive: ASTM D 977, Grade RS-1. Use with straw or hay mulch.
- C. Cellulose Fiber: Use for anchoring straw. Fiber binding shall be applied at a net dry weight of 750 pounds per acre. Cellulose fiber may be mixed with water. Mixture shall contain maximum of 50 pounds of cellulose fiber per 100 gallons of water.
- D. Mulch Netting: Stake light weight plastic netting over the mulch according to manufacturer's recommendations. Stakes shall be driven to ground level.

2.6 WATER

- A. Suitable quality for irrigation.

2.7 EROSION CONTROL MATERIAL

- A. Specified in Section 312500.
- B. Net: Heavy, twisted jute mesh, plastic mesh, biodegradable paper fabric with knitted yarns, or standard weave burlap.

NOTE TO SPECIFIER

Edit paragraph below for BLANKET type selected for Project.

- C. Blanket: [Fiber] [Excelsior] [_____].

2.8 TOPSOIL

- A. Topsoil:

NOTE TO SPECIFIER

Edit paragraph below for percentage of organic matter appropriate to establishment of plants selected for Project.



1. Containing organic matter as needed to support establishment of plants; minimum [____] percent and maximum [____] percent organic matter as determined by soil testing service. Maximum particle size, 3/4 inch, with maximum 3 percent retained on 1/4 inch screen.
2. Component Percentages:
 - a. Silt: 25 to 50
 - b. Clay: 10 to 30
 - c. Sand: 20 to 30
 - d. pH: 5.5 to 7.0
 - e. Soluble Salts: 600 ppm maximum

NOTE TO SPECIFIER

Edit paragraph below to include additional inorganic material such as gypsum as needed to improve workability and drainage of soil and as appropriate to establishment of plants selected for Project.

- f. Gypsum: [____] to [____] .
- g. pH: 5.5 to 7.0.

2.9 pH ADJUSTERS

- A. Lime:
 1. Material: ASTM C 602, Class T, agricultural commercial grade ground limestone containing not less than 50 percent of total oxides.
 2. Gradation: Minimum 75 percent passing 100 mesh sieve and 100 percent passing 20 mesh sieve.
- B. Ferrous Sulfate: Commercial Grade.

NOTE TO SPECIFIER

Edit FERTILIZER below for type of fertilizer appropriate for specific soil conditions at Project Site.

2.10 FERTILIZER

- A. Bonemeal: Commercial, raw, finely ground; minimum 4 percent nitrogen and 20 percent phosphoric acid.
- B.
- C. Superphosphate: Commercial-Grade complete fertilizer of neutral character consisting of fast-and-slow-release nitrogen, 50 percent derived from natural organic sources of urea-form, phosphorous, and potassium in following composition:

NOTE TO SPECIFIER

OPTION 1: Use paragraph below when fertilizer COMPOSITION IS SPECIFIED. Edit for composition .

1. Composition: [1] [____] pound per [1000] [____] square feet of actual nitrogen, [4] [____] percent phosphorous, and [2] [____] percent potassium, by weight.

NOTE TO SPECIFIER

OPTION 2: Use paragraph below when fertilizer COMPOSITION IS DETERMINED BY "Report of Subsurface Investigation" prepared by the Geotechnical Engineer.



2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

- D. Slow-Release Fertilizer: Granular fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorous, and potassium in the following composition:

NOTE TO SPECIFIER

OPTION 1: Use paragraph below when fertilizer COMPOSITION IS SPECIFIED. Edit for composition.

1. Composition: [20] [____] percent nitrogen, [10] [____] percent phosphorous, and [10] [____] percent potassium, by weight.

NOTE TO SPECIFIER

OPTION 2: Use paragraph below when fertilizer COMPOSITION IS DETERMINED BY "Report of Subsurface Investigation" prepared by the Geotechnical Engineer.

2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from qualified soil-testing agency.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION OF SUBSOIL

- A. Prepare subsoil to eliminate uneven areas and low spots. Maintain lines, levels, profiles, and contours. Make changes in grade gradual. Blend slopes into level areas.
- B. Remove foreign materials, weeds, and undesirable plants and their roots. Remove contaminated subsoil.
- C. Scarify subsoil to a depth of 3 inches where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.
- D. Place topsoil as specified in Section 312000.

3.3 FERTILIZING

- A. Apply fertilizer in accordance with manufacturer's published instructions.



- B. Apply after smooth after smooth raking of topsoil and prior to roller compaction.
- C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.
- D. Mix thoroughly into upper 2 inches of topsoil.
- E. Lightly water to aid the dissipation of fertilizer.
- F. No chemical fertilizers.

3.4 SEEDING

- A. Sow one-half of seed in one direction and remainder at right angles to first sowing.

NOTE TO SPECIFIER

Edit paragraph below for depth selected.

- B. Cover seed to average depth of [1/2] [____] inch by means of spike-tooth harrow, cultipacker, or other recommended device.

NOTE TO SPECIFIER

Edit paragraph below for selected Seeding and depth selected.

- C. Drill Seeding:
 - 1. Use [cultipacker seeders] [grass seed drills] [____].
 - 2. Drill seed uniformly to an average depth of [1/2][____] inch and at a rate of [____] pounds per 1,000 square feet.
- D. Hydroseeding:
 - 1. Mix seed, fertilizer, and wood cellulose fiber in required amount of water to product a homogeneous slurry. Add wood cellulose fiber after seed, water, and fertilizer have been thoroughly mixed and apply at the rate of 200 pounds per acre dry weight.
 - 2. Hydraulically spray material on ground to form a blotter-like cover impregnated uniformly with grass seed.

NOTE TO SPECIFIER

Edit paragraph below for depth application rate selected.

- 3. Immediately following application of slurry mix, make separate application of wood cellulose mulch at the rate of [800] [1,000] pounds, dry weight, per acre.
- 4. Apply cover so that rainfall or applied water will percolate to underlying soil.

NOTE TO SPECIFIER

Edit paragraph below for application rate selected.

- E. Mulch:
 - 1. Spread evenly at rate of [____] tons per acre.
 - 2. Anchor by crimping mulch with serrated disc, or by spraying asphalt emulsion on mulched surface.
 - 3. Take precautionary measures to prevent asphalt materials from marking of defacing structures, pavements, utilities, or plantings.



- F. Rolling:
1. Immediately after seeding, firm entire area except for slopes in excess of 3 to 1 with a roller not exceeding 90 pounds for each foot of roller width.
 2. If seeding is performed with cultipacker-type seeder or hydroseeding, rolling may be eliminated.
- G. Erosion Control Material: Install in accordance with manufacturer's instructions.

3.5 SODDING

- A. Placing:
1. Place a maximum of 20 hours after initial harvesting, in accordance with ASPA GSS as modified herein.
 2. Thoroughly moisten areas to be sodded immediately prior to placing.

NOTE TO SPECIFIER

Edit paragraph below for sod spacing and overseeding locations selected.

- B. Spot Sodding:
1. Cut sod into plugs 2 inches square or 2 inches in diameter. Place individual pieces on [____] inch centers and press firmly into soil by foot pressure or by tamping.
 2. Overseed for erosion control on [all] [3 to 1 or greater slopes and drainage ways in] spot sodded areas.
 3. Place seed, as specified above, at the rate of [____] pounds per 1,000 square feet.
- C. Slopes and Ditches:
1. For slopes 2:1 and greater, lay with long edge parallel to slope.
 2. V-ditches and flat bottomed ditches, lay with long edge perpendicular to flow of water.
 3. Anchor each piece of sod with wood pegs or wire staples maximum 2 feet on center.
 4. On slope areas, start sodding at bottom of slope.
- D. Finishing: After completing sodding, blend edges of sodded area smoothly into surrounding area.
- E. Watering: Start immediately after completing each day's sodding. Apply at a rate sufficient to ensure thorough wetting of soil to minimum depth of 4 inches.

3.6 SPRIGGING

- A. Rate:
1. Perform a maximum 36 hours after initial harvesting. Inspect sprigs for heat damage during planting operation.
 2. Plant groups of sprigs at 12 inch maximum intervals. Limit interval between dropping sprigs and covering with soil to 10 minutes.

- B. Planting:

NOTE TO SPECIFIER

OPTION 1: Use paragraph below when BROADCAST method is selected.

1. Broadcast sprigs by hand, manure spreader, or other suitable devices over prepared surface. Force sprigs into soil to a depth of approximately 4 inches with disk harrow or other recommended equipment.



NOTE TO SPECIFIER

OPTION 2: Use paragraph below when FURROW PLANTING method is selected.

2. Plant sprigs in furrows spaced a maximum 12 inches apart. Immediately after opening furrows, place sprigs. Fill furrows so that surface is flush with designated grade and a live portion of each sprig is exposed.

NOTE TO SPECIFIER

OPTION 3: Use paragraph below when FLUSH PLANTING method is selected.

3. Plant to a depth of approximately 4 inches and cover sprigs so that surface is flush with designated grade and a live portion of each sprig is exposed.

NOTE TO SPECIFIER

Edit paragraph below for OVERSEEDING rate selected.

- C. Overseeding: Broadcast additional seed as specified above, at the rate of [____] pounds per 1000 square feet.
- D. Rolling: Immediately after completion of sprigging operations and additional seeding, if required, roll planted area with cultipacker or roller not exceeding 90 pounds for each foot of roller width.
- E. Watering: Apply at time of sprigging operations at a rate sufficient to ensure thorough wetting of soil to a depth of 4 inches.

3.7 CLEANING AND PROTECTION

- F. Remove soil and debris created by lawn work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto surface of roads, walks, or other paved areas.
- G. Immediately after seeding, sodding or sprigging, protect the area against traffic or other use.
- H. Restore existing lawn and grass areas which have been damaged during execution of this work to original condition.
- I. Keep one paved pedestrian access route and one paved vehicular access route to each building clean at all time. Clean other paving when work in adjacent areas is complete.

3.7 ESTABLISHMENT PERIOD

- A. Definitions:
 1. Lawns and grasses establishment period will be in effect until lawns and grasses have been mowed 3 times.
 2. Stand of lawn and grass is 95 percent ground cover of established species.

NOTE TO SPECIFIER

Edit paragraph below for grass average height and fertilizer type selected.

- B. Maintenance During Establishment Period:
 1. Mow lawns and grassed areas to an average height of [____] inches whenever average height of grass becomes [____] inches.



2. Promotion of growth: Mow, remove excess clippings, eradicate weeds, water, fertilize, overseed, and perform other operations necessary to promote growth.
3. Post-fertilize areas with [commercial grade] [controlled release] fertilizer approximately [____] days after planting and at intervals of [____] weeks thereafter until accepted. Apply fertilizer uniformly at the rate of [____] pounds per 1,000 square feet.

3.8 FINAL INSPECTION AND ACCEPTANCE

A. Final Inspection and Acceptance:

1. Final inspection will be made upon written request from the Contractor at least 10 days prior to last day of lawn and grasses establishment period.

NOTE TO SPECIFIER

Edit paragraph below for application rate selected.

2. Final acceptance will be based upon a satisfactory stand of lawns and grasses as defined in the paragraph entitled, "Establishment Period." [Prior to final acceptance apply [[____] pounds per 1,000 square feet] [[____] pounds per acre]] of controlled release fertilizer.

B. Replanting: Replant areas which do not have a satisfactory stand of lawns and grasses.

C. Contractor is to maintain lawns and grasses for one year from completion.

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Last revised: 6/10/2011

END OF SECTION 32 92 00 00

**SECTION 32 92 00 00 - CSF TURF AND GRASSES****

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information must be inserted at that location.

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes:
 - 1. Seed.
 - 2. Sod.
 - 3. Sprigs.
 - 4. Mulches.
 - 5. Asphalt Adhesive.
 - 6. Water.
 - 7. Erosion Control Material.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 311000 - Site Clearing: Mulch from recycled site debris.
 - 2. Section 312000 - Earth Moving: Topsoil material.
 - 3. Section 313200 - Soil Stabilization: Stabilization materials and procedures.
 - 4. Section 312500 - Erosion and Sedimentation Controls: Slope and erosion protection materials.
 - 5. Section 329200 - Plants: Planting materials.
 - 6. Section 092900 - Gypsum Board: Soil amendment from recycled scrap gypsum.

1.2 REFERENCES

- A. American Society For Testing and Materials (ASTM):
 - 1. ASTM C 602 - Specification for Agricultural Liming Materials.
 - 2. ASTM D 977 - Specification for Emulsified Asphalt.
- B. American Sod Producers Association (ASPA):
 - 1. ASPA STSMT - Specification for Turfgrass Sod Materials and Transplanting/Installing.



1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
1. Assurance/Control Submittals:
 - a. Certificates:
 - 1) Submit certificate from seed supplier for each grass-seed mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
 - 2) Submit certificate from sod supplier for each seed mixture, identifying sod source, including name and telephone number of supplier.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
1. Operation and Maintenance Data: Include maintenance instructions, cutting method and maximum grass height, types of application frequency, and recommended coverage of fertilizer for one full growing cycle.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Conform to applicable requirements of the Local and State Department of Agriculture Extension Service of the state in which the project is located.

NOTE TO SPECIFIER

***REQUIRED Article (ENVIRONMENTAL REQUIREMENTS) follows. Do not revise without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer.*

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Resource Management:
1. Renewable Resources: Plants specified are indigenous, low maintenance varieties, tolerant of site's existing soils and climate without supplemental irrigation or fertilization once established.
 - a. Soil amendments: No chemical fertilizers; use organic/natural matter to support establishment of indigenous plants; use inorganic materials such as sand or gypsum to improve workability and drainage of soil as appropriate to indigenous plants.
 - b. Mulch: Provide organic mulch products.
 2. Recycled Content:
 - a. Wood fiber mulch: Provide products manufactured from 100 % post-consumer paper content and yard trimming composts.
 - b. Mulch from recycled site debris: Coordinate with Section 311000 - Site Clearing to identify and prepare suitable organic debris for use as mulch on site.
 - c. Soil amendment from recycled scrap gypsum: Coordinate with Section 092900 - Gypsum Board to prepare scrap gypsum board for use as soil amendment.

PART 2 - PRODUCTS

2.1 SEED

NOTE TO SPECIFIER

Edit paragraph below for classification appropriate for location of Project Site.



A. Classification:

1. [State-Certified] [State Approved] of latest season's crop delivered in original sealed packages bearing producer's guaranteed analysis for percentages of mixtures, purity, germination, weedseed content, and inert material.
2. Label in conformance with applicable state seed laws.
3. Wet, moldy, or damaged seed will be rejected.

2.2 SOD

NOTE TO SPECIFIER

Edit paragraph below for classification appropriate for location of Project Site.

A. Classification:

1. [Nursery grown] [Field] [Certified] as classified in ASPA STSMT.
2. Machine cut sod at a uniform thickness of 3/4 inch with a tolerance of 1/4 inch, excluding top growth and thatch. Each individual sod piece capable of supporting its own weight when lifted by ends.
3. Broken pads, irregularly shaped pieces, torn or uneven ends will be rejected.
4. Wood pegs and wire staples for anchorage as recommended by sod supplier.

2.3 SPRIGS

A. Healthy living stems, stolons, or rhizomes and attached roots of locally adapted grass without adhering soil, including two to three nodes, from 4 to 6 inches long, obtained from heavy and dense sod.

1. Provide sprigs which have been grown under climatic conditions similar to those in locality of Project Site.
2. Coordinate harvesting and planting operations to prevent exposure of sprigs to sun for more than 30 minutes before covering and moistening.
3. Sprigs containing weeds or other detrimental material or that are heat damaged will be rejected.

2.4 MULCHES

A. Provide mulch free from noxious weeds, mold, and other deleterious materials.

NOTE TO SPECIFIER

OPTION 1: Use paragraph below when STRAW is selected for Project.

B. Straw: Stalks from oats, wheat, rye, barley, or rice. Air-dry condition of proper consistency for placing with commercial mulch blowing equipment.

NOTE TO SPECIFIER

OPTION 2: Use paragraph below when HAY is selected for Project.

C. Hay: Use only marsh hay for lawn areas. Air-dry condition of proper consistency for placing with commercial mulch blowing equipment.

NOTE TO SPECIFIER



OPTION 3: Use paragraph below when WOOD FIBER is selected for Project.

D. Wood Cellulose Fiber:

1. Processed to contain no growth or germination-inhibiting factors, dyed with non toxic, biodegradable dye to an appropriate color to facilitate visual metering of materials application.
2. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 3.5 to 5.0
3. Use with hydraulic application of grass seed and fertilizer.
4. Provide organic mulch products manufactured from 100 percent post-consumer paper content and yard trimming composts.
5. Manufacturers:
 - a. National Fiber, Belcher, MA, (800) 282-7711 or (413) 283-8747.
 - b. Wood Recycling Inc., Woburn, MA, (800) 982-8732 or (617) 937-0855.
 - c. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.5 TABILIZING MATERIALS

- A. Specified in Section 313200.
- B. Asphalt Adhesive: ASTM D 977, Grade RS-1. Use with straw or hay mulch.
- C. Cellulose Fiber: Use for anchoring straw. Fiber binding shall be applied at a net dry weight of 750 pounds per acre. Cellulose fiber may be mixed with water. Mixture shall contain maximum of 50 pounds of cellulose fiber per 100 gallons of water.
- D. Mulch Netting: Stake light weight plastic netting over the mulch according to manufacturer's recommendations. Stakes shall be driven to ground level.

2.6 WATER

- A. Suitable quality for irrigation.

2.7 EROSION CONTROL MATERIAL

- A. Specified in Section 312500.
- B. Net: Heavy, twisted jute mesh, plastic mesh, biodegradable paper fabric with knitted yarns, or standard weave burlap.

NOTE TO SPECIFIER

Edit paragraph below for BLANKET type selected for Project.

- C. Blanket: [Fiber] [Excelsior] [_____].

2.8 TOPSOIL

- A. Topsoil:

NOTE TO SPECIFIER

Edit paragraph below for percentage of organic matter appropriate to establishment of plants selected for Project.



1. Containing organic matter as needed to support establishment of plants; minimum [____] percent and maximum [____] percent organic matter as determined by soil testing service. Maximum particle size, 3/4 inch, with maximum 3 percent retained on 1/4 inch screen.
2. Component Percentages:
 - a. Silt: 25 to 50
 - b. Clay: 10 to 30
 - c. Sand: 20 to 30
 - d. pH: 5.5 to 7.0
 - e. Soluble Salts: 600 ppm maximum

NOTE TO SPECIFIER

Edit paragraph below to include additional inorganic material such as gypsum as needed to improve workability and drainage of soil and as appropriate to establishment of plants selected for Project.

- f. Gypsum: [____] to [____] .
- g. pH: 5.5 to 7.0.

2.9 pH ADJUSTERS

- A. Lime:
 1. Material: ASTM C 602, Class T, agricultural commercial grade ground limestone containing not less than 50 percent of total oxides.
 2. Gradation: Minimum 75 percent passing 100 mesh sieve and 100 percent passing 20 mesh sieve.
- B. Ferrous Sulfate: Commercial Grade.

NOTE TO SPECIFIER

Edit FERTILIZER below for type of fertilizer appropriate for specific soil conditions at Project Site.

2.10 FERTILIZER

- A. Bonemeal: Commercial, raw, finely ground; minimum 4 percent nitrogen and 20 percent phosphoric acid.
- B.
- C. Superphosphate: Commercial-Grade complete fertilizer of neutral character consisting of fast-and-slow-release nitrogen, 50 percent derived from natural organic sources of urea-form, phosphorous, and potassium in following composition:

NOTE TO SPECIFIER

OPTION 1: Use paragraph below when fertilizer COMPOSITION IS SPECIFIED. Edit for composition .

1. Composition: [1] [____] pound per [1000] [____] square feet of actual nitrogen, [4] [____] percent phosphorous, and [2] [____] percent potassium, by weight.

NOTE TO SPECIFIER

OPTION 2: Use paragraph below when fertilizer COMPOSITION IS DETERMINED BY "Report of Subsurface Investigation" prepared by the Geotechnical Engineer.



2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

- D. Slow-Release Fertilizer: Granular fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorous, and potassium in the following composition:

NOTE TO SPECIFIER

OPTION 1: Use paragraph below when fertilizer COMPOSITION IS SPECIFIED. Edit for composition.

1. Composition: [20] [____] percent nitrogen, [10] [____] percent phosphorous, and [10] [____] percent potassium, by weight.

NOTE TO SPECIFIER

OPTION 2: Use paragraph below when fertilizer COMPOSITION IS DETERMINED BY "Report of Subsurface Investigation" prepared by the Geotechnical Engineer.

2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from qualified soil-testing agency.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION OF SUBSOIL

- A. Prepare subsoil to eliminate uneven areas and low spots. Maintain lines, levels, profiles, and contours. Make changes in grade gradual. Blend slopes into level areas.
- B. Remove foreign materials, weeds, and undesirable plants and their roots. Remove contaminated subsoil.
- C. Scarify subsoil to a depth of 3 inches where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.
- D. Place topsoil as specified in Section 312000.

3.3 FERTILIZING

- A. Apply fertilizer in accordance with manufacturer's published instructions.



- B. Apply after smooth after smooth raking of topsoil and prior to roller compaction.
- C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.
- D. Mix thoroughly into upper 2 inches of topsoil.
- E. Lightly water to aid the dissipation of fertilizer.
- F. No chemical fertilizers.

3.4 SEEDING

- A. Sow one-half of seed in one direction and remainder at right angles to first sowing.

NOTE TO SPECIFIER

Edit paragraph below for depth selected.

- B. Cover seed to average depth of [1/2] [____] inch by means of spike-tooth harrow, cultipacker, or other recommended device.

NOTE TO SPECIFIER

Edit paragraph below for selected Seeding and depth selected.

- C. Drill Seeding:
 - 1. Use [cultipacker seeders] [grass seed drills] [____].
 - 2. Drill seed uniformly to an average depth of [1/2][____] inch and at a rate of [____] pounds per 1,000 square feet.
- D. Hydroseeding:
 - 1. Mix seed, fertilizer, and wood cellulose fiber in required amount of water to product a homogeneous slurry. Add wood cellulose fiber after seed, water, and fertilizer have been thoroughly mixed and apply at the rate of 200 pounds per acre dry weight.
 - 2. Hydraulically spray material on ground to form a blotter-like cover impregnated uniformly with grass seed.

NOTE TO SPECIFIER

Edit paragraph below for depth application rate selected.

- 3. Immediately following application of slurry mix, make separate application of wood cellulose mulch at the rate of [800] [1,000] pounds, dry weight, per acre.
- 4. Apply cover so that rainfall or applied water will percolate to underlying soil.

NOTE TO SPECIFIER

Edit paragraph below for application rate selected.

- E. Mulch:
 - 1. Spread evenly at rate of [____] tons per acre.
 - 2. Anchor by crimping mulch with serrated disc, or by spraying asphalt emulsion on mulched surface.
 - 3. Take precautionary measures to prevent asphalt materials from marking of defacing structures, pavements, utilities, or plantings.



- F. Rolling:
1. Immediately after seeding, firm entire area except for slopes in excess of 3 to 1 with a roller not exceeding 90 pounds for each foot of roller width.
 2. If seeding is performed with cultipacker-type seeder or hydroseeding, rolling may be eliminated.
- G. Erosion Control Material: Install in accordance with manufacturer's instructions.

3.5 SODDING

- A. Placing:
1. Place a maximum of 20 hours after initial harvesting, in accordance with ASPA GSS as modified herein.
 2. Thoroughly moisten areas to be sodded immediately prior to placing.

NOTE TO SPECIFIER

Edit paragraph below for sod spacing and overseeding locations selected.

- B. Spot Sodding:
1. Cut sod into plugs 2 inches square or 2 inches in diameter. Place individual pieces on [____] inch centers and press firmly into soil by foot pressure or by tamping.
 2. Overseed for erosion control on [all] [3 to 1 or greater slopes and drainage ways in] spot sodded areas.
 3. Place seed, as specified above, at the rate of [____] pounds per 1,000 square feet.
- C. Slopes and Ditches:
1. For slopes 2:1 and greater, lay with long edge parallel to slope.
 2. V-ditches and flat bottomed ditches, lay with long edge perpendicular to flow of water.
 3. Anchor each piece of sod with wood pegs or wire staples maximum 2 feet on center.
 4. On slope areas, start sodding at bottom of slope.
- D. Finishing: After completing sodding, blend edges of sodded area smoothly into surrounding area.
- E. Watering: Start immediately after completing each day's sodding. Apply at a rate sufficient to ensure thorough wetting of soil to minimum depth of 4 inches.

3.6 SPRIGGING

- A. Rate:
1. Perform a maximum 36 hours after initial harvesting. Inspect sprigs for heat damage during planting operation.
 2. Plant groups of sprigs at 12 inch maximum intervals. Limit interval between dropping sprigs and covering with soil to 10 minutes.

- B. Planting:

NOTE TO SPECIFIER

OPTION 1: Use paragraph below when BROADCAST method is selected.

1. Broadcast sprigs by hand, manure spreader, or other suitable devices over prepared surface. Force sprigs into soil to a depth of approximately 4 inches with disk harrow or other recommended equipment.



NOTE TO SPECIFIER

OPTION 2: Use paragraph below when FURROW PLANTING method is selected.

2. Plant sprigs in furrows spaced a maximum 12 inches apart. Immediately after opening furrows, place sprigs. Fill furrows so that surface is flush with designated grade and a live portion of each sprig is exposed.

NOTE TO SPECIFIER

OPTION 3: Use paragraph below when FLUSH PLANTING method is selected.

3. Plant to a depth of approximately 4 inches and cover sprigs so that surface is flush with designated grade and a live portion of each sprig is exposed.

NOTE TO SPECIFIER

Edit paragraph below for OVERSEEDING rate selected.

- C. Overseeding: Broadcast additional seed as specified above, at the rate of [____] pounds per 1000 square feet.
- D. Rolling: Immediately after completion of sprigging operations and additional seeding, if required, roll planted area with cultipacker or roller not exceeding 90 pounds for each foot of roller width.
- E. Watering: Apply at time of sprigging operations at a rate sufficient to ensure thorough wetting of soil to a depth of 4 inches.

3.7 CLEANING AND PROTECTION

- F. Remove soil and debris created by lawn work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto surface of roads, walks, or other paved areas.
- G. Immediately after seeding, sodding or sprigging, protect the area against traffic or other use.
- H. Restore existing lawn and grass areas which have been damaged during execution of this work to original condition.
- I. Keep one paved pedestrian access route and one paved vehicular access route to each building clean at all time. Clean other paving when work in adjacent areas is complete.

3.7 ESTABLISHMENT PERIOD

- A. Definitions:
 1. Lawns and grasses establishment period will be in effect until lawns and grasses have been mowed 3 times.
 2. Stand of lawn and grass is 95 percent ground cover of established species.

NOTE TO SPECIFIER

Edit paragraph below for grass average height and fertilizer type selected.

- B. Maintenance During Establishment Period:
 1. Mow lawns and grassed areas to an average height of [____] inches whenever average height of grass becomes [____] inches.



2. Promotion of growth: Mow, remove excess clippings, eradicate weeds, water, fertilize, overseed, and perform other operations necessary to promote growth.
3. Post-fertilize areas with [commercial grade] [controlled release] fertilizer approximately [____] days after planting and at intervals of [____] weeks thereafter until accepted. Apply fertilizer uniformly at the rate of [____] pounds per 1,000 square feet.

3.8 FINAL INSPECTION AND ACCEPTANCE

A. Final Inspection and Acceptance:

1. Final inspection will be made upon written request from the Contractor at least 10 days prior to last day of lawn and grasses establishment period.

NOTE TO SPECIFIER

Edit paragraph below for application rate selected.

2. Final acceptance will be based upon a satisfactory stand of lawns and grasses as defined in the paragraph entitled, "Establishment Period." [Prior to final acceptance apply [[____] pounds per 1,000 square feet] [[____] pounds per acre]] of controlled release fertilizer.

- B. Replanting: Replant areas which do not have a satisfactory stand of lawns and grasses.
- C. Contractor is to maintain lawns and grasses for one year from completion.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION 32 92 00 00



Task	Specification	Specification Description
32 92 19 13	32 18 26 00	Lawns And Grasses
32 92 19 19	32 18 26 00	Lawns And Grasses
32 92 23 00	32 18 26 00	Lawns And Grasses
32 92 26 00	32 18 26 00	Lawns And Grasses



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**SECTION 32 93 00 00 - MPF PLANTS****

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information must be inserted at that location.

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes:
 - 1. Plants, Trees and Shrubs.
 - 2. Antidesiccants.
 - 3. Pesticides.
 - 4. Fertilizer.
 - 5. Planting Soil Mixtures.
 - 6. Membrane Ground Covers.
 - 7. Drainage Pipe and Bedding.
 - 8. Mulches.
 - 9. Edging Material.
 - 10. Trunk Wrapping Material.
 - 11. Staking and Guying Material.
 - 12. Water.
 - 13. Maintenance of Existing Erosion Control.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 311000 - Site Clearing: Mulch from recycled site debris.
 - 2. Section 312000 - Earth Moving: Topsoil materials.
 - 3. Section 313200 - Soil Stabilization: Stabilization materials and procedures.
 - 4. Section 312500 - Erosion and Sedimentation Controls: Slope and erosion protection materials.
 - 5. Section 329200 - Turf and Grasses: Grass, sod, and sprigs.

1.2 REFERENCES

- A. American National Standards Institute (ANSI):



1. ANSI Z60.1 - American Standard for Nursery stock.

B. American Society for Testing and Materials (ASTM):

1. ASTM C 4 - Specification for Clay Drain Tile.
2. ASTM C 136 - Method for Sieve Analysis of fine and Coarse Aggregates.
3. ASTM C 498 - Specification for Perforated Clay Drain Tile.
4. ASTM C 700 - Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated.
5. ASTM D 1621 - Test Method for Compressive Properties of Rigid Cellular Plastics.
6. ASTM D 2103 - Specification for Polyethylene Film and Sheeting.
7. ASTM D2178 - Specification for Asphalt Glass (Felt) Used in Roofing and Waterproofing.
8. ASTM D 2729 - Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
9. ASTM D 4491 - Test Methods for Water Permeability of Geotextiles by Permittivity.
10. ASTM D 4716 - Test Method for Constant Head Hydraulic Transmissivity (In-Plane Flow) of Geotextiles and Geotextile Related Products.
11. ASTM F 405 - Specification for Corrugated Polyethylene (PE) Tubing and Fittings.

C. National Arborist Association (NAA):

1. NAA PSST - Pruning Standards for Shade Trees.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

- a. Assurance/Control Submittals:
- b. Delivery Schedule: Submit schedule of delivery of trees, plants, and ground covers minimum 10 days prior to first scheduled delivery.
- c. Pesticide Control Plan:
 - 1) Submit plan for proposed sequence of pesticide application including common name, chemical composition, formulation, concentration rate, and method of application of each type of pesticide.

B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.

1. Operation and Maintenance Data: Include maintenance instructions recommending procedures to be established by United States Postal Service for maintenance of trees, plants, and ground covers during entire year. Include cutting and trimming method and types, application frequency, and recommended coverage of fertilizer. Submit before expiration of maintenance during plant establishment period.

1.4 QUALITY ASSURANCE

A. Horticultural Standards:

1. Names conform to "Standardized Plant Names" by American Joint Committee on horticultural Nomenclature.
2. Material selection, sizing, transportation, protection and planting in accordance with "American Standard for Nursery Stock", by American Association of Nurserymen and American National Standard Institute (ANSI) Publication Z60.1.

B. Regulatory Agencies: Conform to applicable requirements of the Local and State Department of Agriculture Extension Service of State where Project is located.

C. Plant, tree, and shrub materials will be inspected by Contracting Officer at growing site; tagged for size and quality, and approved for delivery.



1.5 DELIVERY, STORAGE AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Delivery:
 - 1. Branched Plants: Branches tied and exposed branches covered with material that allows air circulation. Prevent damage to root balls and desiccation of leaves.
 - 2. Fertilizer and Lime: In original, unopened containers bearing manufacturer's chemical analysis, name, trade name, or trademark, and indication of conformance to state and federal rules and regulations. May be furnished in bulk with certificate indicating above information.
 - 3. Labels: Durable waterproof labels in weather-resistant ink, legible for a minimum of 60 days after delivery to planting location, stating the correct name and size as specified in the list of required plants. Attach to plants, bundles and containers of plants. Groups of plants may be labeled by tagging one plant.
 - 4. Pesticides: In original unopened containers with legible label indicating Environmental Protection Agency (EPA) registration number and manufacturer's registered uses.
- C. Storage:
 - 1. Plants, Trees and Shrubs: Store and protect plants not planted on day of arrival at Project Site as follows:
 - a. Shade and protect plants in outside storage areas protected from wind and direct sunlight until planted.
 - b. Heel-in bare root plants.
 - c. Protect balled and burlapped plants from freezing or drying out by covering balls or roots with moist burlap, sawdust, wood chips, shredded bark, peat moss, or other approved material. Provide covering which allows air circulation.
 - d. Keep all plants in a moist condition by watering with fine mist spray until planted.
 - 2. Lime, Fertilizers, Mulch: Store in dry locations away from contaminants.
 - 3. Pesticides, Antidesiccants: Do not store with other landscape materials.
- D. Handling: Do not drop or dump materials from vehicles. Handle plants by rootballs or containers. Do not lift or carry by stems or crown.

1.6 PROJECT CONDITIONS

- A. Jobsite Requirements:
 - 1. Protection of Personnel and Property: Apply pesticides so damage will not result to personnel or property from either direct spray or drifting of chemicals both on and off site.
 - 2. Disposal of Excess Chemicals and Containers: In accordance with federal and state laws.

NOTE TO SPECIFIER

"REQUIRED Article (Environmental Requirements) follows. Do not revise this Article, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer."

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Resource Management:
 - 1. Renewable Resources: Plants specified are indigenous, low maintenance varieties, tolerant of site's existing soils and climate without supplemental irrigation or fertilization once established.
 - a. Soil amendments: No chemical fertilizers; use organic matter to support establishment of indigenous plants; use inorganic materials such as sand or gypsum to improve workability and drainage of soil as appropriate to indigenous plants.
 - b. Mulch: Provide organic mulch products.



- c. Pesticides: No chemical pesticides.
- 2. Recycled Content:
 - a. Mulch from recycled site debris: Coordinate with Section 311000 - Site Clearing to identify and prepare suitable organic debris for use as mulch on site.

1.8 WARRANTY

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Submit written warranty signed by material supplier and installer agreeing that they will:
 - 1. Warrant plants, trees and shrubs unconditionally for 1 year or 1 full growing season, whichever is greater.
 - 2. Replace any material diseased or 25 percent dead or more at no additional cost to United States Postal Service.
 - 3. Warrant deciduous material to break dormancy if planted in dormant season.
 - 4. Warrant perennials to show signs of healthy growth by May 15 to June 1.
 - 5. Provide replacement material during next planting period.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Pre-Bid: If any plant specified is not obtainable, submit a written substitution request to Contracting Officer during bidding.
- B. Substitutions of planting materials will not be permitted unless authorized by Contracting Officer.

NOTE TO SPECIFIER

Edit PLANTS, TREES, AND SHRUBS for planting used for specific Project.

2.2 PLANTS, TREES, AND SHRUBS

- A. Varieties: Botanical names indicated are listed in "HORTUS III". Furnish nursery stock in accordance with ANSI Z60.1, except as otherwise specified or indicated. Furnish plants grown under climatic conditions similar to those in locality of Project Site. Spray plants budding into leaf of having soft growth with an antidesiccant before digging. Provide plants of same specified size in uniform size and character of growth.
- B. Shape: Well branched, well formed, sound, vigorous, healthy planting stock free from disease, sunscald, windburn, abrasion, and harmful insects or insect eggs and having healthy, normal, and unbroken root system.
- C. Deciduous Trees and Shrubs: Symmetrical tops with typical spread of branches for each particular species or variety.
- D. Evergreen Trees and Shrubs: Well developed symmetrical tops with typical spread of branches for each particular species or variety.



- E. Ground Covers and Vines: Number and length of runners and clump sizes indicated, and of proper age for grade of plants indicated, furnished in removable containers, integral containers or formed homogeneous soil section.
- F. Size: Minimum sizes measured before pruning and with branches in normal position, conform to measurements indicated, based on average width or height of plant for species specified in ANSI Z60.1. Plants of larger size than specified may be used with approval of Contracting Officer. When larger plants are used, increase ball of earth or spread of roots in accordance with ANSI Z60.1.
- G. Balled and Burlapped (B&B) and Balled and Potted (B&P) Plants: Ball size and ratios, conform to ANSI Z60.1. Ball plants with firm, natural balls of soil. Wrap B&B plants firmly with burlap or strong cloth, and tie securely.
- H. Balled and Platformed (BP) Plants: Wrap and ball in same manner as B&B plants and fasten securely to strong platforms.
- I. Bare-Root Plants: Dig with root system substantially intact but with earth carefully removed. Cover roots with a thick coating of mud by puddling after plants are dug or wrap with moist material immediately after digging.
- J. Container Grown Plants: Sufficient root growth to hold earth intact when removed from containers. Root bound plants not permitted.

NOTE TO SPECIFIER

Use paragraph below when RELOCATION OF EXISTING PLANTS is a part of the Work.

- K. Existing Plants for Relocation: Ball sizes shall conform to requirements for collected plants in ANSI Z60.1.

NOTE TO SPECIFIER

Add additional Products and manufacturers as appropriate for specific Project.

2.3 ANTIDESICCANTS

- A. Antidesiccants: Subject to compliance with requirements, manufacturers offering specified items which may be incorporated in the work include the following.
 1. "Vapor Guard" - Miller Chemicals & Fertilizer Corp.; Hanover, PA (717) 632-8921.
 2. [_____].

2.4 PESTICIDES

- A. Soil fumigant, herbicide, insecticide and fungicide, EPA registered and state approved. Furnish for preemergence and postemergence application(s).

NOTE TO SPECIFIER

Edit FERTILIZERS below for specific soil conditions at Project Site.



2.5 FERTILIZERS

- A. Commercial Grade Fertilizer: Granular, free flowing, and uniform in composition with nitrogen-phosphorus-potash ratio of [____] nitrogen, [____] available phosphorus, and [____] potash.
- B. Controlled Release Fertilizer: Magnesium ammonia phosphate and magnesium potassium phosphate with nitrogen-phosphorus-potassium ratio, [____] percent nitrogen, [____] percent phosphorus, and [____] percent potassium, granulated to pass 1/8 inch screen.

NOTE TO SPECIFIER

Edit PLANTING SOIL MIXTURES below for specific soil conditions at Project Site.

2.6 PLANTING SOIL MIXTURES

- A. [____] part topsoil, [____] parts [____], and [____] parts [____].

2.7 MEMBRANE GROUND COVERS

NOTE TO SPECIFIER

OPTION 1: Use paragraph below when SHEET POLYETHYLENE is appropriate for Project. Select mil thickness.

- A. Sheet Polyethylene: Black, conforming to ASTM D2103, minimum thickness [4 mils] [6 mils].

NOTE TO SPECIFIER

OPTION 2: Use paragraph below when ASPHALT GLASS FELT is appropriate for Project.

- B. Asphalt Glass Felt: ASTM D2178; Types I, III or IV.

NOTE TO SPECIFIER

OPTION 3: Use paragraph below when ROLL TYPE FIBERGLASS MATS is appropriate for Project. Select mil thickness.

- C. Roll Type Fiberglass Mats: 100 percent lime borosilicate glass fibers with an average fiber diameter of 8 to 12 microns and 2 to 4 inch strands of fiber bonded with phenol formaldehyde resin, water permeable, having a minimum of 1/4 inch and a maximum of 1/2 inch thickness with a density of not less than 3/4 pound per cubic foot.

2.8 DRAINAGE PIPE AND BEDDING

NOTE TO SPECIFIER

OPTION 1: Use paragraph below when DRAINAGE PIPE is selected for Project. Edit for sizes and types of materials required for Project Site conditions.

- A. Drainage Pipe for Plant Pits and Beds: [Plastic polyvinyl chloride pipe, [____] inches in diameter, [unperforated] [perforated] conforming to ASTM D2729.] [Corrugated plastic drainage tubing, [____] inches in diameter, [unperforated] [perforated] conforming to ASTM F405.] [Clay drain tile, [____]



inches in diameter, [unperforated as specified in ASTM C4] [perforated conforming to ASTM C498] [extra strength] [standard strength] conforming to ASTM C700].

NOTE TO SPECIFIER

OPTION 2: Use paragraph below when GRANULAR FILL is selected for Project.

- B. Granular Fill for Plant Pit and Bed Drainage: Uniformly graded sand, stone, gravel, or stone screening free from an excess of soft or unsound particles or other objectionable material. When testing in accordance with ASTM C136, material shall conform to the following gradation limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
3/8 inch 100	
No. 4	85 - 100
No. 16	45 - 80
No. 50	10 - 30
No. 100	0 - 10
No. 200	0 - 3

NOTE TO SPECIFIER

OPTION 3: Use paragraph below when DRAINAGE BOARD is selected for Project.

- C. Drainage Board for Planters:
1. Drainage Board for Planters:
 - a. "Miradrain 9000" - Miradri Moisture Protection Products.; Norcross, GA (888) 863-6781.
 - b. "Hydraway WD3000" - Solutia, Inc.; St. Louis, MO (800) 325-4330.
 - c. "Deck Drain" - Greenstreak; St. Louis, MO (800) 325-9504.

2.9 MULCHES

- A. Free from noxious weeds, mold, or other deleterious materials.

NOTE TO SPECIFIER

OPTION 1: Use paragraph below when INERT MULCH is selected for Project. Edit for types and sizes.

- B. Inert Mulch Materials: [Riverbank stone] [Crushed pit-run rock] [Granite chips] [Marble chips] [Crushed bricks] [Volcanic rock] [_____] ranging in size from [_____] to [_____] inch(es).

NOTE TO SPECIFIER

OPTION 2: Use paragraph below when ORGANIC MULCH is selected for Project. Edit for types and sizes.

- C. Organic Mulch Materials: [Ground or shredded bark] [Shredded hardwood] [Pine needles] [Cypress] ranging in size from [_____] to [_____] inch(es).

2.10 EDGING

NOTE TO SPECIFIER

OPTION 1: Use paragraph below when WOOD EDGING is selected for Project.

- A. Wood Edging: Minimum 8 inches by 1/2 inch, treated in accordance with AWPA C2 with CCA Type C or ACA before installation, free of solvent at time of delivery.



1. Anchoring Stakes: Same material as wood edging, 1/2 inch by 2 inches, 12 inches long.

NOTE TO SPECIFIER

OPTION 2: Use paragraph below when METAL EDGING is selected for Project. Edit for types and sizes.

- B. Metal Edging: [Galvanized steel] [Aluminum with slots for stakes], [1/4] [3/16] [1/8] inch thick by [4] [5] inches deep in [16] [20] foot length. Treat steel edging with rust preventative and factory finish in color [green] [black].
 1. Anchoring Stakes: Tapered galvanized steel with same finish as metal edging, 16 to 18 inch long.

2.11 TRUNK WRAPPING

- A. Two thicknesses burlap minimum 4 inch width.
- B. Tying Material: 3 ply, lightly tarred medium or coarse sisal yarn twine.

2.12 STAKING AND GUYING

- A. Tree Support Stakes: Rough sawn hard wood free of knots, rot, cross grain, bark, long slivers, or other defects that impair strength. Minimum 2 inches square or 2 1/2 inch diameter by 8 feet long, pointed at one end. Paint or stain wood stakes dark brown.
- B. Guying Wire: 12 gauge galvanized steel.
- C. Hose Chafing Guards: New or used 2 ply, 3/4 inch diameter, reinforced rubber or plastic hose, black or dark green, all of same color.
- D. Flags: White surveyor's plastic tape, 6 inches long, fastened to guying wires or cables.
- E. Driven Anchors: May be used instead of guy stakes for trees with 3 to 6 inch caliper. malleable iron, arrow shaped, galvanized.

2.13 WATER

- A. Suitable quality for irrigation.

PART 3 - EXECUTION

NOTE TO SPECIFIER

Edit paragraph below for Planting Date requirements for specific Project Site.

3.1 TIME RESTRICTIONS AND PLANTING CONDITIONS

- A. Planting Dates:
 1. Deciduous material from [_____] to [_____] for spring planting and from [_____] to [_____] for fall planting.
 2. Evergreen material from [_____] to [_____] for spring planting and from [_____] to [_____] for fall planting.



- B. Restriction: Do not plant when ground is frozen, snow covered, or muddy.

3.2 PREPARATION

- A. Layout: Stake out approved plant material locations and bed outlines on the project site before digging plant pits or beds. The landscape consultant reserves the right to adjust plant material locations to meet field conditions.
- B. Verify location of underground utilities prior to excavation. Protect existing adjacent turf before excavations are made. Where planting beds occur in existing turf areas, remove turf to a depth that will ensure removal of the entire root system. Measure depth of pits from finished grade. Depth of excavation shall provide proper relation between top of ball and finished grade as specified in paragraph entitled "Handling."

3.3 PLANTING

NOTE TO SPECIFIER

Edit paragraph below for selected depth requirements.

- A. Handling: Move balled, burlapped and container-grown plants only by supporting the ball or container. Set plants on hand compacted layer of planting soil 6 inches thick and hold in position until soil has been firmly placed around roots or ball. Set plants [1/8 to 1/4 depth of ball above] [_____] surrounding grade. Replace balled plant whose balls are cracked or broken either before or during the planting process.
1. Ball diameter 12 inches or less: Balled or potted items; excavate pits at least 16 inches larger in diameter and 6 inches deeper than size of ball or container.
 2. Ball diameter greater than 12 inches: Balled or potted items; excavate pits at least 24 inches larger in diameter and 6 inches deeper than size of ball or container.
 3. Mulch: Provide mulching material over entire earth saucer and berm surface around trees and shrubs [3 inches deep] [as indicated], ground cover and annuals [2 inches deep] [as indicated]. Keep mulch out of the crowns of shrubs.

NOTE TO SPECIFIER

Edit paragraph below for selected backfill material.

- B. Balled and Burlapped Stock: Backfill with [planting soil mixture] [topsoil] to approximately half the depth of ball and then tamp and water. Carefully remove or fold back excess burlap and tying materials. Tamp and complete backfill, place mulch and water.

NOTE TO SPECIFIER

Edit paragraph below for selected backfill material.

- C. Bare-Root Stock: Plant so roots are arranged in a natural position. Apply tree wound dressing to cuts larger than 1/2 inch in diameter. Carefully work [planting soil mixtures] [topsoil] among roots. Tamp remainder of backfill, place mulch and water.
- D. Container Grown Stock: Remove from container to prevent damage to plant or root system. Cut root ball vertically in 3 to 5 places with sharp knife before planting.



- E. Ground Covers and Vines: Plant after placing mulch. Do not remove from flats and containers until immediately before planting. Space at intervals indicated, sufficiently deep to cover all roots. Immediately sprinkle with water until entire area is soaked. Smooth planting areas after planting to provide even, smooth finish. Mulch as indicated.

NOTE TO SPECIFIER

Edit paragraph below for fertilizer rate. No chemical fertilizers.

- F. Fertilization: After establishment of finished grade around plants, top dress all pit and bed areas with fertilizer at the rate of [____] pounds per 100 square feet of areas. If fertilizer adheres to plants, carefully remove it by flushing.
- G. Application of Pesticides: No chemical pesticides.

3.4 FINISHING

NOTE TO SPECIFIER

Edit paragraph below for selected edging material.

- A. Edging: Uniformly edge beds of individual plants with a 3 inch to 4 inch deep "Vee" cut to provide a clear division line between planted areas and adjacent lawn. Form bed shapes as indicated. Install [metal] [wooden] edging materials as specified. Mulch to bottom edge of cut.

NOTE TO SPECIFIER

Edit paragraph below for selected mulching depth..

- B. Mulching: Provide mulching materials at other indicated locations [3 inches deep] [____]. Keep mulch off buildings, sidewalks, light standards, and other structures.
1. Placing Inert Materials: Lay membrane with edges lapped 6 inches to 12 inches to receive inert mulch material. Punch a grid of 1/4 inch holes for drainage in the membrane one foot on centers over entire area. Spread mulch [3 inches deep] [____] [as indicated].
 2. Placing Mulching Materials: Spread a uniform thickness [of 3 inches] [as indicated].
- C. Wrapping: Tie trunk wrapping material to trunks of deciduous trees with specified material within the next full working day after planting. Contracting Officer will inspect the trunks of deciduous trees for physical damage, insect infestation, or disease, and determine required treatment or rejection prior to wrapping operation. Begin wrapping at base and extend to first branches. Overlap wrapping half with width of underlying wrap and securely tie at top, bottom, and 18 inch maximum intervals with twine.
- D. Staking and Guying:
1. Deadmen: Stake, guy and place deadmen for plantings as indicated.
 2. Chafing Guards: Hold plants firmly between stakes with double-strand of 12 gauge guying wire. Use hose chafing guards, where wire will contact the plant. (Provide turnbuckles as indicated).
 3. Stakes: Drive vertically into ground 3 feet deep outside of plant balls. Do not injure ball or roots.
 4. Ground Stakes: Drive into firm ground outside of plant pit with top of stakes flush with ground.
 5. Deadmen: Place minimum 18 inches below ground surface.
 6. Iron Anchors: Drive minimum 30 inches below ground surface.
 7. Steel Anchors: Insert steel screw anchors as recommended in manufacturer's data.
 8. Flags: Securely fasten flags on each guy [wire] [cable] approximately two-thirds of the distance up from ground level.



- E. Pruning: NAA DSST; prune in accordance with safety requirements of ANSI Z133.1.
1. Trees and Shrubs: Remove dead and broken branches. Prune deciduous trees and shrubs to reduce total amount of branching structure by maximum one-third. Retain typical grown habit of individual plant with as much height and spread as is practical. Make cuts with sharp instruments flush with trunk or adjacent branch, above node.
 2. Wound Dressing: Apply tree wound dressing to cuts 1/2 inch in diameter and larger immediately after pruning.

3.5 MAINTENANCE

- A. Commencement: Begin maintenance immediately after each plant is planted.
- B. Inspection: Inspect plants at least once a week during installation period and perform needed maintenance promptly.

3.6 PLANT ESTABLISHMENT PERIOD

- A. Commencement: On the date that inspection by Contracting Officer shows that all new plants furnished under this Contract have been satisfactorily installed.

NOTE TO SPECIFIER

Edit paragraph below for Establishment Period Dates, fertilizer application rate, and time for removal of dead plants.

- B. Maintenance During Plant Establishment Period:
 1. Promote Plant Growth: Water, prune, mulch, re-guy, re-wrap and perform other operations necessary to promote plant growth.
 2. Fertilizing Plants: At least once during the plant establishment period between the dates of [_____] [_____]. Fertilize by topdressing at [_____] pounds per 100 square feet of plant pit or bed area or by tablet or packet form with controlled release fertilizer.
 3. Remove Dead Plants: Remove and replace dead plants [immediately] [immediately upon commencement of specified planting season] and replace stakes, guys, wraps, and eroded plant saucers required. No additional plant establishment period will be required for replacement plants.
 4. Tracking Unhealthy Plants: Plants not in healthy growing condition, as determined by Contracting Officer, will be noted and removed as soon as seasonal conditions permit and replaced with plants of the same species and sizes as originally specified. Make replacements in same manner as specified for original plantings.

3.7 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection.
- B. Inspect plant conditions, placement, and soil conditions.

3.8 FINAL INSPECTION AND ACCEPTANCE

NOTE TO SPECIFIER

Edit paragraph below for topdressing application rate.



- A. Final Inspection: Upon written request from Contractor at least 10 days prior to last day of the plant establishment period. Prior to final inspection, fertilize all plants by topdressing at [____] pounds per 100 square feet of plant pit or bed area or by tablet or packet form with controlled release fertilizer.
- B. Final Acceptance: Base on compliance with the following:
 - 1. Total Plants on Site: Plants have been accepted and required number of replacement are in place.
 - 2. Mulching and Weeding: Plant beds and saucers are properly mulches and free of weeds.
 - 3. Supports: Stakes and guys are in good condition.
 - 4. Remedial Work: Remedial measures directed by Contracting Officer have been carried out to ensure plant survival.
 - 5. Fertilizing: Plant materials have been fertilized as required.
- C. Contractor is to maintain exterior plants for one year from completion.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 6/10/2011

END OF SECTION 32 93 00 00



SECTION 32 93 00 00 - CSF PLANTS**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

****REQUIRED PARTS OR ARTICLES ARE INCLUDED IN THIS SECTION. DO NOT REVISE WITHOUT A WRITTEN DEVIATION FROM USPS HEADQUARTERS DESIGN AND CONSTRUCTION, THROUGH THE CONTRACTING OFFICER.**

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information must be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Plants, Trees and Shrubs.
 - 2. Antidesiccants.
 - 3. Pesticides.
 - 4. Fertilizer.
 - 5. Planting Soil Mixtures.
 - 6. Membrane Ground Covers.
 - 7. Drainage Pipe and Bedding.
 - 8. Mulches.
 - 9. Edging Material.
 - 10. Trunk Wrapping Material.
 - 11. Staking and Guying Material.
 - 12. Water.
 - 13. Maintenance of Existing Erosion Control.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 311000 - Site Clearing: Mulch from recycled site debris.
 - 2. Section 312000 - Earth Moving: Topsoil materials.
 - 3. Section 313200 - Soil Stabilization: Stabilization materials and procedures.
 - 4. Section 312500 - Erosion and Sedimentation Controls: Slope and erosion protection materials.
 - 5. Section 329200 - Turf and Grasses: Grass, sod, and sprigs.

1.2 REFERENCES

- A. American National Standards Institute (ANSI):



1. ANSI Z60.1 - American Standard for Nursery stock.

B. American Society for Testing and Materials (ASTM):

1. ASTM C 4 - Specification for Clay Drain Tile.
2. ASTM C 136 - Method for Sieve Analysis of fine and Coarse Aggregates.
3. ASTM C 498 - Specification for Perforated Clay Drain Tile.
4. ASTM C 700 - Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated.
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- B. Delivery:
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 2. Fertilizer and Lime: In original, unopened containers bearing manufacturer's chemical analysis, name, trade name, or trademark, and indication of conformance to state and federal rules and regulations. May be furnished in bulk with certificate indicating above information.
 3. Labels: Durable waterproof labels in weather-resistant ink, legible for a minimum of 60 days after delivery to planting location, stating the correct name and size as specified in the list of required plants. Attach to plants, bundles and containers of plants. Groups of plants may be labeled by tagging one plant.
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- C. Storage:
1. Plants, Trees and Shrubs: Store and protect plants not planted on day of arrival at Project Site as follows:
 - a. Shade and protect plants in outside storage areas protected from wind and direct sunlight until planted.
 - b. Heel-in bare root plants.
 - c. Protect balled and burlapped plants from freezing or drying out by covering balls or roots with moist burlap, sawdust, wood chips, shredded bark, peat moss, or other approved material. Provide covering which allows air circulation.
 - d. Keep all plants in a moist condition by watering with fine mist spray until planted.
 2. Lime, Fertilizers, Mulch: Store in dry locations away from contaminants.
 3. Pesticides, Antidesiccants: Do not store with other landscape materials.
- D. Handling: Do not drop or dump materials from vehicles. Handle plants by rootballs or containers. Do not lift or carry by stems or crown.

1.6 PROJECT CONDITIONS

- A. Jobsite Requirements:
1. Protection of Personnel and Property: Apply pesticides so damage will not result to personnel or property from either direct spray or drifting of chemicals both on and off site.
 2. Disposal of Excess Chemicals and Containers: In accordance with federal and state laws.

NOTE TO SPECIFIER

"REQUIRED Article (Environmental Requirements) follows. Do not revise this Article, except as noted below, without a written Deviation from USPS Headquarters Design & Construction, through the Contracting Officer."

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Resource Management:
1. Renewable Resources: Plants specified are indigenous, low maintenance varieties, tolerant of site's existing soils and climate without supplemental irrigation or fertilization once established.
 - a. Soil amendments: No chemical fertilizers; use organic matter to support establishment of indigenous plants; use inorganic materials such as sand or gypsum to improve workability and drainage of soil as appropriate to indigenous plants.
 - b. Mulch: Provide organic mulch products.



- c. Pesticides: No chemical pesticides.
- 2. Recycled Content:
 - a. Mulch from recycled site debris: Coordinate with Section 311000 - Site Clearing to identify and prepare suitable organic debris for use as mulch on site.

1.8 WARRANTY

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Submit written warranty signed by material supplier and installer agreeing that they will:
 - 1. Warrant plants, trees and shrubs unconditionally for 1 year or 1 full growing season, whichever is greater.
 - 2. Replace any material diseased or 25 percent dead or more at no additional cost to United States Postal Service.
 - 3. Warrant deciduous material to break dormancy if planted in dormant season.
 - 4. Warrant perennials to show signs of healthy growth by May 15 to June 1.
 - 5. Provide replacement material during next planting period.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Pre-Bid: If any plant specified is not obtainable, submit a written substitution request to Contracting Officer during bidding.
- B. Substitutions of planting materials will not be permitted unless authorized by Contracting Officer.

NOTE TO SPECIFIER

Edit PLANTS, TREES, AND SHRUBS for planting used for specific Project.

2.2 PLANTS, TREES, AND SHRUBS

- A. Varieties: Botanical names indicated are listed in "HORTUS III". Furnish nursery stock in accordance with ANSI Z60.1, except as otherwise specified or indicated. Furnish plants grown under climatic conditions similar to those in locality of Project Site. Spray plants budding into leaf of having soft growth with an antidesiccant before digging. Provide plants of same specified size in uniform size and character of growth.
- B. Shape: Well branched, well formed, sound, vigorous, healthy planting stock free from disease, sunscald, windburn, abrasion, and harmful insects or insect eggs and having healthy, normal, and unbroken root system.
- C. Deciduous Trees and Shrubs: Symmetrical tops with typical spread of branches for each particular species or variety.
- D. Evergreen Trees and Shrubs: Well developed symmetrical tops with typical spread of branches for each particular species or variety.



- E. Ground Covers and Vines: Number and length of runners and clump sizes indicated, and of proper age for grade of plants indicated, furnished in removable containers, integral containers or formed homogeneous soil section.
- F. Size: Minimum sizes measured before pruning and with branches in normal position, conform to measurements indicated, based on average width or height of plant for species specified in ANSI Z60.1. Plants of larger size than specified may be used with approval of Contracting Officer. When larger plants are used, increase ball of earth or spread of roots in accordance with ANSI Z60.1.
- G. Balled and Burlapped (B&B) and Balled and Potted (B&P) Plants: Ball size and ratios, conform to ANSI Z60.1. Ball plants with firm, natural balls of soil. Wrap B&B plants firmly with burlap or strong cloth, and tie securely.
- H. Balled and Platformed (BP) Plants: Wrap and ball in same manner as B&B plants and fasten securely to strong platforms.
- I. Bare-Root Plants: Dig with root system substantially intact but with earth carefully removed. Cover roots with a thick coating of mud by puddling after plants are dug or wrap with moist material immediately after digging.
- J. Container Grown Plants: Sufficient root growth to hold earth intact when removed from containers. Root bound plants not permitted.

NOTE TO SPECIFIER

Use paragraph below when RELOCATION OF EXISTING PLANTS is a part of the Work.

- K. Existing Plants for Relocation: Ball sizes shall conform to requirements for collected plants in ANSI Z60.1.

NOTE TO SPECIFIER

Add additional Products and manufacturers as appropriate for specific Project.

2.3 ANTIDESICCANTS

- A. Antidesiccants: Subject to compliance with requirements, manufacturers offering specified items which may be incorporated in the work include the following.
 1. "Vapor Guard" - Miller Chemicals & Fertilizer Corp.; Hanover, PA (717) 632-8921.
 2. [_____].

2.4 PESTICIDES

- A. Soil fumigant, herbicide, insecticide and fungicide, EPA registered and state approved. Furnish for preemergence and postemergence application(s).

NOTE TO SPECIFIER

Edit FERTILIZERS below for specific soil conditions at Project Site.



2.5 FERTILIZERS

- A. Commercial Grade Fertilizer: Granular, free flowing, and uniform in composition with nitrogen-phosphorus-potash ratio of [____] nitrogen, [____] available phosphorus, and [____] potash.
- B. Controlled Release Fertilizer: Magnesium ammonia phosphate and magnesium potassium phosphate with nitrogen-phosphorus-potassium ratio, [____] percent nitrogen, [____] percent phosphorus, and [____] percent potassium, granulated to pass 1/8 inch screen.

NOTE TO SPECIFIER

Edit PLANTING SOIL MIXTURES below for specific soil conditions at Project Site.

2.6 PLANTING SOIL MIXTURES

- A. [____] part topsoil, [____] parts [____], and [____] parts [____].

2.7 MEMBRANE GROUND COVERS

NOTE TO SPECIFIER

OPTION 1: Use paragraph below when SHEET POLYETHYLENE is appropriate for Project. Select mil thickness.

- A. Sheet Polyethylene: Black, conforming to ASTM D2103, minimum thickness [4 mils] [6 mils].

NOTE TO SPECIFIER

OPTION 2: Use paragraph below when ASPHALT GLASS FELT is appropriate for Project.

- B. Asphalt Glass Felt: ASTM D2178; Types I, III or IV.

NOTE TO SPECIFIER

OPTION 3: Use paragraph below when ROLL TYPE FIBERGLASS MATS is appropriate for Project. Select mil thickness.

- C. Roll Type Fiberglass Mats: 100 percent lime borosilicate glass fibers with an average fiber diameter of 8 to 12 microns and 2 to 4 inch strands of fiber bonded with phenol formaldehyde resin, water permeable, having a minimum of 1/4 inch and a maximum of 1/2 inch thickness with a density of not less than 3/4 pound per cubic foot.

2.8 DRAINAGE PIPE AND BEDDING

NOTE TO SPECIFIER

OPTION 1: Use paragraph below when DRAINAGE PIPE is selected for Project. Edit for sizes and types of materials required for Project Site conditions.

- A. Drainage Pipe for Plant Pits and Beds: [Plastic polyvinyl chloride pipe, [____] inches in diameter, [unperforated] [perforated] conforming to ASTM D2729.] [Corrugated plastic drainage tubing, [____] inches in diameter, [unperforated] [perforated] conforming to ASTM F405.] [Clay drain tile, [____]



inches in diameter, [unperforated as specified in ASTM C4] [perforated conforming to ASTM C498] [extra strength] [standard strength] conforming to ASTM C700].

NOTE TO SPECIFIER

OPTION 2: Use paragraph below when GRANULAR FILL is selected for Project.

- B. Granular Fill for Plant Pit and Bed Drainage: Uniformly graded sand, stone, gravel, or stone screening free from an excess of soft or unsound particles or other objectionable material. When testing in accordance with ASTM C136, material shall conform to the following gradation limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
3/8 inch 100	
No. 4	85 - 100
No. 16	45 - 80
No. 50	10 - 30
No. 100	0 - 10
No. 200	0 - 3

NOTE TO SPECIFIER

OPTION 3: Use paragraph below when DRAINAGE BOARD is selected for Project.

- C. Drainage Board for Planters:
1. Drainage Board for Planters:
 - a. "Miradrain 9000" - Miradri Moisture Protection Products.; Norcross, GA (888) 863-6781.
 - b. "Hydraway WD3000" - Solutia, Inc.; St. Louis, MO (800) 325-4330.
 - c. "Deck Drain" - Greenstreak; St. Louis, MO (800) 325-9504.

2.9 MULCHES

- A. Free from noxious weeds, mold, or other deleterious materials.

NOTE TO SPECIFIER

OPTION 1: Use paragraph below when INERT MULCH is selected for Project. Edit for types and sizes.

- B. Inert Mulch Materials: [Riverbank stone] [Crushed pit-run rock] [Granite chips] [Marble chips] [Crushed bricks] [Volcanic rock] [_____] ranging in size from [_____] to [_____] inch(es).

NOTE TO SPECIFIER

OPTION 2: Use paragraph below when ORGANIC MULCH is selected for Project. Edit for types and sizes.

- C. Organic Mulch Materials: [Ground or shredded bark] [Shredded hardwood] [Pine needles] [Cypress] ranging in size from [_____] to [_____] inch(es).

2.10 EDGING

NOTE TO SPECIFIER

OPTION 1: Use paragraph below when WOOD EDGING is selected for Project.

- A. Wood Edging: Minimum 8 inches by 1/2 inch, treated in accordance with AWPA C2 with CCA Type C or ACA before installation, free of solvent at time of delivery.



1. Anchoring Stakes: Same material as wood edging, 1/2 inch by 2 inches, 12 inches long.

NOTE TO SPECIFIER

OPTION 2: Use paragraph below when METAL EDGING is selected for Project. Edit for types and sizes.

- B. Metal Edging: [Galvanized steel] [Aluminum with slots for stakes], [1/4] [3/16] [1/8] inch thick by [4] [5] inches deep in [16] [20] foot length. Treat steel edging with rust preventative and factory finish in color [green] [black].
 1. Anchoring Stakes: Tapered galvanized steel with same finish as metal edging, 16 to 18 inch long.

2.11 TRUNK WRAPPING

- A. Two thicknesses burlap minimum 4 inch width.
- B. Tying Material: 3 ply, lightly tarred medium or coarse sisal yarn twine.

2.12 STAKING AND GUYING

- A. Tree Support Stakes: Rough sawn hard wood free of knots, rot, cross grain, bark, long slivers, or other defects that impair strength. Minimum 2 inches square or 2 1/2 inch diameter by 8 feet long, pointed at one end. Paint or stain wood stakes dark brown.
- B. Guying Wire: 12 gauge galvanized steel.
- C. Hose Chafing Guards: New or used 2 ply, 3/4 inch diameter, reinforced rubber or plastic hose, black or dark green, all of same color.
- D. Flags: White surveyor's plastic tape, 6 inches long, fastened to guying wires or cables.
- E. Driven Anchors: May be used instead of guy stakes for trees with 3 to 6 inch caliper. malleable iron, arrow shaped, galvanized.

2.13 WATER

- A. Suitable quality for irrigation.

PART 3 - EXECUTION

NOTE TO SPECIFIER

Edit paragraph below for Planting Date requirements for specific Project Site.

3.1 TIME RESTRICTIONS AND PLANTING CONDITIONS

- A. Planting Dates:
 1. Deciduous material from [] to [] for spring planting and from [] to [] for fall planting.
 2. Evergreen material from [] to [] for spring planting and from [] to [] for fall planting.



- B. Restriction: Do not plant when ground is frozen, snow covered, or muddy.

3.2 PREPARATION

- A. Layout: Stake out approved plant material locations and bed outlines on the project site before digging plant pits or beds. The landscape consultant reserves the right to adjust plant material locations to meet field conditions.
- B. Verify location of underground utilities prior to excavation. Protect existing adjacent turf before excavations are made. Where planting beds occur in existing turf areas, remove turf to a depth that will ensure removal of the entire root system. Measure depth of pits from finished grade. Depth of excavation shall provide proper relation between top of ball and finished grade as specified in paragraph entitled "Handling."

3.3 PLANTING

NOTE TO SPECIFIER

Edit paragraph below for selected depth requirements.

- A. Handling: Move balled, burlapped and container-grown plants only by supporting the ball or container. Set plants on hand compacted layer of planting soil 6 inches thick and hold in position until soil has been firmly placed around roots or ball. Set plants [1/8 to 1/4 depth of ball above] [_____] surrounding grade. Replace balled plant whose balls are cracked or broken either before or during the planting process.
1. Ball diameter 12 inches or less: Balled or potted items; excavate pits at least 16 inches larger in diameter and 6 inches deeper than size of ball or container.
 2. Ball diameter greater than 12 inches: Balled or potted items; excavate pits at least 24 inches larger in diameter and 6 inches deeper than size of ball or container.
 3. Mulch: Provide mulching material over entire earth saucer and berm surface around trees and shrubs [3 inches deep] [as indicated], ground cover and annuals [2 inches deep] [as indicated]. Keep mulch out of the crowns of shrubs.

NOTE TO SPECIFIER

Edit paragraph below for selected backfill material.

- B. Balled and Burlapped Stock: Backfill with [planting soil mixture] [topsoil] to approximately half the depth of ball and then tamp and water. Carefully remove or fold back excess burlap and tying materials. Tamp and complete backfill, place mulch and water.

NOTE TO SPECIFIER

Edit paragraph below for selected backfill material.

- C. Bare-Root Stock: Plant so roots are arranged in a natural position. Apply tree wound dressing to cuts larger than 1/2 inch in diameter. Carefully work [planting soil mixtures] [topsoil] among roots. Tamp remainder of backfill, place mulch and water.
- D. Container Grown Stock: Remove from container to prevent damage to plant or root system. Cut root ball vertically in 3 to 5 places with sharp knife before planting.



- E. Ground Covers and Vines: Plant after placing mulch. Do not remove from flats and containers until immediately before planting. Space at intervals indicated, sufficiently deep to cover all roots. Immediately sprinkle with water until entire area is soaked. Smooth planting areas after planting to provide even, smooth finish. Mulch as indicated.

NOTE TO SPECIFIER

Edit paragraph below for fertilizer rate. No chemical fertilizers.

- F. Fertilization: After establishment of finished grade around plants, top dress all pit and bed areas with fertilizer at the rate of [_____] pounds per 100 square feet of areas. If fertilizer adheres to plants, carefully remove it by flushing.
- G. Application of Pesticides: No chemical pesticides.

3.4 FINISHING

NOTE TO SPECIFIER

Edit paragraph below for selected edging material.

- A. Edging: Uniformly edge beds of individual plants with a 3 inch to 4 inch deep "Vee" cut to provide a clear division line between planted areas and adjacent lawn. Form bed shapes as indicated. Install [metal] [wooden] edging materials as specified. Mulch to bottom edge of cut.

NOTE TO SPECIFIER

Edit paragraph below for selected mulching depth..

- B. Mulching: Provide mulching materials at other indicated locations [3 inches deep] [_____]. Keep mulch off buildings, sidewalks, light standards, and other structures.
1. Placing Inert Materials: Lay membrane with edges lapped 6 inches to 12 inches to receive inert mulch material. Punch a grid of 1/4 inch holes for drainage in the membrane one foot on centers over entire area. Spread mulch [3 inches deep] [_____] [as indicated].
 2. Placing Mulching Materials: Spread a uniform thickness [of 3 inches] [as indicated].
- C. Wrapping: Tie trunk wrapping material to trunks of deciduous trees with specified material within the next full working day after planting. Contracting Officer will inspect the trunks of deciduous trees for physical damage, insect infestation, or disease, and determine required treatment or rejection prior to wrapping operation. Begin wrapping at base and extend to first branches. Overlap wrapping half with width of underlying wrap and securely tie at top, bottom, and 18 inch maximum intervals with twine.
- D. Staking and Guying:
1. Deadmen: Stake, guy and place deadmen for plantings as indicated.
 2. Chafing Guards: Hold plants firmly between stakes with double-strand of 12 gauge guying wire. Use hose chafing guards, where wire will contact the plant. (Provide turnbuckles as indicated).
 3. Stakes: Drive vertically into ground 3 feet deep outside of plant balls. Do not injure ball or roots.
 4. Ground Stakes: Drive into firm ground outside of plant pit with top of stakes flush with ground.
 5. Deadmen: Place minimum 18 inches below ground surface.
 6. Iron Anchors: Drive minimum 30 inches below ground surface.
 7. Steel Anchors: Insert steel screw anchors as recommended in manufacturer's data.
 8. Flags: Securely fasten flags on each guy [wire] [cable] approximately two-thirds of the distance up from ground level.



- E. Pruning: NAA DSST; prune in accordance with safety requirements of ANSI Z133.1.
1. Trees and Shrubs: Remove dead and broken branches. Prune deciduous trees and shrubs to reduce total amount of branching structure by maximum one-third. Retain typical grown habit of individual plant with as much height and spread as is practical. Make cuts with sharp instruments flush with trunk or adjacent branch, above node.
 2. Wound Dressing: Apply tree wound dressing to cuts 1/2 inch in diameter and larger immediately after pruning.

3.5 MAINTENANCE

- A. Commencement: Begin maintenance immediately after each plant is planted.
- B. Inspection: Inspect plants at least once a week during installation period and perform needed maintenance promptly.

3.6 PLANT ESTABLISHMENT PERIOD

- A. Commencement: On the date that inspection by Contracting Officer shows that all new plants furnished under this Contract have been satisfactorily installed.

NOTE TO SPECIFIER

Edit paragraph below for Establishment Period Dates, fertilizer application rate, and time for removal of dead plants.

- B. Maintenance During Plant Establishment Period:
 1. Promote Plant Growth: Water, prune, mulch, re-guy, re-wrap and perform other operations necessary to promote plant growth.
 2. Fertilizing Plants: At least once during the plant establishment period between the dates of [_____] [_____]. Fertilize by topdressing at [_____] pounds per 100 square feet of plant pit or bed area or by tablet or packet form with controlled release fertilizer.
 3. Remove Dead Plants: Remove and replace dead plants [immediately] [immediately upon commencement of specified planting season] and replace stakes, guys, wraps, and eroded plant saucers required. No additional plant establishment period will be required for replacement plants.
 4. Tracking Unhealthy Plants: Plants not in healthy growing condition, as determined by Contracting Officer, will be noted and removed as soon as seasonal conditions permit and replaced with plants of the same species and sizes as originally specified. Make replacements in same manner as specified for original plantings.

3.7 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection.
- B. Inspect plant conditions, placement, and soil conditions.

3.8 FINAL INSPECTION AND ACCEPTANCE

NOTE TO SPECIFIER

Edit paragraph below for topdressing application rate.



- A. Final Inspection: Upon written request from Contractor at least 10 days prior to last day of the plant establishment period. Prior to final inspection, fertilize all plants by topdressing at [____] pounds per 100 square feet of plant pit or bed area or by tablet or packet form with controlled release fertilizer.
- B. Final Acceptance: Base on compliance with the following:
 - 1. Total Plants on Site: Plants have been accepted and required number of replacement are in place.
 - 2. Mulching and Weeding: Plant beds and saucers are properly mulches and free of weeds.
 - 3. Supports: Stakes and guys are in good condition.
 - 4. Remedial Work: Remedial measures directed by Contracting Officer have been carried out to ensure plant survival.
 - 5. Fertilizing: Plant materials have been fertilized as required.
- C. Contractor is to maintain exterior plants for one year from completion.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION 32 93 00 00



Task	Specification	Specification Description
32 94 43 00	01 22 16 00	No Specification Required
32 94 43 00	12 93 13 00	Miscellaneous Site and Street Furnishings
32 94 49 00	01 22 16 00	No Specification Required



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Task	Specification	Specification Description
33 01 30 16	01 22 16 00	No Specification Required
33 01 30 42	22 05 23 00	Piped Utilities Basic Materials And Methods
33 01 30 51	01 22 16 00	No Specification Required
33 01 30 61	01 22 16 00	No Specification Required



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SECTION 33 01 30 72 - PIPE LINING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of pipe lining. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

1.2 PRODUCTS

A. Lining Material:

1. Polyethylene Pipe: Extruded, flexible industrial grade, high density (Type 3 or 4) in 40 foot lengths, complying with ASTM D 2239 and D 2447.
 - a. Diameter: Outside diameter shall be as large as possible while allowing for ease of pulling into the existing pipes. Pipe dimensions shall comply with ASTM D 2447 and D 2837.
 - b. Liner Thickness and Class shall be suitable for the use intended. The tolerance on the pipe wall thickness shall be as noted in Table 2 of ASTM D 2447.
 - c. Gravity Sanitary, Gravity Storm, and Gravity Industrial Sewers shall be Schedule 40.
 - d. Gravity Thermal Discharge Sewers shall be Schedule 80.
 - e. Low Pressure Sewers shall be Schedule 40, complying with ASTM D 2239.
 - f. High Pressure Sewers shall be Schedule 80, complying with ASTM D 2239 and D 2837.
 - g. Chemical Resistance: Pipe liner shall be resistant to chemical attack, erosion, and corrosion.
 - h. Fittings shall be fabricated from polyethylene pipe. The polyethylene fittings shall have the same pressure rating as the pipe and shall comply with ASTM D 3261.
2. Cement-Mortar Lining:
 - a. Portland Cement shall comply with ASTM C 150, Type 1.
 - b. Pozzolan Cement shall comply with ASTM C 618 and shall not comprise more than 20 percent of total cement amount, by weight.
 - c. Sand shall be well graded, clean, free from organic and extraneous matter. One hundred percent shall pass the 16-mesh size screen.
 - d. Lining Thickness: Cement lining shall be not less than 1/8 inch for pipe sizes 4 to 14 inches, not less than 3/16 inch for pipe sized 16 inches and larger, and not less than 1/4 inch for steel pipe 16 inches and larger.
3. Reinforced Mortar Pipe Slip-Lining:
 - a. Gravity Sewers: Slip-lining shall be of glass fiber reinforced polyester mortar pipe, complying with ASTM D 3262.
 - b. Pressure Sewers (Force Mains): Slip-lining shall be of glass fiber reinforced polyester mortar pipe complying with ASTM D 2517.
 - c. Diameter: Outside diameter shall be as large as possible while allowing for ease of pulling into existing pipes, as recommended by the manufacturer.
 - d. Chemical Resistance: Pipe liner shall be resistant to chemical attack, erosion, and corrosion.
4. Fittings: Fittings shall be manufactured of the same materials as is the glass fiber reinforced polyester mortar pipe.
5. Epoxy-Mortar Lining:
 - a. Epoxy compound shall comply with ASTM D 1763.
 - b. Admixtures shall be well graded with one hundred percent passing. The 16-mesh size screen. All admixtures shall improve the workability, density, and strength of the mortar.



- c. Lining Thickness: For pipe sizes 4 to 14 inches, epoxy mortar lining thickness shall be not less than 1/8 inch. For pipe sizes 16 inches and larger, epoxy mortar lining shall be not less than 3/16 inch.

B. Joint:

1. Slip-Lining:

- a. Polyethylene Pipe Butt Joints: Pipe lengths, fittings, and flanged connections to be joined by thermal butt fusion shall be of the same time, grade, and class of polyethylene compound and supplied by pipe supplier.
- b. Flanged Joints shall consist of a polyethylene flange, thermally butt fused to the ends of the pipe. The companion flange shall be steel or cast iron and nylon-coated.
- c. Lateral Service Connections: Sidewall connections shall be made with polyethylene pipe sections of the same material, grade, and class as the liner material and shall have the same pressure ratings. Lateral connections shall be watertight.

2. Reinforced Mortar Lining:

- a. Bell and spigot joints shall be the inverted type.
- b. Manhole Joints and Connections shall be oakum ring and grout as required.

1.3 EXECUTION:

A. Slip-Lining, Polyethylene Pipe:

- 1. Insertion of Liner: Liner shall be laid at a constant line and grade as the existing pipe, without undulations or damage. Where the existing pipe is not at constant grade, the liner shall follow as true a constant grade as possible.
- 2. Grouting: At manholes, annular space shall be packed with oakum and expansion grout or nonshrink grout as required. At existing line, after liner has been inserted, grout wherever existing pipe has failed structurally.
- 3. Concrete Encasement: Crown of liner shall be encased in concrete a minimum thickness of 6 inches for the entire length of the excavated trench and out at least 6 inches each side of the bottom half of the original pipe remaining down to firm soil. Wherever existing concrete encasement has been removed, the liner shall be encased in the same manner as the original pipe.
- 4. Thrust Blocks: Concrete thrust blocks shall be provided as required.

B. Cement Mortar and Epoxy Mortar Lining:

- 1. Cement Mortar Mixing: One part cement to one and one-half parts of sand by volume.
- 2. Application of Lining: The lining shall be applied to produce a smooth, uniform thickness throughout the interior of the pipe line.
- 3. Curing of the Cement Mortar Lining: Immediately upon completion of the lining of a length of pipe between access openings or at the end of a day's run, the section of pipe shall be closed at each end, the access openings covered to prevent the circulation of air, and the atmosphere kept moist.
- 4. Reconnection of Pipes After Lining: Close and make watertight all openings in the lines.
- 5. Pressure Test and Leaks: Hydrostatic and leakage tests shall be conducted on all pipe that is cleaned and lined.

C. Reinforced Mortar Pipe Lining:

- 1. Joining of Pipe Ends: Liner sections containing bell and spigot joints shall be joined using an O-ring.
- 2. Grouting Work shall be accomplished following the same techniques as described in paragraph Slip-Lining, Polyethylene Pipe.

D. Cement Mortar Lining:



1. Epoxy Mortar Lining: Excessive mortar shall be removed from the manhole walls and bottom. Manhole bottom shall receive special care in making all transitions smooth.
2. Work at Service Connections: Plugs or caps shall be placed at the access point of the service connection to the lines and shall be removed once the mortar has set. The completed lining shall not be damaged.
3. Reinforced Mortar Pipe Lining: Joining of fiberglass reinforced polyester mortar pipe shall be carried out in the trench, with the first section of liner already inserted.
4. Lateral Connections: Service to connections shall be provided for and continued after installation of the lining.
5. Testing: Upon completion of lining operation, the sewer line shall be tested for proper operation and shall be observed for a period of 24 hours. All deficiencies shall be corrected.
6. Pavement Restoration: All disturbed pavement shall be restored to its original condition and shall match existing adjacent.
7. Inspection: Large diameter sewers shall be inspected from inside to ensure that all lateral connections and joints are in proper order. Sewers that have been cement-lined may be inspected for a smooth finish, while plugs and caps are being removed.

END OF SECTION 33 01 30 72



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Task	Specification	Specification Description
33 01 30 72	01 22 16 00	No Specification Required
33 01 30 72	22 05 23 00	Piped Utilities Basic Materials And Methods
33 01 30 73	01 22 16 00	No Specification Required
33 01 30 73	22 05 23 00	Piped Utilities Basic Materials And Methods
33 01 30 81	01 22 16 00	No Specification Required
33 05 13 13	01 22 16 00	No Specification Required
33 05 13 13	22 05 23 00	Piped Utilities Basic Materials And Methods
33 05 23 13	01 22 16 00	No Specification Required
33 05 23 16	01 22 16 00	No Specification Required
33 05 26 00	01 22 16 00	No Specification Required



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SECTION 33 11 00 00 - CSF WATER UTILITY DISTRIBUTION PIPING

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Domestic water system pipe and fittings.
2. Connection of domestic water system to municipal water system.

NOTE TO SPECIFIER

Use paragraphs (3 and 4) below when building has a fire sprinkler system as part of the Work.

3. Fire protection water system pipe, fittings, valves, and hydrants.
4. Connection of fire protection water system to municipal water system.

- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:

1. Section 312300 - Excavation and Fill: Earthwork for utilities.
2. Section 033000 - Cast-In-Place Concrete: Concrete for thrust blocks.

1.2 REFERENCES

A. American Society of Mechanical Engineers (ASME):

1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

B. American Society for Testing and Materials (ASTM):

1. ASTM B 88 - Specification for Seamless Copper water Tube.
2. ASTM D 1785 - Specification for Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.
3. ASTM D 2241 - Specification for Polyvinyl Chloride (PVC) Pressure Rated Pipe (SDR Series).
4. ASTM D 3034 - Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.



5. ASTM D 3139 - Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.

C. American Water Works Association (AWWA):

1. AWWA C 110 - Gray-Iron Fittings, 3 inches Through 48 Inches, for Water and Other Liquids.
2. AWWA C 111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. AWWA C 151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
4. AWWA C 504 - Rubber Seated Butterfly Valves.
5. AWWA C 509 - Resilient Seated Gate Valves 3 inch through 12 inch NPS, for Water and Sewage Systems.
6. AWWA C 600 - Installation of Ductile-Iron Water Mains and Appurtenances.
7. AWWA C 900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch, for Water.

1.3 DEFINITIONS

- A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.

Product Data: Data for each type of pipe, pipe fitting, valve and accessory specified.

- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 1. Project Record Documents: Accurately record the following:
 - a. Locations of piping mains, valves, connections, and top of pipe elevations.
 - b. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Perform work in accordance with utility company requirements and local authority having jurisdiction requirements.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver and store valves in shipping containers with labeling in place.

PART 2 - PRODUCTS

2.1 PIPE

- A. Pipe sizes less than 3 inch that are installed below grade and outside building shall comply with one or combination of following:



1. Seamless Copper Tubing: Type "K" soft copper to comply with ASTM B 88 latest edition and installed with wrought copper (95-5 Tin Antimony solder joint) fittings in accordance with ASME B16.22.
 2. Polyvinyl Chloride (PVC) Water Pipe: Pipe shall conform to ASTM D 2241 with an SDR 21 rating and shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 1785 classification. Pipe joints shall be integrally molded bell ends in accordance with ASTM D 3139 with factory supplied elastomeric gaskets and lubricant.
- B. Pipe sizes 3 inch and larger that are installed below grade and outside building shall comply with one of the following:
1. Ductile Iron Water Pipe: In accordance with AWWA C 151, Fittings shall be either mechanical joint or push-on joint complying with AWWA C 110 or AWWA C-111 (CLASS 50).
 2. Polyvinyl Chloride (PVC) Water Pipe: Pipe shall meet the requirements of AWWA C-900 and comply with ASTM D 2241, rated SDR 21 (Class 150). Pipe shall be continually marked as for smaller pipes. Pipe joints shall be integrally molded bell ends in accordance with ASTM D 3034, Table 2, with factory supplied elastomeric gaskets and lubricant.
- 2.2 GATE VALVES - 2 Inches and Larger
- A. Manufacturers: Mueller Resilient Seat Gate Valves.
 - B. AWWA C509, Iron body, bronze mounted double disc, parallel seat type, non-rising stem with square nut, single wedge, resilient seat, flanged or mechanical joint ends, control rod, post indicator where indicated on Drawings, extension box and valve key.
 - C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- 2.3 BALL VALVES - 2 Inches and Smaller
- A. Manufacturers: Mueller Oriseal.
 - B. Brass body, Teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, AWWA compression inlet end, compression outlet with electrical ground connector, with control rod, extension box and valve key.
 - C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- 2.4 BUTTERFLY VALVES - 2 inches to 24 inches
- A. AWWA C504, iron body, bronze disc, resilient replaceable seat, water or lug ends, infinite position lever handle.

NOTE TO SPECIFIER

Use CHECK VALVES, ...etc. below when building has a fire sprinkler system as part of the Work.

2.5 CHECK VALVES, POST INDICATOR VALVES, AND BACKFLOW PREVENTORS

- A. Specified in Section 210000 - Fire Suppression.

NOTE TO SPECIFIER

Use HYDRANTS below when building has a fire sprinkler system as part of the Work.



2.6 HYDRANTS

- A. Hydrant: Type as required by utility company, local authority having jurisdiction, and as indicated on Drawings.
- B. Hydrant Extensions: Provide in multiples of 6 inches with rod and coupling to increase barrel length.
- C. Hose and Stream Connection: Match sizes with utility company, two hose nozzles, one pumper nozzle. Provide connection type as required by local fire marshall and by governing agencies having jurisdiction.
- D. Finish: Primer and two coats of enamel or special coating to color as required by utility company.

2.7 ACCESSORIES

- A. Concrete for Thrust Blocks: Section 033000. Place thrust blocking consisting of 2,500 psi concrete to provide sufficient bearing area to transmit unbalanced thrust from bends, tees, caps, or plugs to undisturbed soil without loading undisturbed soil in excess of 2,500 pounds per square foot when water main pressure is 100 psi.

MINIMUM THRUST BLOCKING BEARING AREAS

Pipe Diameter	Tees Sq. Ft.	90° Bend Sq. Ft.	45° Bend Sq. Ft.	22° Bend Sq. Ft.	11° Bend Sq. Ft.
3"	1.0	1.0	1.0	1.0	1.0
4"	1.0	1.0	1.0	1.0	1.0
6"	1.5	2.0	1.0	1.0	1.0
8"	2.5	3.5	1.8	1.0	1.0
10"	4.0	5.5	2.8	1.5	1.0
12"	6.0	8.0	4.0	2.0	1.5
14"	8.0	11.0	5.5	3.0	2.0
16"	10.0	14.2	7.0	4.0	3.0
18"	21.0	21.0	12.0	6.0	4.0

- B. Locked Mechanical Joint fittings shall be installed where vertical changes in direction are required and, if approved by Contracting Officer, can be installed in lieu of the above thrust blocking requirements.

NOTE TO SPECIFIER

OPTION 1: Use paragraph below when building DOES NOT HAVE a FIRE SPRINKLER SYSTEM as part of the Work.

- C. Trace Wire: Magnetic detectable conductor, clear brightly colored plastic covered, imprinted with "DOMESTIC WATER SERVICE" in large letters.

NOTE TO SPECIFIER

OPTION 2: Use paragraph below when building HAS a FIRE SPRINKLER SYSTEM as part of the Work.

- D. Trace Wire: Magnetic detectable conductor, clear brightly colored plastic covered, imprinted in large letters.



1. Domestic Water Lines: "DOMESTIC WATER SERVICE"
2. Fire Protection Water Lines: "FIRE PROTECTION WATER SERVICE"

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 1. Verify trench cut, excavations, dimensions, and elevations are as indicated on Drawings.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with fine aggregate.
- B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.
- C. Cut pipe ends square, ream pipe and tube ends and remove burrs.
- D. Remove scale and dirt, on inside and outside, before assembly.
- E. Prepare pipe for connections to equipment with flanges or unions.

3.3 BEDDING

- A. Excavate pipe trench and place bedding material in accordance with Section 312300 for work of this Section. Provide trench wall shoring as required.
- B. Form and place concrete for pipe thrust restraints at any change of pipe direction and at fittings as indicated on Drawings. Place concrete to permit full access to pipe and pipe accessories. Provide thrust restraint bearing on subsoil per schedule on Drawings.
- C. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches compacted depth, each layer. Place compacted bedding material to elevation of paving subgrade as indicated on Drawings.
- D. Maintain optimum moisture content of bedding material to attain required compaction density.
- E. Remove excess backfill and excavated material from site.



3.4 INSTALLATION - PIPE AND FITTINGS

- A. Maintain separation of water main from sanitary and storm sewer piping in accordance with state or local code.
- B. Install pipe and fittings in accordance with AWWA C600.
- C. Install pipe to allow for expansion and contraction without stressing pipe or joints or as specified by pipe manufacturer.
- D. Install access fittings in accordance with local codes to permit disinfection of water system performed under this Section.
- E. Connections with Existing Pipelines: Where connections are made between new work and existing piping, make connection using suitable fittings for conditions encountered. Make each connection with existing pipe at time and under conditions which least interfere with operation of existing pipeline and in compliance with the local utility company.
- F. Form and place concrete for thrust blocks or other specified methods of retainage at each change of direction or end of pipe main.
- G. Establish elevations of buried piping in accordance with Section 312300 for work in this Section.
- H. Backfill trench in accordance with Section 312300.
- I. Install trace wire continuous buried 10 inches below finish grade, above pipe line. Trace wire shall be in accordance with local utilities standards.

NOTE TO SPECIFIER

Use VALVES AND HYDRANTS below when building has a fire sprinkler system as part of the Work.

3.5 INSTALLATION - VALVES AND HYDRANTS

- A. Install gate valves as indicated on Drawings and supported on concrete pads with valve stem vertical and plumb. Install valve boxes in a manner that will not transmit loads, stress, or shock to valve body. Center valve box over operating nut of valve vertical and plumb. Securely fit valve box together leaving cover flush with finished surface.
- B. Install fire hydrant assemblies as indicated on Drawings in vertical and plum position with stream/pumper nozzle pointed perpendicular to traffic where hydrant is adjacent to a street, roadway or parking lot drive or toward the protected building unless otherwise directed by local authorities. Support hydrant assembly on concrete pad and firmly braced on side opposite inlet pipe against undisturbed soil and concrete blocking. Place minimum of 6 cu. ft. of crushed stone or gravel around hydrant base and barrel after thrust blocking has cured at least 24 hours. Exercise care when backfilling and compacting so proper vertical position will not be altered.
- C. Provide a drainage pit 36 inches square by 24 inches deep filled with 2 inch washed gravel. Encase elbow of hydrant in gravel to 6 inches above drain opening. Do not connect drain opening to sewer.
- D. Paint hydrants in accordance with local utility company requirements.



3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Disinfect distribution system with chlorine before acceptance for domestic operation. Amount of chlorine shall be such as to provide dosage of not less than 50 parts/million. Thoroughly flush lines before introduction of chlorinating materials and after contact period of not less than 24 hours, system shall be flushed with clean water until residual chlorine content is not greater than 1.0 part/million. Open and close valves in lines being disinfected several times during contact period. After disinfection, take water sample and bacteriological test in accordance with AWWA specifications. Do not place distribution system in service until approval is obtained from applicable governing authorities.

3.7 SERVICE CONNECTIONS

- A. Provide water service connection in compliance with utility company requirements including reduced pressure backflow preventer if required and water meter with by-pass valves and sand strainer.

3.8 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Site Tests:
 - 1. Compaction:
 - a. Perform inspections prior to and immediately after placing bedding.
 - b. Perform tests as specified in Section 312300.
 - 2. Piping: Water distribution system pipe installed below grade and outside building shall be tested in accordance with following procedures:
 - a. Perform the testing of pipe materials, joints, and/or other materials incorporated into the construction of water mains and force mains to determine leakage and watertightness. All pressure pipeline shall be tested in accordance with Section 4 of AWWA C600 latest edition. In the event any state or local code requires a more stringent test, the more stringent shall apply.
 - b. Pressure Test: After the pipe has been laid, all newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure of at least 1.5 times the working pressure at the point of testing and not less than 1.25 times the working pressure at the highest point along the test section.
 - c. Leakage Test: The leakage test shall be conducted concurrently with the pressure test. Leakage is defined as the quantity of water that must be supplied into the newly laid pipeline, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipeline has been filled with water. Leakage shall not be measured by a drop in pressure in a test section over a period of time. No pipeline installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SDP}{133200}$$

L = allowable leakage, (gallons per hour)

S = length of pipe tested, (feet)

D = nominal diameter of pipe, (inches)

P = average test pressure during test, (psig)

- d. Visible Leakage: All visible leaks shall be repaired regardless of the amount of leakage.
- e. Acceptance of Installation: If any test of pipe laid in place discloses leakage greater than that specified, the Contractor shall, at his own expense, locate the leak and make repairs



as necessary until the leakage is within the specified allowance. Contractor shall supply all water for testing at no additional cost to United States Postal Service.

- f. Provide one copy of results of meter test and hydrostatic pressure test to Contracting Officer and utility company upon completion of water distribution backfilling operations.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION 33 11 00 00



SECTION 33 11 00 00 - MPF WATER UTILITY DISTRIBUTION PIPING

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Domestic water system pipe and fittings.
2. Connection of domestic water system to municipal water system.

NOTE TO SPECIFIER

Use paragraphs (3 and 4) below when building has a fire sprinkler system as part of the Work.

3. Fire protection water system pipe, fittings, valves, and hydrants.
4. Connection of fire protection water system to municipal water system.

- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:

1. Section 312300 - Excavation and Fill: Earthwork for utilities.
2. Section 033000 - Cast-In-Place Concrete: Concrete for thrust blocks.

1.2 REFERENCES

A. American Society of Mechanical Engineers (ASME):

1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

B. American Society for Testing and Materials (ASTM):

1. ASTM B 88 - Specification for Seamless Copper water Tube.
2. ASTM D 1785 - Specification for Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.
3. ASTM D 2241 - Specification for Polyvinyl Chloride (PVC) Pressure Rated Pipe (SDR Series).
4. ASTM D 3034 - Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.



5. ASTM D 3139 - Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.

C. American Water Works Association (AWWA):

1. AWWA C 110 - Gray-Iron Fittings, 3 inches Through 48 Inches, for Water and Other Liquids.
2. AWWA C 111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. AWWA C 151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
4. AWWA C 504 - Rubber Seated Butterfly Valves.
5. AWWA C 509 - Resilient Seated Gate Valves 3 inch through 12 inch NPS, for Water and Sewage Systems.
6. AWWA C 600 - Installation of Ductile-Iron Water Mains and Appurtenances.
7. AWWA C 900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch, for Water.

1.3 DEFINITIONS

- A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.

Product Data: Data for each type of pipe, pipe fitting, valve and accessory specified.

- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 1. Project Record Documents: Accurately record the following:
 - a. Locations of piping mains, valves, connections, and top of pipe elevations.
 - b. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Perform work in accordance with utility company requirements and local authority having jurisdiction requirements.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver and store valves in shipping containers with labeling in place.

PART 2 - PRODUCTS

2.1 PIPE

- A. Pipe sizes less than 3 inch that are installed below grade and outside building shall comply with one or combination of following:



1. Seamless Copper Tubing: Type "K" soft copper to comply with ASTM B 88 latest edition and installed with wrought copper (95-5 Tin Antimony solder joint) fittings in accordance with ASME B16.22.
 2. Polyvinyl Chloride (PVC) Water Pipe: Pipe shall conform to ASTM D 2241 with an SDR 21 rating and shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 1785 classification. Pipe joints shall be integrally molded bell ends in accordance with ASTM D 3139 with factory supplied elastomeric gaskets and lubricant.
- B. Pipe sizes 3 inch and larger that are installed below grade and outside building shall comply with one of the following:
1. Ductile Iron Water Pipe: In accordance with AWWA C 151, Fittings shall be either mechanical joint or push-on joint complying with AWWA C 110 or AWWA C-111 (CLASS 50).
 2. Polyvinyl Chloride (PVC) Water Pipe: Pipe shall meet the requirements of AWWA C-900 and comply with ASTM D 2241, rated SDR 21 (Class 150). Pipe shall be continually marked as for smaller pipes. Pipe joints shall be integrally molded bell ends in accordance with ASTM D 3034, Table 2, with factory supplied elastomeric gaskets and lubricant.
- 2.2 GATE VALVES - 2 Inches and Larger
- A. Manufacturers: Mueller Resilient Seat Gate Valves.
 - B. AWWA C509, Iron body, bronze mounted double disc, parallel seat type, non-rising stem with square nut, single wedge, resilient seat, flanged or mechanical joint ends, control rod, post indicator where indicated on Drawings, extension box and valve key.
 - C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- 2.3 BALL VALVES - 2 Inches and Smaller
- A. Manufacturers: Mueller Oriseal.
 - B. Brass body, Teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, AWWA compression inlet end, compression outlet with electrical ground connector, with control rod, extension box and valve key.
 - C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- 2.4 BUTTERFLY VALVES - 2 inches to 24 inches
- A. AWWA C504, iron body, bronze disc, resilient replaceable seat, water or lug ends, infinite position lever handle.

NOTE TO SPECIFIER

Use CHECK VALVES, ...etc. below when building has a fire sprinkler system as part of the Work.

2.5 CHECK VALVES, POST INDICATOR VALVES, AND BACKFLOW PREVENTORS

- A. Specified in Section 210000 - Fire Suppression.

NOTE TO SPECIFIER

Use HYDRANTS below when building has a fire sprinkler system as part of the Work.



2.6 HYDRANTS

- A. Hydrant: Type as required by utility company, local authority having jurisdiction, and as indicated on Drawings.
- B. Hydrant Extensions: Provide in multiples of 6 inches with rod and coupling to increase barrel length.
- C. Hose and Stream Connection: Match sizes with utility company, two hose nozzles, one pumper nozzle. Provide connection type as required by local fire marshall and by governing agencies having jurisdiction.
- D. Finish: Primer and two coats of enamel or special coating to color as required by utility company.

2.7 ACCESSORIES

- A. Concrete for Thrust Blocks: Section 033000. Place thrust blocking consisting of 2,500 psi concrete to provide sufficient bearing area to transmit unbalanced thrust from bends, tees, caps, or plugs to undisturbed soil without loading undisturbed soil in excess of 2,500 pounds per square foot when water main pressure is 100 psi.

MINIMUM THRUST BLOCKING BEARING AREAS

Pipe Diameter	Tees Sq. Ft.	90° Bend Sq. Ft.	45° Bend Sq. Ft.	22° Bend Sq. Ft.	11° Bend Sq. Ft.
3"	1.0	1.0	1.0	1.0	1.0
4"	1.0	1.0	1.0	1.0	1.0
6"	1.5	2.0	1.0	1.0	1.0
8"	2.5	3.5	1.8	1.0	1.0
10"	4.0	5.5	2.8	1.5	1.0
12"	6.0	8.0	4.0	2.0	1.5
14"	8.0	11.0	5.5	3.0	2.0
16"	10.0	14.2	7.0	4.0	3.0
18"	21.0	21.0	12.0	6.0	4.0

- B. Locked Mechanical Joint fittings shall be installed where vertical changes in direction are required and, if approved by Contracting Officer, can be installed in lieu of the above thrust blocking requirements.

NOTE TO SPECIFIER

OPTION 1: Use paragraph below when building DOES NOT HAVE a FIRE SPRINKLER SYSTEM as part of the Work.

- C. Trace Wire: Magnetic detectable conductor, clear brightly colored plastic covered, imprinted with "DOMESTIC WATER SERVICE" in large letters.

NOTE TO SPECIFIER

OPTION 2: Use paragraph below when building HAS a FIRE SPRINKLER SYSTEM as part of the Work.

- D. Trace Wire: Magnetic detectable conductor, clear brightly colored plastic covered, imprinted in large letters.



1. Domestic Water Lines: "DOMESTIC WATER SERVICE"
2. Fire Protection Water Lines: "FIRE PROTECTION WATER SERVICE"

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 1. Verify trench cut, excavations, dimensions, and elevations are as indicated on Drawings.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with fine aggregate.
- B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.
- C. Cut pipe ends square, ream pipe and tube ends and remove burrs.
- D. Remove scale and dirt, on inside and outside, before assembly.
- E. Prepare pipe for connections to equipment with flanges or unions.

3.3 BEDDING

- A. Excavate pipe trench and place bedding material in accordance with Section 312300 for work of this Section. Provide trench wall shoring as required.
- B. Form and place concrete for pipe thrust restraints at any change of pipe direction and at fittings as indicated on Drawings. Place concrete to permit full access to pipe and pipe accessories. Provide thrust restraint bearing on subsoil per schedule on Drawings.
- C. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches compacted depth, each layer. Place compacted bedding material to elevation of paving subgrade as indicated on Drawings.
- D. Maintain optimum moisture content of bedding material to attain required compaction density.
- E. Remove excess backfill and excavated material from site.



3.4 INSTALLATION - PIPE AND FITTINGS

- A. Maintain separation of water main from sanitary and storm sewer piping in accordance with state or local code.
- B. Install pipe and fittings in accordance with AWWA C600.
- C. Install pipe to allow for expansion and contraction without stressing pipe or joints or as specified by pipe manufacturer.
- D. Install access fittings in accordance with local codes to permit disinfection of water system performed under this Section.
- E. Connections with Existing Pipelines: Where connections are made between new work and existing piping, make connection using suitable fittings for conditions encountered. Make each connection with existing pipe at time and under conditions which least interfere with operation of existing pipeline and in compliance with the local utility company.
- F. Form and place concrete for thrust blocks or other specified methods of retainage at each change of direction or end of pipe main.
- G. Establish elevations of buried piping in accordance with Section 312300 for work in this Section.
- H. Backfill trench in accordance with Section 312300.
- I. Install trace wire continuous buried 10 inches below finish grade, above pipe line. Trace wire shall be in accordance with local utilities standards.

NOTE TO SPECIFIER

Use VALVES AND HYDRANTS below when building has a fire sprinkler system as part of the Work.

3.5 INSTALLATION - VALVES AND HYDRANTS

- A. Install gate valves as indicated on Drawings and supported on concrete pads with valve stem vertical and plumb. Install valve boxes in a manner that will not transmit loads, stress, or shock to valve body. Center valve box over operating nut of valve vertical and plumb. Securely fit valve box together leaving cover flush with finished surface.
- B. Install fire hydrant assemblies as indicated on Drawings in vertical and plum position with stream/pumper nozzle pointed perpendicular to traffic where hydrant is adjacent to a street, roadway or parking lot drive or toward the protected building unless otherwise directed by local authorities. Support hydrant assembly on concrete pad and firmly braced on side opposite inlet pipe against undisturbed soil and concrete blocking. Place minimum of 6 cu. ft. of crushed stone or gravel around hydrant base and barrel after thrust blocking has cured at least 24 hours. Exercise care when backfilling and compacting so proper vertical position will not be altered.
- C. Provide a drainage pit 36 inches square by 24 inches deep filled with 2 inch washed gravel. Encase elbow of hydrant in gravel to 6 inches above drain opening. Do not connect drain opening to sewer.
- D. Paint hydrants in accordance with local utility company requirements.



3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Disinfect distribution system with chlorine before acceptance for domestic operation. Amount of chlorine shall be such as to provide dosage of not less than 50 parts/million. Thoroughly flush lines before introduction of chlorinating materials and after contact period of not less than 24 hours, system shall be flushed with clean water until residual chlorine content is not greater than 1.0 part/million. Open and close valves in lines being disinfected several times during contact period. After disinfection, take water sample and bacteriological test in accordance with AWWA specifications. Do not place distribution system in service until approval is obtained from applicable governing authorities.

3.7 SERVICE CONNECTIONS

- A. Provide water service connection in compliance with utility company requirements including reduced pressure backflow preventer if required and water meter with by-pass valves and sand strainer.

3.8 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Site Tests:
 - 1. Compaction:
 - a. Perform inspections prior to and immediately after placing bedding.
 - b. Perform tests as specified in Section 312300.
 - 2. Piping: Water distribution system pipe installed below grade and outside building shall be tested in accordance with following procedures:
 - a. Perform the testing of pipe materials, joints, and/or other materials incorporated into the construction of water mains and force mains to determine leakage and watertightness. All pressure pipeline shall be tested in accordance with Section 4 of AWWA C600 latest edition. In the event any state or local code requires a more stringent test, the more stringent shall apply.
 - b. Pressure Test: After the pipe has been laid, all newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure of at least 1.5 times the working pressure at the point of testing and not less than 1.25 times the working pressure at the highest point along the test section.
 - c. Leakage Test: The leakage test shall be conducted concurrently with the pressure test. Leakage is defined as the quantity of water that must be supplied into the newly laid pipeline, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipeline has been filled with water. Leakage shall not be measured by a drop in pressure in a test section over a period of time. No pipeline installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SDP}{133200}$$

L = allowable leakage, (gallons per hour)

S = length of pipe tested, (feet)

D = nominal diameter of pipe, (inches)

P = average test pressure during test, (psig)

- d. Visible Leakage: All visible leaks shall be repaired regardless of the amount of leakage.
- e. Acceptance of Installation: If any test of pipe laid in place discloses leakage greater than that specified, the Contractor shall, at his own expense, locate the leak and make repairs



- as necessary until the leakage is within the specified allowance. Contractor shall supply all water for testing at no additional cost to United States Postal Service.
- f. Provide one copy of results of meter test and hydrostatic pressure test to Contracting Officer and utility company upon completion of water distribution backfilling operations.

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END OF SECTION 33 11 00 00



Task	Specification	Specification Description
33 11 13 13	01 22 16 00	No Specification Required
33 11 13 13	22 05 23 00	Piped Utilities Basic Materials And Methods
33 11 13 23	01 22 16 00	No Specification Required
33 11 13 23	22 05 23 00	Piped Utilities Basic Materials And Methods
33 11 13 23	22 11 23 39	Water Supply Wells
33 11 13 23	32 91 19 13	Septic Tank Systems
33 11 13 36	22 05 23 00	Piped Utilities Basic Materials And Methods
33 11 13 36	22 11 23 39	Water Supply Wells
33 11 13 39	22 05 23 00	Piped Utilities Basic Materials And Methods
33 11 13 53	01 22 16 00	No Specification Required
33 11 13 53	21 05 00 00	Common Work Results for Fire Suppression
33 12 13 23	01 22 16 00	No Specification Required
33 12 13 23	22 05 23 00	Piped Utilities Basic Materials And Methods
33 12 16 00	01 22 16 00	No Specification Required
33 12 16 00	22 05 23 00	Piped Utilities Basic Materials And Methods
33 12 16 00	22 05 23 00a	General-Duty Valves for Plumbing Piping
33 12 16 00	22 05 23 00b	General-Duty Valves for HVAC Piping
33 12 19 00	22 05 23 00	Piped Utilities Basic Materials And Methods
33 13 00 00	22 05 23 00	Piped Utilities Basic Materials And Methods



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SECTION 33 20 00 00 - MPF WELLS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

Use this section where Water Well is part of the Work. Before editing this Section, obtain the "Report of Subsurface Investigation" prepared by the Geotechnical Engineer. Read the report and incorporate the recommendations included in the report for Water Wells into this Section.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Drilling and casing water well.
 - 2. Pump and controller.
 - 3. Water and system testing and certification.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 012200 - Unit Prices: Procedures related to Work performed under unit price method.
 - 2. Section 331100 - Water Utility Distribution Piping: Site water distribution piping.
- D. Unit Prices:
 - 1. Base bids on vertical foot of well depth indicated on Drawings.
 - 2. Determine change in well depth from depth indicated on Drawings by vertical foot of actual well depth change from Base Bid and recorded in Project Record Documents.
 - 3. Adjustment to price due to changes in depth of well will be based on unit prices established as specified in Section 012200 – Unit Prices.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
- B. American Water Works Association (AWWA):



1. AWWA A100 - Water Wells.
2. AWWA C900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch, for Water.

C. American Society of Mechanical Engineers (ASME):

1. ASME SEC. VIII - Pressure Vessels.

D. National Electrical Manufacturers Association (NEMA):

1. NEMA MG 1 - Motors and Generators.

1.3 SYSTEM DESCRIPTION

NOTE TO SPECIFIER

Edit for design requirements for specific Project. Do not include if this information is indicated on Drawings.

A. Design Requirements: Water well with the following characteristics:

1. Upper Drill Hole: [____] inch diameter, [____] feet deep.
2. Lower Drill Hole: [____] inch diameter, [____] feet deep.
3. Casing Size: [____] inch outside diameter, [____] feet deep.
4. Grout Seal: [____] feet deep.
5. Total Well Depth: [____] feet deep.
6. Pump Depth: [____] feet deep.

NOTE TO SPECIFIER

Edit for required GPM and acceptable PPM for specific Project.

B. Performance Requirements:

1. Water well capable of producing minimum [____] gallons of water per minute.
2. Maximum Sand Suspended in Delivered Water: [____] parts per million.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Procedures for submittals.

1. Product Data: Indicate pump rated capacity, weight, accessories, electrical nameplate data, and wiring diagrams.
2. Shop Drawings: Indicate layout of well pump system, including pumps, controls, related accessories, and piping.
3. Assurance/Control Submittals:
 - a. Test Reports: Submit the following water test reports directly to Contracting Officer from Testing Laboratory, with copy to Contractor.
 - 1) Physical properties.
 - 2) Inorganic chemicals and water quality.
 - 3) Water quality.
 - 4) Radiological.
 - 5) Bacteriological contaminants.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.

1. Project Record Documents: Accurately record the following:
 - a. Actual location of well.
 - b. Well depth.



- c. Subsoil strata.
- d. Drilling difficulties encountered.
- e. Signed copy of driller's log book statements.
- f. Executed certification of well pump after performance testing.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with AWWA A 100.
- B. Drilling Firm Qualifications: Company specializing in performing the Work of this Section with minimum 5 years documented experience, licensed in State where Project is located.
- C. Regulatory Requirements:
 - 1. Conform to State regulatory authority or regulations for water well flow capabilities and water quality.
 - 2. Provide certificate for authority having jurisdiction indicating suitability of water for human consumption.

PART 2 - PRODUCTS

2.1 MATERIALS

NOTE TO SPECIFIER

Edit for Well Casing pipe diameter required for this Project..

- A. Well Casing: ASTM A 120 [____] inch diameter seamless steel pipe and couplings and threaded joints, with pitless adapter and ventilated well cap. Casing diameter as indicated on Drawings.
- B. Grout: Portland cement type, no admixtures.

NOTE TO SPECIFIER

Edit bracketed items below for Pump type required for this Project..

2.2 PUMP

- A. Type: Vertical shaft, multiple stage, close coupled, for insertion in [____] diameter pipe.
- B. Casing: [Cast iron] [Bronze] casting with stainless steel housing and intake screen, check valve with stainless steel stem and valve seat with rubber seal built into discharge casting.
- C. Impellers and Diffusers: [Bronze.] [Glass reinforced thermoplastic with stainless steel wear rings.]
- D. Shaft: Stainless steel with stainless steel shaft sleeve.
- E. Motor: NEMA MG 1, submersible type:
 - 1. Characteristics: [____] hp; [[115] [230] volt, single phase 60 Hertz [[200] [230] [460] [575] volt, three phase 60 Hertz].
- F. Pump: Submersible type for deep well pump, [water lubricated] [oil filled]:
 - 1. Operating Performance: [____] gpm flow capacity, [____] feet total dynamic head, [____] hp motor.



2. Pump Capacity: [[____] gpm] [[____] gph]

- G. Pump Controller: NEMA 250 Type [1] [3R] enclosure with main disconnect interlocked with door, containing across-the-line electric motor starter with starting relay [and ambient compensate quick trip overloads in each phase with manual trip button and reset button]; circuit breaker, control transformer, hand-off-automatic selector switches, pilot light.
- H. Disconnect: NEMA 250 Type [1] [3R] enclosure.
- I. Pressure Sensing Switch: Low voltage relay type, [fixed] [adjustable] settings to start at [20] [30] [____] psig and shut-off at [40] [50] [____] psig [and low pressure cutoff set at [20] [____] psig .
- J. Control Voltage: [120 VAC.] [24 VDC.]
- K. Pump Lift Cable: Stainless steel, multi-stranded aircraft cable, high tensile strength; cable ends fitted with closed loop fittings; length of cable equals depth of shaft plus [20] [____] feet.
- L. Screens: Stainless steel type.

2.3 TANK

- A. Galvanized steel, tested and stamped in accordance with ASME SEC. VIII; Pressurized diaphragm type with integral floor stand; tapping for installation of piping and accessories:
 - 1. Tank Volume: Indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify that site conditions will support equipment for performing drilling operations and testing.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 DRILLING

- A. Drill concentric well shaft to diameters and depths required.
- B. Place well casing immediately after drilling. Set firmly in place.
- C. Clean shaft bottom of loose material.
- D. Allow inspection of casing prior to placement of grout.



- E. Place grout tight to surrounding work.
- F. Maintain well opening and casing free of contaminating materials.
- G. Cut off shaft top 24 inches above grade. Do not permit metal cuttings to enter casing.
- H. Disinfect well.

3.3 INSTALLATION - PUMP

- A. Install pump and accessories in accordance with manufacturer's instructions.
- B. Electrical Connections: Refer to Section 260500.

3.4 CONSTRUCTION

- A. Site Tolerances:
 - 1. Maximum Variation From Plumb: In accordance with AWWA A100.
 - 2. Maximum Offset From True Position: 1 inch.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Test flow rate and certify.
- C. Test Water Quality.
- D. Test for sand content.

3.6 CLEANING

- A. Clean piping in preparation for disinfecting and testing.

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END OF SECTION 33 20 00 00



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SECTION 33 20 00 00 - CSF WELLS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Water Well is part of the Work. Before editing this Section, obtain the "Report of Subsurface Investigation" prepared by the Geotechnical Engineer. Read the report and incorporate the recommendations included in the report for Water Wells into this Section.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Drilling and casing water well.
 - 2. Pump and controller.
 - 3. Water and system testing and certification.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 012200 - Unit Prices: Procedures related to Work performed under unit price method.
 - 2. Section 331100 - Water Utility Distribution Piping: Site water distribution piping.
- D. Unit Prices:
 - 1. Base bids on vertical foot of well depth indicated on Drawings.
 - 2. Determine change in well depth from depth indicated on Drawings by vertical foot of actual well depth change from Base Bid and recorded in Project Record Documents.
 - 3. Adjustment to price due to changes in depth of well will be based on unit prices established as specified in Section 012200 – Unit Prices.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
- B. American Water Works Association (AWWA):



1. AWWA A100 - Water Wells.
2. AWWA C900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch, for Water.

- C. American Society of Mechanical Engineers (ASME):
1. ASME SEC. VIII - Pressure Vessels.

- D. National Electrical Manufacturers Association (NEMA):
1. NEMA MG 1 - Motors and Generators.

1.3 SYSTEM DESCRIPTION

NOTE TO SPECIFIER

Edit for design requirements for specific Project. Do not include if this information is indicated on Drawings.

- A. Design Requirements: Water well with the following characteristics:
1. Upper Drill Hole: [____] inch diameter, [____] feet deep.
 2. Lower Drill Hole: [____] inch diameter, [____] feet deep.
 3. Casing Size: [____] inch outside diameter, [____] feet deep.
 4. Grout Seal: [____] feet deep.
 5. Total Well Depth: [____] feet deep.
 6. Pump Depth: [____] feet deep.

NOTE TO SPECIFIER

Edit for required GPM and acceptable PPM for specific Project.

- B. Performance Requirements:
1. Water well capable of producing minimum [____] gallons of water per minute.
 2. Maximum Sand Suspended in Delivered Water: [____] parts per million.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
1. Product Data: Indicate pump rated capacity, weight, accessories, electrical nameplate data, and wiring diagrams.
 2. Shop Drawings: Indicate layout of well pump system, including pumps, controls, related accessories, and piping.
 3. Assurance/Control Submittals:
 - a. Test Reports: Submit the following water test reports directly to Contracting Officer from Testing Laboratory, with copy to Contractor.
 - 1) Physical properties.
 - 2) Inorganic chemicals and water quality.
 - 3) Water quality.
 - 4) Radiological.
 - 5) Bacteriological contaminants.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
1. Project Record Documents: Accurately record the following:
 - a. Actual location of well.
 - b. Well depth.



- c. Subsoil strata.
- d. Drilling difficulties encountered.
- e. Signed copy of driller's log book statements.
- f. Executed certification of well pump after performance testing.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with AWWA A 100.
- B. Drilling Firm Qualifications: Company specializing in performing the Work of this Section with minimum 5 years documented experience, licensed in State where Project is located.
- C. Regulatory Requirements:
 - 1. Conform to State regulatory authority or regulations for water well flow capabilities and water quality.
 - 2. Provide certificate for authority having jurisdiction indicating suitability of water for human consumption.

PART 2 - PRODUCTS

2.1 MATERIALS

NOTE TO SPECIFIER

Edit for Well Casing pipe diameter required for this Project..

- A. Well Casing: ASTM A 120 [____] inch diameter seamless steel pipe and couplings and threaded joints, with pitless adapter and ventilated well cap. Casing diameter as indicated on Drawings.
- B. Grout: Portland cement type, no admixtures.

NOTE TO SPECIFIER

Edit bracketed items below for Pump type required for this Project..

2.2 PUMP

- A. Type: Vertical shaft, multiple stage, close coupled, for insertion in [____] diameter pipe.
- B. Casing: [Cast iron] [Bronze] casting with stainless steel housing and intake screen, check valve with stainless steel stem and valve seat with rubber seal built into discharge casting.
- C. Impellers and Diffusers: [Bronze.] [Glass reinforced thermoplastic with stainless steel wear rings.]
- D. Shaft: Stainless steel with stainless steel shaft sleeve.
- E. Motor: NEMA MG 1, submersible type:
 - 1. Characteristics: [____] hp; [[115] [230] volt, single phase 60 Hertz [[200] [230] [460] [575] volt, three phase 60 Hertz].
- F. Pump: Submersible type for deep well pump, [water lubricated] [oil filled]:
 - 1. Operating Performance: [____] gpm flow capacity, [____] feet total dynamic head, [____] hp motor.



2. Pump Capacity: [[____] gpm] [[____] gph]

- G. Pump Controller: NEMA 250 Type [1] [3R] enclosure with main disconnect interlocked with door, containing across-the-line electric motor starter with starting relay [and ambient compensate quick trip overloads in each phase with manual trip button and reset button]; circuit breaker, control transformer, hand-off-automatic selector switches, pilot light.
- H. Disconnect: NEMA 250 Type [1] [3R] enclosure.
- I. Pressure Sensing Switch: Low voltage relay type, [fixed] [adjustable] settings to start at [20] [30] [____] psig and shut-off at [40] [50] [____] psig [and low pressure cutoff set at [20] [____] psig .
- J. Control Voltage: [120 VAC.] [24 VDC.]
- K. Pump Lift Cable: Stainless steel, multi-stranded aircraft cable, high tensile strength; cable ends fitted with closed loop fittings; length of cable equals depth of shaft plus [20] [____] feet.
- L. Screens: Stainless steel type.

2.3 TANK

- A. Galvanized steel, tested and stamped in accordance with ASME SEC. VIII; Pressurized diaphragm type with integral floor stand; tapping for installation of piping and accessories:
 - 1. Tank Volume: Indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify that site conditions will support equipment for performing drilling operations and testing.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 DRILLING

- A. Drill concentric well shaft to diameters and depths required.
- B. Place well casing immediately after drilling. Set firmly in place.
- C. Clean shaft bottom of loose material.
- D. Allow inspection of casing prior to placement of grout.



- E. Place grout tight to surrounding work.
- F. Maintain well opening and casing free of contaminating materials.
- G. Cut off shaft top 24 inches above grade. Do not permit metal cuttings to enter casing.
- H. Disinfect well.

3.3 INSTALLATION - PUMP

- A. Install pump and accessories in accordance with manufacturer's instructions.
- B. Electrical Connections: Refer to Section 260500.

3.4 CONSTRUCTION

- A. Site Tolerances:
 - 1. Maximum Variation From Plumb: In accordance with AWWA A100.
 - 2. Maximum Offset From True Position: 1 inch.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Test flow rate and certify.
- C. Test Water Quality.
- D. Test for sand content.

3.6 CLEANING

- A. Clean piping in preparation for disinfecting and testing.

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END OF SECTION 33 20 00 00



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Task	Specification	Specification Description
33 21 13 00	01 22 16 00	No Specification Required
33 21 13 00	22 05 23 00	Piped Utilities Basic Materials And Methods
33 21 13 00	22 11 23 39	Water Supply Wells
33 26 00 00	22 05 23 00	Piped Utilities Basic Materials And Methods



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SECTION 33 30 00 00 - CSF SANITARY SEWERAGE UTILITIES

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sanitary sewer drainage piping, fittings, accessories and bedding.
 - 2. Connection of project sanitary drainage system to the municipal sanitary sewer system.
 - 3. Clean-out and access structures.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 312300- Excavation and Fill: Earthwork for utilities.
 - 2. Section 033000 - Cast-In-Place Concrete: Concrete for cleanout and manhole base pads.

1.2 REFERENCES

- A. American Association of State Highway and transportation Officials (AASHTO):
 - 1. AASHTO M294 - Corrugated Polyethylene Pipe, 300-1200 mm Diameter.
 - 2. AASHTO M252 - Corrugated Polyethylene Drainage Pipe.
- B. American National Standards Institute (ANSI):
 - 1. ANSI A21.14 - Ductile Iron Fittings, 3-Inch Through 24-Inch, for Gas.
- C. American Society for Testing and Materials (ASTM):
 - 1. ASTM C 12 - Practice for Installing Vitrified Clay Pipe Lines.
 - 2. ASTM C 14 - Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
 - 3. ASTM C 76 - Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
 - 4. ASTM C 425 - Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
 - 5. ASTM C 443 - Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
 - 6. ASTM D 3034 - Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.



7. ASTM A 746 - Specification for Ductile Iron Gravity Sewer Pipe.
8. ASTM C 700 - Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength and perforated.
9. ASTM F 477 - Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

1.3 DEFINITIONS

- A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 1. Product Data: Data for each type of pipe and pipe accessory specified.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 1. Project Record Documents: Accurately record the following.
 - a. Actual locations of pipe runs, connections, manholes, cleanouts, and invert elevations.
 - b. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Perform work in accordance with utility company requirements and applicable health codes and authority having jurisdiction requirements.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Edit PIPE MATERIALS paragraph below for type of pipe used for this Project.

2.1 PIPE MATERIALS

- A. Polyvinyl Chloride (PVC) Pipe:
 1. ASTM D 3034, Rated SDR 35 unless otherwise required by local utility having jurisdiction. Continuously mark pipe with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 3034 classification.
 2. ASTM D 3034, Table 2; pipe joints with integrally molded bell ends and factory supplied elastomeric gaskets and lubricant.
- B. Corrugated Polyethylene (CPP) Pipe:
 1. Pipe: AASHTO designation #M294 and #M252; smooth interior, 4 inches through 18 inches as indicated on Drawings.
 2. Fittings: ASTM D 3034, rated SDR 35; with thermo-molded PVC.
 3. Gaskets: ASTM F 477; with thermo-molded PVC fittings and CPP pipe joint assembly.
- C. Vitrified Clay (VCP) Pipe:
 1. Pipe: ASTM C 700.
 2. Joints: ASTM C 425.



3. Gaskets: ASTM C 425; high grade vulcanized elastomeric compound consisting of basic natural or synthetic rubber. Provide gaskets manufactured in compliance with Rubber Manufacturer's Association tolerances for gaskets.
 4. Lubricant: Suitable for lubricating joint components; no deteriorating effects on gasket or pipe material, will not support growth of fungi or bacteria, and of type recommended by gasket manufacturer.
- D. Ductile Iron Pipe:
1. Pipe: ASTM A 746; Extra Heavy type, inside nominal diameter as indicated on Drawings with bell and spigot end.
 2. Pipe Joint: ANSI A21.14, rubber gasket joint devices.
- E. Concrete Pipe:
1. Pipe: ASTM C 14, Class 1, 2, or 3; bell and spigot pipe with inside nominal diameter as indicated on Drawings.
 2. Pipe Joint: ASTM C 443; rubber compression gasket joint devices.
- F. Reinforced Concrete Pipe:
1. Reinforced Concrete: ASTM C 76, Class I, II, III, IV, or V as indicated on Drawings, with Wall type A, B, or C; mesh reinforcement; inside nominal diameter as indicated with bell and spigot end.
 2. Reinforced Concrete: ASTM C 443; rubber compression gasket joint devices.

2.2 PIPE ACCESSORIES

- A. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene ribbed gasket for positive seal.
- B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.
- C. Trace Wire: Magnetic detectable conductor, clear brightly colored plastic covered, imprinted with "SEWER SERVICE" in large letters.

2.3 CLEANOUTS AND MANHOLES

- A. Lid and Frame: Heavy duty cast iron with removable lid as indicated on Drawings.
- B. Shaft Construction: Cast Iron shaft of internal diameter as indicated on Drawings with 2500 psi concrete collar for cleanouts.
- C. Base Pad: Concrete specified in Section 033000.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 1. Verify trench cut, excavations, dimensions, and elevations are as indicated on Drawings.



- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with fine aggregate.
- B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.

3.3 BEDDING

- A. Excavate pipe trench and place bedding material in accordance with Section 312300 for work of this Section.
- B. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches compacted depth, each layer. Place compacted bedding material to elevation of paving subgrade as indicated on Drawings.
- C. Maintain optimum moisture content of bedding material to attain required compaction density.
- D. Remove excess backfill and excavated material from site.

3.4 INSTALLATION - PIPE

- A. Install pipe, fittings, and accessories in accordance with ASTM C 12, ASTM C 14, manufacturer's published instructions and state or local requirements. Seal joints watertight.
- B. Install pipe on minimum 4 inch bedding as specified in Section 312300.
- C. Lay pipe to slope gradients indicated on Drawings.
- D. Refer to Section 312300 for trenching requirements. Do not displace or damage pipe when compacting.
- E. Connect to building sanitary sewer outlet and municipal sewer system as indicated on Drawings.
- F. Install trace wire continuous over top of pipe buried 6 inches below finish grade, above pipe line.

3.5 INSTALLATION - CLEANOUTS

- A. Form bottom of excavation clean and smooth to elevation indicated on Drawings.
- B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe to be placed at required elevations.
- C. Mount lid and frame level in grout, secured to top section at elevation indicated.



3.6 SERVICE CONNECTIONS

- A. Coordinate the Work with termination of sanitary sewer connection outside building including connection to municipal sanitary sewer system.
- B. Connect to existing municipal sanitary sewer system in compliance with utility requirements for new service connections.

3.7 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Site Tests:
 - 1. Perform inspections prior to and immediately after placing bedding.
 - 2. Compaction: Specified in Section 312300.
 - a. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.
 - b. Frequency of Tests: One test for each 50 lineal feet of trench.
 - 3. Perform the following tests in accordance with applicable local Public Works Department Standard Specifications and requirements.
 - a. Pressure Test.
 - b. Infiltration Test
 - c. Deflection Test

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION 33 30 00 00



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SECTION 33 30 00 00 - MPF SANITARY SEWERAGE UTILITIES

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Sanitary sewer drainage piping, fittings, accessories and bedding.
 2. Connection of project sanitary drainage system to the municipal sanitary sewer system.
 3. Clean-out and access structures.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 1. Section 312300- Excavation and Fill: Earthwork for utilities.
 2. Section 033000 - Cast-In-Place Concrete: Concrete for cleanout and manhole base pads.

1.2 REFERENCES

- A. American Association of State Highway and transportation Officials (AASHTO):
 1. AASHTO M294 - Corrugated Polyethylene Pipe, 300-1200 mm Diameter.
 2. AASHTO M252 - Corrugated Polyethylene Drainage Pipe.
- B. American National Standards Institute (ANSI):
 1. ANSI A21.14 - Ductile Iron Fittings, 3-Inch Through 24-Inch, for Gas.
- C. American Society for Testing and Materials (ASTM):
 1. ASTM C 12 - Practice for Installing Vitrified Clay Pipe Lines.
 2. ASTM C 14 - Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
 3. ASTM C 76 - Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
 4. ASTM C 425 - Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
 5. ASTM C 443 - Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
 6. ASTM D 3034 - Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.



7. ASTM A 746 - Specification for Ductile Iron Gravity Sewer Pipe.
8. ASTM C 700 - Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength and perforated.
9. ASTM F 477 - Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

1.3 DEFINITIONS

- A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 1. Product Data: Data for each type of pipe and pipe accessory specified.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 1. Project Record Documents: Accurately record the following.
 - a. Actual locations of pipe runs, connections, manholes, cleanouts, and invert elevations.
 - b. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Perform work in accordance with utility company requirements and applicable health codes and authority having jurisdiction requirements.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Edit PIPE MATERIALS paragraph below for type of pipe used for this Project.

2.1 PIPE MATERIALS

- A. Polyvinyl Chloride (PVC) Pipe:
 1. ASTM D 3034, Rated SDR 35 unless otherwise required by local utility having jurisdiction. Continuously mark pipe with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 3034 classification.
 2. ASTM D 3034, Table 2; pipe joints with integrally molded bell ends and factory supplied elastomeric gaskets and lubricant.
- B. Corrugated Polyethylene (CPP) Pipe:
 1. Pipe: AASHTO designation #M294 and #M252; smooth interior, 4 inches through 18 inches as indicated on Drawings.
 2. Fittings: ASTM D 3034, rated SDR 35; with thermo-molded PVC.
 3. Gaskets: ASTM F 477; with thermo-molded PVC fittings and CPP pipe joint assembly.
- C. Vitrified Clay (VCP) Pipe:
 1. Pipe: ASTM C 700.
 2. Joints: ASTM C 425.



3. Gaskets: ASTM C 425; high grade vulcanized elastomeric compound consisting of basic natural or synthetic rubber. Provide gaskets manufactured in compliance with Rubber Manufacturer's Association tolerances for gaskets.
 4. Lubricant: Suitable for lubricating joint components; no deteriorating effects on gasket or pipe material, will not support growth of fungi or bacteria, and of type recommended by gasket manufacturer.
- D. Ductile Iron Pipe:
1. Pipe: ASTM A 746; Extra Heavy type, inside nominal diameter as indicated on Drawings with bell and spigot end.
 2. Pipe Joint: ANSI A21.14, rubber gasket joint devices.
- E. Concrete Pipe:
1. Pipe: ASTM C 14, Class 1, 2, or 3; bell and spigot pipe with inside nominal diameter as indicated on Drawings.
 2. Pipe Joint: ASTM C 443; rubber compression gasket joint devices.
- F. Reinforced Concrete Pipe:
1. Reinforced Concrete: ASTM C 76, Class I, II, III, IV, or V as indicated on Drawings, with Wall type A, B, or C; mesh reinforcement; inside nominal diameter as indicated with bell and spigot end.
 2. Reinforced Concrete: ASTM C 443; rubber compression gasket joint devices.

2.2 PIPE ACCESSORIES

- A. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene ribbed gasket for positive seal.
- B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.
- C. Trace Wire: Magnetic detectable conductor, clear brightly colored plastic covered, imprinted with "SEWER SERVICE" in large letters.

2.3 CLEANOUTS AND MANHOLES

- A. Lid and Frame: Heavy duty cast iron with removable lid as indicated on Drawings.
- B. Shaft Construction: Cast Iron shaft of internal diameter as indicated on Drawings with 2500 psi concrete collar for cleanouts.
- C. Base Pad: Concrete specified in Section 033000.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 1. Verify trench cut, excavations, dimensions, and elevations are as indicated on Drawings.



- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with fine aggregate.
- B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.

3.3 BEDDING

- A. Excavate pipe trench and place bedding material in accordance with Section 312300 for work of this Section.
- B. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches compacted depth, each layer. Place compacted bedding material to elevation of paving subgrade as indicated on Drawings.
- C. Maintain optimum moisture content of bedding material to attain required compaction density.
- D. Remove excess backfill and excavated material from site.

3.4 INSTALLATION - PIPE

- A. Install pipe, fittings, and accessories in accordance with ASTM C 12, ASTM C 14, manufacturer's published instructions and state or local requirements. Seal joints watertight.
- B. Install pipe on minimum 4 inch bedding as specified in Section 312300.
- C. Lay pipe to slope gradients indicated on Drawings.
- D. Refer to Section 312300 for trenching requirements. Do not displace or damage pipe when compacting.
- E. Connect to building sanitary sewer outlet and municipal sewer system as indicated on Drawings.
- F. Install trace wire continuous over top of pipe buried 6 inches below finish grade, above pipe line.

3.5 INSTALLATION - CLEANOUTS

- A. Form bottom of excavation clean and smooth to elevation indicated on Drawings.
- B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe to be placed at required elevations.
- C. Mount lid and frame level in grout, secured to top section at elevation indicated.



3.6 SERVICE CONNECTIONS

- A. Coordinate the Work with termination of sanitary sewer connection outside building including connection to municipal sanitary sewer system.
- B. Connect to existing municipal sanitary sewer system in compliance with utility requirements for new service connections.

3.7 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Site Tests:
 - 1. Perform inspections prior to and immediately after placing bedding.
 - 2. Compaction: Specified in Section 312300.
 - a. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.
 - b. Frequency of Tests: One test for each 50 lineal feet of trench.
 - 3. Perform the following tests in accordance with applicable local Public Works Department Standard Specifications and requirements.
 - a. Pressure Test.
 - b. Infiltration Test
 - c. Deflection Test

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END OF SECTION 33 30 00 00



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Task	Specification	Specification Description
33 31 00 00	01 22 16 00	No Specification Required
33 31 00 00	22 05 23 00	Piped Utilities Basic Materials And Methods
33 31 00 00	22 11 23 39	Water Supply Wells
33 31 00 00	32 91 19 13	Septic Tank Systems
33 32 16 13	01 22 16 00	No Specification Required



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SECTION 33 36 00 00 - CSF UTILITY SEPTIC TANKS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where a Septic Tank System is part of the Work. Before editing this Section, obtain the "Report of Subsurface Investigation" prepared by the Geotechnical Engineer. Read the report and incorporate the recommendations included in the report for Septic Tank System into this Section.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Septic tank.
 - 2. Distribution box.
 - 3. Filter drainage field system.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Provide data on tank accessories.
 - 2. Shop Drawings: Indicate tank size and configuration; plan, location and inverts of filter field; inverts of connecting piping.
 - 3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
 - c. Manufacturer's Instructions: Indicate special procedures for septic tank installation.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Project Record Documents: Accurately record the following:
 - 2. Actual locations and inverts of buried pipe, components, and connections.



1.3 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 - 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Septic Tank: Reinforced precast concrete construction, 4,000 psi 28 day minimum strength, concrete partitioned chambers, concrete lid with lift rings, vent, inlet inspection hole, inlet turned down minimum 12 inches below effluent level.
 - 1. Tank Capacity: Indicated on Drawings.
- B. Distribution Box: Reinforced concrete, single inlet, two outlets, gate, removable cover with lift ring.

2.2 CONNECTING PIPE MATERIALS

- A. Vitrified Clay Pipe: ASTM C700 Standard strength, bell and spigot joint with seal; nominal inside diameter indicated on Drawings.
- B. Fittings: Same material as pipe, tee bends, elbows, clean-outs, reducers, ends to suit pipe joint.
- C. Pipe Joint Cover: Geotextile fabric.

2.3 FILTER FIELD PIPE MATERIALS

- A. Vitrified Clay Pipe: ASTM C700, Standard strength, plain end joint; nominal inside diameter indicated on Drawings.
- B. Use perforated pipe at filter field system; unperforated through sleeves and at junction with distribution box.

2.4 BEDDING MATERIALS

- A. Aggregate Bedding Material: Fill as specified in Section 312000.

2.5 FILTER AGGREGATE

- A. Filter Aggregate Materials: Fill as specified in Section 312000.

2.6 ACCESSORIES

- A. Geotextile Fabric: Non-woven fabric, polypropylene.



PART 3 - EXECUTION

3.1 PREPARATION

- A. Ream pipe ends and remove burrs.
- B. Remove scale and dirt from components before assembly.
- C. Establish invert elevations for all components in the system.
- D. Hand trim excavation to suit septic tank, distribution box and field tile arrangement. Remove stones, roots or other obstructions.

3.2 TANK AND TANK BEDDING

- A. Excavate in accordance with Section 312300 for work of this section. Hand trim excavation for accurate placement of tank to elevations indicated.
- B. Place bedding material level in one continuous layer not exceeding 8 inches compacted depth, compact to 95 percent.
- C. Backfill around sides of tank, tamp in place and compact to 95 percent.
- D. Maintain optimum moisture content of bedding material to attain required compaction density.
- E. Install septic tank and distribution box and related components on bedding in accordance with manufacturer's instructions. Position components to permit access to inspection ports.

3.3 CONNECTING PIPING

- A. Install vitrified clay pipe in accordance with ASTM C12.
- B. Connect outlet between building sanitary piping and septic tank, between septic tank and distribution box, between distribution box and filter field header [with Type [_____] pipe and fittings].
- C. Place pipe and fittings on clean excavated subsoil.
- D. Slope piping to each successive component, minimum of [1:50.] [_____.]
- E. Cover pipe with aggregate, sides and top. Place geotextile fabric over cover prior to backfilling.
- F. Coordinate the work with connections to building sanitary sewer piping outlet.

3.4 INSTALLATION - FILTER FIELD

- A. Install vitrified clay pipe in accordance with ASTM C12.
- B. Place field pipe header [at constant elevation] [sloping down from header inlet], [1:100.] [_____.]
- C. Place aggregate bed [18] [_____] inch thick, tamp compact firm. Establish slope of bed to suit established invert elevations.



- D. Place pipe sloping away from header minimum of [1:200] [] [, with perforations facing down].
- E. Wrap pipe joints with paper, cover with aggregate, sides and top. Place geotextile fabric over cover prior to backfilling.
- F. Cover entire field with aggregate [12] [] inch, lightly compact. Level prior to placement of subsoil cover as specified in Section 312000.

USPS CSF Specifications issued: 10/1/2013
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END OF SECTION 33 36 00 00



SECTION 33 36 00 00 - MPF UTILITY SEPTIC TANKS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

Use this section where a Septic Tank System is part of the Work. Before editing this Section, obtain the "Report of Subsurface Investigation" prepared by the Geotechnical Engineer. Read the report and incorporate the recommendations included in the report for Septic Tank System into this Section.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Septic tank.
 - 2. Distribution box.
 - 3. Filter drainage field system.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

1.2 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Provide data on tank accessories.
 - 2. Shop Drawings: Indicate tank size and configuration; plan, location and inverts of filter field; inverts of connecting piping.
 - 3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
 - c. Manufacturer's Instructions: Indicate special procedures for septic tank installation.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Project Record Documents: Accurately record the following:
 - 2. Actual locations and inverts of buried pipe, components, and connections.



1.3 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 - 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Septic Tank: Reinforced precast concrete construction, 4,000 psi 28 day minimum strength, concrete partitioned chambers, concrete lid with lift rings, vent, inlet inspection hole, inlet turned down minimum 12 inches below effluent level.
 - 1. Tank Capacity: Indicated on Drawings.
- B. Distribution Box: Reinforced concrete, single inlet, two outlets, gate, removable cover with lift ring.

2.2 CONNECTING PIPE MATERIALS

- A. Vitrified Clay Pipe: ASTM C700 Standard strength, bell and spigot joint with seal; nominal inside diameter indicated on Drawings.
- B. Fittings: Same material as pipe, tee bends, elbows, clean-outs, reducers, ends to suit pipe joint.
- C. Pipe Joint Cover: Geotextile fabric.

2.3 FILTER FIELD PIPE MATERIALS

- A. Vitrified Clay Pipe: ASTM C700, Standard strength, plain end joint; nominal inside diameter indicated on Drawings.
- B. Use perforated pipe at filter field system; unperforated through sleeves and at junction with distribution box.

2.4 BEDDING MATERIALS

- A. Aggregate Bedding Material: Fill as specified in Section 312000.

2.5 FILTER AGGREGATE

- A. Filter Aggregate Materials: Fill as specified in Section 312000.

2.6 ACCESSORIES

- A. Geotextile Fabric: Non-woven fabric, polypropylene.



PART 3 - EXECUTION

3.1 PREPARATION

- A. Ream pipe ends and remove burrs.
- B. Remove scale and dirt from components before assembly.
- C. Establish invert elevations for all components in the system.
- D. Hand trim excavation to suit septic tank, distribution box and field tile arrangement. Remove stones, roots or other obstructions.

3.2 TANK AND TANK BEDDING

- A. Excavate in accordance with Section 312300 for work of this section. Hand trim excavation for accurate placement of tank to elevations indicated.
- B. Place bedding material level in one continuous layer not exceeding 8 inches compacted depth, compact to 95 percent.
- C. Backfill around sides of tank, tamp in place and compact to 95 percent.
- D. Maintain optimum moisture content of bedding material to attain required compaction density.
- E. Install septic tank and distribution box and related components on bedding in accordance with manufacturer's instructions. Position components to permit access to inspection ports.

3.3 CONNECTING PIPING

- A. Install vitrified clay pipe in accordance with ASTM C12.
- B. Connect outlet between building sanitary piping and septic tank, between septic tank and distribution box, between distribution box and filter field header [with Type [_____] pipe and fittings].
- C. Place pipe and fittings on clean excavated subsoil.
- D. Slope piping to each successive component, minimum of [1:50.] [_____.]
- E. Cover pipe with aggregate, sides and top. Place geotextile fabric over cover prior to backfilling.
- F. Coordinate the work with connections to building sanitary sewer piping outlet.

3.4 INSTALLATION - FILTER FIELD

- A. Install vitrified clay pipe in accordance with ASTM C12.
- B. Place field pipe header [at constant elevation] [sloping down from header inlet], [1:100.] [_____.]
- C. Place aggregate bed [18] [_____] inch thick, tamp compact firm. Establish slope of bed to suit established invert elevations.



- D. Place pipe sloping away from header minimum of [1:200] [] [, with perforations facing down].
- E. Wrap pipe joints with paper, cover with aggregate, sides and top. Place geotextile fabric over cover prior to backfilling.
- F. Cover entire field with aggregate [12] [] inch, lightly compact. Level prior to placement of subsoil cover as specified in Section 312000.

USPS Mail Processing Facility Specification issued: 10/1/2013
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END OF SECTION 33 36 00 00



Task	Specification	Specification Description
33 36 13 00	22 05 23 00	Piped Utilities Basic Materials And Methods
33 36 13 00	32 91 19 13	Septic Tank Systems
33 36 33 00	32 91 19 13	Septic Tank Systems
33 39 13 00	01 22 16 00	No Specification Required
33 39 13 00	22 05 23 00	Piped Utilities Basic Materials And Methods



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SECTION 33 40 00 00 - MPF STORM DRAINAGE UTILITIES

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

Use this section where Storm Drainage is part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Site storm sewer drainage piping, fittings and accessories, and bedding.
 - 2. Connection of storm sewer system to municipal storm sewer system.
 - 3. Catch basins, paved area drainage, site surface drainage, and storm water detention facilities.
- B. Related Documents: The Contract Documents, as defined in the General Conditions, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 312300 - Excavation and Fill: Earthwork for utilities.
 - 2. Section 334913- Storm Drainage Manholes, Frames, and Covers: Manholes, manhole lids, frames, and accessories.
 - 3. Section 333000 - Sanitary Sewerage Utilities: Site sanitary sewer system.
 - 4. Section 033000 - Cast-In-Place Concrete: Concrete for catch basins, inlets, and junction boxes.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A 760 - Standard Specification for Corrugated Steel Pipe, Metallic Coated for Sewers and Drains.
 - 2. ASTM C 12 - Practice for Installing Vitrified Clay Pipe Lines.
 - 3. ASTM C 76 - Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
 - 4. ASTM C 443 - Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
 - 5. ASTM D 2321 - Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
 - 6. ASTM D 3034 - Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.
 - 7. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.



1.3 DEFINITIONS

- A. Bedding: Fill placed under, beside and directly over pipe, prior to start of backfill operations.

1.4 SUBMITTALS

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
1. Project Record Documents: Accurately record the following.
 - a. Actual locations of pipe runs, connections, manholes, catch basins, cleanouts, and invert elevations.
 - b. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Conform to local Public Works Standard Specifications for materials and installation of the work of this Section.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Edit PIPE MATERIALS paragraph below for type of pipe used for this Project.

2.1 PIPE MATERIALS

- A. Reinforced Concrete Pipe:
1. Pipe: ASTM C 76, Class III unless indicated otherwise on Drawings.
 2. Gaskets: ASTM C 443; rubber compression gaskets installed in accordance with manufacturer's published instructions.
- B. Corrugated Steel Pipe:
1. Pipe: ASTM A 760; galvanized, aluminized or bituminous coated round pipe, arch pipe, or slotted drain pipe as indicated on Drawings., 16 gage unless otherwise indicated.
 - a. Provide slotted drain pipe with 1.75 inch wide drain guide waterway openings and 6 inch minimum height drain guide.
 2. Fittings:
 - a. Matching band connectors.
 - b. Sleeve gaskets in accordance with manufacturer's recommendations.
- C. Spiral Rib Metal Pipe:
1. Pipe: ASTM A 760, Type 1R; Galvanized, aluminized or bituminous coated as indicated on Drawings.
 2. Fittings: Provide re- corrugated pipe ends with semi-corrugated Hugger-type bands and "O" ring gaskets in accordance with manufacturers recommendations.
- D. Polyvinyl Chloride (PVC) Pipe:
1. Pipe: ASTM D 3034, SDR 35 Rated.
 - a. Continuously mark pipe with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 3034 classification.



2. Joints: ASTM D 3034, Table 2; integrally molded bell ends with factory supplied elastomeric gaskets and lubricant.

E. High-Density Polyethylene (HDPE) Pipe:

1. Pipe: AASHTO M252, M294 & MP7-97 Type "S" (Corrugated Polyethylene Pipe).
 - a. Pipe shall have a smooth interior and a corrugated annular exterior.
 - b. Continuously mark pipe with manufacturer's name, pipe size and AASHTO classification.
 - c. Pipe shall be installed per manufacturer's recommendations.
 - d. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1) Hancor, Findlay, OH (888) 367-7473: Sure-Lok F477.
 - 2) Section 016000 - Product Requirements: Product options and substitutions. Substitutions: permitted.
2. Joints: Pipe shall be joined with a bell and spigot joint incorporating ASTM F477 gasket material insuring a leak resistant performance.

2.2 INLETS, CATCH BASINS AND JUNCTION BOXES

- A. Lid and Frame: Cast iron as indicated on Drawings.
- B. Structure: As indicated on Drawings.
- C. Concrete: Specified in Section 033000.

NOTE TO SPECIFIER

The following item may be included when fuel tanks and on-site fueling is to occur at the facility.

D. Oil/Sediment Separator

1. Separator shall remove oil and sediment from storm water during frequent wet weather events. Separator shall treat a minimum of 75 to 90 percent of the annual runoff volume and be capable of removing 50 to 80 percent of the total suspended sediment load and greater than 90 percent of the floatable free oil. Separator must be capable of trapping silt and clay size particles in addition to large particles. Separator shall be installed underground as part of the storm sewer system and be structurally designed for (HS-20 min.) traffic loading at the surface. Storage in the separator shall be vertically oriented. Separator shall be maintainable from the surface via one access point.
2. Separator shall be equipped with an internal high flow bypass that regulates the flow rate into the treatment chamber and conveys high flows directly to the outlet such that scour and/or re-suspension of material previously collected in the separator does not occur. External bypasses are not acceptable. Bypass area shall be physically separated from the separation area to prevent mixing. Separator shall be circular, and constructed from either fiberglass or precast concrete risers. Concrete separator shall be designed and manufactured in accordance with ASTM C-478. Concrete joints shall be oil resistance, water tight and meet the design criteria according to ASTM C-443. In the concrete separator, a fiberglass insert, bolted and sealed watertight to the inside of the bypass chamber, shall divert low to normal stormwater flows into the treatment chamber. A minimum of 12 inches (30 cm) of oil storage shall be lined with fiberglass to provide secondary containment of any hydrocarbon materials.
3. Difference between the inlet pipe elevation to the separator and the outlet pipe elevation from the separator shall be 1 inch (2.5 cm). For a multiple inlet pipe or inlet design there shall be a 3 inch (7.5 cm) difference between horizontal inlet pipe inverts and the outlet pipe invert. Separator shall be able to be used as a bend structure in the storm sewer system. Access cover for all non-inlet type separators shall clearly indicate that it is an oil/sediment separator.



4. Separator shall be capable of containing spills of floatable substances such as free oil and not be compromised by temporary backwater conditions (i.e., trapped pollutants should not be re-suspended and scoured from the separator during backwater conditions).
5. Capabilities of the selected separator must be documented with scientific studies and reports. Preference will be given to devices that have been verified by a state or federal stormwater verification program.
6. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - a. Stormceptor manufactured by Carder Concrete Products, Littleton, CO (888) 220-9190.
 - b. Stormceptor manufactured by Rinker Stormceptor, Kansas City, MO (800) 909-7763.
 - c. Baysaver manufactured by Baysaver Technologies, Mount Airy, MD (800) 229-7283.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 1. Verify that survey benchmark and intended elevations for the Work are as indicated on Drawings.
 2. Verify that trench cut and excavation is ready to receive Work and excavations, dimensions, and elevations are as indicated on Drawings.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with fine aggregate.
- B. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

3.3 BEDDING

- A. Excavate pipe trench as specified in Section 312300. Hand trim excavation for accurate placement of pipe to elevations indicated.
- B. Place bedding material at trench bottom, level materials in continuous layers not exceeding 6 inches compacted depth, each layer. Place compacted bedding material to elevation of paving subgrade as indicated on Drawings.
- C. Maintain optimum moisture content of bedding material to attain required compaction density.
- D. Remove excess backfill and excavated material from site.



3.4 INSTALLATION - PIPE

- A. Install pipe, fittings, and accessories in accordance with ASTM C 12, ASTM D 2321 or manufacturer's published instructions, and state or local requirements. Seal joints watertight.
- B. Install pipe on minimum 4 inch bedding as specified in Section 312300.
- C. Lay pipe to slope gradients indicated on Drawings.
- D. Install aggregate at sides and over top of pipe. Provide top cover to minimum compacted thickness equal to paving subgrade indicated on Drawings.
- E. Refer to Section 312300 for trenching requirements. Do not displace or damage pipe when compacting.
- F. Refer to Section 334913 for manhole requirements.
- G. Connect to municipal storm sewer systems, manholes, and inlets as indicated on Drawings.

3.5 INSTALLATION - CATCH BASINS, INLETS, AND JUNCTION BOXES

- A. Form bottom of excavation clean and smooth to elevation indicated on Drawings.
- B. Form and place cast-in-place concrete base pad, with provision for storm sewer pipe to be placed at required elevations.
- C. Form and place cast-in-place concrete walls, sleeved at required elevation, to receive storm sewer pipe as indicated on Drawings.
- D. Form and place cast-in-place top of structure as indicated on Drawings.
- E. Mount grate and frame level, in grout, secured to top section at elevation indicated.

3.6 CONSTRUCTION

- A. Interface with Other work: Coordinate the Work with termination of storm sewer connection outside building including connection to municipal storm sewer system.

3.7 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection and testing.
- B. Site Tests:
 - 1. Perform inspections prior to and immediately after placing bedding.
 - 2. Compaction: Specified in Section 312300.
 - a. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.
 - b. Frequency of Tests: One test for each 50 lineal feet of trench.
 - 3. Perform the following tests in accordance with applicable local Public Works Department Standard Specifications and requirements.
 - a. Pressure Test.
 - b. Infiltration Test.
 - c. Deflection Test.



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Last revised: 6/10/2011

END OF SECTION 33 40 00 00



SECTION 33 40 00 00 - CSF STORM DRAINAGE UTILITIES

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Storm Drainage is part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Site storm sewer drainage piping, fittings and accessories, and bedding.
 - 2. Connection of storm sewer system to municipal storm sewer system.
 - 3. Catch basins, paved area drainage, site surface drainage, and storm water detention facilities.
- B. Related Documents: The Contract Documents, as defined in the General Conditions, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 312300 - Excavation and Fill: Earthwork for utilities.
 - 2. Section 334913- Storm Drainage Manholes, Frames, and Covers: Manholes, manhole lids, frames, and accessories.
 - 3. Section 333000 - Sanitary Sewerage Utilites: Site sanitary sewer system.
 - 4. Section 033000 - Cast-In-Place Concrete: Concrete for catch basins, inlets, and junction boxes.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A 760 - Standard Specification for Corrugated Steel Pipe, Metallic Coated for Sewers and Drains.
 - 2. ASTM C 12 - Practice for Installing Vitrified Clay Pipe Lines.
 - 3. ASTM C 76 - Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
 - 4. ASTM C 443 - Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
 - 5. ASTM D 2321 - Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
 - 6. ASTM D 3034 - Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.
 - 7. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.



1.3 DEFINITIONS

- A. Bedding: Fill placed under, beside and directly over pipe, prior to start of backfill operations.

1.4 SUBMITTALS

- A. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
1. Project Record Documents: Accurately record the following.
 - a. Actual locations of pipe runs, connections, manholes, catch basins, cleanouts, and invert elevations.
 - b. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Conform to local Public Works Standard Specifications for materials and installation of the work of this Section.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Edit PIPE MATERIALS paragraph below for type of pipe used for this Project.

2.1 PIPE MATERIALS

- A. Reinforced Concrete Pipe:
1. Pipe: ASTM C 76, Class III unless indicated otherwise on Drawings.
 2. Gaskets: ASTM C 443; rubber compression gaskets installed in accordance with manufacturer's published instructions.
- B. Corrugated Steel Pipe:
1. Pipe: ASTM A 760; galvanized, aluminized or bituminous coated round pipe, arch pipe, or slotted drain pipe as indicated on Drawings., 16 gage unless otherwise indicated.
 - a. Provide slotted drain pipe with 1.75 inch wide drain guide waterway openings and 6 inch minimum height drain guide.
 2. Fittings:
 - a. Matching band connectors.
 - b. Sleeve gaskets in accordance with manufacturer's recommendations.
- C. Spiral Rib Metal Pipe:
1. Pipe: ASTM A 760, Type 1R; Galvanized, aluminized or bituminous coated as indicated on Drawings.
 2. Fittings: Provide re- corrugated pipe ends with semi-corrugated Hugger-type bands and "O" ring gaskets in accordance with manufacturers recommendations.
- D. Polyvinyl Chloride (PVC) Pipe:
1. Pipe: ASTM D 3034, SDR 35 Rated.
 - a. Continuously mark pipe with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 3034 classification.



2. Joints: ASTM D 3034, Table 2; integrally molded bell ends with factory supplied elastomeric gaskets and lubricant.

E. High-Density Polyethylene (HDPE) Pipe:

1. Pipe: AASHTO M252, M294 & MP7-97 Type "S" (Corrugated Polyethylene Pipe).
 - a. Pipe shall have a smooth interior and a corrugated annular exterior.
 - b. Continuously mark pipe with manufacturer's name, pipe size and AASHTO classification.
 - c. Pipe shall be installed per manufacturer's recommendations.
 - d. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1) Hancor, Findlay, OH (888) 367-7473: Sure-Lok F477.
 - 2) Section 016000 - Product Requirements: Product options and substitutions. Substitutions: permitted.
2. Joints: Pipe shall be joined with a bell and spigot joint incorporating ASTM F477 gasket material insuring a leak resistant performance.

2.2 INLETS, CATCH BASINS AND JUNCTION BOXES

- A. Lid and Frame: Cast iron as indicated on Drawings.
- B. Structure: As indicated on Drawings.
- C. Concrete: Specified in Section 033000.

NOTE TO SPECIFIER

The following item may be included when fuel tanks and on-site fueling is to occur at the facility.

D. Oil/Sediment Separator

1. Separator shall remove oil and sediment from storm water during frequent wet weather events. Separator shall treat a minimum of 75 to 90 percent of the annual runoff volume and be capable of removing 50 to 80 percent of the total suspended sediment load and greater than 90 percent of the floatable free oil. Separator must be capable of trapping silt and clay size particles in addition to large particles. Separator shall be installed underground as part of the storm sewer system and be structurally designed for (HS-20 min.) traffic loading at the surface. Storage in the separator shall be vertically oriented. Separator shall be maintainable from the surface via one access point.
2. Separator shall be equipped with an internal high flow bypass that regulates the flow rate into the treatment chamber and conveys high flows directly to the outlet such that scour and/or re-suspension of material previously collected in the separator does not occur. External bypasses are not acceptable. Bypass area shall be physically separated from the separation area to prevent mixing. Separator shall be circular, and constructed from either fiberglass or precast concrete risers. Concrete separator shall be designed and manufactured in accordance with ASTM C-478. Concrete joints shall be oil resistance, water tight and meet the design criteria according to ASTM C-443. In the concrete separator, a fiberglass insert, bolted and sealed watertight to the inside of the bypass chamber, shall divert low to normal stormwater flows into the treatment chamber. A minimum of 12 inches (30 cm) of oil storage shall be lined with fiberglass to provide secondary containment of any hydrocarbon materials.
3. Difference between the inlet pipe elevation to the separator and the outlet pipe elevation from the separator shall be 1 inch (2.5 cm). For a multiple inlet pipe or inlet design there shall be a 3 inch (7.5 cm) difference between horizontal inlet pipe inverts and the outlet pipe invert. Separator shall be able to be used as a bend structure in the storm sewer system. Access cover for all non-inlet type separators shall clearly indicate that it is an oil/sediment separator.



4. Separator shall be capable of containing spills of floatable substances such as free oil and not be compromised by temporary backwater conditions (i.e., trapped pollutants should not be re-suspended and scoured from the separator during backwater conditions).
5. Capabilities of the selected separator must be documented with scientific studies and reports. Preference will be given to devices that have been verified by a state or federal stormwater verification program.
6. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - a. Stormceptor manufactured by Carder Concrete Products, Littleton, CO (888) 220-9190.
 - b. Stormceptor manufactured by Rinker Stormceptor, Kansas City, MO (800) 909-7763.
 - c. Baysaver manufactured by Baysaver Technologies, Mount Airy, MD (800) 229-7283.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 1. Verify that survey benchmark and intended elevations for the Work are as indicated on Drawings.
 2. Verify that trench cut and excavation is ready to receive Work and excavations, dimensions, and elevations are as indicated on Drawings.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with fine aggregate.
- B. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

3.3 BEDDING

- A. Excavate pipe trench as specified in Section 312300. Hand trim excavation for accurate placement of pipe to elevations indicated.
- B. Place bedding material at trench bottom, level materials in continuous layers not exceeding 6 inches compacted depth, each layer. Place compacted bedding material to elevation of paving subgrade as indicated on Drawings.
- C. Maintain optimum moisture content of bedding material to attain required compaction density.
- D. Remove excess backfill and excavated material from site.



3.4 INSTALLATION - PIPE

- A. Install pipe, fittings, and accessories in accordance with ASTM C 12, ASTM D 2321 or manufacturer's published instructions, and state or local requirements. Seal joints watertight.
- B. Install pipe on minimum 4 inch bedding as specified in Section 312300.
- C. Lay pipe to slope gradients indicated on Drawings.
- D. Install aggregate at sides and over top of pipe. Provide top cover to minimum compacted thickness equal to paving subgrade indicated on Drawings.
- E. Refer to Section 312300 for trenching requirements. Do not displace or damage pipe when compacting.
- F. Refer to Section 334913 for manhole requirements.
- G. Connect to municipal storm sewer systems, manholes, and inlets as indicated on Drawings.

3.5 INSTALLATION - CATCH BASINS, INLETS, AND JUNCTION BOXES

- A. Form bottom of excavation clean and smooth to elevation indicated on Drawings.
- B. Form and place cast-in-place concrete base pad, with provision for storm sewer pipe to be placed at required elevations.
- C. Form and place cast-in-place concrete walls, sleeved at required elevation, to receive storm sewer pipe as indicated on Drawings.
- D. Form and place cast-in-place top of structure as indicated on Drawings.
- E. Mount grate and frame level, in grout, secured to top section at elevation indicated.

3.6 CONSTRUCTION

- A. Interface with Other work: Coordinate the Work with termination of storm sewer connection outside building including connection to municipal storm sewer system.

3.7 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection and testing.
- B. Site Tests:
 - 1. Perform inspections prior to and immediately after placing bedding.
 - 2. Compaction: Specified in Section 312300.
 - a. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.
 - b. Frequency of Tests: One test for each 50 lineal feet of trench.
 - 3. Perform the following tests in accordance with applicable local Public Works Department Standard Specifications and requirements.
 - a. Pressure Test.
 - b. Infiltration Test.
 - c. Deflection Test.



USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION 33 40 00 00



Task	Specification	Specification Description
33 41 13 00	22 05 23 00	Piped Utilities Basic Materials And Methods



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SECTION 33 42 16 13 - CULVERTS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for culverts. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

C. Delivery, Storage, And Handling

1. Delivery and Storage: Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the the Owner. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install plastic pipe shall be stored in accordance with the manufacturer's recommendations and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.
2. Handling: Materials shall be handled in a manner that ensures delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

1.2 PRODUCTS

A. Pipe For Culverts

1. Pipe for culverts and storm drains shall be of the sizes indicated and shall conform to the requirements specified.
2. Concrete Pipe
 - a. ASTM C76/ASTM C76M, Class I **OR II OR III OR IV OR V, as directed**, or ASTM C655 D-Load. Note: D-load is defined as the minimum required three-edge test load on a pipe to produce a 0.01 inch crack and/or ultimate failure in pounds per linear foot per foot (no metric definition) of inside diameter.
 - b. Reinforced Arch Culvert and Storm Drainpipe: ASTM C506/ASTM C506M, Class A-II **OR A-III OR A-IV, as directed**.
 - c. Reinforced Elliptical Culvert and Storm Drainpipe: ASTM C507/ASTM C507M. Horizontal elliptical pipe shall be Class HE-A **OR HE-I OR HE-II OR HE-III OR HE-IV, as directed**. Vertical elliptical pipe shall be Class VE-II **OR VE-III OR VE-IV OR VE-V OR VE-VI, as directed**.
 - d. Nonreinforced Pipe: ASTM C14/ASTM C14M, Class 1 **OR 2 OR 3, as directed**.
 - 1) Cast-In-Place Nonreinforced Conduit: ACI 346, except that testing shall be the responsibility of and at the expense of the Contractor. In the case of other conflicts between ACI 346 and project specifications, requirements of ACI 346 shall govern.
NOTE: This type conduit should not be used beneath structures, for drain crossings, adjacent to paved areas, or under high fills.
3. Clay Pipe: Standard or extra strength, as indicated, conforming to ASTM C700.
NOTE: "Bell-and-spigot piping only" in areas where corrosion problems may be anticipated with the stainless steel parts of the couplings used for plain-end piping.



4. Corrugated Steel Pipe
 - a. ASTM A760/A760M, zinc or aluminum (Type 2) coated pipe of either:
 - 1) Type I **OR** II, **as directed**, pipe with annular **OR** helical, **as directed**, 2-2/3 by 1/2 inch (68 by 13 mm) corrugations.
 - 2) Type IR **OR** IIR, **as directed**, pipe with helical 3/4 by 3/4 by 7-1/2 inch (19 by 19 by 190 mm) corrugations.
 - b. Fully Bituminous Coated
 - 1) AASHTO M190 Type A and ASTM A760/A 760M zinc or aluminum (Type 2) coated pipe of either:
 - a) Type I **OR** II, **as directed**, pipe with annular **OR** helical, **as directed**, 2-2/3 by 1/2 inch (68 by 13 mm) corrugations.
 - b) Type IR **OR** IIR, **as directed**, pipe with helical 3/4 by 3/4 by 7-1/2 inch (19 by 19 by 190 mm) corrugations.
 - c. Half Bituminous Coated, Part Paved: AASHTO M190 Type B and ASTM A760/A 760M zinc or aluminum (Type 2) coated Type I **OR** II, **as directed**, pipe with annular **OR** helical, **as directed**, 2-2/3 by 1/2 inch (68 by 13 mm) corrugations.
 - d. Fully Bituminous Coated, Part Paved: AASHTO M190 Type C and ASTM A760/A 760M zinc or aluminum (Type 2) coated Type I **OR** II, **as directed**, pipe with annular **OR** helical, **as directed**, 2-2/3 by 1/2 inch (68 by 13 mm) corrugations.
 - e. Fully Bituminous Coated, Fully Paved: AASHTO M190 Type D and ASTM A760/A 760M zinc or aluminum (Type 2) coated Type I **OR** II, **as directed**, pipe with annular **OR** helical, **as directed**, 2-2/3 by 1/2 inch (68 by 13 mm) corrugations.
 - f. Concrete-Lined: ASTM A760/A760M zinc coated Type I corrugated steel pipe with annular **OR** helical, **as directed**, 2-2/3 by 1/2 inch (68 by 13 mm) corrugations and a concrete lining in accordance with ASTM A849.
 - g. Polymer Precoated: ASTM A 762/A 762M corrugated steel pipe fabricated from ASTM A742/A742M Grade 250/250 10/10 polymer precoated sheet of either:
 - 1) Type I **OR** II, **as directed**, pipe with annular **OR** helical, **as directed**, 2-2/3 by 1/2 inch (68 by 13 mm) corrugations.
 - 2) Type IR **OR** IIR, **as directed**, pipe with helical 3/4 by 3/4 by 7-1/2 inch (19 by 19 by 190 mm) corrugations.
 - h. Polymer Precoated, Part Paved: ASTM A762/A762M Type I **OR** II, **as directed**, corrugated steel pipe and AASHTO M190 Type B (modified) paved invert only, fabricated from ASTM A742/A742M Grade 250/250 10/10 polymer precoated sheet with annular **OR** helical, **as directed**, 2-2/3 by 1/2 inch (68 by 13 mm) corrugations.
 - i. Polymer Precoated, Fully Paved: ASTM A762/A762M Type I **OR** II, **as directed**, corrugated steel pipe and AASHTO M190 Type D (modified), fully paved only, fabricated from ASTM A 742/A 742M Grade 250/250 10/10 polymer precoated sheet with annular **OR** helical, **as directed**, 2-2/3 by 1/2 inch (68 by 13 mm) corrugations.
5. Corrugated Aluminum Alloy Pipe: ASTM B745/B745M corrugated aluminum alloy pipe of either:
 - 1) Type I **OR** II, **as directed**, pipe with annular **OR** helical, **as directed**, corrugations.
 - 2) Type IA **OR** IR **OR** IIA **OR** IIR, **as directed**, pipe with helical corrugations.
- b. Aluminum Fully Bituminous Coated: Bituminous coating shall conform to ASTM A849. Piping shall conform to AASHTO M190 Type A and ASTM B745/B745M corrugated aluminum alloy pipe of either:
 - 1) Type I **OR** II, **as directed**, pipe with annular **OR** helical, **as directed**, corrugations.
 - 2) Type IA **OR** IR **OR** IIA **OR** IIR, **as directed**, pipe with helical corrugations.
- c. Aluminum Fully Bituminous Coated, Part Paved: Bituminous coating shall conform to ASTM A849. Piping shall conform to AASHTO M190 Type C and ASTM B 745/B 745M corrugated aluminum alloy pipe of either:
 - 1) Type I **OR** II, **as directed**, pipe with annular **OR** helical, **as directed**, corrugations.
 - 2) Type IR **OR** IIR, **as directed**, pipe with helical corrugations.
6. Structural Plate, Steel Pipe, Pipe Arches and Arches



- a. Assembled with galvanized steel nuts and bolts, from galvanized corrugated steel plates conforming to AASHTO M167. Pipe coating, when required, shall conform to the requirements of AASHTO M190 Type A **OR** AASHTO M243, **as directed**.
 - b. Thickness of plates shall be as indicated.
7. Structural Plate, Aluminum Pipe, Pipe Arches and Arches
 - a. Assembled with either aluminum alloy, aluminum coated steel, stainless steel or zinc coated steel nuts and bolts. Nuts and bolts, and aluminum alloy plates shall conform to AASHTO M219. Pipe coating, when required, shall conform to the requirements of AASHTO M190, Type A **OR** AASHTO M 243, **as directed**.
 - b. Thickness of plates shall be as indicated.
8. Ductile Iron Culvert Pipe: ASTM A716.
9. Cast-Iron Soil Piping: Cast-Iron Soil Pipe shall conform to ASTM A74, service-weight; gaskets shall be compression-type rubber conforming to ASTM C564.
10. PVC Pipe
 - a. The pipe manufacturer's resin certification, indicating the cell classification of PVC used to manufacture the pipe, shall be submitted prior to installation of the pipe.
 - b. Type PSM PVC Pipe: ASTM D3034, Type PSM, maximum SDR 35, produced from PVC certified by the compounder as meeting the requirements of ASTM D1784, minimum cell class 12454-B.
 - c. Profile PVC Pipe: ASTM F794, Series 46, produced from PVC certified by the compounder as meeting the requirements of ASTM D1784, minimum cell class 12454-B.
 - d. Smooth Wall PVC Pipe: ASTM F679 produced from PVC certified by the compounder as meeting the requirements of ASTM D1784, minimum cell class 12454-B.
 - e. Corrugated PVC Pipe: ASTM F949 produced from PVC certified by the compounder as meeting the requirements of ASTM D 1784, minimum cell class 12454-B.
11. PE Pipe
 - a. The pipe manufacturer's resin certification indicating the cell classification of PE used to manufacture the pipe shall be submitted prior to installation of the pipe. The minimum cell classification for polyethylene plastic shall apply to each of the seven primary properties of the cell classification limits in accordance with ASTM D3350.
 - b. Smooth Wall PE Pipe: ASTM F714, maximum DR of 21 for pipes 3 to 24 inches (80 to 600 mm) in diameter and maximum DR of 26 for pipes 26 to 48 inches (650 to 1200 mm) in diameter. Pipe shall be produced from PE certified by the resin producer as meeting the requirements of ASTM D3350, minimum cell class 335434C.
 - c. Corrugated PE Pipe: AASHTO M294, Type S or D, for pipes 12 to 48 inches (300 to 1200 mm) and AASHTO MP 7, Type S or D, for pipes 54 to 60 inches (1350 to 1500 mm) produced from PE certified by the resin producer as meeting the requirements of ASTM D3350, minimum cell class in accordance with AASHTO M294. Pipe walls shall have the following properties:
 NOTE: Corrugated PE pipe culverts and storm drains shall not be installed beneath airfield pavements, Class A, B, or C roads, or road pavements with a design index of 6 or greater. Type S pipe has a full circular cross-section, with an outer corrugated pipe wall and a smooth inner liner. Type C pipe has a full circular cross-section, with a corrugated surface both inside and outside. Corrugations may be either annular or helical.

Nominal Size (in.)	Minimum Wall Area (square in/ft)	Minimum Moment of Inertia of Wall Section (in to the 4th/in)
12	1.50	0.024
15	1.91	0.053
18	2.34	0.062
24	3.14	0.116
30	3.92	0.163
36	4.50	0.222
42	4.69	0.543



48	5.15	0.543
54	5.67	0.800
60	6.45	0.800
Nominal Size (mm)	Minimum Wall Area (square mm/m)	Minimum Moment of Inertia of Wall Section (mm to the 4th/mm)
300	3200	390
375	4000	870
450	4900	1020
600	6600	1900
750	8300	2670
900	9500	3640
1050	9900	8900
1200	10900	8900
1350	12000	13110
1500	13650	13110

- d. Profile Wall PE Pipe: ASTM F894, RSC 160, produced from PE certified by the resin producer as meeting the requirements of ASTM D3350, minimum cell class 334433C. Pipe walls shall have the following properties:

		Minimum Moment Of Inertia of Wall Section (in to the 4th/in)	
Nominal Size (in.)	Minimum Wall Area (square in/ft)	Cell Class 334433C	Cell Class 335434C
18	2.96	0.052	0.038
21	4.15	0.070	0.051
24	4.66	0.081	0.059
27	5.91	0.125	0.091
30	5.91	0.125	0.091
33	6.99	0.161	0.132
36	8.08	0.202	0.165
42	7.81	0.277	0.227
48	8.82	0.338	0.277
		Minimum Moment Of Inertia of Wall Section (mm to the 4th/mm)	
Nominal Size (mm)	Minimum Wall Area (square mm/m)	Cell Class 334433C	Cell Class 335434C
450	6300	850	620
525	8800	1150	840
600	9900	1330	970
675	12500	2050	1490
750	12500	2050	1490



825	14800	2640	2160
900	17100	3310	2700
1050	16500	4540	3720
1200	18700	5540	4540

B. Drainage Structures

1. Flared End Sections: Sections shall be of a standard design fabricated from zinc coated steel sheets meeting requirements of ASTM A929/A929M.
2. Precast Reinforced Concrete Box: Four-sided box section with open ends to be monolithically cast of reinforced concrete, smooth inside surfaces. Each box section shall be manufactured with chamfered inside corners. Design and manufacture shall conform to ASTM C890.
 - a. Design References: ACI 318.
 - 1) Boxes subjected to highway loadings shall conform to requirements of AASHTO M259 or M273, as applicable, and ASTM C789, C850, C1433, and PS62.
 - 2) Boxes subjected to aircraft loadings shall conform to requirements of FAA specifications.
 - 3) Boxes subjected to railway loadings shall conform to requirements of AREMA specifications.
 - b. Concrete: 5,000 psi @ 30 days, unless otherwise directed.
 - c. Entrained Air: 5 to 9 percent.
 - d. Steel Reinforcing: ASTM A185, A615, A616, Grade 60, 60 ksi.
 - e. Design Loading: AASHTO HS-20-44 or HS-25-44 with 30 percent impact and equivalent soil pressure of 130 psf. Floatation forces not accounted for.
 - f. Joints: Each section shall have a male and female end with no less than 1-1/2-inch of concrete overlap and shall include a 1-inch square neoprene gasket, cemented to male surface of section during manufacture.
 - g. End Sections: As required for the individual installation, provide:
 - 1) Doweled end for 1-inch diameter x 12-inch deep steel dowels, keyway slot.
 - 2) Keyway slot, a shear connection between the precast and field cast sections.
 - 3) Plain end, for use where wing and end walls act independently of precast box.
 - h. Lifting Pins: Each section shall be equipped with 4 OSHA approved lifting pins.
 - i. For multi-cell installations, fill 1-inch spacing between cells with granular material to assume proper load distribution.
3. Three-Sided Structures for Culverts or Short Span Bridge System
 - a. Structures shall conform to requirements of ASTM C1504 and ACI 318. For structures subjected to roadway loadings, conform to requirements of AASHTO specifications.

C. Miscellaneous Materials

1. Concrete
 - a. Unless otherwise specified, concrete and reinforced concrete shall conform to the requirements concrete under Division 03 Section "Cast-in-place Concrete". The concrete mixture shall have air content by volume of concrete, based on measurements made immediately after discharge from the mixer, of 5 to 7 percent when maximum size of coarse aggregate exceeds 1-1/2 inches (37.5 mm).
 - b. Air content shall be determined in accordance with ASTM C231. The concrete covering over steel reinforcing shall not be less than 1 inch (25 mm) thick for covers and not less than 1-1/2 inches (40 mm) thick for walls and flooring. Concrete covering deposited directly against the ground shall have a thickness of at least 3 inches (75 mm) between steel and ground.
 - c. Expansion-joint filler material shall conform to ASTM D1751, or ASTM D1752, or shall be resin-impregnated fiberboard conforming to the physical requirements of ASTM D1752.
2. Mortar: Mortar for pipe joints, connections to other drainage structures, and brick or block construction shall conform to ASTM C270, Type M, except that the maximum placement time shall be 1 hour. The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar. Water shall be clean and free of harmful acids, alkalies, and organic impurities. The mortar shall be used within 30 minutes after the ingredients are mixed with water. The inside of

- the joint shall be wiped clean and finished smooth. The mortar head on the outside shall be protected from air and sun with a proper covering until satisfactorily cured.
3. Precast Concrete Segmental Blocks: Precast concrete segmental block shall conform to ASTM C139, not more than 8 inches (200 mm) thick, not less than 8 inches (200 mm) long, and of such shape that joints can be sealed effectively and bonded with cement mortar.
 4. Brick
 - a. Brick shall conform to ASTM C62, Grade SW; ASTM C55, Grade S-I or S-II; or ASTM C32, Grade MS. Mortar for jointing and plastering shall consist of one part portland cement and two parts fine sand. Lime may be added to the mortar in a quantity not more than 25 percent of the volume of cement.
 - b. The joints shall be filled completely and shall be smooth and free from surplus mortar on the inside of the structure. Brick structures shall be plastered with 1/2 inch (10 mm) of mortar over the entire outside surface of the walls. For square or rectangular structures, brick shall be laid in stretcher courses with a header course every sixth course. For round structures, brick shall be laid radially with every sixth course a stretcher course.
 5. Precast Reinforced Concrete Manholes
 - a. Precast reinforced concrete manholes shall conform to ASTM C478/ASTM C478M.
 - b. Joints between precast concrete risers and tops shall be full-bedded in cement mortar and shall be smoothed to a uniform surface on both interior and exterior of the structure **OR** made with flexible watertight, rubber-type gaskets meeting the requirements of paragraph JOINTS, **as directed**.
 6. Prefabricated Corrugated Metal Manholes
 - a. Manholes shall be of the type and design recommended by the manufacturer.
 - b. Manholes shall be complete with frames and cover, or frames and gratings.
 7. Frame and Cover for Gratings
 - a. Frame and cover for gratings shall be cast gray iron, ASTM A48/A48M,
 - b. Class 35B; cast ductile iron, ASTM A536, Grade 65-45-12; or cast aluminum, ASTM B26M/B26, Alloy 356.OT6. Weight, shape, size, and waterway openings for grates and curb inlets shall be as indicated on the plans.
 8. Joints
 - a. Flexible Watertight Joints
 - 1) Materials: Flexible watertight joints shall be made with plastic or rubber-type gaskets for concrete pipe and with factory-fabricated resilient materials for clay pipe. The design of joints and the physical requirements for plastic gaskets shall conform to AASHTO M198, and rubber-type gaskets shall conform to ASTM C443/ASTM C443M. Factory-fabricated resilient joint materials shall conform to ASTM C425. Gaskets shall have not more than one factory-fabricated splice, except that two factory-fabricated splices of the rubber-type gasket are permitted if the nominal diameter of the pipe being gasketed exceeds 54 inches (1.35 m).
 - 2) Test Requirements: Watertight joints shall be tested and shall meet test requirements of paragraph HYDROSTATIC TEST ON WATERTIGHT JOINTS. Rubber gaskets shall comply with the oil resistant gasket requirements of ASTM C443/ASTM C443M. Certified copies of test results shall be delivered to the the Owner before gaskets or jointing materials are installed. Alternate types of watertight joint may be furnished, if specifically approved.
 - b. External Sealing Bands: Requirements for external sealing bands shall conform to ASTM C877/ASTM C877M.
 - c. Flexible Watertight, Gasketed Joints
 - 1) Gaskets: When infiltration or exfiltration is a concern for pipe lines, the couplings may be required to have gaskets. The closed-cell expanded rubber gaskets shall be a continuous band approximately 7 inches (178 mm) wide and approximately 3/8 inch (10 mm) thick, meeting the requirements of ASTM D1056, Type 2 A1 **OR** B3, **as directed**, and shall have a quality retention rating of not less than 70 percent when tested for weather resistance by ozone chamber exposure, Method B of ASTM D1171. Rubber O-ring gaskets shall be 13/16 inch (21 mm) in diameter for pipe



diameters of 36 inches (914 mm) or smaller and 7/8 inch (22 mm) in diameter for larger pipe having 1/2 inch (13 mm) deep end corrugation. Rubber O-ring gaskets shall be 1-3/8 inches (35 mm) in diameter for pipe having 1 inch (25 mm) deep end corrugations. O-rings shall meet the requirements of AASHTO M198 or ASTM C443/ASTM C443M. Flexible plastic gaskets shall conform to requirements of AASHTO M198, Type B.

- 2) Connecting Bands: Connecting bands shall be of the type, size and sheet thickness of band, and the size of angles, bolts, rods and lugs as indicated or where not indicated as specified in the applicable standards or specifications for the pipe. Exterior rivet heads in the longitudinal seam under the connecting band shall be countersunk or the rivets shall be omitted and the seam welded. Watertight joints shall be tested and shall meet the test requirements of paragraph HYDROSTATIC TEST ON WATERTIGHT JOINTS.

- d. PVC Plastic Pipes: Joints shall be solvent cement or elastomeric gasket type in accordance with the specification for the pipe and as recommended by the pipe manufacturer.
- e. Smooth Wall PE Plastic Pipe: Pipe shall be joined using butt fusion method as recommended by the pipe manufacturer.
- f. Corrugated PE Plastic Pipe: Water tight joints shall be made using a PVC or PE coupling and rubber gaskets as recommended by the pipe manufacturer. Rubber gaskets shall conform to ASTM F477. Soil tight joints shall conform to the requirements in AASHTO HB-17, Division II, Section 26.4.2.4.(e) for soil tightness and shall be as recommended by the pipe manufacturer.
- g. Profile Wall PE Plastic Pipe: Joints shall be gasketed or thermal weld type with integral bell in accordance with ASTM F894.
- h. Ductile Iron Pipe: Couplings and fittings shall be as recommended by the pipe manufacturer.

D. Steel Ladder

1. Steel ladder shall be provided where the depth of the manhole exceeds 12 feet (3.66 m). These ladders shall be not less than 16 inches (406 mm) in width, with 3/4 inch (19 mm) diameter rungs spaced 12 inches (305 mm) apart. The two stringers shall be a minimum 3/8 inch (10 mm) thick and 2-1/2 inches (63 mm) wide. Ladders and inserts shall be galvanized after fabrication in conformance with ASTM A123/A123M.

E. Resilient Connectors

1. Flexible, watertight connectors used for connecting pipe to manholes and inlets shall conform to ASTM C923/ASTM C923M.

F. Hydrostatic Test On Watertight Joints

1. Concrete, Clay, PVC and PE Pipe: A hydrostatic test shall be made on the watertight joint types as proposed. Only one sample joint of each type needs testing; however, if the sample joint fails because of faulty design or workmanship, an additional sample joint may be tested. During the test period, gaskets or other jointing material shall be protected from extreme temperatures which might adversely affect the performance of such materials. Performance requirements for joints in reinforced and nonreinforced concrete pipe shall conform to AASHTO M198 or ASTM C443M ASTM C443. Test requirements for joints in clay pipe shall conform to ASTM C425. Test requirements for joints in PVC and PE plastic pipe shall conform to ASTM D3212.
2. Corrugated Steel and Aluminum Pipe: A hydrostatic test shall be made on the watertight joint system or coupling band type proposed. The moment strength required of the joint is expressed as 15 percent of the calculated moment capacity of the pipe on a transverse section remote from the joint by the AASHTO HB-17 (Division II, Section 26). The pipe shall be supported for the hydrostatic test with the joint located at the point which develops 15 percent of the moment capacity of the pipe based on the allowable span in meters feet for the pipe flowing full or 40,000 foot-pounds (54,233 Newton meters), whichever is less. Performance requirements shall be met



at an internal hydrostatic pressure of 10 psi (69 kPa) for a 10 minute period for both annular corrugated metal pipe and helical corrugated metal pipe with factory reformed ends.

G. Erosion Control Riprap

1. Provide nonerodible rock not exceeding 15 inches (375 mm) in its greatest dimension and choked with sufficient small rocks to provide a dense mass with a minimum thickness of 8 inches (200 mm) or as indicated.

1.3 EXECUTION

A. Excavation for Pipe Culverts and Drainage Structures

1. Excavation of trenches, and for appurtenances and backfilling for culverts and storm drains, shall be in accordance with the applicable portions of Division 31 Section "Earth Moving" and the requirements specified below.
2. Trenching: The width of trenches at any point below the top of the pipe shall be not greater than the outside diameter of the pipe plus 12-inches (300 mm) each side of pipe to permit satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Sheet piling and bracing, where required, shall be placed within the trench width as specified. Contractor shall not overexcavate. Where trench widths are exceeded, redesign with a resultant increase in cost of stronger pipe or special installation procedures will be necessary. Cost of this redesign and increased cost of pipe or installation shall be borne by the Contractor without additional cost to the Owner.
3. Removal of Rock: Rock in either ledge or boulder formation shall be replaced with suitable materials to provide a compacted earth cushion having a thickness between unremoved rock and the pipe of at least 8 inches (200 mm) or 1/2 inch (13 mm) for each meter foot of fill over the top of the pipe, whichever is greater, but not more than three-fourths the nominal diameter of the pipe. Where bell-and-spigot pipe is used, the cushion shall be maintained under the bell as well as under the straight portion of the pipe. Rock excavation shall be as specified and defined in Division 31 Section "Earth Moving".
4. Removal of Unstable Material: Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by the the Owner, is unexpectedly encountered in the bottom of a trench, such material shall be removed to the depth required and replaced to the proper grade with select granular material, compacted as provided in paragraph BACKFILLING. When removal of unstable material is due to the fault or neglect of the Contractor while performing shoring and sheet piling, water removal, or other specified requirements, such removal and replacement shall be performed at no additional cost to the Owner.

B. Bedding

1. The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.
2. Concrete Pipe Requirements: When no bedding class is specified or detailed on the drawings, concrete pipe shall be bedded in a soil foundation accurately shaped and rounded to conform to the lowest one-fourth of the outside portion of circular pipe or to the lower curved portion of pipe arch for the entire length of the pipe or pipe arch. When necessary, the bedding shall be tamped. Bell holes and depressions for joints shall be not more than the length, depth, and width required for properly making the particular type of joint.
3. Clay Pipe Requirements: Bedding for clay pipe shall be as specified by ASTM C12.
4. Corrugated Metal Pipe: Bedding for corrugated metal pipe and pipe arch shall be in accordance with ASTM A798/A798M. It is not required to shape the bedding to the pipe geometry. However, for pipe arches, the Contractor shall either shape the bedding to the relatively flat bottom arc or fine grade the foundation to a shallow v-shape. Bedding for corrugated structural plate pipe shall meet requirements of ASTM A807/A807M.
5. Ductile Iron and Cast-Iron Pipe: Bedding for ductile iron and cast-iron pipe shall be as shown on the drawings.



6. Plastic Pipe: Bedding for PVC and PE pipe shall meet the requirements of ASTM D2321. Bedding, haunching, and initial backfill shall be either Class IB or II material.

C. Placing Pipe

1. Each pipe shall be thoroughly examined before being laid; defective or damaged pipe shall not be used. Plastic pipe shall be protected from exposure to direct sunlight prior to laying, if necessary to maintain adequate pipe stiffness and meet installation deflection requirements. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Lifting lugs in vertically elongated metal pipe shall be placed in the same vertical plane as the major axis of the pipe. Pipe shall not be laid in water, and pipe shall not be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. Deflection of installed flexible pipe shall not exceed the following limits:

TYPE OF PIPE	MAXIMUM ALLOWABLE DEFLECTION (%)
Corrugated Steel and Aluminum Alloy	5
Concrete-Lined Corrugated Steel	3
Ductile Iron Culvert	3
Plastic	7.5

Not less than 30 days after the completion of backfilling, the Owner may perform a deflection test on the entire length of installed flexible pipe using a mandrel or other suitable device. Installed flexible pipe showing deflections greater than those indicated above shall be retested by a run from the opposite direction. If the retest also fails, the suspect pipe shall be replaced.

2. Concrete, Clay, PVC, Ribbed PVC, Ductile Iron and Cast-Iron Pipe: Laying shall proceed upgrade with spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow.
3. Elliptical and Elliptical Reinforced Concrete Pipe: The manufacturer's reference lines, designating the top of the pipe, shall be within 5 degrees of a vertical plane through the longitudinal axis of the pipe, during placement. Damage to or misalignment of the pipe shall be prevented in all backfilling operations.
4. Corrugated PE Pipe: Laying shall be with the separate sections joined firmly on a bed shaped to line and grade and shall follow manufacturer's recommendations.
5. Corrugated Metal Pipe and Pipe Arch: Laying shall be with the separate sections joined firmly together, with the outside laps of circumferential joints pointing upstream, and with longitudinal laps on the sides. Part paved pipe shall be installed so that the centerline of bituminous pavement in the pipe, indicated by suitable markings on the top at each end of the pipe sections, coincides with the specified alignment of pipe. Fully paved steel pipe or pipe arch shall have a painted or otherwise applied label inside the pipe or pipe arch indicating sheet thickness of pipe or pipe arch. Any unprotected metal in the joints shall be coated with bituminous material as specified in AASHTO M190 or AASHTO M243. Interior coating shall be protected against damage from insertion or removal of struts or tie wires. Lifting lugs shall be used to facilitate moving pipe without damage to exterior or interior coatings. During transportation and installation, pipe or pipe arch and coupling bands shall be handled with care to preclude damage to the coating, paving or lining. Damaged coatings, pavings and linings shall be repaired in accordance with the manufacturer's recommendations prior to placing backfill. Pipe on which coating, paving or lining has been damaged to such an extent that satisfactory field repairs cannot be made shall be removed and replaced. Vertical elongation, where indicated, shall be accomplished by factory elongation. Suitable markings or properly placed lifting lugs shall be provided to ensure placement of factory elongated pipe in a vertical plane.
6. Structural-Plate Steel: Structural plate shall be installed in accordance with ASTM A807/A807M. Structural plate shall be assembled in accordance with instructions furnished by the manufacturer. Instructions shall show the position of each plate and the order of assembly. Bolts shall be tightened progressively and uniformly, starting at one end of the structure after all plates are in place. The operation shall be repeated to ensure that all bolts are tightened to meet the torque requirements of 200 foot-pounds (270 Newton meters) plus or minus 50 foot-pounds (68 Newton meters). Any power wrenches used shall be checked by the use of hand torque



wrenches or long-handled socket or structural wrenches for amount of torque produced. Power wrenches shall be checked and adjusted frequently as needed, according to type or condition, to ensure proper adjustment to supply the required torque.

7. **Structural-Plate Aluminum:** Structural plate shall be assembled in accordance with instructions furnished by the manufacturer. Instructions shall show the position of each plate and the order of assembly. Bolts shall be tightened progressively and uniformly, starting at one end of the structure after all plates are in place. The operation shall be repeated to ensure that all bolts are torqued to a minimum of 100 foot-pounds (136 Newton meters) on aluminum alloy bolts and a minimum of 150 foot-pounds (203 Newton meters) on galvanized steel bolts. Any power wrenches used shall be checked by the use of hand torque wrenches or long-handled socket or structural wrenches for the amount of torque produced. Power wrenches shall be checked and adjusted as frequently as needed, according to type or condition, to ensure that they are in proper adjustment to supply the required torque.
8. **Multiple Culverts:** Where multiple lines of pipe are installed, adjacent sides of pipe shall be at least half the nominal pipe diameter or 1 meter 3 feet apart, whichever is less.
9. **Jacking Pipe Through Fills:** Methods of operation and installation for jacking pipe through fills shall conform to requirements specified in Volume 1, Chapter 1, Part 4 of AREMA Manual.

D. Jointing

1. Concrete and Clay Pipe

- a. **Cement-Mortar Bell-and-Spigot Joint:** The first pipe shall be bedded to the established gradeline, with the bell end placed upstream. The interior surface of the bell shall be thoroughly cleaned with a wet brush and the lower portion of the bell filled with mortar as required to bring inner surfaces of abutting pipes flush and even. The spigot end of each subsequent pipe shall be cleaned with a wet brush and uniformly matched into a bell so that sections are closely fitted. After each section is laid, the remainder of the joint shall be filled with mortar, and a bead shall be formed around the outside of the joint with sufficient additional mortar. If mortar is not sufficiently stiff to prevent appreciable slump before setting, the outside of the joint shall be wrapped or bandaged with cheesecloth to hold mortar in place.
- b. **Cement-Mortar Oakum Joint for Bell-and-Spigot Pipe:** A closely twisted gasket shall be made of jute or oakum of the diameter required to support the spigot end of the pipe at the proper grade and to make the joint concentric. Joint packing shall be in one piece of sufficient length to pass around the pipe and lap at top. This gasket shall be thoroughly saturated with neat cement grout. The bell of the pipe shall be thoroughly cleaned with a wet brush, and the gasket shall be laid in the bell for the lower third of the circumference and covered with mortar. The spigot of the pipe shall be thoroughly cleaned with a wet brush, inserted in the bell, and carefully driven home. A small amount of mortar shall be inserted in the annular space for the upper two-thirds of the circumference. The gasket shall be lapped at the top of the pipe and driven home in the annular space with a caulking tool. The remainder of the annular space shall be filled completely with mortar and beveled at an angle of approximately 45 degrees with the outside of the bell. If mortar is not sufficiently stiff to prevent appreciable slump before setting, the outside of the joint thus made shall be wrapped with cheesecloth. Placing of this type of joint shall be kept at least five joints behind laying operations.
- c. **Cement-Mortar Diaper Joint for Bell-and-Spigot Pipe:** The pipe shall be centered so that the annular space is uniform. The annular space shall be caulked with jute or oakum. Before caulking, the inside of the bell and the outside of the spigot shall be cleaned.
 - 1) **Diaper Bands:** Diaper bands shall consist of heavy cloth fabric to hold grout in place at joints and shall be cut in lengths that extend one-eighth of the circumference of pipe above the spring line on one side of the pipe and up to the spring line on the other side of the pipe. Longitudinal edges of fabric bands shall be rolled and stitched around two pieces of wire. Width of fabric bands shall be such that after fabric has been securely stitched around both edges on wires, the wires will be uniformly spaced not less than 200 mm 8 inches apart. Wires shall be cut into



- lengths to pass around pipe with sufficient extra length for the ends to be twisted at top of pipe to hold the band securely in place; bands shall be accurately centered around lower portion of joint.
- 2) Grout: Grout shall be poured between band and pipe from the high side of band only, until grout rises to the top of band at the spring line of pipe, or as nearly so as possible, on the opposite side of pipe, to ensure a thorough sealing of joint around the portion of pipe covered by the band. Silt, slush, water, or polluted mortar grout forced up on the lower side shall be forced out by pouring, and removed.
 - 3) Remainder of Joint: The remaining unfilled upper portion of the joint shall be filled with mortar and a bead formed around the outside of this upper portion of the joint with a sufficient amount of additional mortar. The diaper shall be left in place. Placing of this type of joint shall be kept at least five joints behind actual laying of pipe. No backfilling around joints shall be done until joints have been fully inspected and approved.
- d. Cement-Mortar Tongue-and-Groove Joint: The first pipe shall be bedded carefully to the established gradeline with the groove upstream. A shallow excavation shall be made underneath the pipe at the joint and filled with mortar to provide a bed for the pipe. The grooved end of the first pipe shall be thoroughly cleaned with a wet brush, and a layer of soft mortar applied to the lower half of the groove. The tongue of the second pipe shall be cleaned with a wet brush; while in horizontal position, a layer of soft mortar shall be applied to the upper half of the tongue. The tongue end of the second pipe shall be inserted in the grooved end of the first pipe until mortar is squeezed out on interior and exterior surfaces. Sufficient mortar shall be used to fill the joint completely and to form a bead on the outside.
 - e. Cement-Mortar Diaper Joint for Tongue-and-Groove Pipe: The joint shall be of the type described for cement-mortar tongue-and-groove joint in this paragraph, except that the shallow excavation directly beneath the joint shall not be filled with mortar until after a gauze or cheesecloth band dipped in cement mortar has been wrapped around the outside of the joint. The cement-mortar bead at the joint shall be at least 1/2 inch (15 mm), thick and the width of the diaper band shall be at least 8 inches (200 mm). The diaper shall be left in place. Placing of this type of joint shall be kept at least five joints behind the actual laying of the pipe. Backfilling around the joints shall not be done until the joints have been fully inspected and approved.
 - f. Plastic Sealing Compound Joints for Tongue-and-Grooved Pipe: Sealing compounds shall follow the recommendation of the particular manufacturer in regard to special installation requirements. Surfaces to receive lubricants, primers, or adhesives shall be dry and clean. Sealing compounds shall be affixed to the pipe not more than 3 hours prior to installation of the pipe, and shall be protected from the sun, blowing dust, and other deleterious agents at all times. Sealing compounds shall be inspected before installation of the pipe, and any loose or improperly affixed sealing compound shall be removed and replaced. The pipe shall be aligned with the previously installed pipe, and the joint pulled together. If, while making the joint with mastic-type sealant, a slight protrusion of the material is not visible along the entire inner and outer circumference of the joint when the joint is pulled up, the pipe shall be removed and the joint remade. After the joint is made, all inner protrusions shall be cut off flush with the inner surface of the pipe. If nonmastic-type sealant material is used, the "Squeeze-Out" requirement above will be waived.
 - g. Flexible Watertight Joints: Gaskets and jointing materials shall be as recommended by the particular manufacturer in regard to use of lubricants, cements, adhesives, and other special installation requirements. Surfaces to receive lubricants, cements, or adhesives shall be clean and dry. Gaskets and jointing materials shall be affixed to the pipe not more than 24 hours prior to the installation of the pipe, and shall be protected from the sun, blowing dust, and other deleterious agents at all times. Gaskets and jointing materials shall be inspected before installing the pipe; any loose or improperly affixed gaskets and jointing materials shall be removed and replaced. The pipe shall be aligned with the previously installed pipe, and the joint pushed home. If, while the joint is being made the gasket becomes visibly dislocated the pipe shall be removed and the joint remade.



- h. External Sealing Band Joint for Noncircular Pipe: Surfaces to receive sealing bands shall be dry and clean. Bands shall be installed in accordance with manufacturer's recommendations.
- 2. Corrugated Metal Pipe
 - a. Field Joints: Transverse field joints shall be designed so that the successive connection of pipe sections will form a continuous line free of appreciable irregularities in the flow line. In addition, the joints shall meet the general performance requirements described in ASTM A798/A798M. Suitable transverse field joints which satisfy the requirements for one or more of the joint performance categories can be obtained with the following types of connecting bands furnished with suitable band-end fastening devices: corrugated bands, bands with projections, flat bands, and bands of special design that engage factory reformed ends of corrugated pipe. The space between the pipe and connecting bands shall be kept free from dirt and grit so that corrugations fit snugly. The connecting band, while being tightened, shall be tapped with a soft-head mallet of wood, rubber or plastic, to take up slack and ensure a tight joint. The annular space between abutting sections of part paved, and fully paved pipe and pipe arch, in sizes 30 inches (750 mm) or larger, shall be filled with a bituminous material after jointing. Field joints for each type of corrugated metal pipe shall maintain pipe alignment during construction and prevent infiltration of fill material during the life of the installations. The type, size, and sheet thickness of the band and the size of angles or lugs and bolts shall be as indicated or where not indicated, shall be as specified in the applicable standards or specifications for the pipe.
 - b. Flexible Watertight, Gasketed Joints: Installation shall be as recommended by the gasket manufacturer for use of lubricants and cements and other special installation requirements. The gasket shall be placed over one end of a section of pipe for half the width of the gasket. The other half shall be doubled over the end of the same pipe. When the adjoining section of pipe is in place, the doubled-over half of the gasket shall then be rolled over the adjoining section. Any unevenness in overlap shall be corrected so that the gasket covers the end of pipe sections equally. Connecting bands shall be centered over adjoining sections of pipe, and rods or bolts placed in position and nuts tightened. Band Tightening: The band shall be tightened evenly, even tension being kept on the rods or bolts, and the gasket; the gasket shall seat properly in the corrugations. Watertight joints shall remain uncovered for a period of time designated, and before being covered, tightness of the nuts shall be measured with a torque wrench. If the nut has tended to loosen its grip on the bolts or rods, the nut shall be retightened with a torque wrench and remain uncovered until a tight, permanent joint is assured.

E. Concrete Placement

- 1. Place cast-in-place concrete according to ACI 318/318R.

F. Drainage Structures

- 1. Manholes and Inlets: Construction shall be of reinforced concrete, plain concrete, brick, precast reinforced concrete, precast concrete segmental blocks, prefabricated corrugated metal, or bituminous coated corrugated metal; complete with frames and covers or gratings; and with fixed galvanized steel ladders where indicated. Pipe studs and junction chambers of prefabricated corrugated metal manholes shall be fully bituminous-coated and paved when the connecting branch lines are so treated. Pipe connections to concrete manholes and inlets shall be made with flexible, watertight connectors.
- 2. Walls and Headwalls: Construction shall be as indicated.

G. Steel Ladder Installation

- 1. Ladder shall be adequately anchored to the wall by means of steel inserts spaced not more than 6 feet (1.83 m) vertically, and shall be installed to provide at least 6 inches (152 mm) of space between the wall and the rungs. The wall along the line of the ladder shall be vertical for its entire length.



H. Backfilling

1. **Backfilling Pipe in Trenches:** After the pipe has been properly bedded, selected material from excavation or borrow, at a moisture content that will facilitate compaction, shall be placed along both sides of pipe in layers not exceeding 6 inches (150 mm) in compacted depth. The backfill shall be brought up evenly on both sides of pipe for the full length of pipe. The fill shall be thoroughly compacted under the haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers or rammers. This method of filling and compacting shall continue until the fill has reached an elevation of at least 12 inches (300 mm) above the top of the pipe. The remainder of the trench shall be backfilled and compacted by spreading and rolling or compacted by mechanical rammers or tampers in layers not exceeding 8 inches (200 mm). Tests for density shall be made as necessary to ensure conformance to the compaction requirements specified below. Where it is necessary, in the opinion of the the Owner, that sheeting or portions of bracing used be left in place, the contract will be adjusted accordingly. Untreated sheeting shall not be left in place beneath structures or pavements.
2. **Backfilling Pipe in Fill Sections:** For pipe placed in fill sections, backfill material and the placement and compaction procedures shall be as specified below. The fill material shall be uniformly spread in layers longitudinally on both sides of the pipe, not exceeding 6 inches (150 mm) in compacted depth, and shall be compacted by rolling parallel with pipe or by mechanical tamping or ramming. Prior to commencing normal filling operations, the crown width of the fill at a height of 12 inches (300 mm) above the top of the pipe shall extend a distance of not less than twice the outside pipe diameter on each side of the pipe or 12 feet (4 m), whichever is less. After the backfill has reached at least 12 inches (300 mm) above the top of the pipe, the remainder of the fill shall be placed and thoroughly compacted in layers not exceeding 8 inches (200 mm).
3. **Movement of Construction Machinery:** When compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.
4. **Compaction**
 - a. **General Requirements:** Cohesionless materials include gravels, gravel-sand mixtures, sands, and gravelly sands. Cohesive materials include clayey and silty gravels, gravel-silt mixtures, clayey and silty sands, sand-clay mixtures, clays, silts, and very fine sands. When results of compaction tests for moisture-density relations are recorded on graphs, cohesionless soils will show straight lines or reverse-shaped moisture-density curves, and cohesive soils will show normal moisture-density curves.
 - b. **Minimum Density:** Backfill over and around the pipe and backfill around and adjacent to drainage structures shall be compacted at the approved moisture content to the following applicable minimum density, which will be determined as specified below.
 - 1) Under airfield and heliport pavements, paved roads, streets, parking areas, and similar-use pavements including adjacent shoulder areas, the density shall be not less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material, up to the elevation where requirements for pavement subgrade materials and compaction shall control.
 - 2) Under unpaved or turfed traffic areas, density shall not be less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material.
 - 3) Under nontraffic areas, density shall be not less than that of the surrounding material.
5. **Determination of Density:** Testing shall be the responsibility of the Contractor and performed at no additional cost to the Owner. Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Tests shall be performed in sufficient number to ensure that specified density is being obtained. Laboratory tests for moisture-density relations shall be made in accordance with ASTM D1557 except that mechanical tampers may be used provided the results are correlated with those obtained with the specified hand tamper. Field density tests shall be determined in accordance with ASTM D2167 or ASTM D2922. When ASTM D2922 is used, the calibration curves shall be checked and adjusted, if necessary, using the sand cone method as described in paragraph Calibration of the referenced publications.



ASTM D2922 results in a wet unit weight of soil and when using this method ASTM D3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D3017 or ASTM D2922. Test results shall be furnished to the Owner. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed.

I. Pipeline Testing

1. **Leakage Tests:** Lines shall be tested for leakage by low pressure air or water testing or exfiltration tests, as appropriate. Low pressure air testing for vitrified clay pipes shall conform to ASTM C828. Low pressure air testing for concrete pipes shall conform to ASTM C924/ASTM C924M. Low pressure air testing for plastic pipe shall conform to ASTM F1417. Low pressure air testing procedures for other pipe materials shall use the pressures and testing times prescribed in ASTM C828 or ASTM C924/ASTM C924M, after consultation with the pipe manufacturer. Testing of individual joints for leakage by low pressure air or water shall conform to ASTM C1103/ASTM C1103M. Prior to exfiltration tests, the trench shall be backfilled up to at least the lower half of the pipe. If required, sufficient additional backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permit inspection. Visible leaks encountered shall be corrected regardless of leakage test results. When the water table is 600 mm 2 feet or more above the top of the pipe at the upper end of the pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to the Owner. An exfiltration test shall be made by filling the line to be tested with water so that a head of at least 2 feet (600 mm) is provided above both the water table and the top of the pipe at the upper end of the pipeline to be tested. The filled line shall be allowed to stand until the pipe has reached its maximum absorption, but not less than 4 hours. After absorption, the head shall be reestablished. The amount of water required to maintain this water level during a 2-hour test period shall be measured. Leakage as measured by the exfiltration test shall not exceed 250 gallons per inch in diameter per mile (60 liters per mm in diameter per kilometer) of pipeline per day **OR** 0.2 gallons per inch in diameter per 100 feet (9 mL per mm in diameter per 100 meters), **as directed**, of pipeline per hour. When leakage exceeds the maximum amount specified, satisfactory correction shall be made and retesting accomplished.
2. **Deflection Testing:** Perform a deflection test on entire length of installed plastic pipeline on completion of work adjacent to and over the pipeline, including leakage tests, backfilling, placement of fill, grading, paving, concreting, and any other superimposed loads. Deflection of pipe in the installed pipeline under external loads shall not exceed 4.5 percent of the average inside diameter of pipe. Determine whether the allowable deflection has been exceeded by use of a pull-through device or a deflection measuring device.
 - a. **Pull-through device:** This device shall be a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section. Pull-through device may also be of a design promulgated by the Uni-Bell Plastic Pipe Association, provided that the device meets the applicable requirements specified in this paragraph, including those for diameter of the device. Ball, cylinder, or circular sections shall conform to the following:
 - 1) A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.
 - 2) A homogeneous material throughout, with a density greater than 1.0 as related to water at 39.2 degrees F (4 degrees C), and a surface Brinell hardness of not less than 150.
 - 3) Center bored and through bolted with a 1/4 inch (6 mm) minimum diameter steel shaft having a yield strength of not less than 70,000 psi (483 MPa), with eyes or loops at each end for attaching pulling cables.
 - 4) Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.



- b. Deflection measuring device: Sensitive to 1.0 percent of the diameter of the pipe being tested and accurate to 1.0 percent of the indicated dimension. Deflection measuring device shall be approved by the the Owner prior to use.
 - c. Pull-through device: Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions as specified.
 - d. Deflection measuring device procedure: Measure deflections through each run of installed pipe. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, remove pipe which has excessive deflection, replace with new pipe, and completely retest in same manner and under same conditions.
 - e. Warranty period test: Pipe found to have a deflection of greater than 5 percent of average inside diameter when deflection test is performed just prior to end of one-year warranty period shall be replaced with new pipe and tested as specified for leakage and deflection.
- J. Field Painting
- 1. After installation, clean cast-iron frames, covers, gratings, and steps not buried in masonry or concrete to bare metal of mortar, rust, grease, dirt, and other deleterious materials and apply a coat of bituminous paint **OR** After installation, clean steel covers and steel or concrete frames not buried in masonry or concrete to bare metal of mortar, dirt, grease, and other deleterious materials. Apply a coat of primer and apply a top coat as specified in Division 09 Section "Exterior Painting", **as directed**. Do not paint surfaces subject to abrasion.

END OF SECTION 33 42 16 13



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Task	Specification	Specification Description
33 42 16 13	01 22 16 00	No Specification Required
33 42 16 13	22 05 23 00	Piped Utilities Basic Materials And Methods
33 44 13 13	22 05 23 00	Piped Utilities Basic Materials And Methods
33 44 16 00	22 05 23 00	Piped Utilities Basic Materials And Methods



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SECTION 33 44 19 19 - OIL/WATER SEPARATOR

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for oil/water separator. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Scope

1. The separator shall be designed for gravity separation of sand, grit, settleable solids, or semisolids, and free oils (hydrocarbons and other petroleum products) from wastewater. Separator shall be installed belowground with top access at or above grade level. The source of the influent to the separator shall be gravity flow from storm water runoff, hydrocarbon spills, and/or cleaning/maintenance operations.

C. Performance

1. Influent Characteristics

- a. Provide separator designed for intermittent and variable flows of water, oil, or any combination of non-emulsified oil-water mixtures. Minimum separator retention time shall be 10 minutes. Operating temperatures of the influent oil in water mixture shall range from 40 degrees F. to 80 degrees F. The specific gravity of the oils at operating temperatures shall range from 0.71 to 0.92. The specific gravity of the fresh water at operating temperatures shall range from 1.00 to 1.03.

2. Effluent Characteristics

- a. The free oil and grease concentration in the effluent from the separator shall not exceed 10 mg/l (10 PPM) to satisfy requirements of the NPDES stormwater discharge permit. To achieve this goal, it will be necessary to remove all free oil droplets equal to and greater than 20 microns.

D. Design Criteria

1. The separator shall be listed to Underwriters' Laboratories UL-SU2215. Construction and performance of the oil/water separators shall be in accordance with UL-SU2215. Provide certification documentation detailing criteria under which the system was tested. UL-SU2215 label shall be prominently displayed on manway covers.
2. Separator shall be designed in accordance with Stokes Law and the American Petroleum Institute Publication 421, "Monographs on Refinery Environmental Control - Management of Water Discharges; Design and Operation of Oil/Water Separators." Effective surface area calculations, signed and stamped by a Registered Professional Engineer shall be submitted to document specified effluent quality based on complete removal of the specified oil globule at design flow. A separator with lower effective surface area than required is not permissible.
3. Separator capacities, dimensions, construction, and thickness shall be in strict accordance with Underwriters' Laboratories, Subject UL-58 Standard for Safety, Steel Underground Tanks for Flammable and Combustible Liquids, September 30, 1997, Double Wall construction with 360 degree Steel Secondary Containment. The inner steel tank shall be completely contained within the outer steel tank, enclosing 100% of the tank volume. The tank shall have a double steel shell with a space between the layers. The space between the inner and outer steel walls shall be monitored with an approved electronic leak detection device through a pipe that extends vertically to the top of the tank from a small sump at the bottom. Tank construction using thin walled primary tank with external fiberglass jacket shall not be permissible.
4. Separator Corrosion Control System shall be in strict accordance with Underwriters' Laboratories Inc. Subject UL-1746 Standard for External Corrosion Protection Systems for Steel Underground Storage Tanks and the HighGuard® External Corrosion Protection Specifications.



5. Oil/water separator shall comply with National Fire Protection Association NFPA 30 Flammable and Combustible Liquids Code, 2003 Edition.
6. Separator vessel volume shall allow for a hydraulic retention time of ten (10) minutes to ensure laminar flow conditions which result in hydraulic uniformity and high effluent quality. Volume reduction will adversely affect separator performance by increasing horizontal velocity and turbulence, therefore a separator of smaller volume is not permissible.
7. Separator shall be the standard patented product of a steel tank manufacturer regularly engaged in the production of such equipment. Manufacturer shall have at least 20 years experience in manufacturing similar units for identical applications. No subcontracting of tank fabrication shall be permitted.
8. Separator shall be fabricated, inspected, and tested for leakage before shipment from the factory by manufacturer as a completely assembled vessel ready for installation.
9. Separator shall be cylindrical, horizontal, atmospheric-type steel vessel intended for the separation and storage of flammable and combustible liquids. The separator shall have the structural strength to withstand static and dynamic hydraulic loading while empty and during operating conditions. The Oil/Water Separator's dimensions and thickness shall be in strict compliance with Roark's Formulas for Stress and Strain as presented in UL 58, September 30, 1997. Calculations, signed and stamped by a Registered Professional Engineer shall be submitted to document structural strength under specified overbearing or external pressure. A separator with a reduced shell thickness is not permissible.
10. Separator shall have an oil storage capacity equal to about 43% of the total vessel volume and an emergency oil spill capacity equal to 80% of the total vessel volume.
11. To prevent extensive shutdown and maintenance, the separator design must allow solids to fall unhindered by turbulence, and oil droplets to rise without risk of re-emulsifying due to collisions with interfering solids. The use of plastic perforated tubes, spherical balls, or irregular shaped media will increase the facility's maintenance costs and shall not be permitted.
12. Separator shall consist of inlet and outlet connections, integral sand interceptor compartment, non-clogging flow distributor and energy dissipater device, stationary under flow baffle, presettling chamber for solids, sludge baffle, oil coalescing chamber with removable parallel flat/corrugated plate coalescer, with removable plates, and sectionalized removable polypropylene impingement coalescers to optimize separation of free oil from water, effluent downcomer positioned to prevent discharge of free oil that has been separated from the water, access ways for coalescers and each chamber, fittings for vent, oil pump-out, sampling, gauging, leak detection, and lifting lugs.

E. Submittals:

1. Shop Drawings: shop drawings for oil water separators shall show principal dimensions and location of all fittings.
2. Instructions: provide three complete sets of installation, operation, and maintenance instructions with separator.
3. Quality Control: Quality control, inspection procedures, and reports shall be considered part of the submittal package.

F. Warranty

1. The manufacturer shall warrant its products to be free from defects in material and workmanship for a period of one year from the date of shipment. The warranty shall be limited to repair or replacement of the defective part(s).
2. The manufacturer's warranty shall be standard limited warranty in effect at time of purchase.

1.2 PRODUCTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Highland Tank, One Highland Road, Box 338, Stoystown, PA 15563, Phone 814-893-5701, FAX 893-6126, E-mail ows.info@highlandtank.com, Website <http://www.highlandtank.com>



B. Product

1. Provide and install Highland Tank Model HTC Series "G" UL-SU2215 approved Belowground Double Wall Parallel Flat/Corrugated Plate Gravity Displacement Oil/Water Separator with Integral Sand Interceptor Compartment. Separator shall be furnished with oil level alarm and leak detection systems. Oil/Water Separator shall be of capacity to comply with Spill Prevention Control and Countermeasures (SPCC) plan requirements at the facility. The sizing of this oil/water separator is consistent with industry protocols for complying with the minimum federal spill and discharge regulations therefore a separator of smaller volume is not permissible.
2. Separator shall be furnished with a Corella™ inclined parallel flat/corrugated plate coalescer to simultaneously separate free oil droplets and settleable or suspended solids particles from water without clogging of the coalescer.

C. Description

1. Separator shall be standard prefabricated inclined parallel flat/corrugated plate, gravity displacement type unit.
2. Separator shall be cylindrical with capacities, dimensions, construction, and thickness in strict accordance with Underwriters' Laboratories Subject 58, Double Wall construction using flat-flanged heads. Separator shall comply with National Fire Protection Association NFPA 30 Flammable and Combustible Liquids Code, 2003 Edition.
3. The separator shall be a pre-packaged, pre-engineered, ready to install unit consisting of:
 - a. An influent connection, flanged. An internal influent nozzle at the inlet end of the separator. Nozzle discharge to be located at the furthest diagonal point from the effluent discharge opening.
 - b. An integral sand interceptor compartment containing one (1) manhole, UL approved, complete with extension, cover, gasket, and bolts. A heavy-duty bulkhead shall retain sand, grit, settleable solids or semisolids and prevent them from entering the separation chamber. Bulkhead shall have a transfer pipe.
 - c. A velocity head diffusion baffle at the inlet to:
 - 1) reduce horizontal velocity and flow turbulence.
 - 2) distribute the flow equally over the separator's cross sectional area.
 - 3) direct the flow in a serpentine path in order to enhance hydraulic characteristics and fully utilize all separator volume.
 - 4) completely isolate all inlet turbulence from the separation chamber.
 - d. A sediment chamber to disperse flow and collect oily solids and sediments.
 - e. A sludge baffle to retain settleable solids and sediment and prevent them from entering the separation chamber.
 - f. An Oil/Water Separation Chamber containing a removable Corella™ inclined parallel flat/corrugated plate coalescer. The coalescer shall have individual removable plates, sloped towards the sediment chamber. Each coalescing plate shall be flat on the top and corrugated on the bottom. The flat top plate shall resist clogging and clotting with solids. The corrugations of each of the plate bottoms shall be shaped and positioned to enhance collisions between the rising oil droplets and coalesce between them thereby improving separator efficiency. The coalescer shall:
 - 1) effect separation of oil and solids from all strata of the wastewater stream.
 - 2) shorten the vertical distance that an oil globule or solid particle has to rise or sink, respectively, for effective removal. Minimum plate gap to be 3/4".
 - 3) enhance coalescence and agglomeration by causing the smaller globules and particles (those possessing smaller rising/settling rates) to coalesce and collect on the plates thereby forming larger globules and particles that separate rapidly in water.
 - 4) direct the flow paths of the separated oil to the surface of the separator and separated solids to the bottom of the separator.
 - 5) allow solids to fall unhindered by turbulence, and oil droplets to rise without risk of re-emulsifying due to collisions with interfering solids.
 - g. The Oil/Water Separation Chamber shall also contain a sectionalized removable "Petro-Screen"™ polypropylene impingement coalescer designed to intercept oil globules of less



than 20 microns in diameter. Heavy, one-piece impingement coalescers are not permissible.

- h. An internal effluent downcomer at the outlet end of the separator, to allow for discharge from the bottom of the separation chamber only.
- i. An effluent connection, flanged.
- j. Fittings for vent, interface/level sensor, leak detection, waste oil pump-out, sampling, and gauge.
- k. Two (2) manholes, UL approved, complete with extension, cover, gasket, and bolts. One manway shall be placed between the inlet and the parallel flat/corrugated plate coalescer to facilitate access into sediment chamber for solids removal. One manway shall be placed between the parallel flat/corrugated plate coalescer and outlet to facilitate access into the oil water separation chamber for oil removal.
- l. Lifting lugs at balancing points for handling and installation.
- m. Identification plates: Plates shall be affixed in prominent location and be durable and legible throughout equipment life.
- n. HighGuard® Corrosion Protection System consisting of:
 - 1) Isolation Spool Pieces
 - 2) Dielectric Isolation Gaskets and Bushings
 - 3) External surfaces commercial grit blast, coated 75 mils DFT Self-Reinforcing Polyurethane.
- o. Internal surfaces commercial grit blast and coated with 10 mils DFT heavy duty Polyurethane.

D. Accessories

- 1. Separator shall be supplied with an audible and visual alarm system that indicates hi oil level (visual only) and hi hi oil level (audible and visual) of oil storage in the oil/water separator and an audible and visual leak detection alarm system that indicates hydrocarbon and/or water in the interstice. A silence control shall be provided for the audible alarms. Level sensor(s) shall be intrinsically safe. Level sensor floats shall be made of stainless steel. The control panel shall contain both level sensor and detection control. The control panel shall be NEMA 4. Power to the control panel shall be as directed by the Owner.
- 2. Separator shall be supplied with Polyester Hold-down straps.
- 3. Separator shall be supplied with prefabricated Concrete Deadman Anchors.
- 4. Separator shall be supplied with cylindrical and/or rectangular steel Grade Level Manways designed to AASHTO H20 requirements.

1.3 EXECUTION

A. Installation

- 1. Installation shall be in strict compliance with manufacturer's instructions and shall comply with all applicable local, state, and federal requirements.

END OF SECTION 33 44 19 19



SECTION 33 46 13 00 - CSF FOUNDATION DRAINAGE

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Foundation Drainage is part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Foundation, Subsoil Drainage Systems.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 312300 - Excavation and Fill: Earthwork for utilities.
 - 2. Section 334000- Storm Drainage Utilities.
 - 3. Section 033000 - Cast-In-Place Concrete: Concrete for catch basins, inlets, and junction boxes.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM F 405 Standard Specification for Corrugated Polyethylene (PE) Tubing and Fittings
 - 2. ASTM D 448 Standard Classification for Sizes of Aggregate for Road and Bridge Construction
 - 3. ASTM D 2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures.
- B. Section 017704 - Closeout Procedures and Training.



1.4 QUALITY ASSURANCE

- A. Qualifications:
1. Manufacturer Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Drainage Conduits:
 - a. Advanced Drainage Systems, Incorporated, London, OH, (800) 733-9554.
 - b. CertainTeed Corporation, Valley Forge, PA, (800) 274-8530.
 - c. Flo-Well Products, Centerville, MA, (800) 356-9935.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

- A. Pipes and Fittings:
1. Perforated, Polyethylene (PE) Pipe and Fittings: ASTM F 405, corrugated, for coupled joints.

2.3 ACCESSORIES

1. Couplings: Manufacturer's standard, band type.

2.4 SOIL MATERIALS

- A. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, ASTM D 448, coarse aggregate, Size No. 57, with 100 percent passing 1-1/2-inch (4 cm) sieve and not more than 5 percent passing No. 8 sieve.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution.



- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Where foundation drainage systems are to be installed, examine surfaces and areas for suitable conditions.
 - 2. Do not proceed with Work until negative conditions have been corrected.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 FOUNDATION DRAINAGE SYSTEM APPLICATIONS

NOTE TO SPECIFIER

Products listed below must correlate with specifications in Part 2 Products and pipe size indicated on Contract Drawings.

- A. Systems with 6-Inch (15 cm) (DN 150) Piping:
 - 1. Perforated, polyethylene (PE) pipe and fittings, couplings, and coupled joints.

3.3 INSTALLATION

- A. Contract Drawings and details indicate general location and arrangement of foundation drainage system piping.
- B. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing, solidly in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's instructions and specifications and other requirements indicated.

NOTE TO SPECIFIER

Edit the paragraphs below as required for different minimum slope and cover.

- 1. Install piping pitched down in direction of flow, at a minimum slope of [1 percent (1:100)] and with a minimum cover of [36 inches (100 cm)], except where otherwise indicated in the Contract Drawings.
- 2. Apply and compact impervious fill material to raise low areas or where unsatisfactory bearing soil may occur.
- 3. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
- C. Extend piping and connect to storm [storm drainage system] [building storm drains], of sizes and in locations indicated. Terminate piping as indicated in the Contract Drawings.

3.4 CONSTRUCTION

- A. General Requirements:
 - 1. Join and install pipe and fittings as indicated in the Contract Drawings and according to the following requirements:



B. Polyethylene (PE) Pipe and Fittings:

1. Join pipe, tubing, and fittings with couplings for soiltight joints according to AASHTO "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4 "Joint Properties"; and manufacturer's instructions.
2. Join perforated pipe and fittings with couplings for soiltight joints according to AASHTO "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4 "Joint Properties"; or ASTM D 2321; and manufacturer's instructions.
3. Install according to ASTM D 2321 and manufacturer's instructions.
4. Install perforated pipe with perforations down.

C. System Piping Joints:

1. Make joints using system manufacturer's seals and couplings, except where otherwise specified.
2. Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and that fit both pipe materials and dimensions.

D. Soil Material Insallation:

1. Drainage Fill: Place fill over drain piping after satisfactory testing and covering with filtering material. Cover piping to width of at least 6 inches (15 cm) on each side and above top of pipe to within 12 inches (30 cm) of finish grade. Place fill material in layers not exceeding 3 inches (7.5 cm) in loose depth, and compact each layer placed.
2. Fill to Grade: Place impervious fill material over compacted drainage fill. Place material in loose-depth layers not exceeding 6 inches (15 cm). Thoroughly compact each layer. Fill to finish elevations and slope away from building.

3.5 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field testing and inspection.

NOTE TO SPECIFIER

Add specific test requirements to comply with local and Federal regulations.

B. Testing:

1. Test drain piping with water or visually check piping to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.
2. Place additional filtering material to depth of 4 inches (10 cm) around sides and top of drains after testing.

USPS CSF Specifications issued: 10/1/2013

Last revised: 4/12/2011

END OF SECTION 33 46 13 00



SECTION 33 46 13 00 - MPF FOUNDATION DRAINAGE

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

Use this section where Foundation Drainage is part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Foundation, Subsoil Drainage Systems.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 312300 - Excavation and Fill: Earthwork for utilities.
 - 2. Section 334000- Storm Drainage Utilities.
 - 3. Section 033000 - Cast-In-Place Concrete: Concrete for catch basins, inlets, and junction boxes.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM F 405 Standard Specification for Corrugated Polyethylene (PE) Tubing and Fittings
 - 2. ASTM D 448 Standard Classification for Sizes of Aggregate for Road and Bridge Construction
 - 3. ASTM D 2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures.
- B. Section 017704 - Closeout Procedures and Training.



1.4 QUALITY ASSURANCE

- A. Qualifications:
1. Manufacturer Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

PART 2 - PRODUCTS

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
1. Drainage Conduits:
 - a. Advanced Drainage Systems, Incorporated, London, OH, (800) 733-9554.
 - b. CertainTeed Corporation, Valley Forge, PA, (800) 274-8530.
 - c. Flo-Well Products, Centerville, MA, (800) 356-9935.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.2 MATERIALS

- A. Pipes and Fittings:
1. Perforated, Polyethylene (PE) Pipe and Fittings: ASTM F 405, corrugated, for coupled joints.

2.3 ACCESSORIES

1. Couplings: Manufacturer's standard, band type.

2.4 SOIL MATERIALS

- A. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, ASTM D 448, coarse aggregate, Size No. 57, with 100 percent passing 1-1/2-inch (4 cm) sieve and not more than 5 percent passing No. 8 sieve.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution.



- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Where foundation drainage systems are to be installed, examine surfaces and areas for suitable conditions.
 - 2. Do not proceed with Work until negative conditions have been corrected.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 FOUNDATION DRAINAGE SYSTEM APPLICATIONS

NOTE TO SPECIFIER

Products listed below must correlate with specifications in Part 2 Products and pipe size indicated on Contract Drawings.

- A. Systems with 6-Inch (15 cm) (DN 150) Piping:
 - 1. Perforated, polyethylene (PE) pipe and fittings, couplings, and coupled joints.

3.3 INSTALLATION

- A. Contract Drawings and details indicate general location and arrangement of foundation drainage system piping.
- B. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing, solidly in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's instructions and specifications and other requirements indicated.

NOTE TO SPECIFIER

Edit the paragraphs below as required for different minimum slope and cover.

- 1. Install piping pitched down in direction of flow, at a minimum slope of [1 percent (1:100)] and with a minimum cover of [36 inches (100 cm)], except where otherwise indicated in the Contract Drawings.
- 2. Apply and compact impervious fill material to raise low areas or where unsatisfactory bearing soil may occur.
- 3. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
- C. Extend piping and connect to storm [storm drainage system] [building storm drains], of sizes and in locations indicated. Terminate piping as indicated in the Contract Drawings.

3.4 CONSTRUCTION

- A. General Requirements:
 - 1. Join and install pipe and fittings as indicated in the Contract Drawings and according to the following requirements:



- B. Polyethylene (PE) Pipe and Fittings:
1. Join pipe, tubing, and fittings with couplings for soiltight joints according to AASHTO "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4 "Joint Properties"; and manufacturer's instructions.
 2. Join perforated pipe and fittings with couplings for soiltight joints according to AASHTO "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4 "Joint Properties"; or ASTM D 2321; and manufacturer's instructions.
 3. Install according to ASTM D 2321 and manufacturer's instructions.
 4. Install perforated pipe with perforations down.
- C. System Piping Joints:
1. Make joints using system manufacturer's seals and couplings, except where otherwise specified.
 2. Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and that fit both pipe materials and dimensions.
- D. Soil Material Installation:
1. Drainage Fill: Place fill over drain piping after satisfactory testing and covering with filtering material. Cover piping to width of at least 6 inches (15 cm) on each side and above top of pipe to within 12 inches (30 cm) of finish grade. Place fill material in layers not exceeding 3 inches (7.5 cm) in loose depth, and compact each layer placed.
 2. Fill to Grade: Place impervious fill material over compacted drainage fill. Place material in loose-depth layers not exceeding 6 inches (15 cm). Thoroughly compact each layer. Fill to finish elevations and slope away from building.

3.5 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field testing and inspection.

NOTE TO SPECIFIER

Add specific test requirements to comply with local and Federal regulations.

- B. Testing:
1. Test drain piping with water or visually check piping to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.
 2. Place additional filtering material to depth of 4 inches (10 cm) around sides and top of drains after testing.

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END OF SECTION 33 46 13 00



Task	Specification	Specification Description
33 46 16 00	01 22 16 00	No Specification Required
33 46 16 00	22 05 23 00	Piped Utilities Basic Materials And Methods
33 46 16 00	32 91 19 13	Septic Tank Systems
33 46 23 00	22 05 23 00	Piped Utilities Basic Materials And Methods



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SECTION 33 49 13 00 - MPF STORM DRAINAGE MANHOLES, FRAMES, AND COVERS

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

Use this section where Storm Drainage is part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Monolithic concrete manhole section with the option of monolithic concrete or masonry transition to lid frame, covers, anchorage and accessories.
 2. Modular precast concrete manhole section with tongue-and-groove joints and with the option of precast concrete or masonry transition to lid frame, covers, anchorage and accessories.
 3. Masonry manhole section with masonry transition to lid frame, covers, anchorage and accessories.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 1. Section 312300 - Excavation and Fill: Earthwork for utilities.
 2. Section 334000 - Storm Drainage Utilities: Site storm drainage system.
 3. Section 033000 - Cast-In-Place Concrete: Concrete for utility structure base pads.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 1. ASTM C55 - Specification for Concrete Building Brick.
 2. ASTM A48 - Specification for Gray Iron Castings.
 3. ASTM C478 - Specification for Precast Reinforced Concrete Manhole Sections.
 4. ASTM C923 - Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.
- B. International Masonry Industry All-Weather Council (IMIAC): Recommended Practices and Guide Specification for Cold Weather Masonry Construction.

MPF STORM DRAINAGE MANHOLES, FRAMES, AND



1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Data for manhole covers, manhole steps, component construction, features, configuration, and dimensions.
 - 2. Shop Drawings: Drawings of manhole locations, elevations, piping with sizes, locations and elevations of penetrations.

1.4 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements:
 - 1. Cold Weather Requirements: IMIAC - Recommended Practices and Specifications for Cold Weather Masonry Construction.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Manhole Section: Reinforced precast concrete. in accordance with ASTM C 478 with gaskets in accordance with ASTM C 923.
 - 1. Construct manholes of precast concrete sections as required by Drawings to size, shape, and depth indicated, but never less than 4 foot 0 inch inside diameter.
- B. Manhole Section: Non-reinforced cast-in-place concrete as specified in Section 033000 -- Cast-In-Place Concrete.
 - 1. Cast-in place Manholes shall be constructed of 3500 psi concrete.
 - 2. Forms shall be made of steel sheets accurately shaped and fabricated of sufficient strength to form dense watertight walls to true dimensions.
 - 3. Concrete shall be deposited in evenly distributed layers of about 18 inches, with each layer vibrated to bond it to the preceding layer.
- C. Concrete Brick Units: ASTM C 55, Grade N Type I- Moisture Controlled, normal weight, of same Grade, Type and weight as block units, nominal modular size of 3 5/8 x 7 5/8 x 2 1/4 inches.
- D. Mortar and Grout: Mortar for finishing and sealing shall be Class "C". Honeycombing less than 2 inches deep shall be repaired using Class "D" mortar.
- E. Brick Transition Reinforcement: Formed steel 8 gage wire with galvanized finish.

2.2 COMPONENTS

- A. Lid and Frame: ASTM A 48, Class 30B Heavy Duty Cast iron construction, machined flat bearing surface, removable lid, closed or open as indicated on Drawings; sealing gasket; manufactured by Neenah Foundry Company.
- B. Manhole Steps: Neenah Foundry Company catalog No. R- 1982-F for precast or catalog No. R-1980-0 for brick/cast-in-place manholes or M.A. Industries PS-1.
- C. Base Pad: Cast-in-place concrete as specified in Section 033000 - Cast-In-Place Concrete.



- D. Section 016000 - Product Requirements: Product requirements and substitutions. Substitutions: Permitted.

2.3 CONFIGURATION

- A. Manhole Section Construction: Concentric with eccentric cone top section.
- B. Shape: Cylindrical.
- C. Clear Inside Dimensions: 48 inch diameter or as indicated on Drawings.
- D. Design Depth: As indicated on Drawings.
- E. Clear Lid Opening: 24 inches minimum.
- F. Pipe Entry: Provide openings as indicated on Drawings.
- G. Main and Lateral Pipes: Neatly cut off main and lateral pipes flush with inside of manhole or inlet where they enter structure walls, and point up irregularities and rough edges with nonshrinking grout.
- H. Inverts: Shape inverts for smooth flow across structure floor as shown on Drawings. Use concrete and mortar to obtain proper grade and contour and finish surface with fine textured wood float.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Coordinate placement of inlet and outlet pipe or duct sleeves as indicated on Drawings for drainage system piping specified in Section 334000.

3.3 PLACING PRE-CAST MANHOLE SECTIONS

- A. Place base pad to proper elevation and location and trowel top surface level for placement of manhole section.



- B. Place manhole section plumb and level to correct elevations and anchor to base pad.
 - 1. After completion of slab foundation the first joint of manhole section shall be lowered into position, grooved end first, and set level and plumb on concrete base. Align and adjust to proper grade prior to placing and forming invert which shall be poured immediately after setting of first section of manhole section.
 - 2. Prior to setting subsequent manhole sections, apply primer to tongue and groove ends and allow to set in accordance with manufacturer recommendations. Place "Ram-nek", or equivalent, plastic rope on tongue end. Lower next section into position, and remove excess material from interior of structure. Add additional material on exterior of joint, if necessary, for completely watertight joint.

3.4 MASONRY MANHOLE SECTION CONSTRUCTION

- A. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- B. Lay masonry units in running bond. Course 3 brick units and 3 mortar joints to equal 8 inches.
- C. Form flush mortar joints.
- D. Lay masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- E. Install joint reinforcement 16 inches on center
- F. Place joint reinforcement in first and second horizontal joints above base pad and below lid frame opening.
- G. As work progresses, build-in fabricated metal items.
- H. Cut and fit masonry for pipes as specified herein.
- I. Set cover frames and covers level without tipping, to correct elevations.
- J. Grout base of shaft section to achieve slope to exit piping. Trowel smooth. Contour as required.
- K. Coordinate with other sections of Work to provide correct size, shape and location.

3.5 BACKFILLING

- A. Backfill around manholes as specified in Section 312300.

USPS Mail Processing Facility Specification issued: 10/1/2013
Last revised: 6/10/2011

END OF SECTION 33 49 13 00



SECTION 33 49 13 00 - CSF STORM DRAINAGE MANHOLES, FRAMES, AND COVERS

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Storm Drainage is part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Monolithic concrete manhole section with the option of monolithic concrete or masonry transition to lid frame, covers, anchorage and accessories.
 - 2. Modular precast concrete manhole section with tongue-and-groove joints and with the option of precast concrete or masonry transition to lid frame, covers, anchorage and accessories.
 - 3. Masonry manhole section with masonry transition to lid frame, covers, anchorage and accessories.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 312300 - Excavation and Fill: Earthwork for utilities.
 - 2. Section 334000 - Storm Drainage Utilities: Site storm drainage system.
 - 3. Section 033000 - Cast-In-Place Concrete: Concrete for utility structure base pads.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM C55 - Specification for Concrete Building Brick.
 - 2. ASTM A48 - Specification for Gray Iron Castings.
 - 3. ASTM C478 - Specification for Precast Reinforced Concrete Manhole Sections.
 - 4. ASTM C923 - Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.
- B. International Masonry Industry All-Weather Council (IMIAC): Recommended Practices and Guide Specification for Cold Weather Masonry Construction.

CSF STORM DRAINAGE MANHOLES, FRAMES, AND
COVERS



1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Data for manhole covers, manhole steps, component construction, features, configuration, and dimensions.
 - 2. Shop Drawings: Drawings of manhole locations, elevations, piping with sizes, locations and elevations of penetrations.

1.4 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements:
 - 1. Cold Weather Requirements: IMIAC - Recommended Practices and Specifications for Cold Weather Masonry Construction.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Manhole Section: Reinforced precast concrete. in accordance with ASTM C 478 with gaskets in accordance with ASTM C 923.
 - 1. Construct manholes of precast concrete sections as required by Drawings to size, shape, and depth indicated, but never less than 4 foot 0 inch inside diameter.
- B. Manhole Section: Non-reinforced cast-in-place concrete as specified in Section 033000 -- Cast-In-Place Concrete.
 - 1. Cast-in place Manholes shall be constructed of 3500 psi concrete.
 - 2. Forms shall be made of steel sheets accurately shaped and fabricated of sufficient strength to form dense watertight walls to true dimensions.
 - 3. Concrete shall be deposited in evenly distributed layers of about 18 inches, with each layer vibrated to bond it to the preceding layer.
- C. Concrete Brick Units: ASTM C 55, Grade N Type I- Moisture Controlled, normal weight, of same Grade, Type and weight as block units, nominal modular size of 3 5/8 x 7 5/8 x 2 1/4 inches.
- D. Mortar and Grout: Mortar for finishing and sealing shall be Class "C". Honeycombing less than 2 inches deep shall be repaired using Class "D" mortar.
- E. Brick Transition Reinforcement: Formed steel 8 gage wire with galvanized finish.

2.2 COMPONENTS

- A. Lid and Frame: ASTM A 48, Class 30B Heavy Duty Cast iron construction, machined flat bearing surface, removable lid, closed or open as indicated on Drawings; sealing gasket; manufactured by Neenah Foundry Company.
- B. Manhole Steps: Neenah Foundry Company catalog No. R- 1982-F for precast or catalog No. R-1980-0 for brick/cast-in-place manholes or M.A. Industries PS-1.
- C. Base Pad: Cast-in-place concrete as specified in Section 033000 - Cast-In-Place Concrete.



- D. Section 016000 - Product Requirements: Product requirements and substitutions. Substitutions: Permitted.

2.3 CONFIGURATION

- A. Manhole Section Construction: Concentric with eccentric cone top section.
- B. Shape: Cylindrical.
- C. Clear Inside Dimensions: 48 inch diameter or as indicated on Drawings.
- D. Design Depth: As indicated on Drawings.
- E. Clear Lid Opening: 24 inches minimum.
- F. Pipe Entry: Provide openings as indicated on Drawings.
- G. Main and Lateral Pipes: Neatly cut off main and lateral pipes flush with inside of manhole or inlet where they enter structure walls, and point up irregularities and rough edges with nonshrinking grout.
- H. Inverts: Shape inverts for smooth flow across structure floor as shown on Drawings. Use concrete and mortar to obtain proper grade and contour and finish surface with fine textured wood float.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Coordinate placement of inlet and outlet pipe or duct sleeves as indicated on Drawings for drainage system piping specified in Section 334000.

3.3 PLACING PRE-CAST MANHOLE SECTIONS

- A. Place base pad to proper elevation and location and trowel top surface level for placement of manhole section.



- B. Place manhole section plumb and level to correct elevations and anchor to base pad.
 - 1. After completion of slab foundation the first joint of manhole section shall be lowered into position, grooved end first, and set level and plumb on concrete base. Align and adjust to proper grade prior to placing and forming invert which shall be poured immediately after setting of first section of manhole section.
 - 2. Prior to setting subsequent manhole sections, apply primer to tongue and groove ends and allow to set in accordance with manufacturer recommendations. Place "Ram-nek", or equivalent, plastic rope on tongue end. Lower next section into position, and remove excess material from interior of structure. Add additional material on exterior of joint, if necessary, for completely watertight joint.

3.4 MASONRY MANHOLE SECTION CONSTRUCTION

- A. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- B. Lay masonry units in running bond. Course 3 brick units and 3 mortar joints to equal 8 inches.
- C. Form flush mortar joints.
- D. Lay masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- E. Install joint reinforcement 16 inches on center
- F. Place joint reinforcement in first and second horizontal joints above base pad and below lid frame opening.
- G. As work progresses, build-in fabricated metal items.
- H. Cut and fit masonry for pipes as specified herein.
- I. Set cover frames and covers level without tipping, to correct elevations.
- J. Grout base of shaft section to achieve slope to exit piping. Trowel smooth. Contour as required.
- K. Coordinate with other sections of Work to provide correct size, shape and location.

3.5 BACKFILLING

- A. Backfill around manholes as specified in Section 312300.

USPS CSF Specifications issued: 10/1/2013
Last revised: 4/12/2011

END OF SECTION 33 49 13 00



SECTION 33 51 00 00 - MPF NATURAL-GAS DISTRIBUTION

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location.

NOTE TO SPECIFIER

Use this section where Natural or Propane Gas System is part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [____] indicates information may be inserted at that location. Drawing Coordination Items at end of Section.33 51 00 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

NOTE TO SPECIFIER

Edit below for type of gas used for this Project.

1. Pipe and fittings for site utility [natural] [propane] gas distribution.

NOTE TO SPECIFIER

Use PROPANE STORAGE TANKS for Propane System.

2. Propane storage tanks.

- B. Related Documents: The Contract Documents, as defined in the General Conditions, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:

1. Section 312300 - Excavation and Fill: Earthwork for utilities.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO T180 - Moisture-Density Relations of Soils Using a 10 pound Rammer and an 18 inch Drop.

B. American Society of Mechanical Engineers (ASME):

1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
3. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.



4. ASME Sec. 8D - Pressure Vessels.
5. ASME Sec. 9 - Welding and Brazing Qualifications.
6. ASME Boiler and Pressure Code.

C. American Society for Testing and Materials (ASTM):

1. ASTM B 32 - Specification for Solder Metal.
2. ASTM D 1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 Pound Rammer and 18 inch Drop.
3. ASTM A 53 - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated (Galvanized) Welded and Seamless, for Ordinary Uses.
4. ASTM A234 - Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
5. ASTM B75 - Specification for Seamless Copper Tube.
6. ASTM B88 - Specification for Seamless Copper Water Tube.
7. ASTM D2513 - Specification for Thermoplastic Gas Pressure Pipe, Tubing and Fittings.
8. ASTM D2517 - Specification for Reinforced Epoxy Resin Gas Pressure Pipe and Fittings.
9. ASTM D2683 - Specification for Socket Type Polyethylene Fittings For Outside Diameter Controlled Polyethylene Pipe and Tubing.
10. ASTM D2922 - Test Methods for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).
11. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

D. American Welding Society (ASTM):

1. AWS A5.8 - Brazing Filler Metal.

E. American Water Works Association (AWWA):

1. AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other liquids.

F. American National Standards Institute (ANSI):

1. ANSI B16.3 - Malleable Iron Threaded Fittings.
2. ANSI B16.11 - Forged Steel Fittings, Socket Welding and Threaded.
3. ANSI B31.2 - Fuel Gas Piping.
4. ANSI B31.8 - Gas Transmission and Distribution Piping Systems.

G. National Fire Protection Association (NFPA):

NOTE TO SPECIFIER

OPTION 1: Use NFPA 54 for Natural Gas System.

1. NFPA 54 - National Fuel Gas Code.

NOTE TO SPECIFIER

OPTION 2: Use NFPA 58 for Propane System.

2. NFPA 58 - National Fuel Propane Code.

1.3 DEFINITIONS

- A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.



1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Data for each type of pipe, pipe fitting, valve, and accessory specified.
 - 2. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate certifying that Products meet or exceed specified requirements and standards.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Project Record Documents: Accurately record the following:
 - a. Locations of piping mains, valves, connections, and top of pipe elevations.
 - b. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Perform work in accordance with Utility Company requirements and authority having jurisdiction.

NOTE TO SPECIFIER

Edit below for type of gas used. Use NFPA 54 for Natural Gas. Use NFPA 58 for Propane.

- 1. Conform to [NFPA 54] [NFPA 58], ANSI B31.2 and ANSI B31.8.
- B. Gas Cock: Manufacturer's name and pressure rating marked on valve body.
- C. Welding Materials and Procedures: Conform to ASME Boiler and Pressure Vessel Code and applicable state regulations.
- D. Welders Certification: In accordance with ASME Sec 9.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Deliver and store valves in shipping containers with labeling in place.

PART 2 - PRODUCTS

2.1 PIPE

NOTE TO SPECIFIER

OPTION 1: Use STEEL PIPE Paragraphs A and B below for NATURAL GAS system.

- A. Steel Pipe Below Ground: ASTM A 53, Schedule 40 black:
 - 1. Fittings: ANSI B16.11, forged steel, or ASTM A 234 forged steel welding type.
 - 2. Joints: Welded and seamless.
 - 3. Jackets: AWWA C 105 polyethylene jacket, double layer, half lapped, 10 mil polyethylene tape.
- B. Steel Pipe Above Ground: ASTM A53 Schedule 40 black:



1. Fittings: ANSI B16.3, malleable iron, ANSI B16.11, forged steel, or ASTM A 234, forged steel welding type.
2. Joints: Threaded.

NOTE TO SPECIFIER

OPTION 2: Use COPPER TUBING Paragraphs A and B below for PROPANE system.

- C. Copper Tubing Below Ground: ASTM B 88, Type K, internally tinned:
 1. Fittings: AWWA B16.18, cast copper, or ASME B16.22, wrought copper; internally tinned.
 2. Joint: AWS A5.8 BCuP silver brazed.
- D. Copper Tubing Above Ground: ASTM B 88, Type K, L or ASTM B 75, Type GP; internally tinned:
 1. Fittings: ASME B6.18 cast copper, ASME B16.22, wrought copper, or ASME B16.26, cast copper, internally tinned.
 2. Joint: ASTM B 32, Solder, Grade 95TA or AWS A5.8, BCuP silver brazed.
- E. Polyethylene Pipe: ASTM D 2513, SDR 11.5 or ASTM F 678 Series 125:
 1. Fittings: ASTM D 2513.
 2. Joints: Mechanical or Compression fit.
 3. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Natural Gas Service" in large letters.
- F. Reinforced Epoxy Resin Piping: ASTM D 2517:
 1. Fittings: ASTM D 2517.
 2. Joints: Bell and spigot with epoxy resin.
 3. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Natural Gas Service" in large letters.

2.2 GAS COCKS

- A. 2 Inches and Smaller: 150 psig WOG, bronze body, bronze tapered plug, non-lubricated, Teflon packing, threaded ends with cast iron curb box, cover, and key.
- B. 2 Inches and Larger: 125 psig WOG, Steel or Cast iron body and tapered plug, non-lubricated, Teflon packing, threaded ends, with cast iron curb box, cover, and key.
- C. Applications With Line Pressure Greater Than 60 psig, Over 2 Inches: Cast iron body and plug, pressure lubricated, Teflon packing, flanged ends, with cast iron curb box, cover, and key.

2.3 PRESSURE REGULATING VALVES

- A. Valves: Single stage, malleable iron body, corrosion-resistant, pressure regulator with atmospheric vent, elevation compensator; with threaded ends for 2 inch and smaller, flanged ends larger than 2 inch.
- B. Capacity: For inlet and outlet gas pressures, specific gravity, and flow rate indicated.

NOTE TO SPECIFIER

Use PROPANE STORAGE TANKS for Propane System.



2.4 PROPANE STORAGE TANKS

- A. Construction: Closed, welded steel, tested and stamped in accordance with ASME Section 8D; minimum 250 psig (1 700 kPa) rating; cleaned, prime coated and painted with two coats of silver anti-rust paint, and supplied with steel support saddles, pressure gage; tapping for installation of piping and accessories.
- B. Vaporizer: 1000 watts, heating cable bedded in 1 inch of glass fiber insulation and covered by flexible stainless steel plate, with thermostat in weatherproof box set to turn on at -13 degrees F with manual off-on switch.
- C. Size and Capacity: Diameter and length indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify that building service connection and utility gas main size, location, and depth are as indicated.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with fine aggregate.
- B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.
- C. Cut pipe ends square, ream pipe ends and remove burrs. Bevel plain end ferrous pipe over 2 inches diameter thread ferrous pipe 2 inches diameter and under.
- D. Remove scale and dirt, on inside and outside, before assembly.
- E. Prepare piping connections with flanges or threading and unions.

3.3 BEDDING

- A. Excavate pipe trench and place bedding material in accordance with Section 312300 for work of this Section. Provide trench wall shoring as required.



- B. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches compacted depth, each layer. Place compacted bedding material to elevation of subgrade as indicated on Drawings.
- C. Maintain optimum moisture content of bedding material to attain required compaction density.
- D. Remove excess backfill and excavated material from site.

3.4 INSTALLATION - PIPING

- A. Maintain separation of gas line from sewer, water or storm water piping in accordance with state or local code.
- B. Install piping to allow for expansion and contraction without stressing pipe or joints.
- C. Connections with Existing Pipelines: Where connections are made between new Work and existing piping, make connection using suitable fittings for conditions encountered. Make each connection with existing pipe at time and under conditions which least interfere with operation of existing pipeline and in compliance with the local Utility Company.
- D. Install cocks and other fittings as required.
- E. Establish elevations of buried piping in accordance with Section 312300 for Work in this Section.
- F. Wrap couplings and fittings of steel pipe with polyethylene tape and heat shrink over pipe.
- G. Install trace wire continuous buried 10 inches below finish grade, above pipe line. Trace wire shall be in accordance with local utilities standards.
- H. Backfill trench in accordance with Section 312300.
- I. Center and plumb valve box over valve. Set box cover flush with finished ground surface. Prevent shock or stress from being transmitted through valve box to valve.
- J. Wrap valve and valve box with polyethylene tape and heat shrink or paint valves and valve boxes with red anti-rust primer and one coat of epoxy paint.

3.5 SERVICE CONNECTIONS

- A. Provide sleeve in foundation wall for gas service main. Caulk enlarged sleeve watertight.
- B. Anchor service main to interior surface of foundation wall.
- C. Install service regulator adjacent to building wall in specified location.
- D. Install service regulator and riser pipe to prevent undue stress upon service pipe. For plastic service pipe, use steel pipe riser from below ground to regulator.
- E. Provide regulator vent with rain and insect proof opening, terminating not less than five feet away from building openings.

NOTE TO SPECIFIER

Use PROPANE STORAGE TANKS for Propane System.



3.6 PROPANE STORAGE TANK INSTALLATION

- A. Place tank legs on concrete footings, level within tolerance of 2 inches as indicated on Drawings. Concrete specified in Section 033000.
- B. Prepare and grade an area outside tank perimeter, for a distance of 6 feet. Grade, place and compact gravel fill to a compacted depth of 3 inches. Compact to 95 percent.
- C. Provide tank with relief valve, shutoff valve, pressure regulator, pressure gage and removable protection cover. Install piping, shutoff valve and pressure gage to underground piping.
- D. Set tank regulator to outlet pressure as indicated on Drawings.
- E. Install vaporizer to under side of tank and secure to tank with aluminum tray and two stainless steel straps.
- F. Install weatherproof control box for vaporizer 40 inches above ground surface. Install to 4 x 4 inch cedar post, driven into ground 40 inches.
- G. Install wiring. Install control wire from vaporizer to control box 20 inches below ground surface. Install service wiring 24 inches below ground from control box to building.

3.7 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Site Tests:
 1. Compaction:
 - a. Perform inspections prior to immediately after placing bedding.
 - b. Perform tests as specified in Section 312300.
 2. Piping:
 - a. Test, and purge gas piping in conformance with NFPA 54, Part 4 and local Utility Company requirements.
 - b. Verify capacities and pressure ratings of gas meters, regulators, and valves.
 - c. Verify required pressure settings for pressure regulators.
- C. Inspections: Inspect gas piping in conformance with NFPA 54, Part 4 and local Utility Company requirements.

NOTE TO SPECIFIER

DRAWING COORDINATION

Drawings should indicate the following information related to this Section.

1. *Show location, size and material of existing natural gas distribution main. Show new gas distribution main and service piping. Indicate natural gas heating value in Btu per cubic foot specific gravity, and pressure in psig. Show locations of gas meters, gas service pressure regulators, and specialties, drawn to scale. Indicate gas demand in cubic feet per hour for each meter and pressure regulator, pressure regulator settings, and pipe sizes. Show access to service space requirements.*



2. *Detail or show schematic diagram of gas service. Show manifolds, pressure regulators, meters, specialties, piping, dielectric fittings, unions and flanges, drips, and flexible connections. Include connected gas demand in cubic feet per hour.*
3. *Indicate exact location of connection to gas utility or other source. Clarify responsibility for gas valves, gas service pressure regulators, meter bars, and gas meters.*
4. *Show limits of piping with protective coating.*
5. *Show concrete bases on sections, elevations, and details.*

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Last revised: 6/10/2011

END OF SECTION



SECTION 33 51 00 00 - CSF NATURAL-GAS DISTRIBUTION

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this section where Natural or Propane Gas System is part of the Work.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location. Drawing Coordination Items at end of Section.33 51 00 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

NOTE TO SPECIFIER

Edit below for type of gas used for this Project.

1. Pipe and fittings for site utility [natural] [propane] gas distribution.

NOTE TO SPECIFIER

Use PROPANE STORAGE TANKS for Propane System.

2. Propane storage tanks.

- B. Related Documents: The Contract Documents, as defined in the General Conditions, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:

1. Section 312300 - Excavation and Fill: Earthwork for utilities.

1.2 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO):
 1. AASHTO T180 - Moisture-Density Relations of Soils Using a 10 pound Rammer and an 18 inch Drop.
- B. American Society of Mechanical Engineers (ASME):
 1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
 2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 3. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.



4. ASME Sec. 8D - Pressure Vessels.
5. ASME Sec. 9 - Welding and Brazing Qualifications.
6. ASME Boiler and Pressure Code.

C. American Society for Testing and Materials (ASTM):

1. ASTM B 32 - Specification for Solder Metal.
2. ASTM D 1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 Pound Rammer and 18 inch Drop.
3. ASTM A 53 - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated (Galvanized) Welded and Seamless, for Ordinary Uses.
4. ASTM A234 - Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
5. ASTM B75 - Specification for Seamless Copper Tube.
6. ASTM B88 - Specification for Seamless Copper Water Tube.
7. ASTM D2513 - Specification for Thermoplastic Gas Pressure Pipe, Tubing and Fittings.
8. ASTM D2517 - Specification for Reinforced Epoxy Resin Gas Pressure Pipe and Fittings.
9. ASTM D2683 - Specification for Socket Type Polyethylene Fittings For Outside Diameter Controlled Polyethylene Pipe and Tubing.
10. ASTM D2922 - Test Methods for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).
11. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

D. American Welding Society (ASTM):

1. AWS A5.8 - Brazing Filler Metal.

E. American Water Works Association (AWWA):

1. AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other liquids.

F. American National Standards Institute (ANSI):

1. ANSI B16.3 - Malleable Iron Threaded Fittings.
2. ANSI B16.11 - Forged Steel Fittings, Socket Welding and Threaded.
3. ANSI B31.2 - Fuel Gas Piping.
4. ANSI B31.8 - Gas Transmission and Distribution Piping Systems.

G. National Fire Protection Association (NFPA):

NOTE TO SPECIFIER

OPTION 1: Use NFPA 54 for Natural Gas System.

1. NFPA 54 - National Fuel Gas Code.

NOTE TO SPECIFIER

OPTION 2: Use NFPA 58 for Propane System.

2. NFPA 58 - National Fuel Propane Code.

1.3 DEFINITIONS

- A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.



1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Data for each type of pipe, pipe fitting, valve, and accessory specified.
 - 2. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate certifying that Products meet or exceed specified requirements and standards.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Project Record Documents: Accurately record the following:
 - a. Locations of piping mains, valves, connections, and top of pipe elevations.
 - b. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Perform work in accordance with Utility Company requirements and authority having jurisdiction.

NOTE TO SPECIFIER

Edit below for type of gas used. Use NFPA 54 for Natural Gas. Use NFPA 58 for Propane.

- 1. Conform to [NFPA 54] [NFPA 58], ANSI B31.2 and ANSI B31.8.
- B. Gas Cock: Manufacturer's name and pressure rating marked on valve body.
- C. Welding Materials and Procedures: Conform to ASME Boiler and Pressure Vessel Code and applicable state regulations.
- D. Welders Certification: In accordance with ASME Sec 9.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Deliver and store valves in shipping containers with labeling in place.

PART 2 - PRODUCTS

2.1 PIPE

NOTE TO SPECIFIER

OPTION 1: Use STEEL PIPE Paragraphs A and B below for NATURAL GAS system.

- A. Steel Pipe Below Ground: ASTM A 53, Schedule 40 black:
 - 1. Fittings: ANSI B16.11, forged steel, or ASTM A 234 forged steel welding type.
 - 2. Joints: Welded and seamless.
 - 3. Jackets: AWWA C 105 polyethylene jacket, double layer, half lapped, 10 mil polyethylene tape.
- B. Steel Pipe Above Ground: ASTM A53 Schedule 40 black:



1. Fittings: ANSI B16.3, malleable iron, ANSI B16.11, forged steel, or ASTM A 234, forged steel welding type.
2. Joints: Threaded.

NOTE TO SPECIFIER

OPTION 2: Use COPPER TUBING Paragraphs A and B below for PROPANE system.

- C. Copper Tubing Below Ground: ASTM B 88, Type K, internally tinned:
 1. Fittings: AWWA B16.18, cast copper, or ASME B16.22, wrought copper; internally tinned.
 2. Joint: AWS A5.8 BCuP silver brazed.
- D. Copper Tubing Above Ground: ASTM B 88, Type K, L or ASTM B 75, Type GP; internally tinned:
 1. Fittings: ASME B6.18 cast copper, ASME B16.22, wrought copper, or ASME B16.26, cast copper, internally tinned.
 2. Joint: ASTM B 32, Solder, Grade 95TA or AWS A5.8, BCuP silver brazed.
- E. Polyethylene Pipe: ASTM D 2513, SDR 11.5 or ASTM F 678 Series 125:
 1. Fittings: ASTM D 2513.
 2. Joints: Mechanical or Compression fit.
 3. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Natural Gas Service" in large letters.
- F. Reinforced Epoxy Resin Piping: ASTM D 2517:
 1. Fittings: ASTM D 2517.
 2. Joints: Bell and spigot with epoxy resin.
 3. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Natural Gas Service" in large letters.

2.2 GAS COCKS

- A. 2 Inches and Smaller: 150 psig WOG, bronze body, bronze tapered plug, non-lubricated, Teflon packing, threaded ends with cast iron curb box, cover, and key.
- B. 2 Inches and Larger: 125 psig WOG, Steel or Cast iron body and tapered plug, non-lubricated, Teflon packing, threaded ends, with cast iron curb box, cover, and key.
- C. Applications With Line Pressure Greater Than 60 psig, Over 2 Inches: Cast iron body and plug, pressure lubricated, Teflon packing, flanged ends, with cast iron curb box, cover, and key.

2.3 PRESSURE REGULATING VALVES

- A. Valves: Single stage, malleable iron body, corrosion-resistant, pressure regulator with atmospheric vent, elevation compensator; with threaded ends for 2 inch and smaller, flanged ends larger than 2 inch.
- B. Capacity: For inlet and outlet gas pressures, specific gravity, and flow rate indicated.

NOTE TO SPECIFIER

Use PROPANE STORAGE TANKS for Propane System.



2.4 PROPANE STORAGE TANKS

- A. Construction: Closed, welded steel, tested and stamped in accordance with ASME Section 8D; minimum 250 psig (1 700 kPa) rating; cleaned, prime coated and painted with two coats of silver anti-rust paint, and supplied with steel support saddles, pressure gage; tapping for installation of piping and accessories.
- B. Vaporizer: 1000 watts, heating cable bedded in 1 inch of glass fiber insulation and covered by flexible stainless steel plate, with thermostat in weatherproof box set to turn on at -13 degrees F with manual off-on switch.
- C. Size and Capacity: Diameter and length indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify that building service connection and utility gas main size, location, and depth are as indicated.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with fine aggregate.
- B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.
- C. Cut pipe ends square, ream pipe ends and remove burrs. Bevel plain end ferrous pipe over 2 inches diameter thread ferrous pipe 2 inches diameter and under.
- D. Remove scale and dirt, on inside and outside, before assembly.
- E. Prepare piping connections with flanges or threading and unions.

3.3 BEDDING

- A. Excavate pipe trench and place bedding material in accordance with Section 312300 for work of this Section. Provide trench wall shoring as required.



- B. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches compacted depth, each layer. Place compacted bedding material to elevation of subgrade as indicated on Drawings.
- C. Maintain optimum moisture content of bedding material to attain required compaction density.
- D. Remove excess backfill and excavated material from site.

3.4 INSTALLATION - PIPING

- A. Maintain separation of gas line from sewer, water or storm water piping in accordance with state or local code.
- B. Install piping to allow for expansion and contraction without stressing pipe or joints.
- C. Connections with Existing Pipelines: Where connections are made between new Work and existing piping, make connection using suitable fittings for conditions encountered. Make each connection with existing pipe at time and under conditions which least interfere with operation of existing pipeline and in compliance with the local Utility Company.
- D. Install cocks and other fittings as required.
- E. Establish elevations of buried piping in accordance with Section 312300 for Work in this Section.
- F. Wrap couplings and fittings of steel pipe with polyethylene tape and heat shrink over pipe.
- G. Install trace wire continuous buried 10 inches below finish grade, above pipe line. Trace wire shall be in accordance with local utilities standards.
- H. Backfill trench in accordance with Section 312300.
- I. Center and plumb valve box over valve. Set box cover flush with finished ground surface. Prevent shock or stress from being transmitted through valve box to valve.
- J. Wrap valve and valve box with polyethylene tape and heat shrink or paint valves and valve boxes with red anti-rust primer and one coat of epoxy paint.

3.5 SERVICE CONNECTIONS

- A. Provide sleeve in foundation wall for gas service main. Caulk enlarged sleeve watertight.
- B. Anchor service main to interior surface of foundation wall.
- C. Install service regulator adjacent to building wall in specified location.
- D. Install service regulator and riser pipe to prevent undue stress upon service pipe. For plastic service pipe, use steel pipe riser from below ground to regulator.
- E. Provide regulator vent with rain and insect proof opening, terminating not less than five feet away from building openings.

NOTE TO SPECIFIER

Use PROPANE STORAGE TANKS for Propane System.



3.6 PROPANE STORAGE TANK INSTALLATION

- A. Place tank legs on concrete footings, level within tolerance of 2 inches as indicated on Drawings. Concrete specified in Section 033000.
- B. Prepare and grade an area outside tank perimeter, for a distance of 6 feet. Grade, place and compact gravel fill to a compacted depth of 3 inches. Compact to 95 percent.
- C. Provide tank with relief valve, shutoff valve, pressure regulator, pressure gage and removable protection cover. Install piping, shutoff valve and pressure gage to underground piping.
- D. Set tank regulator to outlet pressure as indicated on Drawings.
- E. Install vaporizer to under side of tank and secure to tank with aluminum tray and two stainless steel straps.
- F. Install weatherproof control box for vaporizer 40 inches above ground surface. Install to 4 x 4 inch cedar post, driven into ground 40 inches.
- G. Install wiring. Install control wire from vaporizer to control box 20 inches below ground surface. Install service wiring 24 inches below ground from control box to building.

3.7 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Site Tests:
 1. Compaction:
 - a. Perform inspections prior to immediately after placing bedding.
 - b. Perform tests as specified in Section 312300.
 2. Piping:
 - a. Test, and purge gas piping in conformance with NFPA 54, Part 4 and local Utility Company requirements.
 - b. Verify capacities and pressure ratings of gas meters, regulators, and valves.
 - c. Verify required pressure settings for pressure regulators.
- C. Inspections: Inspect gas piping in conformance with NFPA 54, Part 4 and local Utility Company requirements.

NOTE TO SPECIFIER

DRAWING COORDINATION

Drawings should indicate the following information related to this Section.

1. *Show location, size and material of existing natural gas distribution main. Show new gas distribution main and service piping. Indicate natural gas heating value in Btu per cubic foot specific gravity, and pressure in psig. Show locations of gas meters, gas service pressure regulators, and specialties, drawn to scale. Indicate gas demand in cubic feet per hour for each meter and pressure regulator, pressure regulator settings, and pipe sizes. Show access to service space requirements.*



2. *Detail or show schematic diagram of gas service. Show manifolds, pressure regulators, meters, specialties, piping, dielectric fittings, unions and flanges, drips, and flexible connections. Include connected gas demand in cubic feet per hour.*
3. *Indicate exact location of connection to gas utility or other source. Clarify responsibility for gas valves, gas service pressure regulators, meter bars, and gas meters.*
4. *Show limits of piping with protective coating.*
5. *Show concrete bases on sections, elevations, and details.*

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END OF SECTION



Task	Specification	Specification Description
33 51 13 00	01 22 16 00	No Specification Required
33 51 13 00	22 05 23 00	Piped Utilities Basic Materials And Methods
33 51 13 00	21 05 00 00	Common Work Results for Fire Suppression
33 51 13 00	23 11 23 00	Facility Liquefied-Petroleum Gas Piping
33 51 33 00	22 05 23 00	Piped Utilities Basic Materials And Methods



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SECTION 33 71 73 00 - CSF ELECTRICAL UTILITY SERVICES**

NOTE TO SPECIFIER

This section contains information and text that may apply to CSF Medium and CSF Small facilities. A colored highlighting is used to identify differences between these two USPS programs: yellow highlighted text applies only to CSF Medium Facilities; and blue highlighted text applies only to CSF Small Facilities. When preparing a specification for a particular project, delete the highlighted text that does not apply, then remove the highlighting from the remaining text.

NOTE TO SPECIFIER

Use this Outline Specification Section for Customer Service Facilities only. This Specification defines "level of quality" for Customer Service Facility construction and is intended as a guide to the Architect/Engineer preparing the Construction Documents.

EDIT THIS SECTION BY ADDING AND/OR DELETING TEXT FOR THE SPECIFIC CONDITIONS AND REQUIREMENTS OF THE PROJECT SITE.

Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Electrical service entrance.
 2. Transformer and pad.
 3. Service entrance equipment.
 4. Service entrance section.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 1. Section 015000 - Temporary Facilities and Controls.
 2. Section 312300 - Excavation and Fill.
 3. Section 251104 - Metering Devices.
 4. Section 251304 - EMS Communication to Remote Enterprise Server.
 5. Section 260500 - Common Work Results for Electrical.
 6. Section 262413 - Switchboards.

1.2 REFERENCES

- A. As specified in Section 260500 – Common Work Results for Electrical .
- B. National Electrical Manufacturer's Association (NEMA):
 1. NEMA PB 2 - Dead Front Distribution Switchboards.
 2. NEMA PB 2.1 - Instructions for Safe Handling, Installation, Operation, and Maintenance of Deadfront Switchboards Rated 600 Volts or Less.
 3. Std Pub No. AB 1: Molded-Case Circuit Breakers.



4. Std Pub No. SG 3: Low-Voltage Power Circuit Breakers.
5. Std Pub No. SG 5: Power Switchgear Assemblies.

C. Underwriter's Laboratories

1. UL 50: Electrical Cabinets and Boxes.
2. UL 489: Molded-Case Circuit Breakers and Circuit-Breakers Enclosures.
3. UL 854: Service-Entrance Cables.
4. UL 869: Electrical Service Equipment.

D. IEEE

1. Std 241; pertaining to service entrances.

1.3 SYSTEM DESCRIPTION

NOTE TO SPECIFIER

Modify if circumstances require different characteristics.

- A. System Characteristics: 480Y/277 volts, three phase, four wire, 60 hertz.

NOTE TO SPECIFIER

Modify if circumstances require different characteristics. Smallest Plan Types may be Single Phase. Verify and coordinate with USPS Contracting Officer.

- B. System Characteristics: [208Y/120 volts, three phase, four wire, 60 hertz.] [120/240 volts, single phase, 3 wire, 60 hertz].

- C. Provide service entrance equipment and accessories which are UL listed and labeled, and marked "SUITABLE FOR USE AS SERVICE EQUIPMENT".

1.4 SUBMITTALS

- A. As specified in Section 260500 – Common Work Results for Electrical.

- B. Section 013300 - Submittal Procedures: Procedures for submittals.

1. Product Data: Service entrance section electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of equipment and components.
2. Shop Drawings:
 - a. Utility company drawings, details, and data for service to Project.
 - b. Service entrance section front and side views of enclosures with overall dimensions indicated; conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral, and ground; [and distribution panel instrument details].
3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
 - c. Manufacturer's Instructions: Service entrance section application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

- C. Section 017704 - Closeout Procedures and Requirements: Procedures for closeout submittals.



1. Operation and Maintenance Data: Service entrance section spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 QUALITY ASSURANCE

- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. Qualifications:
 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience approved by Utility company for installation of electrical utility service.
- C. Regulatory Requirements:
 1. Conform to requirements of NFPA 70.
 2. Products: Listed and classified by Underwriters Laboratories Incorporated as suitable for the purpose specified and indicated.
- D. Pre-Installation Meetings:
 1. Convene a pre-installation meeting one week prior to commencing Work of this Section.
 2. Require attendance of parties directly affecting Work of this Section.
 3. Review conditions of operations, procedures and coordination with related Work.
 4. Agenda:
 - a. Tour, inspect, and discuss conditions of Project Site and location of utility service point.
 - b. Review electrical service entrance design and requirements.
 - c. Review required submittals, both completed and yet to be completed.
 - d. Review Utility company drawings, details, and data.
 - e. Review and finalize construction schedule related to electrical service and verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
 - f. Review required inspections, testing, certifying, and material usage accounting procedures.
 - g. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.
 - h. Review safety precautions relating to electrical service installation operations.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Service Entrance Section:
 1. Deliver individually wrapped for protections and mounted on shipping skids.
 2. Store in clean, dry space. Maintain factory wrapping or provide additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
 3. Handle in accordance with NEMA PB 2.1 and manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to distribution panel internal components, enclosure, and finish.

PART 2 - PRODUCTS

2.1 SERVICE ENTRANCE EQUIPMENT AND ACCESSORIES



- A. Provide service entrance equipment and accessories (of types, sizes, ratings and electrical characteristics indicated) which comply with manufacturer's standard materials, design and construction in accordance with published product information and as required for complete installation; and as herein specified.

2.2 MANUFACTURERS

- A. Approved by Utility company for use on electrical service entrance Work; included on Utility company list of approved Products.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Not Permitted.

2.3 ELECTRICAL SERVICE

- A. Products conforming to Utility company requirements as indicated on Utility company prepared Drawings, Details, and Data.

2.4 TRANSFORMER AND PAD

- A. Transformer: Furnished and installed by Utility company; type and rating as indicated on Drawings.
- B. Transformer Pad: [Precast] [Poured-in-place] reinforced concrete pad [by Contractor] [by Utility company] of size, type, and configuration as required by Utility company.

2.5 SERVICE ENTRANCE EQUIPMENT

- A. Meter Cabinet and Base: Cabinet and base of size, type, and configuration furnished and installed as required by Utility company.
- B. Meters: Furnished and installed by Utility company.

2.6 SERVICE ENTRANCE SECTION

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Eaton Corporation; Cutler-Hammer Products, Pittsburgh, PA (800) 525-2000.
 - 2. General Electric Company (800) 626-2000.
 - 3. Siemens Energy & Automation, Inc., Alpharetta, GA (800) 964-4114.
 - 4. Square D Company, Palatine, IL (800) 392-8781.
 - 5. Substitutions: Not permitted.
- B. Description: NEMA PB 2 and UL 891 with electrical ratings and configurations as indicated and specified.
- C. Section Devices: Panel mounted.
- D. Bus Material: Copper (tin plated).
- E. Bus Connections: Bolted, accessible from front for maintenance.



- F. Fully insulate load side bus bars.
- G. Ground Bus: Extend width of distribution panel.
- H. Line and Load Terminations: Accessible from front only of distribution panel, suitable for conductor materials and sizes indicated.
- I. Pull Section: Size as indicated on Drawings. Arrange as indicated on Drawings.
- J. Enclosure: [NEMA 1] [NEMA 3R].
 - 1. Align sections at front and rear.
 - 2. Distribution Panel Height: As indicated on Drawings, lifting members and pull boxes.
 - 3. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.

2.7 OVERCURRENT PROTECTIVE DEVICES

- A. Provide overcurrent protection devices as indicated on the drawings and specified within related electrical specifications.

NOTE TO SPECIFIER

Customer Service Facilities equal to or larger than 15,000 sq. ft. shall be provided with advanced electric metering. Include Section 2.8 below for these larger facilities.

2.8 ADVANCED METERING EQUIPMENT (ELECTRICAL UTILITY MAINS)

- A. The meter device shall be UL listed. All meters shall have the following ratings, features and functions.
 - 1. Designed for multifunction electrical measurements on 3 phase power systems. The Meter shall support 3-Element Wye, 2.5 Element Wye, 2 Element Delta, 4 wire Delta systems.
 - 2. Provide surge withstand ratings conforming to ANSI C62.41 (6KV)
 - 3. Be user programmable for voltage range to any PT ratio.
 - 4. Accept a direct voltage input range of up to 576 Volts Line to Neutral, and a range of up to 721 Volts Line to Line.
 - 5. Accept a current input of up to 11 amps continuous. Start up current for a 5 Amp input shall be no greater than .005 Amps.
 - 6. Have the following additional ratings and features:
 - a. Fault Current Withstand shall be 100 Amps for 10 seconds, 300 Amps for 3 seconds, and 500 Amps for 1 second.
 - b. Meter shall be programmable for current to any CT ratio.
 - c. All inputs and outputs shall be galvanically isolated to 2500 Volts AC.
 - 7. Accept current inputs of class 10: (0 to 11A), 5 Amp Nominal and class 2 (0 to 2A), 1A Nominal Secondary.
 - 8. Provide an accuracy of +/- 0.5% or better for volts and amps, and 0.5% for power and energy functions and meet or exceed the accuracy requirements of ANSI C12.20 (Class 0.5%).
 - 9. Provide true RMS measurements of voltage, phase to neutral and phase to phase; current, per phase and neutral.
 - 10. Provide sampling at 400+ samples per cycle on all channels measured readings simultaneously.
 - 11. The meter shall utilize 24 bit Analog to Digital conversion.
 - 12. Provide at a minimum Voltage and current per phase, kW, kVAR, PF, kVA, Frequency, kWh, %THD (% of total Harmonic Distortion).

13. Shall be a traceable revenue meter, which shall contain a utility grade test pulse allowing power providers to verify and confirm that the meter is performing to its rated accuracy.
14. The meter shall include 1 independent communications port on the back, with advanced features. The port shall provide Ethernet communication speaking Modbus MS/TCP, Modbus/IP, or BACnet MS/TCP protocols.
15. Provide user configured fixed window or sliding window demand. This shall allow the user to set up the particular utility demand profile.
 - a. Readings for kW, kVAR, kVA and PF shall be calculated using utility demand features.
 - b. All other parameters shall offer max and min capability over the user selectable averaging period.
 - c. Voltage shall provide an instantaneous max and min reading displaying the highest surge and lowest sag seen by the meter.
16. Capable of operating on a power supply of 90 to 265 Volts AC and 100 to 370 Volts DC. Universal Power AC/DC Supply shall be available. An option shall also be available to operate on a power supply from 18-60 VDC.
17. Meter shall provide update rate of 100msec for Watts, Var and VA. All other parameters shall be 1 second.
18. The meter shall be provided with I/O expandability through option card slots.

B. Meter Software features

1. Meter shall provide internally calculated values based in voltage and current inputs. The following parameters shall be provided for each measured phase and total of all 3 phases: volts, amps, kW, kVAR, PF, kVA, frequency., kWh, %THD. predicted kW based on selected demand period.
2. All meter setup parameters shall be adjustable though a software configuration tools, though the front panel keypad or though a web based browser. All meter configurations shall be password protected from alteration.
3. All meter parameters shall be accessible through the Modbus MS/TCP, Modbus/IP, or BACnet MS/TCP protocols.

NOTE TO SPECIFIER

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project.

C. Acceptable Manufactures Models

1. Schneider Electric/Square D – PM750
2. Electro Industries - Shark S100
3. Siemens – PAC3200
4. General Electric – EPM 6000
5. E-Mon/D-Mon – Class 3000.

D. Accessories:

1. Current transformers: All CT's should conform to the ANSI standard accuracy class for metering service of 0.3 or better and shall be provided with certificates of test stipulating the ratio and phase angle corrections at 10% and 100% of rating with the standard ANSI burden nearest to the actual "in-service" burden. Whenever practical, the CT's should be designed to withstand continuous operation and maintain class 0.3 or better metering accuracy at twice or more of rated current (ex. Transformer thermal rating factor greater than or equal to 2).
2. Voltage Transformers: All VT's should conform to the ANSI standard accuracy class for metering service of 0.3 or better and be provided with certificates of test stipulating the ratio and phase angle corrections at 100% rating with zero burden and with the rated maximum standard burden.
3. Test Block/Switches: These test blocks should be designed to provide a means to measure the input quantities from the current and/or voltage transformers and to allow the application of test quantities.



PART 3 - EXECUTION

3.1 EXAMINATION

- A. As specified in Section 260500 – Common Work Results for Electrical.

3.2 PREPARATION

- A. Arrange with Utility Company to obtain permanent electric service to Project.
- B. Coordinate with Contracting Officer and Utility Company service contact person for execution of required Utility Company documents.

3.3 INSTALLATION

- A. Install service entrance equipment as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that service entrance equipment fulfills requirements. Comply with applicable installation requirements of NEC and NEMA Standards.
- B. Electrical Service Conduit:
 - 1. Furnished and installed by Contractor in conformance with Utility Company requirements in locations indicated on Drawings.
 - 2. Trenching, backfilling, and compacting for utilities specified in Section 312300.
 - 3. Install service in accordance with manufacturer's published instructions, Utility Company requirements, and as indicated on Drawings.
- C. Electrical Service Wiring:
 - 1. Primary: Furnished and installed by [Utility Company] [Contractor].
 - 2. Secondary: Furnished and installed by Contractor.
- D. Transformer and Pad:
 - 1. Transformer: Furnished and installed by [Utility Company] [Contractor].
 - 2. Transformer Pad: Furnished and installed by [Utility Company] [Contractor] at location indicated on Drawings in conformance with Utility Company requirements.
- E. Service Entrance Section:
 - 1. Install distribution panel [switchboard] in locations indicated on Drawings, in accordance with NEMA PB 2.1.
 - 2. Tighten accessible bus connections and mechanical fasteners after placing distribution panel.
 - 3. Ground as specified in Section 260500 and as indicated on Drawings.

3.4 FIELD QUALITY CONTROL

- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. Section 014000 - Quality Requirements: Field testing and inspection.
- C. Obtain service entrance quality control inspection and approval of installation by Utility Company.
- D. Inspect and test distribution panel in accordance with NETA ATS, except Section 4.

33 - Utilities



- E. Test service entrance equipment and electrical circuitry upon completion of installation work and after energizing circuitry, and demonstrate its capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise remove and replace with new units and retest. Engineer's or Owner's presence at test is required.
- F. Perform [\[switchboard\]](#) [\[distribution panel\]](#) inspections and tests listed in NETA ATS, Section 7.1.

USPS CSF Specifications issued: 5/1/2014
Last revised: 4/16/2014

END OF SECTION 33 71 73 00



SECTION 33 71 73 00 - MPF ELECTRICAL UTILITY SERVICES

NOTE TO SPECIFIER

Use this Outline Specification Section for Mail Processing Facilities only. This Specification defines "level of quality" for Mail Processing Facility construction. For Design/Build projects, it is to be modified (by the A/E preparing the Solicitation) to suit the project and included in the Solicitation Package. For Design/Bid/Build projects, it is intended as a guide to the Architect/Engineer preparing the Construction Documents. In neither case is it to be used as a construction specification. Text in [brackets] indicates a choice must be made. Brackets with [_____] indicates information may be inserted at that location.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Electrical service entrance.
 - 2. Transformer and pad.
 - 3. Service entrance equipment.
 - 4. Service entrance section.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
 - 1. Section 312300 - Excavation and Fill: Earthwork trenching, backfilling, and compacting.
 - 2. Section 250504 - Building Automation System (BAS) General
 - 3. Section 251104 - Metering Devices.
 - 4. Section 259004 - Sequence of Operation
 - 5. Section 260500 - Common Work Results for Electrical: Grounding.
 - 6. Section 260533 - Raceway and Boxes for Electrical Systems
 - 7. Section 260800 - Commissioning of Electrical Systems

1.2 REFERENCES

- A. National Electrical Contractors Association (NECA):
 - 1. NECA - Standard of Installation.
- B. National Electrical Manufacturer's Association (NEMA):
 - 1. Std Pub No. AB 1: Molded-Case Circuit Breakers.
 - 2. Std Pub No. PB-2: Dead-Front Distribution Switchboards.
 - 3. Std Pub No. SG 3: Low-Voltage Power Circuit Breakers.
 - 4. Std Pub No. SG 5: Power Switchgear Assemblies.
- C. Underwriter's Laboratories
 - 1. UL 50: Electrical Cabinets and Boxes.
 - 2. UL 489: Molded-Case Circuit Breakers and Circuit-Breakers Enclosures.
 - 3. UL 854: Service-Entrance Cables.
 - 4. UL 869: Electrical Service Equipment.
- D. IEEE
 - 1. Std 241; pertaining to service entrances.



- E. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electric Code.

1.3 SYSTEM DESCRIPTION

- A. System Characteristics: 480Y/277 volts, three phase, four wire, 60 hertz.
- B. Provide service entrance equipment and accessories which are UL listed and labeled, and marked "SUITABLE FOR USE AS SERVICE EQUIPMENT".

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data: Service entrance section electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of equipment and components.
 - 2. Shop Drawings:
 - a. Utility company drawings, details, and data for service to Project.
 - b. Service entrance section front and side views of enclosures with overall dimensions indicated; conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral, and ground.
 - c. Instrumentation and metering equipment.
 - 3. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
 - c. Manufacturer's Instructions: Service entrance section application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Maintenance Data: Service entrance section spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 - 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience approved by Utility company for installation of electrical utility service.
- B. Regulatory Requirements:
 - 1. Conform to requirements of NFPA 70.
 - 2. Products: Listed and classified by Underwriters Laboratories Incorporated as suitable for the purpose specified and indicated.
- C. Pre-Installation Meetings:
 - 1. Convene a pre-installation meeting one week prior to commencing Work of this Section.
 - 2. Require attendance of parties directly affecting Work of this Section.
 - 3. Review conditions of operations, procedures and coordination with related Work.
 - 4. Agenda:



- a. Tour, inspect, and discuss conditions of Project Site and location of utility service point.
- b. Review electrical service entrance design and requirements.
- c. Review required submittals, both completed and yet to be completed.
- d. Review Utility company drawings, details, and data.
- e. Review and finalize construction schedule related to electrical service and verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
- f. Review required inspections, testing, certifying, and material usage accounting procedures.
- g. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.
- h. Review safety precautions relating to electrical service installation operations.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Service Entrance Section:
 1. Deliver individually wrapped for protections and mounted on shipping skids.
 2. Store in clean, dry space. Maintain factory wrapping or provide additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
 3. Handle in accordance with NEMA PB 2.1 and manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to distribution panel internal components, enclosure, and finish.

PART 2 - PRODUCTS

2.1 SERVICE ENTRANCE EQUIPMENT AND ACCESSORIES

- A. Provide service entrance equipment and accessories (of types, sizes, ratings and electrical characteristics indicated) which comply with manufacturer's standard materials, design and construction in accordance with published product information and as required for complete installation; and as herein specified.

2.2 MANUFACTURERS

- A. Approved by Utility company for use on electrical service entrance Work; included on Utility company list of approved Products.
- B. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Not Permitted.

2.3 ELECTRICAL SERVICE

- A. Products conforming to Utility company requirements as indicated on Utility company prepared Drawings, Details, and Data.

2.4 TRANSFORMER AND PAD

- A. Transformer: Furnished and installed by Utility company; type and rating as indicated on Drawings.



- B. Transformer Pad: [Precast] [Poured-in-place] reinforced concrete pad [by Contractor] [by Utility company] of size, type, and configuration as required by Utility company.

2.5 SERVICE ENTRANCE EQUIPMENT

- A. Meter Cabinet and Base: Cabinet and base of size, type, and configuration furnished and installed as required by Utility company.
- B. Utility Meters: Furnished and installed by Utility company.

2.6 SERVICE ENTRANCE SECTION

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 1. Eaton Corporation; Cutler-Hammer Products, Pittsburgh, PA (800) 525-2000.
 2. General Electric Company (800) 626-2000.
 3. Siemens Energy & Automation, Inc., Alpharetta, GA (800) 964-4114.
 4. Square D Company, Palatine, IL (800) 392-8781.
- B. Description: NEMA PB 2 and UL 869 with electrical ratings and configurations as indicated and specified.
- C. Section Devices: [Panel mounted] [Draw-out type].
- D. Bus Material: Copper (tin plated).
- E. Bus Connections: Bolted, accessible from front for maintenance.
- F. Fully insulate load side bus bars.
- G. Ground Bus: Extend width of switchboard.
- H. Line and Load Terminations: Accessible from front only of distribution panel, suitable for conductor materials and sizes indicated.
- I. Pull Section: Size as indicated on Drawings. Arrange as indicated on Drawings.
- J. Enclosure: NEMA 1.
 1. Align sections at front and rear.
 2. Distribution Panel Height: As indicated on Drawings, lifting members and pull boxes.
 3. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.

2.7 OVERCURRENT PROTECTIVE DEVICES

- A. Provide overcurrent protection devices as indicated on the drawings and specified within related electrical specifications.

2.8 ADVANCED METERING EQUIPMENT (ELECTRIC UTILITY MAINS)

- A. The meter device shall be UL listed. All meters shall have the following ratings, features and functions.
 1. Designed for multifunction electrical measurements on 3 phase power systems. The Meter shall support 3-Element Wye, 2.5 Element Wye, 2 Element Delta, 4 wire Delta systems.



2. Provide surge withstand ratings confirming to ANSI C62.41 (6KV)
 3. Be user programmable for voltage range to any PT ratio.
 4. Accept a direct voltage input range of up to 576 Volts Line to Neutral, and a range of up to 721 Volts Line to Line.
 5. Accept a current input of up to 11 amps continuous. Start up current for a 5 Amp input shall be no greater than .005 Amps.
 6. Have the following additional ratings and features:
 - a. Fault Current Withstand shall be 100 Amps for 10 seconds, 300 Amps for 3 seconds, and 500 Amps for 1 second.
 - b. Meter shall be programmable for current to any CT ratio.
 - c. All inputs and outputs shall be galvanically isolated to 2500 Volts AC.
 7. Accept current inputs of class 10: (0 to 11A), 5 Amp Nominal and class 2 (0 to 2A), 1A Nominal Secondary.
 8. Provide an accuracy of +/- 0.5% or better for volts and amps, and 0.5% for power and energy functions and meet or exceed the accuracy requirements of ANSI C12.20 (Class 0.5%).
 9. Provide true RMS measurements of voltage, phase to neutral and phase to phase; current, per phase and neutral.
 10. Provide sampling at 400+ samples per cycle on all channels measured readings simultaneously.
 11. The meter shall utilize 24 bit Analog to Digital conversion.
 12. Provide at a minimum Voltage and current per phase, kW, kVAR, PF, kVA, Frequency, kWh, %THD (% of total Harmonic Distortion).
 13. Shall be a traceable revenue meter, which shall contain a utility grade test pulse allowing power providers to verify and confirm that the meter is performing to its rated accuracy.
 14. The meter shall include 1 independent communications port on the back, with advanced features. The port shall provide Ethernet communication speaking Modbus MS/TCP, Modbus/IP, or BACnet MS/TCP protocols.
 15. Provide user configured fixed window or sliding window demand. This shall allow the user to set up the particular utility demand profile.
 - a. Readings for kW, kVAR, kVA and PF shall be calculated using utility demand features.
 - b. All other parameters shall offer max and min capability over the user selectable averaging period.
 - c. Voltage shall provide an instantaneous max and min reading displaying the highest surge and lowest sag seen by the meter.
 16. Capable of operating on a power supply of 90 to 265 Volts AC and 100 to 370 Volts DC. Universal Power AC/DC Supply shall be available. An option shall also be available to operate on a power supply from 18-60 VDC.
 17. Meter shall provide update rate of 100msec for Watts, Var and VA. All other parameters shall be 1 second.
 18. The meter shall be provided with I/O expandability through option card slots..
- B. Meter Software features
1. Meter shall provide internally calculated values based in voltage and current inputs. The following parameters shall be provided for each measured phase and total of all 3 phases: volts, amps, kW, kVAR, PF, kVA, frequency., kWh, %THD. predicted kW based on selected demand period.
 2. All meter setup parameters shall be adjustable though a software configuration tools, though the front panel keypad or though a web based browser. All meter configurations shall be password protected from alteration.
 3. All meter parameters shall be accessible through the Modbus MS/TCP, Modbus/IP, or BACnet MS/TCP protocols..
- C. Acceptable Manufactures Models
1. Schneider Electric/Square D – PM750
 2. Electro Industries - Shark S100
 3. Siemens – PAC3200
 4. General Electric – EPM 6000



5. E-Mon/D-Mon – Class 3000.

D. Accessories:

1. Current transformers: All CT's should conform to the ANSI standard accuracy class for metering service of 0.3 or better and shall be provided with certificates of test stipulating the ratio and phase angle corrections at 10% and 100% of rating with the standard ANSI burden nearest to the actual "in-service" burden. Whenever practical, the CT's should be designed to withstand continuous operation and maintain class 0.3 or better metering accuracy at twice or more of rated current (ex. Transformer thermal rating factor greater than or equal to 2)
2. Voltage Transformers: All VT's should conform to the ANSI standard accuracy class for metering service of 0.3 or better and be provided with certificates of test stipulating the ratio and phase angle corrections at 100% rating with zero burden and with the rated maximum standard burden.
3. Test Block/Switches: These test blocks should be designed to provide a means to measure the input quantities from the current and/or voltage transformers and to allow the application of test quantities

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 1. Verify that field measurements are as indicated on Utility Company Drawings.
- C. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 PREPARATION

- A. Arrange with Utility Company to obtain permanent electric service to Project.
- B. Coordinate with Contracting Officer and Utility Company service contact person for execution of required Utility Company documents.

3.3 INSTALLATION

- A. Install service entrance equipment as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that service entrance equipment fulfills requirements. Comply with applicable installation requirements of NEC and NEMA Standards.
- B. Electrical Service Conduit:
 1. Furnished and installed by Contractor in conformance with Utility Company requirements in locations indicated on Drawings.
 2. Trenching, backfilling, and compacting for utilities specified in Section 312300.
 3. Install service in accordance with manufacturer's published instructions, Utility Company requirements, and as indicated on Drawings.



- C. Electrical Service Wiring:
 - 1. Primary: Furnished and installed by [Utility Company] [Contractor].
 - 2. Secondary: Furnished and installed by Contractor.
- D. Transformer and Pad:
 - 1. Transformer: Furnished and installed by [Utility Company] [Contractor].
 - 2. Transformer Pad: Furnished and installed by [Utility Company] [Contractor] at location indicated on Drawings in conformance with Utility Company requirements.
- E. Service Entrance Section:
 - 1. Install switchboard in locations indicated on Drawings, in accordance with NEMA PB 2.1.
 - 2. Tighten accessible bus connections and mechanical fasteners after placing distribution panel.
 - 3. Ground as specified in Section 260500 and as indicated on Drawings.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
 - B. Obtain service entrance quality control inspection and approval of installation by Utility Company.
 - C. Test service entrance equipment and electrical circuitry upon completion of installation work and after energizing circuitry, and demonstrate its capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise remove and replace with new units and retest. Engineer's or Owner's presence at test is required.
 - D. Inspect and test switchboard in accordance with NETA ATS, except Section 4.
 - E. Perform switchboard inspections and tests listed in NETA ATS, Section 7.1.
- USPS Mail Processing Facility Specification issued: 5/1/2014
 Last revised: 4/16/2014

END OF SECTION 33 71 73 00



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Task	Specification	Specification Description
34 01 43 00	01 22 16 00	No Specification Required
34 41 13 00	01 22 16 00	No Specification Required
34 71 13 13	01 22 16 00	No Specification Required



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SECTION 34 71 13 16 - ACTIVE VEHICLE BARRIERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for active vehicle barriers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Shop Drawings: Installation, Equipment, and Electrical Work
 - a. Detail drawings containing complete wiring and schematic diagrams, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including foundation and clearances for maintenance and operation. For Federal work, detail drawings shall include a copy of the Department of State certificate of barrier performance.
2. Product Data:
 - a. Vehicle Barriers: A complete list of equipment, materials, including industrial standards used and how they apply to the applicable component and manufacturer's descriptive data and technical literature, catalog cuts, and installation instructions. Information necessary to document a minimum 1-year successful field operation performance history for each type of vehicle barrier installed.
 - b. Spare Parts: Spare parts data for each different item of material and equipment used, after approval of the detail drawings. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.
3. Test Reports
 - a. Field Testing: Test reports in booklet form showing all field tests, including component adjustments and demonstration of compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.
4. Operation and Maintenance Data
 - a. Vehicle Barriers: Operating and Maintenance Instructions
 - 1) Six copies of operation and maintenance manuals, a minimum of 2 weeks prior to field training. One complete set prior to performance testing and the remainder upon acceptance. Manuals shall be approved prior to acceptance. Operation manuals shall outline the step-by-step procedures required for system startup, operation, and shutdown. The manuals shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall include routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The manuals shall include piping layout, equipment layout, and simplified wiring and control diagrams of the system as installed. The manuals shall also include synthetic biodegradable hydraulic oil types to be used for ambient temperature ranges of minus 30 degrees F (minus 34 degrees C) to 150 degrees F (plus 66 degrees C) to cover winter operation, summer operation, and ambient temperature ranges in between.

C. General Requirements

1. Performance levels shall be based on the following:
 - a. The Department of State (DOS) publication SD-SDT-02.01 Specification for Vehicle Crash Testing of Perimeter Barriers and Gates (April 1985) in which:
 - 1) Impact Conditions:



Condition Designation	Vehicle Weight	Impact Speed	Kinetic Energy
K4	15,000 lb (6,800 kg)	30 mph (48 km/h)	450,000 ft-lb (610 kJ)
K8	15,000 lb (6,800 kg)	40 mph (65 km/h)	800,000 ft-lb (1084 kJ)
K12	15,000 lb (6,800 kg)	50 mph (80 km/h)	1,250,000 ft-lb (1695 kJ)

2) Performance Levels:

- a) L 3.0 Vehicle and cargo are to be stopped although vehicle partial penetration and/or barrier deflection of up to 3 feet (1 m) permitted.
- b) L 2.0 Vehicle and cargo are to be stopped although vehicle partial penetration and/or barrier deflection of up to 20 feet (6 m) is permitted.
- c) L 1.0 Vehicle is disabled and does not travel more than 50 feet (15 m) after impact.

2. Vehicle Barriers furnished shall in all respects be identical to the unit tested and certified except for the width of the vehicle barrier, which is as indicated and except for bollards which have a diameter based on a required crash rating. Crash test shall be performed and data compiled by an approved independent testing agency. Test vehicle shall not vault or penetrate the barrier during the test. The design and structural materials of the vehicle barrier furnished shall be the same as those used in the crash tested barrier.

D. Nameplates

1. Nameplate data shall be permanently attached to each vehicle barrier. The data shall be legibly marked on corrosion-resistant metal plates and shall consist of at least the following:
 - a. Manufacturer's name.
 - b. Model number.
 - c. Serial number.
 - d. Date of manufacture.

E. Delivery And Storage

1. Components placed in storage shall be protected from the weather, humidity, and temperature variation, dirt and dust, or other contaminants. Structural materials shall be stored on sleepers or pallets and shall be protected from rust and objectionable materials such as dirt, grease, or oil.

F. Spare Parts

1. A manufacturer's standard recommended spare parts package, with current unit prices and source of supply complete with detailed manuals on parts replacement, shall be provided with each barrier to facilitate 1 year of normal operation. Particular consideration shall be given to system components which are not readily available from local or commercial sources and which are critical to the operation of the system.

G. Manufacturer's Services

1. Services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment supplied shall be available. The representative shall supervise the installation, adjustment, and testing of the equipment.

1.2 PRODUCT

- A. Retractable Barriers: When in the raised position, the total retractable barrier heights shall be no less than 28 inches (711 mm) above the roadway surface and shall be 144 inches (3.66 m) wide. When in the lowered position, the retractable barrier shall extend no more than 5/8 inch (16 mm) above the roadway surface. Retractable barriers in the lowered position shall be capable of supporting a 32,000 pound (142 kN) axle load or a 16,000 (71 kN) wheel load. Design for this load shall be in accordance with AASHTO HB-17.
 1. Powered Retractable Barrier: The retractable barrier shall be capable of 300 complete up/down cycles per hour. The retractable barrier motion shall be instantly reversible and shall be capable



of raising the barrier from the lowered position to the raised position within 8 seconds during normal use, and within 2 seconds during an emergency. Also, the barrier shall be capable of being lowered from the raised position to the lowered position in not more than 3 seconds. Retractable barrier shall withstand a K4 **OR** K8 **OR** K12, **as directed**, impact condition with Performance Level of L1.0 **OR** L2.0 **OR** L3.0, **as directed**.

- a. Failure Modes of Operation: The system shall be designed to remain in the last commanded position in the event of hydraulic, electrical, or mechanical failure. A manual pump, or other system, shall be included for operation of hydraulic barriers without power.
 - b. Electric Motors: Unless otherwise indicated, electric motors shall have drip-proof **OR** totally enclosed **OR** totally enclosed fan cooled, **as directed**, enclosures. All couplings, motor shafts, gears, and other moving parts shall be fully guarded in accordance with 29 CFR 1910 Subpart O. Guards shall be removable without disassembling the guarded unit. For multiple barriers operated from a single hydraulic unit it is highly recommended that the electric motor be 3-phase.
 - c. System: The system shall be designed to maintain the barriers in the raised position, without inspection, for periods of time of up to 1 week. If a hydraulic system is used, it shall be equipped with pressure relief valves to prevent overpressure. The system shall not require continuous running of the motor to stay in the raised position, excluding the use of manual pinning to do so.
 - d. Hydraulic Power Unit: The hydraulic power unit shall contain synthetic biodegradable hydraulic fluid which maintains its viscosity operating range, even at constant heaviest use rate, for an ambient temperature range of 20 to 150 degrees F (minus 7 to plus 66 degrees C). A hydraulic fluid heater shall be provided so that the viscosity remains within its operating range if ambient temperatures below 20 degrees F (minus 7 degrees C) are expected. Buried hydraulic lines for the connection of the hydraulic power unit to the barrier shall be flexible or carbon steel pipe, or a combination of flexible and carbon steel pipe. Flexible and rigid hydraulic line working pressures shall exceed the maximum system relief pressure. PVC pipe and fittings for burial of hydraulic lines shall be in accordance with ASTM D 3034 Type PS 46 with minimum pipe stiffness of 46.
 - 1) Flexible hydraulic lines shall be in accordance with SAE J517.
 - 2) Rigid hydraulic lines shall be seamless carbon steel pipe in accordance with ASTM A 106.
 - e. Hydraulic Power Unit Enclosure: A NEMA Type 3R enclosure as specified in NEMA 250 shall be provided to enclose the hydraulic power unit. The enclosure shall be designed for easy removal of the hydraulic power unit and other accessories without complete removal of the enclosure. An access door with hinges and an inside and outside operable/lockable (exterior) door latch shall be provided. Equipment within the enclosure shall be placed and configured so that all periodic maintenance can be performed through the access door without removal of the equipment. The enclosure shall be equipped with weatherproof louver vents appropriately sized and located to dissipate internal heat generation.
2. Manual Retractable Barriers: The manual barrier shall be capable of being raised and lowered by manual means such as levers or hydraulics requiring a maximum 60 pounds (267 N) of force. The manual mechanism shall contain a locking pin which accepts a padlock for securing the barrier when it is in the "UP" position. Retractable barrier shall withstand a K4 **OR** K8 **OR** K12, **as directed**, impact condition with Performance Level of L1.0 **OR** L2.0 **OR** L3.0, **as directed**. Barrier should be capable of being locked in the down position.

- B. Retractable Bollards: The total bollard height when in the raised position shall be no less than 30 inches (750 mm) above the roadway surface and shall have an outside diameter of no less than 8 inches (200 mm). A bollard system shall consist of a minimum of 3 bollards spaced no more than 36 inches (915 mm) from centerline to centerline of bollards across a 10 foot (3.0 m) roadway. Bollards in the lowered position shall be capable of supporting a 16,000 pound (71 kN) wheel load each. Design for this load shall be in accordance with AASHTO HB-17. Retractable bollards shall withstand a K4 **OR** K8 **OR** K12, **as directed**, Impact Condition with Performance Level of L1.0 **OR** L2.0 **OR** L3.0, **as directed**.



1. **Powered Retractable Bollards:** The retractable bollard shall be capable of 300 complete up/down cycles per hour. Bollards shall be capable of being raised or lowered within a 3 to 15-second range during normal use and within 2.5 seconds for emergency operations.
 - a. **Failure Modes of Operation:** The system shall be designed to prevent lowering of the barrier in the event of hydraulic, electrical, or mechanical failure. A manual pump, or other system, shall be included for operation of hydraulic and/or mechanical barriers without power.
 - b. **Electric Motors:** Unless otherwise indicated, electric motors shall have drip-proof **OR** totally enclosed, **as directed**, enclosures. For multiple barriers being operated from a hydraulic power unit it is highly recommended that the electric motor be 3-phase.
 - c. **System:** The system shall be designed to maintain the barriers in the raised position, without inspection, for period of time of up to 1 week. If a hydraulic system is used, it shall be equipped with pressure relief valves to prevent overpressure.
 - d. **Hydraulic Power Unit:** The hydraulic power unit shall contain synthetic biodegradable hydraulic fluid which maintains its viscosity operating range, even at constant heaviest use rate, for an ambient temperature range of 20 to 150 degrees F (minus 7 to plus 66 degrees C). A hydraulic fluid heater shall be provided so that the viscosity remains within its operating range, if ambient temperatures below 20 degrees F (minus 7 degrees C) are expected. Buried hydraulic lines for the connection of the hydraulic power unit to the barrier shall be flexible or carbon steel pipe, or a combination of flexible and carbon steel pipe. Flexible and rigid hydraulic line working pressures shall exceed the maximum system relief pressure. PVC pipe and fittings for burial of hydraulic lines shall be in accordance with ASTM D 3034 Type PS 46 with minimum pipe stiffness of 46.
 - 1) Flexible hydraulic lines shall be in accordance with SAE J517.
 - 2) Rigid hydraulic lines shall be seamless carbon steel pipe in accordance with ASTM A 106.
 - e. **Hydraulic Power Unit Enclosure:** A NEMA Type 3R enclosure as specified in NEMA 250 shall be provided to enclose the hydraulic power unit. The enclosure shall be designed for easy removal of the hydraulic power unit and other accessories without complete removal of the enclosure. An access door with hinges and an inside and outside operable/lockable (exterior) door latch shall be provided. Equipment within the enclosure shall be placed and configured so that all periodic maintenance can be performed through the access door without removal of the equipment. The enclosure shall be equipped with weatherproof louver vents appropriately sized and located to dissipate internal heat generation.
 2. **Manual Retractable Bollards:** Manual bollards shall be capable of being raised and lowered utilizing a recessed handle on the top surface of the bollard or a manual hydraulic pump, either requiring a maximum 60 pounds (267 N) of force. A mechanism, that is lockable, shall be provided to secure the bollard in either the full "UP" or full "DOWN" position.
- C. **Crash Gate:** The crash gate shall consist of steel buttresses anchored into the ground and an above grade assembly consisting of a heavy steel structure or a combination of heavy steel and structural aluminum capable of being opened and closed. The height of the gate shall be a minimum of 84 inches (2.1 m) from the road surface to the top of the gate frame. The length shall close and protect a minimum 120 inch (3.0 m) clear opening. The maximum clear opening between the gate frame and end posts, between the bottom of the gate and finished grade, and between any grill work shall be 3 inches (75 mm).
1. **Powered Crash Gate:** The gate movement shall be controlled by an electro-mechanical gate operator **OR** a hydraulic gate operator, **as directed**, consisting of an operator unit with required control circuits and operator station. The control and operating voltage shall be 24 vac (nominal) or, as an option 24 vdc. A remote control master station shall be capable of driving the gate at minimum 48 fpm (14.6 m per minute) for a slide gate or 6 degrees per second for a swing gate. Unless otherwise indicated, motors shall have drip-proof **OR** totally enclosed, **as directed**, enclosures. Crash gate shall withstand a 15,000 pound (6804 kg) vehicle at impact speed of 30 **OR** 40 **OR** 50, **as directed**, mph (48 **OR** 64 **OR** 80, **as directed**, km/hour), with maximum barrier deflection or vehicle penetration of 3 feet (1 m).



- a. Failure Mode of Operation: The system shall be designed to prevent opening of the crash gate in the event of electrical or mechanical failure. A disconnect system for the gate drive shall be provided to allow manual operation of the barrier in the event of a power outage.
 - b. Hydraulic Power Unit: The hydraulic power unit shall contain synthetic biodegradable hydraulic fluid which maintains its viscosity within its operating range, even at constant heaviest use rate, for an ambient temperature range of 20 to 150 degrees F (minus 7 to plus 66 degrees C). A hydraulic fluid heater shall be provided so that the viscosity remains within its operating range if ambient temperatures below 20 degrees F (minus 7 degrees C) are expected. Buried hydraulic lines for the connection of the hydraulic power unit to the barrier shall be flexible or carbon steel pipe, or a combination of flexible and carbon steel. Flexible and rigid hydraulic line working pressures shall exceed the maximum system relief pressure. PVC pipe and fittings for burial of hydraulic lines shall be in accordance with ASTM D 3034 Type PS 46 with minimum pipe stiffness of 46.
 - 1) Flexible hydraulic lines shall be in accordance with SAE J517.
 - 2) Rigid hydraulic lines shall be seamless carbon steel pipe in accordance with ASTM A 106.
 - c. Hydraulic Power Unit Enclosure: A NEMA Type 3R enclosure as specified in NEMA 250 shall be provided to enclose the hydraulic power unit. The enclosure shall be designed for easy removal of the hydraulic power unit and other accessories without complete removal of the enclosure. An access door with hinges and an inside and outside operable/lockable (exterior) door latch shall be provided. Equipment within the enclosure shall be placed and configured so that all periodic maintenance can be performed through the access door without removal of the equipment. The enclosure shall be equipped with weatherproof louver vents appropriately sized and located to dissipate internal heat generation.
2. Manual Crash Gate: The manual crash gate shall be capable of being hinged from either side. Hinge points of both buttresses shall each contain a locking pin with padlock acceptance for securing the crash gate in the closed position. The crash gate shall withstand a 10,000 pound (4535 kg) vehicle at impact speed of 50 mph (80 km/hour), with maximum gate deflection or vehicle penetration of 10 feet (3 m) 15,000 pound (6804 kg) vehicle traveling at impact speed of 30 **OR** 40 **OR** 50, **as directed**, mph (48 **OR** 64 **OR** 80, **as directed**, km/hour), with a maximum gate deflection or vehicle penetration of up to 3 feet (1 m).
- D. Crash Beam: The crash beam shall be an above-grade assembly that, in the "DOWN" position, shall present a visible obstacle to approaching vehicles. The height of the barrier shall be a minimum of 30 inches (750 mm) as measured from the roadway surface to the centerline of the crash beam. The crash beam shall be capable of blocking a minimum road width of 120 inches (3.0 m). The crash beam end shall contain a locking pin with padlock acceptance for securing the crash beam when it is in the "DOWN" position. Crash beam shall withstand a 15,000 pound (6804 kg) vehicle traveling at 30 **OR** 40 **OR** 50, **as directed**, mph (48 **OR** 64 **OR** 80, **as directed**, km/hour), with maximum vehicle penetration of 20 feet (6 m) 10,000 pound (4535 kg) vehicle at impact speed of 15 mph (24 km/hour), with a maximum vehicle penetration of 10 feet (3 m).
1. Powered Crash Beam: The crash beam shall be operated by means of a hydraulic power system. The crash beam shall be capable of being raised or lowered within an 8 to 15 second time range.
 - a. Failure Mode of Operation: A disconnect system for the crash beam shall be provided to allow manual operation of the barrier in the event of an electrical or mechanical failure.
 - b. Hydraulic Power Unit: The hydraulic power unit shall contain synthetic biodegradable hydraulic fluid which maintains its viscosity operating range, even at constant heaviest use rate, for an ambient temperature range of 20 to 150 degrees F (minus 7 to plus 66 degrees C). A hydraulic fluid heater shall be provided so that the viscosity remains within its operating range if ambient temperatures below 20 degrees F (minus 7 degrees C) are expected. Buried hydraulic lines for the connection of the hydraulic power unit to the barrier shall be flexible or carbon steel pipe or a combination of flexible and carbon steel pipe. Flexible and rigid hydraulic line working pressures shall exceed the maximum system relief pressure. PVC pipe and fittings for burial of hydraulic lines shall be in accordance with ASTM D 3034 Type PS 46 with minimum pipe stiffness of 46.



- 1) Flexible hydraulic lines shall be in accordance with SAE J517.
 - 2) Rigid hydraulic lines shall be seamless carbon steel pipe in accordance with ASTM A 106.
 - c. Hydraulic Power Unit Enclosure: A NEMA Type 3R enclosure as specified in NEMA 250 shall be provided to enclose the hydraulic power unit. The enclosure shall be designed for easy removal of the hydraulic power unit components and other accessories without complete removal of the enclosure. An access door with hinges and an inside and outside operable/lockable exterior door latch shall be provided. Equipment within the enclosure shall be placed and configured so that all periodic maintenance can be performed through the access door without removal of the equipment. The enclosure shall be equipped with weatherproof louver vents appropriately sized and located to dissipate internal heat generation.
 2. Manual Crash Beam: The crash beam shall be manually raised and lowered with the aid of a counterbalanced end requiring approximately 60 pounds (267 N) of force.
- E. Portable Retractable Barrier: The portable retractable barrier shall be transportable and capable of manual and/or electro-mechanical operation. When in the raised position, the total barrier heights shall be no less than 28 inches (711 mm) above the roadway surface and shall be up to 144 inches (3.66 m wide). The barrier shall be equipped with entrance/exit ramps when the barrier extends more than 5/8 inch (16 mm) above the roadway surface. Retractable barriers in the lowered position shall be capable of supporting a 32,000 pound (142 kN) axle load or a 16,000 (71 kN) pound wheel load. Design for this load shall be in accordance with AASHTO HB-17.
1. Powered Portable Retractable Barrier: The portable retractable barrier shall be capable of 300 complete up/down cycles per hour. The retractable barrier motion shall be instantly reversible and shall be capable of raising the barrier from the lowered position to the raised position within 8 seconds during normal use, and within 2 seconds during an emergency. Also, the barrier shall be capable of being closed from the raised position to the lowered position in not more than 3 seconds. Retractable barrier shall withstand a K4 **OR** K8 **OR** K12, **as directed**, impact condition with Performance Level of L1.0 **OR** L2.0 **OR** L3.0, **as directed**. Portable retractable barrier, when impacted by a 15,000 pound (6,800 kg) vehicle at impact speed of 50 mph (80 km/hour) shall disable the vehicle and allow it to travel no more than 50 feet (15.2 m) after impact. Portable power assisted retractable barriers shall be equipped with on and off ramps for smooth transition between surfaces when the barrier extends more than 5/8 inch (16 mm) above the roadway surface.
 - a. Failure Modes of Operation: The system shall be designed to prevent lowering of the barrier in the event of hydraulic, electric, or mechanical failure. A manual pump shall be included for operation of hydraulic and/or mechanical barriers without power.
 - b. Electric Motors: Unless otherwise indicated, electric motors shall have drip-proof **OR** totally enclosed, **as directed**, enclosures.
 - c. System: The system shall be designed to maintain the barriers in the raised position, without inspection, for periods of time of up to 1 week. If a hydraulic system is used, it shall be equipped with pressure relief valves to prevent overpressure.
 - d. Hydraulic Power Unit: The hydraulic power unit shall contain synthetic biodegradable hydraulic fluid which maintains its viscosity operating range, even at constant heaviest use rate, for an ambient temperature range of 20 to 150 degrees F (minus 7 to plus 66 degrees C). A hydraulic fluid heater shall be provided so that the viscosity remains within its operating range if ambient temperatures below 20 degrees F (minus 7 degrees C) are expected. Flexible hydraulic lines shall be used for the connection of the hydraulic power unit to the barrier. Flexible hydraulic line working pressures shall exceed the maximum system relief pressure; flexible hydraulic lines shall be in accordance with SAE J517.
 2. Manual Retractable Portable Barriers: The manual barrier shall be capable of being raised and lowered by manual means such as levers or hydraulics requiring a maximum 60 pounds (267 N) of force. The manual mechanism shall contain a locking pin which accepts a padlock for securing the barrier when it is in the "UP" position and shall also be capable of being locked in the



"DOWN" position. Retractable barrier shall withstand a K4 **OR** K8 **OR** K12, **as directed**, impact condition with Performance Level of L1.0 **OR** L2.0 **OR** L3.0, **as directed**

- F. Portable Crash Beam: The portable crash beam shall be an above-grade assembly that, in the "DOWN" position, shall present a visible obstacle to approaching vehicles. The height of the barrier shall be a minimum of 30 inches (750 mm) as measured from the roadway surface to the centerline of the crash beam. The crash beam shall be capable of blocking a minimum road width of 120 inches (3.0 m). The crash beam end shall contain a locking pin with padlock acceptance for securing the crash beam when it is in the "DOWN" position. Crash beam shall withstand a 15,000 pound (6804 kg) vehicle traveling at 30 mph (48 km/hour), with maximum vehicle penetration and/or barrier deflection of 20 feet (6 m).
1. Powered Portable Crash Beam: The portable crash beam shall be operated by means of a hydraulic power system. The crash beam shall be capable of being raised or lowered within an 8 to 15 second time range.
 - a. Failure Mode of Operation: A disconnect system for the portable crash beam shall be provided to allow manual operation of the barrier in the event of an electrical or mechanical failure.
 - b. Hydraulic Power Unit: The hydraulic power unit shall contain synthetic biodegradable hydraulic fluid which maintains its viscosity operating range, even at constant heaviest use rate, for an ambient temperature range of 20 to 150 degrees F (minus 7 to plus 66 degrees C). A hydraulic fluid heater shall be provided so that the viscosity remains within its operating range if ambient temperatures below 20 degrees F (minus 7 degrees C) are expected. Flexible hydraulic lines shall be used for the connection of the hydraulic power unit to the barrier. Flexible hydraulic line working pressures shall exceed the maximum system relief pressure; flexible hydraulic lines shall be in accordance with SAE J517.
 - c. Hydraulic Power Unit Enclosure: A weather resistant enclosure shall be provided to enclose the hydraulic power unit. The enclosure shall be designed for easy removal of the hydraulic power unit components and other accessories without complete removal of the enclosure. An access door with hinges and an inside and outside operable lockable (exterior) door latch shall be provided. Equipment within the enclosure shall be placed and configured so that all periodic maintenance can be performed through the access door without removal of the equipment. The enclosure shall be equipped with weatherproof louver vents appropriately sized and located to dissipate internal heat generation.
 2. Manual Portable Crash Beam: The crash beam shall be manually operated by means of a counter balanced system requiring approximately 60 pounds (267 N) of force.
- G. Electrical Work: Motors, manual or automatic motor control equipment except where installed in motor control centers and protective or signal devices required for the operation specified herein shall be provided in accordance with Division 22. All field wiring for loop detectors, communication lines, and power circuits shall have surge protection. Any wiring required for the operation specified herein, but not shown on the electrical plans, shall be provided under this section in accordance with Division 22.
- H. Control Panel: A control panel and control circuit shall be provided to interface between all barrier control stations and the power unit. A control panel shall be provided for the inbound lanes and a separate one for the outbound lanes where the barriers are located. The control station is defined as the main control panel and the remote control panel as shown. The control circuit shall contain all relays, timers, and other devices or an industrial programmable controller programmed as necessary for the barrier operation. The control panel shall allow direct interface with auxiliary equipment such as card readers, remote switches, loop detectors, infrared sensors, and sliding **OR** swinging, **as directed**, gate limit switches. Loop controllers shall not cause an automatic barrier raise following power loss or restoration. The enclosure shall be as indicated on the drawings. All device interconnect lines shall be run to terminal strips.
1. Voltage: The control circuit shall operate from a 120 volt 60 **OR** 50, **as directed**, Hz supply. The control circuit voltage shall be 12 **OR** 24, **as directed**, ac **OR** dc, **as directed**, for all external control panels.



2. **Main Control Panel:** A main control panel shall be supplied to control barrier function. This panel shall have a key-lockable main switch with main power "ON" and panel "ON" lights. Buttons to raise and lower each barrier **OR** set of barriers, **as directed**, shall be provided. Barrier "UP" and "DOWN" indicator lights shall be included for each barrier **OR** set of barriers, **as directed**. An emergency fast operate circuit (EFO) shall be operated from a push button larger than the normal controls and have a flip safety cover installed over the push button or toggle switch. The EFO shall also be furnished with an EFO-active light and reset button. The main control panel shall have a key lockable switch to arm or disable the remote control panel. An indicator light shall show if the remote control panel is enabled.
3. **Remote Control Panel:** A remote control panel, one panel for the inbound lane(s) and a separate panel for the outbound lane(s), shall have a panel "ON" light that is lit when enabled by a key lockable switch on the main control panel. Buttons to raise and lower each barrier shall be provided. Barrier "UP" and "DOWN" indicator lights shall be included for each barrier. The EFO shall be operated from a push button larger than the normal controls and have a flip safety cover installed over the push button or toggle switch. Activation of either EFO will operate all barriers. The EFO shall be interconnected with an EFO-active light. When the remote control panel EFO is pushed, operation of the barrier will not be possible from this panel until reset at the main control panel.

I. **Miscellaneous Equipment**

1. **Safety Equipment**
 - a. **Barrier Systems Sensors:** The sensors shall be compatible with the barrier controller and shall function as part of a complete barrier control system. The barrier system sensors shall consist of the following:
 - 1) **Suppression Loops -** Two inductive loops whose outputs shall be used to prevent barriers raising when a vehicle is within a prescribed distance of the barrier. The output of the loops shall override all barrier rise signals until one second after a vehicle clears the suppression loop.
 - 2) **Speed Loops -** Two inductive loops whose output shall be used to signal the barrier controller of a vehicle approaching at a speed greater than the posted speed (25 mph (11.2 m/sec) or less (recommended)). The speed loops shall cause the barrier control panel to annunciate a warning sound alerting the guard to make a decision as to whether the barrier should be raised or not.
 - 3) **Wrong Way Loops -** Two inductive loops whose output shall be used to signal the barrier control panel to enunciate a warning sound if a vehicle is attempting to enter the facility through the exit lane. The warning sound will alert the guard to make a decision as to whether the barrier should be raised or not.
 - b. **Traffic Lights:** Red/yellow 8 inch (200 mm) traffic lights shall be supplied for each entrance and exit to alert motorists of the barrier position. Traffic lights are not required for manual barriers. The yellow flashing light shall indicate that the barrier is fully open. All other positions shall cause the light to show red. Brackets shall be supplied to allow the light to be mounted a minimum 4.5 feet (1.4 m) above the roadway pavement on a 3.5 inch (90 mm) outside diameter metal post or mounted directly on the crash gate.
2. **Warning Annunciator:** Provide a warning annunciator built into the barrier control panel that produces a pulsing audible sound when the speed loop detects a vehicle entering the facility with excess speed. Provide a warning annunciator built into the barrier control panel that produces a continuous sound whenever a wrong way loop detects a vehicle entering from the exit. The warning annunciator shall sound until a warning annunciator silence reset button is pressed.
3. **Heater:** A waterproof barrier heater with a thermostat control and NEMA 4 junction box connection point shall be provided for de-icing and snow melting. The heater shall provide barrier operation to an ambient temperature of minus 40 degrees F (minus 40 degrees C). For retractable bollards, a 250-watt heater shall be provided for each bollard.
4. **Signage:** Signage shall read "Axle Weight Limit 9 Tons" and shall conform to FHWA SA-89-006 sign (R12.2).



5. Vertical Arm Gates (Traffic Arms): Vertical arm gates shall have an opening and closing time of less than or equal to 5 seconds. The gates shall be capable of 500 duty cycles per hour as a minimum. Gate shall operate the arm through 90 degrees. Gate operators shall be supplied with single phase 120 volt motors. Each entry lane shall be provided with a vertical arm gate. Each gate shall be capable of being operated from a remote open-close push button station in each guard booth and the gatehouse for the respective entry lane. Gates shall have a hand-crank, or other means, which will allow manual operation during power failures. Gate arms shall be constructed out of wood, steel, fiberglass, or aluminum, as specified by the manufacturer for the given lengths as shown on the drawings. Gate arms shall be covered with 16 inch (406 mm) wide reflectorized red and white sheeting. Each gate shall be furnished with a spare gate arm. Gate operator cabinets shall be constructed of galvanized steel, or aluminum and shall be painted manufacturers standard color as approved. Each gate operator shall be provided with an obstruction detector that will automatically reverse the gate motor when an obstruction is detected. The obstruction detector shall be any of the following 3 types: An electronic loop vehicle detector buried in the road, a photocell electric eye mounted on the gate operator, or a safety strip mounted on the lower edge of the arm. The detector system shall be automatically deactivated when the arm reaches the fully lowered position. Slab size and anchorage for gate operator shall be per manufacturer requirements.
 6. Vehicle Barrier Vertical Arm Gate (Traffic Arm): A traffic arm, as a separate piece of equipment, will be included with each non-portable active vehicle barrier as part of the barrier safety operating system. This traffic arm shall automatically deploy (close) when the emergency up button is activated and open when the vehicle barrier is reset. This traffic arm will not be equipped with an automatic obstruction detector.
- J. Finish: Surfaces shall be painted in accordance with requirements of Division 09 Section(s) "Exterior Painting" OR "Interior Painting", as applicable. The roadway plate shall have a nonskid surface painted white with reflective red 4 **OR 6, as directed**, inch (100 **OR 150, as directed**, mm) wide red reflective stripes 4 inches (100 mm) apart. The barrier front shall be painted white and have 4 **OR 6, as directed**, inch (100 **OR 150, as directed**, mm) wide reflective red stripes 4 inches (100 mm) apart. The diagonal striping should point down and outward from the center of the device. Bollards shall be painted white with 2 **OR 3, as directed**, inch (50 **OR 75, as directed**, mm) wide reflective red diagonal stripes. The barrier crash gate shall be painted as specified by purchaser and the crash beam shall be painted white with 3 inch (75 mm) wide reflective red diagonal stripes.
 - K. Concrete: The concrete shall conform to Division 03 Section "Cast-in-place Concrete".
 - L. Welding: Welding shall be in accordance with AWS D1.1/D1.1M.
 - M. Pavement: After placement of the vehicle barrier, the pavement sections shall be replaced to match the section and depth of the surrounding pavement. Pavement shall be warped to match the elevations of existing pavement. Positive surface drainage, away from the vehicle barrier, shall be provided by pavement slope.
- 1.3 EXECUTION
- A. Installation: Installation shall be in accordance with manufacturer's instructions and in the presence of a representative of the manufacturer. Manufacturer's representative shall be experienced in the installation, adjustment, and operation of the equipment provided. The representative shall also be present during adjustment and testing of the equipment.
 - B. Hydraulic Lines: Buried hydraulic lines shall be placed in polyvinyl chloride (PVC) sleeves. Positive drainage shall be provided from the hydraulic power unit to the barrier for drainage of condensation within the PVC sleeve.



- C. Pit Drainage: A drain connection and oil/water separator, **as directed**, shall be provided in each barrier that requires pit/vault type construction. Hookups between the storm drains shall be made. The self-priming sump pump shall have the capacity to remove minimum 150 gallons per minute (34 cubic meters per hour).
- D. Electrical: All control power wiring requiring compression terminals shall use ring-style terminals. Terminals and compression tools shall conform to UL 486A. Roundhead screws and lockwashers shall be used to provide vibration-resistant connections. Connections between any printed circuit cards and the chassis shall be made with screw connections or other locking means to prevent shock or vibration separation of the card from its chassis. The electrical power supply breaker for the hydraulic power unit shall be capable of being locked in the power on and power off positions.
- E. Field Testing: Upon completion of construction, a field test shall be performed for each vehicle barrier. The test shall include raising and lowering the barrier, both electrically and manually, through its complete range of operation. Each vehicle barrier shall then be continuously cycled for not less than 30 minutes to test for heat build-up in the hydraulic system. the Owner shall be notified at least 7 days prior to the beginning of the field test. The Contractor shall furnish all equipment and make all necessary corrections and adjustments prior to tests witnessed by the Owner. Any conditions that interfere with the proper operation of the barrier disclosed by the test shall be corrected at no additional cost to the Owner. Adjustments and repairs shall be done by the Contractor under the direction of the Owner. After adjustments are made to assure correct functioning of components, applicable tests shall be completed.
- F. Field Training: A field training course shall be provided for designated operating staff members. Training shall be provided for a total period of not less than 8 hours (for electrical/hydraulic operated units) or 1 hour (for manually operated units) of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the operating and maintenance instructions.

END OF SECTION 34 71 13 16



SECTION 34 71 13 16a - BEAM-TYPE GUARDRAIL

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for beam-type guardrail. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.
2. Shop drawings shall be submitted for approval.

1.2 PRODUCTS

A. Rail Elements, End Sections, and Fasteners

1. ARTBA technical bulletin No. 268-B.
2. Provide galvanized steel W-beam in accordance with AASHTO M-180, class A, type 1.
3. Shop curve rail elements when required radius of installation on horizontal curve is 150 ft (46 m) or less. Provide W-beam rail (ARTBA RE-3) with a flared end section (ARTBA RE-5), rounded end section (ARTBA RE-6) at each end of installations.
4. Provide standard back-up plates behind rail elements at all intermediate, non-splice posts when steel posts and blocks are used.
5. Galvanize the rail sections, including end sections, in accordance with ASTM A 525, coating G-210.

B. Posts

1. Wood: Provide wood posts with blocks, size as required by State DOT. Rough sawn or S4S timber of Douglas Fir or any other locally approved species that is either No. 1 grade or Select Structural grade when graded in accordance with the requirements for Timber and Posts as set forth in WWPA-01 may be used. Give all wood posts and blocks a preservative treatment in accordance with the requirements of AASHTO M-133. Cut to length and bore posts and blocks for bolt holes before treatment.
2. Steel: Provide steel posts with blocks. Fabricate posts and blocks from W6X9 structural steel shapes complying with the requirements of ASTM A 36. Fabricate in the shop, grind smooth all corners and edges, galvanize posts and blocks after fabrication in accordance with ASTM A 123.

C. Bolts, Nuts, and Washers

1. Provide galvanized bolts, nuts, and washers that meet common ARTBA standards, designed to develop the required joint strength. Provide bolts with rounded heads to provide minimum obstruction.
2. Provide galvanized steel bolts conforming to the requirements of ASTM A 307, nuts conforming to the requirements of ASTM A 563, Grade A or better and galvanized steel washers, all galvanized in accordance with the requirements of ASTM A 153. Provide high strength bolts conforming to the requirements of ASTM A 325 where needed.

D. Reflectors: Provide guardrail reflectors as indicated. Place the galvanized steel tabs with reflective sheeting at every post except no reflectors are to be placed along the guardrail end flares.

E. Breakaway Cable Terminal (BCT) Assemblies: Provide BCT assemblies in accordance with the ARTBA details and standards referenced on the details.



- F. Concrete and Reinforcement for the Post Footings: In accordance with applicable sections of Division 03 Section "Cast-in-place Concrete".

1.3 EXECUTION

- A. Guardrail: Erect steel beam-type guardrail in locations and to lines and grades as directed and in accordance with details indicated.
- B. Erection
1. Firmly set posts spaced at 6 ft. 3 in. (1.9 m) centers to the required depth. Set posts by placing in hand or mechanically dug holes or by driving, with or without pilot holes. Backfill gaps around posts with approved material that is moistened and thoroughly compacted. Repair damaged roadway surfacing where pavement is disturbed.
 2. Position the top of W-beam rail at 27 in. (0.69 m) above the finished roadway surface. Align rail both vertically and horizontally within 1/4-in. (6 mm) from the theoretical alignments. Lap the rail sections at posts, in the direction of traffic in the adjacent lane, and lap end sections on the face of the rail.
 3. Exercise care to avoid damage to treated wood and galvanized steel parts. Repair or replace damaged parts at the Contractor's expense. Securely tighten all bolts in the finished guardrail. Toenail the wood blocks to wood posts with two 16 penny galvanized nails, one on each side of the top of the block.

END OF SECTION 34 71 13 16a



Task	Specification	Specification Description
34 71 13 19	34 71 13 16	Active Vehicle Barriers
34 71 13 26	01 22 16 00	No Specification Required
34 71 13 26	34 71 13 16a	Beam-Type Guardrail
34 71 16 00	01 22 16 00	No Specification Required
34 71 16 00	34 71 13 16	Active Vehicle Barriers
34 71 16 00	34 71 13 16a	Beam-Type Guardrail
34 82 23 00	01 22 16 00	No Specification Required
34 82 26 00	01 22 16 00	No Specification Required



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Task	Specification	Specification Description
40 05 13 19	22 05 23 00	Piped Utilities Basic Materials And Methods
40 05 13 19	22 11 23 39	Water Supply Wells
40 05 13 19	21 05 00 00	Common Work Results for Fire Suppression
40 05 13 83	21 05 00 00	Common Work Results for Fire Suppression
40 05 23 43	22 05 23 00	Piped Utilities Basic Materials And Methods
40 05 23 43	22 11 23 39	Water Supply Wells
40 05 23 43	21 05 00 00	Common Work Results for Fire Suppression
40 05 41 00	21 05 00 00	Common Work Results for Fire Suppression



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SECTION 41 01 20 00 - MATERIAL HANDLING HOISTS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material handling hoists. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS

A. Electric Chain Hoists

1. Hoist motors shall be H4 duty classification. Class F insulation shall be used in hoist motor for 30 minute operation. Load chain shall be grade 80 alloy, case hardened and zinc plated sized for the intended load. Hoists shall employ AC motor brakes employing single or multiple all-steel disks. Controls shall be hand-held, low voltage electrical, with emergency shut off and enclosed in NEMA 3R rated weatherproof enclosure. Hoist shall include fail safe limit switches in the hoist enclosure. Hoist shall meet requirements of ANSI B30.16 standard. Load hook shall be heavy-duty drop forged with safety latch. Hoist shall have swivel top and bottom hooks.

B. Manual Chain Hoists

1. Load capacity of hoist shall be as specified. Load chain shall be grade 80 alloy, case hardened and zinc plated sized for the intended load. Load hook shall be heavy-duty drop forged with safety latch. Hoist mechanism shall be double pawl ratchet system with Weston type brake using a non-asbestos friction disk. Hoist shall have swivel top and bottom hooks. Hoist shall require between 50 and 80 pounds effort to move load.

C. Electric Wire Rope Hoists

1. Hoist motors shall be H4 duty classification. Class F insulation shall be used in hoist motor for 30 minute operation. Lift range shall be between 20 and 150 feet. Lifting cable shall be pre-formed wire rope, of hoisting service construction, made of extra improved steel (XIP) with an independent wire rope center. Load hook shall be heavy-duty drop forged with safety latch. Hoist shall have swivel top and bottom hooks. Controls shall be hand held, low voltage electrical, with emergency shut off and enclosed in NEMA 3R rated weatherproof enclosure. Hoist shall include fail-safe limit switches in the hoist enclosure. Hoist shall meet requirements of ANSI B30.16 standard.

1.3 EXECUTION

A. Installation

1. The Contractor shall complete the assembly of any equipment furnished partially assembled and place the items in position as directed. The hoists shall be assembled and securely bolted in position, hoisting chain or wire rope installed, and the hoist made ready for regular operation. The Contractor shall furnish all miscellaneous hardware items required to complete the installation of all equipment and components. Equipment shall be primed and finish painted with a suitable corrosion-resistant paint on all parts and components not made of corrosion-resistant materials or otherwise protected.



END OF SECTION 41 01 20 00



SECTION 41 22 23 13 - MONORAILS WITH AIR MOTOR POWERED HOIST

1.1 GENERAL

- A. Description Of Work
 - 1. This specification covers the furnishing and installation of materials for monorails with air motor powered hoist. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.
- B. Verification Of Dimensions
 - 1. The Contractor shall be responsible for the coordination of his work with the work of all trades involved and as it relates to the building structure. The Contractor shall verify all building dimensions that relate to fabrication of the monorail system, and shall notify the the Owner of any discrepancy before order to the monorail manufacturer is finalized.
- C. Submittals
 - 1. Shop Drawings
 - 2. Design Data
 - 3. Test Reports
 - 4. Certificates
 - 5. Operation and Maintenance Data
- D. Quality Assurance
 - 1. Drawings: Submit drawings showing the general arrangement of the track beam system, including curves and switches, clearances, principal dimensions, details of structural connections, air system details, and all component details. Manufacturer's catalog data will suffice for items of standard manufacturer.
 - 2. Certificates: Submit certification of minimum wire rope breaking strength for each hoist. Where applicable, submit factory certification of the load chain rated capacity.
 - 3. Design Data: Submit design calculations verifying the size of structural members, structural supports (fittings, rods, brackets, and components), and lifting beams for the track beam system. The calculations shall include stress and loading diagrams. Submit calculations with monorail drawings.
- E. Maintenance: Submit data package for the entire monorail system.

1.2 PRODUCTS

- A. Fabrication And Construction
 - 1. The hoist and trolley shall conform to ANSI/ASME HST-5M or ANSI/ASME HST-6M, **2 OR 3 OR 5, as directed**, ton (2 **OR 3 OR 5, as directed**, metric ton), for general service **OR** protected indoor **OR** all weather outdoor, **as directed**, (0 degrees to 100 degrees F (-18 to 38 degrees C)) working conditions. 2 ton (2 metric ton) design criteria shall apply to hoists of 2 ton (2 metric ton), or less, rated lifting capacity. Hoists of 2, 3, or 5 ton (2, 3, or 5 metric ton) rated capacity, shall be equipped with an automatic mechanical load lowering brake.
 - 2. Capacity: The hoist shall have a minimum rated capacity as required to meet project requirements. The monorail system shall have a minimum rated capacity as required to meet project requirements.
 - 3. Hook Lift and Speed: Shall be the manufacturer's standard within the limits specified in ANSI/ASME HST-5M or ANSI/ASME HST-6M. The hook lift shall be at its highest point a minimum height as required to meet project requirements above the finished floor and at its lowest point a minimum as required to meet project requirements below the finished floor.

OR

B. Fabrication And Construction

1. The 1/4 **OR** 1/2 **OR** 1, **as directed**, ton (1/4 **OR** 1/2 **OR** 1, **as directed**, metric ton) hoist and trolley shall meet the design requirements specified in ANSI/ASME HST-5M or ANSI/ASME HST-6M for the 2 ton (2 metric ton) hoist trolley.
2. Capacity: The hoist shall have a minimum rated capacity as required to meet project requirements. The monorail system shall have a minimum rated capacity as required to meet project requirements.
3. Hook Lift and Speed: For 1/4 **OR** 1/2 **OR** 1, **as directed**, ton (1/4 **OR** 1/2 **OR** 1, **as directed**, metric ton) hoist(s), the hook lift shall be at its highest point a minimum height as required to meet project requirements above the finished floor and at its lowest point a maximum **OR** minimum, **as directed**, as required to meet project requirements above **OR** below, **as directed**, the finished floor. The hook lift and speed limits for 1/4 **OR** 1/2, **OR** 1 ton, **as directed**, (1/4 **OR** 1/2 **OR** 1, **as directed**, metric ton) rated capacity hoists shall be within the limits shown in the following table.

Standardized hoist lift ranges and rated lifting speed
ranges for 1/4, 1/2, and 1 metric ton rated capacity

Rated load Capacity (metric tons)	Hoist lift range (meter)	Hoist lifting speed range (mm/s)	
		Low	High
1/4	3 to 15	120	350
1/2	3 to 12	80	250
1	3 to 10	40	225

Standardized hoist lift ranges and rated lifting speed
ranges for 1/4-, 1/2-, and 1-ton rated capacity

Rated load capacity (tons)	Hoist lift range (feet)	Hoist lifting speed range (feet per minute)	
		Low	High
1/4	10 to 50	24	70
1/2	10 to 40	16	50
1	10 to 30	8	45

4. Hooks: Shall be of the safety type with hook nuts keyed to hook shanks by means of a setscrew installed in a plane parallel to the longitudinal axis of the hook shank, or by any other similar easily removable securing device. All hook components shall be magnetic-particle inspected over the entire area in accordance with ASTM A 275/A 275M. The acceptance standard shall be one of no defects. A defect is defined as a linear indication revealed by magnetic-particle inspection that is greater than 1/8 inch (3 mm) long whose length is equal to or is greater than three times its width.
5. Hoist Wire Rope: Rope lengths shall be sufficient to maintain a minimum of two full wraps of rope at the dead end(s) of the drum, with the block in its lowest indicated position.
6. Hoist Chain: Chain hoists of 10 foot (3 m) lift or more shall be equipped with a load chain bucket.
7. Hoist Limit Switch: Hoists shall be equipped with upper and lower hoist limit switches/devices.
8. Control Pendant: Shall extend as required to meet project requirements below the underside of the track beam.
9. Trolley: Shall have a manual **OR** geared manual **OR** air motor powered, **as directed**, drive and shall be designed to operate from track beam section. Where two or more hoists are located on the same monorail beam, the trolleys shall be equipped with rubber bumper devices designed to prevent contact of any part or parts of the hoists.



- C. Monorail Track Beam System
 - 1. Shall conform to MMA MH27.1, for powered hoists. The maximum allowable deflection shall not exceed 1/600 of the unsupported span, with the hoist(s) at rated load(s) and at any location(s). The track beam system shall have trolley stops at all open end locations. The stops shall be designed to retain the hoist on the track. Wheel stops shall interface with the trolley wheel treads on both sides of the track web simultaneously and shall not interface with the trolley wheel flanges. The air supply valve specified shall be of the quick shutoff type, readily accessible from the floor, and located within proximity to the monorail system.
 - 2. Color of Finished Equipment: Shall be the manufacturer's standard brilliant yellow.
 - 3. Identification Plates: The manufacturer shall furnish and install identification plates of noncorrosive metal. Information and data on the plates shall include, in clearly legible permanent lettering, the manufacturer's name, model number, capacity rating, and other essential information. In addition, the monorail track beam system shall be furnished with identification plates showing the capacity of the system, which shall be legible from the floor and from either side of the monorail track beam.

1.3 EXECUTION

- A. Erection And Installation
 - 1. The Contractor shall erect and install the hoist and monorail system in accordance with of MMA MH27.1. The monorail supplier shall provide supervisory erection services.
- B. Field Inspection And Tests
 - 1. Pre-Erection Inspection: Before erection, the Contractor and the manufacturer's representative shall jointly inspect the monorail and hoist systems and components at the job site to determine compliance with specifications and manufacturer's data and detail drawings as approved. The Contractor shall notify the the Owner 3 days before the inspection.
 - 2. Load Tests: Upon completion, and before final acceptance, the hoist, trolley, and monorail shall be tested in operation as specified, carrying 125 percent of the rated capacity, and with the units spaced to obtain maximum possible loads in the monorail track beam systems. The air equipment will not necessarily operate at rated speed with a 125 percent overload. For hoists that incorporate mechanical load brakes, the mechanical load brake shall hold a static, as well as control a dynamic, 125 percent rated load. The systems shall be thoroughly tested in service to determine that each component of the system operates as specified, is properly installed and adjusted, and is free from defects in material, manufacture, installation, and workmanship. The Contractor shall furnish test loads, operating personnel, instruments, and other apparatus as necessary to conduct field tests on hoist and monorail. The test and final adjustments of the equipment shall be under the supervision of the the Owner. The Contractor shall rectify any deficiencies found and completely retest work affected by such deficiencies.

END OF SECTION 41 22 23 13



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SECTION 41 22 23 13a - MONORAILS WITH MANUAL HOIST

1.1 GENERAL

- A. Description Of Work
 - 1. This specification covers the furnishing and installation of materials for monorails with manual hoist. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.
- B. Verification Of Dimensions:
 - 1. The Contractor shall verify all building dimensions that relate to fabrication of the monorail system, and shall notify the Owner of any discrepancy before the order to the monorail manufacturer is finalized.
- C. Submittals
 - 1. Shop Drawings: Submit drawings showing the general arrangement of the track beam system, including curves and switches, clearances, principal dimensions, details of structural connections, and all component details. Manufacturer's catalog data will suffice for items of standard manufacturer.
 - 2. Design Data: Structural design calculations.
 - 3. Test Reports
 - a. Hook and hook nut magnetic-particle tests.
 - b. Monorail system load tests
 - 4. Certificates: Manual hoist load chain
 - 5. Operation and Maintenance Data
 - a. Track beam system
 - b. Hoist and trolley
- D. Quality Assurance
 - 1. Certifications: Submit factory certification of load chain rated capacity.
 - 2. Design Data: Submit design calculations verifying the size of structural members, structural support fittings, rods, brackets, components, and lifting beams for the track beam system. The calculations shall include stress and loading diagrams. Submit calculations with monorail drawings.

1.2 PRODUCTS

- A. Fabrication And Construction: Provide manual hoist and trolley, ANSI/ASME HST-2M, ANSI/ASME HST-3M, trolley suspension. Trolley and wheels shall be suitable for operation on the steel monorail track beam provided, and shall have not less than four wheels.
 - 1. Capacity: The hoist shall have a minimum rated capacity as required to meet project requirements. The monorail system shall have a minimum rated capacity as required to meet project requirements.
 - 2. Hook Lift: Shall be the manufacturer's standard. The hoist lift shall be at its highest point a minimum of 8 feet (2400 mm) above the finished floor and at its lowest point a minimum of 2 feet (600 mm) below the finished floor.
 - 3. Hooks: Shall be of the safety type with hook nuts keyed to hook shanks by means of a setscrew installed in a plane parallel to the longitudinal axis of the hook shank, or by any other similar easily removable securing device. All hook components shall be magnetic-particle inspected over the entire area in accordance with ASTM A 275/A 275M. The acceptance standard shall be one of no defects. A defect is defined as a linear indication revealed by magnetic-particle

inspection that is greater than 1/8 inch (3 mm) long whose length is equal to or is greater than three times its width.

4. Trolley: Shall be designed to operate from track beam section. Where two or more hoists are located on the same monorail beam, the trolleys shall be equipped with rubber bumper devices designed to prevent contact of any part or parts of the hoists.
5. Load Chain: High strength steel links, flexible; minimum safety factor of 5 to 1 based on ratio of minimum chain breaking load to the calculated load on the chain when the hoist is assumed loaded to rated capacity. Certification from hoist manufacturer of provided chain's breaking strength shall be submitted to the Owner and approved prior to final acceptance of hoist. Do not paint or coat the load chain.
6. Load Hooks and Load Hook Components
 - a. Hook: Forged steel; complete with spring-loaded steel throat opening safety device. The hook shall be carried on suitably sealed or shielded anti-friction thrust bearings and shall swivel freely through 360 degrees rotation with full load without twisting chain.
 - 1) Disassembly. Hook and hook nut shall be capable of complete disassembly that enables access to all surfaces of the hook, including shank and hook nut for inspection purposes. Provision shall be made for the hook nut, or other hook-to-block fastener, to be keyed to hook shank by means of a set screw or similar, easily removable, securing device.
 - 2) Hook Non-Destructive Test. Each hook, including shank and hook nut, shall be inspected over the entire surface areas by magnetic particle inspection. If hook nut is not used, any device that functions the same as the hook nut shall be inspected by magnetic particle inspection.
 - a) Procedure: Magnetic particle inspection shall be conducted in accordance with ASTM A 275/A 275M. This inspection shall be conducted at the factory of the hook manufacturer or hoist manufacturer. Alternately, a recognized independent testing lab may conduct the inspections if equipped and competent to perform such a service, and if approved by the the Owner.
 - b) Acceptance Criteria: Defects found on the hook or hook nut shall result in rejection of defective items for use on furnished hoist. For this inspection, a defect is defined as a linear or non-linear indication for which the largest dimension is greater than 1/8 inch (3 mm). Weld repairs for defects on hook or hook nut will not be permitted.
 - c) Test Report: A test report of the magnetic particle inspection of each hook and hook nut provided shall be submitted to and approved by the the Owner prior to final acceptance of hoist installation. Test reports shall be certified by the testing organization.

B. Monorail Track Beam System: Comply with MMA MH27.1 except as modified and supplemented herein.

1. Patented Track: Provide specially designed trackage, e.g., patented track beam, curves, and switches constructed from welded steel components. The lower flange of the track section shall have flat wheel treads; minimum lower flange width of 3.25 inches (80 mm); chemical composition of 0.45 to 0.60 percent carbon content, 0.60 to 1.1 percent manganese content; and wheel treads shall be hardened to a minimum Brinell Hardness Number of 225. Upper flange and web of the track section shall be steel, continuously welded together or provided as one monolithic piece.
2. Track Suspension: Provide means of suspending the monorail track system, including curves and switches from the structural supports. The suspension system shall be the sole responsibility of the track supplier; however, design shall be subject to the requirements specified herein.
 - a. Cataloged Products: If possible, provide track manufacturer's standard cataloged devices for connection of the track to the indicated supporting structures. If track manufacturer's cataloged devices are not provided for this suspension system, complete shop drawings and calculations for the custom suspension device shall be submitted for review and approval by the the Owner. Track suspension devices which are not the track



- manufacturer's cataloged products shall meet the additional requirements specified in Division 05 Section "Metal Fabrications".
- b. Design: The suspension system shall be designed and constructed to ensure no impairment of the strength of track or the structural support. A hanger or suspension shall be located at each rack splice joint. Provide bracing to hold track sections in rigid alignment at all joints.
 - c. Suspension of Curves and Switches: Provide steel framing (structural supports), in addition to that indicated, as required by monorail curve and switch manufacturer to support curves and switches. The additional steel framing shall be the sole responsibility of the monorail supplier. Submit shop drawings and framing design calculations to the the Owner for approval.
 - d. Sway Bracing: Where the track is suspended from hanger rods, track shall be braced laterally and longitudinally to prevent sway.
 - e. Lock Nuts: Where the track is suspended from hanger rods, lock nuts or other means shall be provided to prevent the nuts from backing off the rods.
 - f. Multiple Suspension Devices: Where more than one suspension device attached to the track at a single point, the suspension devices shall be provided so that the loads shall be induced in each in proportion to the device's size.
3. Identification Plates: Provide identification plates of noncorrosive metal. Information and data on the plates shall include, in clearly legible permanent lettering, the manufacturer's name, model number, capacity rating, and other essential information. In addition, the monorail track beam system shall be furnished with identification plates showing the capacity of the system, which shall be legible from the floor and from either side of the monorail track beam.
- C. Painting Of System: Provide manufacturer's standard painting or shop painting of components specified in this section; comply with the requirements specified in Division 07. Do not paint, coat, or galvanize load chain, load, hook nut, or load chain sheave.

1.3 EXECUTION

- A. Erection And Installation: The Contractor shall erect and install the hoist trolley and monorail system in accordance with manufacturers written instructions, MMA MH27.1, and the contract drawings. The monorail supplier shall provide supervisory erection services. Welding new sections of monorail track to existing shall conform to AWS D1.1.
- B. Field Inspection And Tests
 1. Pre-Erection Inspection: Before erection, the Contractor and the manufacturer's representative shall jointly inspect the monorail and hoist systems and components at the job site to determine compliance with specifications and manufacturer's data and shop drawings as approved. The Contractor shall notify the the Owner 3 days before the inspection.
 2. Operational Inspection and Load Tests: Upon completion, and before final acceptance, the hoist, trolley, and monorail shall be given the rated load test specified in ASME/ANSI B30.11, carrying 125 percent (plus 5 percent, minus 0 percent) of the rated capacity, and with the units spaced to obtain maximum possible loads in the monorail track beam systems. Hoists shall hold a static, as well as control a dynamic, 125 percent rated load. The systems shall be thoroughly tested in service to determine that each component of the system operates as specified, is properly installed and adjusted, and is free from defects in material, manufacture, installation, and workmanship. The Contractor shall furnish test loads, operating personnel, instruments, and all other necessary apparatus at no additional cost to the Owner. The test and final adjustments of the equipment will be under the supervision of the Owner. The Contractor shall rectify any deficiencies found and completely retest work affected by such deficiencies.

END OF SECTION 41 22 23 13a

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Task	Specification	Specification Description
41 22 23 13	41 01 20 00	Material Handling Hoists
41 22 23 13	26 05 19 23	Monorails With Electric Powered Hoists



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43 - Process Gas and Liquid Handling, Purification,
and Storage Equipment

Task	Specification	Specification Description
43 21 16 00	22 05 23 00	Piped Utilities Basic Materials And Methods
43 21 33 00	01 22 16 00	No Specification Required
43 21 36 00	22 05 23 00	Piped Utilities Basic Materials And Methods
43 41 31 00	01 22 16 00	No Specification Required



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Task	Specification(s)
01 10 00 00	01 10 00 00
01 11 04 00	01 11 04 00
01 22 16 00	01 22 16 00
01 22 20 00	01 22 16 00
01 22 23 00	01 22 16 00
01 23 00 00	01 23 00 00
01 32 00 00	01 32 00 00
01 32 33 00	01 32 33 00
01 33 00 00	01 33 00 00
01 35 43 00	01 35 43 00
01 40 00 00	01 40 00 00
01 45 23 00	01 22 16 00
01 50 00 00	01 50 00 00
01 51 13 00	26 05 19 13
01 51 26 00	26 05 19 13
01 52 13 00	01 22 16 00
01 52 19 00	01 22 16 00
01 54 23 00	01 22 16 00, 04 05 26 00
01 54 26 00	01 22 16 00
01 54 30 00	01 22 16 00
01 55 26 00	01 22 16 00
01 56 16 00	01 22 16 00
01 56 26 00	01 22 16 00
01 56 29 00	01 22 16 00
01 56 33 00	01 22 16 00
01 56 39 00	01 22 16 00
01 58 13 00	01 22 16 00
01 60 00 00	01 60 00 00
01 66 19 00	01 22 16 00
01 71 13 00	01 22 16 00
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01 73 00 00	01 73 00 00
01 74 13 00	01 71 23 16
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01 74 23 00	01 71 23 16
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01 95 09 00	01 22 16 00
01 95 10 00	01 22 16 00
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01 95 23 00	01 22 16 00
01 95 26 00	01 22 16 00
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02 41 13 13	02 41 13 13
02 41 16 13	02 41 13 13
02 41 19 00	02 41 19 00
02 41 19 13	01 71 23 16, 02 41 13 13
02 41 19 16	02 41 13 13

Task	Specification(s)
02 43 13 00	01 22 16 00
02 62 16 00	01 22 16 00
02 66 13 00	01 22 16 00
02 66 23 00	01 22 16 00
02 82 00 00	02 82 00 00, 01 22 16 00
02 82 33 00	02 82 33 00
02 83 00 00	01 22 16 00
02 85 00 00	02 85 00 00
02 89 00 00	01 22 16 00
03 01 50 00	03 01 50 00
03 10 00 00	03 10 00 00, 03 10 00 00
03 11 13 00	01 22 16 00
03 11 23 00	01 22 16 00
03 20 00 00	03 20 00 00, 03 20 00 00
03 30 00 00	03 30 00 00, 03 30 00 00
03 31 13 00	32 01 11 53, 32 13 13 17
03 41 16 00	03 41 16 00
03 41 26 00	03 41 26 00
03 47 13 00	03 47 13 00, 03 47 13 00
03 51 13 00	03 51 13 00
03 51 16 00	03 51 16 00, 03 51 16 00a, 03 51 16 00b, 03 41 16 00
03 52 16 00	03 52 16 00, 03 41 16 00
03 61 16 00	01 22 16 00
03 64 26 00	01 22 16 00
04 01 20 51	04 01 20 51
04 01 20 52	04 01 20 51
04 01 20 91	04 01 20 51
04 01 40 52	04 01 40 52, 04 01 20 51
04 01 40 91	04 01 40 91, 04 01 20 51, 04 01 40 52
04 01 50 52	04 01 20 51
04 05 13 26	04 05 13 26
04 05 14 00	04 05 14 00, 04 05 14 00
04 05 16 26	04 05 13 26
04 05 19 13	04 05 13 26
04 05 19 16	04 05 13 26
04 05 19 26	04 05 13 26
04 05 23 13	04 05 13 26
04 05 23 16	01 22 16 00
04 05 26 00	04 05 26 00, 04 05 13 26
04 21 00 00	04 21 00 00
04 21 13 00	04 05 13 26
04 21 19 00	04 05 13 26
04 21 26 00	04 05 13 26
04 21 29 00	04 05 13 26
04 22 00 00	04 22 00 00, 04 22 00 00
04 22 23 13	04 05 13 26
04 22 23 23	04 05 13 26
04 22 23 26	04 05 13 26
04 22 23 29	04 05 13 26
04 22 23 31	04 05 13 26
04 23 13 00	04 05 13 26
04 26 13 00	04 05 13 26
04 41 00 00	04 01 40 91

Task	Specification(s)
04 42 43 00	04 01 40 91
04 43 00 00	01 22 16 00, 04 01 40 91
04 51 00 00	04 05 13 26
04 72 00 00	04 05 13 26
05 05 19 00	01 22 16 00
05 05 23 00	01 22 16 00
05 12 00 00	05 12 00 00, 05 12 00 00
05 14 16 00	01 22 16 00
05 21 00 00	05 21 00 00, 05 21 00 00
05 31 00 00	05 31 00 00, 05 31 00 00
05 31 23 00	05 31 23 00
05 40 00 00	05 40 00 00, 05 40 00 00
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06 42 16 00	06 25 16 00
06 42 19 00	06 42 19 00, 06 25 16 00
06 46 19 00	01 22 16 00
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07 31 00 00	07 31 00 00
07 31 13 00	07 31 13 00

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07 31 29 17	01 22 16 00
07 31 33 00	07 31 33 00, 01 22 16 00
07 41 13 00	07 41 13 00
07 42 63 00	01 22 16 00
07 46 00 00	07 46 00 00
07 46 16 00	07 46 16 00, 07 46 16 00a
07 46 19 00	07 46 16 00, 07 46 16 00a
07 46 23 00	06 16 23 00
07 46 29 00	06 16 23 00
07 46 46 00	01 22 16 00
07 46 63 00	07 46 63 00, 07 46 16 00
07 51 13 00	07 51 13 00, 07 51 13 00, 07 51 13 00
07 51 16 00	07 51 16 00, 07 51 16 00, 07 51 16 00
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07 62 02 00	07 62 02 00, 07 62 02 00, 07 62 02 00
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07 71 23 00	01 22 16 00
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07 72 33 00	07 72 33 00
07 72 56 00	07 72 56 00, 07 72 56 00a, 07 72 56 00b, 23 83 13 00
07 72 63 00	01 22 16 00
07 76 16 00	01 22 16 00
07 84 00 00	07 84 00 00, 07 84 00 00
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08 15 13 00	08 14 16 00
08 16 13 00	08 16 13 00, 08 16 13 00a, 08 16 13 00b
08 17 23 00	08 14 16 00
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08 36 14 00	08 36 14 00
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08 42 29 00	08 42 29 00, 08 42 29 00
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09 01 30 91	09 31 00 00
09 01 60 00	09 01 60 00, 01 22 16 00
09 22 13 00	09 22 13 00, 09 22 13 00a, 09 22 13 00b
09 22 16 00	09 22 16 00
09 22 16 13	09 22 16 13
09 22 36 13	09 22 13 00, 09 22 13 00a, 09 22 13 00b
09 22 36 23	09 22 36 23, 09 22 13 00, 09 22 13 00a, 09 22 13 00b
09 22 36 33	09 22 13 00, 09 22 13 00a, 09 22 13 00b, 09 22 36 23
09 23 13 00	09 23 13 00, 09 22 13 00, 09 22 13 00a, 09 22 13 00b, 09 22 36 23
09 24 23 00	09 22 13 00b
09 24 33 00	01 22 16 00
09 28 13 00	09 22 13 00a, 09 31 00 00
09 29 00 00	09 29 00 00, 09 29 00 00, 01 22 16 00, 09 23 13 00
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09 51 23 00	09 51 23 00
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09 66 23 16	09 66 23 16
09 66 33 00	09 66 23 16
09 67 23 00	09 67 23 00, 09 67 23 00, 09 66 23 16
09 68 00 00	09 68 00 00
09 91 00 00	09 91 00 00, 09 91 00 00
09 91 13 00	09 91 13 00, 01 22 16 00
09 91 23 00	09 91 23 00
09 91 33 00	09 91 13 00
09 96 56 00	09 96 56 00, 09 96 56 00, 09 96 56 00b
09 97 63 00	01 22 16 00
10 12 00 00	01 22 16 00
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10 21 16 00	10 21 16 00
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10 44 16 13	10 44 16 13, 01 22 16 00
10 51 13 00	10 51 13 00, 10 51 13 00a, 10 51 13 00a, 01 22 16 00
10 51 53 00	01 22 16 00
10 55 23 23	10 55 23 23
10 55 23 26	10 55 23 23

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10 56 13 16	10 56 13 16
10 56 29 46	10 56 13 16
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10 71 16 13	01 22 16 00
10 71 16 16	01 22 16 00
10 73 13 00	10 73 13 00
10 73 16 00	10 73 16 00
10 73 26 00	01 22 16 00
10 75 00 00	10 75 00 00, 10 75 00 00
10 81 13 00	10 81 13 00, 10 81 13 00a
10 88 00 00	10 88 00 00
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11 12 00 00	11 12 00 00, 11 12 00 00
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12 59 13 00	12 59 13 00
12 59 16 00	01 22 16 00, 12 59 13 00
12 62 23 00	01 22 16 00
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12 93 23 00	01 22 16 00, 12 93 13 00
12 93 33 00	12 93 13 00
12 93 43 53	12 93 13 00
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13 27 00 00	13 27 00 00

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13 60 05 00	13 60 05 00
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22 05 00 00	22 05 00 00, 22 05 00 00
22 05 19 00	01 22 16 00, 21 05 19 00, 21 05 19 00a
22 05 23 00	22 05 23 00, 22 05 23 00a, 22 05 23 00b
22 05 76 00	22 05 76 00
22 07 19 00	22 07 19 00, 22 07 19 00a
22 08 00 00	22 08 00 00
22 10 00 00	22 10 00 00
22 11 16 00	22 11 16 00, 22 11 16 00a, 22 11 16 00b, 22 11 16 00c, 22 11 16 00c, 22 05 23 00, 21 05 00 00
22 11 19 00	22 11 19 00, 22 11 19 00a, 22 11 19 00a, 01 22 16 00, 22 05 23 00, 21 05 00 00
22 11 23 39	22 11 23 39, 22 05 23 00
22 12 23 13	22 34 00 00
22 12 23 26	22 12 23 26, 22 05 23 00
22 13 16 00	22 13 16 00, 22 13 16 00, 22 05 23 00, 22 11 23 39, 21 05 00 00
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22 13 19 13	22 13 19 13
22 13 19 33	22 05 23 00, 22 05 23 00a, 22 05 23 00b, 22 05 76 00
22 13 23 00	01 22 16 00
22 13 29 13	22 13 29 13
22 13 29 16	22 13 29 13
22 13 29 33	01 22 16 00
22 13 63 00	01 22 16 00
22 13 66 00	01 22 16 00

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22 42 39 00	01 22 16 00, 22 01 40 00
22 42 43 00	22 01 40 00
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22 43 39 00	22 43 39 00, 22 01 40 00
22 45 00 00	22 45 00 00, 22 45 00 00
22 47 00 00	22 47 00 00
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22 47 16 00	01 22 16 00, 22 01 40 00
22 51 13 00	01 22 16 00
22 51 16 00	01 22 16 00
22 51 19 00	01 22 16 00
22 66 83 16	22 66 83 16
22 67 13 53	21 05 00 00
23 01 30 51	23 01 30 51
23 01 50 00	23 01 50 00
23 01 60 00	23 01 60 00
23 05 00 00	23 05 00 00, 23 05 00 00
23 05 13 00	26 05 19 13
23 05 16 00	23 05 16 00, 23 05 16 00a
23 05 19 00	22 05 23 00, 21 05 00 00, 21 05 19 00, 21 05 19 00a
23 05 23 00	23 05 23 00, 23 05 23 00, 01 22 16 00, 22 05 23 00, 22 05 23 00a, 22 05 23 00b, 22 05 76 00
23 05 29 00	23 05 29 00, 23 05 29 00a, 22 05 23 00, 21 05 00 00
23 05 48 00	23 05 48 00, 23 05 48 00a, 23 05 48 00b, 01 22 16 00, 22 05 23 00
23 05 53 00	23 05 53 00, 23 05 53 00a
23 05 93 00	23 05 93 00, 23 05 93 00, 01 71 23 16
23 07 13 00	23 07 13 00, 23 07 13 00
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23 08 00 00	23 08 00 00, 23 08 00 00
23 09 04 00	23 09 04 00, 23 09 05 00
23 09 05 00	23 09 05 00
23 09 15 00	23 09 15 00, 23 09 15 00
23 11 23 00	23 11 23 00, 23 11 23 00a, 23 11 23 00a, 22 05 23 00, 22 11 23 39, 21 05 00 00
23 11 33 00	21 05 00 00
23 12 13 00	22 05 23 00
23 12 16 00	01 22 16 00
23 12 23 00	22 05 23 00
23 13 13 13	22 05 23 00, 22 12 23 26, 23 11 23 00

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23 13 13 23	22 05 23 00, 22 12 23 26
23 13 23 16	01 22 16 00, 22 05 23 00, 22 12 23 26, 23 11 23 00
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23 13 23 26	22 05 23 00, 22 12 23 26
23 13 33 00	22 05 23 00
23 21 13 23	23 21 13 23, 22 05 23 00, 22 11 23 39, 21 05 00 00, 22 12 23 26, 23 11 23 00, 22 11 16 00, 22 11 16 00a, 22 11 16 00b
23 21 16 00	01 22 16 00, 22 05 23 00, 21 05 00 00, 22 12 23 26, 23 11 23 00
23 21 23 00	23 21 23 00
23 21 23 13	22 05 23 00, 22 11 23 39
23 21 23 16	22 05 23 00, 22 11 23 39
23 21 23 23	22 05 23 00, 22 11 23 39
23 21 29 00	22 05 23 00
23 22 13 00	23 22 13 00
23 22 16 00	22 05 23 00, 21 05 19 00, 21 05 19 00a
23 23 00 00	23 23 00 00, 23 23 00 00
23 23 13 00	22 05 23 00
23 23 16 00	23 23 16 00, 21 05 00 00, 23 01 60 00
23 23 23 00	23 01 60 00
23 25 13 00	23 25 13 00, 22 05 23 00, 22 12 23 26
23 31 00 00	23 31 00 00, 23 31 00 00
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23 33 13 13	23 33 13 13
23 33 13 29	23 33 13 13
23 33 53 00	01 22 16 00
23 34 14 00	23 34 14 00
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23 34 23 00	23 34 23 00
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23 38 13 16	01 22 16 00
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23 42 13 00	23 42 13 00
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23 52 23 00	23 01 50 00
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23 52 39 13	23 52 36 00
23 55 23 00	23 55 23 00, 23 55 23 00
23 55 23 13	23 55 23 13, 23 55 23 13a
23 55 33 00	01 22 16 00
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23 57 16 00	23 57 13 00
23 57 19 13	23 57 13 00
23 57 19 19	23 57 13 00
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23 62 23 00	23 01 60 00
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23 64 16 00	23 64 16 00
23 64 16 16	23 64 16 16
23 64 19 00	23 64 19 00
23 64 23 00	23 64 23 00, 23 64 23 00a, 23 64 23 00a, 23 64 19 00
23 64 26 00	23 61 16 00
23 65 00 00	23 65 00 00, 23 65 00 00, 01 22 16 00
23 71 13 23	22 05 23 00, 22 12 23 26, 23 11 23 00
23 72 00 00	23 72 00 00
23 73 13 00	23 73 13 00
23 74 13 00	23 74 13 00, 23 74 13 00a, 23 74 13 00b
23 74 23 00	23 74 23 00, 23 74 23 00a
23 74 70 00	23 74 70 00
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23 81 00 00	23 81 00 00, 23 81 00 00
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23 82 33 00	01 22 16 00, 23 82 29 00
23 82 36 00	01 22 16 00, 23 82 29 00
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23 82 39 16	01 22 16 00
23 82 39 19	01 22 16 00, 23 55 23 13
23 83 13 00	23 83 13 00, 07 72 56 00, 07 72 56 00a, 07 72 56 00b
23 83 33 00	01 22 16 00
23 84 13 00	23 84 13 00
23 84 16 00	01 22 16 00, 23 76 13 00
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26 05 33 16	26 05 19 13
26 05 33 23	26 05 19 13
26 05 36 00	26 05 36 00
26 05 39 00	26 05 19 13
26 05 43 00	26 05 19 16a, 26 05 19 16b, 26 05 19 16c, 26 05 19 16d
26 05 53 00	26 05 19 13
26 05 83 00	26 05 19 13, 26 05 13 00
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26 25 00 00	26 05 19 13
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26 27 16 00	01 22 16 00, 26 05 19 13, 26 09 23 00, 26 09 23 00a
26 27 26 00	26 27 26 00, 26 27 26 00, 01 22 16 00, 26 05 19 13, 26 09 23 00
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26 32 29 00	26 32 13 13
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26 42 13 00	26 42 13 00, 01 22 16 00

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27 13 00 00	27 13 00 00, 27 13 00 00
27 15 00 00	27 15 00 00, 27 15 00 00
27 15 13 00	26 05 13 00, 26 05 19 16
27 15 33 00	26 05 13 00, 26 05 19 16
27 41 23 00	26 33 43 00a
27 51 16 00	27 51 16 00, 27 51 16 00
27 51 17 00	27 51 17 00, 27 51 16 00, 27 51 16 00
27 51 23 00	27 51 23 00
27 51 33 00	26 33 43 00a
27 53 13 00	27 53 13 00
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28 05 13 19	26 05 13 00, 26 05 19 16
28 05 13 23	26 05 13 00, 26 05 19 16
28 13 04 00	28 13 04 00
28 13 33 16	26 33 43 00a
28 16 00 00	28 16 00 00, 28 16 00 00
28 23 00 00	28 23 00 00
28 23 04 00	28 23 04 00, 28 23 04 00
28 23 05 00	28 23 05 00, 28 23 05 00
28 31 00 00	28 31 00 00, 28 31 00 00
28 31 23 00	28 31 23 00, 28 31 23 00a
31 00 00 00	31 00 00 00
31 05 13 00	31 00 00 00
31 05 16 00	01 22 16 00, 31 00 00 00
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31 32 13 16	31 32 13 16
31 32 13 19	31 32 13 16
31 32 13 29	31 32 13 16

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31 32 19 16	22 05 23 00, 31 32 13 16
31 37 00 00	01 22 16 00
31 41 16 13	31 23 16 13
31 62 19 00	31 62 19 00, 31 62 19 00
31 62 23 00	31 62 23 00, 31 62 23 00
31 63 29 00	31 63 29 00, 31 63 29 00
32 01 11 53	32 01 11 53
32 01 16 71	32 01 16 71
32 01 26 71	32 01 16 71
32 01 90 00	32 01 90 00, 32 01 90 00
32 01 90 19	01 22 16 00
32 12 16 00	32 12 16 00, 32 12 16 00
32 12 16 39	31 32 13 16
32 12 73 00	32 01 11 53
32 13 13 00	32 13 13 00, 32 13 13 00
32 13 13 17	32 13 13 17, 32 01 11 53
32 13 16 13	32 01 11 53
32 13 43 00	32 01 11 53
32 14 11 00	32 01 11 53
32 14 13 16	32 01 11 53
32 14 16 00	32 01 11 53
32 14 40 00	32 01 11 53
32 14 43 00	32 14 43 00, 32 14 43 00a, 32 01 11 53
32 16 13 13	32 01 11 53
32 16 13 14	32 01 11 53
32 16 13 16	32 01 11 53
32 16 13 19	32 01 11 53
32 16 13 26	32 01 11 53
32 16 13 33	32 01 11 53
32 16 13 43	32 01 11 53, 32 14 43 00
32 16 23 00	32 01 11 53
32 17 23 00	32 17 23 00, 32 17 23 00
32 17 23 13	32 01 11 53
32 17 23 23	32 01 11 53
32 17 23 33	32 01 11 53
32 17 26 00	32 17 26 00
32 18 26 00	32 18 26 00
32 31 13 00	32 31 13 00, 32 31 13 00, 01 22 16 00
32 31 19 00	32 31 19 00, 01 22 16 00
32 31 23 00	01 22 16 00
32 31 29 00	01 22 16 00
32 33 00 00	32 33 00 00
32 39 16 00	12 93 13 00
32 84 13 00	32 84 13 00
32 84 23 00	01 22 16 00, 32 84 13 00, 21 05 00 00
32 91 13 00	32 91 13 00
32 91 13 33	31 00 00 00, 32 18 26 00
32 91 13 36	32 18 26 00
32 91 19 13	32 91 19 13, 02 41 13 13, 31 00 00 00, 32 18 26 00
32 91 19 16	02 41 13 13, 31 00 00 00, 32 91 19 13, 32 18 26 00
32 92 00 00	32 92 00 00, 32 92 00 00
32 92 19 13	32 18 26 00

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32 92 23 00	32 18 26 00
32 92 26 00	32 18 26 00
32 93 00 00	32 93 00 00, 32 93 00 00
32 94 43 00	01 22 16 00, 12 93 13 00
32 94 49 00	01 22 16 00
33 01 30 16	01 22 16 00
33 01 30 42	22 05 23 00
33 01 30 51	01 22 16 00
33 01 30 61	01 22 16 00
33 01 30 72	33 01 30 72, 01 22 16 00, 22 05 23 00
33 01 30 73	01 22 16 00, 22 05 23 00
33 01 30 81	01 22 16 00
33 05 13 13	01 22 16 00, 22 05 23 00
33 05 23 13	01 22 16 00
33 05 23 16	01 22 16 00
33 05 26 00	01 22 16 00
33 11 00 00	33 11 00 00, 33 11 00 00
33 11 13 13	01 22 16 00, 22 05 23 00
33 11 13 23	01 22 16 00, 22 05 23 00, 22 11 23 39, 32 91 19 13
33 11 13 36	22 05 23 00, 22 11 23 39
33 11 13 39	22 05 23 00
33 11 13 53	01 22 16 00, 21 05 00 00
33 12 13 23	01 22 16 00, 22 05 23 00
33 12 16 00	01 22 16 00, 22 05 23 00, 22 05 23 00a, 22 05 23 00b
33 12 19 00	22 05 23 00
33 13 00 00	22 05 23 00
33 20 00 00	33 20 00 00, 33 20 00 00
33 21 13 00	01 22 16 00, 22 05 23 00, 22 11 23 39
33 26 00 00	22 05 23 00
33 30 00 00	33 30 00 00, 33 30 00 00
33 31 00 00	01 22 16 00, 22 05 23 00, 22 11 23 39, 32 91 19 13
33 32 16 13	01 22 16 00
33 36 00 00	33 36 00 00, 33 36 00 00
33 36 13 00	22 05 23 00, 32 91 19 13
33 36 33 00	32 91 19 13
33 39 13 00	01 22 16 00, 22 05 23 00
33 40 00 00	33 40 00 00, 33 40 00 00
33 41 13 00	22 05 23 00
33 42 16 13	33 42 16 13, 01 22 16 00, 22 05 23 00
33 44 13 13	22 05 23 00
33 44 16 00	22 05 23 00
33 44 19 19	33 44 19 19
33 46 13 00	33 46 13 00, 33 46 13 00
33 46 16 00	01 22 16 00, 22 05 23 00, 32 91 19 13
33 46 23 00	22 05 23 00
33 49 13 00	33 49 13 00, 33 49 13 00
33 51 00 00	33 51 00 00, 33 51 00 00
33 51 13 00	01 22 16 00, 22 05 23 00, 21 05 00 00, 23 11 23 00
33 51 33 00	22 05 23 00
33 71 73 00	33 71 73 00, 33 71 73 00
34 01 43 00	01 22 16 00
34 41 13 00	01 22 16 00
34 71 13 13	01 22 16 00

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34 71 13 19	34 71 13 16
34 71 13 26	01 22 16 00, 34 71 13 16a
34 71 16 00	01 22 16 00, 34 71 13 16, 34 71 13 16a
34 82 23 00	01 22 16 00
34 82 26 00	01 22 16 00
40 05 13 19	22 05 23 00, 22 11 23 39, 21 05 00 00
40 05 13 83	21 05 00 00
40 05 23 43	22 05 23 00, 22 11 23 39, 21 05 00 00
40 05 41 00	21 05 00 00
41 01 20 00	41 01 20 00
41 22 23 13	41 22 23 13, 41 22 23 13a, 41 01 20 00, 26 05 19 23
43 21 16 00	22 05 23 00
43 21 33 00	01 22 16 00
43 21 36 00	22 05 23 00
43 41 31 00	01 22 16 00